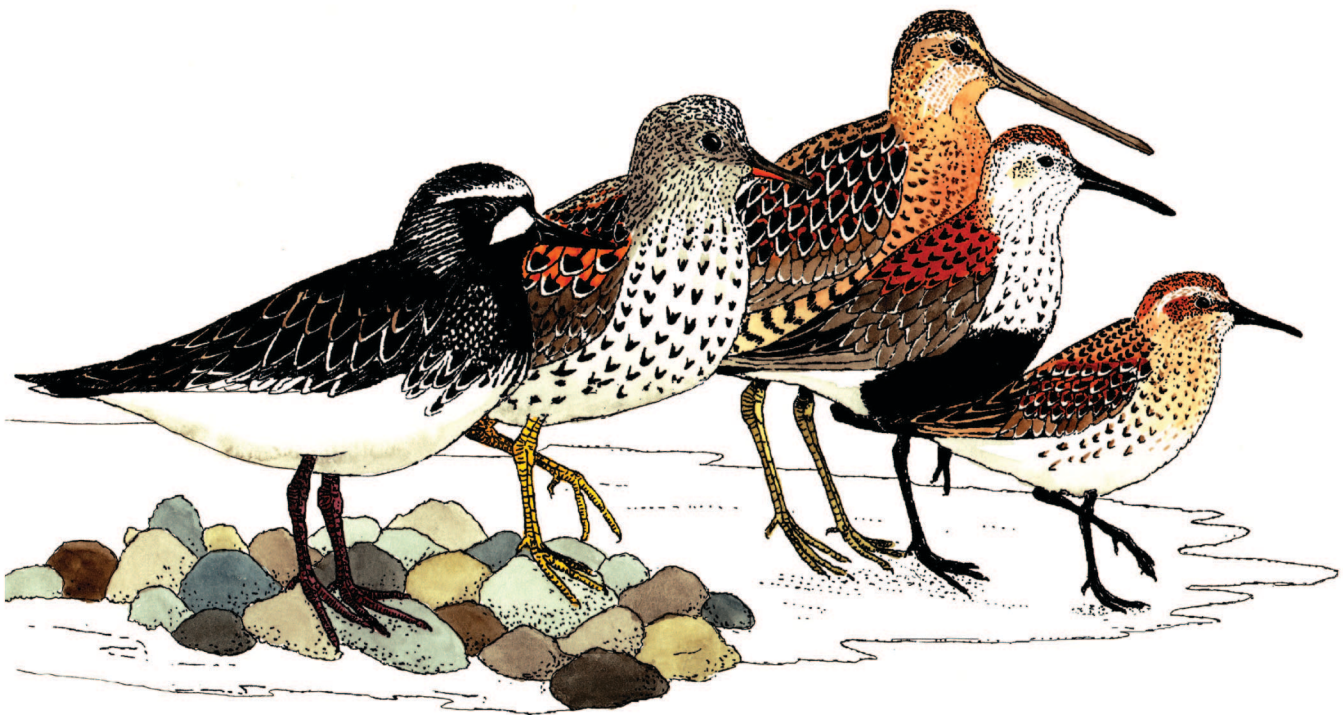


Explore the World with Shorebirds!

Educator's Guide for the Shorebird Sister Schools Program



**Table of
Contents**

**Adobe Acrobat[®]
Tutorial**

*A multidisciplinary guide for grades 2–12 (with sections on “How to Adapt”
for Preschool–1st grade, home schools, youth groups, and nature centers)*



August 2004

<http://sssp.fws.gov>

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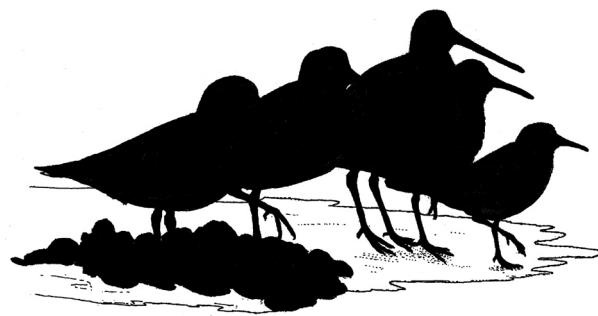


Image by George C. West Copyright ©1995

*Birds from left to right: Black Turnstone, Surfbird,
Short-billed Dowitcher, Dunlin, Western Sandpiper*

Table of Contents

<i>Chapter 1</i>	Introduction	
	Acknowledgments.....	7
	Why Teach About Shorebirds?.....	9
<i>Chapter 2</i>	How to Use This Education Guide	11
	Thumbing Through <i>Explore the World with Shorebirds!</i>	13
	Ideas for Young Audiences (Pre-K – 1).....	14
	Ideas for Home School Groups	16
	Ideas for Youth Groups	18
	Ideas for Nature Center Visitors	19
<i>Chapter 3</i>	Shorebird Sister Schools Program and Connecting Cultures	21
	What Is the Shorebird Sister Schools Program?	
	An Overview of the Shorebird Sister Schools Program	23
	How to Join the Shorebird Education Network	25
	How to Use the Shorebird Sister Schools Web site	26
	Integrating the Shorebird Sister Schools Program into Your Community ..	29
	Register as a Shorebird Sister School	31
	How to Begin a Shorebird Sister Schools Program Pen Pal Exchange....	32
	Connecting to Other Cultures	
	Increasing Cultural Awareness (includes student activity)	34
	List of <i>Explore the World with Shorebirds!</i> Activities with Cultural Connections	35
	Cultural Profiles Activity	36
	*Cultural Profiles	
	Alaska	38
	Canada's Arctic	41
	Hawaii	43
	Paraguay.....	46
	Argentina	48
	Japan	50
	Mexico	52
	<i>*Additional profiles will be posted on the website at http://sssp.fws.gov. We welcome additional profiles. If you would like to write one for your country or state please send an e-mail to sssp@fws.gov.</i>	

Table of Contents

<i>Chapter 4</i>	A Shorebird Primer for Educators	54
	What Makes a Bird a Shorebird?	56
	North American Shorebird Families	60
	How to Identify Shorebird Species	61
	Shorebirds Depend on a Chain of Healthy Habitats	63
	Shorebird Adaptations	65
	Magnificent Shorebird Migration	68
	Shorebird Migration Flyways	70
	The Shorebird Flyway in Your Backyard	72
	Pacific Flyway	74
	Atlantic Flyway	76
	Central Flyway	78
	East Asian — Australasian Flyway	80
	Central Pacific Flyway	81
	Shorebird Nesting and Breeding	82
	Threats to Migrating Shorebirds	85
	Shorebird Conservation — A Hopeful Future	88
	Shorebird Technology and Research	92
 <i>Chapter 5</i>	 Classroom Activities	 95
	Activities Indexes and Correlation to National Standards	
	1. Subject and Skill	97
	2. Visual Arts, English, Math, History/Social Studies, Science	105
	Introduction to Shorebirds	118
	Adaptations	134
	Habitat	162
	Nesting and Breeding	258
	Migration and Migratory Stopover Sites	285
	Shorebird Research and Technology	345
	The Big Shorebird Picture	369
	Shorebirds on Display	375
	Review and Assessment	389



Table of Contents

<i>Chapter 6</i>	Field Trip Planner and Activities	
	Field Trip Planner	405
	Field Trip Checklist	407
	Tips for a Successful Field Trip	409
	Group Management Hints	410
	Good Field Trip Etiquette	411
	Field Trip Safety	413
	Video Hints	414
	Photo/Video Release Form (in-school use)	415
	Photo/Video Release Form (for submission to SSSP)	416
	Field Trip Permission and Medical Information Form	417
	Field Trip Activities	419
	<i>Pre-field trip Activities</i>	
	Using a Field Guide and Binoculars	420
	Map and Miles Study	423
	Making Field Sampling Equipment	424
	Birding Code of Ethics	426
	<i>On-site Activities</i>	
	Shorebird Field Study	429
	Cast a Track	433
	Mud Creatures Study	434
	Sampling Local Shorebird Populations	440
	Migration Headache (Migration Activities Section)	286
	The Incredible Journey (Migration Activities Section)	327
	Behave Yourself (Nesting and Breeding Activities Section)	267
	It's A Tough Life (Nesting and Breeding Activities Section)	279
	Banded Birds (Research and Technology Activities Section)	346
	Shorebirds On The Web (Research and Technology Activities Section)	366
	<i>Post-field trip Activities</i>	
	Sharing Circle	442
	Data Analysis	443
	Shorebirds On The Web (Research and Technology Activities Section)	366
	Field Trip Journals	444
	Field Trip Activity Sheets for Lower Elementary Students	445
	Basic Shorebird Observation Journal Pages	449
	Advanced Shorebird Observation Journal Pages	458
	Advanced Invertebrate Observation Journal	464

Table of Contents

<i>Appendices</i>	Appendix	470
	Shorebird Profiles	472
	Shorebird Coloring Pages	517
	Shorebird Resources	544
	Western Hemisphere Shorebird Reserve Network List of Important Shorebird Sites in North and South America.....	548
	North American Shorebirds and the Habitats They Use	549
	Western Hemisphere Migration Flyways Map	550
	Map of Five Shorebird Flyways in the Shorebird Sister Schools Program.	551
	Shorebird Family Tree	552
	Shorebird Morphology: Flying	553
	Shorebird Morphology: Standing.....	555
	Shorebird Beaks and Feeding Styles	557
	Shorebirds, Wading Birds, Seabirds: Physical and Behavioral Characteristics	559
	Evaluation of Educator's Guide	560

Acknowledgments

Explore the World with Shorebirds! was expanded from the regional Arctic-Nesting Shorebirds Teacher's Guide, written by Maureen de Zeeuw, and from Shorebirds of the Pacific, developed at the U. S. Fish and Wildlife Service's Alaska Maritime National Wildlife Refuge office in Homer, Alaska. The Shorebird Sister Schools Program Coordinator, Hilary Chapman, SSSP educator's guide committee, and environmental education specialist Suzanne Trapp completed this Educator's Guide update.

Special thanks to members of the educator's guide committee for volunteering their time and expertise: *Lori Haynes*, Florida Fish and Wildlife Conservation Commission; *Linda Dill*, New Jersey Audubon Society; and *Maureen de Zeeuw*, *Tamara Mills*, and *Suzanne Fellows* of the U.S. Fish and Wildlife Service. Special thanks to *Brad Andres*, U.S. Fish and Wildlife Service National Shorebird Coordinator for his time and assistance. Many thanks also to *Nancy Whalen* for proof-reading the entire guide.

Heart felt appreciation and thanks to *Suzanne Trapp* who took our innumerable ideas and changes, and made sense out of it!

Great thanks to the following educators who took time out of their busy schedules to review, test, and provide feedback on the revised guide:

Margaret Olsen
Woodward Academy, Jonesboro, Georgia

Susan Raymond
M.Ed., Georgetown Charter School, Millsboro, Delaware

Joe Super
Bishop Ryan High School, Minot, North Dakota

Marilyn Cook
H.G. Olsen Elementary, Port Aransas, Texas

Marcia Bisnett
Miami Norland Senior High, Miami, Florida

Steven Daniel
Department of Education Culture and Employment, Yellowknife, Nunavut, Canada

Dan Butterworth
Crooked River State Park, St. Marys, Georgia

Ashley Dayer
Oregon Coastal National Wildlife Refuge Complex

Bonnie Swarbrick
Buenos Aires National Wildlife Refuge, Arizona

Laura Diprizio
Division of Migratory Birds, U.S. Fish and Wildlife Service, Hadley, Massachusetts

Sue Thomas
Division of Migratory Birds, U.S. Fish and Wildlife Service, Portland, Oregon

Thanks to Project WILD, Alaska Wildlife Curriculum, New Jersey Audubon Society, North American Bluebird Society, Wisconsin Department of Natural Resource, and the many other organizations and agencies that allowed adapted versions of their activities to become part of this curriculum. Illustrations were donated by George C. West and Maureen de Zeeuw.

The Following Project Sponsors Provided Funding:

The U.S. Fish and Wildlife Service:
Division of Migratory Birds and the National Conservation Training Center

The U.S. Fish and Wildlife Service's mission is to work with others to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people. Over 500 refuges and wetland management districts protect fish and wildlife habitat, including areas important to shorebirds.

The National Fish and Wildlife Foundation
By awarding challenge grants, the National Fish and Wildlife Foundation conserves healthy populations of fish, wildlife, and plants — on land and in the sea — through creative and respectful partnerships, sustainable solutions, and better education.

ConocoPhillips Company
For more than a decade, ConocoPhillips has been a partner in bird conservation to benefit birds, their habitats, and the environment. "As a natural resource company, we know the importance of protecting the air, land and water upon which we all depend."

Graphic Design
Kudos and great thanks to Kelly Fike for the layout and design of the guide.

Why Teach About Shorebirds?

With all the curricula that already exist on specialized topics, the natural question arises, why should teachers use this one? While at first glance the focus appears to be on shorebirds only, a closer look reveals that these lessons teach a broad range of scientific concepts and offer a global connection to other students, scientists, and educators. Consider what makes this program unique.

Shorebirds Are a Theme Easily Integrated into Many Subjects!

- The sheer magnitude of what shorebirds accomplish in their efforts to survive is truly amazing and a great tie in to numerous subjects. For example, Hawaii has a rich culture that incorporates its most well-known shorebird, the Kōlea or Pacific-Golden Plover, into its chants, hulas, and folklore. The Kōlea provides a great opportunity to teach about science, but it also brings in history and social studies.
- Calculating distances and mapping where these birds migrate also make great opportunities for bringing math and geography into the classroom in a relevant and fun way.

Curriculum Activities Are Correlated with National Education Standards!

- This provides justification to your school administrators for your time in the classroom and field trip expenses.

Shorebirds Are a Hook for Habitat Conservation!

- By learning about and protecting shorebirds, you are protecting an entire ecosystem and all flora and fauna that depend on these important natural areas.

Shorebirds Are Found Throughout North America!

- Because of the migratory nature of shorebirds, at some time during the year, shorebirds can be seen in all 50 United States, allowing many people to participate in this program.

Shorebirds Connect Us Internationally!

- Shorebirds are among the longest distance migrants of the bird world.
- The Shorebird Sister Schools Program (SSSP) can connect your field site and education program to many different countries and cultures through the E-mail Network, Web site, and pen pal components of the program.
- Geography, history, foreign language and culture are incorporated into what first appears to be a science program.

It Is Easy to Schedule Field Trips!

- Shorebirds migrate in huge flocks and stop at the same places at relatively predictable times of the year. This allows for advanced planning of educational events, festivals, and field trips.
- School children along the flyways can actively observe and report on the migration of shorebirds through their communities to the Shorebird Sister Schools Web site.

Shorebirds Are Fun to Watch!

- The sheer number, variety, and behaviors of shorebirds make them an intriguing, observable species to teach and learn about.

Shorebirds Need Your Help!

- Shorebirds can tell us a lot about the overall health of the habitats in which they live. They are also part of our earth's incredible biodiversity. Scientists fear that many shorebird populations are declining largely due to the loss of habitat and pollution. To protect shorebirds and their habitat means to protect the very environment we all depend on.

How to Use This Guide

Thumbing Through *Explore the World with Shorebirds!* 13

Ideas for Younger Audiences. 14

Ideas for Home School Groups 16

Ideas for Youth Groups. 18

Ideas for Nature Center Visitors 19

Thumbing Through

Explore the World with Shorebirds!

Use this summary to familiarize yourself with the contents and organization of *Explore the World with Shorebirds!*

Introduction

“Why Teach About Shorebirds?” fact sheet

SSSP and Connecting Cultures:

Details on how to participate in the Shorebird Sister Schools Program.

Tips for teaching about cultures and introducing the topic to students.

Profiles of other cultures and their views of conservation and birds.

A Shorebird Primer:

You do not need to be a bird expert to teach about shorebirds!

Background information to teach shorebird behavior, adaptations, migration, research and technology, and conservation.

“How to Identify Shorebird Species” information that is especially useful if you are planning a field trip.

Maps, geographic descriptions, and lists of common shorebirds of your area.

Answers to common migration questions such as: What are migration flyways? What routes do shorebirds take on their long flights between their breeding and wintering grounds? What migration flyway(s) pass through your area?

Classroom and Field Trip

Multidisciplinary Activities include:

Indexes correlating educator’s guide activities with skills and the National Education Standards in science, math, language arts, social studies, and history.

Activities that can be used whether you live near shorebird breeding or nonbreeding areas, migratory stopover sites, or a combination of these.

Multidisciplinary activities designed to help students develop a variety of academic and life skills while learning about migratory shorebirds, shorebird habitat, and the significance of human interaction with both.

You can quickly tell if an activity is for you and your class by looking at key information listed at the beginning of each unit. This includes grade level(s), time requirement, skills and subjects, shorebird concepts, overview, and materials.

Divided By Three Age Categories

Activities are divided into *lower elementary (grades 2–3)*, *upper elementary/lower middle school (grades 4–8)*, and *upper middle/high school (grades 9–12)*. The activities can also be used with *non-school groups and non-formal education centers*. A few activities can be modified for *preschool, kindergarten, and first grade*. Recommendations for using activities with other student groups follow in this section of the guide.

Correlated to National Standards

The lessons in *Explore the World with Shorebirds!* are correlated to National Education Standards and go beyond just science education. They provide opportunities for your students to learn about other cultures and global conservation through the technology components of the program.

Organized by Shorebird Topic

The activities in this education guide are organized into nine Shorebird Learning Topics: *Introduction to Shorebirds*, *Adaptations*, *Habitat*, *Nesting and Breeding*, *Migration*, *Shorebird Research and Technology*, *The “Big” Shorebird Picture*, *Shorebird Field Trips*, and *Review and Assessment*.

Field Trip Planning and Activities

This section provides many resources for planning a field trip and includes many activities.

Appendix includes:

Shorebird Profiles, organized by flyway, that describe the life history of some of the more common shorebirds.

Shorebird Coloring Pages for developing field identification guides or puppets.

Shorebird resources available such as teaching trunks, slide sets, videos, and shorebird field guides.

Glossary that provides definitions for the italicized vocabulary words that appear throughout the guide and in the vocabulary lists at the beginning of each activity unit.

How to Adapt “Explore the World with Shorebirds!” for Young Audiences

Preschool, Kindergarten, First Grade

Young Children Get Excited over the Little Things!

It will not matter if they never get a chance to see a live shorebird. Exploring the topic in a creative and dramatic way will capture their attention and interest in nature.

Most Young Children Love to Create!

Take advantage of their willingness to express their ideas through art.

Many Young Children Are Often Less Inhibited than Older Students.

Harness their desire to be silly! Use the activities that focus on sound, movement, and drama.

Teach Simpler Concepts

Most of the concepts explored in this education guide are too abstract for a young child to grasp. Simply introducing your preschool, kindergarten, and first-grade students to the group known as shorebirds is a great start. Many of the activities written for lower elementary students can be simplified for younger students. Below are some revised concepts to substitute in the lower elementary activities found in the activities section.

Preschool, Kindergarten and First Grade Shorebird Concepts

- Birds are different from all other animals. (Adapt Build a Shorebird into Build a Bird.)
- There are shorebirds in your neighborhood. (Shorebird Profiles; Shorebird Coloring Pages in the Appendix)
- There are many different kinds of shorebirds. (Shorebird Profiles; Shorebird Coloring pages in the Appendix)
- Sometimes male and female shorebirds look different from each other. (Colorful Changes)
- Many shorebirds live in wetlands. (Shorebird Food Webs)
- Wetlands are important to people and animals. (Wetland Metaphors)
- Shorebirds are an important part of their habitat. (Shorebird Food Webs)
- Shorebirds have to protect their nests and chicks from other animals. (Guard Your Nest; Musical Nests)
- Shorebirds are designed to eat certain things. (What Can I Eat with This Beak?)
- Different kinds of shorebirds use different calls and gestures to find a mate. (Behave Yourself, Calling All Birds)

Create a Shorebird Environment in Your Classroom

Young children learn best through discovery and play. Provide them with opportunities to become familiar with shorebirds by incorporating shorebirds into your classroom. Here are some simple, low cost ideas:

- Add shorebird stories to your book collection. (For suggestions, refer to the Glossary at the end of the education guide.)
- Buy or make a variety of shorebird puppets. Add a puppet stage to your classroom.
- Display the shorebird posters included in this binder in the room.
- Clip shorebird pictures out of magazines and make a concentration game.
- Create a bird-watching station in your room by placing binoculars and beginner field guides where children can watch birds.
- Take your students outdoors to look and listen for birds.
- Play bird-call tapes or CDs in the classroom.
- Take a field trip to a local wetland.



Focus on Skills More Than on Information

Young students learn best through active play and personal discovery. The more you can incorporate a shorebird theme into your everyday, skill-building activities, the more they will learn about this group of birds. Here are some examples of *Explore the World with Shorebirds!* activities that can be adapted to focus on skill-building.

Listening and Observation

Musical Nests (an adaptation of the game Musical Chairs) and Behave Yourself! are simple and fun ways to practice listening and observation skills.

Artistic Expression

Encourage creativity by allowing your students to design and build their own shorebird puppets (Get to Know the Shorebirds Puppet Show) or to create their own, unique shorebird design (Build a Shorebird).

Dramatic Play and Storytelling

Write and act out a shorebird story. (For suggestions refer to the Glossary at the end of the education guide.) Perhaps your class would like to write its own story about a local shorebird and illustrate it themselves (A Day in My Life as a Shorebird). Are your students natural actors? Perform the puppet show script provided or write one of your own as a class (Get to Know the Shorebirds Puppet Show).

Comparing Similarities and Differences

Ask students to compare different groups of birds and even different shorebird species. Compare bills, feet, length of their legs, shape of their heads, and plumage. Do all shorebirds act the same? Do all shorebirds sound the same? (Introduction to Shorebirds; What Can I Eat with This Beak?; Shorebird Profiles).

Scientific Discovery

Almost any outdoor excursion offers an opportunity for scientific discovery. Whether it is a field trip to a local wetland, lake, or beach or a simple walk around the playground, there should be many signs of birds nearby. Look for feathers, tracks, nests, and droppings. Listen for bird-calls and songs. Search for bird foods. Simplify Mud Creature Study into a scavenger hunt for things that live in the mud. Use Cast a Track to bring a shorebird track back to your classroom.

If you can not find many signs of birds, ask “What would bring birds into this area?” Use the activity Shorebird Food Webs to help you figure out what is missing in the habitat you are exploring.

Team Building

Explore the World with Shorebirds! offers many opportunities for students to work together. Whether they team up to write a story, create a set of shorebird puppets (Build a Shorebird; Get To Know the Shorebirds Puppet Show), play a learning game (Musical Nests; Behave Yourself), build a food web (Shorebird Food Webs), or explore a wetland together on a field trip, the activities in this education guide will encourage team building.

Invite Older Shorebird Students to Include Younger Ones in Shorebird Lessons

If the older students in your school are using *Explore the World with Shorebirds!*, ask them to incorporate your class into their activities. Can your class be the audience for a Get to Know the Shorebirds Puppet Show? Can your class visit the Shorebird Fair or dress up as shorebirds in an older class's Shorebird Wax Museum? How about a joint field trip where older students pair up with younger ones to help them use binoculars and identify shorebirds? With some creative thinking, advanced planning, and a desire to mentor younger students, almost any activity in this educator's guide can benefit the preschool, kindergarten, and first-grade audience.



How to Adapt “Explore the World with Shorebirds!” for Home School

Why It Works

You Have Maximum Schedule Flexibility to Be Spontaneous

Since you are not bound by a traditional school year, a defined class schedule, or dictated educator’s guide timelines, you can take advantage of teachable moments as they present themselves.

You Can Emphasize Your Child’s Particular Interests

You do not have to be concerned about activities appealing to a wide range of interests and abilities. You can focus on topic areas especially interesting to your child and can more easily integrate shorebirds into subject areas he or she needs to emphasize.

Family Trips Are Learning Experiences

You have tremendous flexibility for shorebird viewing opportunities when you consider family outings, weekend getaways, and longer vacations. Soon you will notice that shorebirds are everywhere. After using *Explore the World with Shorebirds!* you may even consider a family trip to a prime shorebird viewing area.

Let “Explore the World with Shorebirds!” Grow with Your Child

Use the Subjects and Skills Index Charts found in the Classroom Activities to develop a study plan that emphasizes the skills you want to practice and your child’s specific interests. Activities are provided for grades 2 – 12. Take advantage of your flexibility and explore the world of shorebirds for several years, building up to more complicated topics and community-

oriented projects as your child learns and grows. Families with multiple home school children can easily select an activity appropriate for each child’s age and learning level. See the sample study plan at the end of this section.

Use Your Family Computer as a Shorebird Learning Tool

Tracking migrating shorebirds, posting questions to shorebird biologists, and playing shorebird learning games are just a few of the learning opportunities you will find there. For more information on how to use sssp@fws.gov, refer to How to Use the Shorebird Sister Schools Web Site in SSSP and Cultural Connections.

Network with Other Home School Families for Large Group Activities

Since this educator’s guide was initially designed for use by classroom teachers, many large group educational activities are included. With a little advanced planning and creativity, you can incorporate them into your shorebird lessons. Take your interest in shorebirds to your local home school chapter and brainstorm which activities might be best suited for the group to participate in together.

Being part of a larger group can also have certain advantages. For example, booking speakers or presenters and reserving time with a naturalist at a nature center are usually easier if you are part of a group. Community service projects are often more educational if you plan and work within a group.

Here are some ideas for modifying activities designed for a larger group:

- Combine shorebird activities like Shorebird Food Webs, When the Grass Was Greener, Musical Nests, It’s a Tough Life, Migration Headache, The Incredible Journey, Precarious Path, and Banded Bird, with a field trip or a special shorebird presentation.
- Include your extended family and friends in activities like Guard Your Nest and Imaginary Mist Nests. Plan these activities to coincide with their visits.
- Invite your area home school students to work together to plan and present a Get to Know the Shorebirds Puppet Show or an informational Shorebird Fair within the community.
- Host an afternoon of Shorebird Jeo-Bird-Y or Peeps and Predators in which families test their new shorebird knowledge.

Emphasize Field Trips and Seasonally Relevant Topics

You may have noticed in the sample study plan that several field trip activities were suggested each year. You are in a unique opportunity to emphasize teachable moments. Prepare for the impromptu stop at a local wetland on a good weather day when you know shorebirds could be in the area. Time your lessons to coincide with the shorebird seasons. For example, focus on migrations and migratory stopover sites when shorebirds are moving through your area or you are tracking them online. Teach about breeding plumage in the spring and summer when your children may spot local shorebirds in their breeding plumage.



"Explore the World with Shorebirds!"

Sample Home School Study Plan

Year 1

Introduction to Shorebirds

Shorebird Profiles

Adaptations

Build s Shorebird

Habitat

Shorebird Food Webs

Nesting and Breeding

Guard Your Nest

Colorful Changes

Migration

Migration Headache

Shorebird Research and Technology

Where Are the Birds Today?

Field Trips

Using a Field Guide and Binoculars

Shorebird Field Study

Cast a Track

The "Big Shorebird Picture"

Shorebird Values on the Line (to assess what your child thinks and believes)

Year 2

Introduction to Shorebirds

Get to Know the Shorebirds Puppet Show

Adaptations

What Can I Eat with This Beak?

Habitat

Match the Habitat Cards

Nesting and Breeding

It's a Tough Life

Migration

Migration Math Madness

Shorebird Research and Technology

Banded Birds

Field Trips

Using Field Guide and Binoculars (review)

Making Field Sampling Equipment

Mud Creatures Study

Data Analysis

The "Big Shorebird Picture"

Shorebird Poetry

Shorebird News

Year 3

Introduction to Shorebirds

Most Wanted: Shorebirds

Adaptations

Avian Olympics

Habitat

Map Your Habitats

Nesting and Breeding

Shorebird Bubble Map

Migration

Bird's-Eye View

Shorebird Research and Technology

You Be the Scientist

Field Trips

Sampling Local Shorebird

Populations

Data Analysis

The "Big Shorebird Picture"

What You Can Do for Shorebirds!

Shorebird Fair

Shorebird Values on the Line

These activities are more suitable for larger groups. Refer to Network with Other Home School Families for Large Group Activities on the previous page for suggestions on how to use these activities with your group.



How to Adapt “Explore the World with Shorebirds!” for Youth Groups

Why It Works

You Have Greater Time and Schedule Flexibility Than Most Groups

Most of the time, youth groups can visit sites without the complications of arranging bus transportation within the confines of a traditional school week and year.

The Community Likes to Get Involved with Youth Groups

There are usually plenty of interested parent helpers or community volunteers to chaperone group activities. Local civic organizations and businesses such as local bird clubs or bird stores are often eager to sponsor youth events.

Youth Groups Like Service Learning Projects

Since youth groups meet on an extended, regular schedule, it is relatively easy to start and finish a community service project.

Youth Groups Are a Popular Activity

Many sites are eager to attract the local youth group audience. Many children and their parents are looking to become part of a fun, yet educational, group.

Shorebird Field Trips Are a Logical Choice for Youth Groups

Planning a Shorebird Field Trip gives you many suggestions on having a fun and safe field trip. In the Field Trip Activities section, you will find pre-trip, onsite, and post-trip activities for your group. A variety of Field Trip Journal Pages is also located in the Field Trip section. Select the one(s) most suited to your group and your field trip needs.

Take as many shorebird field trips as you can! Ask parents to carpool to nearby shorebird field trip sites. Call ahead to arrange a time with the site's naturalist. If the naturalist is not available, look within your own community for a local shorebird expert to help with field identification and questions. Ask your local natural resource or extension agency about the possibility of talking with a bird biologist about shorebirds. Find out if anyone in your community is banding shorebirds.

Plan a Community Service Project That Benefits Shorebirds

Service projects can attract a lot of attention to your group and to shorebirds. Have your kids research the species of shorebirds that visit your area. What challenges do they face? Are there any controversial issues surrounding these shorebirds within your own community? How can your group help?

The more the project selection and planning is done by your kids, the greater their enthusiasm and commitment will be. Offer them suggestions and guidance when they need it, but resist the urge to take over. For a list of ideas and suggestions on how to plan and organize a community service project, look up What You Can Do for Shorebirds! in The Big Shorebird Picture section.

Ask Older Groups to Mentor Younger Ones

Most of the activities in *Explore the World with Shorebirds!* are most appropriate for children in grades 2 – 12, as written. This provides a wonderful opportunity for older groups to help teach younger ones. Pair up ages for field trips. Look for ways younger students can contribute to the productions and community projects that older groups develop. Use younger groups as an audience for shorebird stories, puppet shows, and art shows hosted by their older counterparts.



Adapting “Explore the World with Shorebirds!” for Nature Center Visitors

Why It Works

Your Audience Chose to Come

You already know that the people in your building are interested in the information and activities you have to offer. You will not have to spend a lot of time soliciting enthusiasm or participation.

Sometimes the Best Learning Happens in Mixed Groups

Most of the time, parents take charge of their children in mixed groups, allowing the presenter to focus on his or her presentation. Often it is the children’s enthusiasm that sparks parents’ interest and gives them permission to enjoy the games and activities you have planned. Most of the time family groups are comfortable “teams” in which even young children can participate with help from an older sibling or parent.

Flexibility

You can plan programs and activities year-round. You are not confined to a classroom or a set block of time. You can decide how big your group will be by setting size limits.

You May Already Have Shorebird Resources

Perhaps you have shorebirds feeding or nesting on-site. You probably arrange space to setup interesting displays and conduct programs and demonstrations. You might even have a naturalist who already knows something about shorebird biology and the identification of local species.

Host a Shorebird-Viewing Workshop

Invite bird enthusiasts to an afternoon or a weekend shorebird workshop. Plan your wildlife-watching workshop around the peak viewing sites and dates in your area. Include activities from *Explore the World with Shorebirds!* and follow up with shorebird viewing trips. Remember, many parents are looking for activities their whole family can enjoy together. Teachers, home school parents, and scout or club leaders are also audiences to consider.

Design a Shorebird Field Trip Teacher Packet

If your site is a frequent field-trip destination, design a field trip with a shorebird theme for your local teachers.

Here are some ideas:

- Assemble a field-trip packet that includes pre- and post- field trip activities, species profiles for shorebirds that use your site, and general shorebird information from the *Shorebird Primer*.
- Provide staff assistance, if possible, or line up volunteers to help with the on-site activities.
- Offer a pre-field trip orientation for teachers who would like to know more about shorebirds and the particular species they can expect to see at your site.

Use Shorebird Demonstrations, Presentations, and Games

Many activities in *Explore the World with Shorebirds!* are easily modified into presentations or demonstrations. Plan to include some of the activities below in your program schedule during peak shorebird viewing times.

Here are a few examples of activities that fit well with a mixed audience:

- **Wetland Metaphors**
(*Classroom Activities — Habitat Section*)
Introduce your audience to the role wetlands play within the ecosystem, their importance to shorebirds, and their value to human health.
- **Build A Shorebird**
(*Classroom Activities — Adaptation Section*)
This activity can be done using a volunteer from your audience. It is also engaging for a roaming interpreter. Simply dress up in all the shorebird adaptations described in the activity and roam the visitor center or observation area, asking your visitors to guess what animal you are. Explain your strange-looking adaptations and how they benefit you.
- **Shorebird Food Webs**
(*Classroom Activities — Habitat Section*)
Prepare a set of shorebird food web cards (found in the Student Appendix) that are suitable to your area’s habitat. Collect volunteers from within your center or advertise a food web activity that anyone can play.
- **Migration Headache, The Incredible Journey, and It’s a Tough Life**
(*Classroom Activities — Migration and the Nesting and Breeding Sections*)
These are all teaching activities that work well when conducted outside with a medium-sized group of almost any age. Read the rules carefully beforehand and assemble the props in a labeled box that can set on the shelf, ready to go at a moment’s notice.



■ **Get to Know the Shorebirds**
Puppet Shows

(*Classroom Activities —
Introduction to Shorebirds
Section*)

Use the sample script, modify it for your specific location, or write a new one for presentation in your nature or visitor center. Look for artistic volunteers to create the puppets and backdrop. This is likely to be especially popular with your preschool visitors and day care groups.

■ **What Can I Eat with This Beak?**
(*Classroom Activities —
Adaptations Section*)

Set up a small “shorebird feeding station” somewhere in your center. Put out the beak-simulation tools as described in the activity. Use pie plates to hold “shorebird foods,” and ask your visitors to try to match the right style beak with the foods it is designed to help a shorebird eat. Be sure to leave the right answers and pictures of the shorebirds you are highlighting on cards at the table.

For example:

To simulate a Dowitcher probing for aquatic worms, bury gummy worms in sand and provide a pair of needle-nosed pliers to pull them out.

To simulate an Oystercatcher feeding on mollusks, leave a pair of heavy pliers for crushing open a nut or a shell

To simulate a Western Sandpiper picking insects off the surface of the beach, use a pair of tweezers to pick up grains of rice from a pie plate of sand.

■ **Host a Shorebird Contest**

Get out the word about the shorebirds in your area by sponsoring a shorebird contest, using one of the activities in *Explore the World with Shorebirds!*

■ **Most Wanted Shorebirds**
(*Classroom Activities —
Introduction to Shorebirds
Section*)

Invite local school children to design a “Most Wanted Poster” for shorebirds in your area. Then select a variety of posters to showcase at the nature center or around town. Perhaps a local printing company would donate the cost of printing posters of the winning artwork.

■ **A Year (a Day or a Week) in My Life as a Shorebird**
(*Classroom Activities —
Introduction to Shorebirds
Section*)

■ Host a writing contest that describes the life of a favorite shorebird. Ask your local newspaper to print the winning article and a little more about where and when readers can see this shorebird.

■ **Shorebird Poetry**
(*Classroom Activities — The Big Shorebird Picture Section*)

Sponsor a community poetry contest. Ask local businesses to contribute prizes. Ask you local paper to print the winning poems.

■ **Shorebirds on Display**
(*Classroom Activities — The Big Shorebird Picture Section*)

Invite scout troops, science clubs, and/or schools to design a display that communicates information about a controversial shorebird issue, little known facts about shorebirds, or identification information about the birds visiting your area.

■ **Organize a Shorebird Service Project on Your Site**

The opportunities for service projects on your site are really only limited by your own imagination and the willingness of your community to lend a hand. Litter clean-ups are pretty simple and fairly typical, especially in the spring when snow melts and people are ready to get outside and enjoy the weather. Go beyond what you may be familiar with and ask yourself “What does our site really need to benefit shorebirds?” If you need concrete ideas, look up *What You Can Do for Shorebirds!*



Shorebird Sister Schools Program (SSSP) and Connecting Cultures

Concepts

- By following shorebirds' movements, we can discover new places and people throughout the world.
- Following shorebird migration broadens our understanding of how we are connected to other people and places and how our actions can influence global conservation efforts.
- Different types of communication media provide a corridor to other places and people.
- Culturally knowledgeable citizens demonstrate an awareness and appreciation of the relationships, processes, and interactions among all elements in the world.

Shorebird Sister Schools

An Overview of the Program	23
Join the Shorebird E-mail Network	25
Use the Shorebird Sister Schools Web Site	26
Integrate the Shorebird Sister Schools Program into Your Community	29
Register as a Shorebird Sister School	31
Begin a Shorebird Sister Schools Program Pen Pal Exchange	32

Connecting Cultures

Cultural Connections in a Conservation Context	34
List of Activities with Cultural Connections	35
Increasing Cultural Awareness Activity	36
SSSP Country Cultural Profiles*	
Alaska	38
Canada's Arctic	41
Hawaii	43
Paraguay	46
Argentina	48
Japan	50
Mexico	52

**Additional profiles will be posted on the Web at <http://sssp.fws.gov>. We welcome additional profiles. If you would like to write one for your state or country please contact the SSSP coordinator at sssp@fws.gov.*



An Overview of The Shorebird Sister Schools Program

What Is the Shorebird Sister School Program (SSSP)?

The Shorebird Sister Schools Program (SSSP) is an Internet-based, multidisciplinary, environmental education program that provides a forum for students, biologists, and shorebird enthusiasts to track, discuss, share information, and learn about shorebirds throughout the year.

The primary components of the program include:

- World Wide Web site, <http://sssp.fws.gov>
- Shorebird E-mail Network (Listserve).
- Educator's guide for Grades 2-12.

Through SSSP your students can:

- Learn about shorebirds, their habitats, and migration.
- Participate in spring tracking projects and learn how researchers use the scientific study method.
- Connect with others to learn about shared natural resources and different cultures.
- Nominate their hometown as a "shorebird sister city" to recognize their community's good land stewardship for shorebirds.
- Develop a variety of academic and life skills using shorebirds as a theme.

How the SSSP Got Its Start

The Shorebird Sister Schools Program began as a supplemental education program of the Kachemak Bay shorebird festival in Homer, Alaska, hosted by the Alaska Maritime National Wildlife Refuge, the local Chamber of Commerce, and local schools. In the early years of the festival, local schools took advantage of the amazing phenomenon that occurs when hundreds of thousands of shorebirds stop at the Kachemak Bay for two weeks in May while

en route to the Arctic breeding grounds. Local festival planners recognized their education efforts were focused only on the two weeks while the birds were in Homer, so they began looking for a way to make the phenomenon of migration more tangible to students. How could this be accomplished? A local teacher proposed the use of E-mail to build an information-sharing network among schools located along the Pacific Flyway. Students from each stopover site would monitor the progress of shorebird migration and report their observations by sending E-mail to the other schools participating in the project. In 1994, seventeen schools from California to Alaska were connected using a basic Internet E-mail service. It was archaic and very slow, but it worked—SSSP was born! The success in the beginning and now is due entirely to the partnership among educators, students, community members, and biologists.

Today, people subscribing to the network include educators, students, biologists, wildlife refuge managers, planners, and shorebird enthusiasts. The Web site is used by thousands of people each month, especially during peak migration, and has expanded from a Pacific Flyway focus to include all major United States and East Asian-Australasian flyways. The Web site is in English, Spanish, Japanese, and Russian. The educator's guide has been translated into Spanish, Russian, Japanese, and Portuguese. Currently, people from numerous countries and most United States are involved in the SSSP program. The program is an integral part of the U.S. Shorebird Conservation Plan. In collaboration with partners, U.S. Fish and Wildlife Service researchers, managers, and educators work together to help guide this education program

toward accomplishing long-term shorebird conservation goals.

How Can My Students Get Involved in the SSSP?

- Subscribe to the E-mail Network so you can receive a monthly update on upcoming events and activities for your students, and new features on the Website.
- Visit National Wildlife Refuges and other wildlife areas to experience shorebirds in their habitat, and then share your students' observations through the SSSP Website.
- Download educational materials and activities, migratory maps, links to related sites, and shorebird photos from the program Website.
- Incorporate the activities, handouts, and shorebird information from the educator's guide *Explore the World with Shorebirds!* into your lesson plans.
- Register your school as a Shorebird Sister School through the Website.
- Send original poems, essays, and artwork for posting on the Website.
- Participate in migration tracking projects by collecting data for biologists or by tracking the migration of shorebirds on a classroom map.

Learn more, contact the Shorebird Sister Schools Program Coordinator

U.S. Fish and Wildlife Service
698 Conservation Way
Shepherdstown, WV 25443-9713
304/876 7783 (phone), 304/876 7231 (fax), sssp@fws.gov (e-mail)

Shorebird Sister Schools Program

*Vision:
The Shorebird Sister Schools Program (SSSP), through education and outreach, engages public participation in the conservation of shorebird species and their wetland, grassland, and shoreline ecosystems.*

Goals:

- Link science and education to facilitate public awareness, knowledge, and assistance in the conservation of shorebird populations in order to reverse species decline and maintain populations not declining.
- Link science and education to facilitate public awareness, knowledge, and assistance in the conservation of wetland, grassland, and shoreline ecosystems important to shorebirds throughout their range.
- Foster shorebird education throughout the major flyways in the Western Hemisphere and the Central Pacific and East Asian-Australasian Flyways.

Objectives:

- Share with all interested educators, communities and partners the tools developed for the SSSP for use with SSSP activities and other education programs.
- Work with SSSP coordinators and partners to identify and develop new tools to support shorebird and ecosystem education and the SSSP.
- Raise awareness and knowledge about shorebirds and their habitats at identified important wetlands in collaboration with National Wildlife Refuges and partners.
- Facilitate community-based shorebird conservation through schools and other youth groups that will be demonstrated by community support and involvement in the conservation of the wetland, grassland, and shoreline ecosystems.
- Promote development of projects that link shorebird populations, ecosystems, and people throughout flyways in order to connect local conservation activities to the larger hemispheric conservation effort.
- Provide opportunities for students to learn about endangered, threatened, and vulnerable species and ecosystems in their local areas.



How to Join the Shorebird E-mail Network (Listserve)

A unique attribute of the Shorebird Sister Schools Program is the active participation of shorebird enthusiasts, kids, educators, and wildlife biologists in the E-mail Network. This Network serves two primary functions:

- A forum to share ideas, educational activities, ask questions, and more.
- A monthly eNews that may include new highlights on the SSSP Website, grant information, updates on bird related issues, and more.

Everyone is invited to subscribe and post messages on education activities, shorebirds, or related topics.

The Shorebird E-mail Network is not a chat room but a system that sends a posted message to all the E-mail addresses listed in the membership. Network members subscribe to receive the free electronic mail. The Shorebird Sister Schools Coordinator monitors the communication to ensure that you receive only relevant information.

1. Computer System Requirements

- Computer: monitor, keyboard, mouse, computer (IBM clone or Apple/MacIntosh)
- An active Internet connection
- Internet browser — Netscape, SPRY, Mosaic, Microsoft Internet Explorer, etc. — some free to schools and some available commercially

2. Setup an E-mail Address

To interact with the network, you will need an E-mail address. This will allow you to send and receive mail messages from other members of the network.

3. Join the Network (Figure 1)

You can join directly from the Web site, <http://sssp.fws.gov>, by clicking on the “Get Involved” link and going to “Join SSSP” or you can send an e-mail to fws-shorebirds-request@lists.fws.gov

Figure 1

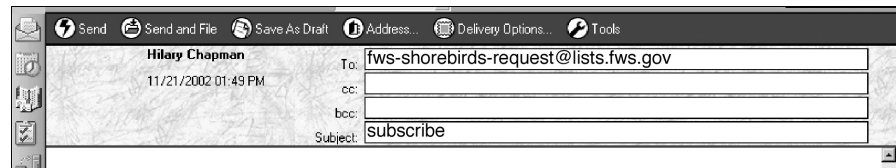
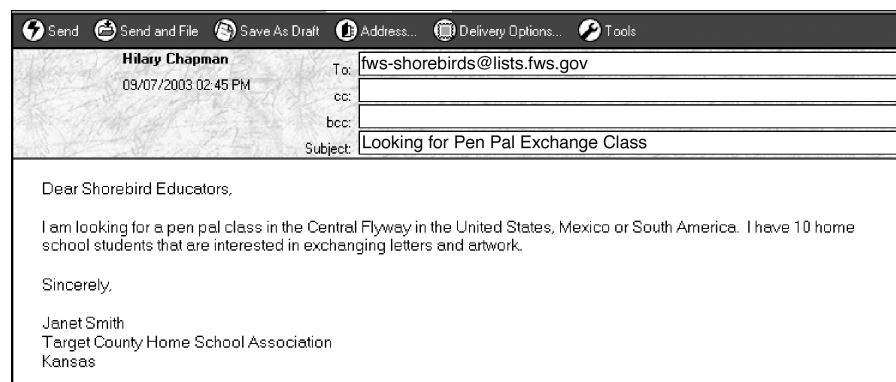


Figure 2



request@lists.fws.gov with the word “subscribe” in the subject field.

You will receive a return message saying that you have been added to the Network. If you have any trouble signing up, please contact the Shorebird Sister School Program Coordinator at sssp@fws.gov.

4. To Post (Send) a Message to the Network (Figure 2)

Send an E-mail message to the network at the address fws-shorebirds@lists.fws.gov. You can also send your message directly to the SSSP Coordinator, sssp@fws.gov, and the coordinator will post your message.

The following are some ideas on how you can use the E-mail Network:

Educators can:

- Ask for educational resources
- Ask about volunteer opportunities to help with shorebird research

- Ask for another educator interested in pan pal exchange

- Share new resources for shorebird education

- Share lesson plans and/or look for a particular lesson plan

Shorebird Conservation Organizations can post

- New Western Hemisphere Shorebird Reserve Sites
- Upcoming distance learning broadcast events
- Requests for volunteers
- Conference announcements or information
- Updates on various environmental issues such as West Nile Virus

How to Use the Shorebird Sister Schools Website

The World Wide Web can offer teachers and students all over the world a wealth of resources for learning about and sharing information on shorebirds. The Shorebird Sister Schools site at <http://sssp.fws.gov> provides information and links to enhance your students learning and allow them to more fully participate in SSSP.

Here are just a few suggestions on how you can use the SSSP Web site.

Register as a Shorebird Sister School.

By registering as a “shorebird sister school,” participants can learn about other schools, find pen pals, receive new materials, and help the SSSP Coordinator track who’s involved for program evaluation. To sign up, go to <http://sssp.fws.gov>.

Follow shorebird migration.

Through the Website you can track shorebird migration by clicking on the “Tracking” link and then “View Shorebird Sightings.” This allows you to monitor the movements of shorebirds reported by researchers, students, and volunteer participants through the Website. Use your own large wall map to track shorebird migration as reports come in via the Website.

Ask a biologist a question about shorebirds.

Through the E-mail network, students can E-mail to biologists questions they have not been able to answer through other sources.

Example Questions:

QUESTION:

Hi, my name is Susan Flores and I just wanted to ask the specific diet of Pacific Golden Plovers also known as Asiatic Golden - Plovers. Do they eat insects, fish, crabs, shrimp or something else? They do stop here in Hong Kong at the Mai Po Marshes. Thank you.

Yours sincerely,
Susan, svflores@netfront.net

ANSWER

Pacific Golden Plovers here in Hawaii tend to inhabit open, grassy areas (parks, golf courses, cemeteries). During a recent observation of them, we noted that they ate earthworms and a variety of insects. We also noted that they pecked at the ground an average of 6 times per minute in an attempt to get food. How often they were successful has yet to be determined. Hope this info is helpful. Aloha from Ewa Beach, Hawaii
Reece Olayvar, hikehi@hgea.org

QUESTION:

I was wondering if shorebird migration starts around Argentina, then they go to the Delaware Bay to eat the horseshoe crab eggs, then they go to the artic to reproduce, then what do they do when they are going back? They don't have the horseshoe crab eggs to eat, and when do they leave the artic?

Dawn Bole
boledawn@smyrna.k12.de.us

ANSWER:

In answer to your question, my understanding is that during the fall migration the shorebirds are found over a wider area and variety of habitats and eat a wider variety

of invertebrates. Clam spat found in peat banks is one item I have heard of. Probably small clams, mussels, mole crabs, etc are also consumed. Shorebirds begin leaving the artic and migrating south in August. Gregory Breese, biologist
United States Fish and Wildlife Service

Follow tracking projects.

Each year biologist tracking projects are featured. Check the Web site for opportunities to participate.

Learn how to use the Web site archives.

Give your students questions to which they must find answers in the archived E-mail messages on the Web site. For example, students could answer the following questions using the archived E-mails from Fall/Winter 2001:
Where are people from who are reporting observations of Piping Plovers? Where are people from who are reporting Red Knots? What bird are people in Hawaii observing? What birds have been seen in Alaska in the spring? What new book on shorebirds has been reported? What was reported from Russia? What banded bird was sighted and reported?

Figure 3

Hi from Anchorage Alaska and the Heritage Christian School!!

We are students with Mrs.Galvis' combined 5th & 6th grade class. We just took a field trip to Homer Alaska for the Katchemak Bay Shorebird Festival. We had a great time! We were able to view the birds as the tide was coming in and we watched as thousands and thousands of birds got closer and closer to us--Very cool!! We also had two other stations: at one we dug around in the mud and learned about the invertebrates that the shorebirds eat and the other we learned about bird banding. We would love to hear from other schools in Alaska, the lower 48 or, even better, from students from other countries. Our bird list is below.

Species sited:

Dunlin	100 - 200
Western Sandpiper	1000's
Semipalmated Plover	5
Golden-Plover	2 (probably American Golden Plover)
Black-bellied Plover	2
Dowitcher	10
Bald Eagle	2
Canada Goose	1 (flying overhead)

Date: May 5, 2000

Time: 1- 3:30 pm

Other: High Tide (coming in)

Weather: Sunny, warm in mid 50's, wind variable

Site: Mud Bay

Habitat Type: Mud flats

Food found in the mud: clams, blue mussels, Baltic macomas, worms, snails

We had a terrific time and thought that the day was interesting and awesome. We learned a lot and became a lot more knowledgeable about shorebirds. It was very worthwhile and we will encourage our families to come out and watch the shorebird migration too.
Please write back.

Sincerely,
Mrs. Galvis' 5th and 6th grade class
Heritage Christian School

**Report shorebird observations.
(Figure 3)**

Report shorebird observations from a class field trip or from your school yard by going to <http://sssp.fws.gov> "Tracking" link and click on "Report Shorebird Sighting".

Example Posting:

Find pen pals interested in shorebirds.

Use the Website to find a "sister school" for a pen pal exchange. Students can share with pen pals what they have learned about shorebirds, habitats, conservation, and also learn about each other's communities and culture. Click on the "About SSSP" and go to "Who's Participating?"

Join an Internet field trip.

Distance learning events that will bring live learning and adventure right into your classroom are posted on the Web. Click on the "Resources" link to learn about upcoming events.

Exhibit your student's shorebird projects. (Figure 4)

Send your creative writings and artwork by following the directions posted on the Web site, <http://sssp.fws.gov>, at "Get Involved" and then click on "Student Gallery." Submit a copy of the SSSP release form with your work. The release form is also available on the Web site. For photo submissions, a separate form is available on the Web and in this guide's Field Trip Planner.

Learn on the "For Kids" corner of the Web site.

Take a shorebird quiz, print coloring pages, view student artwork or photographs of shorebirds in the field, or link to other conservation Web sites especially for kids.

Shorebird Sister Schools Program

Student Gallery Release Form

Name: _____ Grade: _____

School: _____

Item type: ☐ essay ☐ poetry ☐ artwork

I grant permission to the U.S. Fish and Wildlife Service Shorebird Sister Schools Program to post my work on the Shorebird Sister Schools Web site and use in publications.

Signature: _____ Date: _____

Parent/Guardian: _____

Shorebird Sister Schools Program

Student Gallery Release Form

Name: _____ Grade: _____

School: _____

Item type: ☐ essay ☐ poetry ☐ artwork

I grant permission to the U.S. Fish and Wildlife Service Shorebird Sister Schools Program to post my work on the Shorebird Sister Schools Web site and use in publications.

Signature: _____ Date: _____

Parent/Guardian: _____

Use the chart below to help you plan how and where SSSP can fit into your program.

Integrating the Shorebird Sister Schools Program (SSSP) into Your Community:

<i>Assessment:</i>	<i>Are you a teacher?</i>	<i>Are you a non-formal educator?</i>
Where does SSSP fit into your program?	In what subject areas will SSSP meet your goals: science, social studies, math, technology, geography, English?	Does SSSP fit into the conservation goals of your organization?
What do you need to implement the program?	<ul style="list-style-type: none"> ■ Shorebird habitat area for a field trip ■ Shorebird and invertebrate knowledge ■ Field Equipment Kits for your students that contain binoculars, identification guides, and magnifying glasses ■ A spotting scope (a valuable extra) ■ Computer(s) and E-mail account to send field observation data to the Shorebird Sister Schools E-mail Network ■ Language translation assistance if you are doing an international pen pal exchange 	<ul style="list-style-type: none"> ■ Interested school or student groups ■ Integration of SSSP into organization goals ■ Shorebird and invertebrate expertise ■ A computer laptop for entering field observation data with students during the field trip (or afterward at your desk)
How to fill needs?	<p>Ask a local conservation organization to fund field trip and equipment expenses.</p> <p>Write a grant to fund field trip and equipment expenses. Many small grants are available.</p> <p>Contact a local biologist, bird club, National Wildlife Refuge, or conservation organization to provide expertise in the classroom and on the field trip.</p> <p>Team up with a computer science class or school librarian to integrate the technology activities.</p> <p>Team up with a foreign language teacher/student or a local association whose members speak the language.</p>	<p>Talk to local principals or teachers about the program. Ask which school, teacher, and/or school program SSSP might fit into. Get a contact name.</p> <p>Work with a local student conservation organization like a school biology club or Boy Scout or Girl Scout clubs.</p> <p>Gain your supervisor's support. Develop a plan to demonstrate how SSSP will help meet your institution's conservation goals.</p> <p>Work with local biologists to establish partnerships and to assist with the biological aspects of the program.</p>

¹See *Classroom Activities* section on how the *Explore the World with Shorebirds!* curriculum meets National Education Standards

Integrating the Shorebird Sister Schools Program (SSSP) into Your Community:

Assessment:	Are you a teacher?	Are you a non-formal educator?
How do I begin the program?	<p>There are many ways to integrate the <i>Explore the World with Shorebirds!</i> activities into your program. Activities, information, and field trips can be integrated into teaching units throughout the year. The example below is a very general overview focusing on two possible options:</p> <ol style="list-style-type: none"> 1. Is your unit on habitats or ecosystems? Begin with wetlands, then use shorebirds as an example of an indicator of wetland health for the students to study. Optional activities might include: <ul style="list-style-type: none"> What are wetlands? <ul style="list-style-type: none"> ■ Wetland Metaphors ■ Match the Habitat Cards ■ Seven Types of Habitat What are shorebirds? <ul style="list-style-type: none"> ■ Shorebird Profiles ■ What Makes a Bird a Shorebird? How does what you learn apply to the field? <ul style="list-style-type: none"> ■ Plan a field trip with a local environmental center that has wetlands and, if possible, shorebirds. Use: <ul style="list-style-type: none"> ■ Shorebird Field Study ■ Mud Creature Study ■ Sampling Local Shorebird Populations 2. Work with your environmental education contact at a local environmental center to plan the integration of the curriculum. Plan field trips to the center and guest speakers for the classroom to support your topics. Do pre-and post-activities from the curriculum to support the unit of study. Have your class post messages to the SSSP shorebird discussion group about what they are learning and what shorebirds they have seen. Send your postings to fws-shorebirds@lists.fws.gov. 3. Use the Educator's Guide and the Shorebird Sister School Web site (http://sssp.fws.gov) for background information and connections to other resources. 	<p>Work closely with the local school or student club that you have partnered with to implement the program. Important points to keep in mind when planning are:</p> <ul style="list-style-type: none"> ■ Tie activities to national, state, or local education standards your area schools use. ■ Work with the teacher to plan assessment activities to monitor the progress of the students. ■ Help support teachers and students in their planning and posting of messages to the SSSP E-mail Network. ■ Provide biological resource support for the teacher, giving presentations in the classroom and assistance on field trips.

Questions: Contact the Shorebird Sister Schools Coordinator at sssp@fws.gov or call 304/876 7783.

Register as a Shorebird Sister School Participant

Who can register?

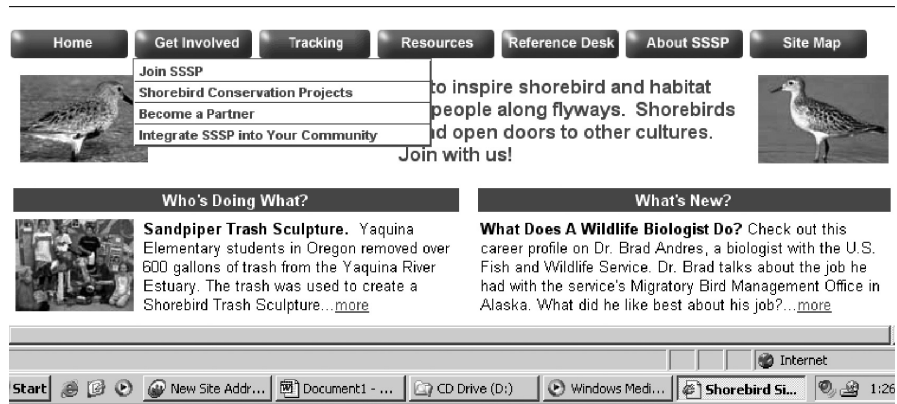
Anyone participating in SSSP can register including schools, nonformal education centers (nature centers, parks, refuges, etc), home schools, youth groups (scouts, 4-H clubs, etc), individual shorebird enthusiasts, partner agencies and organizations, and biologists.

Why register?

- You will receive new materials as they are developed.
- You will learn where other participants are located.
- You will join a network of other participants along your flyway.
- If you choose to do a pen pal exchange, this will be an easy way to find a pen pal.
- You will help support the annual reporting and evaluation process needed to continue the program.

How do you register?

Go to the Shorebird Sister Schools Website at <http://sssp.fws.gov> click on "Get Involved" and then "Join SSSP." Fill out the form provided and submit it electronically through the Web site. It's that simple!



How to Begin a Shorebird Sister Schools Pen Pal Exchange

1. Set objectives and plan your activities.

Before you begin, ask yourself “What do I want my students to learn from the exchange?” Set some reasonable objectives and then align your activities to help meet each of your objectives. For example:

Students will be able to:

- Describe two cultural similarities and/or differences between pen pal communities.

Pen pals can exchange pictures of their communities and activities and describe their daily life activities — the sports they play, their families and favorite family activities, holidays in their communities; and local weather and geography.

- Name two shorebirds in English and the languages of their pen pals.

Pen pals can exchange pictures of shorebirds from the SSSP Web site with their common names at the bottom.

- Compare the appearance of these two shorebirds when in different plumage-breeding vs. non-breeding.

Pen pals can choose two shorebird species and describe how they look when they see them in their communities and including pictures if possible.

- Describe the similarities and differences between shorebird habitat here and those in the pen pals’ countries.

Pen pals can exchange drawings and descriptions of the invertebrates and wetlands in their communities.

2. Consider logistics and follow through.

If there are not enough pen pals for each student to receive one, you may want to pair students or do one pen pal letter for the entire class. If there are more students than you can respond to from the pen pal partner school, invite another teacher to participate.

Once you commit, please follow through; otherwise the children waiting for the pen pal exchange will be very disappointed.

3. Register As A Shorebird Sister School

Go to the SSSP Web site (<http://sssp.fws.gov>), click on “Get Involved,” and then “Join SSSP.” Fill out the form and check the box for “Shorebird PenPals.”

4. Request a pen pal class.

Go to the “About SSSP” link SSSP Website <http://sssp.fws.gov>. Look at the “Who’s Participating?” link to find another group interested in exchanging pen pals. Send the group’s contact an E-mail message including the following information:

- Where your school is located: town, state, and flyway
- How many students are in your class

If you would like to exchange pen pals with another country who may not speak the same language, send an E-mail message to the SSSP Coordinator (sssp@fws.gov) asking for assistance. The SSSP Coordinator will assist in making the international contact. However, you must consider how you will handle translating the pen pals from another country into English. For example, could the Spanish class or teacher at your school assist with the translations? Is there an organization in your community that could assist with translations?

Next, establish communication with the pen pal exchange teacher.

- If possible, share your project objectives with each other. Sharing expectations will help broaden your understanding of each other and improve communication and success.

- Make sure each teacher knows how long, how often, and what will be exchanged. Remember, school year calendars can be different too!



Tips on What to Send to Your Pen Pals

Keep exchanges simple and balanced. Do not send elaborate packages that cannot be reciprocated. If you question whether or not to send an item, consider selecting something else.

Help Your Pen Pals Get to Know Each Other

Use the *Cultural Profiles* in this section to learn more about the culture, customs, and shorebird habitat in the country of the pen pal(s) with whom your students correspond.

Help your students on their first letters. Give them some ideas and guidelines on what to write and share based on the objectives you have established for the project. The first letters could focus on introducing themselves, their community and their culture. Later letters could discuss wetlands, birds, weather, and other activities.

- Send photos of the children, the local community and habitats.
- Have each student write an autobiography.

Handmade Items Are the Best

Crafts, drawings and sketches are great, especially for international exchanges, but remember that the students may not be able to translate the letters.

- Start a mural that your pen pal class could finish.

- Have students create a comic strip or board game depicting local birds and wetlands or explaining topics such as migration or conservation.

- Develop a chart depicting the average weather by month in your community and corresponding numbers of birds.

Avoid Expensive Items or Things That Require High Technology

If you want to send a video or cassette tape, ask your pen pal teacher if he or she has the proper equipment before sending it.

- Patches, buttons, and pins are easy and simple to send.
- Maps, brochures, and pictures of the local community are other inexpensive but interesting options.



Cultural Connections in a Conservation Context

What more clearly demonstrates the global scope of environmental issues than the decline of migratory bird populations? When birds migrate across political boundaries, they don't pass through customs or receive any notification that they have crossed a line on a human-devised map. Shorebirds that breed in North America migrate through or winter in no fewer than 41 countries!

When birds depend on multiple habitats, they may be at the mercy of the attitudes of the people who view them through varied perspectives. The farmer may see the birds through different eyes than the industrial worker, the politician, or the naturalist. This creates a range of personal views and behaviors that will positively and negatively impact migratory bird species.

Research has shown that populations of many long-distance migrants have declined, but most researchers have not yet shown where the greatest impact on these declining populations occurs. Is it in the United States, Canada, Mexico, or Central or South America? When the landscape is changing everywhere, it is difficult to point to one particular location that puts the birds at greatest risk. But it is clear that, if we are to conserve habitat and support the

survival of these species, we must work together across our different cultural and geographic borders. If a conservation project creates more habitat for birds in Latin America, will it make any difference if available habitat in the United States continues to decline?

Migratory bird conservation requires that we communicate with our neighbors in other cultures and countries to understand each other's perspective, what each of us values, and our varied attitudes toward birds and their habitat. Education can help us share perspectives and concerns about the issue. Research will help us understand the needs of the birds in each of their habitat areas, especially collaborative research that includes partners along the migration path. Conservation efforts that can bridge cultural and geographic gaps will be most likely to achieve the most positive results for birds. A good example is the ongoing research on the Red Knot which migrates from Tierra del Fuego, Argentina to the Atlantic coast of the United States, to the Canadian Arctic. Researchers from Argentina, the United States, and Canada are working together to understand the complex reasons for this bird's decline.

Education can facilitate awareness and knowledge about migratory birds and the diverse values and attitudes that people have toward them. Because the Shorebird Sister Schools Program is working to connect people along flyways for the conservation of shorebirds, it can help facilitate connections between cultures too.

SSSP provides several ways to learn about other cultures.

- Tips for teaching about culture background and student activities
- Cultural profiles of some SSSP partner countries (more will be posted on the Web site)
- Pen pal exchanges
- E-mail Network
- SSSP registration on the Web site
- Cultural extension for many of the activities in the educator's guide—look for this symbol!



To learn more about the E-mail Network and SSSP registration, go to the [beginning of this section](#).



List of Activities with Cultural Connections

The following activities have optional cultural extensions. Look for the symbol of the earth to quickly locate the cultural extension. Have fun learning about other cultures!

Introduction to Shorebirds

Shorebird Profiles	119
A Year In My Life as a Shorebird.	125
Get to Know the Shorebirds Puppet Show	127
Build a Shorebird.	135

Adaptations

Build a Shorebird.	135
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Habitat

Shorebird Food Webs	163
Can't We Share	186
Wetland Metaphors	202
Map Your Habitats	250

Migration

Migration Headache	286
The Incredible Journey	327
Precarious Paths	335
Birds-eye View.	343

Nesting and Breeding

Guard Your Nest	261
-----------------------	-----

Shorebird Research and Technology

You Be the Scientist	356
Imaginary Mist Nests	361

The Big Shorebird Picture

Shorebird News	377
Shorebirds on Display.	375
Shorebird Decision Dilemmas.	379
What You Can Do for Shorebirds	382

Assessment

Wild Spellers	390
Shorebird Jeo-Bird-Y	391
Shorebird Speeches and Listening Tests	397
Shorebird Bubble Map and Concept Map	401



Increasing Cultural Awareness Activity

Grade Level: upper elementary/
middle school and high school

Duration: one class period, two
optional if you add research time

Skills: vocabulary, discussion,
team building, communication,
comparison,

Subjects: language arts, fine arts,
social studies; technology optional
(if students do research)

Vocabulary: culture

Overview:

Students will study the cultural profiles in this section, present what they learn to the class, then work in pairs to compare similarities and differences between the cultures they studied.

Concepts:

- By following shorebirds movements, we can discover new places and people throughout the world.
- Following shorebird migration broadens our understanding of how we are connected to other people and places and how our actions can influence global conservation efforts.
- Culturally knowledgeable citizens demonstrate an awareness and appreciation of the relationships, processes, and interactions among all elements in the world.

Objectives:

After this activity, students will be able to:

- Define culture.
- Name two reasons it is important to understand and respect other cultures.
- List two similarities and differences between two cultures

Materials:

- Copies of the cultural profiles for each group

Note: New cultural profiles not in the educator's guide can be found on the Shorebird Sister Schools Program Web site, <http://sssp.fws.gov>.

- Atlas or world map

Introduction

How can we practice cultural sensitivity? Guidelines for teaching about cultures:

Regardless of the topic of classroom discussion, we benefit from understanding the genuine complexity of cultural viewpoints and customs among us. We have a great diversity of cultures in many of our classrooms in the United States. This is a starting point for teaching about cultural sensitivity and awareness. Cultural awareness will help students be successful as adults in interactions that will occur daily in their personal and professional lives. The common exchange of ideas, products, information, materials, and people increases the importance of being globally and culturally aware, especially in a world of tumultuous events.

Culturally sensitive teachers realize that those individuals raised in different cultures may be different but are equally human and deserving of respect. The most successful teachers:

- Practice viewing cultures and situations non-judgmentally.
- Work to uncover and neutralize their own stereotypes, biases, assumptions and prejudices.
- Teach students to view differences as wonderful features.

A common cross-cultural problem is that those with little cross-cultural experience often view those from other cultures (and their behaviors) as strange, weird or even inferior. Teachers who successfully teach about other cultures help students to appreciate the differences as unique, interesting and novel. The following activity will increase your students' cultural awareness and their understanding of the culture of other people participating in the SSSP.

Procedure

1. Present the following mini-activities below to introduce students to the importance of being aware of other cultures.

What is the importance of teaching about cultures?

The culture in which we grow up shapes the way we see things. As a quick example, what do you read below?

*A bird
in the
the hand*

If you read "a bird in the hand," you missed the second "the." Why? You saw with your mind rather than with your eyes.

Similarly, spell aloud these words:

*joke
smoke
folk
the word for the white of an egg*

If you spelled "yolk," you spelled the word for an egg's yellow, partially because the exercise led you into a pattern.

Similarly, the culture in which we grow up leads us into patterns and shapes our views toward natural resource conservation or environmental issues.

- If you grow up in a culture in which your survival depends on the birds, fish and mammals you eat, you develop a strong connection to those birds.
- If you grow up in settings and amid cultural groups in which more birds seem to live in cages than in the wild, you may find that birds appeal to you aesthetically but rank lower in priority than, say, motorcycles or lunch.

Because we feel our cultural conditioning in ways we often do not notice, we need to teach about culture so we can understand how others relate to conservation issues.

What is culture?

Culture is:

- A set of perceptions and systems with which we grow up and which we believe are true, real, and the way things should be.
- The rules for behavior that shape, color and filter how we see the world and how we interact.
- The assumptions and assigned meanings that we give to behaviors.

Your culture and cultural conditioning shapes the way in which you relate to everything in your world.

Why do we need to learn about other cultural groups?

In teams of three, brainstorm words or phrases that come to mind when you see or think about each of these words:

- Rich people
- Skinny people
- Eskimos
- Japanese people
- Egyptians
- Southerners
- Gang members
- Men
- Women

If you are like most people, certain words came to mind when you when you saw or thought about most of these nine categories; and perhaps you had no idea what to write about one or two categories. What this activity shows is that we have stereotypes about some cultural groups and occasionally no information about others. When interacting with people, it is good to keep an open mind (not let our personal biases influence what we think about others) and make the effort to understand other perspectives.

2. Divide students in teams of two and assign each team a cultural profile. Ask each team to:
 - Find where the country is located in the atlas or world map.
 - Read the cultural profile and identify five interesting aspects of that culture. Two of the team's choices must relate to shorebirds and/or the environment.
 - Present what the team has learned to the class.

Note: Interesting aspects of each culture do not have to be different from that of students. They can present aspects that are similar, such as the culture they are studying also enjoys computer games.

Optional Team Assignment: Give each team time to research its assigned country using encyclopedias and/or the Internet. In addition to the five interesting aspects in the cultural profile, ask students to include in their presentations additional information not included in the cultural profile, such as the country's national bird, popular music, sports, heroes, food, dress, etc.

3. After the presentations, assign or allow students to find a partner who studies a different culture.

Ask the students to interview their partners and identify two differences and two similarities between the cultures they study.

4. Facilitate a group discussion among the class about what they learned from each other.

Additional Activities:

1. Pen Pal Exchanges

The class can request to do pen pal exchanges with another class in the United States or in another country. Follow the directions from the "How to Begin a Shorebird Sister Schools Pen Pal Exchange."
2. Research Other Shorebird Sister Schools

Go to Who's Participating on the [SSSP Web site](#). Click on the dots representing other Sister schools. Ask students to choose three and learn the following:

 - School or group name.
 - Location (Ask advanced students to figure out in which flyway the school is located)
 - What type of shorebirds lives there and in what type of habitat?
 - One item unique to that school or group's community.

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Culture and Shorebirds of Alaska

Daily Life in Alaska

Alaska is one of the most culturally diverse areas of North America. In addition to cultures found in the lower 48 United States, many are unique to Alaska, including Indian, Unangan (Aleut), and Eskimo groups. The vast array and diversity of cultures in Alaska make for highly contrasting tales of daily life. From urban to subsistence lifestyles, Alaskans are confronted with challenges posed not only by the natural world around them, but also by changes to policies and government, both locally and nationally.

Much of rural Alaska maintains a subsistence lifestyle rooted in traditional practices from generations past. Whales, seals, birds, fish and other animals are still harvested by many rural communities. They not only serve as a food source but also play a role in many aspects of culture. Animal skins and parts may be used for clothing, cooking implements, weapons, and often in traditional ceremonies.

“Urban” Alaskans experience the typical day-to-day life of many Americans. Television, computers, Game Boys, and gadgets of all types have found a place in Alaska. Residents of urban Alaska mirror other citizens of cities with long work days, two-income families, and daycare for children. However, many Alaskans in urban areas take advantage of nearby wilderness areas, national forests, and state parks. There are many opportunities to experience nature and outdoor life within a short drive, and this increased accessibility to untouched wilderness makes for a convenient escape from typical city life. Spring and summertime are busy with the migration of fishermen to salmon-rich streams, while wintertime welcomes the swish of skis and buzz

of snowmobiles zooming along the packed snow.

Shorebirds in Alaskan Cultures

Birds play a tremendous role in the lives of Alaskans. Both traditionally and in modern times, birds are recognized as important spiritual, social, and economic natural resources. Many cultures in Alaska have a spiritual connection to birds through tales and legends passed on from generation to generation, while other groups look to birds for recreation and a means to reconnect with nature.

One example of the traditional importance of birds is found in the Tlingit and Haida cultures. The Tlingit and Haida are two of the major groups of native people living in southeast Alaska. Besides the seasonal use of bird eggs for food and other such subsistence uses, one bird in particular is known for its importance in Tlingit and Haida cultures. The raven, the largest North American passerine, or “songbird,” is a supernatural figure in their belief systems, known for its intelligence, deception, and tricks. Tlingit and Haida Indians organize their populations into two important social divisions, Raven and Eagle or Wolf. These two groups, in turn, contain many clans that are represented by various animal or mythical crests. This social organization is respectfully retained today, and one can still admire the beautiful artwork that represents these clans on the large wooden clan houses in several Southeast Alaskan towns. While most birds have some link to traditional cultures in Alaska, shorebirds have more recently been recognized as important socioeconomic resources. These marathon migrants are celebrated by several Alaskan communities through festivals and events, bringing not only awareness of the need for shorebird and habitat

conservation, but also an economic boom to host communities. The Kachemak Bay Shorebird Festival of Homer and the Copper River Shorebird Festival of Cordova, Alaska, are two examples of communities celebrating shorebirds. The spectrum of people who attend these festivals to marvel at the numbers of shorebirds includes; birdwatchers, naturalists, students, educators, families, and tourists. Shorebird festivals in Alaska continue to grow, becoming increasingly popular and serving as major attractions to residents and tourists looking to reconnect with nature through birds.

Shorebirds and Their Habitat in Alaska

Because of its size and northerly position, Alaska provides breeding habitat for more shorebird species than any other state in the U.S. Shorebirds take advantage of rocky shores along the Aleutian Islands, mudflats within Kachemak Bay and the Copper River Delta, marshes of the Yukon-Kuskokwim National Wildlife Refuge, or tundra along the northern coasts.

The diversity of habitat within Alaska is reflected in the diversity of bird life and numbers that visit the state each year. Seventy-one species of shorebirds have occurred in Alaska; 37 of them, including several unique Beringian species and Old World subspecies, regularly breed in the region. Most of these species migrate south of the U.S.- Mexico border, and one-third migrate to South America or the islands in the Central Pacific. Concentrations of shorebirds at several coastal staging and migratory stopover sites exceed one million birds; on the Copper River Delta alone, five to eight million shorebirds stop to forage and rest each spring.



Shorebird Species of High Concern* in Alaska

Pacific Golden-plover
Wandering Tattler
Whimbrel
Black Oystercatcher
Bristle-thighed Curlew
Hudsonian Godwit
Marbled Godwit
Black Turnstone
Surfbird
Rock Sandpiper Dunlin
Buff-breasted Sandpiper
Short-billed Dowitcher
Bar-tailed Godwit

** High concern means that biologists have indications these species may be declining, so they are high priority for research.*

Threats to Shorebirds in Alaska

The previous century witnessed unprecedented changes to natural landscapes throughout much of the United States. Alaska, however, remains largely unchanged with less than 1 percent of the state having been permanently altered by human settlement and activity. This is not to imply that ecosystems in Alaska are not being affected by human activities. On the contrary, the nation's demand for natural resources drives Alaska's economy, particularly development and production of oil and gas, timber and commercial fisheries. The threats posed to shorebirds by these and other activities are both real and potential. Shorebird-specific conservation issues identified in the Alaska Shorebird Conservation Plan include oil and gas development and infrastructure, marine-based recreation, mining development, subsistence harvest, and increased populations of native and introduced predators.

Shorebird Conservation in Alaska Today

To ensure the conservation of shorebirds in Alaska, a group of scientists, educators, and naturalists from various governmental agencies and non-governmental organizations formed the Alaska Shorebird Group (ASG) in 1997. The ASG was created to raise the visibility of shorebirds in Alaska, achieve consensus on needed conservation actions, and exchange information on issues, research findings, and education. The ASG provides information and conservation recommendations for Alaska to the National Shorebird Council for consideration in the U.S. Shorebird Conservation Plan.

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Culture and Shorebirds of One Canadian Arctic Province—Nunavut

Daily Life in Nunavut

Nunavut became the largest native land claim settlement in Canadian history on April 1, 1999. Because it is newly established you may not see it designated on maps. Nunavut covers a vast expanse of land—over 2-million square kilometers—one-fifth of Canada. Yet, only 27,000 people scattered over 13 communities live there! Half of Nunavut lies on the northern part of Canada's mainland, and the rest is distributed throughout a large archipelago of hundreds of islands, including Canada's largest, Baffin Island. Eighty percent of the people in Nunavut are Inuit (Native Americans).

The Inuit and their predecessors have occupied this land for the past 5,000 years. (One individual is an Inuk, two are Inuuk, and three or more are Inuit). The language of the Inuit is Inuktitut, and there are almost as many dialects as there are communities in Nunavut. Still, the Inuit dialects are similar enough so that people from Siberia to Greenland are able to communicate.

The main way to get to Nunavut is by air. Supplies such as fuel oil for heating, construction materials, and bulk food shipments are transported to Nunavut on large ships during the summer season when the sea routes are open. The only "highways" in Nunavut are the snowmobile routes that hunters follow during the winter, across frozen land and ocean to favoured hunting spots.

Changes in technology over the past few decades have brought Nunavut into the modern world. Several weekly flights link most communities to larger centers in southern Canada, such as Ottawa, Winnipeg and Edmonton. Satellite television and the Internet connect Nunavut communities to the rest of the world.

Most Inuit have experienced tremendous changes in their lifetimes. Most people over the age of forty were born in camps on the mainland. Back then, families lived in seasonal camps, camping close to where sea mammals and caribou were plentiful enough to provide them with food, clothing and shelter. Today, Inuit live in modern houses, purchase food and supplies at the local Northern Store and visit the nurses at the local Health Center when they are ill. Young people attend modern, well-equipped schools, wear brand-name clothing, play computer games and drink vast amounts of soda pop.

Despite the rapid leap into the modern world, Inuit are still firmly rooted in their culture and land. The forces of the natural environment are ever present, and the connections to wildlife are still strong. Store-bought food is prohibitively expensive for many, at least double or more than the cost of food in southern Canada. Hunting is necessary to keep families healthy. Hunting and camping are also a big part of family life. Many families, from infants to elders, head out "on the land" for weeks at a time, beginning in the glorious month of June when the sun does not set north of the Arctic Circle.

Birds in Inuit Culture

In a culture where wildlife has been the key to survival for thousands of years, there is a strong connection to birds in general. Birds appear frequently in Inuit art, in distinctive and colorful prints and in sculpture. People believe that birds must be respected. Making fun of birds invites the risk that the birds will get back at those who mock them.

When a child caught his first bird, he would give it to the midwife who assisted at his birth. Children, especially boys, learn to hunt at a very young age in Nunavut. Killing

small animals (such as birds and ground squirrels) with rocks is a way young boys learn to practice their hunting skills before they move on to larger animals. Many adults take pleasure (and pride) in watching their young people develop these skills, so the practice is not discouraged.

To have thrived in the arctic environment for as long as they have, Inuit had to be innovative and self-sufficient. The inflated skins of duck feet became children's toys. Containers were built of dried-out, inflated bird feet, sewn together, claws and all. The skins of Gulls or Ptarmigan were made into hand towels used after butchering and eating. Bird wings became brooms, used to sweep out debris from sod houses, and they are still in use today in tents, homes and boats. In the Belcher Islands in southernmost Nunavut, Inuit used bird skins to make parkas when there were not enough caribou skins available.

Migrating birds signal the approach of spring, which is eagerly anticipated by everyone. People will often call their local radio station with great excitement to announce the first sighting of a snow bunting in their community.

Shorebirds and Their Habitat

Most of Canada's nearly 40 species of shorebirds breed almost exclusively in or near the Arctic. Arviat and Coral Harbor are two locations in Nunavut where shorebirds may be seen. Many of these species, particularly the long distance migrants, are in decline. The Buff-breasted Sandpiper is perhaps the only "species of concern" at this time.

Shorebirds are important in the tundra food web. They feed on small invertebrates and in turn are prey for foxes and weasels, owls and hawks.



Shorebird Conservation in Nunavut

Today, the Nunavut government struggles to fill job vacancies for several reasons. Many Inuit have received very little education. There is also a lack of housing in the territory. This is causing all government programs, including biological programs, to suffer. While time, patience and perseverance are needed, there are still many reasons to be optimistic.

Efforts are underway to incorporate the worldview and experience of Inuit into the school programs and educator's guide imported from southern Canada. There is currently no specific "bird" education in Nunavut schools, but this will change in the coming years, especially in communities with large concentrations of migrating or nesting birds. The talented and dedicated personnel at the Nunavut Department of Education, located in Arviat, are progressive and open to new ideas.

The Canadian Wildlife Service (CWS) is actively working to conserve wildlife, including shorebirds in the Nunavut region. More information is needed about arctic-breeding shorebirds to determine how best to conserve them. Preliminary data suggest that 80 percent of Arctic-nesting shorebirds are declining. CWS has developed a Northern Shorebird Conservation Strategy to help conserve these birds. As part of the strategy, CWS is doing shorebird research to learn more about the shorebirds and their habitat. Researching these birds in the vast area of Nunavut is a challenge. Biologists only have the short summer breeding season to study the birds each year. Also, because of the very large size of Nunavut and the few people who can do this work, CWS biologists are only able to study small portions of the region each year.

Shorebirds of Nunavut

Black-bellied Plover
Semi-palmated Plover
Common-ringed Golden-Plover
Lesser Golden-Plover
Ruddy Turnstone
Dunlin
Pectoral Sandpiper
Least Sandpiper
Baird's Sandpiper
Purple Sandpiper
Buff-breasted Sandpiper
Semi-palmated Sandpiper
Stilt Sandpiper
White-rumped Sandpiper
Red Phalarope
Northern Red-necked Phalarope

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More Info on Nunavut:

<http://www.gov.nu.ca/Nunavut/>

View Map:

<http://www.gov.nu.ca/Nunavut/English/about/>

Culture and Shorebirds of Hawai`i

I. Daily Life in Hawai`i

The residents of the islands of Hawai`i are literally worlds apart from the rest of the nation, isolated in the huge Pacific Ocean. With a cultural diversity to rival New York City, the islands are truly a thriving melting pot. So different are the lifestyles, you can see the hustle and bustle of the Asian and Mainland cultures and still be laidback with true islander style. Island life reflects many different races living together and mixing their foods, cultures and views of the natural world. The “plate lunch,” a popular local dish, is a good example of the blending of cultural cuisines with rice, macaroni salad, and a meat dish such as teriyaki chicken. Another example of this cultural mix is the local “Pidgin” English which combines Hawaiian, Chinese, Japanese, Filipino, Tahitian and other Pacific Island languages with English.

In a climate so moderate, it is easy to see why most people here tend to be healthy and active. Sports like soccer, baseball, football, volleyball and surfing are enjoyed year-round. The toughest part is going to school on a beautiful day in paradise! Schools add Hawai`i flavor to the classroom with cultural activities and marine science field trips. When one goes about their day in a living laboratory it is easy to see all aspects of this amazing ecosystem and watch the changes that occur with each season. Only here can you be drenched by rain in the rainforest mountain tops or baked by the hot and arid sun on the lava fields all in the same field trip.

Most kids have seen the movie **Lilo & Stitch** and while there is disagreement with the portrayal of locals in the movie, the essence of `OHANA, family in Hawaiian, really stands clear. The family unit is a very strong bond in Hawai`i. With the high cost of land and basic necessities, extended families must pool their resources to afford to live in their island home. Families stay close by and help each other out. Calabash families, which include good friends and extended family, are the norm in Hawai`i. Everyone is “Uncle” and “Auntie” and you always kiss your family on both cheeks when you see them! Here, ALOHA is more than a word, it is a way of Life.

II. Shorebirds in Hawaiian Culture

Shorebirds have been coming to Hawai`i for thousands of years, long before humans had discovered the beauty and richness of these islands. In fact, some people think that the Kōlea (the Pacific Golden-Plover) led the first people to Hawai`i. Shorebirds have rich traditions in Hawaiian culture, songs, chants, and legends. Native Hawaiians were familiar with these yearly visitors, and found them both mysterious and beautiful. Come share the songs, sayings and legends of these beloved shorebirds of Hawai`i!

“Kōlea Kau āhau, a uliuli ka umauma ho`i i Kahiki” means the “plover that perches on the mound, waits till his chest darkens, then departs to foreign places.” Kōlea are one of the most common shorebird on the islands, “vacationing” here during the fall, winter, and spring, then departing for the short Arctic summer to nest.

Kōlea, ‘Ūlili (Wandering Tattler) and ‘Akekeke (Ruddy Turnstone) are considered messengers of the gods according to Hawaiian legends.

Kāhuli aku was an old chant about Kōlea and the singing tree snails of legend (the Kāhuli or shell). That chant is now a classic children’s song, much like “Ring Around the Rosy”. The snails chirp in the evening and ask the birds (Kōlea) to bring them a drink of water. Here is their song:

Kāhuli aku

Kāhuli aku	Turn little shell
Kāhuli mai	Turn this way little shell
Kāhuli lei `ula	The tree shell is a red ornament in
Lei `ākōlea	The lei of the `ākōlea fern
Kōlea, Kōlea	Little bird, little bird
Kī`i ka wai	Go down to the stream
Wai `ākōlea	Sip the sweet nectar
Wai `ākōlea	From the `ākōlea fern

III. Hawaiian Shorebirds and their Habitat

The migratory shorebirds that visit Hawai`i nest in the Arctic regions of Alaska, Canada, and Siberia. In the fall they migrate to warmer areas. Birds may stop and winter in the Hawaiian Islands or they may continue flying south. Some shorebirds travel as far as the South Pacific, South America, New Zealand and Australia.

We know the shorebirds that are commonly found in Hawai`i by slightly different names. Try to pronounce them, if you dare!

Hawaiian Name	Phonetic Spelling	Meaning	Common Name
Kōlea	ko-lay-ah	“one who takes and leaves”	Pacific Golden-Plover
`Ūlili	oo-lee-lee	sound of it’s call	Wandering Tattler
`Akekeke	ah-k-k-k	sound of it’s call	Ruddy Turnstone
Huna-kai	hoo-na-kie	“sea foam”	Sanderling
Kioea	key-oh-ay-a	Also the name of a Hawaiian forest bird with a very long decurved bill; they are now extinct	Bristle-thighed Curlew
Ae`o	ay-oh	“one standing tall”	Hawaiian Stilt

While in the Hawaiian Islands, shorebirds are found from the Big Island of Hawai`i to Kure Atoll Wildlife Sanctuary. Most of Hawai`i’s wetland habitats have been drained for housing, agriculture and other land uses. Did you know that Waikiki, on the island of O`ahu, used to be a huge coastal marsh? National Wildlife Refuges (NWR) such as Kealia Pond NWR and James Campbell NWR provide a safe haven for multitudes of shorebirds to enjoy. For a map and description of the little known, remote islands of Hawai`i go to <http://pacificislands.fws.gov/wnwr/nwrindex.html#hawaii>.

Shorebirds like the Kōlea and `Ūlili are common visitors each year, seen in large numbers around the islands. However species like the Kioea (the Bristle-thighed Curlew) are anxiously anticipated in small numbers each year. They usually spend time in the northwestern Hawaiian islands, all of which are protected as NWRs or State Wildlife Sanctuary. Once young Kioea find an island home, they will live there for three years, without migrating! Unusual for shorebirds, the Kioea molt most of their flight feathers simultaneously. Some birds are even flightless for up to two weeks as they await new flight feathers.

The Hawaiian Stilt, Ae`o, is one of the rare and endangered waterbirds found elegantly wading in Hawaiian ponds, mudflats and marshes. It is considered endangered because of low population numbers. The Ae`o is closely related to the Black-necked Stilt on the mainland but is found only in the Hawaiian Islands. They are permanent residents throughout the main Hawaiian Islands, except Lāna`i and Kaho`olawe. In 1985, all of the main islands were searched for Ae`o, resulting in a total population of 1,200. Now the numbers have increased slightly to approximately 2,000. Historically, this bird has suffered from hunting, predation by non-native animals like mongoose and rats, and habitat loss.

IV. Shorebird Education in Hawai`i

In addition to managing the Shorebird Sister Schools list serve, curriculum and lending box, the USFWS has created an educational packet with information focusing on the shorebirds found in Hawai`i including the more common Pacific Golden-Plover, Bristle-thighed Curlew, Sanderling, Ruddy Turnstone, and Wandering Tattler. It gives educators and students an overall idea of the types of birds that spend all or some of their lives in the islands. We have chosen to highlight the Pacific Golden Plover because they are so easy to observe, often occurring in our neighborhood school grounds!

Kōlea Watch, a very active research project, focuses on the amazing migration of Kōlea to Alaska and gives our young students an opportunity to engage in “real” research. This project was founded by the University of Hawai`i, Mānoa to connect current scientific researchers and kids throughout Hawai`i. Since 1978, scientists have been banding Kōlea in Hawai`i and Alaska. During that time, they discovered that Kōlea leave O`ahu every year around April 25, give or take a couple of days. Now we are trying to determine if the birds leave on the same day from other islands? To find out more about this project, check out the web site at www.hawaii.edu/bird/ or stay tuned to the SSSP list serve, we post regular updates on the Kōlea project there.

Culture and Shorebirds of Paraguay

Daily Life in Paraguay

Paraguay has two official languages, Spanish and Guaraní. The inhabitants of the eastern region prefer to speak Guaraní (the native language) and those living in the western region, or the Chaco, speak various other native languages that differ from Guaraní. Even though there are many other native languages spoken here, it is possible to communicate throughout the country in Spanish.

Because of the diversity of social conditions in Paraguay, it is difficult to describe a typical day. Yet it is fair to say that children living in the interior of the country are more connected with nature than those living in the cities. In order to get to school, many children have to cross streams, countryside, and small forests, giving them opportunities to become familiar with many wildlife species. After about five to seven hours in school, students play or do small chores outside where

they again have a chance to learn a great deal about their local wildlife.

In contrast, children who live in the capital spend more time watching television, going on the Internet, and playing computer games after school. The birds living around the city often pass by unnoticed by people who live there.

Shorebirds in the Paraguayan Culture

The majority of native birds can be identified by a specific name in the native language. Shorebirds found only during one part of the year in our country have the Guaraní name mbatui and almost always appear gray in color due to their nonbreeding plumage.

The Paraguayan culture has a lot of myths and legends that surround birds in general. The presence of some birds is said to predict rain, pregnancy, hidden love, or death. Many birds are said to be mythic

characters that were transformed into birds. For example, one bird has the Guaraní name *el kuarahy memby*, meaning “child of the sun.”

Although there are not any known rituals, festivals, or customs specifically associated with shorebirds, migratory birds in general get special recognition. Each year in October, the Guyra Paraguay Association organizes an international festival of birds.

Shorebirds and Their Habitats in Paraguay

Migratory shorebirds are found in the greatest numbers at the Bay of Assention and the lagoons of Chaco Central.

The Bay of Assention is known globally as a conservation site for birds. Here you can find 26 species of migratory birds that breed in the Northern Hemisphere. The largest congregation of the rare Buff-breasted Sandpiper is found here.

Shorebirds of Paraguay

<i>Scientific Name</i>	<i>Spanish Name</i>	<i>English Name</i>
Common Shorebirds		
<i>Pluvialis dominica</i>	Mbatuirusu	American Golden-Plover
<i>Trioga flavipes</i>	Pitotio chico	Lesser Yellowlegs
<i>Trioga solitaria</i>	Mbatuitui	Solitary Sandpiper
<i>Actitis macrura</i>	Playero manchado	Upland Sandpiper
<i>Bartramia longicauda</i>	Mbatui flu	White-rumped Sandpiper
<i>Calidris fuscicollis</i>	Playerito rabadilla blanca	Pectoral Sandpiper
<i>Calidris himantopus</i>	Playerito pectoral	Stilt Sandpiper
<i>Phalaropus tricolor</i>	Falaropa comu'n	Wilson's Phalarope
<i>Calidris aplina</i>	(need Spanish name here)	Dunlin

Endangered Shorebirds

<i>Numenius borealis</i>	Playero esquimal	Eskimo Curlew
<i>Tryngites subruficollis</i>	Playerito canela	Buff-breasted Sandpiper



At the Lagoons of Chaco Central, 64 migratory species have been sighted. The latest census counted 47,500 birds and 21 species, including a group of 25,000 Wilson's Phalaropes and 2000 flamingos. Lagoon of Chaco Central is also home to the largest number of Dunlin in the interior of South America. As many as 4000 White-rumped Sandpipers, 1 percent of the entire global population, have been counted here.

Shorebird Conservation in Paraguay

Unfortunately, shorebirds, and wildlife in general, are not nationally recognized as important. The principle threats facing shorebirds in Paraguay today are the same threats facing shorebirds all over the world--loss of biodiversity and loss of habitat. The expansion of agriculture, the clearing of forests for production of coal, expansion of transportation systems, air pollution, and channelization of lakes all present severe and immediate threats for migratory birds of Paraguay. In general, there is little social support for the conservation of biological diversity and even less for conservation of migrant species. At this time the government supports socio-economic development at the expense of nature.

However, there are organizations like Guyra Paraguay that are working for the protection of migratory birds in Paraguay. Since 1999 a database tracks numbers and species that use sites designated as conservation areas for shorebirds. Today, Guyra Paraguay is working on management plans for these conservation sites and educational activities that build awareness and support for conservation.

Suggestions for Pen-Pal Programs

A student exchange would be an excellent way to motivate individuals to understand and conserve shorebirds and share knowledge. Try initiating activities that promote interest in the observation of migratory birds or that create bird observation programs for children during school and afterwards. Contact Guyra Paraguay at the address below to facilitate a pen-pal program.

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Culture and Shorebirds of Argentina

Daily Life in Argentina

Most people living in the capital city of Argentina have little contact with nature. City kids spend most of their time watching TV. Their favorite TV programs are cartoons, science fiction movies, and series.

However, the situation is different throughout the rest of the country. In the small cities, children spend most of the day in contact with nature. This helps them to become more involved with and caring toward the environment.

Today, Argentina is going through hard economic times. Few people are able to invest their time and their money to promote “ecotourism.”

Shorebirds in Argentinean Culture

Bird-watching is not developed in Argentina, although there are some small bird-watching groups like the *Foundation for Wildlife* and the *Shorebird Sister Schools Program*. These organizations promote special celebrations such as

International Migratory Bird Day (first Saturday of October), which often coincides with the arrival of migrating birds to each region, and Beach Cleaning Days.

These celebrations have taken place in Rio Grande (Tierra del Fuego) and San Antonio Oeste (Rio Negro) for four years. They include a beach-cleaning campaign, bird-watching trips, and activities to teach about birds. It is common for the entire community to participate in the special activities. Parents, kids, and teachers join wildlife biologists and conservation officers on the beaches to welcome the birds back from their long migratory trips.

Argentina’s Most Important Shorebird Sites

Litoral Marítimo Bonaerense, Bahía de Samborombón

More than 100,000 shorebirds live here each winter. It is a resting and feeding place for

large concentrations of Hudsonian Godwits.

■ *Reserva Costa Atlántica de Tierra del Fuego*

More than 500,000 shorebirds live here each winter. This is an important site for large concentrations of Nearctic non-reproductive shorebirds, especially Red Knot, White-rumped Sandpiper, Sanderling and Hudsonian Godwit.

■ *Bahía de San Antonio Oeste*

More than 100,000 shorebirds feed and rest here for the winter. This area is a rich fish-spawning ground, abundant in clams and mussels. Here you will commonly find Red Knot, White-rumped Sandpiper, Hudsonian Godwit, American Golden-Plover, Greater Yellowlegs and Lesser Yellowlegs.

Shorebird Conservation in Argentina

Many institutions work toward

Shorebirds Common to Argentina

<i>English Name</i>	<i>Scientific Name</i>	<i>Spanish Name</i>
Red Knot	<i>Calidris canutus</i>	Playero rojizo
Hudsonian Godwit	<i>Limosa haemastica</i>	Becasa de mar
White-rumped Sandpiper	<i>Calidris fuscicollis</i>	Playero de rabadilla blanca
Sanderling	<i>Calidris alba</i>	Playerito blanco
Ruddy Turnstone	<i>Arenaria interpres</i>	Vuelvepiedaras
Baird’s Sandpiper	<i>Calisris bairdii</i>	Playero de rabadilla parda
Two-banded Plover	<i>Charadrius falklandicus</i>	Chorlo de doble collar
Collared Plover	<i>Charadrius collaris</i>	Chorlito de collar
Black Oystercatcher	<i>Haematopus ater</i>	Ostero negro
Rufous-chested Dotterel	<i>Zonibyx modestus</i>	Chorlito pecho canela
Magellanic Oystercatcher	<i>Haematopus leucopodus</i>	Ostero austral



the conservation of the natural environments migratory birds depend upon. Government and non-government organizations, museums, universities, and national and provincial parks bring people together to watch, record information, band, and monitor bird populations. These groups also train environmental educators so that they can teach environmental conservation to the people in their own community.

There are also worldwide-known institutions that affect the health of the natural resources of Argentina. Law also influences the conservation of the natural environment.

Threats to Migratory Shorebirds Along the Atlantic Coast

Pollution is one of the main threats shorebirds face in Argentina today. Other threats to include tourism, degradation and loss of habitat, wild dogs, agriculture, and climate change.

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Cultural Profile of Japan

Daily Life in Japan

As in the United States, a lot of children's time is spent on TV, computers, and computer games like Pokemon, replacing time spent outside connecting with nature. In fact, Pokemon is a Japanese creation by the computer game company Nintendo. Children these days are not getting important outdoor experiences like swimming in the sea, watching birds, catching worms, and hiking in the mountains. Some educators in Japan are now working with the school system to connect kids to their local environment.

Regarding pen pal exchanges, the Japanese school year begins in April and ends in March.

Shorebirds in Japanese Culture

The number of people in Japan who enjoy bird-watching seems to be decreasing gradually. It is safe to say that young people today do not have much of an interest in bird-watching. This is the case for other nature-related activities too.

Even among birders, shorebird-watching is not especially popular because the birds are relatively

difficult to identify. The birds are seen only in their winter plumage or when they are just beginning to molt into their breeding plumage. The few shorebird enthusiasts who do understand how amazing shorebird migration is greatly enjoy watching these birds.

In Japan, birds are categorized as chidori. Most Japanese people are familiar with the term "chidori" since we call a kind of pattern or design called a "chidori pattern." When a drunken man or woman walks in a zigzag pattern, they say that he or she is doing a "chidori walk." The word "chidori" can also be found in traditional Japanese songs, which may show that Japanese people in past generations were more familiar with chidori than the Japanese of today.

Shorebirds and Their Habitats in Japan

Japan is in the East Asian-Australasian shorebird flyway. Shorebirds born in Siberia or Alaska fly to wetlands in Japan, Korea, and China to rest and feed in the course of their long distance migration. Some species of shorebirds such as Dunlins

and Grey Plovers stay in Japan in winter, but most shorebirds fly further to southern wetlands in the Southeast Asian countries, Australia and New Zealand. Shorebirds can be seen throughout Japan, both in the northernmost and southernmost parts of the country, where they can find good wetlands with a variety of creatures to feed upon such as crabs, long worms, clams and others.

One endangered species that is rarely seen in Japan is the Spoon-billed Sandpiper. During fall migration of 2002, a few Spoon-billed Sandpipers appeared in Japan, and enthusiastic birders went to the tidal flats to view them.

Important Shorebird Sites in Japan

Six East Asian-Australasian Shorebird Network sites have been designated so far:

- Yatsu tidal flat in Chiba prefecture
- Tokyo Port Bird Sanctuary in Metropolitan Tokyo (artificially-created wetland)

Some Shorebirds in Japan

Dunlin	Sanderling	Red-necked Stint
Grey Plover	Common Sandpiper	Mongolian Plover/Lesser Sand Plover
Grey-tailed Tattler	Little Ringed Plover	Terek Sandpiper
Ruddy Turnstone	Kentish Plover	Eurasian Curlew
Whimbrel	Great Knot	Far Eastern Curlew
Bar-tailed Godwit	Pacific Golden Plover	Common Greenshank
Latham's Snipe	Common Redshank	Common Snipe
Eurasian Oystercatcher	Greater Painted-Snipe	Black-tailed Godwit



- Osaka Nanko Bird Sanctuary in Osaka City (artificially-created wetland)
- Yoshinogawa River estuary in Tokushima prefecture
- Kashima shingomori tidal flat in Saga prefecture
- Manko estuary in Okinawa prefecture

This is a short list of the many other important shorebird sites not yet included in the Shorebird Network:

- Banzu tidal flat at the mouth of river Obitsu in Chiba prefecture
- Fujimae tidal flat in Nagoya city
- Hakata Bay in Fukuoka prefecture
- Sone tidal flat in Fukuoka prefecture
- Daijyugarami tidal flat in Saga prefecture
- River mouth of Kumagawa in Kumamoto prefecture

Yatsu, Manko, and Fujimae are designated as wetland sites of international importance.

Shorebird Conservation in Japan

Japanese people, in general, do not know much about shorebirds. Shorebird education is one of the keys to the success of shorebird conservation. Shorebird education should be provided not only to children, but also to adults. Japan's shorebird education programs is adapted from the Shorebird Sister Schools Program in the United States and is proving to be a useful way to raise public awareness. We are working to encourage people from different groups (schools, government, bird-watchers) to become involved in wetlands conservation in their local communities.

Shorebird-monitoring (surveys) is carried out by biologists and bird-watchers. The information gathered from monitoring is very important for determining what wetlands to protect. So far, biologists have determined, based on the survey information, that 70 wetlands meet the criteria for the shorebird site network. Biologists also band birds to learn where the shorebirds go when they leave Japan.

Threats to Shorebirds and Their Habitats in This Flyway

In the years after the Second World War, 40 percent of tidal flats in Japan had already been turned into lands for agriculture, housing, and factories. Today there are some large scale plans for wetland restoration.

“Restoration,” along with “conservation,” has become buzzwords in Japan recently. We understand that carrying out “restoration” is not an easy task. Many wetlands have been damaged, so the restoration of wetlands cannot be done haphazardly or quickly; it must be done with care and attention.

Habitat loss in China, Korea, and some Southeast Asian countries may become more critical in the future. These countries, in particular China, are developing at an extremely rapid pace.

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SSSP Mexican Culture Profile

Historical Background

Native indigenous cultures have inhabited Mexico for thousands of years. Their traditions, languages and culture in general, have been passed from generation to generation. Mexico has also been invaded by many other countries, such as Spain, that have introduced their language, religion, and culture into Mexico's indigenous culture. As a result, Mexico is a melting pot of many different cultures. In Mexico, each person's relationship with the environment varies according to the habitat, culture, social-economic status, and traditions of each specific place.

Daily Life of a Child in Mexico

Children in rural areas are often more in touch with nature. Nature is part of their daily routine. Often they have chores to do before going to school, some help to milk the cows others take care of the chickens or feed the animals, others have to go fetch water from nearby rivers or wells. There are no Nintendo games or endless TV watching.

Children in cities suffer from the same technological disease as those in the rest of the world. Children have electronic games and watch lots of television. Many do not have chores to do. Many city children have never seen a cow and often think that milk comes from a package and money from ATMs.

Environmental education is now part of school curriculum for first through sixth grades. But, students do not yet go on many field trips to learn about their local habitats.

Mexican Perceptions of Birds

The bird-watching movement is fairly new. Environmental education and knowledge of birds has been increasing over the past two decades. Birders and ornithologists (biologists who

study birds) have been training indigenous or local people in wildlife conservation and bird observation. Conservation activities have also become alternative income. Local people serve as guides and guardians of their own environment.

Common names for birds vary according to each language and area within Mexico, for this reason ornithologists always refer to birds using their scientific name. Some, like the Mexican people Amuzgos, call most birds of prey "eagles" and all the songbirds and parrots "real birds." Native indigenous people know birds according to their own observations. The first thing they are likely to tell you is whether a bird is edible or not, and whether it is a good or bad omen.

Basically a "good" bird is one that they can get some benefit from. In the Mexican state of Oaxaca the Amuzgos will eat doves and ducks, besides domesticated birds like chickens and turkeys. In Michoacán, the Nahuas will eat Chachalacas (*Ortalis poliocephala*) all year round, some doves and pigeons (*Columba flavivestris*, *Zenaidura macroura*, *Columbina passerina*), and a few cormorants and ducks (*Phalacrocorax* spp. and *Anas* spp.). Not all cultures like the same birds. In the coast of Michoacán, for instance, people scare away or kill Orange-fronted parakeets (*Aratinga canicularis*) because they eat the corn crops.

Some birds are regarded as "bad" or pests, such as crows and grackles that eat corn and woodpeckers and orioles that eat fruit. Cowbirds and blackbirds are other bird pests that come in such great numbers they look like "black clouds." On the coasts, some fishermen consider some sea birds as competitors to their fishing livelihood. For example, in

La Mancha, in the Mexican state of Veracruz, fishermen believe the large numbers of cranes and egrets are problems.

Some cultures have traditional beliefs attached to birds. For many people owls represent a bad omen. There is even a popular saying that "Cuando el tecolote canta, el indio muere" (when the owl sings, the Indian dies). Hummingbirds are used as charm amulets or for love remedies. Road-runner broth is said to heal pains and problems in the legs.

Birds have been part of the Mexican culture for thousands of years. In most Mexican cultures, there are folklore songs and dances which have birds as their main theme. Some describe the bird's courtship, some their flight or even their migration. Even the very foundation of Mexico is linked with a bird. The legend goes that the wandering natives were told by their God to settle down in the place where they will find a golden eagle eating a snake on top of a cactus in a middle of a great lake. This scene is represented over and over again in the Mexican flag, currency, and government seal.

Mexican Shorebirds and Their Habitat

Mexico is a very biologically rich country. It has more species of plants and animals than the United States and Canada put together. Forty-seven shorebird species migrate through, breed, or spend the nonbreeding season in Mexico. It has been estimated that one third of the shorebirds wintering in the Pacific Coastal region of North America occur in two bays in the state of Sinaloa: Ensenada Pabellones and Bahía Santa María. The former hosts nearly ten percent of the world population of American Avocets (*Recurvirostra americana*) during the winter. Moreover, 50

percent of North American Pacific Coast Snowy Plovers, (*Charadrius alexandrinus*) nest in Baja California.

Shorebirds are found along both coasts, the Atlantic and Pacific, as well as within the inland states of Chihuahua, Durango and Jalisco. On the West Coast the major shorebird areas are located in Baja California, and in the states Sinaloa and Nayarit. On the East coast shorebirds are found along the coast during the winter migration and all year round in the Yucatan peninsula.

The following categories of shorebirds are present in Mexico:

- Resident (For example: Snowy Plover, *Charadrius alexandrinus*, Northern Jacana, *Jacana spinosa*)
- Short distance migrants (For example: Mountain Plover, *Charadrius montanus*, American Avocet, *Recurvirostra americana*),
- Intermediate-distance migrants (For example: Western Sandpiper, *Calidris mauri*, Long-billed and short-billed dowitchers, *Limnodromus* spp.)
- Long distance migrants (For example: Pectoral Sandpiper, *Calidris melanotos*, and Stilt Sandpiper, *Calidris himantopus*)

Shorebird Conservation in Mexico Today

The most serious threat for shorebirds in Mexico is habitat destruction. There have been several attempts to protect shorebirds by conserving the habitat for all birds. One of the most important tools to protect wetland sites in Mexico is to declare them as wetlands of international importance by the Ramsar Convention (www.ramsar.org). In addition, shorebird experts have been meeting in Mexico to work on the Mexican Shorebird Conservation Plan whose goal is “to provide for the life cycle needs of shorebirds that utilize habitats in Mexico.”

To the public, there is no real distinction of shorebirds as a separate group. People only have some understanding of shorebirds in the few places where they winter or stop over. This is due mainly to the work of biologists or conservation organizations working in these places. A focus on shorebird education in Mexico is fairly new. Though general bird education has been going on for a longer time in the states of Michoacan, Veracruz, Chiapas, Guanajuato and elsewhere.

The Shorebird Sister Schools Program (SSSP) began in 1997 along the East Coast of Mexico. The Institute of Ecology started SSSP in the La Mancha basin area in the State of Veracruz. Seven

elementary schools from different municipalities in the La Mancha basin were involved as well as another rural school in Xalapa. In 1998 the first shorebird festival was organized by the Institute of Ecology at the La Mancha research center CICOLMA. Since then the festival has taken place every spring on a weekend in March or April. For information about the dates and activities of the La Mancha Shorebird Festival contact Gudelia Salinas (gudelia@ecologia.edu.mx) or Dr. Patricia Moreno (patricmo@ecologia.edu.mx), coordinators of the La Mancha project.

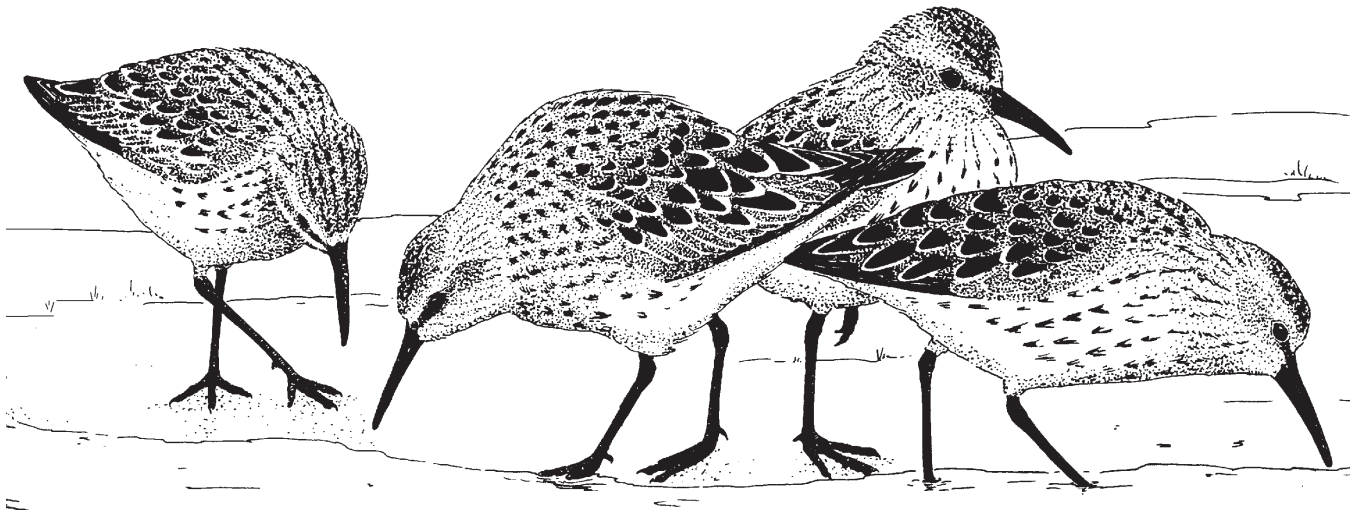
Some biologists and environmental organizations in the states of Sinaloa and Nayarit, along Mexico's Pacific Coast, are beginning to organize shorebird festivals. Also, some teachers in the state of Nayarit are getting their schools involved with shorebird education and conservation by working with local groups and the Shorebird Sister Schools Program.

Written By Yuriria Blanco-Castillo, M.Phil

A Shorebird Primer for Educators

What Makes a Bird a Shorebird?	56
General Characteristics of Shorebirds	59
North American Shorebird Families	60
How to Identify Shorebird Species	61
Shorebirds Depend on a Chain of Healthy Habitats	63
Shorebird Adaptations	65
Magnificent Shorebird Migration	68
Shorebird Migration Flyways	70
The Shorebird Flyway in Your Backyard	72
Pacific Flyway	74
Atlantic Flyway	76
Central Flyway	78
East Asian - Australasian Flyway	80
Central Pacific Flyway	81
Shorebird Nesting and Breeding	82
Threats to Migrating Shorebirds	85
Shorebird Conservation — A Hopeful Future	88
Shorebird Technology and Research	92

What Makes a Bird a Shorebird?



“We are utterly convinced that shorebirds are among the most interesting, puzzling and challenging of all life forms. They offer a delightful spectacle—agile, exciting, unpredictable, beautiful, and tantalizing.”

—Des Thompson and Ingvar Byrkjedal, *Shorebirds*

Habitat

Birds of Open Land

Land and water—they are the two most basic geographic features of the Earth’s surface. What happens along the narrow lines where these two great bodies meet? This fragile strip, whether inland along the edge of a lake or river, or between ocean and the beach, contains some of the greatest variety of living organisms, or *biodiversity*, on our planet. The narrow strip where the two meet is called the *shore*. This part of the land is enriched by life-sustaining water, yet must also endure powerful daily and seasonal natural forces created by water. Water levels can change through natural events—such as periodic flooding, drought, evaporation, and fluctuation of tides, and through human-caused-mechanical release of water from dams or planned water drawdowns. These modifications of water level affect water properties such as salinity and other chemical composition. These, in turn, affect the plant and animals species that can live there.

Organisms that live in this precious environment are built to live in these variable conditions. *Shorebirds* are a group of birds

especially *adapted* to thrive in these areas. Rather than characterizing this group of birds as “shore-living,” they are more accurately described as “birds of open land” because of the wide range of places they are found. For example, shorebird habitat includes estuaries, mudflats, grasslands, tundra, alpine areas, and shorelines.

Migration

Most Shorebirds Migrate Long Distances

Each spring and fall, enormous flocks of shorebirds swarm along the coasts in great *migrations*. It is a thrilling sight when the shore comes alive with feeding birds, or a flock swiftly wheels and turns in flight. These flocks pulse to and fro with the cycles of the tides, and on a broader scale, with the cycles of the seasons. Shorebirds eat, breed, travel, and rest as a part of these cycles of nature.

Shorebirds are one of the most migratory groups of animals on the planet. Of the 51 species that breed in North America, 40 species (78 percent) spend the northern winter in countries other than the United States or Canada. In addition to Latin American and Caribbean

destinations, some shorebirds breeding in North America winter in Eastern Asia, Australia, Polynesia, and Northern Europe. For example, the Pacific-Golden Plover flies non-stop from Hawaii to Alaska in two or three days. That's 2400 miles! Other Pacific-Golden Plovers winter in Tahiti and fly non-stop to Alaska--a distance of 5000 miles! To accomplish these amazing migratory feats, all long-distance migratory shorebirds have long, pointy wings that allow them to fly fast and far and have the ability to store lots of fat to fuel their journeys.

Shorebirds Depend on Three Distinct Geographical Areas

Because most shorebirds are migratory, they need healthy habitat in at least three distinct geographic areas: northern breeding grounds, southern non-breeding grounds, and stopover sites scattered along their migration routes. Stopover habitats are crucial for shorebirds to rest and refuel during migration. For example, Sanderlings, cardinal-sized sandpipers, breed in northern Alaska and may spend their non-breeding season as far away as the southernmost tip of South America, in Tierra Del Fuego, Argentina. To successfully complete their migration, Sanderlings depend on numerous stopover sites along the Atlantic and Pacific Flyways.

They require tundra habitat for breeding, beaches and mudflats for stopover habitat, and beaches during the winter.

Not All Shorebirds Are Long-Distance Migrants!

Although shorebirds are generally known for long-distance migrations, some species migrate very short distances. In fact, not all shorebirds breed in the Arctic.

Long-billed Curlews, for example, nest on the interior grasslands of North America and spend the winters along the Gulf Coast of North America. A few shorebird species do not migrate at all. For example, the Wilson's Plover remains in Florida throughout the year, and the Black Oystercatcher remains on the Pacific Coast.

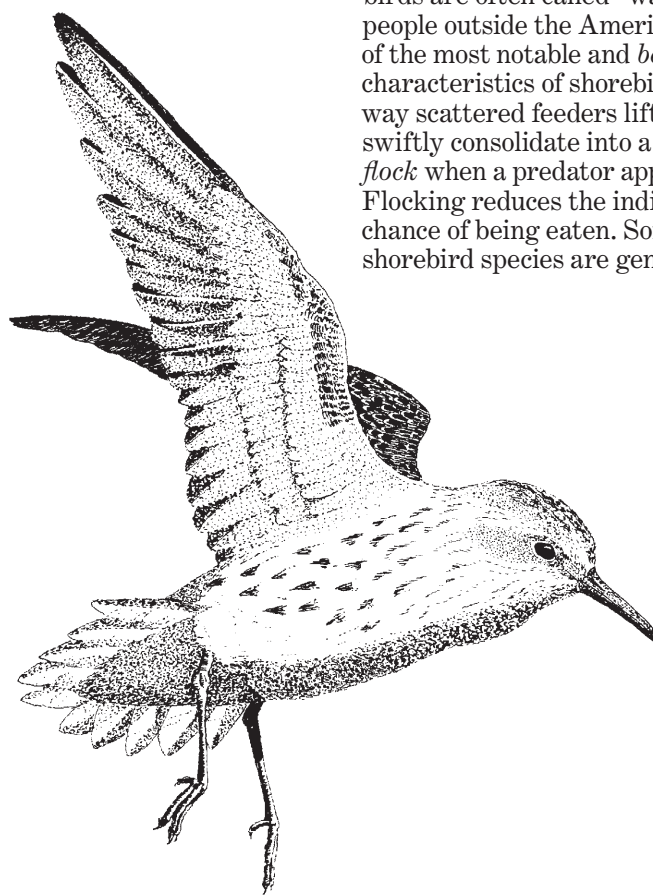
Shorebirds Are Unique in Form and Function

Shorebird families include the sandpipers, plovers, oystercatchers, snipes, and stilts, among others. Shorebirds share morphological and life history characteristics that set them apart from other birds. They are distinguished by their small-to-medium-sized, narrow, pointy bills, long legs, long pointy toes, long wings, and unique feeding

behaviors. They are different from many other groups of birds you may observe using the same habitats. For example, although found in coastal wetlands, herons, egrets, gulls, and pelicans are not true shorebirds. Upon closer examination, you will see they differ from shorebirds in their lifestyles (food, behavior, nesting, etc.) and in the way they look. Check out a bird identification guide to note their differences. To aid in your comparison of shorebirds to seabirds and wading birds see the chart in the Appendix.

Shorebirds Have Unique Feeding Behaviors

Because of their lifestyle of wading through water and mud to find food, particularly during their spectacular migrations, these small-to-medium-sized, long-legged birds are often called "waders" by people outside the Americas. One of the most notable and *behavioral* characteristics of shorebirds is the way scattered feeders lift off and swiftly consolidate into a graceful *flock* when a predator approaches. Flocking reduces the individual's chance of being eaten. Some shorebird species are generally



solitary, but most will readily join a flock in response to a *disturbance*. Mixed-species flocks are common, making bird-watching more interesting and challenging.

You can also recognize shorebirds by the way they search for food. Many shorebirds use their bills to *probe* the mud for tiny clams, snails, sand fleas, and worms. Those with short bills probe for animals living very near the surface. Shorebirds with longer bills can reach animals buried deeper in the mud. Oystercatchers, on the other hand, have strong, laterally-flattened, chisel-like bills. They use their bills to pry open, or sometimes crush, the oysters and clams they eat. Many shorebirds, particularly sandpipers, run up and down the beach, as if they are chasing the waves, as they pick tiny food items off the surface of the sand. Plovers are visual feeders, so they have large eyes to glean insects from the land's surface.

Shorebirds Are Known for Elaborate Behaviors and Displays

Besides their regular migrations, shorebird lifestyles include other highly developed rituals of behavior such as elaborate courtship and predator distraction displays. Most of us have never had the pleasure of witnessing these displays because many migratory shorebirds nest in remote Arctic areas of North America (the *NeArctic*), Northern Europe and Russia (*PaleArctic*), or in isolated grasslands.

During the breeding season, many shorebird pairs defend territories. Individuals of some species also defend mobile feeding territories, the area around their bodies as they forage. Another distinctive behavioral *adaptation* of shorebirds is their one-legged posture while roosting. Keeping

one leg and the bill tucked under the body feathers conserves heat. This is important in the often chilly, open areas of their habitat.

Shorebirds Contribute to a Healthy Ecosystem

Did you know that shorebirds contribute to a healthy *ecosystem*? Shorebird droppings, called *guano*, fertilize the mudflats where they feed and the water over which they fly. The guano helps microscopic plants, called *phytoplankton*, grow. This *phytoplankton* forms the base of the food chain for the ocean fish and other seafood we eat.

Shorebirds Are Indicators of Healthy Ecosystems

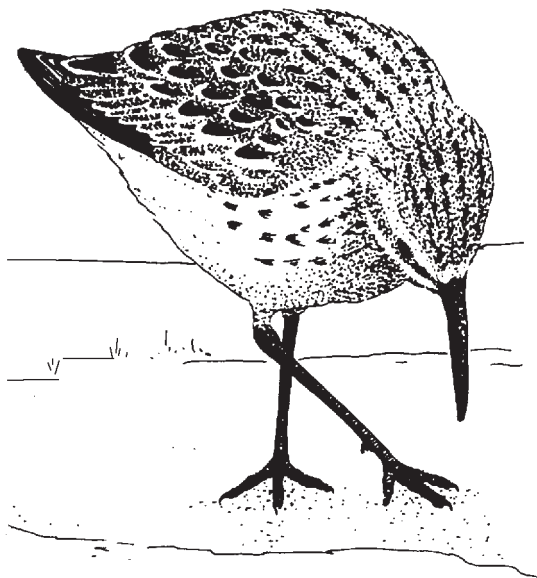
Shorebirds are also good indicators of ecosystem health. *Indicator species* tell biologists how they and other creatures in the habitat are doing. For instance, a change in the shorebird population could suggest a decline in their food resources or a problem with one of the *abiotic* (nonliving, such as water and soil) components of the ecosystem.

Shorebirds Are Part of the Earth's Vast Biodiversity

Shorebirds are also a part of our earth's *biodiversity*. Every day scientists make new discoveries about how species are connected to one another, including us. The survival of one species often depends upon the presence of another. The greater the biodiversity in an area, the more stable and healthy the animal and plant populations will be in order to survive tough times such as drought or disease.

To teach your students about the general characteristics of shorebirds, try these classroom activities found in the guide.

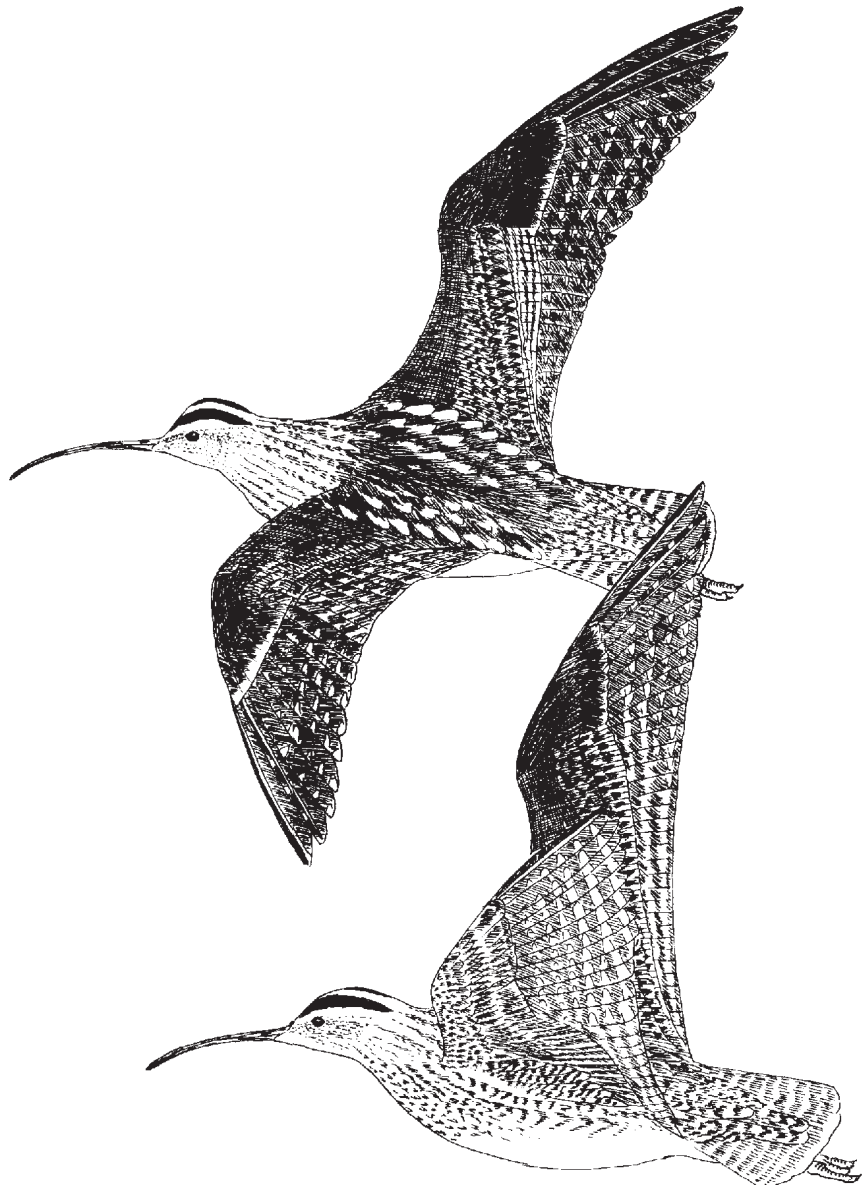
- **Shorebird Profiles**
- **Build a Shorebird**
- **Most Wanted: Shorebirds!**
- **A Year (a Day or a Week) in My Life as a Shorebird**
- **Get to Know Shorebirds Puppet Shows**



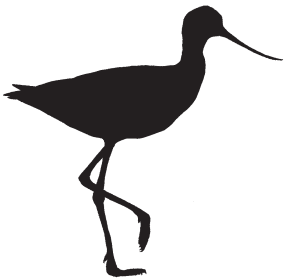
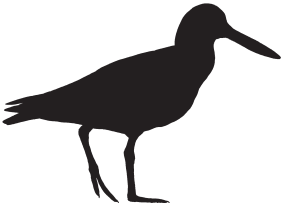
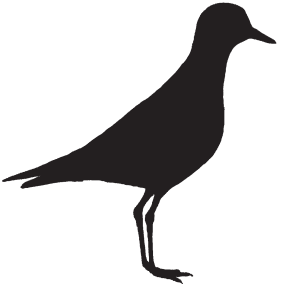
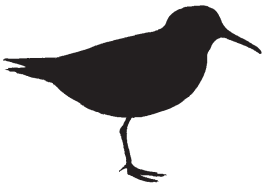
General Characteristics of Shorebirds

- Most shorebirds have long, wading legs and long, pointy toes.
- Most shorebirds have long, slender, probing beaks.
- Most shorebirds are ground-nesters.
- Many shorebirds migrate long distances.
- Most shorebirds have long, pointy wings.
- Most shorebirds depend on three distinct geographic areas: breeding grounds, non-breeding grounds, and migratory stopover sites.
- Many shorebirds have a system of elaborate courtship and distraction displays.
- Shorebirds feed on insects, mollusks, crustaceans, and other *invertebrate* animals.
- Many shorebirds are found on coastal and interior wetlands.
- Migratory shorebirds can store 50 percent to 100 percent of their body weight to fuel their long journeys.

NOTE: To compare shorebirds to seabirds (gulls, terns, pelicans) and wading birds (herons and egrets), see the [chart in the Appendix](#).



Shorebird Families Regularly Represented in North America

<p>Avocet and Stilts (<i>Recurvirostridae</i>) 2 species</p> <p>Sleek and graceful waders with long, slender bills and lanky legs. Only two representatives of this family are found in North America.</p> <p>The American Avocet is fairly common to shallow ponds, marshes and lakeshores. It is recognized by the way it sweeps its slightly upcurved bill from side to side through the water in search of food.</p> <p>The Black-necked Stilt is easily recognized by its long red or pink legs. It is generally found in the interior of North America.</p> <p>The subspecies Hawaiian Black-necked Stilt is only found in Hawaii. It is a non-migratory shorebird.</p> 	<p>Oystercatchers (<i>Haematopodidae</i>) 2 species</p> <p>These are chunky shorebirds of the coastline. They have strong, laterally flattened red-orange bills, which are used to pry open the shells of clams and oysters. They also probe in the sand for worms and crabs.</p> <p>Two species of oystercatchers are found in North America: the Black Oystercatcher (along the Pacific Coast) and the American Oystercatcher (along the Gulf and Atlantic coasts).</p> 	<p>Plovers (<i>Charadriidae</i>) 9 species</p> <p>These are compact birds with relatively short legs. They use their short, fairly thick bills to pick prey from the surface of the sand or mud. They are known for the way they feed in a step, step, stop pattern.</p> <p>Plovers are divided into two groups, the Ringed-plovers (which are the smaller plovers) and the Dark-bellied plovers. Nine species of plovers are found in North America.</p> 	<p>Sandpipers (<i>Scolopacidae</i>) 37 species</p> <p>The greatest majority (37 species) of North American shorebirds are sandpipers.</p> <p>Sandpipers vary greatly in size and shape. Generally, sandpipers are longer-billed and longer-legged than plovers. Unlike plovers, they walk continuously while feeding.</p> <p><i>Sandpipers Include</i> Typical Sandpipers (14) Snipes (1) Godwits (3) Curlews (4) Shanks (5) Yellowlegs (2) Turnstones (2) Phalaropes (3) Dowitchers (2) Woodcocks (1)</p> 
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How to Identify Shorebird Species

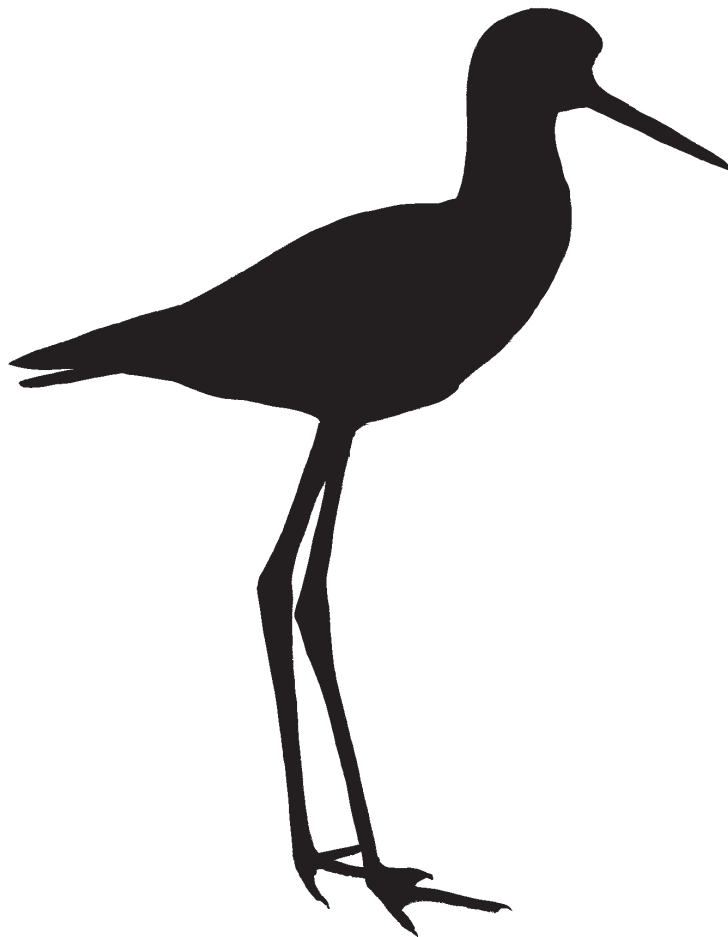
Shorebird Morphology

The term *morphology* refers to what an organism physically looks like. Shape, color, and size are all examples of morphology. Shorebirds are generally small-to-medium-sized birds. Many are chunky, some have a stately posture, while others are more hunched over like they have no necks. Perhaps one of their most striking physical traits is their long legs. Most have long, narrow, pointed *bills* to probe for food in the mud or water. Shorebirds have long, pointed wings and are strong, fast fliers.

Most shorebirds are speckled brown, rust, and white on the back. Some have white or black patches on the head, breast, or belly. The coloration of shorebirds might first seem rather ordinary. However, the value of their dull coloration becomes obvious the first time you see a beach with 10,000 legs! This coloration serves as *camouflage*. Their ability to blend in with the sandy, muddy, or grassy areas where they feed and nest protects them from predators like falcons, gulls, jaegers, and foxes.

Is It Necessary to Recognize Different Shorebird Species?

It is not necessary to identify individual shorebird species in order to learn about them! By knowing their basic characteristics, you will be able to pick shorebirds out of the bird crowd. Because of their camouflaged coloration and similarities among species, identifying individual species can be challenging. If you decide to take on the challenge, you have a greater chance of success by using a logical approach. On the next page are some tips on identifying shorebirds that not only will improve your chances of success, but also of having an enjoyable time in the process.



Tips on Identifying Shorebird Species

Tip 1. Become familiar with shorebird *anatomy*. This will help you to describe what you see and understand the descriptions found in bird field guides. Illustrations of shorebird anatomy, in flight and standing, can be found in the *Appendix*. This graphic can be used in the field or as an instructional overhead transparency in the classroom.

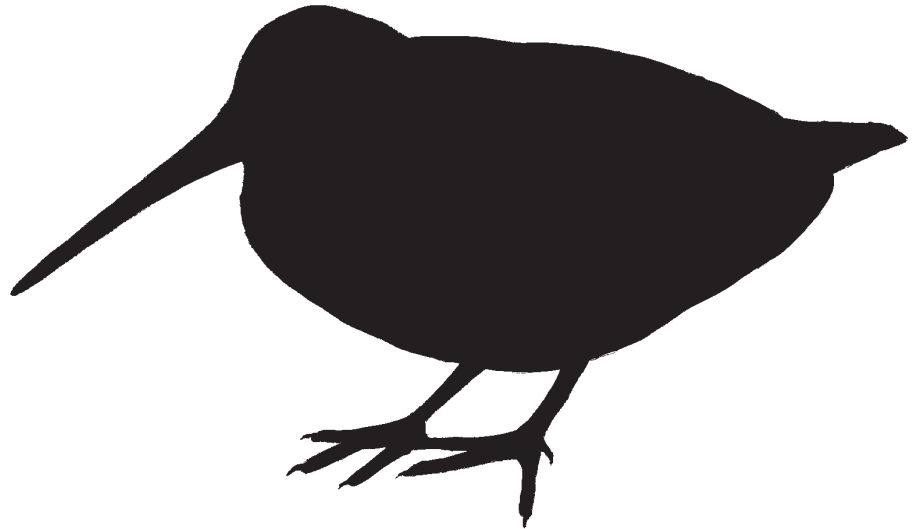
Tip 2. Obtain a field guide that shows breeding, non-breeding, and juvenal *plumages* and *range maps*. Plumages can change the birds' appearance from one season to the next. Range maps help predict what species you can expect in your area. Make sure it has clear photos or illustrations.

Tip 3. Practice using binoculars before going out to watch shorebirds. If you are taking students on a field trip to observe shorebirds, use the pre-trip activity *Using a Field Guide and Binoculars*, found in the educator's guide section *Field Trip Activities*.

Tip 4. Use a spotting scope as well as binoculars to watch shorebirds. Shorebirds often feed or rest in the same open area long enough to make setting up a spotting scope worthwhile. A spotting scope is easy to set up, has more powerful magnification than binoculars, and gives your arms a rest!

Tip 5. Start with easily recognized species common in your area. Study the birds in your field guide, making note of the species found in your area. Another quick way to identify common birds is to get a local bird list from a local or nearby bird-watching organization or from park, refuge, forest, or nature center staff.

Tip 6. Focus on learning just a few birds at a time to keep from becoming overwhelmed.



Tip 7. Do not try to identify a bird based on one characteristic alone. Since many shorebirds do not have readily distinctive plumage, especially in the winter, use body size and shape, and the comparative length of the bill, neck, and legs to help narrow down the possibilities. Here are some questions to ask yourself:

- Is it a small (sparrow-size), medium (mourning dove or robin-size) or large (crow or duck-size) shorebird?
- Is the silhouette like a plover, curlew, or other?
- Does the color of the feathers, also called *plumage*, have distinct white, rust, or black patches? Does the bird have spots or streaks on its breast?
- What color is the bird's *bill*? Is it longer or shorter than the length of its head? Is it straight or slightly curved up or down? Is the bill one color its entire length?
- What color are the legs? How long are the legs?
- When the bird is flying, can you see wing stripes or a distinct tail pattern?

■ How is the bird behaving? Is it picking up its food or probing below the surface for prey? Where is it located—in vegetation, water, or mud?

■ Is the bird you are observing alone, in a small group, or part of a large flock?

Tip 8. Join a natural history or birding club. The more time you spend in the field in the company of “experts,” the more quickly you will learn shorebird identification.

Tip 9. Start a shorebird field journal. Sketch pictures and write descriptions of the birds you see. Note how they behave, their location, and the season. Eventually you can start studying each species during different seasons, noting changes in their plumage. A variety of master journal pages are available to you in the Field Trip section.

Explore the World with Shorebirds!
To practice shorebird identification skills with your students, try the pre-field trip activity *Using a Field Guide and Binoculars*. Follow it up with the activity *Sampling Local Shorebird Population* if you take a shorebird field trip.

Shorebirds Depend on a Chain of Healthy Habitats

Habitat Sweet Habitat!

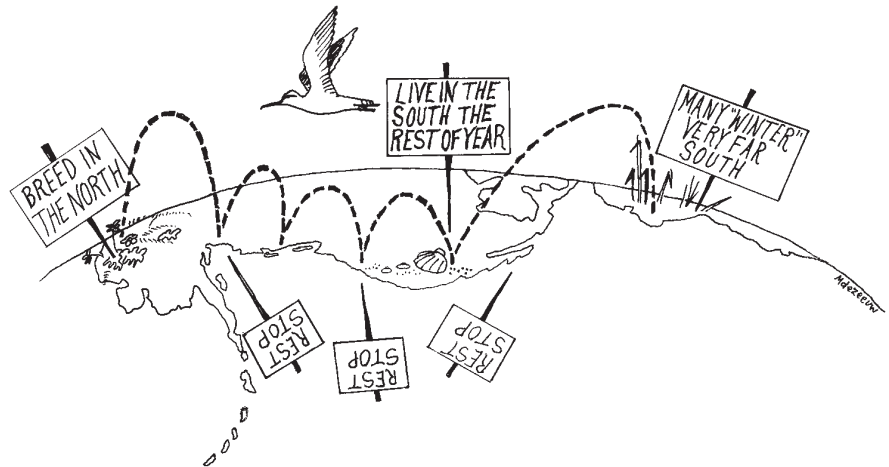
- Migratory shorebirds depend on at least three habitats for their survival: where they breed, where they winter, and migratory stopover sites in between.
- Habitat loss is the leading cause for declining animal populations, including shorebirds!
- White-rumped Sandpipers that breed in northern Canada and Alaska are also found in virtually every Latin American and Caribbean country during the rest of the year.
- Biologists estimate that five to eight million shorebirds rest and refuel at Alaska's Copper River Delta mudflats each spring. This makes it one of the most important stopovers in the world.

Healthy Habitat

Shorebirds, like all wildlife populations, rely on healthy habitat. This means that where they find food, water, and shelter is pollution-free and supports a food web rich in biological diversity. The greater the biodiversity in an area, the more stable and healthy the animal and plant populations will be in order to survive tough times such as drought or disease.

Birds of Open Space

In its most basic definition, shorebird *habitat* is open space. Open, in landscape terms, means without significant canopy cover (plants blocking the sky above). A few shorebird species live or *roost* in deciduous woodlands, but in general they are *adapted* to live on sandy or rocky *shores* and open grassy areas. For adult shorebirds, the *flock* supplies more shelter than the habitat. Individuals in the flock take shelter from wind behind each other. The bird at the end of the



flock, facing the wind, eventually hops to the back of the flock, forcing another to take its turn as windbreak.

Shorebird Habitats Many Shorebirds Rely on Wetlands

Wetlands are areas with soils that hold water and with plants and animals adapted to wet conditions on land. There are many different types of wetlands, including *estuaries, inland mudflats, tundra, river and stream corridors, potholes, playa lakes, salt and freshwater marshes*. Ocean shoreline habitats like *beaches, mudflats, and rocky-intertidal* areas can also be considered wetlands. For a more detailed description of these wetlands, see the Glossary or the Student Readings found in the Appendix.

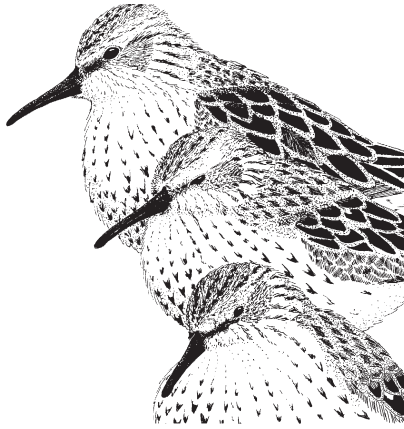
These areas all have in common water that pools on or near the surface and saturates the soil. How long and how wet an area stays depend on the type of soil, plants, and the slope of the land. Some kinds of wetlands dry up each year, but they are still wetlands. Remember: a sponge is still a sponge, even when it is dry. Many shorebirds, like Western Sandpipers, nest on upland tundra in the Arctic, a relatively dry type of habitat formed on *permafrost*.

This frozen ground does not allow rain or melting snow to drain, so pools of water abound.

The shallow water in wetlands provides for plant growth, allows penetration of light and warmth, and provides buoyancy and an abundance of food for young and adult shorebirds. Wetlands are an *invertebrate* soup of snails, worms, insect larvae, crabs, shrimp, and sand fleas (the staple of many shorebird diets).

Some Shorebirds Prefer Uplands

Shorebirds that do not need wetlands are found on grasslands. For example, Buff-breasted Sandpipers and Killdeer have adapted to live in open, short-grass habitats. Unlike most ground-nesting shorebirds, the American Woodcock prefers to nest in trees found near grassland habitat. These birds snatch bugs from the grass and the surface of the soil. Unfortunately, like wetlands, grasslands are being replaced with human development and agriculture. Because there are fewer short-grass prairies, these birds are now trying to use pastures, farm fields, gravel areas, golf courses, school grounds, and lawns for resting, feeding, and nesting. In these areas they face another set of hazards — poisoning



from lawn and agricultural pesticides and disturbance and destruction of nests by machinery and recreational vehicles. With a little awareness and some minor changes, shorebirds and people can share these habitats.

Most Shorebirds Depend on Habitat in Three Geographical Areas

Shorebirds may use three very different habitat types and geographic areas for breeding, resting during migration, and living the majority of the year. For instance, shorebirds that nest in the northern tundra may migrate

inland, stopping near ponds and spending the winter on southern *mudflats*.

During the *breeding season*, migratory shorebirds spend only two months each year nesting and raising their young in inland tundra, grassland, or on ocean, lake, or river beaches. During the *nonbreeding season*, they live in more southern areas at mudflats, estuaries, and beaches.

During migration, shorebirds depend on areas where they can stop to rest and feed. Shorebirds follow different paths during spring and fall migration, increasing the number of different places they may use throughout their journeys. These *stopover sites* tend to be small beaches, prairie potholes, inland lakes, and estuaries, areas where a stream or river drains into the sea. Some shorebird species stop in agricultural fields, short-grass prairies, and other open, dry areas. Stopover sites might be small but are full of food and support a concentration of thousands, or even millions, of shorebirds every spring and fall.

Shorebirds Use Traditional Sites

The migratory paths and stopover sites used by shorebirds year after year are considered traditional shorebird sites. When a large flock congregates at one stopover or nesting site, the entire group is extremely vulnerable. A storm, oil spill, or some other threat can mean disaster! Shorebirds do not have the time or energy to search for an alternative site. Each shorebird species has evolved over many generations into a design best suited to its habitat type. Good land stewardship by landowners, managers, and the public can help ensure that healthy habitats are available to migratory birds throughout their life cycles.

Explore the World with Shorebirds!

To teach your students about the habitats shorebirds need, try these classroom activities found in the guide:

- [Shorebird Food Webs](#)
- [Can't We Share?](#)
- [Wetland Metaphors](#)
- [Match the Habitat Cards](#)
- [Types of Habitat](#)
- [Map Your Habitats](#)
- [When the Grass Was Greener](#)

Some Shorebirds and the Habitats They Use

Sandy Beach

Wilson's Plover
Sanderlings
American Oystercatcher
Long-billed Curlew
Dunlin
Red Knot

Rocky-intertidal

Ruddy Turnstone
Black Oystercatcher

Tundra

Ruddy Turnstone
Buff-breasted Sandpiper
American Golden-Plover
Red Knot
White-rumped Sandpiper

Saltwater Marsh

Wilson's Phalarope
Greater Yellowlegs
Dunlin
Short-billed Dowitcher
Killdeer

Freshwater Marsh

Greater Yellowlegs
Dunlin
Short-billed Dowitcher
Killdeer
White-rumped Sandpiper

Grassland

Buff-breasted Sandpiper
American Golden-Plover
Long-billed Curlew
Mountain Plover
Killdeer

**See Appendix for full list*



Shorebirds Have Special Adaptations

“Each shorebird is a beautifully functioning organism, the parts finely tuned by natural selection to work together to adapt the bird to its environment.”

—Dennis Paulson, *Shorebirds of the Pacific Northwest*

Amazing Shorebird Designs!

- Up to 50 percent of a migrating sandpiper’s body weight is deposited as fat. This fat provides the energy for long-distance flight.
- Long, pointed wings enable some shorebirds to fly up to 50 miles per hour!
- Curlews and woodcocks have extremely sensitive bills. They are *tactile* feeders and can “feel” their prey deep in the mud, allowing them to find food they cannot see.
- Long-billed shorebirds probe in the mud, opening just the tip of their bills. This helps them pick out their food without getting a mouthful of mud in the process!
- Plovers are visual feeders and have large eyes so they can see their prey.

How Adaptations Evolve over Time

A group of *organisms* that can breed and produce fertile offspring is called a *species*. For example, bulldogs and collies belong to the same species (dog) because they can mate and produce puppies that will grow up and have their own puppies. Members of a species have similar *traits* or characteristics.

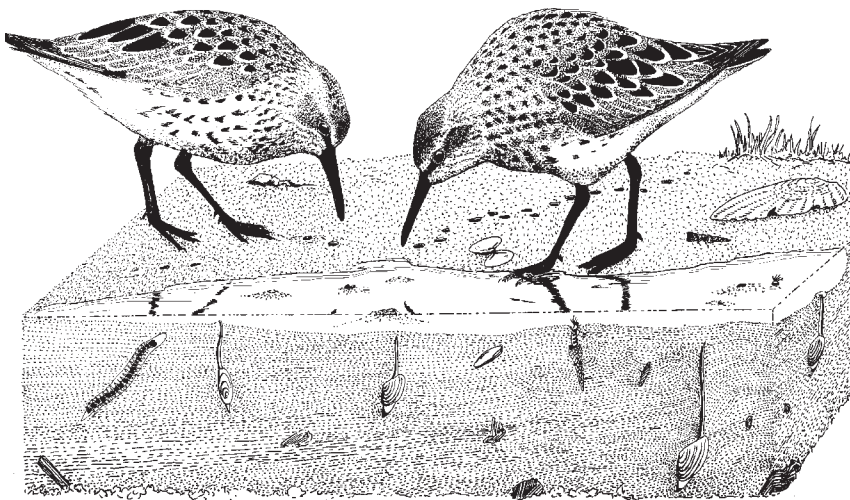
These traits are what help species use the resources found in their *habitat* to survive and reproduce. A trait can be physical or behavioral. If a trait gives a species an advantage in surviving to *breed* (flying faster than others, having better eyesite or coloration), it will be passed on from generation to generation through the species *DNA* or *genes*. This helpful trait, called an *adaptation*, enables the individual to out-compete others. The *Theory of Natural Selection* explains this process: those individuals of a species best suited to survive and reproduce in their environment will pass their genes to the next generation.

Physical Adaptations

Colored to Blend in with Their Surroundings

Shorebirds are designed, or *adapted*, to survive in open habitats. Their brown, rust, black, and white *plumage* makes them less conspicuous to predators. Their bi-coloration, dark on the back and lighter on the belly, further *camouflages* them from *predators*. Their light bellies blend in against the light sky when seen from below. When observed from above, by a falcon for example, their dark backs blend in with the beach or *mudflat* below. Have you ever seen a flock of brown sandpipers suddenly appear white as they turn together in the air and flash their undersides at you?

Shorebirds also have special adaptations to successfully nest



in open habitats. Most shorebirds lay three or four eggs in a nest on the ground. Nesting on the ground exposes the eggs and the incubating parent to many predators. The camouflage coloring of the adults, eggs, and chicks are physical adaptations to help keep them from being seen by predators. Additionally, the eggs are small and perfectly formed to fit tightly together so the parent can fully cover them.

Legs Designed for Wading and Walking on Mud

Shorebirds have long legs for wading. Their long toes give them the stability they need for their seemingly endless walking and running along the water's edge and in soft mud.

Bills Designed for Feeding and Preening

Their *bills* are highly adapted tools for finding food. Some species will probe for invertebrates in mud or water, poking their bills up and down in rapid succession like a sewing machine until they feel something to eat. Others have bills perfectly adapted to swishing through the water to filter food from the water column. Oystercatcher bills are able to pry mollusks from rocks, while turnstones use their bills to flip rocks and find food underneath. By closely observing bill length, shape, and how the bird uses it, you can separate shorebird species.

Not only used for finding food, bills are used for preening as well. A special *oil gland* located at the base of their tails helps to keep their feathers dry. The birds spread the oil from this gland with their bills or the backs of their heads when *preening* themselves. The oil repels water from the feathers, keeping them warm and dry.

Wings Designed for Distance and Speed

The long, pointed shape of a shorebird's wing is designed for flying long distances at fast speeds. Red Knots have been tracked flying over 40 mph. Other species have been clocked at 60 mph with good tail winds. Some shorebirds, like the America Black Oystercatchers, make short migrations, and their wings are not so long and pointed.

Behavioral Adaptations

Flocking for Protection

Shorebirds also have many *behavioral adaptations* that increase the odds they will survive from one season into the next. For example, they tend to lift off in unison from a beach or mudflat when they sense trouble. Traveling in huge migratory flocks is an adaptation to protect individual birds from predators. Just like a school of fish, these large flocks zig-zag back and forth to appear to be a much larger animal. In fact, even other bird species will join these

flocks to take advantage of this "safety in numbers" strategy.

Migrating to Favorable Habitat

Even migration itself is a behavioral adaptation. By nesting within the few months of Arctic summer, shorebirds take advantage of the abundant seasonal food sources of insects and the long daylight to feed. In the Arctic, the vast open space means there is little competition from other bird species, and it is a relatively predator-free environment, that is otherwise inhospitable most of the year.

Fooling Predators

Many shorebirds, like the common Killdeer, use *distraction displays* to protect their nests and chicks from predators. One such display is the "broken wing act." In this case, the shorebird parent, who is faster and less naïve when it comes to predator evasion, lures the predator away from its nest or young chicks by pretending to have a broken wing. The predator follows, thinking that it has found an easy meal, only to be disappointed. As soon as the predator gets close, the



Distraction Display

adult Killdeer flies away to safety. This distracts the predator from the nest or from slower moving, less experienced chicks.

Attracting a Mate

Perhaps some of the most interesting behavioral adaptations occur on shorebird breeding grounds. Generally, male shorebirds reach the Arctic nesting grounds first. They quickly establish *territories*. Once the females arrive, the males begin an elaborate system of *courtship displays*, which are adaptations to ensure they will attract females and increase their chances of *breeding*. These displays may include wing fluttering, tail cocking, nest scraping, and, of course, singing. For more details, read the *Elaborate Shorebird Mating Systems and Displays* section.

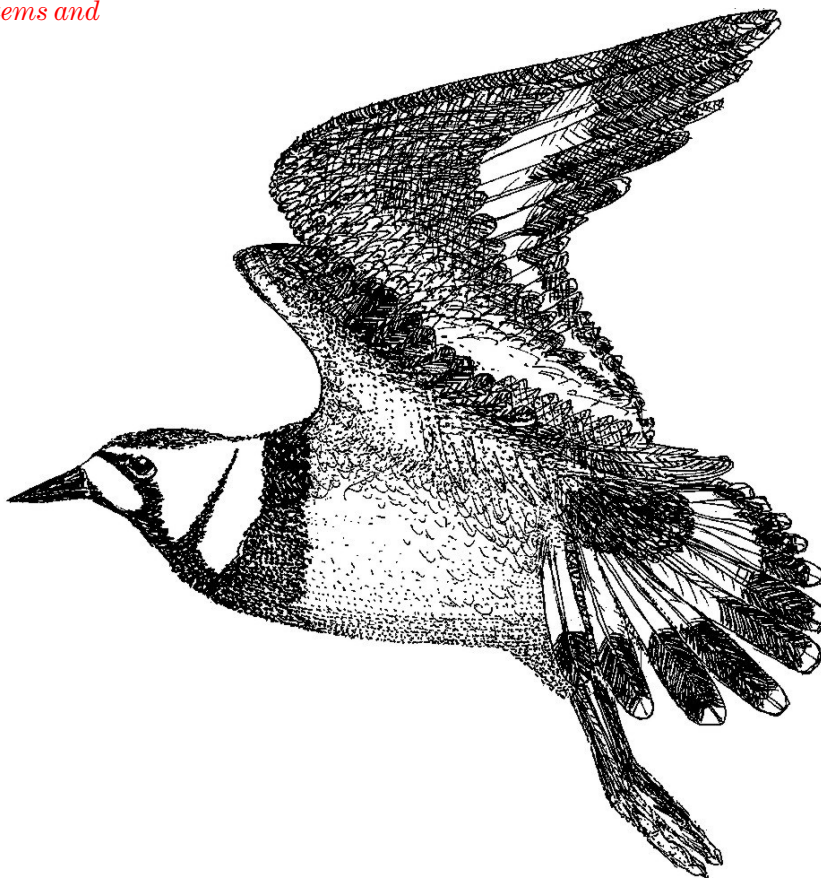
Raising Chicks

Another behavioral adaptation is seen in the rearing of chicks. In some species, the male is solely responsible for incubating the eggs and raising the chicks to fledgings. In others, both parents may care for the chicks together. How parents care for the chicks is specific to the species and an adaptation to the environmental conditions. Once shorebird chicks hatch, they quickly leave the nest. Chicks are able to feed on their own but depend on their parents for protection from weather and predators.

Explore the World with Shorebirds!

Help your students discover the amazing adaptations of shorebirds with these classroom activities

- **Build a Shorebird**
- **What Can I Eat with This Beak?**
- **Avian Olympics**



The Magnificent Shorebird Migration



Shorebirds Are Record Breakers!

■ *The Largest Congregation of Shorebirds*

Over one million shorebirds, mostly Western Sandpipers and Dunlins, have been recorded in a single spring day on Alaska's Copper River Delta. In fact, practically the entire North American population of Western Sandpipers stops there to rest and refuel on a diet that consists almost entirely of tiny clams!

■ *The Longest Nonstop Flyer*

Bar-tailed Godwits make the longest nonstop migration of any shorebird species traveling 6500 miles from Alaska to New Zealand, one way, without stopping.

■ *The Farthest Traveler*

Pectoral Sandpipers make the longest migratory flights of all birds! They winter in southern South America but breed as far North as Central Siberia.

■ *The Fastest Flyers*

When migrating with good tail winds, shorebirds can fly up to 60 miles per hour!

■ *Timed to Dine*

Eighty-percent of Red Knots in the Western Hemisphere time their arrival at the Delaware Bay, from the southern tip of Argentina, just in time to dine on millions of horseshoe crab eggs. The eggs have been stirred up to the beach surface by tides and the masses of egg-laying horseshoe crabs.

■ *Ravenous Eaters*

In order to gain enough weight to continue their migration to the Arctic, Sanderlings eat one horseshoe crab egg every 5 seconds for 14 hours each day until they have rested and fed enough to continue migrating.

The Mystery of Migration

Bird *migration*, the seasonal movement of birds from their *breeding grounds* to their *wintering grounds*, is perhaps one of the most spectacular, physically demanding, and mysterious wildlife events. We know that some birds are physically designed for long, rapid flight. There are a variety of remarkable migrating birds, including songbirds, waterfowl, and raptors. Arctic-nesting shorebirds are famous for their spectacular migrations, both because of the long distances they fly to extreme-north summer destinations and for the huge numbers of birds that concentrate at *stopover* sites along the way.

How and why do birds migrate? How do they find their way across such long distances? Why do they travel in swarms of hundreds of thousands of birds? How do they know when to leave for either their breeding or wintering areas? Although migration is still not fully understood by scientists, it is a strategy that has evolved over time as conditions in the Earth's geography and climate changed. One theory suggests that as the last Ice Age ended and northern areas began to experience warmer weather, short summers favored

insects because of their short life spans and rapid breeding cycles. Some birds moved north to take advantage of this abundant food source and because there were fewer species to compete for food. Soon *natural selection* took hold. The birds that were most *efficient* at migrating arrived at the breeding grounds first and were more likely to produce and raise young successfully. Do you know of other reasons (theories or stories) in your culture or science books to explain why birds migrate?

Although we may not know what first enticed birds to migrate, we do know that shorebirds still take advantage of abundant sources of invertebrate prey. Since the insects are only available as a food source during the Northern Hemisphere summers, the birds need to fly south again to find food for the rest of the year. This involves flying long distances over traditional routes (see Flyways section) and often across international boundaries. Shorebirds' habitat needs must be met within designated time periods and at specific sites.

A Note About Migration Terminology

■ In any discussion of globally-occurring animals like shorebirds, "spring" and "fall" are relative terms. We often use the terms "summer" and "breeding" to mean the same season, because the Arctic is experiencing summer when shorebirds are there to breed. Also, we tend to use the terms "nonbreeding" and "winter" interchangeably.



Migration Terminology Continued

- Remember that winter in the Northern Hemisphere (from November to March) is actually summer in the Southern Hemisphere. We might refer to those shorebirds which have migrated south of the equator for their “nonbreeding” months as “wintering” in, say, South America, but they are really experiencing another summer. While the equator divides two physical halves of the globe, because of the tilt of the Earth’s axis, it generally divides the seasons too.
- In North America, we generally refer to our seasons as “spring,” “summer,” “fall,” and “winter.” In other areas of the world, particularly those close to the equator, seasons may be divided differently, such as “rainy,” “dry,” or “monsoon.”

Timing of Migration

The shorebird migration season lasts a long time. Some individuals begin heading toward their breeding grounds as early as February. They fly just behind the 35 degree Fahrenheit *isotherm*, an imaginary moving line that represents air temperature at any one given time, stopping along the way to rest and refuel. This ensures that when the birds reach their nesting areas, the water and ground will not be frozen. This explains why peak migration dates may vary from year to year and emphasizes that shorebirds are affected by the weather.

Shorebirds do not migrate in family groups like geese, swans, or cranes. In both spring and fall migrations, there is often a difference in timing between the females and males. Adults leave the breeding grounds first during fall migration. Juveniles follow in an average of two weeks. This gives the chicks extra time to grow strong before migration and to fatten up without the added competition of the adults. Because of these trends, you can see that shorebird migration, as a whole, can cover a period of time between February and November.

Spring Migration Is a Rush to the Breeding Grounds

The tendency to *bottleneck* is most prominent in the spring when shorebirds are racing to reach their *breeding grounds*. To find mates successfully, an entire population needs to arrive within a few days of each other. The short Arctic summer compounds the rush, giving shorebirds only about two months to find a mate, establish a territory, lay eggs, and raise a family!

Fall Migration Is a More Leisurely Trip

Fall migration back to wintering areas occurs in waves from late June through November. The first to head south are usually failed breeders, those with no chicks to raise. Successful breeders may begin flying south by mid-July. Fall migrants also use stopover sites but are not concentrated in nearly the same numbers as in the spring, and they appear more spread out over time. They also use other wetlands as refueling stops, besides the main stopover sites. Without the rush to breed, the migratory pace to wintering grounds is relatively leisurely by comparison to spring migration.

Amazing Travelers

Biologists separate migratory shorebirds into three groups: long-distance migrants (those that fly more than 8000 miles one way); medium-distance migrants (those that fly 3500 – 7500 miles; and short-distance migrants (those that travel fewer than 3000 miles). As a group, shorebirds are among the world’s record holders for long-distance migration. The White-rumped Sandpiper is an example of a species found breeding in northern Alaska and living during the nonbreeding season in Tierra del Fuego (the most southern tip of South America). However, some shorebirds do not migrate all the way to the Arctic to nest. Several species, such as the Marbled Godwit, nest in the prairies of North Dakota and Saskatchewan while wintering along the Gulf Coast or in San Francisco Bay. The endangered Piping Plover winters in Florida, then migrates a short distance to breed along the Atlantic Coast from Georgia to Massachusetts. Some populations of other species have a very short migration distance. The Wilson’s Plover breeds and winters in Florida.

For those species that do migrate, enormous energy requirements are necessary for these biannual flights. Most individuals spend their time preparing for migration by feeding and storing fat reserves for their upcoming flight. Some shorebirds will gain half their weight or more in stored fat.

Flyways—Sky Paths

The migratory routes of birds, referred to as *flyways*, are not specific, narrow “highways.” Instead, they are general routes that most migrants tend to follow. Scientists have proposed that birds use the stars, the sun, and even the Earth’s magnetic field for guidance.

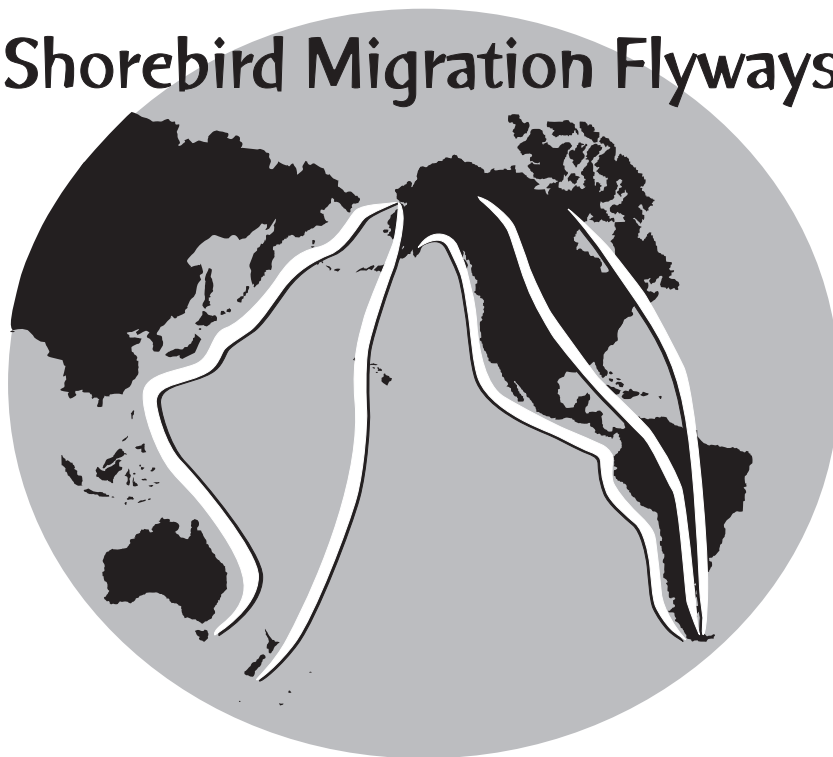
Many shorebirds follow coastlines. Two flyways, the *American Pacific* and the *American Atlantic*, follow the coasts of the North American continent. They extend from the Alaskan and Canadian Arctic, along the Pacific and Atlantic coasts to the southern tip of South America. In North America, shorebirds also migrate inland along the *American Central Flyway*.

Other shorebird migration routes that use the North American Arctic include the Central Pacific and the East Asian-Australasian Flyways. The *Central Pacific Flyway* extends across the ocean from New Zealand to Pacific islands like Hawaii and up through the Alaskan Arctic. The *East Asian-Australasian Flyway* runs from Australia, along the east of the Asian continent, through countries such as Japan, China, and Korea, to the Russian and Alaskan Arctic.

Migrating Shorebirds Stop to Rest and Feed

Most migrating birds require the presence of *wetlands* in their breeding habitat and on their wintering grounds. These two regions are often thousands of miles apart. Shorebirds depend on wetlands in between for food and rest to reach their final destinations. Large numbers of

Shorebird Migration Flyways



migrating shorebirds will return to the same *stopover site* year after year. Termed *staging*, these large flocks of shorebirds will feed for several days or weeks in order to build up their energy reserves to continue their flight. Wetland *estuaries*, rich habitats where a source of freshwater meets the ocean, provide some of the most important shorebird *staging areas* in the world.

Arctic-nesting shorebirds are also famous for the huge numbers of birds that concentrate at stopover sites along the flyway. Since most Arctic-nesting shorebirds tend to use the same relatively

few stopover sites, a *bottleneck* results at these few vital wetlands. These critically important staging areas can host tens of thousands, even hundreds of thousands, of shorebirds at one time. In fact, five sites in North America support more than a million shorebirds each spring.

Shorebirds Congregate at Important Staging Areas!

- The Copper River Delta is thought to be the most heavily used stopover site for all Western Sandpipers along the *Pacific Flyway*. Shorebirds stop at this site because of the superabundance of crustaceans, mollusks, worms, and other energy-rich foods.
- Shepody Bay, in the Bay of Fundy, is another important shorebird site for at least 34 species of shorebirds that use the marshes and mudflats. About one million Semipalmated Sandpipers visit this stopover site along the *Atlantic Flyway* from mid-July to early September.
- Cheyenne Bottoms, considered the largest interior marsh in the United States, hosts as many as 45 to 90 percent of all our shorebird, duck, and geese species that stop to rest and feed during their migration along the *Central Flyway*.

Critical Staging Areas of North America

Pacific Flyway

Copper River Delta, Alaska
Kachemak Bay, Alaska
Mono Lake, California
Salton Sea, California
San Francisco Bay, California
Gray's Harbor, Washington
Great Salt Lake, Utah
Lahontan Valley, Nevada

Central Flyway

Cheyenne Bottoms, Kansas
Sand Lake, South Dakota
Quill Lake, Saskatchewan
Bolivar Flats, Texas
Quivira NWR, Kansas
Rainwater Basin, Nebraska
Horicon Marsh, Wisconsin

Atlantic Flyway

Delaware Bay, New Jersey,
Delaware, Maryland
Bay of Fundy, Canada
Maryland/Virginia Barrier
Islands
Cape Romain NWR, South
Carolina
Monomoy Island, Massachusetts

Migrating Shorebirds Are Extremely Vulnerable!

If a traditional stopover is lost to development or contaminated with pollution, the birds do not have the energy or the time to look for another suitable place to stop. Sometimes an entire population will move through a stopover site within a week or two. This makes shorebirds extremely vulnerable to habitat changes or loss. *One environmental disaster at a critical staging site could impact the survival of an entire species of shorebird!*

Explore the World with Shorebirds!

Discover the mysteries and challenges of migration through math, simulation games, and creative writing using these activities:

- [Migration Headache](#)
- [Migration Math Madness](#)
- [The Incredible Journey](#)
- [Precarious Paths](#)
- [Bird's-Eye View](#)



The Shorebird Flyways in Your Backyard

What is a Migration Flyway?

A migration flyway is an invisible “highway in the sky,” a general route birds follow as they fly from their breeding grounds in the north to more southern areas where they spend their winters.

How Did Scientists Determine Where the Flyways Are?

Biologists have determined migration routes through the use of radio telemetry and observation of banded and flagged birds. For some species, they can even tell where birds are from by bill length and coloration. Many shorebirds that have been banded have also been flagged. This is a band that sticks out from the side of the bird’s leg. Each country has an assigned color so biologists can determine where the birds have come from. For more information on the flagging program go to <http://www.mb.ec.gc.ca/nature/migratorybirds/pasp/dc29s01.en.html>.

Where Are These Flyways Located?

Scientists have grouped these flight paths into generalized flyways. When talking about migration flyways, biologists have most often referred to the routes of *waterfowl* that follow four fairly narrow migration paths through North America: the Pacific Flyway, the Central Flyway, the Mississippi Flyway, and the Atlantic Flyway.

Shorebird flyways are more general and tend to overlap. For this reason, *shorebird biologists* have identified three broader shorebird flyways within North America: the *American Pacific Flyway*, the *American Central Flyway* (which combines the Central and Mississippi flyways of songbirds and waterfowl), and the *American Atlantic Flyway*. Other shorebird migration routes that use the North American Arctic include the *Central Pacific* and the *East*

Shorebird Migration Flyways



Asian-Australasian Flyways. The *Central Pacific Flyway* extends across the ocean from New Zealand to Pacific islands like Hawaii, and up through the Alaskan Arctic. The *East Asian-Australasian Flyway* runs from Australia, along the east of the Asian continent through countries such as Japan, China, and Korea, to the Russian and Alaskan Arctic.

Flyway Names

You will notice that the flyways are named with “American” at the beginning. This is to clarify that these flyways are located in the Western Hemisphere. Without that clarification, people from other countries may look at this information and confuse these flyways with other regions of the globe. For example, if you take into account the entire globe, the

American Atlantic Flyway is really on the western side of the Atlantic Ocean and should be called the Western Atlantic Flyway. However, we felt that would confuse our primary audience which is in the United States. By adding “American” to Atlantic Flyway, people will understand that we are speaking of the Atlantic flyway in the Americas.

Interested in more information about the flyway in your backyard? The following pages describe the geographic zones and highlight exciting shorebird facts about the area where you live.

How Do Birds Find Their Way?

Birds probably use a variety of methods to navigate. Though scientists are not exactly sure how birds navigate along these routes,

there are several theories. Some think birds find their way using the stars as a guide. There is evidence that some large flocks of migrating birds have seemed to “lose their way” over large metropolitan areas where city lights brighten the sky and make the stars harder to see. Other scientists believe that birds migrate using an internal magnetic compass. This system guides the birds along the earth’s magnetic routes.

How Are Shorebirds Able to Migrate Such Long Distances?

Shorebirds have specific physical adaptations for long distance flight, including long, pointed wings and the ability to gain and store highly concentrated fat to fuel their journey. Some shorebirds can fly nonstop for thousands of miles to reach their migratory destinations. However, most shorebird species stop along the way to rest and feed. Stopover sites with abundant food sources have become traditional areas where hundreds of thousands of birds congregate during the migration season. Here they gorge themselves on nutrient-rich invertebrates to replenish the body fat that fuels the rest of their journey. These sites are vitally important to shorebird survival and breeding success.

Where Are Important Shorebird Stopover Sites Located?

Important stopover areas are located along each flyway. Some are famous, like the Copper River Delta in Alaska, for the hundreds of thousands of birds that stop each year; other sites are smaller but just as important. Today pollution, development, and agriculture expansion threaten to wipe out many shorebird stopover sites. The Western Reserve Network (WHSRN) is a multinational coalition of scientists and conservationists working together to identify important sites for protection. Sites nominated into the WHSRN network fall into one of three categories: Hemispheric Sites that host a minimum of 500,000 shorebirds annually, International Sites with a minimum of 100,000 shorebirds each year, and Regional Sites where at least 20,000 shorebirds migrate through annually. The network provides recognition and information for managing these sites. New sites are nominated each year. Of course there are many sites that have fewer than 20,000 birds. These sites are also very important for shorebirds and can be recognized through the National Audubon Society’s Important Bird Area (IBA) network (<http://www.audubon.org/bird/iba/>). Schools and communities can also nominate their towns as Shorebird Sister Cities through the Shorebird Sister Schools Program (<http://sssp.fws.gov>).

For answers to more questions commonly asked about shorebird migration and adaptations, please refer to the sections *The Magnificent Shorebird Migration* and *Shorebirds Have Special Adaptations* in the *Shorebird Primer*.

Explore the World with Shorebirds!

Have students identify the shorebird flyway(s) they live in. Use the WHSRN site listings found later in this section or log on to the WHSRN Web site (www.manomet.org/WHSRN/) to identify important shorebird stopover sites in their flyway. Then have your students mark them on a wall map of North America. Students can learn specific information about the site’s resources from the WHSRN Web site. Interested in knowing which shorebirds are found in your area? Refer to any of the field guides listed in the Appendix, or check out the *Shorebird Profiles* to learn more about birds specific to your flyway.



American Pacific Flyway

Route Description

The American Pacific Flyway generally follows the eastern Pacific coastline from the western Arctic, including Alaska and the Aleutian Islands, down the Rocky Mountain and Pacific coastal regions of Canada, the United States, and Mexico, to where it blends with other flyways in Central and South America. The extensive American Pacific flyway system is separated into four **geographic regions**: Alaska, the Northern Pacific, the Intermountain West, and the Southern Pacific Region.

A map of the **geographic regions** is in the U.S. Shorebird Conservation Plan located at <http://shorebirdplan.fws.gov>.

Facts About the Flyway

Alaskan Region

- Alaska's size and northerly position provide breeding habitat for more types of shorebirds than anywhere else in the United States.
- Of the 71 species which have occurred in this region, 37 breed here.
- Most Alaskan shorebirds migrate to southern areas of the United States and Mexico. About one third head to South America or Oceania (Australia and New Zealand).
- More than one million birds congregate at Alaskan staging sites. In the spring, as many as five to eight million shorebirds use the food resources of the famous Copper River Delta.

Northern Pacific Region

- Estuaries like Gray's Harbor, Willapa Bay, and Bandon Marsh support over 100,000 shorebirds during peak migration.
- Other important shorebird habitats, such as the Willamette Valley are a mix of wetlands and agriculture and are used extensively in winter by Dunlin and Wilson's Snipe.
- Of the 50 shorebird species that breed in the United States, 40 are found regularly in this region.
- Important habitats include coastal estuaries, sandy beaches, rocky shorelines, freshwater marshes, pastures, and agricultural lands.

Intermountain West Region (IMW)

- Eleven species of shorebirds breed and another 23 migrate regularly through this huge region that includes a variety of wetlands, from saline sinks to alpine streams.
- Up to 90 percent of the world's adult Wilson's Phalaropes molt and stage in the IMW hypersaline lakes prior to their trip to South America.
- Important habitats include large saline lakes, marshes, upland, agricultural fields, ephemeral wetlands, man-made impoundments, and riparian areas.

Southern Pacific Region

- Internationally and nationally significant numbers of Western Sandpipers, Snowy Plovers and Mountain Plovers are found here.
- Important habitats include tidal wetlands and marshes, salt ponds, seasonal wetlands, flooded agricultural lands, managed wetlands, and range and agricultural land.
- Twenty eight species of shorebirds spend the nonbreeding season here.

Shorebirds Most Characteristic of the American Pacific Flyway

With the exception of the Snowy Plover, the shorebirds on this list are common and can be observed by students. The list is also a "snapshot" of species diversity in the flyway, providing a variety of natural history stories to learn about. Shorebirds that are rare on this flyway are noted with an asterisk. Consider researching these shorebirds using this guide, the library, and the World Wide Web.

Western Sandpiper
Black-bellied Plover
Short-billed Dowitcher
Dunlin
Marbled Godwit
Black Oystercatcher
Black Turnstone
Long-billed Curlew
*Snowy Plover**
Black-necked Stilt

Shorebird Migration Flyways



Western Hemisphere Shorebird Reserve Network Sites on the American Pacific Flyway*

Refer to the Shorebirds Across the Americas poster included in your educator's binder or request a copy by sending an e-mail to sssp@fws.gov.

Hemispheric Sites

A minimum of 500,000 shorebirds use these sites each year.

United States

Copper River Delta, Alaska
Grays Harbor, Washington
Great Salt Lake, Utah
Lahontan Valley, Nevada
San Francisco Bay, California
Yukon Delta, Alaska

Argentina

Tierra del Fuego

International Sites

A minimum of 100,000 shorebirds use these sites each year.

United States

Kachemak Bay, Alaska
Grasslands, California
Humboldt Bay, California
Mono Lake, California

Mexico

Estero Rio Colorado
Guerrero Negro
Marismas Nacionales

Brazil

Argentina

Regional Sites

A minimum of 20,000 shorebirds use these sites each year.

United States

Elkhorn Slough, California
Kvichak Bay, Alaska
Nushagak Bay, Alaska
Sacramento Valley, California
San Diego Bay, California
South Salton Sea, California
Springfield Bottoms, Idaho
Yukon Delta, Alaska

* For a detailed description of these sites, please go to the WHSRN Web site at <http://www.manomet.org/WHSRN/> and click on the Shorebird Reserve Network button.



American Atlantic Flyway

Route Description

The American Atlantic Flyway extends from the offshore waters of the Atlantic Coast west to the Appalachian Mountains. Many birds using the American Atlantic Flyway start at the southern tip of South America or the coast of Chile and then move through the interior of South America (Argentina, Paraguay, Bolivia, Brazil, and Suriname) and across the Caribbean. They reach the United States touching Maryland, Virginia, and Delaware. From there they head to James Bay and Hudson Bay in Canada.

The Atlantic Flyway is divided into two geographic areas: the Northern Atlantic and the South East Coastal Plain/Caribbean.

A map of the geographic areas is in the U.S. Shorebird Conservation Plan located at <http://shorebirdplan.fws.gov>.

Facts About the Flyway

Northern Atlantic Region

- This is the most heavily populated area in the United States.
- Wetlands are affected by development. Still, beaches in this region are essential, high-quality habitat for shorebirds.
- This region is considered critical to the survival of Red Knots, Piping Plovers, and Whimbrels.
- The Delaware Bay was the first WHSRN site. It supports huge concentrations of spring migrants that feast on horseshoe crab eggs.

- There is good access to shorebird viewing opportunities. Large portions of publicly owned coastal habitat and strong state land use regulations have strengthened local support for shorebird conservation.

South East Coastal Plain/Caribbean Region

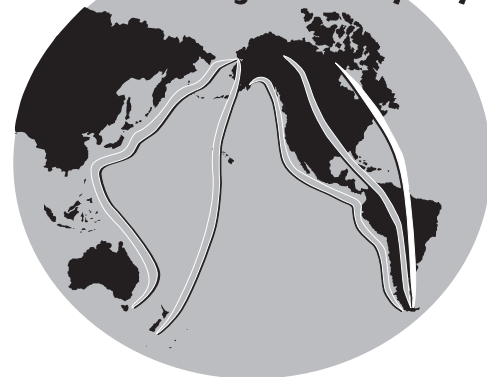
- This is an important area for breeding American Oystercatchers, Snowy Plovers, Wilson's Plovers, and Piping Plovers.
- Over five million shorebirds use the 50,000 acres of publicly managed wetlands in this region.

Shorebirds Most Characteristic of the American Atlantic Flyway

With the exception of the Piping Plover, shorebirds on this list are common and can be observed by students. The list is also a “snapshot” of species diversity in the flyway, providing a variety of natural history stories to learn about. Shorebirds that are rare on this flyway are noted with an asterisk. Consider having your students research these shorebirds using this guide, the library, and the World Wide Web.

Semipalmated Sandpiper
Purple Sandpiper
Red Knot
Willet
Ruddy Turnstone
Sanderling
Greater and Lesser Yellowlegs
American Oystercatcher
*Piping Plover**
Least Sandpiper

Shorebird Migration Flyways



Western Hemisphere Shorebird Reserve Network Sites on the American Atlantic Flyway*

Refer to the Shorebirds Across the Americas poster included in your educator's binder or request a copy by sending an e-mail to sssp@fws.gov.

Hemispheric Sites

A minimum of 500,000 shorebirds use these sites each year.

United States
Delaware Bay, Delaware, New Jersey,
Maryland

Canada
Bay of Fundy, Nova Scotia

Suriname
Bigi Pan
Coppename
Wia Wia

Brazil
Reentrancias/Maranhenses/
Maranhao

Argentina
Laguna Mar Chiquita
Tierra del Fuego

International Sites

A minimum of 100,000 shorebirds use these sites each year.

United States
Barrier Islands, Maryland and Virginia
Cape Romain, South Carolina

Brazil
Logoa de Peixe, Brazil
Argentina
Bahía de San Antonia Oeste

Regional Sites

A minimum of 20,000 shorebirds use these sites each year.

United States
Altamaha River Delta, Georgia
Edwin B. Forsythe, New Jersey
Monomoy Islands, Massachusetts

Peru
Paracas

* For a detailed description of these sites, please go to the WHSRN Web site at <http://www.manomet.org/WHSRN/> and click on the Shorebird Reserve Network button.

American Central Flyway

Route Description

The American Central Flyway covers a wide band of land that extends from the eastern edge of the Rocky Mountains, including the Midwest, the Mississippi River, and the Gulf of Mexico, to the western edge of the Appalachian Mountains.

There are four geographic regions within the Central Flyway: the Northern Plains and Prairie Potholes, the Central Plains and Playa Lakes, the Upper Mississippi Valley and Great Lakes, and the Lower Mississippi and Western Gulf Coast.

A map of the geographic areas is in the U.S. Shorebird Conservation Plan located at <http://shorebirdplan.fws.gov>.

Facts About the Flyway

Northern Plains/ Prairie Pothole Region

- This is one of the major migration routes of Western Hemisphere shorebirds. Thirteen species also breed here.
- It encompasses prairies, potholes, and badlands in all or part of seven states.
- There are constantly changing habitat conditions. Shorebirds here are opportunistic.
- Habitat in this area includes rolling hills of prairie grasses, temporary and semi-permanent wetlands, and agricultural fields.

Central Plains and Playa Lakes

- Three stopover sites in this region are part of WHRSN.
- This region supports a large percentage of the hemisphere's long-distance migrants, including the Stilt and White-rumped Sandpipers.

- Mosaics of temporary wetlands, like playa lakes, are extremely important to shorebirds but are unpredictable in their locations due to weather conditions and hydrological changes from human activities.
- Important habitats in this region include temporary wetlands, agricultural fields, short-grass prairies, freshwater marshes, and rivers.

Upper Mississippi Valley and the Great Lakes

- The region experiences dynamic climate changes and unpredictable habitat conditions.
- Thirty-two species of shorebirds occur in this region.
- Habitats in this region include managed and natural wetlands, river floodplains, lake shoreline, sand and gravel bars, reservoirs, and flooded agricultural fields.

Lower Mississippi and Western Gulf Coast

- A rich variety of shorebird habitats provides important areas for shorebirds in the United States.
- Five highly imperiled shorebirds—the Snowy Plover, Piping Plover, Mountain Plover, Eskimo Curlew, and Long-billed Curlew, have historically been or are presently found along the Gulf Coast.

Shorebirds Most Characteristic of the American Central Flyway

With the exception of the Buff-breasted Sandpiper, shorebirds on this list are common and are readily observed by students. The list is also a “snapshot” of species diversity in the flyway, providing a variety of natural history stories to learn about. Shorebirds that are rare on this flyway are noted with an asterisk. Consider having your students research these shorebirds using this guide, the library, and the World Wide Web.

White-rumped Sandpiper
American Golden-Plover
Long-billed Dowitcher
American Avocet
Upland Sandpiper
Hudsonian Godwit
Lesser Yellowlegs
*Buff-breasted Sandpiper**
Pectoral Sandpiper
Spotted Sandpiper

Shorebird Migration Flyways



The Western Hemisphere Shorebird Reserve Network Sites on the American Central Flyway*

Refer to the Shorebirds Across the Americas poster included in your educator's binder or request a copy by sending an e-mail to sssp@fws.gov.

Hemispheric Sites

A minimum of 500,000 shorebirds use these sites each year.

United States

Great Salt Lake, Utah
Cheyenne Bottoms, Kansas

Canada

Chaplin/Old Wives/Reed Lakes,
Saskatchewan

Brazil

Reentrancias/
Maranhenses/Maranhao

Argentina

Laguna Mar Chiquita
Tierra del Fuego

International Sites

A minimum of 100,000 shorebirds use these sites each year.

United States

Bolivar Flats, Texas
Brazoria NWR, Texas
Laguna Madre (bi-national), Texas and
Mexico

Mexico

Laguna Madre (bi-national),
Texas and Mexico

Canada

Quill Lakes, Saskatchewan

Regional Sites

A minimum of 20,000 shorebirds use these sites each year.

United States

Benton Lake NWR, Montana
Chautauqua NWR, Illinois
J. Clark Slayer NWR, North Dakota
Long Lake NWR, North Dakota
Quivira NWR, Kansas
Salt Plains NWR, Oklahoma
Swan Lake NWR, Illinois

Canada

Beaverhill Lake,
Saskatchewan
Last Mountain Lake,
Saskatchewan

Mexico

Playa Ceuta

Peru

Paracas

*For a detailed description of these sites, please go to the WHSRN Web site at <http://www.manomet.org/WHSRN/> and click on the Shorebird Reserve Network button.



East Asian-Australasian Flyway

Route Description

The East Asian-Australasian Flyway (EAA) stretches nearly pole to pole. Birds breed on the tundra inside the Arctic Circle in Alaska and Russia. Countries with important wintering and stopover sites include: Australia, New Zealand, Japan, China, Taiwan, the Koreas, Singapore, Malaysia, Indonesia, Philippines, Mongolia, Bangladesh, Vietnam, India, Papua New Guinea, Myanmar, and Thailand.

Facts About the Flyway

- The EAA Shorebird Site Network identifies some of the flyway's most important sites for shorebirds. As of July 2002, this network contained 31 sites in ten countries. Wildlife scientists estimate that about 400 sites in the EAA are critical to shorebirds.
- Wildlife scientists estimate at least four million migratory shorebirds use this flyway. Australia alone hosts at least two million shorebirds at some time during the year. More than 60 species of migratory shorebirds use the flyway.
- Wildlife scientists are concerned about the survival of 11 species of migratory shorebirds in this flyway. Some of the flyway's most threatened shorebirds include the Spoon-billed Sandpiper, Asian Painted Snipe, and Spotted Greenshank.
- Dunlins, Great Knots, and Bar-tailed Godwits are the most common birds in the flyway. The least common species are the Spoon-billed Sandpiper, Asian-painted Snipe, and Spotted Greenshank. Other shorebirds which occur in this flyway include the Red-necked Stint, Little and Long-toed Stints; Curlew, Marsh, Terek, and Broad-billed Sandpipers; Black-bellied, Kentish (snowy), Little-ringed and Mongolian Plovers; Eurasian and Far Eastern Curlews; Asian Dowitchers; Red Knots; Pied Avocets; Spotted Redshanks; Black-winged and Banded Stilts; Whimbrels; Pied and Sooty Oystercatchers; and Pheasant-tailed Jacanas.
- The greatest threats to shorebirds in the flyway come from loss and degradation of wetlands from agriculture, pollution, overfishing, logging, and soil erosion.
- Some of the most important shorebird sites along the flyway include China's Yellow Sea; the Yalu Jiang National Nature Reserve; Manko, on the island of Okinawa in Japan; and the Moroshechnaya River estuary in Russia.

Shorebirds Most Characteristic of the East Asian-Australasian Flyway

Most of the shorebirds on this list are common and can be observed by students. The list is also a "snapshot" of species diversity in the flyway, providing a variety of natural history stories to learn about. Shorebirds that are rare on this flyway are noted with an asterisk. Consider having your students research these shorebirds using this guide, the library, and the World Wide Web.

Little Curlew
Bar-tailed Godwit
Great Knot
Gray-tailed Tattler
Red-necked Stint
Sharp-tailed Sandpiper
Spoon-billed Sandpiper
Spotted Greenshank

Shorebird Migration Flyways



Central Pacific Flyway

Route Description

The Central Pacific Flyway includes New Zealand and hundreds of islands spread over thousands of miles in the Pacific Ocean. Some of the island groups include Hawaii, Guam and the Northern Mariana Islands, Phoenix Islands, Line Islands, and American Samoa. Most of the birds that use this flyway for migration or nonbreeding habitat fly to the Arctic or sub Arctic regions of North America and Asia to breed.

Facts About the Flyway

- The Hawaiian and Pacific/Remote Islands National Wildlife Refuges (NWR) play an important role in shorebird migration in the Central Pacific Flyway. Some of the refuges in this complex include Midway Atoll NWR, Kealia Pond NWR on Maui, James Campbell NWR, and Hanalei NWR on Kaua'i Island. Palmyra Atoll is another part of the Pacific/Remote Islands NWR Complex. This is a group of about 50 islands near the equator in the Line Islands.
- Guam and islands off the coasts of Micronesia and Tahiti are also important for shorebirds.
- This flyway is crucial for the Bristle-thighed Curlew, Pacific Golden-Plover, and Wandering Tattler which spend the nonbreeding season on the islands within this flyway.
- Shorebird species in this flyway perform incredible migratory journeys. Bar-tailed Godwits appear to make a nonstop 6500-mile flight Alaska to New Zealand in the fall. Bristle-thighed Curlews and Pacific Golden Plovers may fly over 3000 miles non-stop during both their fall and spring migrations.
- Hawaii is home to an endangered non-migratory shorebird, the Hawaiian Stilt. Native Hawaiians call this bird the 'Ae'o.
- Threats in this flyway include nonnative plants and animals, land development, wetland drainage, water pollution, and disturbance.
- Some species of migratory shorebirds in this flyway are also threatened by how little we know about them. For example, we could lose important habitats before we even know they are important.

Shorebirds Most Characteristic of the Central Pacific Flyway

With the exception of the Bristle-thighed Curlew, the shorebirds on this list are common and can be observed by students. The list is also a "snapshot" of species diversity in the flyway, providing a variety of natural history stories to learn about. Shorebirds that are rare on this flyway are noted with an asterisk. Consider having your students research these shorebirds using this guide, the library, and the World Wide Web.

Pacific Golden-Plover
Wandering Tattler
Bristle-thighed Curlew
Ruddy Turnstone

Shorebird Migration Flyways



Shorebird Nesting and Breeding

Stellar Performances!

- The male Pectoral Sandpiper draws the attention of females by pumping up a fat-filled breast sac, hooting, and making low-level flights over the tundra.
- The Wilson's (Common) Snipe's mating call is made with its tail feathers! The Snipes repeatedly flies high into the sky and then plunges straight toward earth before beating his wings to rise again. When he falls he holds his tail at an angle. The air rushing over his stiff feathers produces his unique "winnowing" or "bleating" mating call.
- The calcium content of the shells in a sandpiper clutch is greater than the calcium content of the female that laid the eggs.
- Some sandpipers in the Arctic eat lemming (a small mammal) teeth as a source of calcium for eggshell formation.
- Western Sandpipers weigh about 25 grams (less than one ounce). They lay four eggs, each weighing 7.5 grams-almost one-third of each female's body weight per egg!
- Black-bellied Plovers migrate thousands of miles yet often return to within 300 feet of the previous year's nest.

Shorebird Breeding

Shorebirds, like most vertebrates, breed only during one particular time of year. Shorebird breeding also depends on ritual behaviors. Most *breeding behaviors* occur within the *breeding season* and on the *breeding grounds*. Some shorebirds are very *site-faithful*, returning to the same breeding grounds, and sometimes the same territory, year after year. In fact, oystercatchers even use the same nests.

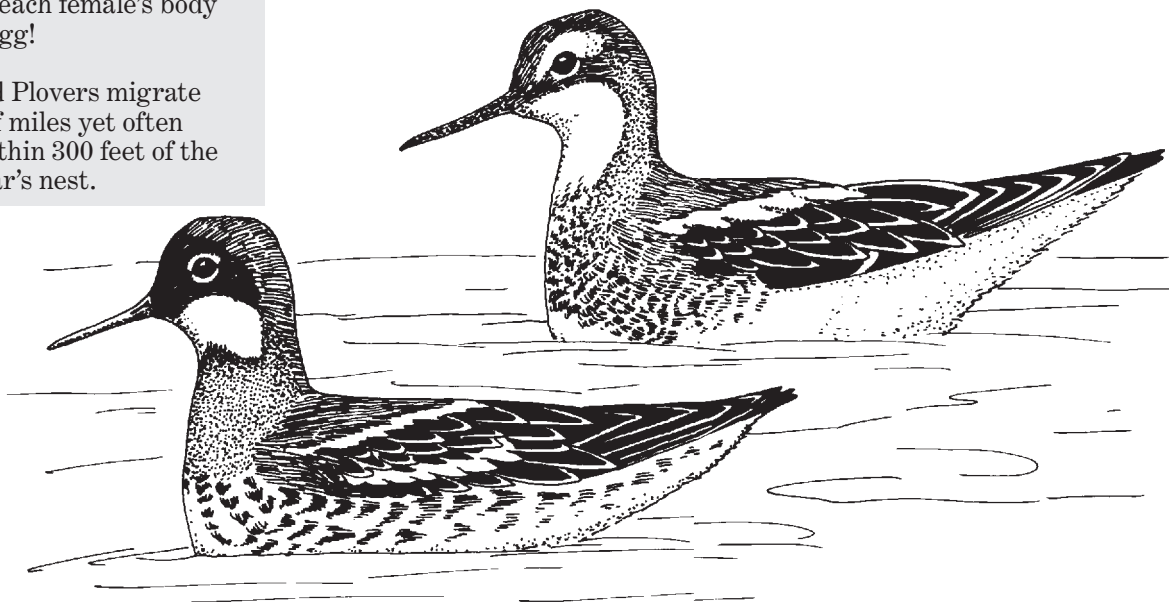
Male and Female Shorebirds Can Be Hard to Tell Apart

Most female and male shorebirds look the same in *breeding plumage*. There are some species, however, in which females are larger than males! In some species, the males have distinctly different patterns and colors from the females. In all three species of phalaropes, the female is more brightly colored than the male.

Most Shorebirds Are Ground-Nesters

Shorebirds generally nest on the ground. Most of these nests, called *scrapes*, are simple, shallow, saucer or cup-shaped structures. They may be lined with grass or lichen. Some are made entirely of pebbles and a few bits of shells.

You might ask "Why would ground-nesting shorebirds choose to build their nests in wetlands?" In fact, wetlands make a wonderful nursery habitat for many animals. Wetlands provide an abundance of plankton, plants, and invertebrate foods. The leaves, blades, and roots of wetland plants provide a substrate for tiny invertebrates and conceal baby shorebirds from predators. Despite the water in this habitat, shorebirds find a clump of grass or move to slightly higher ground within the wetland to nest. Some shorebird species will even rebuild their nests if they are flooded or destroyed.



Shorebirds Establish Breeding Territories

Although a population of shorebirds may nest in the same habitat, most are not colonial breeders like seabirds. Instead, most shorebirds stake out territories where they perform their breeding displays. Any intruder of the same species is greeted with vigorously territorial displays before the defending shorebird resorts to a chase or a fight.

Concealing the Nest Is Critical for Survival

Shorebirds depend on camouflage, a simple and shallow nest structure, and sometimes small nearby or overhanging plants to hide their nests. Their own cryptic coloration helps conceal their nests while they incubate. Birds that nest in trees are concealed by leaves and protected from ground predators by their height, but there are very few trees in areas where most shorebirds nest.

The Typical Shorebird Clutch

Shorebirds generally lay four buff-colored, speckled eggs that are pointed on one end, though some species lay only three eggs. Biologists think shorebird eggs are designed this way so they fit together in a pinwheel shape that keeps more of each egg's surface covered and warm during incubation.

Parental Roles Can Vary Greatly among Shorebird Species

Incubating the Eggs

Care of the eggs or brood is handled in different ways by different species. Most often both the male and female take turns incubating the eggs for about 24 days. Bar-tailed Godwit females, for example, incubate the eggs by day, and the males incubate them by night. Dunlins do just the opposite. In a few species only the female incubates the eggs. Occasionally the male takes on sole responsibility for incubating the *clutch*.

Caring for the Chicks

How shorebirds care for their chicks varies among species. Not all shorebird parents stay to care for their young. The female Black-bellied Plover deserts the chicks when they are only half-way to *fledging*, which is when they have all their flight feathers and are just beginning to fly. The Common Snipe pair divides its brood, and each parent cares for only some of the chicks. Chicks from unrelated groups of Least Sandpiper nests are moved to communal feeding grounds.

Shorebird chicks do not grow their flight feathers and begin to fly until they are about three or four weeks old. However, most are very *precocial* and begin to aggressively search for food only a day or two after hatching. During this time on the ground, chicks hide from predators by using their *cryptic coloration* to blend in with their surroundings and freeze in place when the parent makes an alarm call.

Exceptional Shorebird Parents

Some shorebird parents will go to great lengths to protect and train their offspring. For example, Short-billed Dowitcher males are believed to roll their eggs to a new nest if their original nest is threatened. Oystercatchers may feed their chicks for more than 100 days after hatching, teaching them how to pry open or crack oyster shells. Many shorebird parents use *distraction displays* to protect their offspring. The parent purposely draws the attention of an intruder with calls or exaggerated movements. The parent may pretend to drag a broken wing or tail, hoping the intruder will see the parent as easy, helpless prey and go after him or her instead of the eggs or chicks. The Killdeer is most well known for doing the broken-wing display to distract predators.

Shorebirds Have the Most Varied Mating System of All Birds

Shorebirds have a wide variety of *mating systems*, the roles taken on by breeding males and females. A shorebird's mating system refers to differences in the number of partners that the bird breeds with and the kind of social bond it forms with these mates.

Monogamy

Many shorebirds are *monogamous*, meaning that a female and male mate only with each other for one nesting season. Here both parents protect the nest. This arrangement greatly improves the chances of the chicks making it to adulthood. Dunlins, Western Sandpipers, Turnstones, Yellowlegs, Dowitchers, Godwits, and Red Knots are usually monogamous.

Polygamy

Other shorebirds are *polygamous*, breeding with more than one mate during a breeding season. Those that are *polyandrous*, like the Red-necked and Red Phalaropes, have one female forming *pair bonds* with two or more males in one summer. The females of these non-territorial little shorebirds are more brightly colored than males, and the females attract the opposite sex with special calls, flights, and postures. By contrast, White-rumped Sandpipers are *polygynous*, meaning that a male breeds with and defends more than one female and nest within his *territory*.

Promiscuity and Lekking

Some shorebirds are also *promiscuous*, breeding with more than one mate without forming pair bonds to help defend and protect the nest or raise the chicks. Female snipe, for example, are promiscuous at the beginning of the season, but when the nest site is chosen she forms a *pair bond* with one male for the rest of the season.

A promiscuous mating system includes *leks*, places where a group of males gather to make vigorous displays to attract females for the purpose of mating. *Lekking* often occurs at the same sites every year. Anywhere from two to 15 male Buff-breasted Sandpipers gather at dawn on broad upland tundra leks every year to engage in rituals of wing-stretching, waving and jumping. Imagine seeing the strange gathering of male sandpipers-glinting, white underwings waving in the low, bright light of an Arctic dawn. Researchers believe they choose to display at this time of day when the bright undersides of their wings are the showiest.

Elaborate and Complex Breeding Rituals

A *ritual* is a set of behaviors or activities that is performed in a particular way for a specific reason or occasion. A ritual may be as simple as always arranging food on a plate the same way or as elaborate as a traditional church wedding. People recognize, respond to, and expect certain rituals. What kinds of rituals do you have in your classroom?

Shorebirds, like people, also have developed a set of ritualized behaviors. As a matter of fact, shorebirds have evolved some of the most elaborate and complex breeding displays seen among all *orders* of birds. In most cases, these involve repeated, exaggerated movements and postures designed to draw the attention of the opposite sex. However, many displays are initiated to facilitate courtship and copulation, distract predators away from nests and chicks, and advertise breeding and nesting territory.

Upon arriving at the breeding grounds, territorial birds, usually males, advertise themselves or the territory they have staked out. To advertise they may make dramatic aerial and ground displays that include wing fluttering, tail cocking, nest scraping, and calls to attract a mate and potential competitors.

Courtship Displays and Nest building

Courtship rituals are specific to the species. The birds may respond to each other with bows, tail movements, calls, or the way they hold their bills. Behaviors of the courting pair may include neck preening and calls.

The courting ritual also often involves nest building. In some shorebird species, the female selects the nest site; in others, it is the male that makes the decision. Some shorebird pairs build the nest together, sometimes with separate tasks like selecting materials, building, and then lining. Many shorebirds build several scrapes before selecting one to lay their eggs in.

Explore the World with Shorebirds!

Discover the elaborate and complex breeding displays and nesting habits of shorebirds and the breeding challenges they face using these activities:

- Musical Nests
- Guard Your Nest
- Behave Yourself!
- It Is a Tough Life!
- Colorful Changes



Threats to Migrating Shorebirds

Shorebirds Face Almost Insurmountable Odds!

- Research shows a steep decline in the populations of several shorebird species, and it is suspected that many others have declining populations.
- Habitat loss is the number one reason for the decline of wildlife populations.
- Fifty-seven percent of *prairie potholes* of the American Great Plains are gone. Fifty percent of all wetlands across the United States have been drained for agriculture and urbanization.
- Sandpipers are genetically programmed to stop, rest, and replenish their energy in certain wetlands along the Pacific Coast from South America to Alaska. If one of these wetlands is lost to natural or human causes, sandpipers that depend on that area might not survive to migrate further.
- ATVs, Jet skis, and even more passive recreation like dog walking and jogging along our coastal beaches may chase shorebirds from critical wintering, breeding, and feeding areas.

What threats affect *migratory shorebirds* each year, even though their total population currently numbers more than 20 million? There are a variety of natural threats such as *predators*, weather, and disease. However, human-influenced changes are by far the most serious threats to shorebird survival today.

Vanishing Habitat

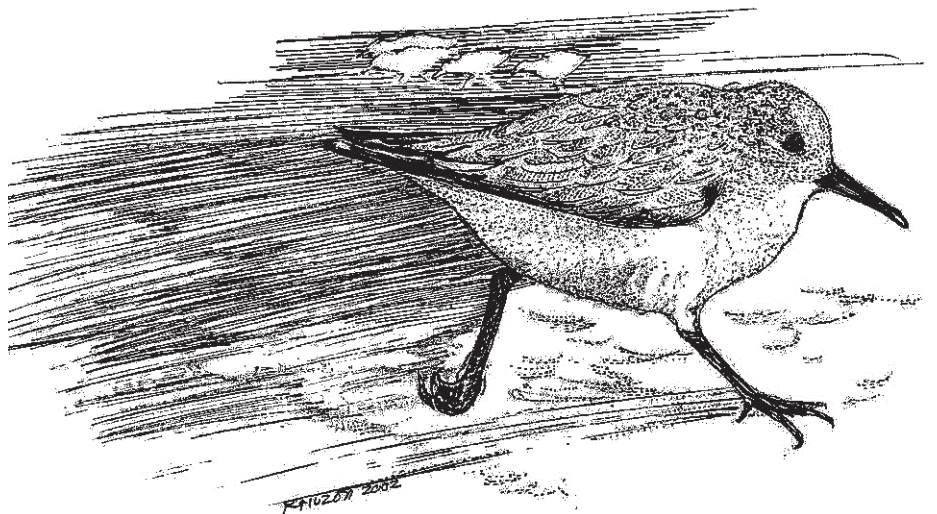
Today the primary threat to the survival of migratory birds is the disappearance and degradation of habitat. Many migrant shorebird populations are dependent for vital food and rest on the same wetlands, estuaries, and grasslands year after year. In some circumstances, if one of these stopover locations is lost, shorebirds may not stop nearby even if an alternate site exists. Instead, they fly on to the next stop, perhaps hundreds of miles away, without resting or feeding. Many birds may not survive.

In many situations the habitat is still there, but it has been degraded to the point that it is no longer healthy and cannot support the wildlife as it

did in its unspoiled state. Even if the habitat is not completely removed from the landscape, things such as disturbances from people, effects of nearby industry, and the increase of predators can make a habitat unhealthy for wildlife that depends on it. Urban sprawl and industry are reducing the availability of habitat. This type of development also reduces the quality of neighboring conservation lands because nonnative species, chemical pollutants, and an increase in predators associated with humans (dogs, cats, raccoons, rats) can be introduced.

Agriculture and Shorebird Habitat

Wetlands were historically drained or the water diverted for irrigation. Rivers have been dredged and diked for navigation and flood control. Prairies and “reclaimed” wetlands were quickly replaced by agriculture. Our modern system of agriculture, called *monoculture*, uses a piece of land for a single type of crop which effectively eliminates habitat and species diversity. The use of pesticides to control weeds and



insects on crop fields also is thought to have both direct and indirect effects on shorebirds. Food resources may be removed, causing the birds to starve. Chemicals may also accumulate within the birds' tissues, leading to deformities and poisoning. In places where agriculture and shorebirds attempt to coexist, eggs and young birds are often crushed by machinery.

Pollution Hurts Shorebirds and Their Invertebrate Foods

Many types of *pollution*, including *runoff*, *pesticides*, lead shot, acid rain and snow, may all be affecting shorebirds and the insects and fish they feed on.

An oil spill near coastal stopover areas, especially one timed with the peak of migration, would be a disaster to shorebirds. For example, Delaware Bay, a critical stopover site for 600,000 migrating shorebirds, is also the second largest petrochemical port in the eastern United States. A major oil spill would coat the feathers of shorebirds, making it impossible for them to fly or stay warm and dry. Birds that try to clean themselves and accidentally ingest oil would be poisoned. An oil spill would also kill horseshoe crabs and their eggs, a critical food source for the shorebirds that pass through the area.

Human Recreation Can Disturb Wintering and Feeding Shorebirds

Migrating shorebird populations are also threatened by disturbances at their stopover sites. If the disturbance is intense enough, migrating shorebirds will continue migrating without stopping at all. Without adequate refueling, individuals may not have enough energy to reach their breeding grounds and/or breed successfully.

Popular recreation activities like riding off-road vehicles on barrier beaches sometimes leave deep tire tracks in the sand or mud, trapping

newly hatched chicks. They also flush birds into the air at a time that is critical for the birds to rest and feed. Operating Jet skis and boats near shorebird wintering areas scares birds away.

Even more passive recreation can be a problem for shorebirds. Off-leash dog walking, kite flying, sunbathing, and surfing also chase birds from their choice feeding sites and cause them to use valuable energy in the process.

Shorebirds and Hunting

Historically, flocks of migrating shorebirds were highly vulnerable to shooting. Market shooting was a common occurrence in the Nineteenth century. Market shooters took advantage of the need for fresh meat in the urbanizing eastern United States. Shorebirds could be easily and economically harvested because they concentrated in huge flocks at predictable migratory staging areas, could be decoyed into shooting range, and would return back for wounded flock mates. Most species of shorebirds were hunted throughout the 1800s, some to the point of extinction.

The Arctic-breeding Red Knot, which migrates in massive flocks northward across the United States, was severely affected by market hunters in the 1800s. The *endangered* Eskimo Curlew, called the "doughbird," was hunted for food and sport until it reached the verge of extinction. Today, even if a few individuals are alive, their numbers may be so low that they may never be seen again. Even though regulations were passed to stop the killing of shorebirds, their low reproductive rate and highly social lifestyle have prevented their comeback.

Today in the United States, there are only two shorebird species (American Woodcock and Wilson's (common) Snipe) that have large enough

populations to support a regulated harvest season. *Subsistence* egg gathering by native indigenous people in the Arctic is still traditional practice that is allowed. Migrating shorebirds are still being hunted in many other countries today. Working with international, national, and regional communities is important to ensure that shorebirds are not overharvested.

The Spread of Exotic Species May Change Shorebird Habitat

Nonnative or exotic species are being introduced into wetlands. Sometimes these introduced species seriously alter the structure of the wetland by competing with native plants and animals. As healthy wetland habitat shrinks, shorebirds lose the feeding and resting sites they rely on. Consider these examples:

European Beach Grass

Introduced in 1898 to stabilize sand dunes, this grass has invaded the once bare beaches where Snowy Plovers prefer to nest. The grass also creates habitat for their predators near their remaining nesting sites.

Great Lakes Aliens

Many nonnative plants and animals have been introduced into the Great Lakes ecosystem, including the zebra mussel, spiny water flea, carp, and purple loosestrife. Little is known about how these exotic species may affect shorebirds that migrate through and breed in the Great Lakes. Biologists suspect that other exotic plants and nonnative invertebrates may have unpredictable effects on the shorebird food base.

Resource Management Sometimes Conflicts with Shorebirds

Many of our activities like mosquito-control programs, oyster-culture practices, and salt pond management can conflict with shorebird conservation.

In places where agriculture and shorebirds attempt to coexist, eggs and young birds are often crushed by harvest machinery. As many as 400-600 birds were killed in a 10-day mowing season in the hay fields of the Silvies Floodplain in Oregon. Without grasses to hide in, the chicks that escaped the machinery were caught quickly by predators.

Throughout Los Angeles County and parts of Orange County, California, entire beaches are raked daily or weekly to remove trash and tidal debris. This makes it impossible for Snowy Plovers to nest. Noisy and large, these machines can crush plover nests and chicks and scare the adults away. Beach raking also removes the kelp and driftwood that invertebrate foods live on.

Shorebirds and Deadly Diseases

Shorebirds are also susceptible to diseases. Most diseases are natural occurrences, but their effects on the bird population are dependent upon how many individuals are concentrated in the area at the time of the outbreak. Some of the diseases that may have a devastating effect on shorebirds include avian botulism and West Nile Virus.

Avian botulism outbreaks are common within the interior of North America during the summer and early fall when temperatures are warm and water conditions are low. A toxin is produced by a bacterium and is ingested by birds as they feed on invertebrates in infected waters. During late summer and fall, water resources are rare and migrating birds concentrate in the few areas where water does occur. Control of botulism outbreaks is difficult because there is still a lot to be learned about this disease. Land managers spend a lot of time and energy trying to avoid massive die-offs. Many critical shorebird staging

areas are known to have botulism outbreaks. Several thousands of shorebirds can be lost during severe outbreaks.

West Nile Virus is a blood-borne disease that can also affect humans. Birds can become ill and die if bitten by an infected mosquito. In northern latitudes, freezing winters that would stop the cycle of the disease kill adult mosquitoes; however, because of the migratory nature of many species of birds, they may harbor the virus throughout the winter and bring it back when they return. It is not known what the full impact of West Nile Virus will be on bird populations, but it too could become a threat to entire populations of shorebirds.

Predators Out of Balance

Shorebirds have few natural mammalian predators on their remote nesting grounds. Their cryptic coloration helps them hide from avian predators like *falcons* and *jaegers*. As Arctic nesting areas are developed, introduced predators may become an increased concern.

Shorebirds that nest, stop to rest and refuel, and winter on coastal beaches and mudflats near large population centers are vulnerable to predators. Many shorebird predators such as foxes, skunks, crows, gulls, rats, and raccoons are extremely successful at coexisting with people. Their population numbers have increased to the point that the delicate predator/prey relationship is out of balance. Normally predators would not impact the shorebird population. However, shorebirds that are already at a disadvantage due to other human-related threats become vulnerable to these predators, including people's pets—dogs and cats! Even if not actively hunted by these predators, the energy used by shorebirds to move out of their way can jeopardize their health.

Habitat: Valuable to People and Shorebirds

Wetlands are important habitats to people. They are a source of water for power, crop irrigation, transportation, drinking water, and recreation. More and more people are finding wetlands attractive home sites. Highway bridges span them, sewer plants are built near them, and ports are developed on them. Grasslands provide people with space and rich soil for farmers to raise cattle, horses, and crops like corn, soybeans, and sunflowers. They are also important places for our communities and for wildlife we like to observe and hunt.

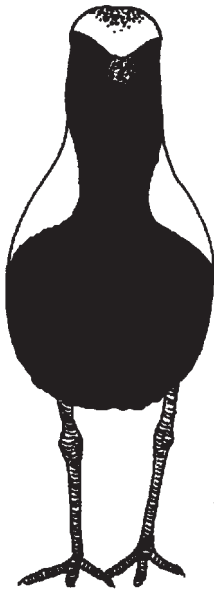
As these vital habitats shrink, shorebirds and countless other animals and plants lose the habitats they rely on. We will lose the benefits of clean water, flood control, fishing areas, and beauty that wetlands provide. We lose the rich soil, vast space, and diversity of life in grasslands. Is it possible that people and shorebirds can survive, possibly even thrive, together using these habitats? Yes—with good land stewardship. The more we learn about these ecosystems and the intricate interactions among all the organisms living there, the better our chances of making good resource management decisions in the future!

Explore the World with Shorebirds!

Let your students discover the threats shorebirds face in these simulation and critical thinking activities:

- **It Is a Tough Life!**
- **Migration Headache**
- **The Incredible Journey**
- **Shorebird Decision Dilemmas**
- **Guard Your Nest**
- **When the Grass Was Greener**

Shorebird Conservation



Shorebird Conservation Provides a Hopeful Future

- Over 20 million acres of shorebird habitat are part of the Western Hemisphere Shorebird Reserve Network (WHSRN). This voluntary consortium of over 240 organizations and agencies across the Americas is working together to protect and manage wetlands.
- The National Wildlife Refuge system, managed by the U.S. Fish and Wildlife Service, provides quality habitat for shorebird breeding, nesting, and wintering.
- Working with land managers and landowners, we are finding a way to manage for people and shorebirds.
- By managing habitat for shorebirds, numerous other species that depend on these ecosystems will benefit too.

Shorebird Conservation Is Very Challenging!

Land managers and biologists are faced with many tough questions that often have many possible answers, depending on an individual's perspective. Consider a private landowner who is trying to keep a family-owned ranching business alive. He or she will probably have different ideas and feelings about protecting shorebird habitat on land where his or her cattle grazes than a research biologist will. A community development committee elected to create jobs and attract tourist dollars into the community will probably have different coastal development priorities than a member of a bird-watching group.

Below are some of the difficult questions scientists are forced to answer when promoting or defending shorebird conservation. Which of these questions do think are easily answered?

How Can We Work to Protect Birds beyond Our Borders?

Perhaps one of the most significant conservation challenges is protecting species with long-distance migrations. The shorebirds that breed in North America migrate through or spend the nonbreeding season in no fewer than 41 nations! Protecting shorebirds involves cooperation and agreement among many different countries. Cultural differences, gaps in scientific understanding, and varying conservation ethics can create challenges to cooperation among countries.

How Can We Increase Our Own Shorebird Knowledge?

There is a need for more research and monitoring of many shorebird species. Biologists need more

information on baseline population numbers, an inventory of habitats used by shorebirds, and the development of long-term monitoring programs. Existing data suggest that populations of many shorebird species are already declining.

How Can We Reverse Past Population Declines?

Another significant conservation challenge is the low reproductive potential of shorebirds. The fact that most species lay a clutch of four or fewer eggs each season, with only a very few species re-nesting, makes it very difficult for biologists to reverse past population declines and increase shorebird numbers quickly.

How Can We Protect Shorebirds from Disasters?

The fact that shorebirds concentrate in such high numbers at migration stopover sites poses another challenge to biologists. Huge populations of shorebirds are vulnerable to any number of catastrophic environmental changes like weather events, oil spills, toxic chemical residues, habitat development, or human disturbances at many of these key sites.

How Might Climate Change Affect Shorebirds?

Climate change is possibly the least studied threat to shorebirds across all the flyways. Scientists suspect that global warming could change water levels along the coast and eliminate important shorebird habitat. Warmer winters might change the migration patterns of shorebirds, causing some to winter further north, bypassing the more southern conservation lands specifically set aside for them.

How Can We Help Private Landowners Save Important Habitat?

Much of the land used by shorebirds is privately owned. Several federal and most state natural resource agencies have programs to assist private landowners in managing wildlife and wildlife habitat on their property. These programs are limited in staff and funding.

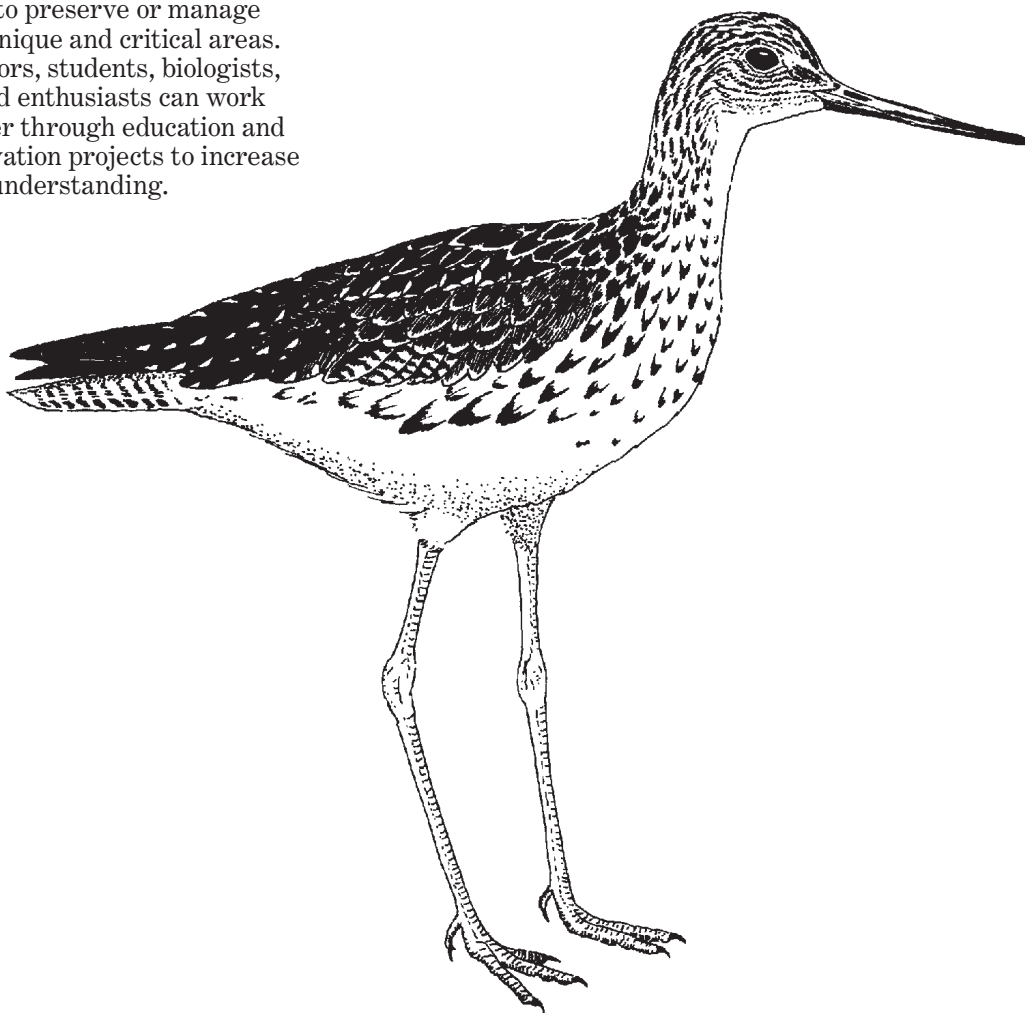
How Do We Increase Public Understanding?

Many people do not see wetlands and grasslands as important. They are not aware of the benefits that wetlands and grasslands provide them. Therefore, they do not see a need to preserve or manage these unique and critical areas. Educators, students, biologists, and bird enthusiasts can work together through education and conservation projects to increase public understanding.

National and International Partnership Programs Help

Thankfully, an increasing number of individuals and countries are recognizing these conservation challenges and the threat of habitat destruction all over the world. Many federal, state, indigenous, and private groups have purchased and protected millions of acres for local and migratory wildlife. There is a worldwide effort to identify critical staging areas and then to protect them. More studies are

conducted each year to answer questions about shorebird migration patterns, current population numbers, and habitat needs. Education programs, like the Shorebird Sister Schools Program, are teaching people about the value of wetlands and grasslands for shorebirds and all the other species that depend on these vital ecosystems. The following is a description of some of the most influential national and international partnership programs established to help protect shorebirds and their habitats.



■ *The National Wildlife Refuge System*

In the United States, the U.S. Fish and Wildlife Service has principal legal responsibility for managing 93 million acres for migratory wildlife at the federal level. There are more than 500 National Wildlife Refuges and Wetland Management Districts and most are considered important to shorebirds. Many refuges host huge flocks of shorebirds during some time of the year. To learn more about the National Wildlife Refuge System see its Web site at www.fws.gov

■ *The North American Bird Conservation Initiative (NABCI)*

NABCI is an agreement among organizations and agencies from Canada, Mexico, and the United States to facilitate the conservation of all native North American birds. Established in 1997, members of the NABCI subscribe to the motto “together we are stronger” and are sharing knowledge, experiences, and ideas to conserve birds and their critical habitats in North America. For more information on NABCI log on www.nabci.org.

■ *The United States Shorebird Conservation Plan*

This is a partnership effort of state and federal agencies, non-governmental conservation organizations, academic institutions, and individuals across the country committed to restoring and maintaining stable and self-sustaining populations of shorebirds in the United States and throughout the Western Hemisphere. This plan includes conservation goals for each region of the country, identifies conservation and research needs for critical habitats, and proposes education and outreach programs to increase public awareness of shorebirds and understanding

of the threats they face. The plans can be found at <http://shorebirdplan.fws.gov>.

■ *The North American Waterfowl Management Plan (NAWMP)*

MAWMP was originally designed to address the loss of waterfowl populations and habitat. Although international in scope, it depends on regional joint ventures to implement habitat and population goals. It has been successful in raising awareness of waterfowl conservation issues and protecting waterfowl habitat. Habitat joint ventures have been given the task of providing the framework to implement habitat goals from the other three bird group initiatives which include shorebirds. For more information log onto <http://northamerican.fws.gov/NAWMP/nawmphp.htm>.

■ *The Western Hemisphere Shorebird Reserve Network (WHSRN)*

This network brings together over 200 private and public organizations in seven countries working toward the conservation, restoration, and management of critical shorebird habitats throughout the Americas. Sites are recognized as significant to shorebirds when they fit one of three requirements: Regional Sites host at least 20,000 shorebirds; International Sites are used by at least 100,000 shorebirds; and Hemispheric Sites provide habitat to 500,000 or more shorebirds throughout the year. To date, WHSRN has over 50 wetland sites in seven countries that are critical links in a shorebird migration chain. For more information contact www.manomet.org.

■ *The Ramsar Convention on Wetlands*

This intergovernmental treaty signed in Ramsar, Iran, in 1971 was established to provide a framework for international cooperation for the conservation and wise use of wetlands and their resources. More than 122 countries from all regions of the world are now part of the convention. They meet every three years to discuss progress and wetland conservation. As part of membership, these countries agree to consider wetland conservation in their natural resource planning, promote wise use of wetlands in their countries, and establish nature reserves. They are also required to designate at least one site for inclusion on the “List of Wetlands of International Importance” based on criteria adopted under the convention. For more information go to <http://www.ramsar.org>.

■ *The International Shorebird Survey (ISS)*

ISS is a volunteer program organized by Manomet Center for Conservation Sciences. The purpose ISS is to collect information on shorebirds and the wetlands they use during migration. To date, more than 800 shorebird watchers have collected information from 1650 locations throughout the Western Hemisphere. Volunteers have added to our knowledge of migration routes, timing of peak migrations, trends in species declines, and locations of key stopover areas for shorebirds. The work of ISS volunteers has shown that many species of shorebirds concentrate at key staging areas to such a degree that their populations now depend on these critical sites. This led to the creation of the Western Hemisphere Shorebird

Reserve Network. To learn more about this important volunteer group, contact Manomet at <http://www.manomet.org>.

■ *Pan American Shorebird Program (PASP)*

This is an international program to promote conservation of and research on shorebirds in the Americas by coordinating shorebird color marking in the Americas and connecting observers of marked shorebirds with the banders of those birds. For more information go to <http://www.pnr-rpn.ec.gc.ca/nature/migratorybirds/pasp/index.en.html>

■ *The Shorebird Sister Schools Program (SSSP)*

The SSSP enables students to learn about shorebirds and their habitats, track migration, interact with shorebird biologists, and share their experiences with other “sister schools” shorebird enthusiasts around the world. Participation can include subscribing to the E-mail Network, viewing the World Wide Web site, and/or completing activities from the Grades 2-12 education guide *Explore the World with Shorebirds!* To learn more, visit the Web site at <http://sssp.fws.gov>.

Explore the World with Shorebirds!

If you would like to get your students thinking about their own conservation values get them and involved in shorebird education and conservation, try these activities:

- **What You Can Do for Shorebirds!**
- **Birding Code of Ethics**
- **Shorebird Values on the Line**
- **Shorebird Decision Dilemmas**
- **Shorebird News**
- **Shorebird Fair**
- **Shorebirds on Display**
- **Shorebird Wax Museum**
- **Shorebird Poetry**

You Can Help Shorebirds Too!

Learn about shorebirds.

The more you know about shorebirds, the more you will understand how you can help.

Never chase flocks of shorebirds.

Chasing shorebirds forces them to use up valuable energy and reduces the time they spend feeding and roosting.

Never let dogs chase shorebirds.

Choose to take your pets to an exercise area away from where shorebirds nest, rest, and feed. Always keep your pets on a leash.

Explain to others why it is so important not to disturb shorebirds.

Many people do not know that their actions hurt shorebirds. Share what you know with them so they can make better choices.

Become a shorebird observer.

Keep track of migrants coming through your local area. Help scientists identify critical staging areas for preservation. Submit your information to the ISS, c/o Manomet Bird Observatory, Box 1770, Manomet, MA 02345; Tel. 508/224 6521; Fax 508/224 9220.



Shorebird Research and Technology

Discovering More About Shorebirds Through Research

- New technology is allowing biologists to isolate stable isotopes in shorebird feathers and to trace what location the bird was in when it grew those feathers.
- Stable isotopes are helping to identify what shorebirds eat in specific areas and the importance of those types of food to shorebirds.
- Radio telemetry is helping biologists to determine the location of shorebirds most important habitat.

Scientists are still searching for answers to many questions about shorebirds. To discover what kind of birds live in a *habitat*, we can walk the area throughout the year and watch for different *species*. With a good field guide, binoculars, and lots of practice, we could identify all of the species that come to an area. But what about questions dealing with age, *survivorship*, *mortality*, or *behavior*? We can help birds best if we understand where they live, what they need, and where they travel.

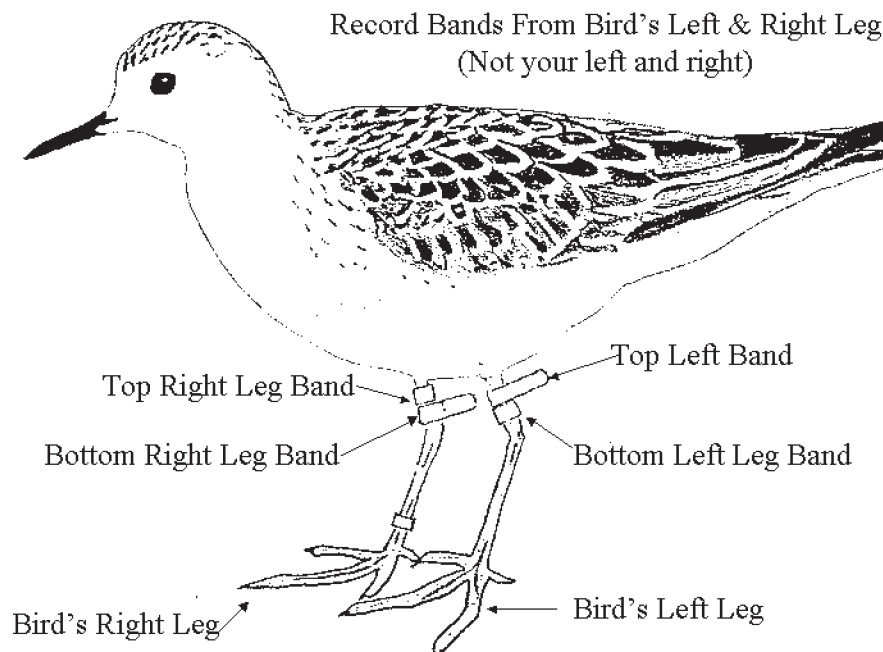
Often, in order to focus management efforts more clearly, researchers need to know where a specific bird population spends its entire year. Individual shorebirds, because of their migratory patterns, are difficult to track throughout the year. There is often a need to link

birds breeding in Siberia with those migrating through Missouri and wintering in Argentina. Because of this need, ornithologists use several methods such as banding and other forms of marking, radio and satellite telemetry, DNA testing, and, most recently, stable isotope analysis.

Bird Banding

Bird Banding helps to answer many of these questions. Marking birds for study has been done for more than 100 years—ever since John James Audubon captured an Eastern Phoebe in the 1850s, wrapped a small piece of silver wire around its leg, and determined that the same bird returned the following year.

Today, bird banding involves attaching a loose-fitting aluminum band around the bird's leg that is coded ahead of time with a unique



identification number. Also attached at times is a series of colored bracelets and flags that represent the country where the bird was banded, the banding year, and perhaps the age of the bird.

There are several ways to capture birds for banding:

1. Researchers can stretch a fine net called a *mist net* across an area where birds are likely to fly. Where and when the net is placed depends on the species and purpose. Once caught in the net, the bird is quickly and carefully untangled by the researcher who bands it, collects data on the species such as age, weight, and sex, then releases it.
2. Chicks can be banded before they leave the nest. By banding birds in the year they hatch and recording their annual return, researchers can see how long they live and if they are being replaced by a sufficient number of young. Shorebirds, unlike other bird species, are tolerant of humans handling their chicks.
3. *Cannon netting* involves using an electrical charge to catapult a net into the air over feeding shorebirds. This method is usually used in coastal areas where many birds can be captured quickly.

Because learning to handle birds properly requires special training, and to ensure that valuable information is not wasted or lost if birds are banded incorrectly, a special permit from the U.S. Fish and Wildlife Service is required for all birdbanding in the United States. Trained biologists handle birds carefully and keep stress to the birds to a minimum, ensuring that they are rarely injured.

Many birds that have been banded disappear and die without the researchers knowing where, when, or why. If you find a dead bird with a band, please report it to the appropriate agency.

To Report a Metal-Banded Bird

Notify your local state wildlife agency or the U.S. Fish and Wildlife Bird Banding Lab. Record the entire number on the band, the date you found the bird, the species (if you know it), and the exact location in which you found it.

Send this information along with the band, if possible, to:

Chief, Bird Banding Laboratory
Office of Migratory Bird Management
U.S. Fish and Wildlife Service
Laurel, MD 20810
Or call: 1 800/327 2263

To Report a Color-Banded or Flagged Bird

Describe each band: type (metal, color band, flag); colors (as exactly as possible—light green, dark blue); and location on bird (left or right leg, upper or lower leg, above or below other bands). Report if you are unsure of any bands or if you did not see all parts of both legs clearly. Please also report species, location of sighting, date, and any other information about behavior or other birds.

Mail shorebird color band sightings to:
PASP, Canadian Wildlife Service,
115 Perimeter Road,
Saskatoon, SK, S7N 0X4,
Canada

Or submit online at
<http://www.pnr-rpn.ec.gc.ca/nature/migratorybirds/pasp/index.en.html>

Radio Telemetry

Sometimes biologists will clip the feathers between a shorebird's shoulder blades and attach a small radio transmitter with glue. Each transmitter has a unique frequency like a radio station so that the biologist can use an antenna to "tune-in" to the banded bird. The transmitter does not injure the bird and eventually falls off; also the feathers grow back without affecting the bird's ability to fly. This technique allows scientists to study shorebirds in their natural habitats while performing their natural behaviors. They can learn what habitat the birds are using, how long they stay there, where they fly to next, and much more.

Satellite telemetry is a similar technology that uses satellites to track birds. Satellite transmitters have not been used on shorebirds because shorebirds are too small for these larger transmitters. Satellite technology is used more often with larger birds like swans. Also, satellite transmitters are more expensive than radio transmitters. Perhaps as technology improves, smaller, cheaper transmitters will be invented for use with shorebirds.

Stable Isotopes

Several species of shorebirds replace their flight feathers (wing and tail feathers) on their southern wintering grounds prior to beginning their northern migration during the spring. As the bird eats, traces of minerals and elements are deposited in the growing feather. Feathers grow quickly, and once they are fully grown, they are "lifeless." Because they do not change, elements are "stamped" into the feather. Stable isotopes are naturally occurring elements incorporated into an animal when

taken in by the foods the animal eats. The stable isotopes revealed in bird tissue reflect the same stable isotopes found in the bird's diet at its local habitat. By analyzing elements found in shorebird tissue, scientists may trace some birds to specific geographical locations. Collecting a feather from a shorebird caught at one site, analyzing it for stable isotopes, and comparing the results with stable isotopes from known geographic sites may allow a scientist to trace a bird to the general location where it grew the feather. This technology is relatively new and exciting to biologists because of its potential to link geographic areas used by shorebirds during migration, breeding, and wintering. To read more about stable isotopes in shorebirds, go to the following Web site: http://www.fort.usgs.gov/resources/spotlight/shorebird_isotopes/isotopes_home.asp

DNA Testing

DNA or genetic analysis is a powerful tool to assess whether shorebird populations and species are related. By taking a small sample of blood or tissue, scientists can learn about the evolutionary history of shorebirds in relation to other species and other groups of birds. This technique can also be used to compare different populations of the same species. For example, through DNA analyses scientists learned that the Piping Plovers wintering along the Gulf Coast of Mexico were actually two different subpopulations—genetically different within the species. They learned that one subpopulation breeds in the Great Lakes and the other along the Atlantic Coast. This can be very important for managing the species as a whole, as well as discovering different problems associated with each subpopulation.

Explore the World with Shorebirds!

Give your students the opportunity to collect shorebird data through simulations or by observing real shorebirds. Here are some research and technology activities:

- **Banded Birds**
- **You Be the Scientist**
- **Imaginary Mist Nets**
- **Shorebird Field Study (field trip)**
- **Bird Beans**
- **Mud Creatures Study**
- **Sampling Local Shorebird Populations (field trip)**
- **Shorebirds on the Web**



Classroom Activities

Activities Indexes and Correlation to National Standards

1.Subject and Skill.....	97
2.Visual Arts, English, Math, History/Social Studies, Science	105

NOTE: Cultural awareness activity in the SSSP & Connecting Cultures section of this guide.

Introduction to Shorebirds118

Shorebird Profiles	119
Most Wanted: Shorebirds!	122
A Year (a Day or a Week) In My Life as a Shorebird	125
Get to Know the Shorebirds Puppet Shows	127

Adaptations 134

Build a Shorebird.....	135
What Can I Eat with This Beak?	152
Avian Olympics	156

Habitat..... 162

Shorebird Food Webs	163
Can't We Share?.....	186
Wetland Metaphors	202
Match the Habitat Cards	206
Types of Habitats	224
Student Habitat Readings	228
Map Your Habitats	250
When the Grass Was Greener.....	252

Nesting and Breeding 258

Colorful Changes	259
Guard Your Nest	261
Behave Yourself!	267
Musical Nests	273
It's a Tough Life!	279

Migration and Migratory Stopover Sites 285

Migration Headache	286
Migration Math Madness	321
The Incredible Journey	327
Precarious Paths	335
Bird's-eye View	343

Shorebird Research and Technology	345
Banded Birds	346
Bird Beans	351
You Be the Scientist	356
Imaginary Mist Nets	361
Shorebirds on the Web	366
 The Big Shorebird Picture	 369
Shorebird Poetry	370
Shorebird Wax Museum	373
Shorebirds on Display	375
Shorebird Fair	376
Shorebird News	377
Shorebird Decision Dilemmas	379
What You Can Do for Shorebirds!	382
Shorebird Values on the Line	385
 Review and Assessment	 389
Wild Spellers	390
Shorebird Jeo-Bird-Y	391
Shorebird Speeches and Listening Tests	397
Peeps and Predators	398
Shorebird Bubble Map	401

Explore the World with Shorebirds! Activities by Subjects Index

Activity Unit	Shorebird Topic	Page Number	Subjects								
			Science	Language Arts	Fine Arts	Geography	Social Studies	History	Physical Ed.	Math	Technology
Lower Elementary											
Build a Shorebird	Adaptations		■				▲	■			
What Can I Eat with This Beak?	Adaptations		■	▲	▲					■	
Shorebird Food Webs	Habitat		■				▲				
Wetland Metaphors	Habitat		■	■			▲				
Can't We Share?	Habitat		■				▲				
Migration Headache	Migration		■						■	■	▲
Colorful Changes	Nesting and breeding		■		■						
Guard Your Nest	Nesting and breeding		■		■		▲				
Behave Yourself!	Nesting and breeding		■		■				■		
Musical Nests	Nesting and breeding		■						■	■	
Shorebirds on the Web	Research and technology		■	■			■				■
Shorebird Wax Museum	The big shorebird picture		■	■	■						▲
Map and Miles Study	Pre-field trip activity					■				■	
Using Field Guides and Binoculars	Pre-field trip activity		■								
Making Sampling Equipment	Pre-field trip activity		■	■							
Shorebird Field Study	On-site field trip activity		■	■	▲						■
Cast a Track	On-site field trip activity		■		■						
Mud Creatures Study	On-site field trip activity		■							■	
Sharing Circle	Post-field trip activity		■	■	▲						
Peeps and Predators	Assessment activity		■						■		
Wild Spellers	Assessment activity		■	■							
Upper Elem. / Middle School											
Increasing Cultural Awareness	SSSP & Cultural Connections			■	▲	■	■				
Get to Know the Shorebirds	Introduction to shorebirds		■	■	■		▲				
Shorebird Profiles	Introduction to shorebirds		■	■	▲	▲	▲				
What Can I Eat with This Beak?	Adaptations		■	▲	▲					■	

▲ Denotes that the subject is addressed in the unit's additional activities



Explore the World with Shorebirds! Activities by Subjects Index

Activity Unit	Shorebird Topic	Page Number	Subjects								
			Science	Language Arts	Fine Arts	Geography	Social Studies	History	Physical Ed.	Math	Technology
Upper Elem. / Middle School											
Wetland Metaphors	Habitat		■	■			▲				
Match the Habitat Cards	Habitat		■	■	▲						
Types of Habitat	Habitat		■	■	■	■					
Shorebird Food Webs	Habitat		■								
Migration Headache	Migration		■			▲	▲		■	■	▲
Migration Math Madness	Migration		■			■				■	
The Incredible Journey	Migration		■			■	■	■	■	■	▲
Guard Your Nest	Nesting and breeding		■		■		▲				
Colorful Changes	Nesting and breeding		■		■						
It's a Tough Life!	Nesting and breeding		■	▲					■		
Bird Beans	Research and technology		■							■	
Banded Birds	Research and technology		■							■	
Shorebirds on the Web	Research and technology		■	■		■					■
Shorebirds on Display	The big shorebird picture		■	■	■						
Shorebird Fair	The big shorebird picture		■	■	■						
Shorebird Decision Dilemmas	The big shorebird picture		■	■			■				
Shorebird Poetry	The big shorebird picture		■	■							■
Map and Miles Study	Pre-field trip activity					■				■	
Using Field Guides and Binoculars	Pre-field trip activity		■								
Making Sampling Equipment	Pre-field trip activity		■	■							
Birding Code of Ethics	Pre-field trip activity		■		■						
Shorebird Field Study	On-site field trip activity		■	■	▲						■
Cast a Track	On-site field trip activity		■		■						
Mud Creatures Study	On-site field trip activity		■							■	
Sharing Circle	Post-field trip activity		■	■	▲						
Data Analysis	Post-field trip activity		■							■	
Shorebird Jeo-Bird-Y	Assessment activity		■			■	▲				
Peeps and Predators	Assessment activity		■						■		
Shorebird Bubble or Concept Map	Assessment activity		■	■	▲		▲		■		

▲ Denotes that the subject is addressed in the unit's additional activities

Explore the World with Shorebirds! Activities by Subjects Index

Activity Unit	Shorebird Topic	Page Number	Subjects								
			Science	Language Arts	Fine Arts	Geography	Social Studies	History	Physical Ed.	Math	Technology
Upper Elem. / Middle School											
Shorebird Speeches & Listening Tests	Assessment activity		■	■			▲				■
Upper Middle / High School											
Increasing Cultural Awareness	SSSP & Cultural Connections			■	▲	■	■				
Shorebird Profiles	Introduction to shorebirds		■	■	▲	▲	▲				
A Year in My Life as a Shorebird	Introduction to shorebirds		■	■		■	▲				
Most Wanted: Shorebirds	Introduction to shorebirds		■	■	■	■	■				
Avian Olympics	Adaptations		■						■	■	
Map Your Habitats	Habitat		■	▲		■	▲				
When the Grass Was Greener	Habitat		■	■			■			▲	
Bird's-eye View	Migration		■	▲	■	■					▲
Precarious Paths	Migration		■	■	▲	■					
Colorful Changes	Nesting and breeding		■		■						
Shorebird Bubble Map	Nesting and breeding		■	■	▲						
You Be the Scientist	Research and technology		■	■			▲				
Imaginary Mist Nets	Research and technology		■	■			▲			■	
Shorebirds on the Web	Research and technology		■	■						■	■
Shorebird Values on the Line	The big shorebird picture		■	■			■				
Shorebird Decision Dilemmas	The big shorebird picture		■	■			■				
What You Can Do for Shorebirds!	The big shorebird picture		■	■			■				
Shorebird News	The big shorebird picture		■	■			▲				■
Shorebird Poetry	The big shorebird picture		■	■							■
Shorebird Fair	The big shorebird picture		■	■	■						■
Shorebirds on Display	The big shorebird picture		■	■	■		▲				
Birding Code of Ethics	Pre-field trip activity		■		■					■	
Shorebird Field Study	On-site field trip activity		■	■	▲						■
Sampling Local Shorebird Populations	On-site field trip activity		■							■	■
Cast a Track	On-site field trip activity		■		■					■	
Mud Creatures Study	On-site field trip activity		■							■	
Data Analysis	Post-field trip activity		■							■	
Shorebird Speeches and Listening Tests	Assessment activity		■	■			▲			■	
Sharing Circle	Assessment activity		■	■	▲						
Shorebird Jeo-Bird-Y	Assessment activity		■			■	▲	▲			
Shorebird Bubble/Concept Map	Assessment activity		■	■	▲		▲				

▲ Denotes that the subject is addressed in the unit's additional activities



Explore the World with Shorebirds! Activities by Skills Index

Activity Unit	Shorebird Topic	Page Number	Skills													
			Application	Collecting / Interpreting Data	Comparison	Communication / Presentation	Critical Thinking	Forming Hypotheses	Observing	Predicting	Problem Solving	Spelling / Vocab.	Discussion / Evaluation	Team Building	Visualization	Using Technology
Lower Elementary																
Build a Shorebird	Adaptations				■							■	■		■	
What Can I Eat with This Beak?	Adaptations			■	■						■	■	■		■	
Shorebird Food Webs	Habitat						■			■	■	■	■			
Wetland Metaphors	Habitat		■			■						■	■	■	■	
Can't We Share?	Habitat			■		■		■	■			■	■			
Migration Headache	Migration			■	■				■			■	■			▲
Colorful Changes	Nesting and breeding					■			■						■	
Guard Your Nest	Nesting and breeding					■	■		■	■	■	■	■			
Behave Yourself!	Nesting and breeding		■		■	■			■							
Musical Nests	Nesting and breeding			■								■	■			
Shorebirds on the Web	Research and technology			■		■										■
Shorebird Wax Museum	The big shorebird picture					■										▲
Map and Miles Study	Pre-field trip activity		■	■			■						■			
Using Field Guides and Binoculars	Pre-field trip activity				■				■					■		
Making Sampling Equipment	Pre-field trip activity		■			■								■		
Shorebird Field Study	On-site field trip activity		■	■	■				■				■			■
Cast a Track	On-site field trip activity		■		■				■							
Mud Creatures Study	On-site field trip activity		■	■	■		■	■	■				■	■		
Sharing Circle	Post-field trip activity												■		▲	
Peeps and Predators	Assessment activity						■					■		■		
Wild Spellers	Assessment activity											■		■		
Upper Elem. / Middle School																
Increasing Cultural Awareness	SSSP & Connecting Cultures				■	■						■	■	■		
Get to Know the Shorebirds	Introduction to shorebirds					■						■	■	■	■	
Shorebird Profiles	Introduction to shorebirds				■	■	■					■				

▲ Denotes that the subject is addressed in the unit's additional activities



Explore the World with Shorebirds! Activities by Skills Index

Activity Unit	Shorebird Topic	Page Number	Skills													
			Application	Collecting / Interpreting Data	Comparison	Communication / Presentation	Critical Thinking	Forming Hypotheses	Observing	Predicting	Problem Solving	Spelling / Vocab.	Discussion / Evaluation	Team Building	Visualization	Using Technology
Upper Elem. / Middle School																
What Can I Eat with This Beak?	Adaptations			■	■						■	■	■		■	
Wetland Metaphors	Habitat		■			■						■	■	■	■	
Match the Habitat Cards	Habitat						■					■			■	
Types of Habitat	Habitat				■	■	■					■			■	
Shorebird Food Webs	Habitat						■			■	■	■	■			
Migration Headache	Migration			■	■				■			■	■			▲
Migration Math Madness	Migration			■	■											▲
The Incredible Journey	Migration				■		■		■	■		■	■			▲
Guard Your Nest	Nesting and breeding					■	■		■	■	■	■	■			
Colorful Changes	Nesting and breeding					■			■						■	
It's a Tough Life!	Nesting and breeding			■			■					■	■		■	
Bird Beans	Research and technology			■	■		■					■	■			
Banded Birds	Research and technology			■		■		■	■			■	■	■		
Shorebirds on the Web	Research and technology			■		■										■
Shorebirds on Display	The big shorebird picture					■									■	
Shorebird Fair	The big shorebird picture					■									■	
Shorebird Decision Dilemmas	The big shorebird picture		■			■	■				■		■	■		
Shorebird Poetry	The big shorebird picture		■			■	■					■				■
Map and Miles Study	Pre-field trip activity		■	■			■						■			
Using Field Guides and Binoculars	Pre-field trip activity				■				■						■	
Making Sampling Equipment	Pre-field trip activity		■			■									■	
Birding Code of Ethics	Pre-field trip activity				■	■	■		■				■			
Shorebird Field Study	On-site field trip activity		■	■	■				■				■			■
Cast a Track	On-site field trip activity		■		■				■							
Mud Creatures Studies	On-site field trip activity		■	■	■		■	■	■				■	■		
Sharing Circle	Post-field trip activity												■		■	
Data Analysis	Post-field trip activity			■			■						■			

▲ Denotes that the subject is addressed in the unit's additional activities

Explore the World with Shorebirds! Activities by Skills Index

Activity Unit	Shorebird Topic	Page Number	Skills													
			Application	Collecting / Interpreting Data	Comparison	Communication / Presentation	Critical Thinking	Forming Hypotheses	Observing	Predicting	Problem Solving	Spelling / Vocab.	Discussion / Evaluation	Team Building	Visualization	Using Technology
Upper Elem. / Middle School																
Shorebird Bubble / Concept Map	Assessment activity					■	■					■	■			
Peeps and Predators	Assessment activity						■							■		
Shorebird Speeches & Listening Tests	Assessment activity			■		■										
Upper Middle / High School																
Increasing Cultural Awareness	SSSP & Connecting Cultures				■	■						■	■	■		
Shorebird Profiles	Introduction to shorebirds				■	■	■					■				
A Year in My Life as a Shorebird	Introduction to shorebirds		■	■		■						■			■	
Most Wanted: Shorebirds	Introduction to shorebirds					■	■					■	■	■	■	
Avian Olympics	Adaptations			■	■							■	■	■		
Map Your Habitats	Habitat			■				■	■			■	■			
When the Grass Was Greener	Habitat						■					■	■		■	
Bird's-eye View	Migration					■						■	■		■	▲
Precarious Paths	Migration			■	■	■	■					■	■			
Colorful Changes	Nesting and breeding					■			■						■	
Shorebird Bubble Map	Nesting and breeding					■						■	■		■	
You Be the Scientist	Research and technology					■	■	■				■	■	■		
Imaginary Mist Nets	Research and technology			■		■		■				■	■			
Shorebirds on the Web	Research and technology			■		■										■
Shorebird Values on the Line	The big shorebird picture				■		■					■	■			
Shorebird Decision Dilemmas	The big shorebird picture		■			■	■			■			■	■		
What You Can Do for Shorebirds!	The big shorebird picture		■			■			■	■	■	■	■	■		
Shorebird News	The big shorebird picture		■			■										■
Shorebird Poetry	The big shorebird picture		■			■	■					■				■
Shorebird Fair	The big shorebird picture					■								■		■
Shorebirds on Display	The big shorebird picture					■								■		
Shorebird Jeo-Bird-Y	Assessment activity					■						■		■		
Birding Code of Ethics	Pre-field trip activity				■	■	■		■				■			

▲ Denotes that the subject is addressed in the unit's additional activities



Explore the World with Shorebirds! Activities by Skills Index

Activity Unit	Shorebird Topic	Page Number	Skills													
			Application	Collecting / Interpreting Data	Comparison	Communication / Presentation	Critical Thinking	Forming Hypotheses	Observing	Predicting	Problem Solving	Spelling / Vocab.	Discussion / Evaluation	Team Building	Visualization	Using Technology
Upper Middle / High School																
Sampling Local Shorebird Populations	On-site field trip activity		■	■	■	■		■	■				■			■
Shorebird Field Study	On-site field trip activity		■	■	■		■		■				■			■
Cast a Track	On-site field trip activity		■		■				■							
Mud Creatures Study	On-site field trip activity		■	■	■		■	■	■				■	■		
Data Analysis	Post-field trip activity			■			■						■			
Shorebird Speeches and Listening Tests	Assessment activity			■		■										
Shorebird Jeo-Bird-Y	Assessment activity					■						■		■		
Shorebird Bubble / Concept Map	Assessment activity					■						■	■		■	
Sharing Circle	Assessment activity												■			

▲ Denotes that the subject is addressed in the unit's additional activities

Explore the World with Shorebirds!

Correlation with National Visual Arts Content Standards

All Grades

<h1>Explore the World with Shorebirds!</h1> <h2>Correlation with National Visual Arts Content Standards</h2> <p><i>All Grades</i></p>			Understanding & Applying media, techniques, & processes.	Using knowledge of structures & functions.	Choosing & evaluating range of subject matter, symbols & ideas.	Understanding visual arts in relation to history & cultures.	Reflecting upon & assessing characteristics & merits of their work & work of others.	Making connections between visual arts & other disciplines.
Activity	Shorebird Topic	Grades						
Get to Know the Shorebirds	introduction to shorebirds	5-8	■	■				■
Shorebird Profiles	introduction to shorebirds	5-8, 9-12	▲	▲				▲
Most Wanted: Shorebirds	introduction to shorebirds	9-12	■	■			■	■
What Can I Eat With This Beak?	adaptations	K-4, 5-8	▲	▲				▲
Types of Habitat	habitat	5-8	■	■	■			■
Match the Habitat Cards	habitat	5-8	▲	▲				▲
Wetland Metaphors	habitat	K-4, 5-8	▲	▲				▲
Bird's Eye View	migration	9-12	■	■	■			■
Precarious Paths	migration	9-12	▲	▲	▲			▲
Colorful Changes	nesting & breeding	K-4, 5-8, 9-12	■	■			■	■
Guard Your Nest	nesting & breeding	K-4, 5-8	■	■			■	■
Shorebird Wax Museum	big shorebird picture	K-4	■	■				■
Shorebird Fair	big shorebird picture	5-8, 9-12			■			■
Shorebirds on Display	big shorebird picture	5-8, 9-12	■	■	■		▲	■
Birding Code of Ethics	pre-fieldtrip activity	5-8, 9-12	■	■	■			■
Shorebird Field Study	on-site fieldtrip activity	All grades	■					■
Cast a Track	on-site fieldtrip activity	All grades	■					■
Sharing Circle	post fieldtrip activity	All grades	▲	▲				▲
Shorebird Bubble or Concept Map	assessment activity	5-8, 9-12	▲	▲	▲			▲

▲ Indicates the standard is addressed in the unit's additional activities

Explore the World with Shorebirds!

Correlation with National English Language Arts Standards

All Grades

			Read texts for understanding of text, themselves, & cultures of the United States & the world.	Apply wide range of strategies to comprehend, interpret, evaluate, & appreciate texts.	Adjust spoken, written, & visual language to communicate effectively with variety of audiences & purposes.	Employ wide range of strategies to communicate effectively with different audiences for different purposes.	Apply knowledge of language structure, conventions, etc. to create, critique, & discuss print & non-print texts.	Research issues, interests; gather, evaluate, & synthesize data.	Use variety of resources to gather & synthesize information & create & communicate knowledge.	Develop understanding & respect for diversity use of language across cultures, ethnic groups, geo. regions & social roles.	English as 2 nd language students; use 1 st language to develop competency in English.	Participate as knowledgeable, reflective, creative, & critical members of variety of literacy communities.	Use spoken, written, & visual language to accomplish own purpose.
Activity Unit	Shorebird Topic	Grades											
Increasing Cultural Awareness	SSSP&ConnectingCultures	5-8, 9-12	■	■	■	■				■		■	
Get to Know the Shorebirds	introduction to shorebirds	5-8	■		■	■	▲	▲	▲			■	■
Shorebird Profiles	introduction to shorebirds	5-8, 9-12	■	■	■	■		■				■	
A Year In My Life As A Shorebird	introduction to shorebirds	9-12	■	■	■		■	■	■			■	■
Most Wanted Shorebirds!	introduction to shorebirds	9-12	■		■				■			■	■
What Can I Eat With This Beak?	adaptations	K-4, 5-8			▲		▲		▲			▲	▲
Wetland Metaphors	habitat	K-4, 5-8			■	■			▲			■	
Match the Habitat Cards	habitat	5-8	■	■			■	■	■			■	■
Types of Habitat	habitat	5-8	■	■	▲	■	■	■	■			■	■
When the Grass Was Greener	habitat	9-12	■	■	▲	▲	▲	▲	▲			■	▲
Map Your Habitat	habitat	9-12	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Precarious Paths	migration	9-12	■	■			■					■	
Bird's Eye View	migration	9-12				▲	■	■	■			■	▲
It's a Tough Life!	nesting and breeding	5-8	▲	▲			▲	▲	▲			▲	▲
You Be the Scientist	research and technology	9-12	■	■	■	■	■	■	■			■	■
Imaginary Mist Nets	research and technology	9-12	■	■	■	■	■	■	■			■	■
Shorebirds on the Web	research and technology	All grades	■	■	■	■	■	■	■	■	■	■	■
Shorebirds on Display	big shorebird picture	5-8, 9-12			■	■	■		■			■	■

▲ Indicates the standard is addressed in the unit's additional activities

Explore the World with Shorebirds!

Correlation with National English Language Arts Standards

All Grades continued

Activity Unit	Shorebird Topic	Grades	Read texts for understanding of text, themselves, & cultures of the United States & the world.	Apply wide range of strategies to comprehend, interpret, evaluate, & appreciate texts.	Adjust spoken, written, & visual language to communicate effectively with variety of audiences & purposes.	Employ wide range of strategies to communicate effectively with different audiences for different purposes.	Apply knowledge of language structure, conventions, etc. to create, critique, & discuss print & non-print texts.	Research issues, interests; gather, evaluate, & synthesize data.	Use variety of resources to gather & synthesize information & create & communicate knowledge.	Develop understanding & respect for diversity use of language across cultures, ethnic groups, geo. regions & social roles.	English as 2nd language students: use 1st language to develop competency in English.	Participate as knowledgeable, reflective, creative, & critical members of variety of literacy communities.	Use spoken, written, & visual language to accomplish own purpose.
Shorebird Fair	big shorebird picture	5-8, 9-12			■	■	■		■			■	■
Shorebird Decision Dilemmas	big shorebird picture	5-8, 9-12	■	■	■							■	■
Shorebird Poetry	big shorebird picture	5-8, 9-12			■	■	■			■		■	■
Shorebird Wax Museum	big shorebird picture	K-4			■	■	▲				■	■	■
Shorebird News	big shorebird picture	9-12					■		■			■	■
What You Can Do For Shorebirds!	big shorebird picture	9-12			■	■	■	■	■	■		■	■
Shorebird Values on the Line	big shorebird picture	9-12			■	■						■	■
Wild Spellers	assessment activity	K-4									■		■
Shorebird Bubble or Concept Map	assessment activity	5-8, 9-12			■	■			■			■	■
Shorebird Speeches & Listening Tests	assessment activity	5-8, 9-12	■	■	■	■	■	■	■			■	■
Making Field Sampling Equipment	pre-fieldtrip activity	K-4, 5-8						■	■			■	■
Shorebird Field Study	on-site fieldtrip activity	All grades			■	■	■	■	■			■	■
Sharing Circle	post-fieldtrip activity	All grades			■							■	■

▲ Indicates the standard is addressed in the unit's additional activities

Explore the World with Shorebirds!

Correlation with National History* and Social Studies Standards

Upper Elementary/Middle School (5-8)

**There is no significant correlation of activities to National History Standards for grades 5-8.*

Explore the World with Shorebirds!

Correlation with National History* and Social Studies Standards

Upper Elementary/Middle School (5-8)

**There is no significant correlation of activities to National History Standards for grades 5-8.*

		Social Studies Standards																
		Culture		People, Places & Environments									Science, Technology & Society			Global Connections		
		Compare similarities & differences in ways groups, societies, & cultures meet human needs & concerns.	Explain why individuals & groups respond differently to physical & social environments &/or changes to them....	Elaborate mental maps of locales, regions, & the world...	Create, interpret, use & distinguish various representations of the earth...	Use appropriate resources, data sources, & geographic tools...	Estimate distance, calculate scale, & distinguish other geographic relationships...	Locate & describe varying landforms & geographic features...	Describe physical system changes like seasons, climate & weather & identify associated geographic patterns.	Observe & speculate about social & economic effects of environmental changes & crises...	Propose, compare, & evaluate alternative uses of land & resources in communities, regions, nations & the world.	Show how science & technology have changed people's perceptions of the social & natural world.	Describe examples where values, beliefs & attitudes were influenced by new scientific & technological knowledge.	Seek reasonable & ethical solutions to problems when scientific advancements conflict with social norms or values.	Explore causes, consequences & possible solutions to global issues such as environmental quality...	Describe & analyze the effects of changing technologies on the global community.	Describe & explain relationships & tensions between nations & global interests in matters like natural resources.	
Activity Unit	Shorebird Topic																	
Types of Habitat	habitat			■	■	■		■										
Migration Headache	habitat			▲					▲									
Migration Math Madness	migration			■	■	■	■	■										
The Incredible Journey	migration			■	■	■			▲									
Shorebirds on the Web	research and technology	■	■	■	■	■		■	■	■	■	■			■	■		
Map & Miles Study	pre-fieldtrip activity			■	■	■	■	■										
Shorebird Jeo-Bird-Y	assessment activity			■				■	■									
Shorebird Decision Dilemmas	the big shorebird picture		■								■							

Explore the World with Shorebirds!

Correlation with National History and Social Studies Standards

Upper Middle School/High School (9-12)

		History Standards				Social Studies Standards											
		Historical Issues-Analysis & Decision-Making Identify issues & problems in the past. ☒	Evaluate alternative courses of action. ☒	Formulate a position or course of action on a position. ☒	Evaluate the implementation of a decision. ☒	Culture		People, Places & Environments							Science, Technology & Society	Global Connections	
						Analyze & explain the ways groups, societies, and cultures address human needs & concerns.	Compare & analyze societal patterns for preserving & transmitting culture while adapting to environmental or social change.	Refine mental maps of locals, regions, & the world that demonstrate understanding of relative location, direction, size, and shape.	Create, interpret, use & synthesize information form various representations of the earth...	Use appropriate resources, data sources, & geographic tools to generate & manipulate, & interpret information.	Calculate distance, scale, area & density & distinguish spatial distribution patterns.	Describe, differentiate, & explain relationships among various regional & global patterns of geographic phenomena.	Use of knowledge of physical system changes such as seasons, climate & weather, & water cycle to explain geographic phenomena.	Propose, compare, & evaluate alternative policies for the use of land & other resources....	Analyze how science & technology influence the core values, beliefs, & attitudes of society, & how core values, beliefs, and attitudes of society shape scientific & technological change.	Analyze & evaluate the effects of changing technologies on the global community.	Analyze the causes, consequences, & possible solutions to persistent, contemporary, & emerging global issues such as environmental quality.
Activity Unit	Shorebird Topic																
Increasing Cultural Awareness	SSSP & Cultural Connections					■	■	■							■		
Shorebird Profiles	introduction to shorebirds							▲	▲	▲			▲				
A Year In My Life As A Shorebird	introduction to shorebirds							■	■	■			■				
Most Wanted: Shorebirds	introduction to shorebirds							■				■	■				
Map Your Habitats	habitat							■	■	■							
When the Grass Was Greener	habitat	■	■	■	■			■					■	■			
Bird's Eye View	migration							■	■			■	■				
Precarious Paths	migration							■	▲	■	■	■					
Shorebirds on the Web	research and technology					■	■	■	■	■		■	■		■	■	
Shorebird Values on the Line	big shorebird picture	■	■	■		■								■	■		■
Shorebird Decision Dilemmas	big shorebird picture	■	■	■	■									■			
What You Can Do For Shorebirds!	big shorebird picture			■	■									■			
Shorebird Jeo-Bird-Y	assessment activity	▲						■				■	■				

▲ Indicates the standard is addressed in the unit's additional activities

Explore the World with Shorebirds!

Correlation with National Science Content Standards

Lower Elementary
(K-4)

Explore the World with Shorebirds! Correlation with National Science Content Standards Lower Elementary (K-4)		Unifying Concepts & Processes					Science as Inquiry		Life Science			Science & Technology			Science in Personal & Social Perspectives					History & Nature of Science
		Systems, order & organization	Evidence, models & explanation	Change, consistency & measurement	Evolution & equilibrium	Form & function	Abilities to do scientific inquiry	Understanding scientific inquiry	Characteristics of organisms	Life Cycles of organisms	Organisms and environments	Abilities of Technological design	Understanding science and technology	Distinguish natural and human objects	Personal health	Characteristics & changes in pop.	Types of resources	Changes in environments	Science & tech. In local challenges	Science as human endeavor
Activity Unit	Shorebird Topic																			
Build A Shorebird	adaptations		■		■	■			■	■	■									
What Can I Eat With This Beak?	adaptations		■	■		■	■	■	■		■									
Shorebird Food Webs	habitat	■	■	■	■						■					■	■	■		
Wetland Metaphors	habitat	■									■				■		■			
Can't We Share?	habitat	■	■	■																
Migration Headache	migration	■	■	■		■	■	■	■	■	■					■		■		
Colorful Changes	nesting and breeding			■		■	■		■	■	■									
Guard Your Nest	nesting and breeding					■	■	■	■	■	■									
Behave Yourself!	nesting and breeding					■			■	■										
Musical Nests	nesting and breeding		■	■					■	■	■									
Shorebirds on the Web	research and technology	■	■	■			■	■	■	■	■	■	■			■		■	■	■
Using Field Guides & Binoculars	pre-fieldtrip activity								■		■			■						■
Making Field Sampling Equipment	pre-fieldtrip activity											■								■
Shorebird Field Study	on-site fieldtrip activity	■				■	■	■	■	■	■			■						■
Cast a Track	on-site fieldtrip activity		■			■			■		■									■
Mud Creatures Study	post fieldtrip activity	■	■	■		■	■	■	■		■	■		■		■				■
Sharing Circle	post fieldtrip activity		■			■			■		■									■
Shorebird Wax Museum	big shorebird picture											▲								
Peeps and Predators	assessment activity																			
Wild Spellers	assessment activity																			

Shading indicates that the activity may touch on any number of science topics.

▲ Indicates the standard is addressed in the unit's additional activities

Explore the World with Shorebirds!

Correlation with National Science Standards

Upper Elementary/Middle School (5-8)

Explore the World with Shorebirds!		Unifying Concepts & Processes					Science as Inquiry		Life Science					Science & Technology			Science in Personal & Social Perspectives					History & Nature of Science	
		Systems, order & organization	Evidence, models & explanation	Change, consistency & measurement	Evolution & equilibrium	Form & function	Abilities to do scientific inquiry	Understanding scientific inquiry	Structure & function in living systems	Reproduction & heredity	Regulation & behavior	Populations & ecosystems	Diversity & adaptations of organisms	Abilities of Technological design	Understanding science and technology	Distinguish natural and human objects	Personal health	Pop. , resources, environments	Natural hazards	Risks & benefits	Science & tech. In society	Science as human endeavor	Nature of science
Activity Unit	Shorebird Topic																						
Increasing Cultural Awareness	SSSP & Connecting Culutres																	■				■	
Get to Know the Shorebirds	introduction to shorebirds	■				■	▲		■	■	■	■	■					■	■				
Shorebird Profiles	introduction to shorebirds					■			■	■	■	■	■					■	■				
What Can I Eat With This Beak?	adaptations		■	■		■	■		■				■										
Shorebird Food Webs	habitat	■	■	■	■				■			■						■					
Wetland Metaphors	habitat																						
Match the Habitat Cards	habitat	■		■		■			■			■	■					■	■				
Types of Habitat	habitat	■	■	■		▲			■			■	■										
Migration Headache	migration	■	■	■		■			■	■	■	■	■					■	■				
Migration Math Madness	migration	■	■	■						■	■	■	■										
The Incredible Journey	migration	■	■	■		■	▲		■	■	■	■	■						■				
Colorful Changes	nesting and breeding			■		■	■			■		■	■						■				
Guard Your Nest	nesting and breeding					■	■	■		■	■	■	■						■				
It's a Tough Life	nesting and breeding	■	■			■			■	■	■	■	■			■		■	■				
Banded Birds	research & technology	■	■	■			■	■	■		■	■		■	■	■		■	■			■	■
Shorebirds on the Web	research & technology	■	■	■			■	■				■		■	■			■				■	■
Bird Beans	research & technology	■	■	■			■				■	■				■		■				■	■
Shorebird Fair	big shorebird picture	■	■	■	■	■			■	■	■	■	■			■	■	■	■			■	■
Shorebird Decision Dilemmas	big shorebird picture	■				■	■		■		■	■	■			■		■	■			■	■

Shading indicates that the activity may touch on any number of science topics.

▲ Indicates the standard is addressed in the unit's additional activities

Explore the World with Shorebirds!

Correlation with National Science Standards

Upper Elementary / Middle School
(5-8) continued

Explore the World with Shorebirds!		Unifying Concepts & Processes					Science as Inquiry		Life Science					Science & Technology			Science in Personal & Social Perspectives					History & Nature of Science	
		Systems, order & organization	Evidence, models & explanation	Change, consistency & measurement	Evolution & equilibrium	Form & function	Abilities to do scientific inquiry	Understanding scientific inquiry	Structure & function in living systems	Reproduction & heredity	Regulation & behavior	Populations & ecosystems	Diversity & adaptations of organisms	Abilities of Technological design	Understanding science and technology	Distinguish natural and human objects	Personal health	Pop. , resources, environments	Natural hazards	Risks & benefits	Science & tech. In society	Science as human endeavor	Nature of science
Activity Unit	Shorebird Topic																						
Shorebird Poetry	big shorebird picture																						
Shorebirds on Display	big shorebird picture																						
Using Field Guides & Binoculars	pre-fieldtrip activity											■				■						■	
Making Field Sampling Equipment	pre-fieldtrip activity						■		▲					■								■	
Birding Code of Ethics	pre-fieldtrip activity	■	■								■	■							■				
Shorebird Field Study	on-site fieldtrip activity	■				■	■		■		■	■	■									■	
Cast A Track	on-site fieldtrip activity		■			■			■				■			■						■	
Mud Creatures Study	on-site fieldtrip activity	■	■	■		■	■	■	■			■	■	■		■						■	
Data Analysis	post-fieldtrip activity	■	■	■			■	■						■								■	
Sharing Circle	post-fieldtrip activity																						
Shorebird Bubble or Concept Map	assessment activity																						
Shorebird Jeo-Bird-Y	assessment activity																						
Peeps and Predators	assessment activity																						
Shorebird Speeches & Listening Tests	assessment activity																						

Shading indicates that the activity may touch on any number of science topics.

▲ Indicates the standard is addressed in the unit’s additional activities

<h1>Explore the World with Shorebirds!</h1> <h2>Correlation with National Science Standards</h2> <p><i>Upper Middle School / High School (9-12)</i></p>		Unifying Concepts & Processes					Science as Inquiry		Life Science			Science & Technology		Science in Personal & Social Perspectives						History & Nature of Science		
		Systems, order & organization	Evidence, models & explanation	Change, consistency & measurement	Evolution & equilibrium	Form & function	Abilities to do scientific inquiry	Understanding scientific inquiry	Interdependence of organisms	Matter, energy & organization	Behavior of organisms	Abilities of Technological design	Understanding science and technology	Personal & community health	Population growth	Natural Resources	Environmental quality	Natural & human induced hazards	Science & technology challenges	Science as human endeavor	Nature of scientific knowledge	Historical perspectives
Activity Unit	Shorebird Topic																					
Increasing Cultural Awareness	SSSP & Connecting Cultures															■	■	■		■	■	■
Shorebird Profiles	introduction to shorebirds					■			■		■											
A Year In My Life As A Shorebird	introduction to shorebirds	■				■			■		■					■	■	■				
Most Wanted: Shorebirds	introduction to shorebirds					■			■		■				■			■				
Avian Olympics	adaptations			■		■				■	■											
Map Your Habitats	habitat																					
When the Grass Was Greener	habitat	■	■	■												■	■	■	■			
Bird's Eye View	migration	■				■	■		■		■					■	■	■				
Precarious Paths	migration	■		■		■			■		■					■	■	■	■			
Colorful Changes	nesting and breeding			■		■	■				■											
Imaginary Mist Nets	research & technology	■	■	■		■	■				■		■						■	■	■	
You Be the Scientist	research & technology	■	■	■		■	■				■	■	■						■	■	■	
Shorebirds on the Web	research & technology	■	■	■		■	■	■	■		■	■	■		■	■	■	■	■	■	■	■
Shorebird Values on the Line	big shorebird picture													■	■	■	■	■	■			
Shorebird Decision Dilemmas	big shorebird picture																					
What You Can Do For Shorebirds!	big shorebird picture																		■	■	■	
Shorebirds News	big shorebird picture		▲											▲		▲	▲	▲		■		

Shading indicates that the activity may touch on any number of science topics.

▲ Indicates the standard is addressed in the unit's additional activities

Explore the World with Shorebirds!

Correlation with National Science Standards

Upper Middle School / High School
(9-12) continued

		Unifying Concepts & Processes					Science as Inquiry		Life Science			Science & Technology		Science in Personal & Social Perspectives						History & Nature of Science		
		Systems, order & organization	Evidence, models & explanation	Change, consistency & measurement	Evolution & equilibrium	Form & function	Abilities to do scientific inquiry	Understanding scientific inquiry	Interdependence of organisms	Matter, energy & organization	Behavior of organisms	Abilities of Technological design	Understanding science and technology	Personal & community health	Population growth	Natural Resources	Environmental quality	Natural & human induced hazards	Science & technology challenges	Science as human endeavor	Nature of scientific knowledge	Historical perspectives
Activity Unit	Shorebird Topic																					
Shorebird Poetry	big shorebird picture																					
Shorebird Fair	big shorebird picture																					
Shorebirds on Display	big shorebird picture																					
Birding Code of Ethics	pre-fieldtrip activity	■	■						■		■							■			■	
Shorebird Field Study	on-site fieldtrip activity	■				■	■		■		■				■	■	■	■		■	■	
Cast a Track	on-site fieldtrip activity		■			■														■	■	
Mud Creatures Study	on-site fieldtrip activity	■	■	■		■	■	■	■		■	■					■		■	■	■	
Sampling Local Shorebird Populations	on-site fieldtrip activity	■	■	■			■	■	■	■	■	■	■		■		■	■	■	■	■	
Data Analysis	post fieldtrip activity																					
Sharing Circle	post fieldtrip activity																					
Shorebird Speeches & Listening Tests	assessment activity																					
Shorebird Jeo-Bird-Y	assessment activity																					
Shorebird Bubble Map	assessment activity																					

Shading indicates that the activity may touch on any number of science topics.

▲ Indicates the standard is addressed in the unit's additional activities

Explore the World with Shorebirds!

Correlation with National Math Standards

All Grades

<div>Explore the World with Shorebirds!</div> <div>Correlation with National Math Standards</div> <div>All Grades</div>			Numbers & Operations			Data Analysis & Probability				Measurement		Problem Solving			Communication			Connections			Representation																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
			Understand numbers, ways of representing numbers, relationships among numbers, & number systems.			Understand meanings of operations & how they relate to one another.			Compute fluently & make reasonable estimates.			Formulate & answer questions with relevant data.			Select & use appropriate statistical methods to analyze data.			Develop & evaluate inferences & predictions that are based on data.			Understand & apply basic concepts of probability.			Units, systems, and processes of measurement.			Apply appropriate techniques, tools, and formulas to determine measurements.			Build new mathematical knowledge through problem solving.			Solve problems that arise in math & in other contexts.			Apply and adapt a variety of appropriate strategies to solve problems.			Organize & consolidate math thinking through communication.			Comm. Math thinking coherently & clearly to peers, teachers & others.			Analyze & evaluate math thinking & strategies of others.			Use the lang. of math to express math ideas precisely.			Recognize & use connections among math ideas.			Understand how math ideas interconnect & build on one another.			Recognize & apply math in contexts outside of math.			Create & use representations to record, organ., & comm. math ideas.			Select, apply, & translate among math ideas.			Use representations to model & interpret physical, social, & math phenomena.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				

<div> <h1>Explore the World with Shorebirds!</h1> <h2>Correlation with National Math Standards</h2> <p><i>All Grades continued</i></p> </div>			Numbers & Operations			Data Analysis & Probability				Measurement		Problem Solving			Communication				Connections			Representation		
			Understand numbers, ways of representing numbers, relationships among numbers, & number systems.	Understand meanings of operations & how they relate to one another.	Compute fluently & make reasonable estimates.	Formulate & answer questions with relevant data.	Select & use appropriate statistical methods to analyze data.	Develop & evaluate inferences & predictions that are based on data.	Understand & apply basic concepts of probability.	Units, systems, and processes of measurement.	Apply appropriate techniques, tools, and formulas to determine measurements.	Build new mathematical knowledge through problem solving.	Solve problems that arise in math & in other contexts.	Apply and adapt a variety of appropriate strategies to solve problems.	Organize & consolidate math thinking through comm.	Comm. Math thinking coherently & clearly to peers, teachers & others.	Analyze & evaluate math thinking & strategies of others.	Use the language of math to express math ideas precisely.	Recognize & use connections among math ideas.	Understand how math ideas interconnect & build on one another.	Recognize & apply math in contexts outside of math.	Create & use representations to record, organ., & communicate math ideas.	Select, apply, & translate among math ideas.	Use representations to model & interpret physical, social, & math phenomena.
Activity Unit	Shorebird Topic	Grade Level																						
Musical Nests	nesting & breeding	K-4	■	■		■						■	■		■	■					■	■		■
Bird Beans	research & technology	5-8	■	■	■	■	■	■	■	■	■	■	■						■	■		■	■	■
Banded Birds	research & technology	5-8	■	■	■	■	■	■					■			■	■		■	■		■	■	■
Imaginary Mist Nets	research & technology	9-12	■	■	■	■	■	■	■			■	■	■					■	■	■	■	■	■
Map & Miles Study	pre-fieldtrip activity	All grades	■	■	■	■				■	■	■												

Explore the World with Shorebirds!

Correlation with National Math Standards

All Grades continued

<div>Explore the World with Shorebirds!</div> <div>Correlation with National Math Standards</div> <div>All Grades continued</div>			Numbers & Operations			Data Analysis & Probability				Measurement		Problem Solving		Communication			Connections			Representation				
			Understand numbers, ways of repr. Numbers, relationships among numbers, & number systems			Understand meanings of operations & how they relate to one another.			Compute fluently & make reasonable estimates.			Formulate & answer questions with relevant data.			Select & use appropriate statistical methods to analyze data.			Develop & evaluate inferences & predictions that are based on data.			Understand & apply basic concepts of probability.			
			Units, systems, and processes of measurement.			Apply appropriate techniques, tools, and formulas to determine measurements.			Build new mathematical knowledge through problem solving.			Solve problems that arise in math & in other contexts.			Apply and adapt a variety of appropriate strategies to solve problems.			Organize & consolidate math thinking through communication.						
			Comm. Math thinking coherently & clearly to peers, teachers & others.			Analyze & evaluate math thinking & strategies of others.			Use the lang. Of math to express math ideas precisely.			Recognize & use connections among math ideas.			Understand how math ideas interconnect & build on one another.			Recognize & apply math in contexts outside of math.						
			Create & use representations to record, organ., & communicate math ideas.			Select, apply, & translate among math ideas.			Use representations to model & interpret physical, social, & math phenomena.															
Activity Unit	Shorebird Topic	Grade Level																						
Shorebird Field Study	on-site fieldtrip	on-site fieldtrip	■	■	■	■	■	■	■	■	■	■	■				■	■		■	■	■	■	■
Sampling Local Shorebird Populations	on-site fieldtrip	9-12	■	■	■	■	■	■	■	■	■	■	■				■	■		■	■	■	■	■
Mud Creatures Study	on-site fieldtrip	on-site fieldtrip	■	■	■	■	■	■		■	■	■	■			■	■		■	■		■	■	■
Data Analysis	post-fieldtrip	5-8, 9-12	■	■	■	■	■	■	■	■	■	■	■				■	■		■	■		■	■
Shorebird Speeches & Listening Tests	assessment activity	5-8, 9-12	■	■	■	■	■	■		■	■	■	■						■	■	■	■	■	■

▲ Indicates the standard is addressed in the unit’s additional activities

Introduction to Shorebirds

Concepts

- Shorebirds have a unique combination of physical and behavioral characteristics that help us in their identification.
- Shorebirds are birds specially adapted to live in open land and often near water.
- Most shorebirds are migratory.
- Shorebirds form some of the largest migratory groups of all vertebrate species.
- Shorebirds are international travelers that link people and places.
- Learning about representative species of shorebirds and their ecology can help us learn about birds in general.
- Many shorebird species are declining.

Activities

Shorebird Profiles

(upper elementary/middle school; upper middle school/high school)
By critically reading four shorebird profiles provided in this educator's guide, students make direct comparisons among the appearance, food habits, migration routes, and mating behaviors of four shorebirds found in their area. They will explore values associated with, as well as threats to, these four shorebirds.

Most Wanted: Shorebirds!

(upper middle school/high school)
Students work in teams to research and then create a "wanted" poster that highlights key information about a shorebird species whose population is of concern to biologists.

A Year (a Day or a Week) In My Life as a Shorebird

(upper middle school/high school)
Students imagine themselves as a shorebird and write a "first-bird" account of a day, a week, or a year in its life.

Get to Know the Shorebirds Puppet Shows

(lower and upper elementary/middle school)
By creating shorebird puppets and putting on a shorebird puppet show, students learn the physical and behavioral characteristics that make a bird a shorebird.



Shorebird Profiles

Grade Level: upper elementary/
middle school; upper middle school/
high school

Duration: one 40-minute class
period

Skills: critical thinking, vocabulary,
comparison of similarities and
differences, and communication
Subjects: science and language arts,
social studies (geography), and fine
arts (in the additional activities)

Concepts

- Shorebirds have a unique combination of physical and behavioral characteristics that help us in their identification.
- Shorebirds are birds specially adapted to live in open land and often near water.
- Most shorebirds are migratory.
- Learning about representative species of shorebirds and their ecology can help us learn about birds in general.

Vocabulary

This list will vary depending on the shorebird species you study. See the highlighted words in each profile you select to build your own vocabulary list for this activity.

Overview

By reading four shorebird profiles provided in this education guide, students will learn to make direct comparisons among the appearance, food habits, migration routes, and mating behaviors of four shorebirds found in their area. They will explore values associated with, as well as threats to, these four shorebirds.

Objectives

After this activity, students will be able to:

- Name four shorebirds found in their area.
- List the differences in appearance, food habits, migration routes, and mating behavior of these four shorebirds.
- Describe at least one interesting fact about each of the four shorebirds they studied.

Materials

- *Shorebird Profiles* (found in the **Appendix**)
- Student worksheet (included in this activity)

Introduction

You will find 20 descriptions of shorebirds commonly seen in the United States in the *Shorebird Profiles* section of the *Appendix*. Select four profiles for your students to read. Be sure to select shorebirds that are found in your area. If you are not sure which species to choose, check the list of shorebird species for your flyway at the beginning of the profiles. If you are not sure which flyway you are in refer to the flyway section in the *Shorebird Primer*.

Activity Preparation

1. Make one copy of each shorebird profile you select for each student.
2. Make one copy of the student worksheet for each student.

Procedure

1. Instruct your students to read each shorebird profile. Ask them to concentrate on making direct comparisons among the species.
2. Have students fill out the accompanying worksheet table or use the table as a guideline for a discussion of what they read. Encourage them to:
 - Avoid simply listing information under each heading.
 - Compare similarities and differences among the species.
 - Limit the number of variables they compare. In this case, the only variable should be “species.” For example, when comparing what these birds eat, do not compare food eaten in winter to food eaten in summer (unless you indicate that you are aware you are introducing season as another variable).
 - Translate the table to sentence form on the back of the worksheet: “The similarity between the way a female Western Sandpiper and a female Dunlin behaves is -----. The difference between their behaviors is -----.”



Additional Activities



Cultural Extension

Students can use the cultural profiles in the *SSSP and Connecting Cultures* section to add an interesting fact about one of the countries that the shorebirds migrate through.

Shorebird Profile Jigsaw

Divide the class into four cooperative groups with each responsible for reading and then teaching the class about one of the four shorebirds. Give each group 30 minutes or more to prepare its presentations. Encourage them to include a drawing of their bird in its most colorful plumage, a color-coded map showing where the bird winters, migrates, and breeds, and unique facts in the oral presentation. Have each group write and turn in two quiz questions about its shorebird. After all the groups have made their presentations, choose at least one question from each group for a short shorebird quiz.

Community Research

Assign your students to do additional research for more information on your local shorebirds. Where and when can you find them nearby? What habitats are most likely to attract shorebirds? Talk to local wildlife biologists, conservation groups, and bird-watchers.

Map Your Habitats

Using the activity *Map Your Habitats* (found in the *Habitat Activity* section), have students study maps of your local area to determine where suitable shorebird habitat is located and which species you might find there.

Creative Writing

Have each student write a creative story about one of the shorebirds. Ask them to include at least five facts found in the profile. Suggest writing from the perspective of the bird, describing an exciting fall migration south to its wintering grounds or an especially difficult breeding season, selecting just the right mate and nest site.

Shorebird Adaptations

Advanced students can practice critical thinking skills by choosing one behavioral or morphological adaptation for a shorebird they studied. Ask them to write their own theories on how or why this trait may have developed. Then have him or her research to see if his or her theory could be accurate.



Shorebird Profiles Student Worksheet

Directions: List the common names of the four shorebirds you read about. Then fill in the table below with direct comparisons among the shorebirds.

<i>Shorebird Name</i>	<i>Physical Description</i>	<i>Food (note the season)</i>	<i>Spring Migration (time and place)</i>	<i>Mating Behavior</i>	<i>Most Interesting Fact</i>

Most Wanted: Shorebirds!

Grade Level: upper middle school/ high school

Duration: several class periods for research and illustration

Skills: communication, presentation, critical thinking, spelling, vocabulary, team building, visualization, discussion, and evaluation.

Subjects: science, language arts, fine arts, social studies (geography) and technology

Concepts

- Many shorebirds species are declining

Vocabulary

- endangered
- species of high concern
- threatened
- population
- species

Overview

Students work in teams to research and create a “wanted” poster to highlight key information about a shorebird species whose population is of concern to biologists.

Objectives

After this activity, students will be able to:

- Differentiate between the terms “endangered” and “threatened.”
- Name at least three shorebird species of concern to biologists.
- Explain why these shorebird species are declining.
- Identify any local shorebird populations that are considered threatened or endangered.

Materials

- Field guides and shorebird reference books
- Copies of the *Shorebird Profiles* located in the *Appendix*
- One large white sheet of drawing paper for each student or each team
- Drawing pencils, markers, pastels, or crayons to make the shorebird drawings

Introduction

In the United States 2001 Shorebird Conservation Plan, biologists from many agencies and conservation organizations in the United States worked together to rank the overall stability of North American shorebird *populations*. Each species was assigned a Conservation Category ranging from Category 1 (the species is not considered at risk) all the way to Category 5 (the species is considered highly imperiled). To see the entire species list and ranking go to <http://shorebirdplan.fws.gov>.

All the species listed as federally *threatened* or *endangered* were placed in the “Highly Imperiled” category. These include:

Category 5 Highly Imperiled Shorebirds

Snowy Plover
Piping Plover
Mountain Plover
Eskimo Curlew (considered extinct)
Long-billed Curlew

Shorebird species that are known or thought to be *declining* and have another known or potential threat that biologists fear will escalate the population’s downward trend were placed in the “High Concern” category. These include:

Category 4 Species of High Concern

American Golden-Plover
Pacific Golden-Plover
Wilson’s Plover
American Oystercatcher
Black Oystercatcher
Solitary Sandpiper
Upland Sandpiper
Whimbrel
Bristle-thighed Curlew
Hudsonian Godwit
Bar-tailed Godwit
Marbled Godwit
Ruddy Turnstone
Black Turnstone
Surfbird

Red Knot
Sanderling
Western Sandpiper
Buff-breasted Sandpiper
Short-billed Dowitcher
American Woodcock
Wilson’s Phalarope

There are a number of species that are of moderate (Category 3) and low concern (Category 2). These lists can be seen at <http://shorebirdplan.fws.gov>

A wide variety of studies monitors population trends, the affects of pollution, human disturbance, habitat loss, and predators on different shorebird populations. Still, the population numbers of 17 species (including *subspecies*) are considered to be little more than an “educated guess” by biologists because additional surveys are needed.

Shorebird research is very challenging. Funding needs, partnerships across national and state lines, and the vast geographic expanse that shorebirds inhabit make it difficult to monitor and study them. However, biologists need to learn as much as possible in order to conserve shorebirds and their habitat before they decline to such low numbers that they require federal listing and protection. It is a benefit to the species, natural resource professionals, partners, and the public to work proactively.

Preparation

1. Decide which species (listed in the *Introduction* of this activity) to highlight in this activity. Try to select at least one shorebird found in your area or state.
2. Decide if students will work in teams or individually to create the “Most Wanted” posters.
3. Create a shorebird research corner in your classroom by gathering up shorebird field



guides and resource books from the school library or by borrowing a shorebird education trunk. (Go to <http://sssp.fws.gov> and click on the “educators” link to find out how to borrow a trunk.)

4. Make photocopies of the *Shorebird Profiles*, found in the *Appendix*, that describe the shorebirds your class is researching. Add them to your shorebird research corner.

Procedure

1. Explain to your students that they are going to learn about shorebirds that are considered to have populations that are endangered, threatened, or declining. Discuss with your class what it means to be an endangered or threatened species. Ask them what might cause a species to become endangered or threatened.
2. Assign each student or student team a shorebird species from the list provided. Explain the assignment: to learn as much about your shorebird as possible and then create a “wanted” poster to display in the school or within the community. The purposes of this poster are to give people as much information as possible about the bird so they can identify it and to bring about general awareness of shorebirds and endangered species.
3. Refer your students to the following Web sites: <http://sssp.fws.gov>, <http://endangered.fws.gov>, <http://www.manomet.org/WHSRN/Prairies/index.htm>, <http://shorebirdplan.fws.gov>, and <http://migratorybirds.fws.gov>. Also refer them to the materials in your shorebird research corner. Write the guidelines found below on the chalkboard for

the students to refer to as they collect shorebird information. If the students will be working in teams, distribute the work as if they are part of a real production team—one illustrator, one researcher, one writer, one layout/graphic designer. Remind them that even though they each have specific responsibilities, they should work as a team to design, develop, review, and edit their poster.

Most Wanted Poster Guidelines

- Include why this shorebird is “wanted” (reasons for its population decline).
 - If it is endangered or threatened federally, explain why.
 - Provide a drawing or photograph of the species.
 - Give both the common and scientific names of the species.
 - Give the location of where it might be seen (habitat).
 - Provide a list of distinguishing physical features and natural history.
 - Note any unique behavioral characteristics.
 - Describe the call of this species.
4. Although an example poster is included for your reference, emphasize creativity with your students. Encourage them to come up with their own layout designs and additional headings.
 5. When all the posters are complete, hand them around the room and give the class an opportunity to carefully study their classmates’ posters. Move your “most wanted” posters to the hallway, library, or school cafeteria for the whole school to view. Eventually move them to a community library, bank, or government center.

6. Consider asking the class, or even the whole school, to vote on the finished products using a variety of categories like “best illustration,” “best layout,” “most interesting information,” etc.
7. Take a class vote for the “Overall Best Poster” and send it in to the Shorebird Sister Schools Coordinator for posting on the Web site. Please submit only one poster per class following the directions on the SSSP Web site, <http://sssp.fws.gov>

Additional Activities

Research Studies on Endangered and Threatened Shorebirds
As a follow-up to the Most Wanted Shorebirds Posters, have your students research what scientists are doing today to keep track of the populations of these shorebirds. Use the Web site <http://sssp.fws.gov> to learn more about shorebird studies and to “Ask a Biologist a Question.”

Imaginary Mist Nets and You Be the Scientist
These additional classroom activities are found in the *Shorebird Research and Technology Section* of this chapter. They provide students the opportunity to simulate the gathering of shorebird data scientists use to estimate shorebird population numbers and determine resource management actions that can save shorebirds.

Wanted

Snowy Plover (*Charadrius alexandrinus*) *Federally Threatened Species*

Recently Spotted

July 4, 2002, on the sand beaches
along the Pacific Coast

Call

A low “krut” and a soft, whistled
“ku-wheet”

Physical Features

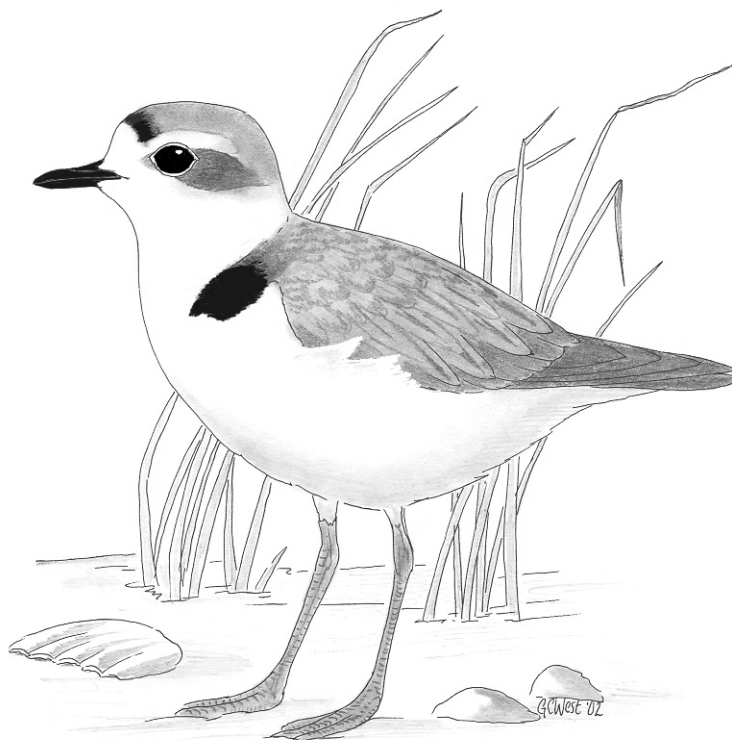
The Snowy Plover is a small
bird with a slender bill and black
legs. Males in breeding season
(mid- March to mid-September)
have a black forehead, ear patch,
and partial neckring. In winter
plumage, both males and females
are a dull buffy color.

Notable Behaviors

- This shorebird species is
extremely wary of people and
continues to move away as they
approach. They will abandon their
chicks if disturbed!
- Snowy plovers nest on flat, open,
sandy beaches and feed on the
beaches or in the sand dunes.

Reasons for Population Decline

Beach raking, summer beach
recreation, off-road vehicles,
residential and industrial
development, predators like the
crow, raven and red fox, and the
spread of European Beach Grass



If you see this bird do not attempt capture! This species is Federally protected. Contact your nearest U.S. Fish and Wildlife Service Office or state wildlife agency.



A Year (a Day or a Week) In My Life as a Shorebird

Adapted with permission from *Quinlan, Alaska Wildlife Week*. Special thanks to David Jaynes, University of Alaska Fairbanks, 1994.

Grade Level: upper middle school/ high school

Duration: several class periods for research, discussion of the writing process, and peer editing

Skills: application, communication, presentation, spelling, vocabulary, collection of information, and visualization

Subjects: science, language arts, social studies (geography)

Concepts

- Shorebirds are birds specially adapted to live in open land and often near water.
- Most shorebirds are migratory.
- Shorebirds are international travelers that link people and places.
- Learning about representative species of shorebirds and their ecology can help us learn about birds in general.

Overview

Students imagine themselves as a shorebird and write a “first-bird” account of a day, a week, or a year in its life.

Objectives

After this activity, students will be able to:

- Describe the basic life history of one shorebird common to their area.
- Use the writing process which includes brainstorming, rough draft writing, peer editing, and re-writing to create a factually and grammatically accurate story.
- Provide feedback on content, clarity, and grammar of another writer’s work.

Materials

- Books
- Videos
- Slide shows
- Bird identification books
- *Shorebird Profiles*, located in *Appendix*, as reference material

Introduction

This activity is intended to introduce your students to creative writing as a “process”: prewriting, writing, revising, editing, and rewriting, using shorebirds as the topic. The result will be a finished product that is written to the best of the students’ abilities with good spelling, grammar, punctuation, handwriting (or typing), and requested content.

■ **Prewriting:** This includes brainstorming the content elements, “mapping” and “bubbling” to organize information, researching the topic, and noting related personal experiences and observations. (For an example on how to use this technique, see the classroom activity Shorebird Bubble Map in the Assessment Activities Section of this chapter.)

■ **Writing:** The author takes the prewriting ideas, converts them into sentences and paragraphs, and then organizes them into a story.

■ **Revising:** The author makes changes to improve the flow of information, increases clarity, and incorporates information or ideas that may have been left out of the first draft.

■ **Editing:** The project is proofread by the author, another student, and/or the teacher in order to provide feedback on content, correctness, grammar/usage, and clarity.

■ **Rewriting to Final Draft:** Once the author receives editorial comments, he or she then re-writes the work accordingly.

■ **Publishing and Evaluation:** The next step, in some cases, is submission to class magazines, newspapers, and bulletin boards, reading to an audience, or posting on the Shorebird Sister Schools network to share with other students.

Procedure

1. Ask each student to select a shorebird to study. Using the *Shorebird Profiles*, World Wide Web, and books from your library, give students time to research basic information about their birds. Students can also interview elders, scientists, or other knowledgeable people. Have the class brainstorm a list of questions to research about their birds. For example:

- What does it eat?
- Where does it spend its winters?
- What migration route does it take to its breeding grounds?
- Where does it breed?
- Does it use any unique breeding displays to attract a mate?
- What predators threaten this shorebird?
- What other things threaten this bird’s survival?
- What cultures encounter this shorebird?
- How do the cultures view the shorebird differently?
- How can people help?

2. Ask students to imagine that they are this shorebird. Ask them to write a short story in first person (“first shorebird”) that describes one day, one week, or one year of their life. The story should be based on the factual information they uncovered during their research.

3. If your class will be going on a field trip to observe shorebirds, encourage your students to observe and gather information for use in their stories. Ask students to use all their senses to observe the habitat-temperature, smells, sights from different perspectives, sounds, other species, textures of the habitat (e.g., plants, soil, air, water), and light levels-to include in their stories.
4. Review the steps of the writing process described in the *Introduction* to this activity. Ask each student to select one classmate to act as his or her peer editor who will proofread his or her text and provide comments on content, clarity, and grammar.
5. Submit your students' writing for posting on the Shorebird Sister Schools Web site, by following the guidelines posted at <http://sssp.fws.gov>.

Additional Activities



Cultural Extension

Students can include information in their report about the cultures that encounter the shorebird they study.

Shorebird Story Dilemmas

Encourage students to edit their stories to incorporate a realistic environmental crisis into them. To start, have the class brainstorm a list of possible environmental changes or crises that shorebirds face. Examples might be a wind or snow storm during migration, loss of a favorite habitat, loss of a mate or nest, flooding, or disturbance by off-road vehicles. Have the students choose one crisis appropriate to the shorebirds they have chosen and rewrite their original stories, this time including the crisis and some resolution (negative, positive, or otherwise).



Get to Know the Shorebirds Puppet Shows

Grade Level: upper elementary/middle school

Duration: 30 minutes to present the puppet shows, several class periods to create puppets and scenery and to practice the production

Skills: communication, presentation, discussion, vocabulary, team building, and visualization

Subjects: science, language arts, and fine arts

Concepts

- Shorebirds have a unique combination of physical and behavioral characteristics that help us in their identification.
- Shorebirds are birds specially adapted to live in open land and often near water.
- Most shorebirds are migratory.
- Shorebirds are international travelers that link people and places.
- Learning about representative species of shorebirds and their ecology can help us learn about birds in general.

Vocabulary

- Shorebird
- Wetland
- Grassland
- Migration
- Predator
- Camouflage
- Adaptation
- Refuge
- Arctic
- Tundra
- Stopover site
- Fat-loading
- Adapted

Overview

By creating shorebird puppets and putting on a shorebird puppet show, students learn the physical and behavioral characteristics that make a bird a shorebird.

Objectives

After this activity, students will be able to:

- Describe at least three physical

characteristics common to shorebirds.

- Explain at least two behavioral characteristics common to shorebirds.
- Give three examples of threats to shorebird survival.

Materials

- An assortment of puppet-making materials, including paper lunch bags, paper plates, craft sticks, clay or papier-mâché material, tempera paint, crayons, markers, yarn, pipe cleaners, fishing line
- Copies of [shorebird coloring pages](#) to use in puppet-making or as templates (found in the Appendix)
- Magazine pictures of shorebirds and shorebird habitat

Introduction

Children love to create puppets. There are many terrific ideas for constructing puppets from very simple designs that preschool children can make and enjoy, to complex and time-consuming creations made from clay and papier-mâché. Here are a few simple ideas using materials you can probably find right in your classroom. If you are interested in creating more complicated puppets that will outlast this one production, check out these wonderful resources:

Puppet-making Books

Simple Puppets from Everyday

Author: Barbara MacDonald
Buetter

Publisher: Sterling Publishing
Company, Inc.

Puppets: Methods and Materials

Author: Cedric Flower

Publisher: Sterling Publishing
Company, Inc.

Paper Bag Puppets

Students draw, then color or paint a shorebird silhouette; cut out and

color or paint one of the shorebird coloring page illustrations; or cut out a shorebird magazine picture and glue it to the front of a brown paper lunch sack.

Bird-on-a-Stick Puppets

Students draw, then color or paint a shorebird silhouette; cut out and color or paint one of the shorebird coloring page illustrations; or cut out a shorebird magazine picture and glue it to the front of a large craft stick.

Paper Plate Puppets

Students create a shorebird head on a paper plate using construction paper, felt, or cloth material to create the bird's beak, eyes, and facial markings. To manipulate these puppets, students can either glue the shorebird heads to craft sticks or add elastic bands to the back of the plates to slip over their hands.

Shorebird Marionettes

First create a shorebird head from clay or papier-mâché using tempera paints. Thread painted Styrofoam balls on pipe cleaners or yarn to begin creating a shorebird body. Attach felt or other material to the balls for tail and wing features. Tie fishing line or thread to different parts of the puppet to manipulate it like a marionette.

Activity Preparation

1. Collect the materials suggested for any, or all, of the puppet styles found in the Introduction to this activity. Ask students and parents to help collect materials from home.
2. Setup three stations in your classroom--one for puppet making, a second for set design, and a third for script practice.
3. Select the puppet plays (or plan to have students write their own) to use in this activity and



make seven photocopies of each one you select, one copy for each cast member and the production team.

Procedure

1. Introduce the topic of shorebirds to your students. Discuss the characteristics that make a bird a shorebird. Show your class pictures of shorebirds in your area using field guides, magazine pictures, or the posters included in this education guide.
2. Create a list of shorebird characteristics on the chalkboard. This list should include the physical attributes students can see from their pictures. Do not forget to include behavioral characteristics to the list. Below is a list of some characteristics to include.

Physical and Behavioral Characteristics of Shorebirds

Physical Traits

- They have long legs (relative to their body size) for wading.
- They have slender toes for balance while walking.
- They have long, slender beaks (relative to their body size) for probing in the mud or water.
- They have camouflage coloring.

Behavioral Traits

- Most nest on the ground.
- They nest independently.
- They prefer open habitats like wetlands and grasslands.
- They feed on invertebrates.
- They use simple vocalizations that include peeps, whistles, or short trills.
- They breed in the tundra and central grasslands.
- They make extremely long migrations between breeding grounds & nonbreeding grounds.
- They establish territory and use breeding and distraction displays.

- They have a variety of foraging habits due to many different bill types.

3. Explain to your students that the class will be learning and presenting two plays about shorebirds.
4. Divide your class into two to four groups based on the number of puppet shows you want to present and the size of your class. Provide each group a copy of the shorebird play it is to present. One copy should go to each puppeteer and one to each team of set designers, puppet designers, and the director. They can select two other shorebirds found in their area if they do not want to use the Western Sandpiper and Killdeer. Ask them to decide who in their groups will take on the following roles.

Puppeteers

(Keep in mind that if you choose to substitute either the Western Sandpiper or the Killdeer for another species of shorebird, you will probably have to edit the script. Use the *Shorebird Profiles* located in the *Appendix* for the migration patterns, food preferences, and threats for other species of shorebirds.)

- Western Sandpiper (or another local species)
- Killdeer (or another local species)
- Bird-watcher
- Narrator (an actual puppet or a student reading the narrator's commentary)

Set Designer(s)

Students who take on this job will be creating a backdrop for the puppet production. They should create a realistic habitat drawing or painting for the audience.

Puppet Designer(s)

This team creates the Western Sandpiper, Killdeer, and birdwatcher puppets, keeping in mind that they should be as realistic as possible so the audience can recognize the shorebird species and can tell them apart.

Director(s)

These students help the “actors” practice reading or memorizing their lines and manipulating their puppets.

5. Let each group work to pull its production together. Create areas in the classroom where the puppet designers can create their puppets, the set designers have all the materials to create backdrops, and the actors can practice their lines. It is certainly easier to ask the groups to create the same type of puppet (i.e. Paper Bag Puppets, Bird-on-a-Stick Puppets). However, the productions will be more interesting and the students more enthusiastic if you allow each puppet designer to choose his or her own style puppet and encourage them to try using many different materials.
6. Once each group has finished preparing for its production, assign the order of performances. Send out invitations to parents and other classrooms.
7. After each performance, ask the audience (which will include the students who are waiting to perform their own puppet shows) what they learned about shorebirds from the play. Add their responses to the original list of shorebird characteristics. Depending on the puppet show you select, your students should mention shorebird facts like the following:



- Shorebirds are long-distance migrants.
- They are birds of open spaces, including wetlands and grasslands.
- They travel in large migratory flocks.
- They stop to rest and feed at migratory stopover sites.
- Many nest in extreme northern areas like the Arctic tundra.
- Shorebirds spend the winter resting and feeding in warm, southern climates.
- Shorebirds, their eggs, and chicks are well camouflaged to help them hide from predators.
- Shorebirds have long, sensitive beaks for probing in the mud; short-tweezer-like beaks for snapping small invertebrates off the top of the sand or mud; or strong, chisel-like beaks for opening clams and mussels.
- Gulls, jaegers, foxes, peregrine falcons, snakes, skunks, crows, dogs, cats, and sometimes people are all shorebird predators.
- Wetland loss, pollution, and some types of human recreation all threaten shorebird survival.

Additional Activities



Cultural Extension

Students can incorporate a word, phrase, or sentence from one of the cultures that shorebirds migrate through, such as “hello” or the name of the bird.

Write Your Own

Shorebird Puppet Production

Divide your class into teams and give each a more detailed shorebird theme to research. For example:

- Which shorebirds nest in grassland habitat?
- What types of shorebirds are found in the area?
- How do shorebirds attract a mate (courtship displays)?
- What role does camouflage play in the life of shorebirds?
- How does the presence of people affect beach-nesting shorebirds?

When they can answer the question posed, ask them to create a puppet show that will teach their audience about the shorebird question they researched.



Get to Know the Shorebirds Puppet Show

Winging it North to Nest!

Cast: Narrator, Bird-watcher Sam, Western Sandpiper and Killdeer
Scene: A wetland in the spring

Narrator: *Sam is out bird-watching along a wetland in the spring when he sees an unfamiliar bird.*

Sam: “Wow! Cool! Look at that bird! Hey, what kind of bird are you?”

Narrator: *Western Sandpiper feeds in the mud, ignoring Sam*

Sam: “Excuse me, but what kind of bird are you?”

Western Sandpiper: “Oh hi! I’m a Western Sandpiper. I’m a shorebird.”

Sam: “Why are you called a shorebird? This isn’t the seashore!”

Western Sandpiper: “Shorebirds are birds that are found by the ocean, around wetlands, and sometimes grasslands. We like eating small clams, insects, and some types of worms.”

Sam: “What are you doing right now?”

Narrator: *Western Sandpiper starts quickly feeding again.*

Western Sandpiper: “Yum, yum, I am eating blood worms. They are really good! I have to eat as much as I can before my flight to Alaska.”

Sam: “Why do you fly all the way to Alaska?”

Western Sandpiper: “Well, that’s where I find a mate, nest, and then raise my chicks!”

Sam: “Can’t you do all that here?”

Western Sandpiper: “Oh no, that would never work! All the really good insects are in the Arctic. My chicks will need lots of food to grow big and strong. I am only stopping here for a quick snack and rest.”

Narrator: *Most shorebirds have to stop to rest and feed as they make their long flights between where they spend their spring and summer and where they spend their winter. Biologists call these areas stopover sites. As many as 500,000 shorebirds can be found together at one time in the spring at some stopover sites.*

Sam: “Oh, do all shorebirds nest on the tundra?”

Western Sandpiper: “Only some of us go way up there. Ask that bird over there where she nests!”

Narrator: *Western Sandpiper points its wing (or beak) toward Killdeer. Killdeer is dragging one wing on the ground trying to get Sam’s attention.*

Sam: “Are you a shorebird too?”

Narrator: *Killdeer continues to flap and drag its wing.*

Killdeer: “Yes I am.”

Sam: “So what’s wrong with your wing?”

Narrator: *Killdeer straightens up.*

Killdeer: “Nothing! I’m trying to distract you and make you move away from my nest!”

Sam: “Oh, where is your nest?”

Killdeer: “Right there, right next to your foot! Down on the ground. Can’t you see it!”

Narrator: *There, lying in the gravel on the ground, Sam sees four speckled eggs!*

Sam: “Oh wow! I almost didn’t see it! You didn’t build much of a nest though.”

Killdeer: “Most of us shorebirds lay 3 or 4 eggs in just a little scrape on the ground. Our brown and gray colored feathers help hide us from predators.”

Narrator: *This coloration is called camouflage.*

Sam: “Why are you acting like you have a hurt wing?”

Killdeer: “When a predator gets too close, we Killdeer pretend to have a broken wing. The predator thinks we will be easy to catch. When he chases after us we fly away. By then he has forgotten about our nest--and our eggs and chicks are safe.”

Narrator: *Many shorebirds use this technique to fool predators. Biologists call these acts distraction displays.*

Sam: “What are predators?”

Killdeer: “Any animal that wants to eat me, my chicks, or my eggs. Peregrine falcons, snakes, skunks, crows, sea gulls, foxes--even dogs and cats are predators.”

Narrator: *Sometimes disturbance from people will also cause shorebirds to do distraction displays. Walkers, joggers, and beach machinery or people on ATVs and four-wheelers sometimes accidentally crush shorebird nests.*



Killdeer: “When our chicks hatch, we all leave the nest and go feed in the wetlands. The chicks also have a pattern that camouflages them. When something scares them, they will lie still on the ground and not move until the danger passes. When they grow feathers and learn to fly, they can also escape predators.”

Sam: “Do birds nesting in the Arctic have to watch out for predators too?”

Western Sandpiper: “Oh yes! Jaegers, birds that look a lot like gulls, will eat our eggs and chicks! We also have to watch out for foxes. They follow our smell and find our nests--and us if we aren’t careful!”

Sam: “Wow! It sounds dangerous to be a shorebird!”

Western Sandpiper: “And nesting is easy compared to migration!”

Narrator: *Migration is the long flight shorebirds make in the spring and fall between their breeding grounds in the north and their winter homes in the south.*

Western Sandpiper: “Those of us who migrate north to breed have to make sure we have enough body fat to use as energy. The long flight uses up most of our body fat.”

Narrator: *The scientific term for this kind of feeding is called fat-loading.*

Sam: “So what else can go wrong?”

Western Sandpiper: “Well, sometimes the places between our winter and our summer grounds have changed, and we can’t find the food we need. The loss of wetlands and grasslands is a real problem for us.”

Sam: “How do you ‘lose’ a wetland?”

Western Sandpiper: “Well, sometimes there is a drought that dries up all the water. Some wetlands are drained so the land can be used for buildings. Sometimes people need the water to irrigate crops.”

Killdeer: “Grasslands are used a lot for other things too. Many shorebirds have to use habitats that are similar to grasslands, like agricultural fields, schoolyards, golf courses, and grassy areas around airports. But there are many dangers for us in these areas.”

Western Sandpiper: “Yeah, remember last fall when there was an oil spill along the coast? It killed a lot of the things we eat and left icky globs of oil along the beach. Lots of us died that year.”

Killdeer: “We might accidentally eat chemicals when we’re feeding in areas like golf courses where they apply lots of chemicals to keep the grass pretty.”

Narrator: *Birds are poisoned when they accidentally eat oil while trying to clean off their feathers or eat food that has been sprayed with chemicals. Oil also ruins the feathers’ ability to stay dry and insulate the bird from the cold.*

Sam: “That doesn’t sound good at all.”

Killdeer: “We face a lot of dangers every day. Luckily there are folks who help us.”

Sam: “Like who?”

Western Sandpiper: “There are many refuges set aside for birds. The people there make sure there is enough water and food at the right time for us. They also close parts of the refuge from people so we can rest and eat in peace.”

Sam: “That’s good. Get back to eating so you can get on with your migration. It was good talking with you shorebirds!”

Western Sandpiper and Killdeer: “Bye Sam! See you later!”



Get to Know the Shorebirds

Puppet Show

Fall Flight to a Warmer Winter and Food

Cast: Narrator, Bird-watcher Sam, Western Sandpiper and Killdeer
Scene: A wetland in the fall

Narrator: *Sam is out bird-watching along a wetland in the fall when he sees an unfamiliar bird.*

Sam: “Wow! Cool! Look at that bird! Hey, what kind of bird are you?”

Narrator: *Western Sandpiper feeds in the mud, ignoring Sam*

Sam: “Excuse me, but what kind of bird are you?”

Western Sandpiper: “Oh hi! I’m a Western Sandpiper. I’m a shorebird.”

Sam: “Why are you called a shorebird? This isn’t the seashore!”

Western Sandpiper: “Shorebirds are birds that are found by the ocean, around wetlands, and sometimes grasslands. We like eating small clams, insects and some types of worms.”

Sam: “What are you doing right now?”

Narrator: *Western Sandpiper starts quickly feeding again.*

Western Sandpiper: “Yum, yum, I am eating blood worms. They are really good! I have to put on lots of extra weight because I am on my way back to South America from Alaska.”

Narrator: *Many shorebirds spend the summer nesting in the Alaskan Arctic where there are lots of insects to eat and fewer predators to watch out for.*

Sam: “Why are you are flying to South America?”

Western Sandpiper: “Because it gets very cold in Alaska. Pretty soon everything I can eat will be frozen under the ice and snow, so I have to migrate to a place where I can find food for the winter.”

Narrator: *Migration is the long flight shorebirds make in the spring and fall between their breeding grounds in the north and their winter homes in the south.*

Sam: “That sounds smart to me. Do all shorebirds go to South America?”

Western Sandpiper: “No, many of my cousins go to Mexico and Central America. Some even stay in Texas and Arizona and other warm states here in the United States, like my friend Killdeer.”

Narrator: *Sam looks around for Killdeer.*

Sam: “I don’t see your friend. Oh there she is now! So, are you a shorebird too?”

Killdeer: “Yes, I am Killdeer.”

Sam: “That’s neat. Western Sandpiper says you go to Mexico for the winter. Is that true?”

Killdeer: “Yes! But many of my Killdeer friends stay in the warmer areas of the United States where there is still plenty to eat!”

Sam: “Where do you stay when you are in Mexico?”

Killdeer: “Well, I like dry grassy areas with some wetlands nearby. Western Sandpiper likes wetlands and ocean shores.”

Sam: “Wetlands? What are wetlands?”

Killdeer: “Wetlands are places that are wet all or part of the year.”

Western Sandpiper: “Yes, that’s where I get all of my food! I like to eat clams, worms and insects in the water and the mud.”

Sam: “Do you feed in the water too, Killdeer?”

Killdeer: “Oh no. I have a short little beak, so I like to walk along the gravel, sand, and short grass and pick insects off the surface of the ground. I have gotten really good at it, and it’s LOTS of fun!”

Narrator: *Shorebirds have beaks adapted to catch the type of food they eat. Some shorebird beaks are long and sensitive for probing in the mud in search of worms, clams, and larvae. Other shorebirds have heavy, chisel-like beaks for breaking open mussels and oysters. Some shorebirds, like Killdeer, have short, tweezer-like beaks for picking insects from the grass.*

Sam: “That is so cool! I wish I could get really good at catching insects. They’re too fast for me. I can’t wait for you to come back from your long trip. When do you migrate back?”

Killdeer: “I come back in the spring when the insects start to hatch. I usually get started on my journey in March. I fly until I’m tired and hungry, then stop to rest and eat.”

Narrator: *Big mud flats full of clams and worms are like giant gas stations to shorebirds. They stop to refuel, just like people stop to get gas and snacks on a long trip. Biologists call these areas stopover sites.*

Sam: “How about you Western Sandpiper? When do you come back?”



Western Sandpiper: “I come back in the spring too, and I stop along the way to rest and feed. I have a long journey, all the way to Alaska, so I take my time and make several stops along the way. I would sure like to stop here again. Is that okay with you, Sam?”

Sam: “Sure! I’ll be looking for you. Is there anything I can do to make sure your journey goes well?”

Killdeer: “One thing you can do is to tell all your friends to keep our habitats clean. If you see garbage, pick it up. That way it won’t pollute the water and we won’t get hurt tangling our wings in the trash.”

Western Sandpiper: “Yes! Tell your friends not to throw their trash on the ground! Tell them to put it in the garbage where it won’t pollute the wetlands.”

Narrator: *Shorebirds depend on healthy wetlands and grasslands. They are a breeding ground for many insects, worms, clams, snails, and other invertebrates that shorebirds eat.*

Sam: “Ok! I’ll tell all my friends! It was great to meet you! I’ll see you again in the spring. Have a nice trip and be careful. We want all you shorebirds to come back safely.”

Killdeer: “Thanks Sam. I enjoyed meeting you too. I’ll try to have a safe trip. I’ll see you this spring.”

Western Sandpiper: “Yes! Thanks, Sam. See you next spring!”



Adaptations

Concepts

- Shorebirds, like other animals, are adapted in three ways to survive: physically, physiologically, and behaviorally.
- Shorebirds have many physical, or morphological, adaptations to help them walk, find food, hide, reproduce, and fly long distances during migration.
- Shorebirds are also adapted physiologically to their migrating lifestyle, particularly in their fat-loading abilities which enable them to store energy for long flights.
- Adaptations are naturally selected over a long period of time, and specialized animals like shorebirds cannot adapt overnight to damage or alteration of their habitat.

Activities

Build a Shorebird

(lower elementary)

Students will learn about the physical adaptations unique to shorebirds by dressing up a volunteer with bird “adaptations” that gradually transform him or her into a bird--and then into a shorebird. They will discover that shorebirds are a diverse group of birds designed to feed and nest in specific habitats. They will become familiar with some of the most common threats to shorebird survival.

What Can I Eat with This Beak?

(lower elementary, upper elementary/middle school)

Students collect a variety of simulated shorebird food items, using “tools” that represent four different shorebird beak designs. Then they determine which type of food their beak was designed to collect by sorting and identifying which food items they were most successful at catching.

Avian Olympics

(upper middle school/high school)

By competing in physical and math/science activities, students come to understand that shorebirds are incredibly adapted to long distance migration.



Build a Shorebird

Adapted from *Learn About Seabirds*. U.S. Fish and Wildlife Service.

Grade level: lower elementary

Duration: one 40 to 60-minute class period.

Skills: vocabulary, discussion, visualization, comparing similarities and differences

Subjects: science and history

Concepts:

- Shorebirds, like other animals, are adapted in three ways to survive: physically, physiologically, and behaviorally.
- Shorebirds have many physical, or morphological, adaptations to help them walk, find food, hide, reproduce, and to fly long distances during migration.
- Adaptations are naturally selected over a long period of time, and specialized animals like shorebirds cannot adapt overnight to habitat damage or alteration.

Vocabulary

- adaptation
- physical adaptation
- behavioral adaptation
- guano
- habitat
- market shooting
- habitat loss
- plumage
- down feathers
- contour feathers
- migration
- camouflage
- invertebrate

Overview

Students will learn about the physical adaptations unique to shorebirds by dressing up a volunteer with bird “adaptations” that gradually transform him or her into a bird—and then into a shorebird. They will discover that shorebirds are a diverse group of birds designed to feed and nest in specific habitats. They will

become familiar with some of the most common threats to shorebird survival.

Objectives

After this activity, students will be able to:

- Define the term adaptation
- Describe three adaptations unique to birds
- Describe three adaptations unique to shorebirds
- Name the most significant threats shorebirds face today
- Name two other human related activities harmful to shorebirds

Materials

- Red, yellow, and blue student flash cards (provided in this activity)
- Down jacket or vest
- Pictures of down and contour feathers
- Two large paper bird wings
- Several drinking straws or toilet paper tubes
- Chicken bone
- Balloons
- Camouflage patterned hat, vest or cloth
- Large enough piece of blue felt or paper to stand on
- Spray bottle
- Scissors
- Duct tape
- Cardboard bill or tweezers tied on a string necklace
- Empty baby oil bottle
- M&Ms or gummy worms
- Popcorn
- String (20-40 feet)
- Black paper oil splashes
- Blue paper wetland
- 6-pack can rings or a net
- Clothespins

Optional

- Electric fan
- Rubber boots or waders

Introduction

Most shorebirds are uniquely *adapted* to living in open spaces that also provide an abundant source of *invertebrate* foods. Their adaptations are both *physical* (the way they are built) and *behavioral* (the way they act). This activity focuses on the physical adaptations of birds--and then specifically of shorebirds: their *down* and *contour feathers*, hollow bones, air sacs, long and pointed wings, *camouflage plumage*, long legs and toes, specialized bills, and oil glands.

Migration itself is considered an adaptation that enables shorebirds to take advantage of the abundant Arctic food resources in the spring and summer yet escape to more hospitable southern climates for the winter. Unfortunately, migration also exposes these birds to a wide variety of threats along the way. *Habitat loss*, oil contamination, disturbance, and trash are just a few examples.

For more information shorebird adaptations go the *Shorebird Primer*.

Activity Preparation

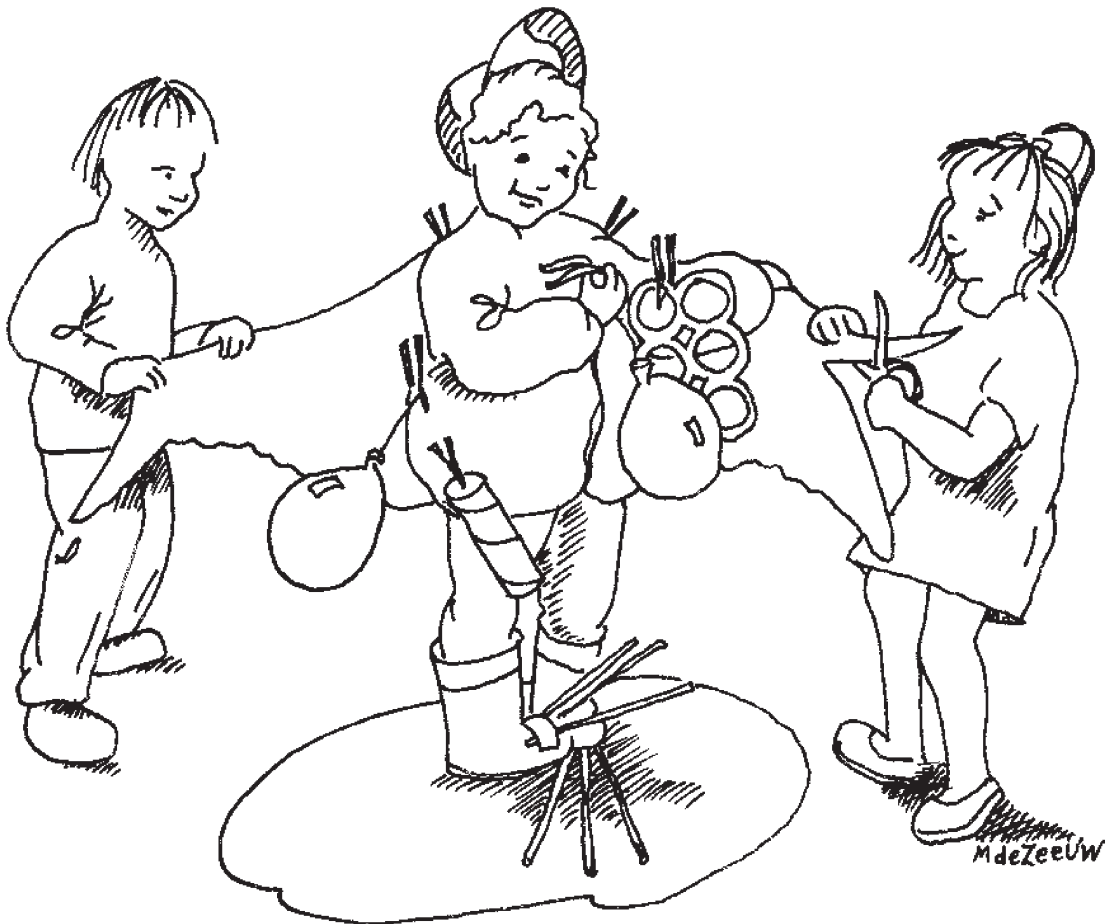
1. Gather the materials listed. Consider enlisting help from your students.
2. Assign your students or a parent volunteer to construct:
 - one student-sized set of paper wings (to be cut and modified during the activity)
 - one blue paper wetland to stand on
 - one cardboard bill
 - several black construction paper cut-outs of oil spills

3. Photocopy on cardstock and then cut out the activity flash cards (included here) in the colors shown below. There should be enough so that every student except the bird volunteer has at least one card. For large classes, students can share a card; on person reads the card the other attaches the adaptation to the “bird”.

- General Bird Adaptation Cards - yellow
- Special Shorebird Adaptation Cards - blue
- Threats to Shorebird Cards - red

Procedure

1. Explain the term *adaptation* (a physical or behavioral characteristic that has evolved over time to help a species survive and reproduce in the environment where it lives). Tell the students that they will be exploring the world of shorebird adaptations by building a shorebird.
2. Ask for a volunteer. This person will be turned first into a bird, then into a shorebird, and finally into a Western Sandpiper. He or she will also be subjected to some threats a shorebird may face.
3. Distribute all the flash cards to the students. Tell them as you describe what is needed by the bird, they should look at their flash cards and raise their hand if they have the adaptation you are describing. They will place their adaptation on the “bird” using clothespins.
4. Begin to transform your volunteer into a bird with the *yellow flash cards*. Use the Teaching Notes 1-4 to guide the students through the activity. Repeat this process until all the yellow cards have been read and the adaptations added to the volunteer



Teacher Notes: General Bird Adaptations (Yellow Cards)

<i>Adaptation</i>	<i>Description</i>	<i>Material Needed</i>
<p>1. Down Feathers Ask students to imagine they are birds in flight. How does it feel to be soaring above the earth? Is it cold? Is skin enough to insulate you up there? You will have had to adapt to temperature extremes. How? With feathers.</p> <p>2. Contour Feathers What sort of material is strong and flexible enough for the wings and tail to help you fly?</p>	<p>Feathers are a unique adaptation found only in birds. All birds have two kinds of feathers:</p> <p>1) <i>Down feathers</i> — a kind of bird underwear — fluffy, underfeathers for insulation</p> <p>2) <i>Contour feathers</i> — strong outer feathers for flight that are also the bird's clothes and coloration</p>	<p>Dress bird in <i>down jacket</i> and <i>bird wings</i>.</p> <p>Study <i>comparison pictures of down and contour feathers</i>.</p>
<p>3. Hollow Bones Ask students to think about how much they weigh. How much do you think a Bald Eagle weighs? It only weighs between 8–14 lbs. and has a 7–8 ft. wing span.</p>	<p>Hollow bones reduce weight. Most of the bird's weight is in the breast and wings (where the flight muscles are). Our bones are not hollow but instead are filled with marrow for red blood cell production. Birds have marrow only in their breast bone.</p>	<p>Attach <i>drinking straw</i> or <i>cardboard paper roll</i> to down jacket.</p> <p>Pass <i>chicken bone</i> around for the students to examine.</p>
<p>4. Air Sacs Ask a volunteer to stand up and become a crow by flapping his or her wings 20 times in 10 seconds. Does flapping like a bird make you breath faster than just walking? Yes!</p>	<p>Air sacs help birds take in enough oxygen for rigorous flight. Birds have lungs like we do, but that is not enough. Air sacs, like balloons, extend from the lungs, between and into hollow bones. During inhalation and exhalation, air flows through the lungs and the air sacs to maximize the absorption of oxygen.</p>	<p>Attach the <i>balloons</i> with clothespins to your volunteer. Each student with a yellow card places one balloon on the bird.</p>



Teacher Notes: Special Shorebird Adaptations (Blue Flash Cards)

<i>Adaptation</i>	<i>Description</i>	<i>Material Needed</i>
5. Long, pointed Wings Think about the different shapes of bird wings. Why do penguins have short, stubby wings while an eagle has big, broad wings? Do you think that wing shape might be related to the bird's lifestyle?	Shorebirds migrate (fly long distances) between their habitat where they breed and the habitat where they winter. Long, pointed wings help shorebirds fly fast over such long distances. Their wings also allow them to do aerial maneuvers to escape predators.	Use the <i>scissors</i> to shape the tip of the volunteer's paper wings so they look long and pointed.
6. Camouflage Plumage How can a small bird protect itself from larger predators? Would small shorebirds have much luck fighting with hawks on the beach or with foxes on the tundra?	Cryptic coloration, or camouflage, makes birds less conspicuous. Their brown, black and white plumage blends in well with their habitat--mudflats, beaches, or grassy tundra. Larger shorebirds, like avocets and oystercatchers, cannot hide as easily and therefore are not so camouflaged.	Place the <i>camouflage clothing</i> on the bird.
7. Long Legs Do you need long legs to sit in a tree, fly, or walk? How about running from the waves? What do humans use to walk and work in wet conditions?	Shorebirds seldom perch in trees but rather walk or roost on the ground. Many shorebirds walk on shorelines or mud to find food. Having long legs helps them wade through water or mud. (The length of the legs of a shorebird gives a clue to where it feeds.)	Place the <i>blue material</i> representing a wetland on the ground for the shorebird to walk on. Optional: Put the <i>rubber boots/waders</i> on the bird.
8. Long Toes What are your toes for? Toes are for stability in walking.	Most shorebirds do not spend much time swimming. Therefore, they do not need webbed feet, just long toes for stability and walking.	Using duct tape, attach three long <i>drinking straws</i> to each toe of the bird.

5. Now, explain that the class is going to continue adding adaptations, this time with adaptations unique to shorebirds. Clarify to your students that shorebirds are birds of open spaces that fly long distances (migrate) to between their breeding and nonbreeding habitats.

6. Spray the volunteer lightly with the water spray bottle and have them stand on the blue felt or construction paper. Our bird is now a wetland-loving shorebird.

7. Continue with using the Teaching Notes 5–11 to guide the class through the *blue flash cards*.



Teacher Notes: Special Shorebird Adaptations (Blue Flash Cards)

<i>Adaptation</i>	<i>Description</i>	<i>Material Needed</i>
9. Bills What do people use to feed themselves—(forks, straws, chopsticks, fingers, lips, teeth, etc.)? Do you use different things to help you eat different types of foods?	Bills, or beaks, are used for picking up food, nest construction, courtship, preening, and defense. Curlews probe deeply into the ground with their long, curved bills. Plovers and Surfbirds have short, stout bills to pick up prey they spot on the surface of sand or rocks. Sanderlings have tapering, tweezer-like bills to help them “stitch” the sand—a rapid, repeated probing) to pull up worms and crustaceans right below the surface of the beach.	Attach a <i>cardboard bill</i> to the volunteer or tie <i>tweezers</i> on a string necklace around the neck of the “bird” to represent the shorebird’s bill. Place <i>gummy worms</i> in the mouth of the volunteer. These represent the segmented worms or the long, stretchy nemertean worms that some Sandpipers like to eat. You may also feed the bird <i>M&Ms</i> or other candy-coated treats, representing crunchy-coated invertebrates.
10. Oil Glands Pour oil (cooking or other colored oil) and water into a beaker and observe the separation. Does the oil get wet? What does “get wet” mean? “Wet” means saturated with water. Ask students how they keep dry in the rain. Is rain gear treated with any special coating? Yes!	The oil glands help keep shorebirds’ feathers waterproof. Feathers are kept clean and smooth by constant preening with oil from the oil gland found above the base of the tail. The oil is transferred to the plumage (feathers) with the bill or the back of the head.	Attach the <i>baby oil bottle</i> to the back of the down jacket. Ask the bird to try to preen!
11. Guano Imagine all the shorebird droppings left behind by the large migratory flocks of birds! Do you think there is any value to guano?	Guano from shorebirds, just as from other birds and bats, contributes to the chain of life. Tiny plants and animals use guano nutrients. They in turn become food for small fish, crustaceans, and other animals that shorebirds and even people eat.	Sprinkle the <i>popcorn</i> around the volunteer shorebird.

Congratulations your class has built a shorebird!

Teacher Notes: Threats To Shorebirds (Red Cards)

<i>Threat</i>	<i>Description</i>	<i>Material Needed</i>
12. Habitat Destruction Define the term <i>estuary</i> and <i>wetland</i> . Have you seen any shorebirds around your area? What kind of habitat is it? Is there any threat of it being destroyed? If there is not a local concentration of shorebirds, another well-known local animal can be substituted for the discussion.	Most shorebirds depend on habitat in three areas: breeding, nonbreeding, and migration stopover sites. Wetlands, estuaries in particular, are important stopover sites. They are also very attractive to humans as a source of water or home sites. Water is drained away or its course altered, and bridges, houses, and docks are built. Animals and plants that provide food and shelter for the shorebirds are destroyed.	Restrict the habitat available to the shorebird flock by penning it in with <i>desks</i> or by winding <i>string</i> around the student birds to tie them together. Now pass out <i>gummy worms</i> to all shorebirds that have habitat. What about everyone else? Can we make new habitat? How can we fix ruined habitat?
13. Oil Contamination	Oil spills kill shorebirds and destroy their habitat for many years.	Pin <i>oil splashes</i> on the volunteer shorebirds.
14. Disturbance How could disturbance harm a shorebird or flock of young birds? Can you think of some examples of disturbance? (planes, people coming too close to nesting shorebirds, Jet skis, pets)	If flocks are disturbed and cannot refuel with food at their traditional stopover points, they may not have another chance to find enough food for their long migrations.	Have the students make noise to simulate ATVs or motorcycles. Alternatively, turn on the <i>electric fan</i> and point it toward the flock to simulate a disturbance.
15. Trash Have you ever seen trash littering our wetlands? Where did it come from? Remember to put trash in cans, cut up plastic rings and long strings, and dispose of tangled fish line at home.	Plastic debris and other trash can be mistaken for food. Shorebirds can also get tangled in discarded fish line and six-pack can rings. Abandoned cars, appliances, and other trash items can leak poisons into wetlands.	Place netting or plastic six-pack rings somewhere on the sandpipers.

8. Now discuss the importance of shorebird scat (guano). Sprinkle the popcorn around the volunteer shorebird. Guano from shorebirds, just as from other birds and bats, contributes to the chain of life. Nutrients from guano area returned to the wetlands that the shorebird uses. The (elemental and molecular) nutrients in guano are made available for

manufacture of food by time plants and plankton. These “food makers” (photosynthesizers) become food in turn for small fish, invertebrates, and other animals. The food web is continued, and eventually includes the shorebirds and even humans. Every organism, and its activities, has a part in the chain of life on our planet.

9. Now turn the volunteer into a Western Sandpiper that is part of a huge flock. Western Sandpipers are very small Arctic-nesting shorebirds familiar to many people because of their huge migratory flocks. Select a few students to join the volunteer shorebird, perhaps holding hands to create a flock of Western Sandpipers. If you do not have Western Sandpipers in

your area (check the Shorebird Profile list in the Appendix), select another flocking shorebird, a Dunlin for example, to create a class flock. *Do not put students still holding red flashcards in the flock.*

10. Even with all these wonderful adaptations, life is not easy for a shorebird! In addition to the difficulties of migrating long distances over the ocean or in bad weather, shorebirds face many human-caused dangers. Market hunting has killed millions of shorebirds in the past. While it is illegal to kill and sell shorebirds today, other threats have grown significantly. Habitat loss is the biggest threat to shorebird survival today.

11. Now guide the students through the *red flash cards* that represent shorebirds threat. Explain to those students how to “carry out the threat” on the flock of students as directed in the Teacher Notes.

12. Wrap-up the activity using the question below.

What Makes a Bird a Bird?

Describe three unique adaptations of birds.

Feathers
Hollow Bones
Air Sacs

Describe three special adaptations of shorebirds.

Camouflage plumage
Long, pointed wings
Legs for walking, wading, and running
Bill for probing or picking

Why are shorebirds important?

Add diversity
Important part of food web, including prey for raptors and their guano fertilizes habitat

What is the most significant threat to shorebirds today?

Habitat alteration or loss

Name two other human-related activities that can be harmful to shorebirds.

Oil contamination (oil spills)
Trash
Disturbing birds from their nests, or while resting or feeding

Additional Activities

Build a Shorebird, Maya (activity sheet)

Have younger students complete the worksheet Build A Shorebird, Maya. Ask each student to write his or her own story about where Maya lives or develop the story together as a class. Ask them to color Maya so that she is well camouflaged for the habitat she lives in.

Comparing Wings

Have older students look for at least four different wing sizes and shapes found in birds of your area. Some examples might include pheasant, eagle, hummingbird, and tree swallow. Ask them to make drawings of the wing shapes they choose and compare the lifestyles, food habits, and habitat types of these birds.

Plumage Coloration

Have students work in small teams. Have each team select a shorebird from the Shorebird Coloring Pages in the Appendix. Make multiple copies of the coloring pages your students select. Using a bird field guide for reference, have them color a drawing for each of the birds’ plumages (adult breeding, adult wintering, and juvenile). When everyone is done, compare the plumages of different species. Which have very different wintering and breeding plumages? Which are very similar? Do females always look like males?

Create Your Own

“Super” Shorebird

Ask students to design their own shorebird to fit into the habitat of their choice. Explain to them that this bird does not have to resemble a real shorebird and that it does not have to live in a “natural” habitat. It does, however, have to be well adapted to its surroundings so it can find food, nest, and migrate. Instruct each student to write a brief bird biography that describes where it lives during the breeding and nonbreeding seasons, what it eats, and any special behaviors it has.



Build a Shorebird Student Activity Flash Cards Bird Adaptations

(Photocopy back-to-back on yellow cardstock.)

Bird Adaptation	Bird Adaptation
<p><i>Down Feathers</i></p>	<p><i>Contour Feathers</i></p>
Bird Adaptation	Bird Adaptation
<p><i>Hollow Bones</i></p>	<p><i>Air Sacs</i></p>



Build a Shorebird Student Activity Flash Cards Bird Adaptations

(Photocopy back-to-back on yellow cardstock.)

Bird Adaptation	Bird Adaptation
<p>Strong outer feathers are used for flight. These are also the bird's clothes and coloration.</p>	<p>These are the fluffy underfeathers for insulation (the bird's underwear).</p>
Bird Adaptation	Bird Adaptation
<p>A lot of energy is needed to give birds energy to fly. Air sacs come from the lungs, between and into hollow bones. They help increase the amount of oxygen the bird can absorb.</p>	<p>These help a bird keep its weight low so it can fly.</p>



Build a Shorebird Student Activity Cards Shorebird Adaptations

(Photocopy back-to-back on blue cardstock.)

Shorebird Adaptation	Shorebird Adaptation
Long Pointed Wings	Camouflage Plumage
Shorebird Adaptation	Shorebird Adaptation
Long Toes	Long Legs



Build a Shorebird

Student Activity Cards

Shorebird Adaptations

(Photocopy back-to-back on blue cardstock.)

Shorebird Adaptation	Shorebird Adaptation
Camouflage helps birds blend in with their surroundings so they are not easily seen.	Long, pointed wings are designed for long and fast flight.
Shorebird Adaptation	Shorebird Adaptation
Long legs help keep shorebirds dry as they wade through the mud and water looking for food.	Long toes help birds keep their balance while they walk on wet, slippery mud as they search for food.



Build a Shorebird Student Activity Cards Shorebird Adaptations

(Photocopy back-to-back on blue cardstock.)

Shorebird Adaptation	Shorebird Adaptation
Bill	Oil Gland
Shorebird Adaptation	Shorebird Adaptation
Guano	(blank)

Build a Shorebird Student Activity Cards Shorebird Adaptations

(Photocopy back-to-back on blue cardstock.)

Shorebird Adaptation	Shorebird Adaptation
The oil gland, found near the base of the tail, helps keep a shorebird's feathers waterproof.	Shorebirds use their bills for picking up food, building their nests, courtship, preening, and defense.
Shorebird Adaptation	Shorebird Adaptation
(blank)	Shorebird droppings, or guano, act like a fertilizer to the mudflats and waters where they feed

Build a Shorebird Student Activity Cards Shorebird Threats

(Photocopy back-to-back on red cardstock.)

Shorebird Threat	Shorebird Threat
Habitat Destruction	Oil Spill
Shorebird Threat	Shorebird Threat
Disturbance	Trash



Build a Shorebird Student Activity Cards Shorebird Threats

(Photocopy back-to-back on red cardstock.)

Shorebird Threat	Shorebird Threat
Oils spills can kill shorebirds and destroy their habitats.	Changing or developing wetlands can destroy the plants and animals that give shorebirds food and shelter.
Shorebird Threat	Shorebird Threat
Trash kills shorebirds. Some shorebirds confuse trash for food. They can get caught in fishing line, six-pack rings, and old fish netting.	Planes, boats, and people can scare shorebirds away from important feeding areas or chase them away from their nests.

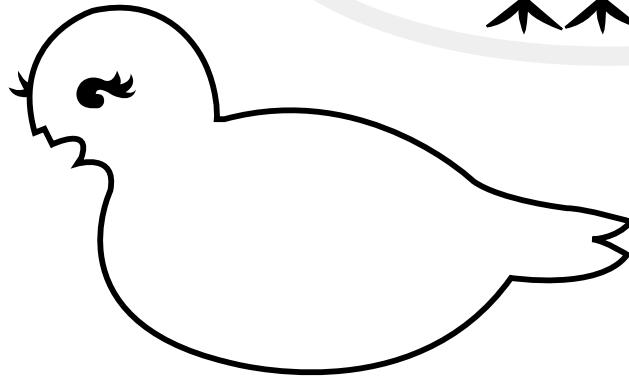
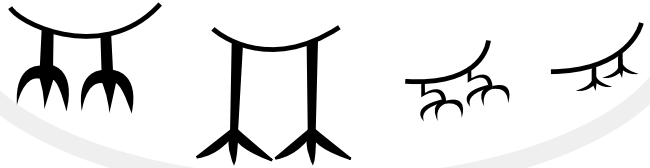


Add the beak, legs, feet and wings to Build a Shorebird, Maya!

What **beak** would best help a shorebird probe in the mud for food?



Which **legs** would best suit a shorebird for its wetland habitat?



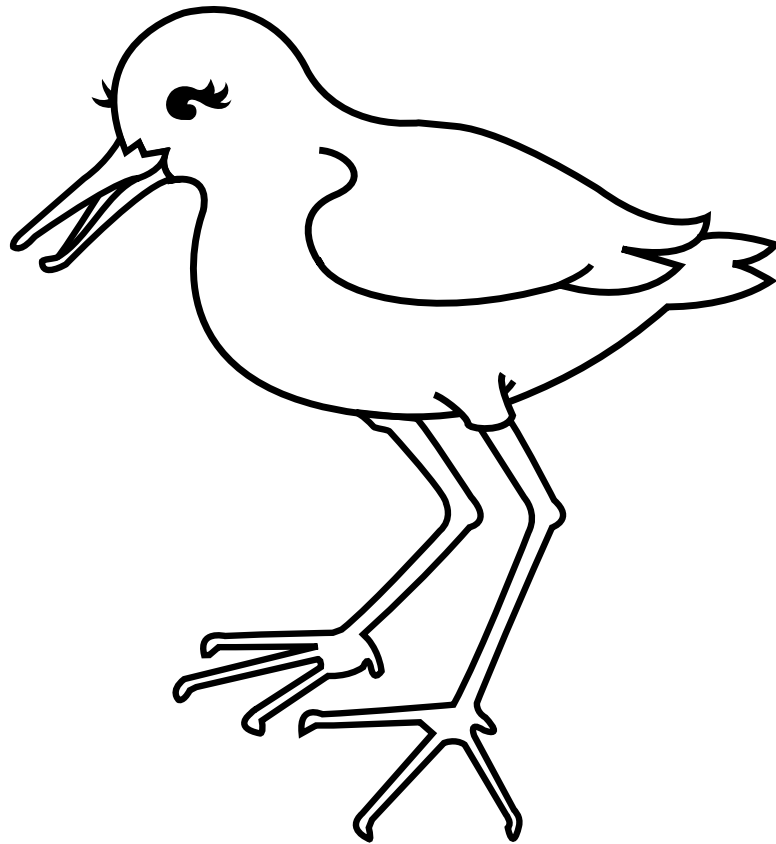
Which **feet** would best suit a shorebird for walking in its wetland habitat?



What type of **wings** help the shorebird fly long distance and escape quickly from predators?



Maya the Shorebird



Correct bird parts



What Can I Eat with This Beak?

Adapted from “Salt Marsh Manual: An Educator’s Guide.” San Francisco Bay National Wildlife Refuge.

Grade Level: lower elementary and upper elementary/middle school
Duration: one 40-minute class period.
Skills: comparison, evaluation, problem solving, discussion, vocabulary, visualization, and interpretation of data.
Subjects: science, math, language arts, and fine arts (additional activity)

Concepts:

- Shorebirds have many physical, or morphological, adaptations to help them walk, find food, hide, and reproduce in their habitat and to fly long distances during migration.

Vocabulary

- adaptation
- beak
- invertebrates
- coexist
- feeding success
- crustaceans

Overview

Students collect a variety of simulated shorebird food items, using “tools” that represent four different shorebird beak designs. Then they determine what type of food their beak was designed to collect by sorting and identifying which they were most successful at catching.

Objectives

After this activity, students will be able to:

- Describe how shorebird beaks are adapted for the foods they eat.
- Explain why many types of shorebirds may live in the same habitat at the same time.
- Match four common shorebirds to the foods they eat by looking at their beak design.

Materials (for a group of 30)

- *Shorebirds Across the Americas* poster (included in this education guide)
- Chalkboard/easel paper
- Beaks
 - 6 spoons
 - 6 pairs of scissors
 - 6 pairs of tweezers
 - 6 spring-type clothes pins
- Bird stomachs
 - One paper cup per student
- Food items
 - 50 marbles (snails)
 - 100 toothpicks or cut pipe cleaners (worms)
 - 100 3/16” metal washers (*crustaceans*)
- One copy of the activity sheet *What Can I Eat with This Beak?* (included here) for each student.

Introduction

Mudflats are home to hundreds of different species of organisms that shorebirds eat. Most are *invertebrates*: worms, clams, snails, and crustaceans. Birds have different types of *bills* that allow them to eat different kinds of prey. Their bills are *adapted* to match their food types.

Many shorebirds have tweezer-like beaks. A bird with a “short tweezer” beak will take food near the surface of the mud while a “long tweezer” beak can reach animals that burrow deeper. Some birds like eagles and owls have tearing scissor-like beaks for ripping their food into bite-sized pieces. Other birds use their clothespin-like beaks to crush the hard covering of seeds. Chickadees and Pine Grosbeaks are two clothespin-beaked forest birds. The oystercatcher, a type of shorebird, has a beak that looks like a red clothespin for prying open mussels and chiseling limpets off rocks. Some birds have spoon-like beaks to scoop up small fish or strain plant material from the mud.

Since shorebirds eat different types of foods found in different places within a habitat, many different species can *coexist*. This is why you see many types of shorebirds feeding together in one area.

For additional information, read *Shorebirds Have Special Adaptations in Wetlands* found in the *Shorebird Primer*.

Procedure

1. Discuss with students the many different kinds of shorebird beak adaptations and how they relate to the foods that birds eat. What kinds of beaks have they seen? Show examples of beaks using the *Shorebirds Across the Americas* poster included in this education guide or your own pictures, study skins, masks, or puppets.
2. Hold up the beak “tools” one at a time and ask the students for examples of birds that have beaks similar to each “tool.”
3. After the discussion, ask the class to imagine that they are a flock of shorebirds.
4. Have students count off in fours, with “ones” being spoon-beaks, “twos” being scissor-beaks, etc. Hand one “stomach” (paper cup) and one bird beak to each player.
5. Explain the rules:
 - Each shorebird (student) can only pick up food with its beak.
 - They have to drop the food into their stomachs (the paper cups).
 - Food may not be scooped or thrown into the stomach; the stomach must be held upright.
 - The teacher is a hawk that eats birds. Unruly behavior or violation of rules will result in the hawk capturing the



conspicuous bird and making it sit out for one round. (In reality, unusual behavior of a bird draws attention from a predator.)

6. Have students sit in a large circle (their habitat). Scatter one food type inside the circle and give the signal to start feeding. Feeding may occur only when a signal is given. One option is to simulate a normal feeding cycle. When the classroom lights are out, it is night and the birds are asleep. When the lights are on they can feed. Let them feed for a set time (up to two minutes). Turn off the lights as if the sun had set to signal when the birds should stop feeding.

7. Have similar beak-types get together and count the combined number of food items collected. Record the data for the entire class to see on one poster paper or the chalkboard as shown on the *Example Data Table*. Older students can record averages or graph beak efficiency (the number of items eaten for each beak type).

8. Repeat steps six and seven for each type of food.

9. To simulate a more natural feeding situation, mix all three food types together and let the “birds” gather food simultaneously. Record the data. The birds should first eat the food they can gather the easiest (as discovered in the earlier rounds), then switch to a secondary food item as it gets harder to gather their first choice.

10. Looking at the data table, discuss the following questions in class:

■ Are some beaks better at getting a particular food item than other beaks? How does the feeding success (measured as number of items captured, or number of items per minute) change for each beak type as the food changes? Some birds eat food that lives in mud, some find food in water, and others eat plants. In which habitat does each of these beak types belong?

■ Does having a different beak shape cause a bird to use it differently? Which beak types do shorebirds

have? Which beak types do shorebirds not have? Why? Looking at the shorebird poster, can you find any other beak types besides the four studied in this activity?

■ What other parts of the bird, besides its beak, are important to its feeding success (webbed or differently-shaped feet, length of neck, length of legs, etc.)? What differences do you detect in the feeding behavior of the birds when all food items are available at once? (Hint: More fighting or more relaxed and less fighting?)

11. Pass out a copy of the activity sheet *What Can I Eat with This Beak?* to each student. This activity sheet can also serve as an evaluation tool.

Additional Activities



Cultural Connections

Have students research what people eat in one of the countries that shorebirds in their flyway migrate through.

Feeding Techniques

Have your students research different shorebird feeding techniques like probing, picking, crushing, and swirling. Give examples of local shorebird species that use these techniques to catch their food. Draw the bill shapes that go with each feeding technique.

Create a Beak

Ask students to design their own shorebird beaks and then write an advertisement meant to “sell” the design to a shorebird. What could you eat with this beak? Where would you have to live? Are there any other adaptations required to use this design—for example, would you already need to have long legs or a long neck?

What Can I Eat with This Beak? Example Data Table

Beak Type	Food Items			
	Worms	Snails	Crustaceans	All Food Types
Tweezer				
Scissors				
Spoon				
Clothespin				





What Can I Eat With This Beak?

Activity Instructions:

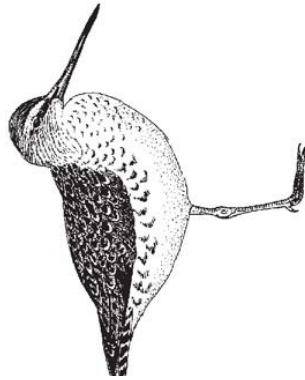
In a wetland or on a beach food is everywhere.

Even though you cannot easily see it--shorebirds can!!

Each shorebird species has a uniquely adapted beak to find its food. Below is picture of a beach with food buried in the soil. Your task is to read the clues for each of the shorebirds species and choose which food item in the picture you think the bird is best adapted to eat.



Whimbrel: I am a whimbrel. I use my down curved bill to probe very deeply into the mud for my food.



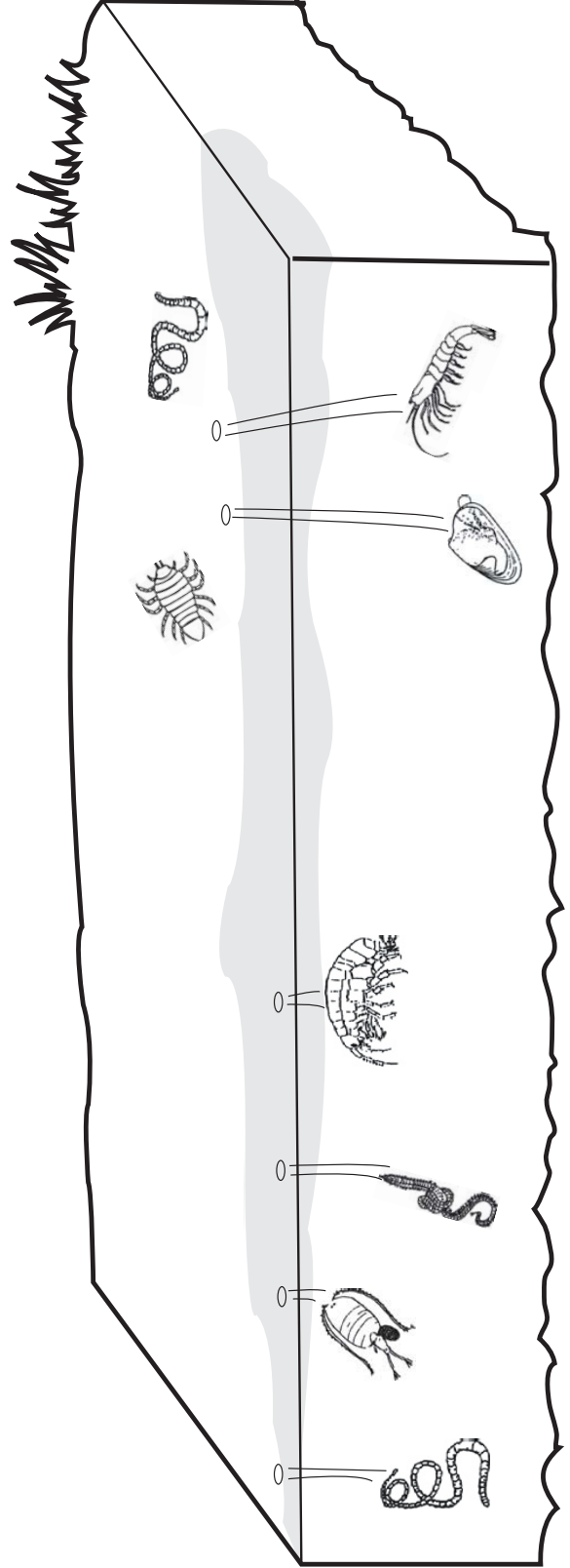
Long-billed dowitchers: The clue is in my name! I probe deeply in the mud for food.



Western sandpipers: Some people think my beak looks like tweezers when I eat. I probe the mud near the surface.



Sanderling: I nab insects on the surface of the soil with my beak.



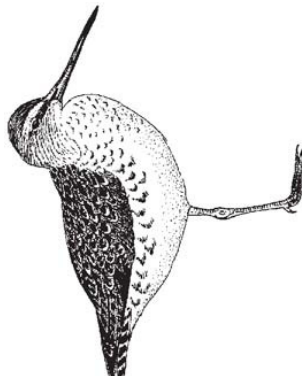


What Can I Eat With This Beak?

ANSWER SHEET



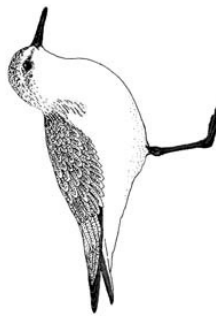
Whimbrel: I am a whimbrel! I use my down curved bill to probe very deeply into the mud for my food.



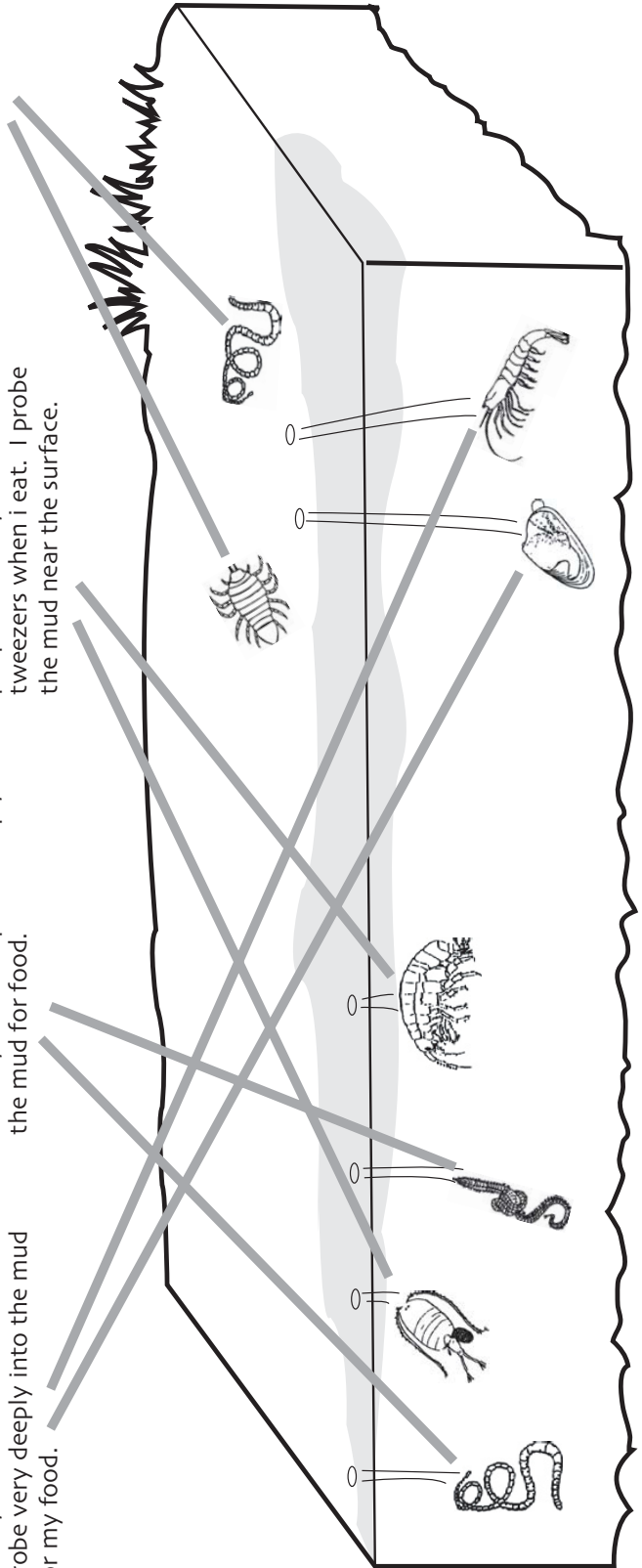
Long-billed dowitchers: The clue is in my name! I probe deeply in the mud for food.



Western sandpipers: Some people think my beak looks like tweezers when I eat. I probe the mud near the surface.



Sanderling: I nab insects on the surface of the soil with my beak.



Avian Olympics

*Adapted with permission from
“One Bird-Two Habitats.”
Wisconsin Department of Natural
Resources.*

Grade Level: upper middle school/
high school

Duration: up to three 40-minute
class periods

Skills: vocabulary, discussion, team
building, comparison, and collection
and interpretation of data

Subjects: science, math, and
physical education

Concepts:

- Shorebirds, like other animals, are adapted in three ways to survive: physically, physiologically, and behaviorally.
- Shorebirds have many physical, or morphological, adaptations to help them walk, find food, hide, and reproduce in their habitat, and to fly long distances during migration.
- Shorebirds are also adapted physiologically to their migrating lifestyle, particularly in their fat-loading abilities which enable them to maintain energy for long flights.

Vocabulary

- migration
- fat-loading
- stopover site
- flyway

Overview

By competing in physical and math/science activities, students come to understand that shorebirds are incredibly adapted to long distance migration.

Objectives

After this activity, students will be able to:

- Define the term migration.
- Explain why shorebirds migrate.
- Give three examples of adaptations that help shorebirds successfully migrate long distances.
- Give two common reasons why shorebirds might not survive a difficult migration.
- Explain the relationship between calories, fat, energy, and stopover sites.

Materials

- Triple-beam balance or other scale
- Clock with second hand visible to the entire room or one stop watch per group
- World map with kilometer scale
- Student worksheet and answer sheet
- Fifty meter track or running area

Introduction

Most shorebirds are uniquely *adapted* to living in open spaces (often wetlands) that also provide an abundant supply of invertebrate foods. Their adaptations are both physical (the way they are built) and behavioral (the way they act). This activity focuses on the physical adaptations of *fat-loading* and long-distance flight.

Migration itself is considered an adaptation that allows shorebirds to take advantage of the abundant Arctic food resources in the spring and summer, yet escape to warmer food-rich southern climates for the winter.

For more information about shorebird adaptations, read *Shorebird Adaptations* and *The Magnificent Shorebird Migration* found in the *Shorebird Primer*.

Activity Preparation

1. Photocopy one student worksheet for each student or each team of three to six students.
2. Have the student worksheet answers available for your reference during the activity.

Procedure

1. Divide the class into teams of three to six students to compete against each other in math skills, speed, and endurance. Ask each team to select a mascot migratory shorebird group, such as plovers, oystercatchers, sandpipers, curlews, turnstones, godwits, or phalaropes. The object of each team is to get the most possible points. You may wish to shorten or lengthen the lesson by awarding points only to certain answers or doing some of the calculations as a class.
2. Hand out a copy of the student worksheet to each group. Work through each problem as a class. Award the teams points. All the teams that get the right answer are automatically awarded one point; the first team to get the right answer gets two points.
3. Go outside to complete *Problem 3: Fast Travel* and *Problem 4: Wing-flapping*.
4. Provide a reward to the teams for most points, best effort, etc.

Additional Activities

Mechanics of Flight

Have students research the mechanics of flight. Compare the flight of birds to the flight of bats, insects, or airplanes. What are the differences between fixed and mobile wings? Why don't birds flying in a flock run into each other when they change directions?



Energy of Flight

Ask students to research the following questions: What kind of energy transfer is involved in flight? How do birds transfer chemical food energy into mechanical flight energy? What role does oxygen play in the trapping of the sun's energy (photosynthesis) and the release of energy (respiration) in animals? What role do hollow bones, bone marrow, and air sacs play in respiration?

Shorebird Types

Have students research the main shorebird types (plovers, sandpipers, etc.) and list their identifying characteristics.

Scientific Names

Practice learning the hierarchical structure (i.e., Kingdom, Phyla, Class, Order, Family, Genus, Species) of the animal kingdom and scientific (Latin) names by tracing one or two species of shorebirds through the hierarchy.

Local Shorebird Olympics

Ask your students to develop additional math problems that focus on the feats of local shorebirds.

- First assemble a list of your local shorebirds using field guides or a local bird list
- Divide the class into teams and assign each a local shorebird species from the list. Use the Shorebird Sister Schools Web site, the *Shorebird Profiles* found in the *Appendix*, and shorebird field guides and texts from your local library to find interesting facts.
- Assemble a new Avian Olympics Worksheet that highlights shorebird of your area.
- Repeat *Avian Olympics* using this new worksheet.



Avian Olympics

Student Worksheet

Answers

Problem 1—Weigh-in

The average middle school student weighs 100 pounds or 45 kilograms. How many grams are in 45 kilograms?

Answer: 45,000 grams

Compare that to the weight of the Western Sandpiper, about 25 grams (less than 1 ounce). Find an object in the classroom that you think weighs 25 grams. Weigh your object on a triple-beam balance.

How many Western Sandpipers (at 25 grams) would it take to equal the weight of an average middle school student (at 45 kilogram)?

Answer:
 $45,000 \text{ g} \div 25 \text{ g} = 1800$ Western Sandpipers

Problem 2—Eating Like a Bird (Fat-loading)

One quarter-pound hamburger and fries is an average-sized meal for a student. Two or three burgers would be a huge meal. What is the largest number of quarter-pound hamburgers any of the students has ever eaten in a single meal?

What percentage of the average weight of a middle school student is this? (Assume a quarter-pound hamburger = 114 grams.)

Example answer:
 If 3 is the number of quarter-pound hamburgers eaten:
 $3 \text{ burgers} \times 114 \text{ g (burger weight)} = 342 \text{ g}$
 $342 \text{ g} \div 45,000 \text{ g (student weight)} = 0.0076\%$, or less than 1%

Compare this with the Pacific Golden-Plover which gains enough fat to increase its body weight by almost 30% for its migration from Hawaii to Alaska. If an average student weighing 45 kilogram were going to increase his or her body weight by 30%, how much weight would he or she gain?

Answer: $45 \text{ kg (student weight)} \times .30 = 13.50 \text{ kg}$ or 13,500g

How many quarter-pound hamburgers is this equal to?

Answer: $13,500 \text{ g} \div 114 \text{ g (hamburger wt)} = 118$ burgers

Problem 3—Fast Travel (outside activity)

With each team entering its fastest runner, have a 50-meter dash to determine how long it takes a student to sprint 50 meters.

How long would it take this runner to cover 1 kilometer?

Example answer: If a student runs 50 meters in 15 seconds,

$$\frac{15 \text{ seconds}}{50 \text{ meters}} \times \frac{Y \text{ seconds}}{1000 \text{ meters}}$$

$$15,000 = 50X \quad \frac{15,000}{50} = Y \text{ seconds} = 300 \text{ seconds}$$

$$300 \text{ seconds} \div 60 \text{ minutes} = 5 \text{ minutes to cover } 1,000 \text{ meters}$$

Use a map of the world to estimate the distance in kilometers from the school to Lima, Peru. Using these two measurements, calculate how long it would take the fastest runner on your team to get to Lima. Assume your runner could travel in a straight line without stopping.

Example answer:
 $60 \text{ minutes} \div 5 \text{ min/km} = 12 \text{ km/hour}$
 $7500 \text{ km} \div 12 \text{ km/hour} = 625 \text{ hours, or}$
 $625 \text{ hours} \div 24 \text{ hours/day} = 26 \text{ days}$

Discussion: Compare these results with Sanderlings, which are able to migrate 7500 kilometer (4650 miles) between Oregon and Peru in 230 hours--or about 10 days!



Avian Olympics Student Worksheet Answers

Problem 4—Wing-flapping (outside activity)

Have each team select a representative. Using a clock with a second hand, ask each team to determine the highest number of arm flaps possible in 10 seconds. Give a point to the group whose representative flapped the fastest (most times per 10 seconds).

Using the time from Problem 3--Fast Travel, how many arm flaps would it take a person to fly to Peru?

Example answer:

For 11 flaps in 10 seconds,
 $\frac{11 \text{ flaps}}{10 \text{ seconds}} = 1.1 \text{ flaps per second}$

$1.1 \text{ flaps} \times \frac{60 \text{ seconds}}{1 \text{ minute}} \times \frac{60 \text{ minutes}}{1 \text{ hour}} \times \frac{24 \text{ hours}}{1 \text{ day}}$

$= 95,040 \text{ flaps per day}$
 1 day

$95,040 \text{ flaps} \times 26 \text{ days} = 2,471,040 \text{ flaps}$

Discussion: What assumptions were made to get this answer? What might affect the accuracy of our answer? We are comparing flaps (flying) with running time and comparing the abilities of two different students. We are assuming the same distance will be covered in the same amount of time in either way and that all students will perform at the same speed. In science, it is important not to "compare apples to oranges" and to be aware of all assumptions made.

Problem 5—Non-stop Travel

Which student can continue flapping his or her arms the longest?

Discussion: How does this feat compare with the American Golden-Plover which flies nonstop for 48 hours as it migrates from Nova Scotia to South America? The Pacific Golden-Plover and some curlews and tattlers fly nonstop for two to three days from Hawaii and other Pacific Islands to Alaska.

How far do you think the best classroom runner can run without stopping?

Discussion: How does this compare with some plovers, curlews and tattlers which fly non-stop from Hawaii and other Pacific Islands to Alaska, a distance of over 3500 miles? The little Western Sandpiper flies over 250 miles per day between stopover points along the Pacific Coast flyway to Alaska.

Problem 6—Long-distance Travel

Which team member has lived farthest from his or her current home? Using a map, determine how many kilometers away that is?

Discussion: How does this compare with Sanderlings that fly over 11,000 kilometer twice a year from their high-Arctic breeding grounds to nonbreeding grounds in Peru?

Problem 7—Fuel-Efficiency

Humans burn about 60 calories by running one kilometer. At this rate, how many calories would a student need to run from here to Peru?

Answer: Use a map to determine how many kilometers it is from your town to Lima, Peru. Multiply this number by 60 calories.

Example answer:

$60 \text{ calories} \times 7500 \text{ km} = 450,000 \text{ calories}$

If one gram of fat yields 9 calories of heat, how many kilograms of fat would this student need to eat before making the trip?

Example answer:

$450,000 \text{ calories} \div 9 \text{ calories/g} = 50,000 \text{ g}$
 $50,000 \text{ g} \times 1,000 = 50 \text{ kg}$

Discussion: Compare this with the Pacific Golden-Plover, which can travel 3900 kilometers (2400 miles) in 48 continuous hours of flying, using fewer than 60 grams (2.1 oz) of body fat. Does this bird burn more calories per kilometer or few calories per kilometer than a student?

Avian Olympics

Student Worksheet

Directions

Answer the following questions one at a time. Do not proceed to the next question until your teacher tells you to. Show all your calculations (carrying your units through the calculations to see if your answer makes sense).

Problem 1 – Weigh-In

The average middle school student weighs 100 pounds or 45 kilogram. How many grams are there in 45 kilograms?

Compare the above weight to the weight of the Western Sandpiper, about 25 grams (less than one ounce.) Find several objects in the classroom that you think weigh 25 grams. Now weigh the objects and record which object comes closest.

How many Western Sandpipers (at 25 grams) would it take to equal the weight of an average middle school student (at 45 kilograms)?

Problem 2 – Eating Like a Bird (Fat-loading)

What is the largest number of quarter-pound hamburgers any person on your team has eaten in a single meal?

What percentage of the average weight of a middle school student is this? (Assume that a quarter-pound hamburger = 114 grams.)

If an average student weighing 45 kilograms were going to increase his or her body weight by 30%, how much weight would he or she need to gain?

How many quarter-pound hamburgers does this equal?

Problem 3 – Fast Travel

How long did it take the fastest student to sprint 50 meters?

Calculate how long it would take this runner to cover one kilometer.

Using a map of the world, estimate the distance in kilometers from your school to Lima, Peru.

Using your answer from above, calculate how long it would take the fastest student to sprint directly to Lima. (Assume he or she could run in a straight line without stopping.)



Avian Olympics

Student Worksheet

Continued

Problem 4 – Wing-flapping

How many arm flaps can your group's representative do in ten seconds?

Using the time calculated in problem three, calculate how many arm flaps a student would make in a "flight" to Lima, Peru.

Problem 5 – Nonstop Travel

Which group member can continue flapping his or her arms the longest? How long?

How far do you think the best runner of middle school age can run without stopping?

How far do you think the average middle school student can run without stopping?

Problem 6 – Long-distance Travel

Which group member has lived the farthest away from his or her current home? How many kilometers away is that?

How does this compare with Sanderlings that fly over 11,000 kilometer twice a year from their high-Arctic breeding grounds to nonbreeding grounds in Peru?

Problem 7 – Fuel Efficiency

Humans burn about 60 calories by running one kilometer. At this rate, how many calories would you need to run from here to Peru?

If one gram of fat yields nine calories, how many kilograms of fat would you need to eat before making the trip?

How does this compare with the Golden-plover which can travel 3900 kilometers (2400 miles) in 48 continuous hours of flying using fewer than 60 grams (2.1 ounce) of body fat?



Habitat

Concepts

- Habitat is the place where an organism lives because it is adapted to find food, water, shelter, and space there. Numerous habitats are located within an ecosystem.
- Shorebirds are one part of a healthy functioning ecosystem.
- Shorebirds depend on at least three different places for habitat every year of their lives.
- Shorebirds face numerous threats.
- The most serious threat to shorebirds is loss of habitat.
- Both shorebirds and humans depend on clean, healthy ecosystems.
- Wetland and grassland ecosystems provide extremely important habitats for shorebirds.
- Your local environment may provide important habitat for shorebirds.
- Your local environment is part of a natural ecosystem that we all depend on.

Activities

Shorebird Food Webs

(lower elementary, upper elementary/middle school)

In this activity, students take on the roles of abiotic or biotic components of a wetland or grassland habitat. Using a ball of yarn, students create a web to demonstrate how shorebirds are connected to all parts of their habitat. They discover how changes in the food web can affect a shorebird's survival.

Can't We Share?

(lower elementary)

Students learn how natural and man-made events affect shorebird survival by playing a game of musical chairs in which the students are shorebirds and the chairs are different habitats.

Wetland Metaphors

(lower elementary, upper elementary middle school)

Students make comparisons between unrelated objects through metaphors to learn the functions of a wetland.

Match the Habitat Cards

(upper elementary/middle school)

By playing a card-matching game, students learn that shorebirds use diverse habitats. Students will discover that shorebirds use these habitats to meet their own specific needs.

Types of Habitats

(upper elementary/middle school)

By building a three-dimensional model, students learn principles of geography and the components of aquatic and terrestrial shorebird habitats.

Map Your Habitats

(upper middle school/ high school)

By examining maps, students discover the variety of habitats that local shorebirds might use.

When the Grass Was Greener

(upper middle school / high school)

Through simulation, participants will see how the reduction of grassland habitat and the altering of agricultural practices such as corn production, grazing, and mowing can affect grassland nesting shorebirds.



Shorebird Food Webs

Adapted from “Salt Marsh Food Web.” San Francisco Bay National Wildlife Refuge. “Salt Marsh Manual.”

Grade Level: lower elementary, upper elementary/middle school

Duration: one 30-minute class period

Skills: critical thinking, problem solving, predicting, discussion, and vocabulary

Subject: science

Concepts

- Habitat is the place where an organism lives because it is adapted to find food, water, shelter, and space there. Numerous habitats are located within an ecosystem.
- Shorebirds are one part of a healthy functioning ecosystem.
- Both shorebirds and humans depend on clean, healthy ecosystems.
- Wetland and grassland ecosystems provide extremely important habitats for shorebirds.

Vocabulary

- ecosystem
- endangered
- extinct
- food web
- producers
- consumers
- predators
- prey
- habitat

Overview

In this activity, students take on the roles of abiotic or biotic components of a wetland or grassland habitat. Using a ball of yarn, students create a web to demonstrate how shorebirds are connected to all parts of their habitat. They discover how changes in the food web can affect a shorebird’s survival.

Objectives

After this activity, students will be able to:

- Identify at least five different plants and animals from one of the seven habitats.
- Name at least two relationships between plants and animals.
- Name at least two shorebirds that live within the habitat studied.
- Explain what it means to be an endangered species.
- Define the word extinct.

Materials

- Ball of yarn to create a web
- Shorebird Food Web Cards for either: tundra, salt marsh, freshwater marsh, mudflat and sandy beaches, rocky-intertidal habitat, or grasslands.

Introduction

Habitat is the place where species find food, water, shelter, and space to survive. Habitat is found within an *ecosystem*. An ecosystem consists of all living parts (plants and animals) and the nonliving parts (air, water, soil, minerals) in an area of any size, interacting and linked together by nutrient flow and energy from the sun. There are many relationships and interactions between the *producers*, the green plants that use sunlight to produce their food, and the *consumers*, those animals that feed on plants and each other. These relationships and interactions in an ecosystem can be demonstrated as a “web,” with each plant, animal, or nonliving part connected to each other either directly or indirectly. When one part of the web is touched, every part is affected.

Plants and animals are considered *endangered* when there are so few of a particular species left that it runs the risk of becoming *extinct*. Many shorebird populations today are in trouble because the habitats they depend on for nesting, migration, stopover, and

nonbreeding have been lost to development.

For more information on shorebird habitats, read *Shorebirds Depend on a Chain of Healthy Habitats* in the *Shorebird Primer*.

Activity Preparation

1. Select the habitat food web that you want to explore with your students from the Shorebird Food Web Cards.
2. Photocopy the Food Web Cards onto cardstock and cut them out.
3. If you have more students in your class than you have cards, photocopy and cut extra producer cards. It is okay for more than one student to represent the producers in the food web. In reality, a healthy food web requires a greater number of producers to support the other organisms.

Procedure

1. Ask the students to form a circle. Hand out a food web card to each student. Save the sun card for yourself. Let the students know that it is okay for several people to have the same cards.
2. Ask the students if they know why several students are representing *producers* in the web? These are the producers at the base of the food web which usually do outnumber the *consumers* in nature. They have to support the animals at the top.
3. Have the students read their cards silently, then aloud to the rest of the class. Ask them to listen to each other carefully for clues to the order of the web. Explain that they will have to connect their organisms to other organisms they depend on.

4. You, the “sun,” start the web activity. Read your card, then wrap one end of the yarn around your hand and pass the ball of yarn to the student representing the organism you are connected to. For example, the “sun” would connect to a “plant” and say “I am the sun and I provide energy for the plant to grow.” NOTE: Connections can be indirect—that is animals also require air, water, and sunlight.
5. Now the student with the ball of yarn reads his or her card and passes the ball to the organism he or she is connected to. For example, a student with a plant card would then pass the ball of yarn to an animal that eats it and say “I am a plant and provide food for ____.”
6. Continue this until all the students are connected by the web of yarn.
7. Discuss with students what might happen if one species were lost from the web. Simulate removing one of the organisms from the web by tugging on one line in the web or have one “organism” drop its line. Instruct everyone who feels the tug to *gently* tug the line(s) she or he is holding. This ripple effect should pass through everyone in the web.
8. Have a class discussion of the following questions:
 - How does the loss of one species in the food web affect the other species?
 - What would happen to the food web if one of these species were to be permanently removed from the habitat?
 - What does it mean when a species is listed as *endangered*?
 - Are any animals in this food web endangered?
 - What do you think we can do to keep shorebirds from becoming endangered?

Additional Activities

Food Webs in Other Habitats

Make another set of food web cards for a habitat not found in your area. After creating this food web as a class, ask students to research this food web further. What other plants and animals live there? What are the environmental conditions in this habitat? Refer older students to the *Habitats Student Readings* in the *Types of Habitat* activity in this section for more information about important shorebird habitats.

Shorebirds of Your Habitat

Read the *Shorebird Profiles* found in the *Appendix* to find the shorebirds mentioned in your food web. Find and color the matching shorebird illustrations in the *Shorebird Coloring Pages* of the *Appendix*.

Make a Food Web Mobile

Divide your class into seven teams and assign each team one of the habitat types included in this activity. Instruct each team to color its food web cards and assemble them into a mobile. Ask them to highlight, in any way they choose, any species in the web that are endangered. Have each team present its food web mobile to the entire class before hanging it in the classroom.



List of Food Web Cards

Food Web Habitats

Tundra	166
Freshwater Marsh	169
Rocky-Intertidal Habitat	173
Mudflats and Sandy Beaches	176
Grassland	180
Salt Marsh	183



Tundra Food Web Cards

Sun

I am the sun. *Everything* on earth depends on me. And in my hands I hold the web of life.

Water

I am water. *All living things* need me to survive. Most plants and animals find me pooled in small depressions on top of the soil. I cannot seep into the hard frozen permafrost of the tundra.

Air

I am air. I am made up of oxygen and nitrogen. I am very important to *all living things*. *Fish*, which do not breathe air directly, get oxygen from the water. It is important to keep me clean because pollution in the air is harmful to all creatures.

Soil

I am soil. I am very important to *all living things*. *Plants* use the nutrients in me to grow. Only the top six inches of me thaws in the summer. *Animals* get their nutrients from plants. When living things die, they decompose and form a spongy layer on top of me called peat.

Zooplankton

I am *zooplankton*. I like to eat *detritus*, *phytoplankton*, and other *zooplankton*. I am eaten by lots of different animals, including *small fish*, *crabs*, *worms* and *snails*. I can be found in the small pools of water scattered across the tundra.

Phytoplankton

I am phytoplankton. I use *sunlight* to produce my own food. Many different organisms like to eat me, including *aquatic worms*, *zooplankton*, and *insect larvae*. You can find me floating in the small pools of water scattered across the tundra.

Lichen

I am lichen—part algae, part fungus. I use *sunlight* and nutrients in the *soil* to grow. I am one of the main diets of the *caribou* that nibble on me year round!

Detritus

I am detritus—dead plant material. When I was a live plant, I used *sunlight* to produce my own food. When I died, I decomposed into a material that feeds lots of other animals. *Zooplankton*, *insect larvae*, *grasshoppers*, and *beetles* eat me.



Tundra Food Web Cards

Cloudberry

I am cloudberry. I use *sunlight* and the *nutrients* in the soil to grow. *Ptarmigan*, *Arctic foxes*, *Arctic hares*, and *lemmings* eat my ripe berries in the fall.

Cotton Grass

I am a cotton grass. I use *sunlight* and the nutrients in the *soil* to grow in clumps across the tundra. I provide shelter and nesting material to many small animals. *Lemmings*, *Arctic hares*, and *musk ox* nibble my delicate shoots and eat my seeds.

Mosquito/Insect Larva

I am an insect larva. I hatch from an egg my parent laid on the *cotton grass*, *cloudberry*, or in the *water* of the small wetlands pools scattered across the tundra. I eat *zooplankton*, *phytoplankton*, and *detritus*. Tundra shorebirds like the *Pacific-Golden Plover*, the *Buff-breasted Sandpiper*, and the *Dunlin* time their arrival at the yundra just when I am hatching because I give them lots of energy to raise their chicks.

Ptarmigan

I am a ptarmigan. I eat *cloudberry*, *cotton grass seed*, and *insect larva*. *Arctic fox*, *gray wolf*, and *snowy owl* all try to make a meal of me. Thank goodness for camouflage! There aren't many places to hide from predators on the flat, barren tundra landscape.

Lemming

I am a lemming. I eat tundra plants like *cloudberry* and *cotton grass* and *insect larvae*, *beetles*, and *grasshoppers*. I have to watch out for *Arctic foxes*, *gray wolves*, and *snowy owls*—tundra predators that eat me.

Arctic Fox

I am an Arctic fox. I eat almost anything smaller than myself. I chase tundra shorebirds like *Pacific Golden-Plover*, *Buff-breasted Sandpiper*, and *Dunlin*. I will also eat *lemming*, *ptarmigan*, *Arctic hare*, and even *beetles*, *grasshoppers*, and the berries of the *cloudberry* plant!

Caribou

I am a caribou, the wild relative of the reindeer. Even though I am one of the largest animals on the tundra, I survive by nibbling the *lichen* growing on the rocks scattered across the landscape. While I graze, I keep a careful watch for *gray wolf* which tries to catch the young and weak members of my herd.

Pacific Golden-Plover

I am a Pacific Golden-Plover. Like other tundra shorebirds, I feast on *insect larvae*, *beetles* and *grasshoppers*. *Arctic fox*, *gray wolf*, and *snowy owl* prey on my chicks and me.



Tundra Food Web Cards

Buff-breasted Sandpiper

I am a Buff-breasted Sandpiper. I use *lichen* and *dead willow leaves* to line my nest. I eat *beetles*, *grasshoppers*, and *insect larvae*. Sometimes *caribou* trample my nest and eggs as they slowly graze across the tundra.

Dunlin

I am a Dunlin. I feed on the abundant supply of tundra insects—*beetles*, *grasshoppers*, and *insect larvae*. My camouflage helps hide me from the *Arctic fox*, *gray wolf*, and *snowy owl* which like to eat my chicks and me.

Beetle

I am a beetle. I eat whatever I can find including the bodies of dead animals! Mostly I feed on *insect eggs and larva*, *detritus*, *cotton grass*, *cloudberry*, and other tundra plants. In turn, I am food for *Arctic fox*, *Pacific Golden-Plover*, *Buff-breasted Sandpiper*, and *Dunlin*.

Grasshopper

I am a grasshopper. I feed on tundra plants like *cloudberry*, *cotton grass*, and *dwarf willow*. *Arctic fox*, *Pacific Golden-Plover*, *Buff-breasted Sandpiper*, and *Dunlin* eat me.

Dwarf Willow

I am a dwarf willow. I offer shelter and protection to many tundra birds and small animals. *Ptarmigan*, *grasshopper*, *caribou*, *lemming*, and *Arctic hare* eat my tender buds.

Snowy Owl

I am a snowy owl. I hunt from above, soaring in search of *lemming*, *arctic hare*, *Arctic fox kits*, *Pacific Golden-Plover*, *Buff-breasted Sandpiper*, *Dunlin* adults and chicks, and *ptarmigan*. Few tundra predators can catch me, but *gray wolf* will eat me if he can.



Freshwater Marsh Food Web Cards

Sun

I am the sun. *Everything* on earth depends on me. And in my hands I hold the web of life.

Water

I am water. *All living things* need me to survive. Rain and snowmelt bring me into the marsh.

Air

I am air. I am made up of oxygen and nitrogen. I am very important to *all living things*. *Fish*, which do not breathe air directly, get oxygen from the water. It is important to keep me clean because pollution in the air is harmful to all creatures.

Soil

I am soil. I am very important to *all living things*. *Plants* use the nutrients in me to grow. *Animals* get their nutrients from plants. When living things die, they decompose and return their nutrients to me.

Zooplankton

I am *zooplankton*. I like to eat *detritus*, *phytoplankton* and other *zooplankton*. I am eaten by lots of different animals, including *small fish*, *aquatic worms*, *snails*, *tadpoles*, and *mosquito larvae* as I swim through the water.

Phytoplankton

I am phytoplankton. I use *sunlight* to produce my own food. Many different organisms like to eat me, including *aquatic worms*, *zooplankton*, *insect larvae*, and *tadpoles* as I float in the water.

Detritus

I am detritus—dead plant material. When I was a live plant, I used *sunlight* to produce my own food. When I died, I decomposed into a material that feeds lots of other animals. *Zooplankton*, *insect larvae*, *tadpoles*, and *fish fry* eat me.

Cattail

I am a cattail. I use the *sun*, *water*, and *soil* to grow in the shallows of the freshwater marsh. *Muskrat* eat my tender shoots and collect my stalks to make their huts. *Red-winged Blackbirds* nest within my tall growth.



Freshwater Marsh Food Web Cards

Rush

I am a rush. I use the *sun*, *water*, and *soil* to grow along the edges of the freshwater marsh. Many wetland creatures including *Mallard ducks* eat the seeds I drop.

Snail

I am a snail. I eat *phytoplankton* and *zooplankton*. Lots of different birds prey on me, such as *Spotted Sandpiper*, *Hudsonian Godwit*, and *Great Blue Heron*. I live in the mudflats of the wetland.

Duckweed

I am duckweed. I float on top of the *water* like little green dots, using the sun to make food for myself. *Mallard ducks* use their strainer-like bills to collect me off the water's surface.

Dragonfly

I am a dragonfly. As a winged adult I am a fierce *mosquito* predator. I have to watch out for birds that like to eat me, like the *Red-winged Blackbird* and *sunfish* that grab me as I drink from the surface of the water. *Humans* who sometimes like to collect me are a danger too!

Insect Larva

I am a dragonfly larva. I begin life in the water eating *detritus*, *small fish*, *tadpoles*, and other *insect larvae*. However, *fish*, *frogs*, and *turtles* like to eat me when they can.

Mosquito

I am a female mosquito. When I am hungry I look for any warm-blooded animal to feed on. At the wetland, I feed on *muskrat*, *Mallard duck*, *Red-winged Blackbird*, *Spotted Sandpiper*, and *Hudsonian Godwit*, but I like *humans* the best!

Mallard Duck

I am a Mallard duck. I spend my time straining *duckweed* from the water's surface. I often get an *invertebrate* along with my plant meal. Unleashed *dogs* and *humans* are my biggest threats.

Great Blue Heron

I am a Great Blue Heron. I use my sharp, pointed bill to spear *fish* and *frogs*. Like Mallard duck, unleashed *dogs* are a threat to my chicks and me.

Freshwater Marsh Food Web Cards

Sunfish

I am a sunfish. I take shelter as a young fry among the *cattails* and *rushes*, eating *detritus*, *zooplankton*, *phytoplankton*, and small *insect larva*. As I grow, I venture out into the open water area of the pond in search of a bigger meal—dragonflies as they try to take a drink, *tadpoles*, and small *frogs*.

Muskrat

I am a muskrat. I eat *cattails* and use them to build my home. If I am not careful I may be trapped by a *human being* or caught by an unleashed *dog*. *Red fox* likes to eat my young—and me too!

Leopard Frog/Tadpoles

I am a leopard frog. As a tadpole I feast on the *detritus* near the edges and on the bottom of the wetland. I am food to *fish* and *dragonfly larvae* when I am young. Once I am a frog, even more wetland creatures consider me food, including *Great Blue Heron*.

Red-winged Blackbird

I am a Red-winged Blackbird. I make my nest among the tall *cattails* at the edge of the wetland pond. I eat wetland insects like *dragonflies* and *mosquitoes*. A stray *dog* or a *red fox* will make a meal of me when they catch me.

Spotted Sandpiper

I am a Spotted Sandpiper. I probe the wetland mud for *tiny snails* and *insect larvae*. I move quickly and am well camouflaged to help me hide from *red fox* and *dog*.

Hudsonian Godwit

I am a Hudsonian Godwit. My long, slightly upcurved bill is perfect for finding *snails* and *insect larvae* in the mud. If I am not careful, I can become food for *red fox* or *dog*.

Red Fox

I am a red fox. I am the great hunter of the wetland. I eat *Mallard ducks*, *muskrats*, *Red-winged Blackbirds*, *Spotted Sandpipers*, and *Hudsonian Godwits* when I can catch them. I am happy, however, to eat *leopard frogs* too. I watch out for *dogs*, a relative of mine that is often quite bigger than I am. I also stay clear of *human beings* who sometimes trap me for my beautiful red fur coat.

Dog

I am a dog. I love to chase anything that runs. I can catch *Mallard ducks*, *muskrats*, *Red-winged Blackbirds*, *Spotted Sandpipers*, *Hudsonian Godwits*, *Great Blue Herons*, and even *leopard frogs* when I am loose in the wetland!



Freshwater Marsh Food Web Cards

Human Being

I am a human being. As you know, I eat a huge variety of foods including *ducks* and *fish*. I am at the top of the food chain, so no animals prey on me except that pesky *mosquito*! Sometimes I drain wetlands to build homes and businesses or to make way for roads and shopping centers. *Dog* often accompanies me on my walks, and I let him run off-leash for exercise.



Rocky-Intertidal Habitat Food Web Cards

Sun

I am the sun. *Everything* on earth depends on me. And in my hands I hold the web of life.

Water

I am water. *All living things* need me to survive. Saltwater from ocean tides and freshwater from the rain collect in small pools among the rocks.

Air

I am air. I am made up of oxygen and nitrogen. I am very important to *all living things*. *Fish*, which do not breathe air directly, get oxygen from the water. It is important to keep me clean because pollution in the air is harmful to all creatures.

Rocky Substrate

I am rock. I take the place of soil in the rocky intertidal habitat. *Seaweed* anchors its roots to me. *Mussels*, *limpets*, *barnacles*, *starfish*, and *sea urchins* cling to my surface as waves crash to shore.

Zooplankton

I am *zooplankton*. I like to eat *detritus*, *phytoplankton* and other *zooplankton*. I am eaten by lots of different animals, including *small fish*, *aquatic worms*, *shrimp*, *clams*, and *barnacles* as I swim through the water.

Phytoplankton

I am phytoplankton. I use *sunlight* to produce my own food. Many different organisms like to eat me, including *small fish*, *aquatic worms*, *zooplankton*, *shrimp*, *clams*, and *barnacles* as I float in the water.

Detritus

I am detritus—dead plant material. When I was a live plant, I used *sunlight* to produce my own food. When I died, I decomposed into a material that feeds lots of other animals. *Zooplankton*, *phytoplankton*, *tidepool shrimp*, *aquatic worms*, *clams*, and *barnacles* eat me.

Seaweed

I am seaweed. I use *sunshine* to make food for myself. *Sea urchins* and *small fish* nibble at me as I cling to the rocks. I also provide places for fish and other wildlife to hide. When I die and become *detritus*, I am eaten by many other organisms.



Rocky-Intertidal Habitat Food Web Cards

Tidepool Shrimp

I am a tidepool shrimp. I feed on *seaweed* and *detritus* floating through the water. *Ruddy Turnstones*, *starfish*, and *gulls* make a meal of me.

Limpet

I am a mussel called a limpet. I cling to the rocks like a suction cup. I eat *phytoplankton* and *zooplankton* that floats in with the tide. *American Oystercatchers* use their strong, flattened beak to pry me off the rocks to eat my soft body that is hidden under my shell.

Razor Clam

I am a razor clam. I burrow deep into the sand and wait for the tide to bring me a fresh supply of *phytoplankton* and *zooplankton* with each pulse of the surf. Birds like *gulls*, *Ruddy Turnstones*, and *oystercatchers* are always looking to make a meal of me. *Starfish* and *Gulls* eat me too when rough surf brings me to the surface.

Starfish

I am a starfish. I cling to the *rocks* as the surf rolls in out of the tidepool. I eat anything that I can get my strong arms around, mostly *clams*, *limpets*, *barnacles*, *oysters*, and *sea urchins*. *Gulls* like to eat me if they can tear me loose from the rocks.

Sea Urchin

I am a sea urchin. I cling to the *rocks* as the surf rolls in and out of the tidepool. I eat *seaweed* that grows on the rocks or is brought in with the surf. *Gulls*, *sea otters*, and *starfish* like to eat me.

Gull

I am a gull. I eat almost anything I can find on the beach—*starfish*, *sea urchins*, *clams*, and even the chicks and eggs of shorebirds like *oystercatcher* and *Ruddy Turnstone*!

Oystercatcher

I am an oystercatcher. I use my chisel-like beak to pry open the shells of *razor clams* and *oysters* and to pull *limpets* from the rocks. *Gulls* prey on my eggs and chicks.

Ruddy Turnstone

I am a Ruddy Turnstone. I get my name from the way I flick over *seaweed* or turn over small stones in search of small marine invertebrates like *snails*, *aquatic worms*, *razor clams*, and *tidepool shrimp* to eat. *Gulls* prey on my eggs and chicks.



Rocky-Intertidal Habitat Food Web Cards

Small Fish

I am a small marine fish. The tide brings me into the rocky tidepool where I spend my time nibbling on the *seaweed* I find there. If I am not careful, a *starfish* or a *Gull* may make a meal of me.

Barnacle

I am a barnacle. I filter *zooplankton*, *phytoplankton*, and *detritus* from the water for food. *Starfish* eat me.

Oyster

I am an oyster. I filter *zooplankton* and *phytoplankton* by sucking ocean water into my shell through my siphon. *Crabs*, *starfish*, *oystercatchers* and *human beings* eat me.

Aquatic Worm

I am an aquatic worm. I eat mostly *detritus*, *phytoplankton*, and *zooplankton*. Lots of animals eat me, including *gulls* and *Ruddy Turnstones*. I live in the wet sand along the shoreline.

Human Being

I am a human being. I harvest *oysters* from the sea for food. I sometimes bring my pets to the ocean for a swim and accidentally disturb *Ruddy Turnstones* and *oystercatchers* when they are feeding.



Mud Flats and Sandy Beaches Food Web Cards

Sun

I am the sun. *Everything* on earth depends on me. And in my hands I hold the web of life.

Water

I am water. *All living things* need me to survive. Saltwater from ocean tides and freshwater from the rain bring me to mudflats and sandy beaches.

Air

I am air. I am made up of oxygen and nitrogen. I am very important to *all living things*. It is important to keep me clean because pollution in the air is harmful to all creatures.

Soil

I am soil. I am very important to *all living things*. *Grasses* use the nutrients in me to grow. When living things die, they decompose and return their nutrients to me.

Zooplankton

I am *zooplankton*. I like to eat *detritus*, *phytoplankton* and other *zooplankton*. I am eaten by lots of different animals, including *small fish*, *aquatic worms*, *snails*, *invertebrate larvae*, and *sand fleas* as lake tides and river floods carry me in.

Phytoplankton

I am phytoplankton. I use *sunlight* to produce my own food. Many different organisms like to eat me, including *aquatic worms*, *zooplankton*, *invertebrate larvae*, and *sand fleas* as lake tides and river floods carry me in.

Detritus

I am detritus--dead plant material. When I was a live plant, I used *sunlight* to produce my own food. When I died, I decomposed into a material that feeds lots of other animals. *Zooplankton*, *phytoplankton*, *shrimp*, *sand fleas*, *aquatic worms*, *fiddler crabs*, and *clams* depend on me for food.

Invertebrate Eggs and Larvae

I am an invertebrate egg that will hatch into a larva. Snails, worms, sand fleas, clams, shrimps, and crabs all lay eggs. Sooner or later many of me end up becoming food for Sanderlings, Dowitchers, Black-bellied Plovers, and fiddler crabs.



Mud Flats and Sandy Beaches Food Web Cards

Snail

I am a snail. I eat *phytoplankton* and *zooplankton*. Lots of different birds prey on me—such as *Dowitchers*, *Laughing Gulls*, *Sanderlings*, and *Black-bellied Plovers*. I live in the grasses of the mudflats and the *seaweed* that washes up along the sandy beach.

Aquatic Worm

I am an aquatic worm. I eat mostly *detritus*, *phytoplankton*, and *zooplankton*. Lots of animals eat me, including *Laughing Gulls*, *Sanderlings*, *Dowitchers*, and *Black-bellied Plovers*. I live in the wet sand and mud along the shoreline.

Sand Flea

I am a sand flea, but you may know me as a “sand hopper.” I am not really a flea at all but a marine crustacean. I feed mostly on decaying seaweed called *detritus*. Shorebirds like *Sanderlings*, *Dowitchers*, and *Black-bellied Plovers* pick through washed up *seaweed* and *grasses* along the edges of the mudflat in search of me.

Fiddler Crab

I am a fiddler crab. I get my name from my one oversized claw that looks like a violin (fiddle) and the smaller one that looks like a bow. I eat any small plants or animals I can pick up with my claws—*sand fleas*, *aquatic worms*, *snails*, *invertebrate eggs* and *larvae*, *clams*, and *shrimp*. *Laughing Gulls* and *raccoons* catch and eat me when I venture too far away from the safety of my underground burrow.

Clam

I am a clam. I burrow deep into the sand and wait for the tide to bring me a fresh supply of *phytoplankton* and *zooplankton* with each pulse of the surf. Birds like *Laughing Gulls*, *Dowitchers*, and *Black-bellied Plovers* probe the sand for me.

Shrimp

I am a shrimp. I feed on *seaweed* and *detritus* floating through the water. *Laughing Gulls*, *Dowitchers*, and *Black-bellied Plovers* make a meal of me.

Dowitcher

I am a Dowitcher. I use my bill like a sewing machine needle, probing the sand and mud for *invertebrate eggs and larva*, *snails*, *aquatic worms*, *sand fleas*, and *clams*. I am afraid of *raccoons*, *Laughing Gulls*, and *human beings*.

Black-bellied Plover

I am a Black-bellied Plover. You will find me running back and forth from the water's edge, picking food off the surface of the sand or mud. I eat *snails*, *aquatic worms*, *sand fleas*, *clams*, and *invertebrate eggs and larvae* like the other shorebirds here.



Mud Flats and Sandy Beaches Food Web Cards

Sanderling

I am a Sanderling, sometimes called a “wave chaser.” What I am really doing is trying not to get wet while I peck for small bits of food like *invertebrate eggs and larvae, aquatic worms, sand fleas, clams, and snails*.

Laughing Gull

I am a Laughing Gull. I am a bold and persistent predator. I will attack unsuspecting *Sanderlings, Black-bellied Plovers, and Dowitchers*. I also eat *shrimp, snails, crabs*, and even *mice* when I can catch them!

Grass

I am grass. I grow in the *soil* along the edges of the mudflats and on areas of the sand dunes. I use *sunlight, water, and air* to grow and produce my own food. *Mice* nibble on me; *shorebirds* use my dead stalks to line their nests; some *invertebrate eggs and larva* cling to me where I am wet and grow near the water’s edge. *Crabs* and *snails* hide within me.

Mouse

I am a mouse. I eat grasses growing along the edges of the mudflat. *Laughing Gulls* and *raccoons* sometimes eat my young and me.

Raccoon

I am a raccoon. I eat just about anything I can find. *Human beings* help me by leaving their food scraps and trash behind. When they get too close to a shorebird nest, they unknowingly leave a scent trail that I can follow right to my prey!

Human Being

I am a human being. I accidentally disturb *Sanderlings, Black-bellied Plovers, and Dowitchers* when I walk too close to where they are feeding. I unknowingly trample nests and lead predators like the *raccoon* right to the nests of shorebirds when I get close enough to see the eggs and chicks.



Mud Flats and Sandy Beaches Food Web Cards

Flyway-Specific Additional Cards

Horseshoe Crab

(Atlantic Flyway)

I am a horseshoe crab, a coastal scavenger. I will eat just about any small animal the surf brings me, including clams and aquatic worms. I am a favorite food of coastal birds including gulls. When I am just an egg, Ruddy Turnstones feast on me too. In fact, thousands of shorebirds time their spring migration along the Atlantic flyway to arrive when I am laying eggs. My eggs provide important energy that shorebirds need to continue their journey to the Canadian tundra. It is okay that they eat my eggs because the eggs are on top of the sand and would not hatch anyway.

Red Knot

(Atlantic Flyway)

I am a Red Knot. I migrate from Tierra Del Fuego, Argentina to the Delaware Bay to feast on horseshoe crab eggs. This gives me the energy to continue my flight to the Canadian tundra to nest.

Snowy Plover

(Pacific Flyway)

I am a Snowy Plover. I nest in the flat, open sandy beach habitat. Laughing Gulls and raccoons eat my eggs and even sometimes my chicks. Human beings get too close to me and scare me off my nest or disturb me while I am feeding on snails, aquatic worms, sand fleas, and clams. They also unknowingly walk or drive on my nests.

Piping Plover

(Atlantic Flyway)

I am a Piping Plover. I nest in the flat, open sandy beach habitat. Laughing Gulls and raccoons eat my eggs and even sometimes my chicks. Human beings get too close to me and scare me off my nest or disturb me while I am feeding on snails, aquatic worms, sand fleas, and clams. They also unknowingly walk or drive on my nests.



Grassland Food Web Cards

Sun

I am the sun. *Everything* on earth depends on me. And in my hands I hold the web of life.

Water

I am water. *All living things* need me to survive. Rainwater brings me to the potholes hidden within the grassy landscape.

Air

I am air. I am made up of oxygen and nitrogen. I am very important to *all living things*. It is important to keep me clean because pollution in the air is harmful to all creatures.

Soil

I am soil. I am very important to *all living things*. *Plants* use the nutrients in me to grow and provide food to many other kinds of animals. When living things die, they decompose and return their nutrients to me.

Big Bluestem

I am big bluestem. I use the *soil* and the *sun* to grow. I am eaten by lots of different animals, including *grasshoppers*, *beetles*, *prairie dogs*, *ground squirrels*, *cottontail rabbits*, and even the noble *bison*.

Purple Coneflower

I am purple coneflower. I use the *soil* and the *sun* to grow. *Bees* and butterflies drink nectar and take pollen from my flowers.

Bumblebee

I am a bumblebee. I visit *purple coneflower* and collect nectar and pollen from the flower of this prairie plant. Birds like the *Bobolink* and the *Upland Sandpiper* eat me.

Beetle

I am a beetle. I feed on prairie grasses, including *purple coneflower* and *big bluestem*. *Killdeers*, *Upland Sandpipers*, and *Long-billed Curlews* eat my larvae and me.



Grassland Food Web Cards

Grasshopper

I am a grasshopper. You can find me eating prairie plants like *purple coneflower* and *big bluestem*. I also hide in the prairie grasses to keep from being eaten by *Bobolink*, *Upland Sandpiper*, *Marbled Godwit*, *Long-billed Curlew*, and *Killdeer*.

Earthworm

I am an earthworm. I live deep in the prairie soil, chewing on plant material like *big bluestem*, helping to decompose it into nutrients for other plants. *Long-billed Curlew* and *Marbled Godwit* both have bills designed to probe for me under the soil.

Bison

I am a bison. I roam across the grassland grazing on the plants growing there, including *purple coneflower* and *big bluestem*. *Human beings* hunt me in some parts of the grasslands for meat and for my coat. Sometimes *coyote* catches one of my sick or injured calves.

Coyote

I am a coyote. I like to eat *prairie dog*, *ground squirrel*, *cottontail rabbit* and *red fox*. *Human beings* do not like me around and will shoot or trap me if I venture into their territory.

Prairie Dog

I am a prairie dog. I live together with many other prairie dogs. We take turns watching out for *coyotes*, *red foxes*, and *Red-tailed Hawks* that would eat us if they caught us. *Human beings* trap or poison us if we try to start a "town" on their property. I guess they do not like our system of underground tunnels.

Bobolink

I am a Bobolink. I eat insects like *bumblebees* and *grasshoppers*. *Coyotes*, *red foxes*, and *Red-tailed Hawks* try to eat me.

Ground Squirrel

I am a ground squirrel. I eat plants like *big bluestem* and *purple coneflower*. *Coyote* and *red fox* eat me. If I am not careful and venture into the territory of a *human being*, I might get trapped or poisoned.

Red Fox

I am a red fox. I eat *ground squirrels*, *cottontail rabbits*, *Bobolinks*, and *prairie dogs* when I can catch them. *Grasshoppers* are often an easier meal for me. I have to watch out for *coyote* because he would like to eat my kits and me. *Human beings* love my fur coat and try to shoot or trap me in some areas.



Grassland Food Web Cards

Cottontail Rabbit

I am a cottontail rabbit. I eat grassland plants like *purple coneflower* and *big bluestem*. I hide from the animals that want to eat me—*red fox*, *coyote*, and *Red-tailed Hawk*.

Long-billed Curlew

I am a Long-billed Curlew. I eat *grasshoppers*, *beetles*, and *earthworms*. *Red-tailed Hawk*, *red fox*, and *coyote* will eat my chicks and me. *Human beings* have drained the prairie potholes where I breed.

Upland Sandpiper

I am an Upland Sandpiper. I eat *grasshoppers*, *beetles*, and *earthworms* just like the Long-billed Curlew. *Red-tailed Hawks*, *red foxes*, and *coyotes* are the predators that hunt me. When *human beings* graze their cattle in areas where I nest, my eggs and chicks are often trampled.

Killdeer

I am a Killdeer. I eat *grasshoppers*, *beetles*, and *earthworms* like other grassland shorebirds. *Red-tailed Hawks*, *red foxes*, and *coyotes* eat me. I have adapted to living around *human beings* but am sometimes killed by their loose dogs and cats.

Red-tailed Hawk

I am a Red-tailed Hawk. I soar over the grasslands in search of shorebirds and their chicks like the *Killdeer*, *Upland Sandpiper*, and the *Long-billed Curlew*. I also eat *ground squirrel*, *cottontail rabbit*, *prairie dog*, and *Bobolink*.

Human Being

I am a human being. I hunt the *buffalo* for meat and fur and because they compete with my cattle for tender prairie grasses. I graze my cattle, farm crops, and build homes on the grasslands. I do not like *prairie dogs* and *ground squirrels* because their underground tunnels make a mess of my pastures, yard and gardens. Birds like the *Killdeer* that have adapted to living in my territory sometimes fall victim to my free-roaming cats and dogs.



Salt Marsh Food Web Cards

Sun

I am the sun. *Everything* on earth depends on me. And in my hands I hold the web of life.

Water

I am water. *All living things* need me to survive. Most plants and animals in the salt marsh are adapted to salt water. Twice a day, the high tide fills the slough and marsh with salty bay water. This area is sometimes called an estuary because salt and fresh water mix here.

Air

I am air. I am made up of oxygen and nitrogen. I am very important to *all living things*. Fish like the *goby*, which do not breathe air directly, get oxygen from the water. It is important to keep me clean because pollution in the air is harmful to all creatures.

Soil

I am soil. I am very important to *all living things*. *Plants* use the nutrients in me to grow. *Animals* get their nutrients from plants. When living things die, they decompose and return their nutrients to me.

Zooplankton

I am *zooplankton*. I like to eat *detritus*, *phytoplankton* and other *zooplankton*. I am eaten by lots of different animals, including small *fish*, *crabs*, *worms*, and *snails*. I can be found in the slough.

Phytoplankton

I am phytoplankton. I use *sunlight* to produce my own food. Many different organisms like to eat me, including *aquatic worms*, *zooplankton*, *snails*, *crabs*, and fish such as the *goby*. You can find me in the slough.

Northern Harrier

I am a northern harrier. I eat different animals, including the *salt marsh harvest mouse*, *rail*, *Mallard duck*, and *stilts*, *avocets*, and *phalaropes*. I am at the top of the food chain so other animals do not prey upon me.

Rail

I am a rail. I eat lots of different things such as *crabs*, *small fish*, *snails*, and even *salt marsh harvest mice*. I am sometimes eaten by *northern harriers*. I live in the salt marsh, hiding and nesting in the *pickleweed* and *cordgrass*.



Salt Marsh Food Web Cards

Mallard Duck

I am a Mallard duck. Some of the foods I like to eat are *detritus*, *worms*, *phytoplankton*, and *zooplankton*. Sometimes *people* eat me. I live in the *waters* of lakes, ponds, sloughs, and rivers.

Snail

I am a snail. I eat *phytoplankton* and *zooplankton*. Lots of different birds such as *egrets*, *rails*, *Killdeer*, *American Avocets*, *Black-necked Stilts*, and *Wilson's Phalaropes* prey on me. I live in the mudflats of the slough.

Salt Marsh Harvest Mouse

I am a salt marsh harvest mouse, an endangered species. I eat *pickleweed*. *Northern harriers*, *rails*, and *egrets* like to eat me. You can only find me living in the salt marshes of San Francisco Bay, but you will not see me during the day because I am nocturnal.

Snowy Egret

I am a snowy egret. I eat lots of different things, including *small fish*, *mice*, *snails*, and *crabs*. *Northern harriers* try to eat my young. In the past, *human beings* killed me to decorate their hats with my feathers. I live in the salt marshes and tidal sloughs.

Pickleweed

I am pickleweed. I use the *sun* to produce my own food. The *salt marsh harvest mouse* eats me. The *rails* build their nests on me. I live in the salt marsh and get wet when tidal *water* comes in from the bay.

Cordgrass (Detritus)

I am cordgrass. I use *sunlight* to produce my own food. When I die, I decompose into a material called *detritus*. Lots of animals feed on *detritus*, such as *zooplankton*, *ducks*, *fish*, *worms*, and *crabs*. I grow close to the slough and the *rail* hides under me.

Black-necked Stilt

I am a Black-necked Stilt. I use my long, needle-like bill to pick *aquatic snails*, *worms*, *insects*, *small fish*, and *crabs* from the shallow water. Sometimes *northern harriers* will eat my chicks and me. *Human beings* sometimes scare me away from my feeding grounds. You can find me in the salt pond, salt marsh, and mudflats.

American Avocet

I am an American Avocet. I sweep my slim, upcurved bill from side to side, straining *aquatic snails*, *worms*, *insects*, *small fish*, and *crabs* from the water. Sometimes *northern harriers* will eat me and my chicks. *Human beings* sometimes scare me away from my feeding grounds. You can find me in the salt pond, salt marsh, and mudflats.



Salt Marsh Food Web Cards

Wilson's Phalarope

I am a Wilson's Phalarope. I am known for spinning like a top to create a temporary whirlpool in the water in order to stun the *aquatic snails, worms, insects, small fish*, and *crabs* I eat. Sometimes *northern harriers* will eat my chicks and me. *Human beings* sometimes scare me away from my feeding grounds. You can find me in the salt pond, salt marsh, and mudflats.

Aquatic Worm

I am an aquatic worm. I eat mostly detritus, phytoplankton, and zooplankton. Lots of birds, including Killdeer, Black-necked Stilts, American Avocets and Wilson's Phalaropes, like to eat me. Goby like to eat me as well. I live in the mudflats of the slough.

Crab

I am a crab. I eat different foods, including detritus, phytoplankton, zooplankton, and dead gobys. Lots of animals feed on me, including birds such as egrets, rails, Killdeer, avocets, phalaropes, and stilts. I burrow in the mudflats of the slough.

Aquatic Insect

I am an aquatic insect. Salt marsh birds like *avocets, stilts, phalaropes, Killdeer, egrets*, and *rails* are constantly probing and stirring the water looking for me. Small *fish* and *crabs* eat me too.

Bay Goby

I am a bay goby. I feed on the bottom of the slough, eating *phytoplankton, zooplankton, detritus*, and tiny mud creatures such as *aquatic worms*. Many different birds, including egrets, rails, stilts, avocets, and phalaropes, eat me. I live in the slough *water*.

Killdeer

I am a Killdeer. You will often find me probing the mud for food such as *aquatic worms, snails*, and small *crabs*. Many animals try to eat me, including the *northern harrier*. I can usually be found on the mudflats during low tide.

Human Being

I am a human being. As you know, I eat a huge variety of different foods, including *Mallard ducks* and fish. I am at the top of the food chain so no animals prey on me. Sometimes I build my home on top of salt marshes. I may get too close to feeding shorebirds like *Black-necked Stilts, American Avocets*, or *Wilson's Phalaropes* and scare them away from their feeding grounds.

Can't We Share?

Adapted with permission from "Bridges to the Natural World" from the New Jersey Audubon Society

Grade Level: lower elementary
Duration: 30-minute class period
Skills: communication, observation, interpretation of data, formulation of hypotheses, discussion, and vocabulary
Subject: science

Concepts

- Habitat is the place where an organism lives because it is adapted to find food, water, shelter, and space there. Numerous habitats are located within an ecosystem.
- Shorebirds are one part of a healthy functioning ecosystem.
- Both shorebirds and humans depend on clean, healthy ecosystems.
- Shorebirds face numerous threats.
- The most serious threat to shorebirds is loss of habitat.

Vocabulary

- ecosystem
- habitat
- species
- breeding habitat
- nonbreeding habitat
- migration stopover site
- environmental stewardship

Overview

Students learn how natural and man-made events affect shorebird survival by playing a game of musical chairs in which the students are shorebirds and the chairs are different habitats.

Objectives

After this activity, students will be able to:

- List the four components of an animal's habitat.
- Explain how animal populations respond to habitat loss.
- Give at least one example of environmental stewardship.

Materials

- 1 chair per student
- Tape recorder/cd player
- Tape or cd
- Index cards
- Felt marker
- Sticking tape
- 2 copies of the Environmental Events sheet (included here)

Introduction

A healthy functioning *ecosystem* has adequate *habitat* (food, water, space, and shelter) for individual *species*, as well as population controls such as herbivores to maintain plant growth and carnivores to maintain animal population.

Often human actions, such as development pollution, fragmentation of habitats, and/or management for a single species upset a healthy functioning ecosystem. *Environmental stewardship* can help ensure that people and wildlife can coexist.

Natural conditions such as erosion, climate change, disease, flooding, and fire affect the functioning of an ecosystem. As a result of natural and human-related conditions, many animals will die, relocate, or increase their populations by adapting to the new circumstances. For example, species like the Pacific-Golden Plover now feed on lawns in their nonbreeding

grounds and roost on rooftops. Buff-breasted Sandpipers now use agricultural fields instead of grasslands. Shorebirds rely on a variety of habitats for *breeding*, *nonbreeding*, and *migration stopover sites* where they rest and feed.

Important Shorebird Habitats

Tundra: A vast, flat, treeless wetland of the Arctic regions of northern and western Alaska and Canada. (Shorebird species found here are Red Knot, Ruddy Turnstone, Sanderling, Hudsonian Godwit, Black-bellied Plover.)

Stream and River Corridors: Low wetland areas along the banks of rivers and streams. These areas flood in the spring as snow and ice melt in the mountains and then dry up in late summer and fall. (Shorebird species found here are Killdeer, American Avocet, Spotted Sandpiper, Buff-breasted Sandpiper.)

Marshes: An open wetland of grassy areas that get freshwater from creeks, streams, rain, and snow or saltwater from coastal tides. (Shorebird species found here are Hudsonian Godwit, Killdeer, American Avocet, Black-necked Stilt, Spotted Sandpiper, Wilson's Phalarope)

Rocky Intertidal Habitat: A wetland area of the ocean shoreline made up of boulders, cliffs, gravel, shale, or rocks that are covered by saltwater during high tide and exposed to air during low tide. (Shorebird species found here are Black Oystercatcher and Ruddy Turnstone)



Mudflats and Sandy Beaches: Open sandy or muddy wetland habitats found in the area of the ocean shoreline, exposed to air during low tide, and covered by saltwater during high tide. (Shorebird species found here are Sanderling, Ruddy Turnstone, Dowitcher, Black-bellied Plover, Snowy Plover, Long-billed Curlew, Marbled Godwit, and Spotted Sandpiper.)

Grasslands: The prairie habitats of the central United States and Canada are comprised of three grass types. Some shorebirds will use human-made habitats that are similar to grasslands such as cemeteries, golf courses, school yards, and agricultural fields. (Shorebird species found here are Pacific Golden-Plovers, Killdeer, Mountain Plover, Upland Plover, and Buff-breasted Sandpiper.)

Prairie Potholes and Playa Lakes: Interspersed within grasslands of the United States are shallow, temporary wetlands called prairie potholes or playa lakes. (Shorebird species found here are Black-bellied Plover, Killdeer, American Avocet, Long-billed Curlew, and Marbled Godwit.)

For more information on shorebird habitats, refer to *Shorebirds Depend on a Healthy Chain of Habitats* in the *Shorebird Primer* and the *Habitat Readings*.

Activity Preparation

1. Select the music and arrange the chairs in two rows back to back, as in musical chairs.
2. Photocopy and cut the *Habitat Cards* included in this activity. If possible, select from the cards representing the habitats most common to your area.
3. Attach a habitat name to each chair, alternating the cards for equal distribution.
4. Photocopy and cut the *Shorebird Species Cards*, also included in this activity, so that each student has one. Be sure your selections match the number and types of habitat samples marked on the chairs.
5. Photocopy and cut two copies of the *Environmental Stewardship Cards*. Add your own local events to the blank cards provided. Place them in a box for random selection.

Procedure

1. Explain that each chair represents a specific shorebird habitat, such as marsh, mudflat, grassland, or stream corridor. Give a description of each habitat. Explain that each habitat supplies the shorebirds that live there with their basic life needs.
2. Hand out the species cards. Have the students read the cards and tell what kind of shorebirds they are and which habitat they live in.

3. Tell the students to stand in front of a chair representing their habitat and face the same direction, as if they were going to play musical chairs.

Note: Students may question why some shorebird species are represented in more than one habitat type. Explain that most shorebirds breed in one habitat type (often Arctic tundra) but use another during migration and the nonbreeding season. For example, the Red Knot breeds in the Arctic tundra but uses coastal wetlands during migration and the nonbreeding season.

4. Start the music and tell the students to walk around the chairs slowly. When the music stops, each student should sit down in one of the chairs representing his or her habitat.
5. The teacher or a student chooses an “event” from the box, reads it aloud, and removes a chair that represents the affected habitat.
6. Continue the game, removing one or more chairs at each stop in the music and as “events” are selected and read. As students are eliminated from the game, they keep the environmental events that affected their habitats.
7. Play until there is one student left.



8. Now discuss the following questions with the class:

- Ask students to tell how events affected them in their habitats. What basic needs were shorebirds deprived of in these situations? What will they do now?
- When more than one person was trying to take the same chair, what happened? How is the same behavior reflected in nature?
- Which events were natural phenomena and which were the result of human behaviors? Which of these events can people do something about and which cannot be controlled?
- What can people do to correct natural disasters? What alternatives exist for the human “events” that hurt shorebirds and their habitat?

9. Now tell students that they are going to do the activity again, but in reverse. Explain that humans have an important responsibility to be good land *stewards*. Explain that land stewardship is taking care of the land so it is available for all species and future generations of people.

10. Using the *Environmental Stewardship Cards*, play the activity backwards.

11. Discuss how students can be good stewards of the land in their community--for example, putting trash in its proper place, recycling, helping with conservation projects, etc.

Additional Activities

Research Your Shorebird

Use the **Shorebird Profiles** located in the *Appendix* of this education guide, the Web site, and the local library to learn more about the shorebirds in the activity. Ask student to research what the birds eat, where they live, and what unique adaptations and behaviors they have.

Hold a Mock Town Hearing.

Choose one of the environmental events named in the game as the issue to be discussed. The mayor and council (four or five students) listen to personal interest groups regarding a solution to the problem. Personal interest groups should represent many different points of view. This can also be expanded to include representatives from the different cultures along the shorebird's migration flyway.



Cultural Connection

In the ‘mock town meeting’ under *Additional Activities* at the end of this activity, have students represent different cultures along the shorebirds flyway expressing their view on the environmental issue.



Can't We Share? Habitat Cards

(Copy one card per chair. If possible,
use only habitats found in your
area.)

Habitat Type	Habitat Type
Tundra	Tundra
Habitat Type	Habitat Type
Tundra	Tundra
Habitat Type	Habitat Type
Marsh	Marsh
Habitat Type	Habitat Type
Marsh	Marsh



Can't We Share? Habitat Cards

(Copy one card per chair. If possible,
use only habitats found in your area.)

Habitat Type	Habitat Type
Stream and River Corridor	Stream and River Corridor
Habitat Type	Habitat Type
Stream and River Corridor	Stream and River Corridor
Habitat Type	Habitat Type
Rocky-Intertidal	Rocky-Intertidal
Habitat Type	Habitat Type
Rocky-Intertidal	Rocky-Intertidal



Can't We Share? Habitat Cards

(Copy one card per chair. If possible,
use only habitats found in your area.)

Habitat Type	Habitat Type
Mudflats and Sandy Beaches	Mudflats and Sandy Beaches
Habitat Type	Habitat Type
Mudflats and Sandy Beaches	Mudflats and Sandy Beaches
Habitat Type	Habitat Type
Prairie Potholes or Playa Lakes	Prairie Potholes or Playa Lakes
Habitat Type	Habitat Type
Prairie Potholes or Playa Lakes	Prairie Potholes or Playa Lakes

Can't We Share?

Shorebird Species Cards

(Photocopy so each child has one card.)

Tundra	Tundra
Red Knot	Ruddy Turnstone
Tundra	Tundra
Sanderling	Hudsonian Godwit
Tundra	Tundra
Black-bellied Plover	Western Sandpiper
Marsh	Marsh
Killdeer	American Avocet



Can't We Share? Shorebird Species Cards

(Photocopy so each child has one card.)

Marsh	Marsh
Black-necked Stilt	Spotted Sandpiper
Marsh	Marsh
Greater Yellowlegs* <small>* No Shorebird Profile in Educator's Guide.</small>	Wilson's Phalarope
Stream and River Corridor	Stream and River Corridor
American Avocet	Spotted Sandpiper
Stream and River Corridor	Stream and River Corridor
Lesser Yellowlegs* <small>* No Shorebird Profile in Educator's Guide.</small>	Killdeer

Can't We Share?

Shorebird Species Cards

(Photocopy so each child has one card.)

Rocky-Intertidal	Rocky-Intertidal
Black Oystercatcher	Ruddy Turnstone
Rocky-Intertidal	Mudflats and Sandy Beaches
American Oystercatcher	Snowy Plover
Mudflats and Sandy Beaches	Mudflats and Sandy Beaches
Ruddy Turnstone	Sanderling
Mudflats and Sandy Beaches	Mudflats and Sandy Beaches
Marbled Godwit	Long-billed Curlew



Can't We Share? Shorebird Species Cards

(Photocopy so each child has one card.)

Mudflats and Sandy Beaches	Mudflats and Sandy Beaches
Black-bellied Plover	Dowitcher
Grasslands	Grasslands
Buff-breasted Sandpiper	Upland Sandpiper
Grasslands	Grasslands
Pacific Golden-Plover	Mountain Plover* * No Shorebird Profile in Educator's Guide.
Grasslands	Grasslands
Long-billed Curlew	Marbled Godwit



Can't We Share? Shorebird Species Cards

(Photocopy so each child has one card.)

Playa Lakes	Playa Lakes
American Avocet	Long-billed Curlew
Playa Lakes	Playa Lakes
Mountain Plover* <small>* No Shorebird Profile in Educator's Guide.</small>	Snowy Plover
Prairie Potholes	Prairie Potholes
Dowitcher	Spotted Sandpiper
Prairie Potholes	Prairie Potholes
Marbled Godwit	Long-billed Curlew



Can't We Share? Environmental Events Cards

(Make 2 copies)

Environmental Event	Environmental Event
A town has 300 acres of undeveloped grassland. It is replaced by a shopping mall and office complex.	Tanks of toxic chemicals buried in a field eventually leak into the soil of a nearby wetland.
Environmental Event	Environmental Event
A coastal community sells 50 miles of beachfront property to a local developer who builds homes, a strip mall, and a hotel complex.	Silt barrier fences are not installed at a new construction project. Rain carries loose soil into a nearby wetland.
Environmental Event	Environmental Event
An oil spill off the Atlantic Coast near Delaware Bay threatens migrating shorebirds that feed there.	A drought threatens to dry out local freshwater wetlands.
Environmental Event	Environmental Event
An unusually heavy rainy season causes streams to flood lowland fields.	A hurricane blows away sand dunes where Snowy Plovers are nesting.



Can't We Share? Environmental Events Cards

(Make 2 copies)

Environmental Event	Environmental Event
A once restricted area of beach is opened up to public recreation. Personal watercraft vehicles (For example Jet Skis.) now scare away nesting and feeding shorebirds.	A farmer cuts hay in a field where shorebirds are nesting.
Environmental Event	Environmental Event
Agricultural chemicals are carried by runoff into a nearby wetland.	Because of habitat loss from disturbance, pollution, and development, migrating shorebirds have not been able to stop at their traditional stopover sites. They do not have enough energy to continue their migration to the Arctic to breed.
Environmental Event	Environmental Event
(Write your own local event here.)	(Write your own local event here.)
Environmental Event	Environmental Event
(Write your own local event here.)	(Write your own local event here.)



Can't We Share?

Environmental Events Cards

(Make 2 copies)

Environmental Stewardship	Environmental Stewardship
A town has 300 acres of undeveloped grassland. Of that, 200 acres will be used for a mall. The remaining 100 acres will be set aside as a preserve for local wildlife that includes an outdoor learning and research area.	Tanks of toxic chemicals buried in a field are removed by the Environmental Protection Agency. The company that buried the chemicals is paying to restore the land and the wetland.
Environmental Stewardship	Environmental Event
A coastal community sells 50 miles of beachfront property to a local developer for building homes, a mall, and a hotel. The developer also plans to work with biologists to protect important beach habitat by landscaping with native plants.	Silt barrier fences are installed at a new construction project. The silt barrier stops rain from carrying loose soil into a nearby wetland.
Environmental Stewardship	Environmental Stewardship
A federal law is passed that requires all oil tankers to be double-hulled to help prevent hull punctures that result in oil spills.	Through water management projects, the local National Wildlife Refuge is able to provide water for the wetland so that shorebirds can use the habitat.
Environmental Stewardship	Environmental Event
An unusually heavy rainy season causes streams to flood lowland fields. Shorebirds are able to find other nearby habitat to feed and rest.	Biologists plant native grasses to stabilize beach dunes, preventing them from blowing away. Though some natural damage still occurs from a hurricane, Snowy Plovers and the dunes survive.



Can't We Share? Environmental Events Cards

(Make 2 copies)

Environmental Stewardship	Environmental Stewardship
A once restricted area of beach is opened up to public recreation. However, boats and skiers stay 200 feet away from the beach and use provided ramps for access.	A farmer cuts hay in a field after the shorebirds finish nesting in mid-July.
Environmental Stewardship	Environmental Event
When applying agricultural chemicals, a landowner follows the directions on the label to keep chemicals 100 feet away from wetlands. He also applies only during the recommended weather conditions. As a result, there are not pollutants in the wetland.	Important stopover habitat is protected by national and state wildlife refuges and parks. Shorebirds have enough energy to complete their journey to the Arctic and breed successfully.
Environmental Stewardship	Environmental Stewardship
(Write your own local action here.)	(Write your own local action here.)
Environmental Stewardship	Environmental Event
(Write your own local action here.)	(Write your own local action here.)



Wetland Metaphors

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Grade level: lower elementary and upper elementary/middle school

Duration: one hour gathering objects and a 30-minute class period

Skills: application, visualization, team work, vocabulary, discussion, and communication/presentation

Subjects: science and language arts, fine arts (with additional activity)

Concepts

- Shorebirds are one part of a healthy functioning ecosystem.
- Both shorebirds and humans depend on clean, healthy ecosystems.
- Wetland ecosystems provide extremely important habitats for shorebirds.

Vocabulary

- Metaphors
- Microorganisms
- Decomposition
- Phytoplankton
- Zooplankton
- Algae
- Nutrients
- Runoff

Overview

Students make comparisons between unrelated objects through metaphors to learn the functions of a wetland.

Objectives

After this activity, students will be able to:

- Use metaphors to describe the basic functions of a wetland.
- Describe the value of wetlands.

Materials

- Large, concealing container (pillowcase, bag, or box)
- Sponge
- Small pillow
- Egg beater
- Toy doll's cradle or baby doll
- Sieve or strainer
- Can of soup or whole-grain cereal
- One copy of *Wetlands Metaphors* activity page per student (included here)

Optional

- Pictures illustrating other comparisons (e.g., gardens = food production for animals; airports/landing and takeoff = places for migrating birds)

Introduction

Coastal and freshwater wetlands provide unique habitats for a great diversity of plants and animals. They are nurseries for countless life forms.

Wetlands often act as buffers in times of both flood and drought. Absorbing overflow from flooding, wetlands often swell with *runoff* water and reduce potential flooding downstream. In drier periods, wetlands hold precious moisture after other ponds and lakes have disappeared.

Wetlands have a unique ability to trap silt and other solids, promoting the *decomposition* of many toxic substances, extra *nutrients*, and the neutralization of sewage wastes by *microorganisms* that live there. Yet it must be remembered that as remarkable as they are, the actions and capacities of wetlands have limits. Too much pollution can destroy a wetland.

Many of the functions of wetlands can be explored through *metaphors*. A metaphor is a direct comparison between two things. It gives a vivid image through direct (that is without using the terms "like" or "such as") comparison. "A tree is a home," "books are windows of thought,"

and "she is a tower of strength" are examples of metaphors. In this activity, a variety of objects represent the characteristics of wetlands in order to help students visualize (that is "paint a picture") and remember the valuable functions of wetlands.

For more information about wetlands and shorebird habitat, read *Shorebirds Depend on a Chain of Healthy Habitats* in the *Shorebird Primer*.

Activity Preparation

1. *Prepare a Mystery Metaphor Container* by collecting the metaphor objects listed above and placing them in a concealing box or paper sack.

Procedure

1. Discuss wetland functions and the meaning of *metaphor* with the class. Metaphors offer a dramatic way of drawing a comparison. For example: "Robin is a chip off the old block" or "Wes is a barrel of laughs."
2. Tell students that objects can be used to represent wetland functions.
3. Now bring out the *Mystery Metaphor Container*. Tell the students that everything in the container can be a metaphor that relates to the functions of wetlands.
4. Divide the class into six different groups. Announce that when it is his or her turn, you want a representative of each group to draw an object from the container.
5. Have the designated student reach into the container and withdraw one object.
6. When each group has an object, ask it to describe and demonstrate the relationships between their



Wetland Mystery Metaphors Chart

Object *Metaphorical Wetland Function: Wetlands...*

Sponge	...absorb excess water which helps to prevent flooding; and absorb excess, harmful nutrients from fertilizers and other sources that may cause contamination downstream (related also to filtering--see "Sieve" below).
Pillow or bed	...provide a resting place for migratory birds; and provide a home for resident microorganisms, fish, birds, and wildlife.
Egg beater or whisk	...mix nutrients and oxygen into water.
Cradle or baby doll	...provide shelter and protection (like a nursery) for young fish, insects, mammals, and birds. Have you seen mosquito larvae, dragonfly nymphs, frog eggs, duck nests, or moose calves in wetlands?
Sieve (strainer)	...can strain or filter debris and suspended material such as soil from erosion out of the water..
Can of soup (or whole-grain cereal)	...provide food for many animals in the form of <i>phytoplankton</i> , <i>algae</i> , tiny <i>zooplankton</i> , insects, and fish.
Soap	...clean polluted water that enters. Of course, even wetlands can be overpowered by too much pollution.
Flower	...are beautiful places.
	Add your own objects and ideas.

object and wetlands. Encourage the students to build on each other's ideas. You can also assist by strengthening their connections. Refer to the *Wetland Mystery Metaphors Chart* for guidelines. Be sure to allow each group time to discuss its ideas before presenting them to the class.

- Ask students to summarize the way wetlands contribute to a health habitat for wildlife. Ask them if their own attitudes about wetlands are different as a result of doing this activity. If so, how?
- Pass out a copy of the *Wetland Metaphors* activity page (included here) to each student to complete.

This page may be used as an evaluation tool.

Additional Activities

Poetry Writing

Have each student write a poem or essay about wetlands using a metaphor. This lesson is especially appropriate after a field trip.

Transforming a Metaphor into a Picture

Have your students use drawing or painting materials to create an actual image of a metaphor (for example, a tree as a home, a person as a chip off the old block, or a wetland as a sponge).

Shorebird Metaphors

Have students brainstorm other

wetland metaphors that demonstrate the value or function of wetlands specifically for shorebirds. Some other metaphors are: airport; bus transfer ticket for migration; restaurant; "singles" meeting place; even a place or ticket that represents the freedom which shorebirds would lose if they were endangered and confined to zoos.

When Nutrients Are Bad

Some minerals that are normally vital to a healthy wetland can sometimes become detrimental. Ask students to research this dilemma. Which nutrients pose a risk when found in excess? Where do these excesses come from? What is the effect when a wetland gets "too much of a good thing"?

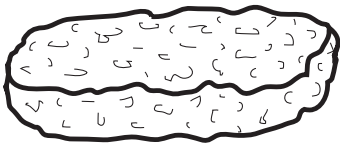


Wetland Metaphors

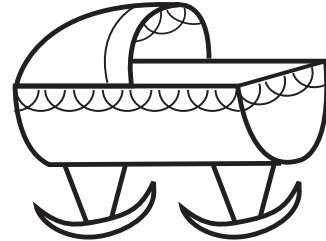
What is a home, a sponge, and a strainer all at the same time?

Metaphors are a way to compare unrelated things, such as "Wes is a barrel of laughs." Below are pictures of items seemingly unrelated to wetlands. Can you figure out how these items compare to a wetland? In other words, think about what each item does. Then compare that item's function to how a wetland might function in that same way. Good luck!

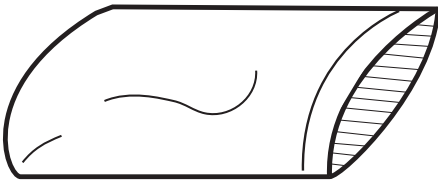
Sponge



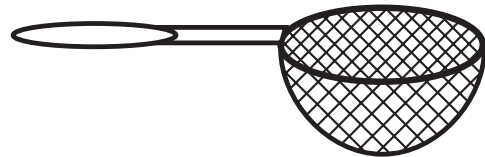
Cradle



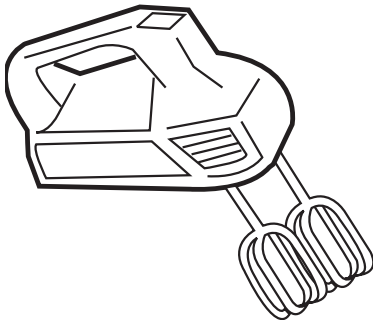
Pillow



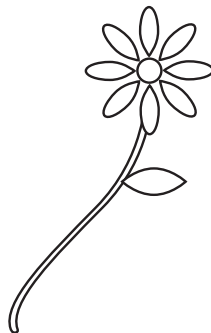
Strainer



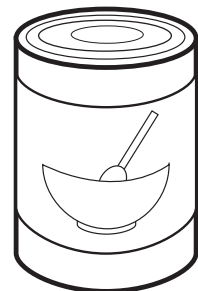
Egg beater



Flower



Can of soup

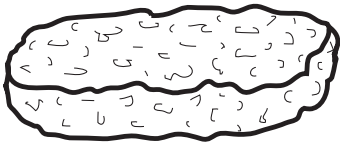


Wetland Metaphors Answer Sheet

What is a home, a sponge, and a strainer all at the same time?

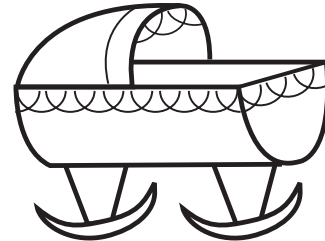
WETLAND

Sponge



help prevent floods,
absorbs water, holds moisture

Cradle



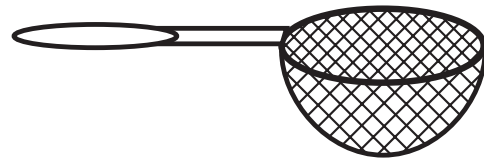
raise young, provide shelter

Pillow



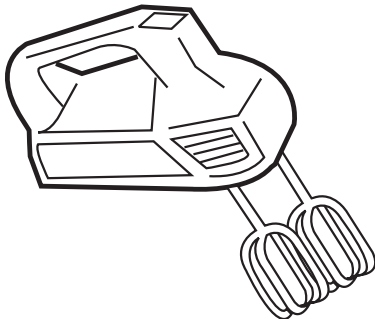
a resting place for migratory birds,
home for resident wildlife

Strainer



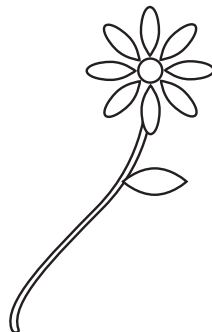
strain out debris and pollution

Egg beater



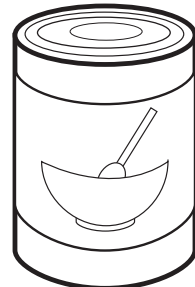
mix and cycle nutrients

Flower



beautiful places

Can of soup



food, nutrients



Match the Habitat Cards

Grade Level: upper elementary/middle school

Duration: one 40-minute class period.

Skills: vocabulary, critical thinking, and team building

Subjects: science and language arts, fine arts (with additional activity)

Concepts

- Habitat is the place where an organism lives because it is adapted to find food, water, shelter, and space there. Habitat is located within ecosystems.
- Shorebirds are one part of a healthy functioning ecosystem.
- Wetland and grassland ecosystems provide extremely important habitats for shorebirds.
- Your local environment may provide important habitat for shorebirds.

Vocabulary

See the *Match the Habitat Terms and Definitions Cards* for 35 words.

Overview

By playing a card-matching game, students learn that shorebirds use diverse habitats to find food and a place to breed or to rest. Students will discover that shorebirds use these habitats to meet their own specific needs.

Objectives

After this activity, students will be able to:

- Name seven different habitat types used by shorebirds.
- Describe the three reasons many shorebirds use more than one habitat type throughout the year.
- Correctly match habitat terms with their definitions.

Materials

- Set of 30–60 game cards (included here)
- A completed *Match the Habitat Clues Sheet*

- A copy of the *Habitat Readings* for each student or student team found in the *Types of Habitats* activity

Introduction

Bog, mudflat, tundra, swamp, marsh, prairie pothole, playa lake, and beach are some of the many areas that people recognize as wetlands. Although these wetlands may have very different climates, plant communities, and food webs, they all have one thing in common—they are wet at least part of the year.

Most shorebirds depend on many different wetlands to nest, migrate, and rest during the winter season. In fact, shorebirds are especially adapted for life in the wetlands they inhabit. Shorebirds with long legs easily keep their bodies dry as they wade into water in search of invertebrates. The long toes of mudflat shorebirds help them balance on the slippery, wet mud or sand. Those with long, sensitive, pointed bills can easily probe the mud for small crustaceans. Shorebirds of rocky-intertidal wetlands have strong, chisel-like beaks designed for cracking open the mussels they find clinging to the rocky shores.

Some shorebird species live in dry upland grasslands. Their bills are adapted for gleaning insects from the surface instead of probing in the mud.

For more information about the unique adaptations of shorebirds, read *Shorebirds Have Special Adaptations* in the *Shorebird Primer*. For more information about shorebird habitats read *Shorebirds Depend on a Chain of Healthy Habitats*, also found in the *Shorebird Primer*.

Activity Preparation

1. Photocopy and cut out the *Match the Habitat Terms and Definitions Cards* included at the end of this activity. Add your own terms and definitions to the blank cards provided. Vary the definitions according to the reading level of your students. Focus on the habitats and definitions most appropriate for your area, and combine this activity with information your class studied in other shorebird activities.

Note: Twenty to 40 possible matches (40 to 80 cards) are a good level for seventh and eighth grade students. For younger students, use 15 matches (30 cards). You may choose to increase the number slightly for small classes (five to ten students).

2. Read through the *Habitat Readings* and complete the column “Source Clue” for each term on your master *Match the Habitat Cards Clue Sheet* by indicating what page and habitat reading the term came from.
3. Write your students’ names in alphabetical order on the chalkboard or flipchart.

Procedure

1. Have students take out one or two blank sheets of notebook paper to write their sentences on (explained below.) A set of *Habitat Readings* should be available as resource material.
2. Mix the term and definition cards together. Deal the cards to the students. It is not necessary that all students initially receive the same number of cards.



3. Explain the rules of this card game:

- The object of the game is to make as many matches as possible in the given amount of time (30 minutes is suggested). Tell the students the number of matches possible (example: 60 cards, 30 matches).
- Point out that more than one definition may match a term, but they should be looking for the best match.
- To make matches they will have to move around the room, find the students with their matching cards, and write down on their paper exactly what is written on the cards. This is a critical part of the game because this way you can tell that they actually found the match and did not just make up a definition or copy one from a book glossary. Once a student finds the person with a matching card, both write down the sentence. Do not actually exchange cards.

Note: Alternatively, students must form sentences using the pair of cards and the word “shorebird(s)” or you may choose to have them write the terms and definitions as a complete sentence (“A wetland is land that is covered or saturated with water at least part of the time.”). Another option is to have students write the terms and definitions separated by a period or “equals” sign. Write an example of what you want them to do on the chalkboard.

- The original owner of the term card then passes his or her card to the classmate whose name comes alphabetically after his or hers. The owner of the matching definition card does the same. If the holder of one of the matches happens to be the person who is next alphabetically, pass the card anyway after both students have written down the sentence. The match-holder should immediately pass the card to the next person in order.

Example: Wesley has the card “wetland” and recognizes that Franny’s card that reads “Land that is covered or saturated with water at least part of the time” is the match. Wesley and Franny each write “A wetland is land that is covered or saturated with water at least part of the time” on their own papers. Then Wesley passes the “wetland” term card to William (or Archie, if Wesley is the last student, alphabetically, in the class), and Franny passes the definition card to Grace (because “Grace” is the first name in the class, alphabetically, after “Franny”).

- Keep your private “clue” sheet of sources you prepared earlier. If you notice that a student is really stumped on a card, use your “clue” sheet to refer him or her to “page so-and-so in such-and-such reading” for help with a definition. Knowing a basic definition should help them recognize the matching card.
- The game ends when the time limit has run out. Students turn in their papers. The student(s) with the most correct matches are the winners.
- Follow up the game with a discussion to ensure that the students know all the terms. Go around the room, asking each student to read one sentence from his or her paper and see if the rest of the class agrees that he or she has made the best match. What other matches might work?

Keep in Mind....

- Let students discover their own efficient ways to find matches (like spreading out their cards on the desk in front of them).

Term Cards

Surfbird

Pampas

Mudflats

Definition Cards

Nests in alpine tundra

Wintering habitat of American Golden-Plover

Habitat type where migrating Dunlin and Western Sandpipers are found



- Some students will accumulate a large pile of cards. Others will quickly go through their own cards. Either way, you may have to facilitate reluctant students to get up, move around the room, and communicate with each other to find matches.
- You may choose to accept some matches that work even if they are not “the best.”
- To make the game more difficult, alter the definitions so they reflect the habits of specific shorebirds of your area. See the example alternatives below.

Additional Activities

Match More Habitats

Hand out four index cards to each student (more for smaller classes), and instruct the students to choose two of their own shorebird habitat terms and compose definitions for them. Gather all of the cards, shuffle, and play the game with the student-made cards.

Habitat Card Rummy

Create a batch of cards with the habitat terms on them. Write down the list of corresponding definitions on a sheet of paper for yourself. Deal out the cards, at least three each, to the students (duplicates are okay). Read the first definition out loud to the class. Ask the students who think they have the matching term card to raise their hands. If they have the correct match they turn in their cards to the teacher. The first student to give up all of his or her cards is the winner.

Habitat Card Bingo

Create a batch of bingo cards with habitat terms in place of numbers. Remember to vary the order of the terms. Print the title “Habitat Bingo” across the top of each card and a small shorebird illustration in the center as the free space. Pass out one card and bingo markers (pinto beans, marshmallows, etc.) to each student. Read the definition of the term. Students who can match the definition with the correct term on their cards cover the spaces with a marker. The first student who completes a row horizontally, vertically, or diagonally wins.

Say It with a Picture

Have each student draw a picture that represents one of the matches. Hang up or presented the pictures to the class. Ask students to try to guess what each picture represents. If you prefer, create a larger wetland mural as a class. Start by brainstorming a list of wetland habitat elements so students have specific ideas about what to draw. Unroll a long sheet of paper on the floor and provide colored pencils, crayons, markers, or paints.



Match the Habitat Terms and Definitions Cards

(Make one photocopy.)

Term Card	Definition Card
Habitat	A place where organisms are adapted to live and find food and shelter
Term Card	Definition Card
Wetlands	Land that is covered or saturated (soaked) with water at least part of the time
Term Card	Definition Card
Marsh	Open, wet, grassy areas that can be inland or coastal
Term Card	Definition Card
Ocean Beach	Sandy habitat affected by the tides; home of oystercatchers and migrating Sanderlings

Match the Habitat Terms and Definitions Cards

(Make one photocopy.)

Term Card	Definition Card
Mudflat	Mud habitat that is exposed at low tide and is home to many invertebrate animals
Term Card	Definition Card
Freshwater Marsh	Inland habitat where the roots of grasses, sedges, and rushes are always under water
Term Card	Definition Card
Saltwater Marsh	Coastal or inland habitat made of ocean water and plants adapted to salt water
Term Card	Definition Card
Tundra	Northern Arctic wetland habitat with permafrost and no trees



Match the Habitat Terms and Definitions Cards

(Make one photocopy.)

Term Card	Definition Card
Intertidal Zone	Nutrient-rich, rocky beach habitat between the high and low tide mark
Term Card	Definition Card
Estuaries	Nutrient-rich places where freshwater and saltwater meet
Term Card	Definition Card
Roost	Flock of resting shorebirds or the place where they rest together on migration or in winter
Term Card	Definition Card
Tide	Daily movement of ocean water as it is affected by the moon's gravity

Match the Habitat Terms and Definitions Cards

(Make one photocopy.)

Term Card	Definition Card
Prairie Potholes	Shallow, temporary wetlands found within grasslands
Term Card	Definition Card
Permafrost	Permanently frozen subsoil of the tundra
Term Card	Definition Card
Playa Lakes	Shallow temporary wetlands in grasslands that are lined with a water-tight layer of bedrock
Term Card	Definition Card
Migration	The regular movement of shorebirds every spring and fall



Match the Habitat Terms and Definitions Cards

(Make one photocopy.)

Term Card	Definition Card
Stopover Sites	Important habitats where shorebirds stop every year on migration
Term Card	Definition Card
Nonbreeding Season	The portion of the year when shorebirds are not breeding
Term Card	Definition Card
Breeding Season	The portion of the year when shorebirds are nesting
Term Card	Definition Card
Shelter	A place in the habitat where an animal can escape from wind, weather, and predators

Match the Habitat Terms and Definitions Cards

(Make one photocopy.)

Term Card	Definition Card
Food	tiny clams and worms in the winter, and insects in the summer eaten by shorebirds
Term Card	Definition Card
Invertebrates	Small animals without a spine or backbone that shorebirds eat
Term Card	Definition Card
Crustaceans	Group of animals that includes small shrimp and crabs which shorebirds, especially phalaropes, feed on
Term Card	Definition Card
Grasslands	Upland dry habitat that some shorebirds are adapted to use instead of wetlands



Match the Habitat Terms and Definitions Cards

(Make one photocopy.)

Term Card	Definition Card
Mudflats, Estuaries, and Sandy Beaches	Places where organisms adapted to changes in wetness and salinity live
Term Card	Definition Card
Black Oystercatchers	A group of shorebirds specially adapted to nest and feed in rocky coastal habitat
Term Card	Definition Card
Stream and River Corridors	Low areas along the banks of rivers and streams that flood in the spring as snow and ice melt in the mountains
Term Card	Definition Card
Grasslands	Prairie habitats found in the Central United States and Canada that are breeding grounds for six species of shorebirds

Match the Habitat Terms and Definitions Cards

(Make one photocopy.)

Term Card	Definition Card
Halophytes	Plants adapted to high levels of salt
Term Card	Definition Card
Runoff	Water that carries nutrients from land into freshwater wetlands and streams
Term Card	Definition Card
Upland Sandpipers	Shorebirds that live in tallgrass prairies
Term Card	Definition Card
Riparian Habitat	Vital habitat for many migrating birds, such as Spotted and Solitary Sandpipers, found along the banks of rivers and streams

Match the Habitat Terms and Definitions Cards

(Make one photocopy.)

Term Card	Definition Card
Tundra	A habitat made up of mounds of grasses and sedges with low areas in between that are filled with water
Term Card	Definition Card
Ecosystems	A collection of habitats that include all the living and nonliving parts interacting and linked by nutrient and energy flow
Term Card	Definition Card
Common Snipe	A shorebird adapted to live in freshwater marshes
Term Card	Definition Card
Shorebird Habitats	Streams and river corridors, freshwater and saltwater marshes, grasslands, tundra, mudflats and sandy beaches, rocky intertidal areas, playa lakes and prairie potholes



Match the Habitat Terms and Definitions Cards

(Make one photocopy.)

Term Card	Definition Card
Spotted Sandpiper	A shorebird that uses riparian habitat
Term Card	Definition Card
Sanderlings	Small shorebirds adapted to running along the shoreline and probing for food
Term Card	Definition Card
Greater Yellowlegs	A group of shorebirds adapted to live in freshwater marsh habitat
Term Card	Definition Card
Black-necked Stilts	A group of shorebirds adapted to live in saltwater marsh habitat

Match the Habitat Terms and Definitions Cards

(Make as many copies as necessary
for your own terms and matching
definitions.)

Term Card	Definition Card
Term Card	Definition Card
Term Card	Definition Card
Term Card	Definition Card

Match the Habitat Clues Chart

Term Card

Definition Card

Source Clue

Habitat	A place where organisms are adapted to live and find food and shelter	
Wetlands	land that is covered or saturated (soaked) with water at least part of the time	
Marsh	Open, wet, grassy areas that can be inland or coastal	
Ocean beach	Sandy habitat affected by the tides; home of Oystercatchers and migrating Sanderlings	
Mudflat	mud habitat that is exposed at low tide and is a home to many invertebrate animals	
Freshwater Marsh	Inland habitat where the roots of grasses, sedges, and rushes are always under water	
Saltwater Marsh	Coastal or inland habitat made of ocean water and plants adapted to salt water	
Tundra	Northern Arctic wetland habitat with permafrost and no trees	
Intertidal Zone	Nutrient-rich, rocky beach habitat between the high and low tide mark	
Estuaries	Nutrient rich places where freshwater and saltwater meet	
Roost	Flock of resting shorebirds, or the place where they rest together on migration or in winter	
Tide	Daily movement of ocean water as it is affected by the moon's gravity	
Prairie Potholes	Shallow, temporary wetlands found within grasslands	
Permafrost	Permanently frozen subsoil of the tundra	
Playa Lakes	Temporary wetlands in grassland or desert areas that are lined with a water-tight layer of bedrock	
Migration	Regular movement of shorebirds every spring and fall	
Nonbreeding season	The portion of the year when shorebirds are not nesting	
Stopover sites	Important habitats where shorebirds stop every year on migration	



Match the Habitat

Clues Chart

<i>Term Card</i>	<i>Definition Card</i>	<i>Source Clue</i>
Breeding Season	The portion of the year when shorebirds are nesting.	
Shelter	a place in the habitat where an animal can escape from wind, weather, and predators	
Food	tiny clams and worms in the winter and insects in the summer eaten by shorebirds	
Invertebrates	Small animals without a spine or backbone that shorebirds eat	
Crustacean	The group of animals that includes small shrimp and crabs which shorebirds, especially phalaropes, feed on	
Grasslands	Upland dry habitat that some shorebirds are adapted to use instead of wetlands	
Mudflats, Estuaries, and Sandy Beaches	Places where organisms adapted to changes in wetness and salinity live	
Black Oystercatcher	A group of shorebirds specially adapted to nest and feed in rocky coastal habitat	
Stream and River Corridors	Low areas along the banks of rivers and streams that flood in the spring as snow and ice melt in the mountains	
Grasslands	Prairie habitats found in the Central United States and Canada that are breeding grounds for six species of shorebirds	
Halophytes	Plants adapted to high levels of salt	
Runoff	Water that carries nutrients from land into freshwater wetlands and streams	
Upland Sandpipers	A group of shorebirds that live in tallgrass prairie	
Riparian Habitat	Vital habitat for many migrating birds, such as spotted and solitary sandpipers, found along the banks of rivers and streams	
Common Snipe	A shorebird adapted to live in freshwater marshes	
Shorebird Habitats	Stream/river corridors, freshwater/saltwater marshes, grasslands, tundra, mudflats/sandy beaches, rocky-intertidal areas, playa lakes, or prairie pothole	



Match the Habitat Clues Chart

<i>Term Card</i>	<i>Definition Card</i>	<i>Source Clue</i>
tundra	A habitat made up of mounds of grasses and sedges with low areas in between that are filled with water	
ecosystem	A collection of habitat that include all the living and nonliving parts interacting and linked by nutrient and energy flow	
Spotted Sandpiper	A shorebird that uses riparian habitat	
Sanderlings	Small shorebirds adapted to running along the shoreline probing for food	
Greater Yellowlegs	A group of shorebirds adapted to live in freshwater marsh habitat	
Black-necked Stilts	A group of shorebirds adapted to live in saltwater marsh habitat	

Add Your Own Terms and Definitions

<i>Term Card</i>	<i>Definition Card</i>	<i>Source Clue</i>



Types of Habitats Frequently Used by Shorebirds

Grade Level: upper elementary/middle school

Duration: one class period for reading and presentations, *plus* two 40 to 60-minute class periods for a short field trip to collect natural items and to build the model

Skills: vocabulary, comparison of similarities and differences, team building, critical thinking, and presentation.

Subjects: science, language arts, fine arts, and social studies (geography)

Concepts

- Habitat is the place where an organism lives because it is adapted to find food, water, shelter, and space there. Numerous habitats are located within an ecosystem.
- Shorebirds are one part of a healthy functioning ecosystem.
- Wetland and grassland ecosystems provide extremely important habitat for shorebirds.
- Your local environment might provide important habitat for shorebirds.

Vocabulary

- habitat
- grassland
- wetlands
- nutrients
- estuary
- riparian
- tundra
- permafrost
- peat
- algae
- stream/river corridor
- sandy beach
- prairie pothole/playa lake
- niche
- tidepool
- rocky intertidal habitat
- mudflat
- habitat components
- abiotic factor
- biotic factor
- freshwater marsh
- saltwater marsh

Overview

By building a three-dimensional model, students learn principles of geography and the components of aquatic and terrestrial shorebird habitats.

Objectives

After this activity, students will be able to:

- List types of habitats used by shorebirds.
- Describe at least four components of each habitat.
- Categorize the components of each habitat into a list of abiotic and biotic elements.
- Build a visual representation of one of the habitats.

Materials

- Copies of the *Habitat Students Readings* and drawings
- Plywood, wood scraps, or small boxes for the base of the habitat models
- Scissors
- Glue
- Tempera paints
- Paint brushes
- Decoupage or other clear varnish
- Assorted pipe cleaners, tissue paper, toothpicks
- Collection of twigs, pebbles, grasses, mosses, and bags for collection
- Small plastic animals or handmade wildlife models

Introduction

There are many kinds of wetlands and grassland habitats that provide habitat for shorebirds. You may learn that you have these habitats near your community. Comparing and contrasting these shorebird habitats helps us learn about components common to all. We also need to understand the similarities and differences among habitats to understand some of the reasons why shorebirds can use more than one and why they migrate between them.

In this activity, there are descriptions of habitats frequently used by shorebirds: stream/river corridors, tundra, marshes, sandy beaches and mudflats, rocky intertidal zone, and prairie potholes, playa lakes, and grasslands. Below is one activity suggested for use with these habitat readings. Other suggestions for using these habitat readings are included under *Additional Activities*.

Additional Activities

For more information on shorebird habitats, read *Shorebirds Depend on a Chain of Healthy Habitats* found in the *Shorebird Primer*.

Activity Preparation

1. Photocopy and cut out the Salt Clay Recipe Cards provided in this unit so that each student has one to take home.
2. Ask each student to mix up one batch of the salt clay the night before the activity and bring it to school.
3. Photocopy the Student Habitat Readings you choose to use in this activity. You may choose to study all the habitats or just a few depending on which Procedure #1 option you choose.

Procedure

1. Introduce shorebird habitats you selected in one of the following ways:
 - Divide your class into teams. Give each team a set of the student readings. Ask each student on the team to read about one of the habitat types and then tell the rest of his or her team what he or she learned.
 - Divide your class into enough teams so that each team is assigned one habitat type. Give each team one of the student

readings to study. Have each of the groups study and then present a different habitat type to the class. Assign tasks—drawing plants, animals, and abiotic parts of the habitat; preparing and coordinating the oral presentation; doing additional research in one other source; etc.

2. Together, prepare a chart listing the components for each habitat type. List them under “*biotic* (living)” or “*abiotic* (nonliving)” headings on the chalkboard. This chart will give the students a reminder about how different these habitats are from each other. Your chart may look something like the one below with a column for each habitat you choose to study with the class.
3. Take your class on a short field trip outside to collect small amounts of twigs, pebbles, leaves, grass, moss, even dead insects or snail shells that represent their habitat types. Stress collecting only *small* amounts and only organisms that are *already dead*. You may wish to take scissors and small bags for collection.
4. Explain to your students that they will create a model habitat. Each model should contain or display at least three biotic (such as shorebird, snails, grasses)

and three abiotic (such as snow, gravel, water) components from the list on the chalkboard.

5. Begin by forming the clay over a base such as a piece of cardboard or plywood. Insert paper cutouts or bits of the natural material collected to simulate the different components of the habitat before the clay dries. Once the clay is hard, paint areas that represent sand, mud, or water. Encourage the students to glue plastic figures or handmade “wildlife” to the habitat model. Remind them to label their habitat and include the names of their team members.

Alternative – A Large Class Model: Instead of making individual models, have the class work on one large model that incorporates several habitat types into the landscape. Divide up the work by assigning individual tasks (such as collection and care of materials, landscape planning) or forming teams responsible for just one section of the whole model.

6. Display the models somewhere within the school or invite other classes for a habitat “art show.” Give each team a chance to tell other students about the habitat it studied and how it is important to shorebirds.

Grassland		Tundra	
<i>Abiotic</i>	<i>Biotic</i>	<i>Abiotic</i>	<i>Biotic</i>
Heat Fire Lightning Potholes	Grasses Insects Wildflowers Prairie dogs Bison Upland Sandpipers	Cold Wind Water Permafrost Snow	Lichens Sedges Grasses Fairy shrimp Copepods Insect larvae Caribou Ruddy Turnstones

Additional Activities



Cultural Connection

Students can make a collage of pictures depicting one of the interesting groups of people that live near the shorebirds’ habitat.

Compare and Contrast the Different Habitat Types Presented

- Have students practice critical thinking skills by comparing and contrasting the habitat types. Have them record their observations in a table, a list, or a written paragraph. What do all these habitats have in common? What characteristics are unique? Which habitats are found within your community?
- Students can research a wetland and/or grassland habitat on other continents and compare them to North American habitats.

Habitat Illustrations

Ask students to draw a picture of a wetland or grassland based on the student readings. Remember to include plants and invertebrates into the scene.

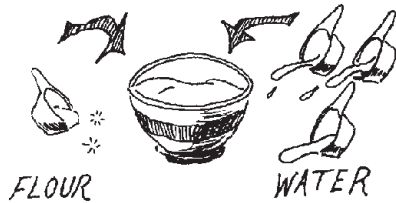
Relating Adaptations to Habitat

Ask students to come up with adaptations they would need to survive in the shorebird habitat they built (or studied). Give them ten minutes to brainstorm (alone or in pairs or groups) what modifications (snorkeling gear, wet suit, shovels for clam digging, etc.) would be needed to enable them to survive (eat, drink, rest) in these habitats :

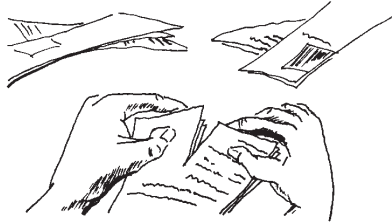
- An open ocean beach where the water comes in over their heads twice a day
- A dry, open prairie where they would be exposed to strong wind, intense summer sun, bitter winter cold, drenching rains and wildfires



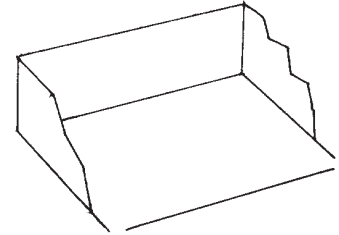
Steps To Make Salt Clay



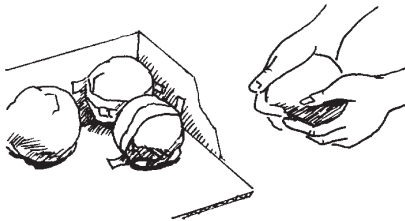
a.) Mix wallpaper paste or flour with water until it is like thin cream without any lumps.



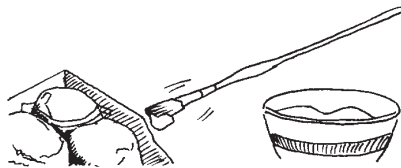
b.) Tear sheets of newspapers into long strips, about 1 inch wide and 6 inches long.



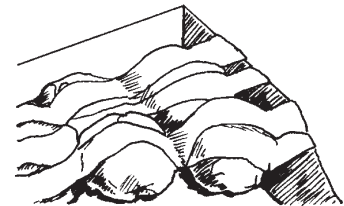
c.) If necessary, cut box into desired shape. This will form the base on which to build.



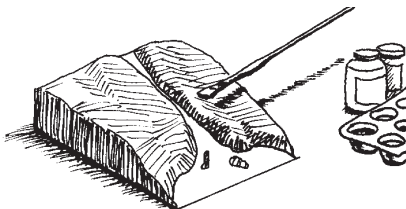
d.) Scrunch up newspaper into tight balls and tape into place as hills or tussocks.



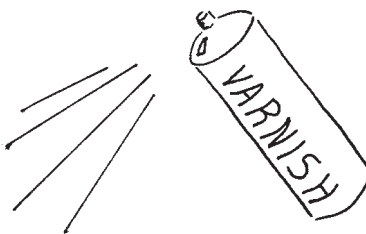
e.) Brush paste mixture over newspaper.



f.) Smooth and shape the form by layering strips of newspaper over it, brushing paste between layers.



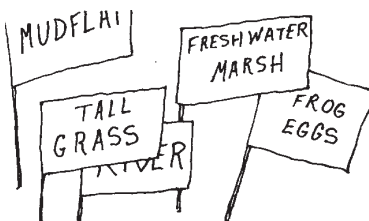
g.) Let the form dry for at least one day. Then paint the wetland model all over with a thick layer of paint.



h.) To help seal and prolong the life of the model, brush with decoupage or spray with varnish.



i.) Attach paper plants and animals, or the ones you collected, to complete a stream/river corridor, tundra, marsh, beach, or mudflat.



j.) Make labels for the wetland components out of paper and toothpicks.

Salt Clay Map Recipe Cards

(Photocopy and cut one recipe card
for each student.)

Recipe for Salt Clay

2 cups flour

1 cup salt

1 Tablespoon alum (You must include this.)

1 cup water

Stir ingredients and then knead until smooth and blended. Store in a ziplock bag or in a tight plastic container until ready to use.

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Habitat Readings

Contents	Page
What Is a Wetland?	230
What Is Grassland?	231
Stream and River Corridors	232
Tundra	234
Saltwater Marsh Habitat	236
Freshwater Marshes	238
Rocky-Intertidal Habitat	240
Mudflat and Sandy Beach Habitats	242
Prairie Potholes	244
Playa Lakes	246
Grasslands	248

Habitat Illustration Note: The habitat illustrations are general and do not represent all the plant and animal species found in each habitat.

As students learn more about these habitats, they can draw in new species and habitat differences. Students could also explore a local wetland or grassland and add the plants and animals they find.



What Is a Wetland?

What do you think of when you hear the word *wetland*? Do you picture mud squishing between your toes, mosquitoes buzzing in your ear, or a good place to catch a frog? What kind of plants do you think of--trees, grass, or something in between?

To understand a wetland, break the word in two. A wetland is both wet and land! Wetlands are places where water and land meet. Here, plants are adapted to wet, soggy conditions. Wetlands are usually found in the area between deep water (a lake, pond, river, or ocean) and dry land. Wetlands are low spots within a *watershed* where water collects. If the water is too deep for plants to grow (more than six feet deep), then wetland scientists call these areas deep-water habitats. If the land is too dry for wetland plants to grow, then it is called upland.

What Makes a Wetland

Wetlands are all about water. *Hydro* is the Latin word for water, and it can be found in the scientific words that describe wetlands. Can you find the water (hydro) in the following description? (Hint: Look at the words in the parentheses). All wetlands have: 1) water (*hydrology*), 2) wet (*hydric*) soils, and 3) water-loving plants (*hydrophytic* vegetation).

Water

Wetlands get their water in several different ways, including rain water and runoff from higher ground, groundwater coming to the surface from deep underground, and flooding from nearby rivers, streams or ocean tides. Some wetland may be wet all the time, such as estuaries. Other wetlands are only be wet for short periods of time like prairie potholes. Wetlands, whether wet temporarily or year-round, provide vital habitat for plants and wildlife.

Soil

The way a wetland soil looks and feels indicates its watery surroundings. Dig up a small amount of soil in a wetland, and it will either be wet (dripping water off the end of your shovel) or saturated. Saturated soils will drip if you squeeze them tightly in your hand. Wetland soil is dark brown or black near the surface and shades of gray deeper down (a foot or two). Rub the soil between your fingers, and it will feel either slick or sticky. Slick means the soil is rich in decaying plant matter or silt (fine inorganic material that settled out from flood waters). Sticky means the soil has a lot of clay in it. These soils hold lots of water and will not dry very fast. Some of the soils will smell like rotten eggs. Then you know you are in a really wet wetland!

Plants

Wetland plants have special adaptations to grow in wetland soil. Some plants, such as water lilies and bald cypress trees, grow in shallow water. Others, like cottonwood trees and many grasses, grow in wetlands where the water is visible for only part of the year. Wetland plant names can sometimes give you a hint that they grow in wet places--swamp rose, pondweed, duck potato, alligator weed, river birch, water lily, northern bog orchid, salt marsh cordgrass, sea lavender, and marsh fern.

Many Types of Wetlands

There are many different types of wetlands, and they come in all sizes. Wetlands can be as small as your bedroom or as large as the Florida Everglades which originally covered 2.3 million acres!

Freshwater marshes are the type of wetland most people think of first when someone says "wetland." They mainly have herbaceous

(non-woody) plants such as cattails growing up out of the water. These plants are called emergents. Many other types of wetlands have trees growing in them and are called forested wetlands. Swamps are a type of forested wetland. All wetlands with fresh water are in a group called *palustrine* wetlands. All wetlands with a mixture of fresh and salt water are in a group called *estuarine* wetlands.

Are There Wetlands Near You?

To find your closest wetland, first look on a map for the nearest water source. Maps will show you creeks, streams, rivers, oceans, ponds, and lakes. Some maps even have little symbols that show wetland areas. Once you have found your closest water source on the map, go out to that area and look around. Where is the ground soggy? What kinds of plants are growing there? What does the soil look, feel, and smell like? If you have water, wet soil, and water-loving plants, then you have found a wetland!

What Is Grassland?

What do you think of when you hear the word *grassland*? Do you picture grasses rolling like waves, tossed by a brisk wind? Do you see herds of bison grazing under an almost endless blue sky? Do you feel the sun beating down on you as grasshoppers buzz around your head?

Grasslands were once a vast *ecosystem* that covered much of the central and western part of the United States. Large herds of bison roamed and grazed freely. Huge colonies of prairie dogs dug through the soil, making it easier for grasses and wildflowers to sprout and grow. These creatures and the others living in the grasslands were adapted to extreme climates—cold, hard winters and blazingly hot summers. Great floods often followed droughts that dragged on for years. Wildfire, sparked by intense storms, killed the bushes and shrubs that threatened to take over the open grassland, but the deeply rooted grasses quickly grew back.

What Makes a Grassland

Just as the name suggests, grasslands are mostly made up of grass, but not the kind you find outside your front door. Big Bluestem, one of the tallest grassland grasses, grows over six feet tall and could easily hide a man on horseback. There are three types of grasslands, each named for the height of the grasses found there.

Plants

Tallgrass prairies are the wettest and run through the center of North America. They are dominated by big bluestem, little bluestem, Indian grass, switchgrass, prairie cordgrass, and wheat grass.

The *short-grass prairie* is the driest and most westerly type of

grassland, stretching east and south from the Rocky Mountains. Here you find mainly buffalo grass along with some blue grama grass, needle grass, and wheatgrass.

In between these two types of grasslands—in part of the Dakotas, south to northern Texas, and through parts of Oklahoma, Kansas, and Nebraska—the plants of the tall- and short-grass prairies mix. The *mixed grass prairie* is where you find the most plant and animal diversity.

Water

While it may seem that there is little water in grasslands, the area is dotted with shallow, temporary wetlands. These areas provide vital water and habitat for many grassland songbirds, shorebirds, and waterfowl and drinking areas for prairie mammals.

Soil

Grassland soils are dark and rich with humus (dead and decaying plant material). It was fertile soil for farming. Farmers quickly learned how to break down through the dense carpet of grass roots with their plows. The majority of prairie grasslands are now farmed.

Grasslands Today

Many of the original grasslands and temporary wetlands have disappeared today. Some states have lost over 99 percent of their tall-grass prairies. Among North American birds, grassland birds have shown the steepest population declines of any bird group and are now considered the highest conservation priority. These important ecosystems have been replaced by the needs of a growing population for development and farming. As a result, many species are doing their best to adapt to the changing habitat conditions. American Golden-Plovers and

Buff-breasted Sandpipers now use agricultural fields, highly grazed pastures, and burned fields that mimic their natural habitat. It is good they are adapting, but they are now exposed to new threats such as pesticides. Nesting shorebirds like the Mountain Plover are threatened by mowing during their breeding season. Biologists are investigating what long-term impacts these habitat changes may have on prairie-dependent species. They are also looking for ways to promote good land stewardship that will benefit landowners and shorebirds. There are many organizations working to conserve this ecosystem for the good of all species.

Are There Grasslands in Your Backyard?

Finding true grassland in your neighborhood may be harder than you think. Of all the grassland habitat that once stretched across the United States, less than 1 percent is left today. Most of the prairie we still have is missing some of the very elements that made it true grassland: bison and prairie dogs. Was your state part of the grassland ecosystem? How much is left today?



Stream and River Corridors

In many parts of the world, wetlands undergo a natural change with the seasons. In the spring, snow and ice melts in the mountains. This melt water rushes downstream causing streams and rivers to overflow their banks and fill nearby lowlands. Sometimes this seasonal flooding makes it all the way to *estuaries* where fresh and saltwater meet the sea.

This melt water carries *nutrients* that fertilize the plants growing alongside streams and rivers. These plants provide food for many different kinds of *zooplankton*, *invertebrates*, insects, and insect larvae, which are, in turn, food for the area's fish, mammals, and birds.

Inland stream and river corridors (also called riparian habitat) are good wetland habitat for shorebirds in the spring. Shorebirds, like the Solitary and Spotted Sandpiper and Yellowlegs, stop on their northward migration to *breeding grounds* south of the Arctic to probe in the mud for snails, worms, and insect larvae.

From July to September, depending on where you live, the spring melt water has all run downstream and soon the water levels drop. The plants and animals that live along these river corridors must be adapted to survive a couple of months of dry conditions. Eventually, fall rains come and the rivers and streams rise and flood the lowlands once more before winter. Is there a river near where you live? Look carefully for shorebirds and other birds using the banks of streams and rivers.

Looking at the illustration, list the names of the plants and animals you recognize that live in the stream and river corridor habitat. Some of these might not be found in your area. What other species of wildlife might you expect to see in your area of the country?



Stream and River Corridors

(Source of illustration: Wetlands and Wildlife)



Tundra

The *tundra* is a vast, treeless land found in northern and western Alaska and northern Canada. Here it is very cold in the winter, cool in the summer, and the wind almost always blows. Because of the cold and the wind, no trees grow on the tundra. Plants that do survive here grow very close to the ground where it is warmer.

Many people think that the tundra is flat. In fact, the tundra is made up of lots of little mounds of grasses and sedges that grow together like little cushions in the hard, cold ground. Low spots are wet, or even filled with water, and form little ponds or lakes that make the ground squishy. Even where it looks high and dry, it often is not.

Although very little rain or snow falls here each year the tundra always feels wet. This is because permanently frozen ground lies just under a thin layer of topsoil. This permafrost does not allow rain or snow to drain away, so moisture continues to collect on or near the surface of the tundra all year. The *permafrost* does not thaw even in summer.

Permafrost changes the way tundra plants grow. Because the ground is hard and frozen, plant roots, like those of the Dwarf Willow, grow sideways (prostrate) instead of straight down. Centuries of decaying vegetation have produced a thick, spongy layer of organic material called *peat*.

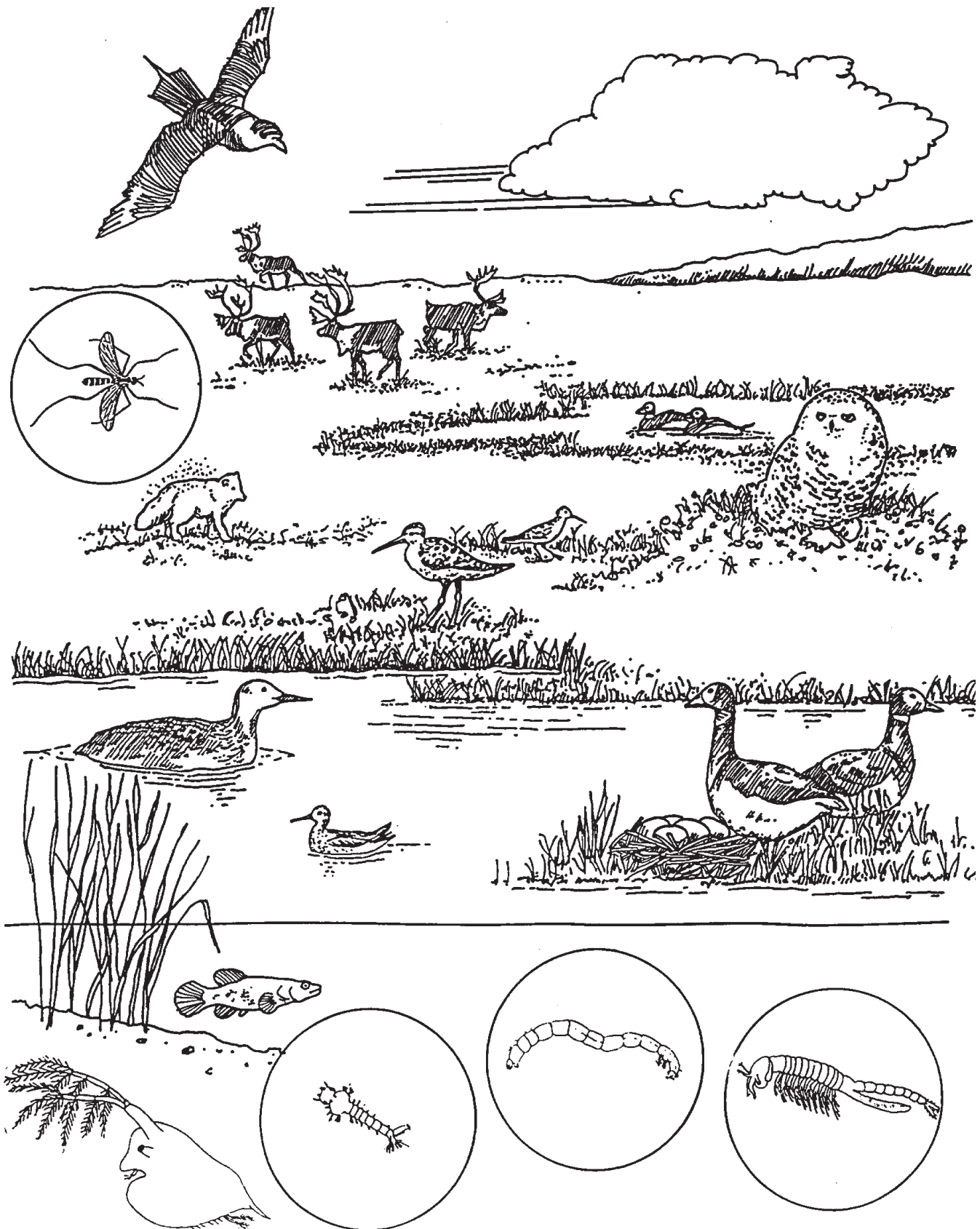
Fungi and lichens are very important tundra organisms that grow across the tundra and provide food to herds of caribou. Berry-producing plants like cloudberry and bearberry also provide food to tundra wildlife. Millions of shorebirds nest each year on the tundra. They feed on the billions of larvae, hatching insects, and on aquatic prey like copepods and fairy shrimp that appear each summer.

Looking at the illustration, list the names of the plants and animals you recognize that live in the tundra habitat.



Tundra

(Source of illustration: Wetlands and Wildlife)



Saltwater Marsh Habitat

Saltwater marshes are open, wet, treeless, grassy wetlands. They may be found along ocean coasts or inland. The rocks and soils of inland saltwater marshes are naturally high in salt. There are also inland salt lakes such as the Great Salt Lake in Utah. Coastal saltwater marshes are fed by the rise and lowering of the salty ocean tide.

Most coastal saltwater marshes are near *estuaries*, areas where salt water mixes with freshwater, such as where a river meets the ocean. A salt marsh is a transition habitat found between the water and dry land of the estuary. Tidal flooding causes the soils here to become very salty, making it difficult for most plants to grow.

Some plants have adapted to these high levels of salt. They are called *halophytes*, meaning “salt loving.” Because these plants spend so much of their energy trying to get rid of the salt in their cells and drawing water into their roots, they are not able to grow very large. They tend to be short with smaller leaves than plants found in freshwater marshes. Plants of the salt marsh grow in zones, depending on the amount of flooding they can tolerate. Here are some common zones in North American saltmarshes:

- Cordgrass grows in the lower marsh zone. It can tolerate being completely under water for as long as 22 hours. When it dies, it decomposes into detritus, an important food for small estuarine animals.
- The middle marsh zone is made up mostly of pickleweed. While this plant is also very salt-tolerant, it can not survive being under-water for long periods of time like cordgrass. Pickleweed gets rid of the salt that collects in its cells by moving it to the tips of its stems. The tips eventually turn red and break off.
- The most plant diversity is found in the upper salt marsh zone. Here you will find alkali heath, Australian salt bush, and salt grass. These plants sweat the extra salt out of their pores where it crystallizes on their leaves.

The salt marsh is also home to many different types of animals that are adapted to the salty conditions. Salt-tolerant bacteria, protozoa, brine flies, and brine shrimp thrive in salt marshes. Shorebirds such as Avocets and Black-necked Stilts probe the mud at low tide, searching for brine shrimp and the eggs and larvae of brine flies.

Looking at the illustration, list the names of the plants and animals you recognize that live in saltwater marshes. Some of these might not be found in your area. What other species of wildlife might you expect to see in the salt marshes in your area of the country?



Saltwater Marshes



Freshwater Marshes

Freshwater marshes are open, wet, grassy wetlands fed by creeks and streams or by rain and snow. They can fill broad, flat areas or tiny pockets that are surrounded by higher land. Freshwater marshes are often found along the edges of ponds, lakes, or rivers. Stream water or *runoff* continuously brings nutrients into them. Freshwater marshes come in many shapes and sizes, and there are many kinds, including swamps, bogs, and prairie potholes.

Freshwater marshes are very nutrient-rich. They support a great variety of plant communities that in turn support a wide variety of wildlife within this vital wetland ecosystem. In addition to their great habitat value, marshes help absorb floodwaters and filter excess nutrients from surface runoff. They are excellent natural water purifiers.

Plants that grow in a marsh are *adapted* to being wet. Their roots are always under water and grow where water is shallow and slow-moving. The sedges, rushes, and grasses that grow in the freshwater marshes of western North America resemble a wet meadow. Small shrubs and delicate, flowering herbs can also grow in freshwater marshes.

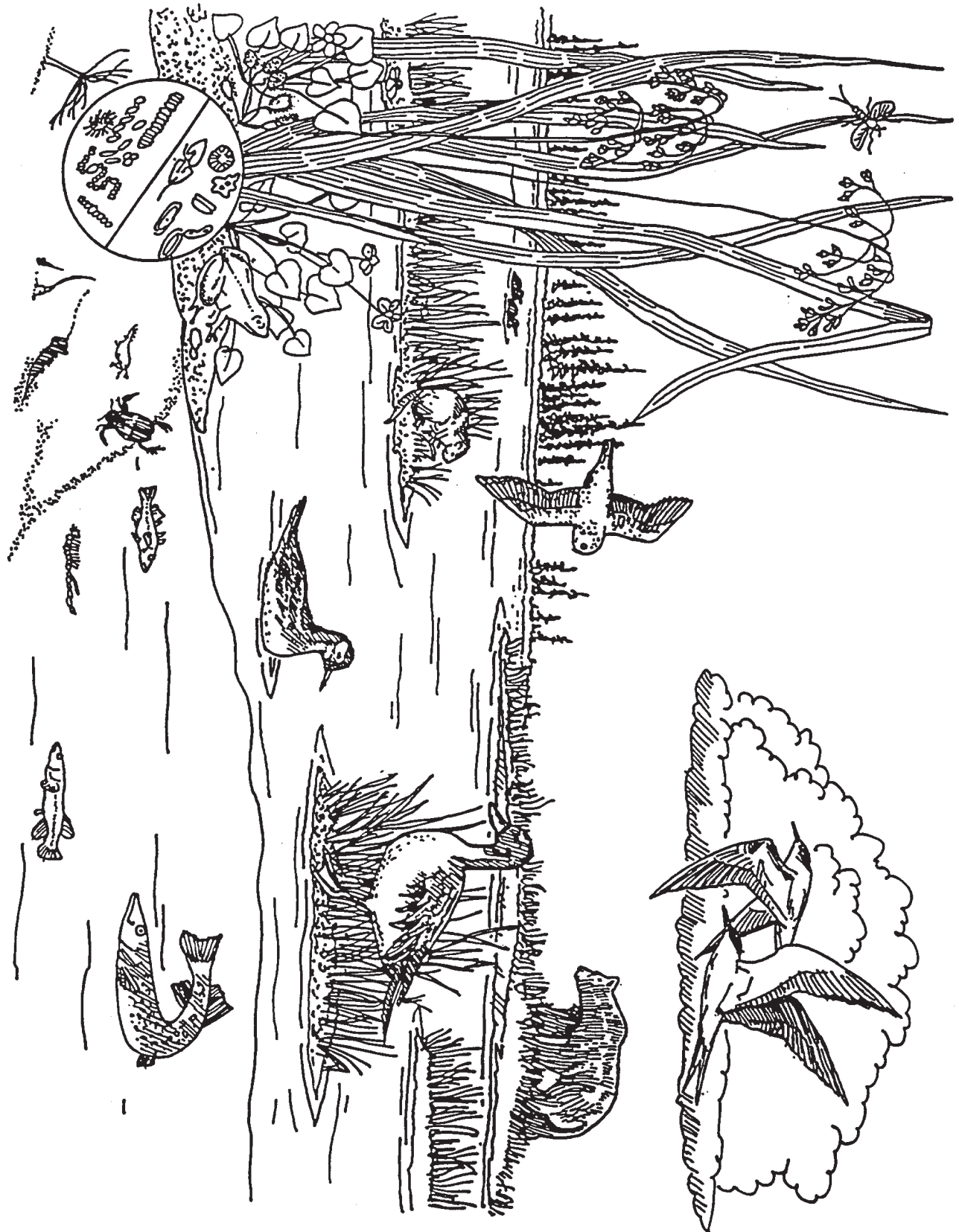
Insects, snails, and other small animals thrive among these plants in the slow-moving water. Fish and aquatic insects find shelter in the underwater parts of the plants. Shorebirds and other birds find plenty of food in a marsh and can hide from predators in the tall grass. Have you ever seen a Common Snipe, a yellowlegs, a dowitcher, or a phalarope in a freshwater marsh?

Looking at the illustration, list the names of the plants and animals you recognize that live in freshwater marshes. Some of these might not be found in your area. What other species of wildlife might you expect to see in the freshwater marshes in your area of the country?



Freshwater Marshes

(Source of illustration: *Wetlands and Wildlife*)



Rocky-Intertidal Habitat

The *intertidal zone* is the part of the ocean shoreline that is covered by saltwater when the tide is high and exposed to the air when the tide is low. Life here has both challenges and rewards. Plants, animals, and other organisms like *algae*, often called seaweed, must be very tough and able to adapt to changing water levels, salinity, and pounding surf!

Plants and animals that live in this intertidal habitat have to survive being covered and then uncovered by water once or twice a day. These plants must be able to get oxygen from the air and from the water. They must also keep from drying out when the tide is low. The *salinity* (or level of saltiness) of the water constantly changes here too. As the last drops of water evaporate at low tide, salt is left behind. This can make small tidal pools even saltier than when they were completely underwater. When it rains, on the other hand, these same plants and animals must adjust to pools diluted with fresh water.

Salt marshes, sandy beaches, and mudflats can all be found within the intertidal zone. The part of this zone made up of boulders, cliffs, gravel, shale, or just plain rocks is called the *rocky-intertidal* habitat. While this rocky-intertidal zone has no soil, pools or crevices that hold water, *tidepools*, are teeming with life just like any other wetland habitat!

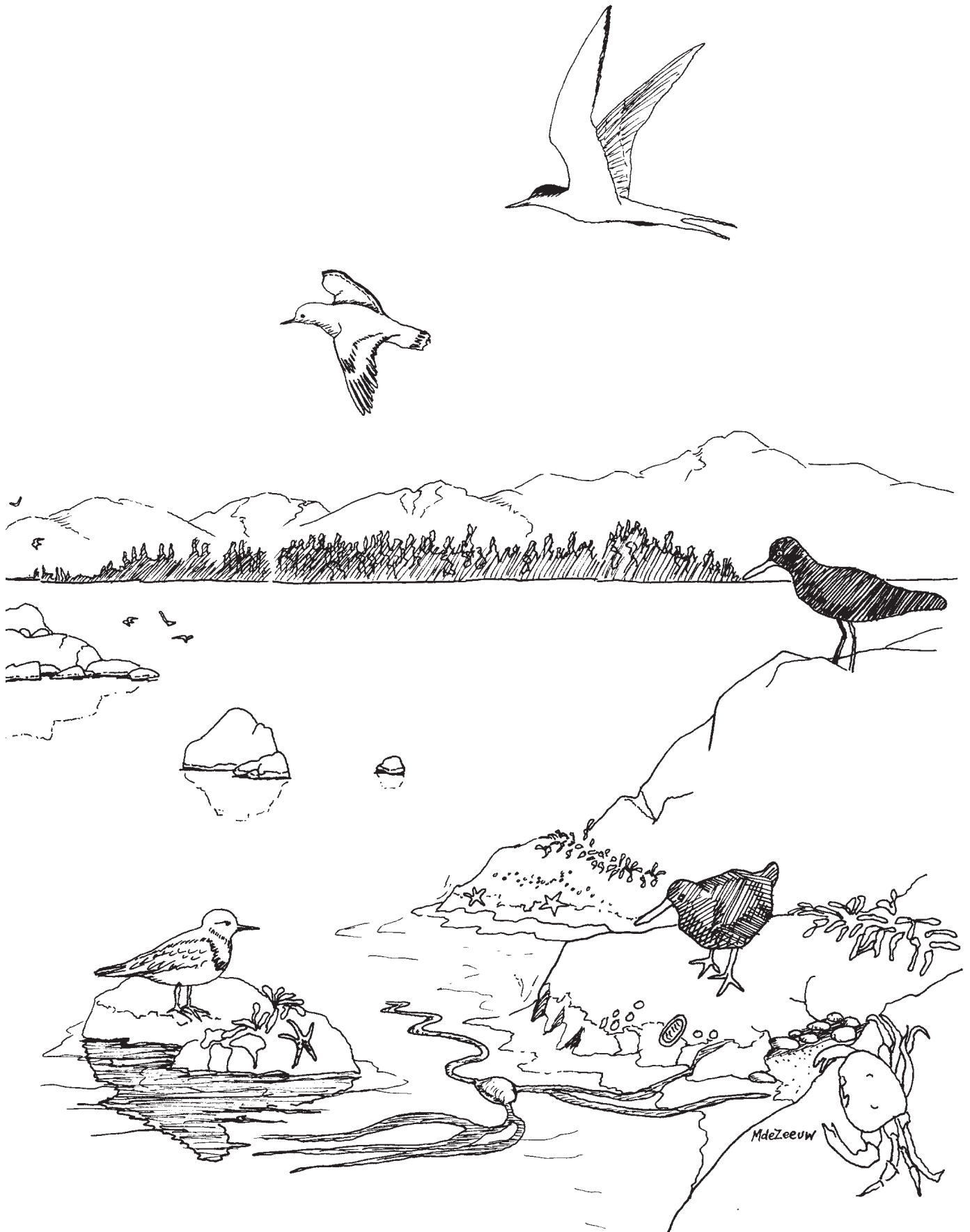
There is another challenge facing tidepool animals--rolling or even pounding ocean waves! Many have developed ways to cling to the exposed rocks and walls. Almost no plants grow here; there is no soil for their roots. Wave action keeps soil from collecting on the exposed rocks. However, large seaweed and kelp take the place of plants in the food web. They capture the sun's energy, grow, and then provide food and shelter for tiny marine animals.

The larger *predators* and *scavengers* of the rocky intertidal habitat have a hard time finding shelter from the sun, surf, and wind but are well *adapted* to find food among the rocks. Many shorebirds use the rocky-intertidal habitat. The Black Oystercatcher feeds almost nowhere but here most of the year. Its strong, red bill is specially designed for prying hard-shelled animals off rocks or cracking them open. Turnstones and surfbirds also live here during migration and winter.

Looking at the illustration, list the names of the plants and animals you recognize that live in the rocky-intertidal habitat. Some of these might not be found in your area. What other species of wildlife might you expect to see in this habitat in your area of the country?



Rocky-Intertidal Habitat



Mudflat and Sandy Beach Habitats

Mudflats and sandy beaches are important shorebird habitats. Both habitats can be found inland, bordering lakes and streams, and along the coasts within the *intertidal zone*. What else do mudflats and sandy beaches have in common?

They are both very open areas with few plants, subjected to constant change. *Organisms* that live here have to be hearty to survive! Plants and animals of coastal mudflats and sandy beaches are *adapted* to the cycle of high and low tides. They must tolerate changes in wetness and *salinity* twice a day. Water levels at inland mudflats and sandy beaches change too. Rainfall, flooding, and evaporation change water levels and nutrient concentrations. In some areas, water is actually pumped out of lakes to provide irrigation and drinking water.

Both inland and coastal mudflats and sandy beaches are nutrient-rich habitats. Salts and minerals are carried by rainwater and snowmelt into rivers. They are then swept downstream where they eventually mix with ocean or lake water. This constant input of nutrients makes mudflats and sandy beaches some

of the most *productive* areas on the earth, rich in *invertebrate* foods. If you scooped up one pail of wet mud or sand and examined it with a microscope, you would see hundreds or thousands of tiny snails, worms, and invertebrate eggs and larva. There would be larger animals like clams, shrimp, and long worms as well.

The high numbers of invertebrate foods make mudflats and sandy beaches critical to shorebird *migration*. Hundreds of thousands of shorebirds will concentrate here, sometimes feeding and resting for days before moving on. Shorebirds rely on these *stopover sites* for energy-rich foods to make it to their next stop, which might be hundreds or even thousands of miles away!

Mudflats and sandy beaches are also critical *breeding grounds* for several shorebird species. Snowy Plovers nest along the sandy beaches of the West Coast. Wilson's Plover, another sandy beach nester, is found in the east. Black Oystercatchers prefer the coastal and inland mudflats of Alaska while their counterparts, American Oystercatchers, nest on eastern mudflats.

Looking at the illustration, list the names of the plants and animals you recognize that live on mudflats and sandy beaches. Some of these might not be found in your area. What other species of wildlife might you expect to see in these habitats in your area of the country?



Mudflats and Sandy Beaches

(Source of illustration: Wetlands and Wildlife)



Prairie Potholes

Dotted across the northern grasslands of the United States are thousands of shallow, temporary wetlands called prairie potholes. Glaciers scraping over the landscape during the Pleistocene, thousands of years ago, formed the *prairie potholes* of Canada and the United States. They are found in North and South Dakota, Nebraska, Wisconsin, and Minnesota. They fill in the spring with snowmelt and rainwater.

Because of the numerous shallow lakes and marshes, rich soils, and warm summers, the prairie pothole region is described as being one of the most important wetland regions in the Central Pacific Flyway. This region provides birds with a feast of insects, worms, clams, snails, and other invertebrate foods for both breeding and migrating birds. Because most prairie potholes are fed by rain and snow, they vary greatly in their sizes and water levels. This also means the suitable habitat for shorebirds is unpredictable from year to year. Because these wetlands are unpredictable, shorebirds disperse across the region wherever suitable potholes can be found instead of concentrating at predictable areas as they do along the Atlantic and Pacific Coasts.

This region provides refuge for approximately 36 species of migrating and breeding shorebirds, such as the White-rumped Sandpiper, Long-billed Dowitcher, and Lesser Yellowlegs. Many of the shorebirds that occur here are found in shallow wetlands, wet pastures, flooded agricultural fields, and lake shores. The area is home to over 50 percent of North American migratory waterfowl, with many species dependent on the potholes for breeding and feeding. In addition to supporting a great diversity of wildlife, prairie potholes also absorb excess rain, snowmelt, and floodwaters, reducing downstream flooding.

Looking at the illustration, list the names of the plants and animals you recognize that live in and around the prairie potholes of the grassland habitat. Some of these might not be found in your area. What other species of wildlife might you expect to see in your area of the country?



Prairie Pothole



Playa Lakes

Scattered across the grasslands of West Texas, Oklahoma, New Mexico, Colorado, and Kansas are thousands of round, shallow, temporary wetlands called *playa lakes*. These special wetlands are lined with a watertight layer of bedrock. They fill with water only after spring rainstorms when freshwater collects in the round depressions of the mostly flat landscape. There are many theories as to the origin of playas, but the most widely accepted are that playas are either carved by wind or formed by sinkholes. Whatever their origin, playas are important to humans, animals, and plants.

Playas are important because they store water in a part of the country that receives as little as 20 inches of rain a year and where there are no permanent rivers or streams; so playas are the main support for an astounding array of wildlife. An estimated 15 million birds migrate through the playa lakes, and one-third commonly winter there. Mayflies, dragonflies, salamanders, bald eagles, endangered whooping cranes, jackrabbits, and raccoons also can be found at playa lakes. Because

playa lakes support such a wide variety of animals, they contribute significantly to the biodiversity of this grassland region. Playas also help support the surrounding agriculture by providing irrigation water and seasonally recharging underground water sources called aquifer. The Ogallala Aquifer is North America's largest aquifer that underlies the Southern High Plains¹ and is being used for irrigation and drinking water faster than it is being replenished. Aquifers are like huge underground sponges made of porous sediments of sand and gravel that catch the water as it percolates through the grassland soils

Some shorebird species, such as the Long-billed Curlew, Mountain Plover, and Snowy Plover, nest in the playa lakes region. Curlews breed in grassy areas often associated with playas, while Snowy Plovers nest on saline lake beds with little water and often no vegetation. Mountain Plovers prefer the sparse shortgrass prairie area near the playas.

Looking at the illustration, list the names of the plants and animals you recognize that live in and around the playa lakes of the grassland habitat. Some of these might not be found in your area. What other species of wildlife might you expect to see in your area of the country?

¹ Southern High Plains: This is a distinct geographic region of the United States that extends from West Texas, Oklahoma, New Mexico, Colorado, and Kansas. This region is made up of shortgrass and mixed grass and ranges in elevation from 900 to 6000 feet.



Playa Lake



Grasslands

Grasses roll in waves, tossed by a brisk wind. Winters can be very cold and summers very hot. Droughts can drag on for years and can be followed by great floods. The creatures and plants living in grasslands are adapted to an extreme climate.

There are three types of grasslands that are defined by the typical height of the grass. Tallgrass prairies are the wettest and run through the center of North America. They occur in the southern Canadian province of Manitoba, down through eastern North Dakota, western Minnesota, and parts of Oklahoma, South Dakota, Kansas, and Nebraska. The dominant grasses in the tallgrass prairie are big bluestem, little bluestem, Indian grass, switchgrass, prairie cordgrass, and wheat grass. Upland Sandpipers nest and feed within tallgrass prairies.

The shortgrass prairie is the driest and most westerly type of grassland. It stretches from the Rocky Mountains east and south through parts of the Canadian province of Saskatchewan, Montana, the Nebraska panhandle, Wyoming, Colorado, Kansas, Oklahoma, New Mexico, and Texas. Buffalo grass is the dominant grass with some blue grama grass, needle grass, and wheatgrass. Mountain Plovers and Long-billed Curlews nest and feed here.

The mixed-grass prairie covers part of the Dakotas and extends south to northern Texas and through parts of Oklahoma, Kansas, and Nebraska. Here, the plants of the tall- and shortgrass prairies mix. The vegetation in these areas is more diverse than in either of the other two types of grasslands. During migration, Buff-breasted Sandpipers and American Golden-Plovers rest and feed in pockets of highly grazed and freshly tilled farm fields and other grassy areas within mixed-grass prairies.

Playa lakes in the south, prairie pot holes in the north, and farms are all part of the grasslands. Looking at the illustration, list the names of the plants and animals you recognize that live in and around grassland habitat. Some of these might not be found in your area. What other species of wildlife might you expect to see in your area of the country?



Grassland



Map Your Habitats

Grade Level: upper middle school/ high school

Duration: one 30-minute class period

Skills: vocabulary, discussion, observation, collecting and interpreting data, forming hypotheses

Subjects: social studies (geography) and science; language arts (with additional activity)

Concepts

- Habitat is the place where an organism lives because it is adapted to find food, water, shelter, and space there. Numerous habitats are located within an ecosystem.
- Shorebirds depend on at least three different places for habitat every year of their lives.
- Your local environment may provide important habitat for shorebirds.
- Your local environment is part of a natural ecosystem that we all depend on.

Vocabulary

Refer to the words highlighted in the *Habitat Readings*.

Overview

By examining maps of the states they live in, students discover the variety of habitats that local shorebirds might use.

Objectives

After this activity, students will be able to:

- List the different habitat types found within their home states.
- Identify, on a map of their home states, where these habitats are located.
- Describe three characteristics of each of these habitat types.
- Conclude where they might find shorebirds in their state.

Materials

- One copy of a blank outline of your state or province per student or team

- Copies of textbook maps or copies of topographical or state maps as research material for the students.

- Felt tip pens or colored pencils

- Copies of the *Habitat Readings* (found in the activity *Types of Habitats*)

Introduction

Given the migratory nature of shorebirds and the variety of habitats they use, chances are good that some representatives of this large group of birds can be found in your own “backyard.” The first step to observing shorebirds in the field is to identify suitable shorebird habitat within your community. For information on types of habitats shorebirds use, read *Shorebirds Depend on a Chain of Healthy Habitat* in the *Shorebird Primer* and the *Habitat Readings* found in the activity *Types of Habitats*.

Maps

Maps can be made by you or your students through numerous Internet resources:

National Geographic Map Machine
<http://plasma.nationalgeographic.com/mapmachine/index.html>

National Atlas of the United States
<http://www.atlas.usgs.gov>

Geography Network

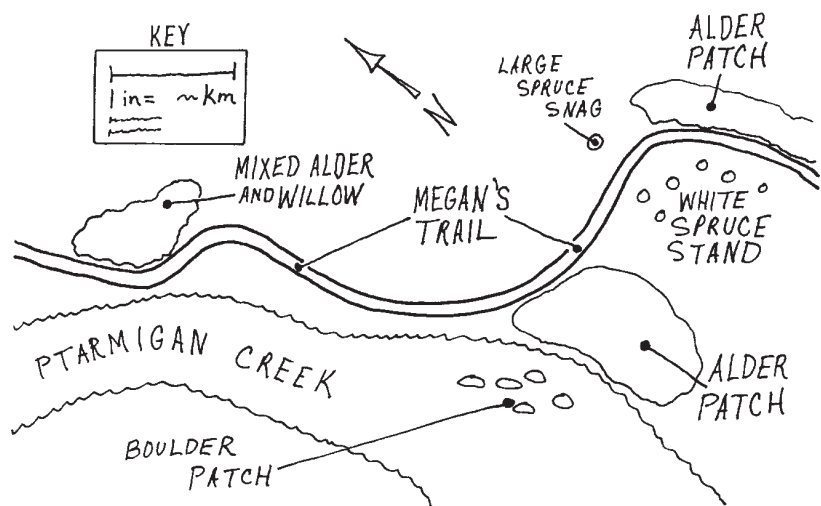
<http://www.geographynetwork.com>

MapQuest

<http://www.mapquest.com>

Procedure

1. Pass out copies of the *Habitat Readings*. Students, individually or in teams, should read each of the descriptions to become familiar with the shorebird habitat types.
2. Pass out one copy of the blank map to each student or team or have students make a local map using the Internet.
3. Have students locate as many shorebird habitat types as possible on the map(s). Ask them to draw and label these habitats on their blank maps.
4. Discuss the following questions:
 - What wildlife do you find in your state, community, or neighborhood?
 - Would your map look the same in winter? How would the habitat change?
 - Are all the habitats marked



on your map suitable for shorebirds? Why or why not?

- Where are good shorebird habitats in your state during the breeding season, during migration, and during winter?
- How many habitat terms can you find among the names on your state (or town) map? (Examples: “Shady Slough,” “Dandelion Meadow,” “Parker’s Knoll”)

Additional Activities



Cultural Connection

Ask students to research and map a habitat in an environment geographically distant from their own community. Ask that as part of the habitat mapping they include information about the cultural group that lives near that habitat.

Map Your Neighborhood

Have students draw a map of the local area where their school and home are located. Label roads, paths, buildings, and all areas of natural or human-made habitat. (Human-made habitat might include gravel beds, sewer lagoons, or dumps.)

Community Atlas Project

ESRI (Environmental Systems Research Institute) has a U.S. Community Atlas project that enables teachers and students to develop a community profile using GIS mapping tools. To learn how to participate, go to <http://www.esri.com>, click on “Education and Training”, scroll down and click GIS K-12, scroll down and click “Community Atlas.”

Community Interviews

Have students interview local community members about how nearby natural areas have changed over the years. Has anything been lost to development? How have the populations of local wildlife changed? Have special areas been set aside for wildlife?

Explore the History of Your Local Parks

Have students research to find what state or federal parks, refuges, or nature preserves are in your state, province, or within 50 to 100 miles of your town. What animals, plants, or habitat types do these parks protect? In which ones do you find shorebirds?

Internet Resources include:

All public lands:

<http://www.recreation.gov>

National Wildlife Refuge Systems:

<http://refuges.fws.gov>

National Park Service:

<http://www.nps.gov>

USDA Forest Service:

<http://www.fs.fed.us>

Bureau of Land Management:

<http://www.blm.gov>



When the Grass Was Greener

*Adapted with permission from
“One Bird-Two Habitats.”
Wisconsin Department of Natural
Resources*

Grade Level: upper middle school/
high school

Duration: 60-minute class period

Skills: critical thinking, vocabulary,
discussion, and visualization

Subjects: social studies, science,
language arts, and math (with
additional activity)

Concepts

- Shorebirds face numerous threats.
- The most serious threat to shorebirds is loss of habitat.

Vocabulary

- tallgrass prairie
- shortgrass prairie
- mixed-grass prairie
- prairie potholes
- playa lakes
- invertebrates

Overview

Through simulation, participants will see how the reduction of grassland habitat and the alteration of agricultural practices such as corn production, grazing, and mowing can affect nesting grassland shorebirds.

Objectives

After this activity, students will be able to:

- Show on a map the general area where prairie once occurred in the United States.
- Name three shorebird species that nest in grassland habitat.
- Differentiate between prairie potholes and playa lakes.
- Explain the importance of prairie potholes and playa lakes to prairie nesting shorebirds.
- List key factors limiting nesting success for grassland shorebirds.

Materials

- Transparency of *Prairie Habitat*
- Copies of the *What Are Grasslands, Prairie Potholes, Playa Lakes, and Grasslands Habitat Reading* (found in the *Types of Habitat* activity).
- Pieces of green, yellow, and orange papers to cover part of the classroom floor.
- Baseball-size, round pieces of brown paper to represent nests
- A field guide or copies of the *Shorebird Profiles* of grassland species (*Upland Sandpiper, Long-billed Curlew, American Avocet, Buff-breasted Sandpiper, and Killdeer* are included in the *Appendix*.)
- A yard stick or ruler
- A set of activity cards (provided here)

Optional

- Gum for “cows” to chew

Introduction

There are three types of grasslands found in North America, defined by the typical height of the grass. Tallgrass prairies, the wettest grasslands, run through the center of North America. They are dominated by big bluestem, little bluestem, Indian grass, switchgrass, prairie cordgrass, and wheatgrass. Upland Sandpipers nest and feed within tallgrass prairies.

The shortgrass prairie is the driest and most westerly type of grassland. Here you find blue grama grass, needle grass, and wheatgrass. Mountain Plovers and Long-billed Curlews nest and feed here.

The mixed-grass prairie is sandwiched between the other two. It covers part of the Dakotas, extending south to northern Texas and through parts of Oklahoma, Kansas, and Nebraska. Here the

plants of the tall- and shortgrass prairies mix. During migration, Buff-breasted Sandpipers and American Golden-plovers rest and feed in the pockets of highly grazed and freshly tilled farm fields and other grassy areas.

Many of these grasslands are dotted with shallow, temporary wetlands that provide vital habitat and resting areas for shorebirds. Here they find the insects, worms, clams, snails, and other invertebrates that sustain them through the breeding season and migration. In the northern prairie region, these wetlands are called prairie potholes. In the southern reaches of the prairies, they are called playa lakes.

North America’s grasslands and the wildlife that lives there face many threats. Some states have lost 99.9 percent of their original tallgrass prairies to agriculture or development. Many prairie potholes and playa lakes have been drained for irrigation water. Cattle have almost completely replaced bison on shortgrass prairies. The natural cycle of wildfires that once sustained prairies is now suppressed. Shorebirds that are using areas intensely managed by people, such as golfcourses and sod farms, risk exposure to pesticides. As a result, biologists are concerned about the long-term survival of birds such as the Long-billed Curlew, Mountain Plover, and the Buff-breasted Sandpiper.

For more information about shorebird habitats and the threats they face, read *Shorebirds Depend on a Chain of Healthy Wetlands* and *Threats to Shorebirds*, both found in the *Shorebird Primer*.

Activity Preparation

1. Copy the *Prairie Habitat* map onto transparency film.

2. Make each student a copy of *What are Grasslands?*, *Prairie Potholes*, and *Playa Lakes*, and *Grasslands* habitat readings found in the activity *Types of Habitats*.
3. Photocopy and cut the activity cards. Attach a yarn loop or safety pin to each card so students can wear them.
4. Cut out a brown paper circle that represents a nest for each student.

Procedure

1. Give students a copy of the student readings to read before the activity. Show the students the *Prairie Habitat Then and Now* map, presenting the grasslands that once covered the continent from Indiana to the Rocky Mountains.
2. Explain that grassland once covered 400,000 square miles of North America. Discuss why people once called the prairie a “sea of grass.”
3. Referring to the student readings, discuss the following questions:
 - What kept the prairies open grasslands?
 - What kinds of birds nested there?
 - Where would you find their nests?
 - What types of risks did these birds face in nesting on the ground?
4. Explain to the students that they will participate in a simulation activity. For the purpose of the game, the classroom will represent a large prairie. Push the classroom furniture out of the way to create a large, open space.
5. Give each student a brown circle

of paper symbolizing a nest. Tell students to put their “nests” anywhere on the open floor, at least a yard away from any other nests. Demonstrate this distance by putting a yardstick between two nests. (If the classroom is too small, use a foot-long ruler instead.) Have them place their nests on the “prairie” and count how many nests fit there. Record this number in the appropriate column on your chart, then pick up the nests.

6. Begin to describe changes in the prairie landscape.

■ “Buffalo hunters” came and killed the bison. Railroads and roads crossed the continent, bringing more and more people. Towns and cities sprang up. *Move the classroom furniture back to represent the built environment where grassland birds find no suitable place to nest.* As you make each change, remove the nests until they have all been picked up.

■ People began suppressing fire so it would not damage their property. Forests grew in areas once kept open by fires and bison. Settlers planted trees for shade. *Set one part of the room aside to represent woodlands not suitable for grassland birds.*

■ People plowed the land and planted crops such as corn and hay. Cover a portion of the floor completely with yellow paper to represent corn. *Cover another corner with orange paper to represent hay.*

■ Now the grasslands have been fragmented—one house, one field at a time. Today less than one tenth of one percent of the eastern tallgrass prairie remains. *Cover the remaining*

floor with pieces of green paper, reducing the prairie to a small patch of pasture.

7. Give a nest back to each student. Ask the students to place their nests on this fragmented prairie. Remind them to avoid woodlands, railroads, roads, towns, and cities. Nests still have to be one yard apart (or the distance you determined earlier).

8. Count the number of nests that fit the “modern” prairie. Record this number in the appropriate column of your chart. Students who were not able to find suitable nest sites can leave their nests on the sidelines.

9. Now take one-third of the class out of the room. Divide that third into three groups—farmers cultivating corn, hay mowers, and cows. Give each group its associated activity cards to wear. Explain that they will have only 45 seconds to “harvest” or “eat” back in the classroom in the following manner:

■ **Cultivators:** Walk slowly back and forth through the corn area, picking up and removing each yellow paper as they go.

■ **Mowers:** Quickly walk back and forth over the hay area, picking up every piece of orange paper as they go and trying to cover the area twice before the time is up.

■ **Cows:** Graze in the green pasture where they are fenced in. They should pick up the green papers they either walk on or “eat.” However, cows must chew four times between picking up pieces of paper. (Give cows gum.)

10. Divide the other two-thirds of the students into “birds.”



Assign them the roles of Upland Sandpiper, Buff-breasted Sandpiper, or Killdeer. Give each student the associated activity card to wear. Instruct them to put their brown paper circles under the colored pieces of paper to represent building nests in the grass at least one yard away from other nests.

■ *Upland Sandpipers* and *Buff-breasted Sandpipers* can nest in the *green pasture* or the *orange hay areas*.

■ Only the *Killdeer* can nest in the *yellow corn area*.

Have the students hide their nests and then move away. Any birds unable to find a suitable nesting site return to the sidelines, their nesting attempts unsuccessful.

11. After the nests are hidden, invite the “mowers,” “cultivators,” and “cows” to return and follow their instructions. Let them graze and harvest for 45 seconds (or just enough time for them to destroy most nests). Nests touched or exposed by the “cultivators,” the “mowers,” or the “cows” are considered unsuccessful or destroyed. Count the number of successful nests. Add this number to the appropriate column on the chart.

12. Discuss what happened.

- How have changes in the landscape affected grassland birds? Their population has declined significantly over the past 30 years. In the Midwest, grassland birds have declined more extensively than birds associated with other habitats.)
- Do you think it is harder to find appropriate nesting sites now than it might have been 160 years ago? Yes, because there is less suitable and safe habitat for nesting shorebirds.

■ Which nesting site was least in demand? Corn. There is a correlation between declines in Midwest grassland birds and declines in regional acreage of pastures and hay fields.

■ Would abbreviating or lengthening the time period have had any effect in the simulation? How does timing and frequency of mowing affect grassland-nesting birds? It takes a nesting pair of grassland birds four to five weeks to build the nest, hatch the eggs, and raise their young. The current predominance of alfalfa is mowed repeatedly during the nesting season (on a 30-day schedule). This provides less viable nesting habitat than the traditional grassy hay which was not mowed until later in the season, after most young birds had fledged.

■ Would increasing or decreasing the numbers of cows have an effect? More cows grazing in the same small area would likely be more damaging to nests.

■ What additional effects might fragmentation of grasslands have on birds? Predators were omitted from this activity. However, smaller fragments of grasslands and the close proximity to woods and farms would likely increase nest predation by skunks, raccoons, cats, etc, and nest Parasitism by cowbirds.

■ What can people do to conserve grassland-nesting shorebirds? Practice grazing with low cattle density or experiment with grazing practices to reduce negative impacts on grassland birds. Delay mowing until after the baby birds have fledged. Consider maintaining more open grasslands by cutting trees where grasslands historically occurred and by burning periodically. Create

and conserve grasslands that are not disturbed during the breeding season.

- Ask students to sum up some key factors in the decline of grassland bird populations. Loss and degradation of habitat, mowing, predation, and trampling.

Additional Activities

Experiment with Different Harvesting Scenarios

Graph the proportion of successful nests in each area. Simulate experiments with rotational grazing or delayed mowing by altering time factors and counting the number of successful nests.

Write Letters

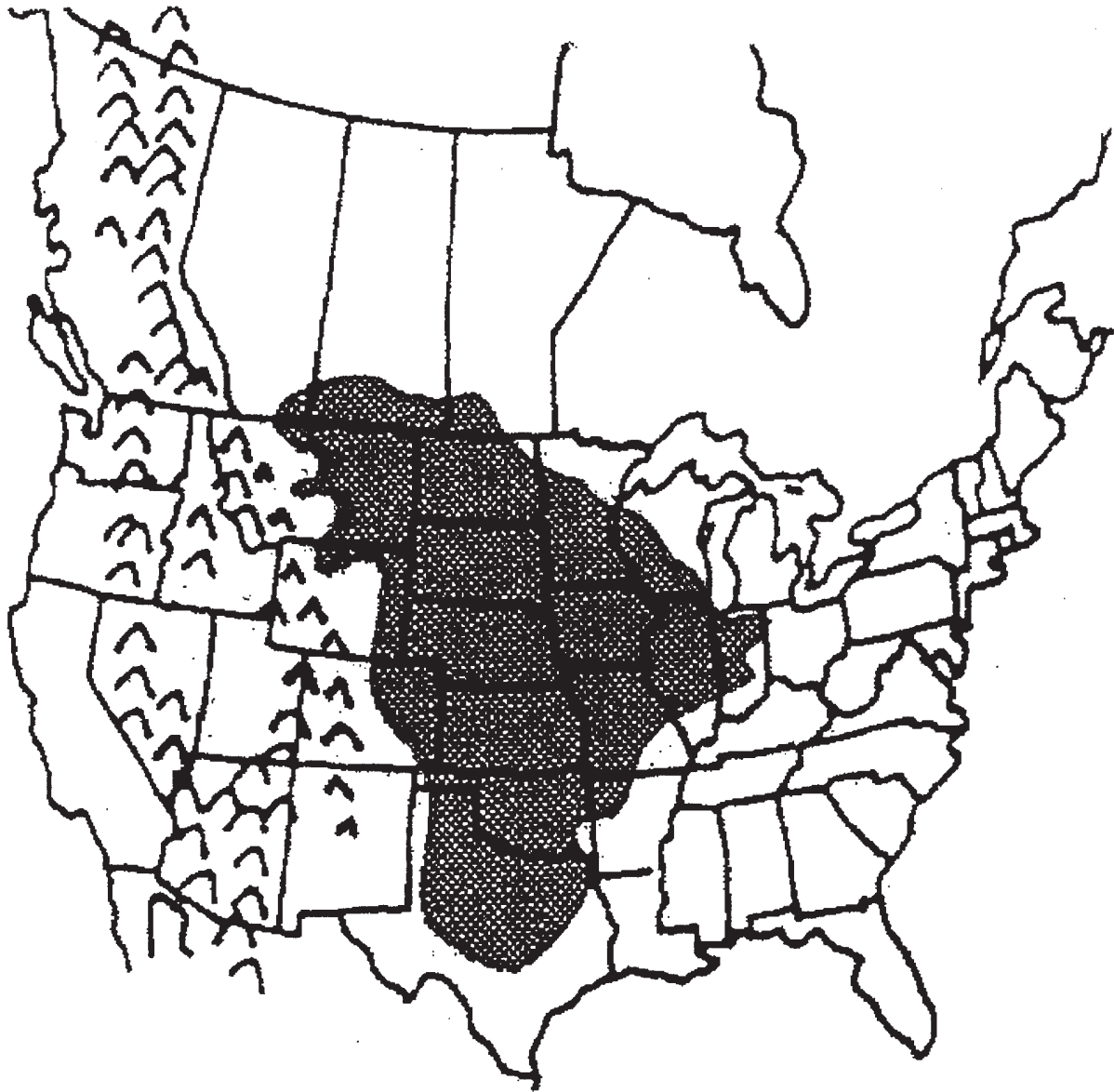
Research and write the appropriate local, state, or federal regulatory agencies and land managers (such as planning and zoning boards, state departments of fish and game, and the U.S. Fish and Wildlife Service), asking for information on the status (such as land ownership and resource use designation) of local grasslands used by shorebirds. Try writing letters to the editor of your local paper on issues concerning local shorebird habitat.

Research Grassland Shorebirds

Give each student copies of the *Upland Sandpiper*, *Long-billed Curlew*, *American Avocet*, *Buff-breasted Sandpiper*, and *Killdeer Shorebird Profiles* to read and study. Then divide the class into four shorebird teams. Have each team answer the “Something to Think About” question at the end of each shorebird profile and present their team’s answers to the entire class.

Mountain Plovers also nest in grasslands but a Shorebird Profile for this species is not included in this Educator’s Guide. Students could write their own profile of the species.

Central Prairie Prior to Settlement by Europeans



When the Grass Was Greener Activity Cards

(Photocopy so that each student will
get one card.)

Hay Mower	Farmer
Cow	Killdeer
Buff-breasted Sandpiper	Buff-breasted Sandpiper
Upland Plover	Upland Plover



Nesting and Breeding

Concepts

- During a shorebird's breeding season, its habitat is where it courts, nests, and raises its young.
- The Arctic tundra is critically important breeding habitat for many migratory shorebirds.
- Your local environment may be important breeding habitat for some shorebirds.
- Shorebirds migrate to higher latitudes (like the Arctic) for breeding so they can take advantage of the summer's abundance of invertebrates.
- Some shorebirds defend breeding territories.
- Shorebirds nest on the ground.
- Shorebirds face numerous threats at their breeding grounds.
- Shorebirds have elaborate behavioral adaptations for courtship display and protection of their nests and young.
- The elaborate behaviors of shorebirds for attracting mates and protecting young are some of the most spectacular and complex of all birds.
- Shorebird nests are camouflaged. Chicks use both camouflage and behavior to stay concealed from predators.
- Most shorebirds look different during the nonbreeding and breeding seasons.

Activities

Colorful Changes

(lower elementary, upper elementary/middle school; upper middle/high school)

Students discover that some shorebirds have dramatically different breeding and nonbreeding plumage. They then create an artistic representation of a shorebird species in both seasons.

Guard Your Nest

(lower elementary, upper elementary/middle school)

Students, pretending to be shorebirds, must guard their nests from a multitude of predators and threats. They discover that camouflage and distraction displays are two strategies that increase a shorebird's chance of nesting success.

Behave Yourself!

(lower elementary)

Students participate in a game in which they attempt to communicate with each other by acting out shorebird gestures and vocalizations.

Musical Nests

(lower elementary)

Students play a version of musical chairs and learn about the hazards that nesting shorebirds face.

It's a Tough Life!

(upper elementary/middle school)

Students play a game that simulates the challenges shorebirds face when trying to feed along many coastal beaches. Students actively begin thinking about what shorebirds need and the things that are threatening their survival.



Colorful Changes

Grade Level: lower elementary, upper elementary/middle school; upper middle school/ high school

Duration: one class period for research, two or more class periods to complete the art work depending on the medium used.

Skills: communication, observation, and visualization

Subjects: science and fine arts

Concepts

- During a shorebird's breeding season, its habitat is where it courts, nests, and raises its young.
- Most shorebirds look different during the nonbreeding and breeding seasons.

Vocabulary

- camouflage
- courtship
- plumage
- breeding season
- nonbreeding season
- cryptic coloration
- polyandrous
- breeding plumage

Overview

Students discover that some shorebirds have dramatically different breeding and nonbreeding plumage. They then create an artistic representation of a shorebird species in both seasons.

Objectives

After this activity, students will be able to:

- Define the term plumage.
- Name at least one shorebird that looks different during the breeding and nonbreeding seasons.
- Explain the purpose for this change in appearance.

Materials

- *Shorebird Coloring Pages* (for lower elementary students)
- *Shorebird Field Guides* (refer to the *Appendix* for a list of suggested books)

- Magazine or newspaper photographs of shorebirds
- Shorebird posters (including those in this education guide)
- Illustration and coloring materials (depending on the medium you and your students choose)

Introduction

In the world of shorebirds, it is often hard to distinguish between males and females, as well as juveniles and adults, of the same species. This is partly due to their *cryptic coloration*. The colors and patterns on their feathers, or *plumage*, provide effective *camouflage* and makes it a challenge to tell them apart.

For some shorebirds, however, this is not true during the short and hurried *breeding season*. Males rush ahead of females to establish a breeding territory, sometimes even selecting a nesting site before finding a mate. It is in the best interest of the pair—and the species for that matter—that males and females find each other quickly. They may have as little as three months to breed before winter returns. A more colorful male stands out against other species, females of the same species, and the surrounding habitat. The males' colorful breeding *plumage*

helps a female find an appropriate mate more quickly on the crowded nesting grounds.

While it is male songbirds that have the brighter breeding colors, that is not always the case with shorebirds. In *polyandrous* species, such as the Red-necked and Red Phalaropes, it is the female that is more brightly colored in the breeding season.

Shorebirds do not rely only on *breeding plumage* to attract a mate. They also use a complex and elaborate set of breeding rituals, including gestures and calls to get each other's attention.

For more information on shorebird breeding, refer to *Shorebird Nesting and Breeding* in the *Shorebird Primer*. For a list of shorebirds in your flyway that have significantly different breeding and nonbreeding plumage, refer to the table below.

Activity Preparation

For Lower Elementary Students

1. Make a list of shorebirds found in your area that display different breeding and nonbreeding plumage. Use the information in this activity and in the *Shorebird Profiles*, located in the *Appendix*, for help making your list.

Shorebirds with Different Breeding and Nonbreeding Plumage

<i>Atlantic Flyway</i>	<i>Central Flyway</i>	<i>Pacific Flyway</i>
Black-bellied Plover Dunlin Red Knot Sanderling Spotted Sandpiper Western Sandpiper	American Avocet Black-bellied Plover Dunlin Hudsonian Godwit Spotted Sandpiper Western Sandpiper Wilson's Phalarope	Black-bellied Plover Dowitcher Dunlin Pacific Golden-Plover Ruddy Turnstone Sanderling Spotted Sandpiper Western Sandpiper



2. Photocopy the *Shorebird Coloring Pages* that match the birds on your list. Make enough copies so each student in your class will have two copies of the same shorebird illustration.
3. Display pictures of these shorebirds in both breeding and nonbreeding plumage around the room. Use shorebird posters (included in this guide) and shorebird pictures from magazines or newspapers, or pictures from these Web sites: <http://sssp.fws.gov>, <http://www.manomet.org/WSRHN/Prairies/index.htm>

For Upper Elementary/ Middle School Students

1. Make a list of shorebirds found in your area that display different breeding and nonbreeding plumage. Use the information in this activity and in the *Shorebird Profiles*, located in the *Appendix*, for help making your list.
2. Set up a shorebird reference corner in your classroom that includes magazine and newspaper photographs of shorebirds, shorebird posters (provided in this education guide), and shorebird field guides. Use the resource list in the *Appendix* for ideas.

For Upper Middle/ High School Students

1. Ask your students to make a list of shorebirds found in your area that display different breeding and nonbreeding plumage. Provide them with the list in this activity and the *Shorebird Profiles*, located in the *Appendix*, for help making the list.
2. Have your students work together to assemble a shorebird reference corner in your classroom that includes magazine

and newspaper photographs of shorebirds, shorebird posters (provided in this education guide), and shorebird field guides. For ideas, provide them with the resource list found in the *Appendix*.

Procedure

1. Discuss the term *plumage* with your class. Ask them why they think some shorebird species have a different plumage during the breeding and nonbreeding seasons. Do all shorebirds have a dramatic change in coloration during the breeding season? Ask them to speculate why they do not.
2. Show the students the shorebird resources you have. Explain that their task is to create an artistic representation of one shorebird that does have dramatically different breeding and nonbreeding colors. Assign or let the students choose from the species list you have prepared.

Lower Elementary Students

3. Ask them to color two *Shorebird Coloring Pages* for the shorebird they selected, using crayons, colored pencils, markers, or chalk. One coloring page should represent the shorebird in its nonbreeding plumage and the other in its breeding colors. Encourage them to be as realistic as possible.

Upper Elementary/Middle School

3. Ask these students to make two drawings of their shorebird species using the reference material provided. These can be simple outline drawings (similar to the *Shorebird Coloring Pages*) or more elaborate pencil or pen and ink drawings. Instruct them to add color to their drawings so that one illustration represents the shorebird in its nonbreeding plumage and the

other in its breeding colors. Encourage creativity and artistic expression. For example, an enthusiastic student might choose to add habitat to their drawings. Make sure they have done their research and know where their shorebird spends its summers and its winters.

Upper Middle/High School

3. Encourage older students to create three-dimensional models of their shorebirds. Suggest using clay, cardboard, fabric, or papier-mâché. The only requirement is that their work show the shorebird in both its breeding and nonbreeding plumage.
4. Arrange a shorebird art show to display the students' work within the school or the community. Upper Middle/High School students may want to include a brief description of their work that explains their choice of medium and how their work progressed.

Additional Activities

Shorebirds on Display and Shorebird Fair

Make *Colorful Changes* one part of a larger shorebird fair. Look up *Shorebirds on Display* and *Shorebird Fair* found in the section *The Big Shorebird Picture*.

Guard Your Nest

Grade Level: lower elementary, upper elementary/middle school

Duration: 20 to 30 minutes of preparation and post-activity discussion; and one full day or 60-minute class period where this activity can run simultaneously with other classroom activities.

Skills: communication, observation, prediction, critical thinking, problem solving, discussion, and evaluation

Subjects: science and fine arts

Concepts

- During a shorebird's breeding season, its habitat is where it courts, nests, and raises its young.
- Shorebirds nest on the ground.
- Shorebirds face numerous threats at their breeding grounds.
- Shorebirds have elaborate behavioral adaptations for courtship display and protection of their nests and young.
- Shorebird nests are well camouflaged. Chicks use both camouflage and behavior to stay concealed from predators.

Vocabulary

- camouflage
- cryptic coloration
- distraction display
- courtship
- scrape
- tundra
- jaegers
- egging
- piracy

Overview

Students, pretending to be shorebirds, must guard their nests from a multitude of predators and threats. They discover that camouflage and distraction displays are two strategies that increase a shorebird's chance of nesting success.

Objectives

After this activity, students will be able to:

- Give three examples of natural threats to shorebird nests.
- Describe two ways people hurt shorebird nests.
- Explain what role camouflage plays in the protection of shorebird nests and eggs.
- Describe two distraction displays shorebirds use to protect their nests and chicks.

Materials

- Construction paper or paper plates
- Scissors
- Masking tape
- Crayons or colored pencils
- One set of Shorebird Threat Cards (included here)
- An activity or lesson to conduct simultaneously

Introduction

Most shorebirds nest on the ground. Many breed in the high Arctic, mating and nesting on open tundra. The nests are generally very simple, shallow, saucer or cup-shaped depressions hollowed or "scraped" into the ground. These scrapes are often lined with grass, leaves, pebbles, or bits of shell. Other birds, including ptarmigan, grouse, and some ducks, make scrapes. Black Oystercatchers and Snowy Plovers, which nest on coastal beaches, also make simple scrapes.

Shorebirds protect their nests in a variety of ways. Nests are concealed within the surrounding landscape. The eggs are camouflaged with speckled coloration. Incubating parents have cryptically colored plumage and sit very still on the nest so they will not attract a predator's attention.

Shorebird parents are known for their clever predator distraction displays. One or both parents

pretend that they have a broken wing or are small mammalian prey. Using these wing-dragging, hunching, or stiff-walking gestures, they attempt to lead the intruder away. Shorebirds also use exaggerated gestures for courtship.

After the chicks have hatched, they learn to drop into a prone position at a parent's alarm call. This quiet, flattened posture, combined with their cryptic coloration, helps conceal them from hunting predators.

For more information on shorebird nesting and displays, read *Elaborate Shorebird Mating Systems and Displays* in the *Shorebird Primer*.

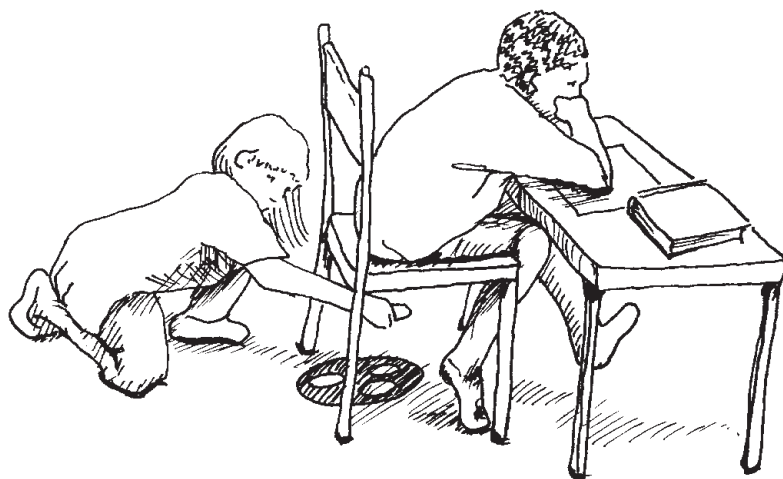
Activity Preparation

1. Copy and cut out a set of the Shorebird Threat Cards (included in this activity). Space is provided for you to add local issues and threats to the deck. There should be one card for every three students in the class. Duplicate cards are okay.

Procedure

1. Have each student construct a simple shorebird scrape using either a paper plate or a six inch diameter circle of construction paper. Add four construction paper eggs to the nest, taking care to make sure that all eggs fit within the diameter of the nest, touching but not on top of each other. Do not glue or tape eggs onto the nest.
2. Help your students brainstorm a list of possible threats to shorebird nesting success in each of the following categories: Arctic tundra, sandy coastal beaches, and/or grasslands. Write their ideas on the chalkboard in a table like the one below.





Threats to Nesting Shorebirds in Three Habitats

<i>Arctic Tundra</i>	<i>Sandy Coastal Beaches</i>	<i>Grasslands</i>
Predators: jaegers, gulls, foxes, weasels, etc.	People jogging and walking unleashed dogs on the beach	Hunting
Egging (collecting eggs)	Children chasing flocks of birds	Predators like falcons, foxes, etc.
Hunting	Riding ATVs on the beach	Agricultural pesticides
Riding ATVs off trails	Jet Skiing close to the shore	Habitat lost to agriculture
	Unusually high tides	Mowing and harvesting equipment
	Oil spills	Cattle over-grazing
	Predators: gulls, foxes, raccoons, feral cats etc.	
	Litter	
	Habitat lost to beach homes and hotels	

3. Explain that every student in the class is going to pretend to be a nesting shorebird. Their job is to protect their nests and eggs from environmental threats and predators (their other classmates). They may protect their nests in any way possible except physically touching the intruder. Help the class brainstorm acceptable ways to protect the nest and list their ideas on the board as a reminder. Here are some suggestions.

Ideas on How to Protect Your Nests

- Hiding the nest
- Making the nest and the eggs the same color as their surroundings
- Staying very close to the nest so as to be aware of any danger that approaches
- Sitting very still and trying not to draw attention to yourself and your nest
- Gesturing at any threatening predator in such a way as to distract it from your nest (For the purpose of this activity, vocal calls may be considered part of a distraction display although they are not always present in actual shorebird distractions.)
- Distracting intruders by leading them away from the nest with some gesture or pretense

4. Explain that several students will secretly get a *Shorebird Threat Card* to use against the other “shorebirds” in the class. If they get a card, they must attempt to “attack” one nest by following the instructions on the card—to take one egg, all the eggs, or the entire nest with all the eggs. “Attackers” have all day to attack, but they must turn in their cards to the teacher as soon as they are successful. Remind the “attackers” that they also must continue to protect their own nests from other “attackers.”

Attackers Cannot

- Touch the parent bird (In real life, parent shorebirds can fly away from a threat!)
- Attack during periods when the class is leaving or gone for recess, lunch, etc.

5. If a student “shorebird” senses an “attack” coming, the shorebird can protect its nest in any way without touching the “attacker.” “Shorebirds” cannot pick up their nests. Birds may try to distract the “attacker” with talking or gesturing in some wild way. If a “shorebird” can distract the “attacker” long enough, he or she may move on to another unsuspecting classmate.
6. Instruct students to consider carefully where they should place their nests. They must be somewhere on the floor or a countertop, but not up high on top of cabinets (shorebirds are ground nesters). Tell students that the nests cannot be moved from their original location.
7. Encourage students to color their nests and eggs so they are well camouflaged. Instruct them to use a loop of masking tape to secure their nest (but not their eggs). Give the students time to carefully place their nests.
8. It is important to simulate a more natural state. Nesting shorebird parents also need to feed, preen, and guard their nests all at the same time. Predators also have to care for their young while at the same time hunting for prey. To accomplish this, hand out reading or worksheet assignments that

can be completed at the same time with some disruption. Other activities may also proceed during this time. Allow students to work together so that some talking and moving about is okay.

9. Discreetly hand out the *Shorebird Threat Cards* to about one-third of the class.
10. Quietly pass the *Shorebird Threat Cards* to other students as they are turned in. Let the activity proceed for as long as possible so that all the students have a chance to use their *Shorebird Threat Cards*.

Example Game Scenarios

Mona receives a *Shorebird Threat Card* that says “ATV.” She watches for a good opportunity to attack an unguarded nest. Ten minutes later she notices that Daniel is across the room sharpening his pencil. Daniel comes back to discover his inattention has cost him of his eggs and nest. Mona puts all the eggs in her own nest and hands the card to the teacher, who later passes it to Sylvia. Daniel asks the teacher for more paper to make 4 new eggs.

Archie receives a *Shorebird Threat Card* that says “jaeger.” He watches and waits for a good opportunity to “attack.” Five minutes later he tries to sneak up to Chad’s nest and snatch an egg. Chad and Larry see him coming their way and decide to distract him by asking him about last night’s basketball game. To Chad’s disappointment, Archie picks up one of Chad’s eggs anyway, puts it in his own nest, and hands the card to the teacher. Chad may remember that he can choose to make another egg.

11. When the activity is over, ask students to count their eggs.

12. Discuss some of the following questions:

- Was the color of your nest important? Could you have concealed it better? Would you have chosen a different habitat?
- Did you lose time making a new nest or new eggs? Is time important to shorebirds? What might keep a second brood from fledging? (some possible answers are: insect hatch dies off, weather changes, and the parents’ need to migrate.)
- Are humans effective predators? Why were human predators allowed to take only one egg? (Humans who egg frequently leave some eggs so that more shorebirds will be born.) What other human activities pose a threat to shorebird nests? (They may inadvertently drive over nests on the beach or the tundra with ATVs, get too close on Jet Skis or when walking or jogging nearby. Researchers and other people who find nests may leave a scent trail. Weasels can follow human scents, and ravens and magpies sometimes look for nests by watching people. If you find a nest, walk on past it in the same direction you were going. Don’t leave a “v-shaped” scent-trail.)
- What happens to a shorebird nest if the parents are killed? What could kill them? Why are the parents in less danger than the eggs or chicks? (They can fly and they are experienced at avoiding predators.)

- Did you see any of your classmates work together to protect their eggs? Did distraction work? If not, why? (Card-holding predators wanted the egg more than whatever else was offered.) Why do birds use distraction displays? (A predator may be fooled into thinking that the distracting parent bird is injured and can be snatched easily.)

Additional Activities



Cultural Connection

Shorebird Egging: Ask students to research the sensitive issue of shorebird and seabird egging (the harvesting of eggs for subsistence purposes) in the Arctic.

Students can research how the Exxon Valdez oil spill affected nesting birds and the local communities.

Shorebird Chick Development

Have students research the chick development for a particular shorebird species. How many eggs does this species lay? What type of nest does it build? How many days old are the chicks when they fledge? What do the chicks look like? What are the biggest threats these chicks encounter? How old are these shorebirds when they first breed? Have scientists determined the nesting success of this species? Ask older students to pick two shorebird species and compare and contrast the chick development information they find.

Volunteer to Guard Real Shorebird Nests

If you live on the coast of the Atlantic or Pacific Flyways in the United States, you could help protect plover nests!

- Atlantic Flyway: Piping Plover – Volunteer Opportunities <http://pipingplover.fws.gov>
- Pacific Flyway: Snowy Plover – Do an Internet search for Snowy Plovers with volunteers in quotes



Shorebird Threat Cards

(Photocopy so there is one card for every three students.)

(Write your own local examples on the blank cards.)

Predator Threat	Predator Threat	Predator Threat	Predator Threat
People (Take one egg.)	Jaeger (pronounced "yay-ger") (Take one egg.)	Fox (Take one egg.)	Weasel (Take one egg.)
Predator Threat	Predator Threat	Predator Threat (Local)	Predator Threat (Local)
Gulls (Take all the eggs.)	Falcon (Take one egg.)		
Habitat Threat	Habitat Threat	Habitat Threat	Habitat Threat
Inexperienced Parents (Take one egg.)	Flooding (Take the entire nest and all the eggs.)	Dangerous Waves (Take the entire nest and all the eggs.)	Loss of Habitat (Take the entire nest and all the eggs.)
Habitat Threat	Habitat Threat (Local)	Habitat Threat (Local)	Habitat Threat (Local)
Extra High Tides (Take the entire nest and all the eggs.)			
Human Threat	Human Threat	Human Threat	Human Threat
Egging (Take one egg.)	Hunting (Take the entire nest and all the eggs.)	Jet Skis (Take all the eggs.)	ATVs (Take the entire nest and all the eggs.)

Shorebird Threat Cards

(Photocopy so there is one card for every three students.)

(Write your own local examples on the blank cards.)

Human Threat	Human Threat	Human Threat	Human Threat
Dog Walking (Take one egg.)	Jogging on the Beach (Take one egg.)	Trash (Take one egg.)	Chasing Flocks of Birds (Take one egg.)
Agricultural Threat	Agricultural Threat	Agricultural Threat	Agricultural Threat
Mowing Equipment (Take the entire nest and all the eggs.)	Pesticides (Take all the eggs.)	Habitat Loss to Agriculture (Take the entire nest and all the eggs.)	Harvesting Equipment (Take the entire nest and all the eggs.)
Human Threat (Local)	Human Threat (Local)	Human Threat (Local)	Human Threat (Local)
Agricultural Threat (Local)	Agricultural Threat (Local)	Agricultural Threat (Local)	Agricultural Threat (Local)

Behave Yourself!

Grade Level: lower elementary

Duration: one 30 to 40-minute class period.

Skills: communication, observation, application, and comparison of similarities and differences

Subjects: science, fine arts, and physical education

Concepts

- Shorebirds have elaborate behavioral adaptations for courtship display and protection of their nests and young.
- Elaborate courtship displays include vocalizations and gestures to attract mates.
- The elaborate behaviors of shorebirds for attracting mates and protecting young are some of the most spectacular and complex of all birds.

Vocabulary

- gestures
- breeding territory
- nonbreeding grounds
- mates
- aerial displays
- vocalizations
- polyandrous

Overview

Students participate in a game in which they attempt to communicate with each other by acting out shorebird gestures and vocalizations.

Objectives

After this activity, students will be able to:

- Give three examples of shorebird gestures or vocalizations.
- Explain why shorebirds make these gestures and vocalizations.
- Identify that males are most often the ones that perform vocalizations and gestures.
- Define the term polyandrous.

Materials

- One classroom set of *Shorebird Behavior Cards*
- One classroom set of *Shorebird Charades Cards*

Introduction

Shorebirds are renowned for elaborate mating *gestures*, *vocalizations*, and *displays*. Some of these displays are *aerial* (performed in the air), while others are performed on the ground. Shorebirds engage in these complex displays for a variety of purposes. The most spectacular displays sometimes involve plunging and hovering flights, accompanied by trilling, hooting, or buzzing sounds. They are used to attract and court *mates* and to protect nests and young. They are also performed as acts of aggression, particularly when defending *breeding territories*. Many shorebirds also defend their winter feeding territories on their *nonbreeding grounds*.

Gestures and vocal displays are vital forms of shorebird communication. Repeated, commonly understood rituals help shorebirds express their intentions quickly. This is especially important to tundra-breeding birds that are rushed by the short Arctic summer. Territorial displays allow birds to retreat from another's territory without risking a battle.

For more information about shorebird breeding and nesting, read *Elaborate Shorebird Mating Systems and Displays* in the *Shorebird Primer*.

Activity Preparation

1. Photocopy and cut out a set of *Shorebird Behavior Cards* (included in this activity). There should be one card for each student.
2. Photocopy and cut out a set of the *Shorebird Charades Cards* (included in this activity). There should not be duplicate cards. There should be one card per pair of students. To personalize your card set, write a few shorebird scenarios that are specific to your local species or issues on the blank cards provided.

Procedure

1. Have students stand in two lines facing each other. Join the line if there is an odd number of students. Students in one line are male shorebirds. These are the ones who will act like shorebirds trying to get the attention of a possible mate. The students in the second line represent female shorebirds.
2. Choose a pair of *Shorebird Behavior Cards* for each pair of students. Separate the cards into two identical decks. Shuffle each deck.
3. Take one of the decks and pass out a card to each "male shorebird." Let the students look at the cards, then collect them. Pass out the other deck to the "female shorebirds." The students can huddle with the shorebirds of their gender for help reading or understanding their cards. But male shorebirds cannot see the females' cards or vice versa.



4. Now explain to the “male shorebirds” that they must attract their mates by acting out the gestures listed on their cards. The female shorebirds must find their matches as quickly as possible. “Male shorebirds” need to exaggerate their gestures and sounds and repeat their actions until they are recognized.
5. Give a signal like “Behave Yourself!” to prompt the “male shorebirds” to begin.
6. End the round when all the students have found their mates.
7. Pick a shorebird pair to select a *Shorebird Charade Card* from the deck (maybe the last or the first pair to have found each other, the loudest “male shorebird”, etc.). Give them a few minutes to decide how they

can act out the scenario. After they perform their charade, ask the class to guess the sentence that was on their card. It is not necessary to guess the exact words—only the general meaning.

8. The pair that correctly guesses the charade can pass out the next round of cards.
9. Repeat the activity until all students have had a chance to perform displays and charades. Alter the roles by announcing that the class is now a flock of *polyandrous* shorebirds, and the “female shorebirds” must gesture to attract the males!

Additional Activities

Shorebird Simon Says

(good for younger groups)

Use the shorebird action cards to play “Simon Says” and follow up with a game of charades afterward.

Escalating Confusion

Increase the complexity of the game by asking the “male shorebirds” to make four to five different gestures at the same time. Add sound distractions into the game by playing background music. The “male shorebirds” will have to be even louder and gesture more wildly to be recognized.



Shorebird Behavior Cards

(Make one photocopy.)

Actions and Sounds	Actions and Sounds
Wing flash Bow Hoot	Wing flash Bow Hoot
Actions and Sounds	Actions and Sounds
Purr Stretch neck Walk stiff-legged	Purr Stretch neck Walk stiff-legged
Actions and Sounds	Actions and Sounds
Stamp feet Stretch/extend neck High trill	Stamp feet Stretch/extend neck High trill
Actions and Sounds	Actions and Sounds
Wing spread Hop Whistle	Wing spread Hop Whistle
Actions and Sounds	Actions and Sounds
Beat wings rapidly Open bill Call loudly and endlessly	Beat wings rapidly Open bill Call loudly and endlessly
Actions and Sounds	Actions and Sounds
Dip-shake Food exchange Purr	Dip-shake Food exchange Purr

Shorebird Behavior Cards

(Make one photocopy.)

Actions and Sounds	Actions and Sounds
Droop wings Scrape (kick backwards) Chatter gurgle (gargle)	Droop wings Scrape (kick backwards) Chatter gurgle (gargle)
Actions and Sounds	Actions and Sounds
Flutter wings Zig-zag chase Hoot loudly	Flutter wings Zig-zag chase Hoot loudly
Actions and Sounds	Actions and Sounds
Beat wings slowly Wing-vibration Hum	Beat wings slowly Wing-vibration Hum
Actions and Sounds	Actions and Sounds
Bow Lunge head first Laugh	Bow Lunge head first Laugh
Actions and Sounds	Actions and Sounds
Rear up Spread wings Hoot loudly	Rear up Spread wings Hoot loudly
Actions and Sounds	Actions and Sounds
Dance Jump Whistle	Dance Jump Whistle

Shorebird Charades Cards

(Make one photocopy.)

Shorebird Charade	Shorebird Charade
I am a wounded rabbit and you can catch me.	I am retreating (running away) from you.
Shorebird Charade	Shorebird Charade
My leg is broken and you can catch me.	You are in my territory (home) and I want you to stay.
Shorebird Charade	Shorebird Charade
I am a hungry chick.	Look at me!
Shorebird Charade	Shorebird Charade
Where do you want to build the nest?	My eggs are gone!
Shorebird Charade	Shorebird Charade
I am going to migrate now.	I am thirsty.
Shorebird Charade	Shorebird Charade
I see a fox.	Get out of here!

Shorebird Charades Cards

(Make one photocopy.)
(Write your own scenarios on the
blank cards provided.)

Shorebird Charade	Shorebird Charade
Get down, kids!	Come back here, kids!
Shorebird Charade	Shorebird Charade
I like you.	
Shorebird Charade	Shorebird Charade
Shorebird Charade	Shorebird Charade
Shorebird Charade	Shorebird Charade
Shorebird Charade	Shorebird Charade

Musical Nests

Adapted with permission from “Musical Nests” in “Bridges to Birding.” The North American Bluebird Society.

Grade Level: lower elementary
Duration: one 30-60 minute class period
Skills: interpretation of data, discussion, and vocabulary
Subjects: science, physical education, and math

Concepts

- During a shorebird’s breeding season, its habitat is where it courts, nests, and raises its young.
- Shorebirds nest on the ground.
- Shorebirds face numerous threats in their breeding habitat.

Vocabulary

- habitat
- scrape
- clutch
- nesting success
- breeding grounds
- camouflage
- predators

Overview

Students play a version of musical chairs and learn about the hazards that nesting shorebirds face.

Objectives

After this activity, students will be able to:

- Explain the relationship between nesting success and shorebird population numbers.
- Give at least three examples of shorebird predators.
- Give two other threats, besides predators, that shorebirds face on their breeding habitat.

Materials

- Chairs
- Game cards
- Portable tape or CD player
- Music
- Data sheet or chalk board
- Classroom set of *Musical Nests Game Cards* (included here)

Introduction

Most shorebirds nest on the ground in a simple grass-lined depression called a *scrape*. Their *clutch*, typically two to four or four to six eggs, are well *camouflaged* with earth-colored speckles. In spite of their inconspicuous nests and dull-colored eggs, shorebirds face a number of threats that affect their *nesting success*.

Many *predators* such as raccoon and fox hunt not only the shorebird’s chicks, but will eat their eggs as well. Birds like crows, gulls, and hawks are also fierce shorebird predators. Agriculture and development is replacing many grassland, wetland, and shoreline *habitats*. Agricultural and industrial pollution weaken many birds and reduce their chances at successful nesting.

Nesting success is a critical factor in the survival of shorebirds. Faced with the perils of long migratory flights each spring and fall—and the threats they face on their nonbreeding grounds—a sufficient number of juvenile birds must be raised on *breeding grounds* to replace the adults that will not return the next year to breed.

To learn more about shorebird nesting and breeding, read *Elaborate Shorebird Mating Systems and Displays*. To learn more about the threats shorebirds face, read *Threats to Migrating Shorebirds*. Both of these sections are found in the *Shorebird Primer*.

Activity Preparation

1. Photocopy the Musical Nests Game Cards (included in this activity) on cardstock. You will need a set of cards equal to two and one half times the number of participants.
2. Plan for a group of 20 by photocopying and cutting 50 cards as follows:

20 copies of the
SAFE NEST CARDS
10 copies of the
UNSAFE NEST CARDS
10 copies of the
SHOREBIRD CARDS
10 copies of the
THREAT CARDS

Procedure

1. Place chairs as you would for a traditional game of musical chairs. You will need a set of chairs equal to half the number of participants. Shuffle the safe and unsafe nest cards and place one face down on each chair. Participants should not look at these cards!
2. Before beginning the game, discuss the different habitats where shorebirds nest. Brainstorm a list of threats nesting shorebirds face that might limit nesting success. Explore what habitats might be safer for nesting and which might be more hazardous. Make a list of these threats under the habitat headings where they belong: tundra, grassland, sandy beach, rocky-intertidal habitat, and freshwater/saltwater marsh. Refer to the chart below for ideas.



Threats to Nesting Shorebirds

<i>Tundra</i>	<i>Grassland</i>	<i>Sandy Beach</i>	<i>Rocky Intertidal Habitat</i>	<i>Freshwater and Saltwater Marshes</i>
Predators like jaegers, gulls, foxes, weasels, etc.	Predators like falcons, foxes, weasels, etc.	People jogging and walking dogs on the beach	Oil spills	Wetland Drainage
Egging	Habitat loss to agriculture	Children chasing flocks of birds	Predators like gulls, foxes, raccoons, wild cats, etc.	Runoff water that contains oil, pesticides and agricultural chemicals
Junting	Agricultural chemicals	Riding ATVs on the beach	Litter	Habitat lost to coastal & agricultural development
	Mowing and harvesting equipment	Jet Skiing close to the shore		
	Cattle grazing	Extra high tides		
		OPl spills		
		predators like gulls, foxes, raccoons, wild cats, etc.		
		Beach litter		
		Habitat lost to beach homes and hotels		

to stay. If it reads UNSAFE NEST, the “threat” gets the chair because it has eaten or destroyed the shorebird’s eggs. Total the number of chairs, shorebirds, and safe nests.

8. Play the game for two to three rounds, shuffling and replacing the nest cards each time. Re-deal the second deck so participants have the chance to play different roles. Add some additional factors such as habitat loss for nest sites. Just remove one chair between rounds. At the same time, you must remove one THREAT CARD and one SHOREBIRD CARD before shuffling and dealing.
9. Keep track of totals and graph shorebird numbers at the end of each round. Players will notice that when there are more safe places to nest, more shorebirds survive!

Additional Activities

Guard Your Nest

In this classroom activity, students become nesting shorebirds that must guard against predators and threats, while at the same time take care of their own needs.

Shorebird Detective Work

Investigate the shorebird habitats of your area to uncover the threats shorebirds face right in your own backyard. Organize what you learn into two categories: Natural Threats and Human Threats. Which of the human threats can you do something about?

3. Select ten of the threats the students identified and write them on the THREAT CARDS.
4. Shuffle the SHOREBIRD and THREAT CARDS and give one to each participant. Participants may look at these cards.
5. Each player who receives a SHOREBIRD CARD should walk around the chairs as the music plays. When the music stops, each shorebird must “nest” in the nearest site (chair). Instruct them not look at the cards on their chairs!
6. Now that the shorebirds have settled into their nests, the students with a THREAT CARD begin to prowl. Ask the students to really play the part. Snakes should slither, birds flap, raccoons creep, a bulldozer rumble, etc. Play some appropriate, less jolly music. When the music stops, the “threats” choose the closest nests.
7. Now players may look at what is written on the cards on their chairs. If the card reads SAFE NEST, then the shorebird gets



Musical Nest Cards

Safe Nest Cards
(Make two copies for a group of 20.)

SAFE NEST	SAFE NEST
SAFE NEST	SAFE NEST
SAFE NEST	SAFE NEST
SAFE NEST	SAFE NEST
SAFE NEST	SAFE NEST



Musical Nest Cards

Unsafe Nest Cards
(Make one copy for a group of 20.)

UNSAFE NEST	UNSAFE NEST
UNSAFE NEST	UNSAFE NEST
UNSAFE NEST	UNSAFE NEST
UNSAFE NEST	UNSAFE NEST
UNSAFE NEST	UNSAFE NEST

Musical Nest Cards

Shorebird Cards
(Make one copy for a group of 20.)

SHOREBIRD	SHOREBIRD
SHOREBIRD	SHOREBIRD
SHOREBIRD	SHOREBIRD
SHOREBIRD	SHOREBIRD
SHOREBIRD	SHOREBIRD



Musical Nest Cards

Threat Cards
(Make one copy for a group of 20.)

<u>THREAT</u>	THREAT
THREAT	THREAT
THREAT	THREAT
THREAT	THREAT
THREAT	THREAT



It's a Tough Life!

Adapted with permission from "Plover Survival: A Simulation Game." U.S. Fish and Wildlife Service.

Grade Level: upper elementary/middle school

Duration: one 50-minute class period

Skills: vocabulary, critical thinking, discussion, visualization, and interpretation of data

Subject: science and physical education; language arts (with additional activity)

Concepts

- During a shorebird's breeding season, its habitat is where it courts, nests, and raises its young.
- Shorebirds nest on the ground.
- Some shorebirds defend breeding territories.
- Shorebirds have elaborate behavioral adaptations for courtship display and protection of their nests and young.
- Shorebird nests are well camouflaged. Chicks use both camouflage and behavior to stay concealed from predators.
- Your local environment may be important breeding habitat for many migratory shorebirds.
- Shorebirds face numerous threats in their breeding habitat.
- Disturbance from human activities, animals, and trash limit a shorebird's opportunity to feed and nest successfully.

Vocabulary

- invertebrates
- behavior
- threat
- human disturbance
- predator
- chicks

Overview

Students play a game that simulates the challenges shorebirds face when trying to feed along coastal beaches. Students begin to think about shorebirds' needs and what

threatens their survival.

Materials

- Outdoor or indoor playing field with enough room to move around freely
 - One rope at least 16 feet long
 - Four small brown bags or sandwich bags
 - One beach ball, Frisbee, or small ball
 - One additional 16-foot rope marked in four foot intervals or five orange goal cones or other markers to establish boundaries
 - Soda cans, candy wrappers, a couple of bags of chips (to simulate litter)
 - One to two bags of dried beans, the same color as the playing field
 - One copy of *It's a Tough Life! Record of Feeding and Survival Success* data chart
 - One large sheet of paper or flip chart for recording data
 - Markers for recording data
- ### Optional
- One large inner tube, tire, or ball
 - One kite

Introduction

Shorebirds face many *threats* and *disturbances* that can interfere with their ability to nest and feed. One of the biggest threats to beach-nesting shorebirds is *human disturbance*. As our population grows, so does our need for recreational space. This is especially true in rapidly growing coastal communities. Many times shorebird nesting coincides with the peak of our summer beach recreation season. Since shorebirds are naturally wary, they will move away from their nests and important feeding areas when disturbed, often before people even notice their presence. Of course, noisy beach activities such as personal water crafts and off-road vehicles scare shorebirds away; but so do more passive, seemingly unobtrusive activities like jogging or walking along the beach.

For more information about the threats shorebirds face, read *Threats to Migrating Shorebirds* in the *Shorebird Primer*. To learn more specific information about a sandy beach-nesting shorebird, read the *Snowy Plover Shorebird Profile* located in the *Appendix*.

Activity Preparation

1. Draw the *It's a Tough Life! Record of Feeding and Survival Success* data chart on a flip chart so you can record data as you play the game. You may also want to prepare a transparency of this data sheet for use in the classroom

Procedure

Set up the Scenario

1. Ask students to describe the wave action on a beach or lake. Is the water always at the same level or does it vary? Describe the area where a wave has just passed; is it wet or dry? Ask for two volunteers to move the rope to simulate gentle wave action. Have them demonstrate this motion.
2. Ask students if they have ever seen small birds along the water's edge. If so, what did they observe? Were the birds feeding? Did they move when the water approached? How? (If students have not observed these behaviors, explain that birds move back and forth with the advancing and retreating waves. They peck and poke with their beaks for small invertebrates in the mud.)
3. Ask for four volunteers—two to model the behavior of the adult shorebirds and two to model the behavior of the chicks. You may actually want to label these volunteers so you can distinguish between the adults and chicks.



4. Explain that in this game, or simulation, the birds (played by the students) will be feeding on beans (representing small *invertebrates* found in the mud). Spread the beans on the ground near the “water’s edge” and hand out small sacks or bags (a “stomach”) to each of your shorebirds. When the shorebirds find an “invertebrate,” they must pick it up with one hand and put it in their “stomach.” They can only pick up one bean at a time with one hand—the other hand must be holding their “stomachs.”

5. Have the shorebirds move with the waves. Model this feeding behavior for about 30 seconds. Count each bird’s beans at the end of this time and record the number on the *It’s a Tough Life! Record of Feeding and Survival Success* data chart.

Note: The range of beans collected during this first round will be your standard healthy diet. As the game progresses, if a shorebird collects only half of this amount, it will survive but be unhealthy. If a shorebird collects only one quarter of this number, it may eventually die.

6. Introduce students to the shorebird they will be representing. Select a shorebird that you might find at your local beach, lakeshore, or flyway from the list below.
- Atlantic Flyway: Piping Plover, Wilson’s Plover
 - Central Flyway: Piping Plover, Snowy Plover, Wilson’s Plover
 - Pacific Flyway: Snowy Plover, Wilson’s Plover
7. Explain that this activity will help them understand some of this bird’s *behaviors* and needs, as well as the things that are threatening its survival.

Add Human Disturbance to the Game

8. Ask students what a typical lakeshore or ocean beach looks like. Ask them to describe different types of people-related activities that take place there. Make sure their responses include some sort of game activities (playing Frisbee or catch, flying kites, etc.). What do you think shorebirds do if people or other animals come too close? Can shorebirds feed when they are constantly avoiding people?

9. Establish an area that will be a “safe haven” for the shorebirds. This should be located at least ten feet away from where they are feeding at the water’s edge. Mark off this area with the second rope, goal cones, or other objects. Establish four foot wide “corridors” through which the plovers will move from the water’s edge to the safe haven if any form of disturbance, like people, approaches. (See the diagram.)

10. Explain to the students that each shorebird will have a corridor in which to feed and move. If a person comes into the shorebird’s corridor, the shorebird has to be in the “safe haven.” This means that the shorebird must anticipate the approach of a human and run to the “safe haven” before the person is actually in its corridor. (In real life, most shorebirds will move long before people get too close.)

11. Ask for six new volunteers. Ask the plovers to resume feeding along the water’s edge. Tell the plovers they must “fly” to the “safe haven” when disturbed and go back to feeding when it is safe again. Then send two student volunteers to walk along the water’s edge at normal walking pace. When they are through, send another two students into

the game—this time playing ball or Frisbee for a few minutes. When they leave the area, send in another two students carrying soda cans, bags of chips, and other trash into the shorebird area. They should walk along, dropping some of their trash. Allow variable amounts of time between each pair of students to allow the plovers to attempt to return and feed.

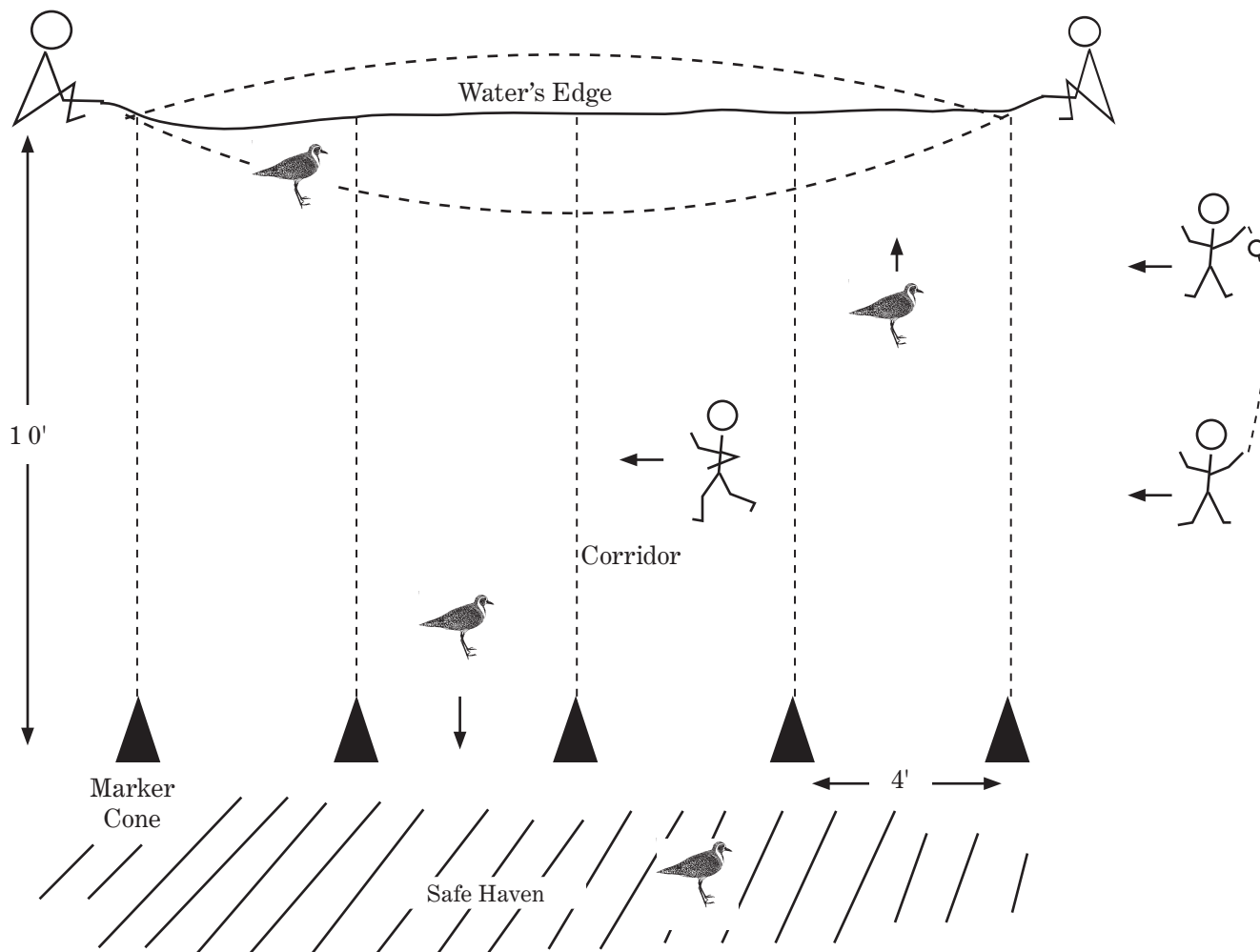
12. Count and record the beans collected by the shorebirds in this round. Compare the results with those of the first round. Discuss the number of beans collected. Remind the class that more time was spent on this round but the birds still caught less food! Will these be healthy shorebirds? Will they even survive in this area? Ask the shorebirds how they feel physically. Are they tired? Given that real shorebirds will actually be running farther than the ten feet established in this game, what has the class learned about how much energy shorebirds use to get food? (Point out to students that with human interference, the shorebirds are using more energy to obtain less food.)

Add Predators to the Game

13. Ask students if the trash left by people in the last round affected the birds’ ability to feed. Explain to the students that when people leave trash in an area, it attracts other kinds of animals like dogs, cats, raccoons, skunks, foxes, and gulls.

Note: Gulls are fast-moving birds that prey on shorebird eggs and chicks. When a gull or other predator approaches a shorebird with its young, both the chicks and adult respond. The adult will move away, faking an injury like a broken wing in an attempt to lead the predator away from the





chicks. If both adults are present, the second parent will lead the chicks to safety. Because they are unable to fly, chicks are easy prey for predators.

14. In this round, instruct the chicks to squat on the ground and the adults to remain standing while they feed. Select a volunteer to be a gull or other predator. If the predator can tag a shorebird chick, this constitutes an attack—and the shorebird dies. The adult plover can fake an injury and/or lead the chick away to safety. Allow the predator to enter the area for 30 seconds.

15. Count and record the beans and living shorebirds at the end of the round. Discuss the impact this predator had on the shorebirds' ability to feed and survive.

16. **OPTIONAL:** Play additional rounds, rotating students into the roles of shorebirds. Add a round to introduce recreational disturbances with simulations like kite-flying, playing Frisbee, riding Off-road vehicles (ORVs) on the beach, or walking an unleashed dog. See options below to do these rounds.

Kite-flying: Kites look like large predatory birds to plovers. In

fact, plovers have been known to respond to the presence of a kite that was over 100 meters (109 feet) away!

- Ask two students to fly a kite. By running around, the students can keep the kite in the air for brief periods of time, assuming there is a little wind.
- Every time the plovers see the kite in the air, they must stop feeding and go to the "safe haven."
- Have the plovers feed and then let the students fly the kite for 30 to 60 seconds, depending on their success at getting it in the air.
- Count and record the beans the plovers picked up.



Off-road vehicles (ORVs): These vehicles include trucks, four-wheelers, dune buggies, etc. The deep tracks these vehicles create generally run parallel to the water's edge. The shorebird chicks sometimes get stuck in them and cannot feed. In addition, they frequently get run over because they are stuck in the track or their instincts cause them to freeze.

- Have two students "drive" the ORV which can be a large tire, inner tube, or ball. To "drive" it, the students must keep the ORV in between them with their hands on it at all times.
- The chicks should squat and not move in this round. If the tire touches the plover, it dies. However, all plovers should feed.
- Count beans when the round is over.

Discuss the following questions:

- What happened to the shorebird's ability to obtain food based on the number of beans recorded at the end of each round? How did they feel as it got harder and harder to feed? How might feeling tired or frustrated with the interference affect a shorebird's ability to feed?
- What happened to the size of the shorebird population on this beach? Will the plovers continue to nest here? If not, where will they go? What if the same problems occur on other beaches? What does this mean for the survival of this shorebird species?

Discuss Solutions

Plovers need space and so do people. Ask the class what can be done so that both the plovers' and people's needs can be met. Listen to all of their ideas and try to get the class to agree on one. This idea should involve some sort of beach management. Have the class think of what could prevent their idea from working. What happens if people do not want to go along with the management plan? What kinds of things can be done about this? You may want to do one more round, implementing their idea. Explain to students that people are implementing beach management programs to help protect the plovers. Their programs may be similar to the idea of the class.

Additional Activities



Cultural Connection

Students work in teams of two representing the following groups: generation of shorebirds that lived through the spill, generation of shorebirds after the spill, Alaska natives, the oil company, Prince William Sound fisherman, Coast Guard, local chamber of commerce, and U.S. Fish and Wildlife Service. Each team is to research how its group was impacted by the Exxon Valdez oil spill. All the groups then gather to outline what they learned from the oil spill and what they recommend should be done to protect their groups.

Arctic Breeding Challenges and Threats

Because of the relative remoteness and wilderness quality of the high Arctic, loss of habitat is generally not considered to be a major threat. However, other threats exist, including predators and potential over-harvesting by local peoples. Have students research what the threats are in the Arctic.

Develop a Shorebird Management Plan

Ask the class to brainstorm what might be done to meet the needs of shorebirds and people on the beach. Make a list of their ideas. Divide the class into teams. Ask each team to pick one of the management options and develop a management plan. Their plans should consider what might prevent success, including public opposition. Have each team present its plan to the entire class. Take a class vote on which plan to implement or give them the option of putting together a new class plan, selecting the best components of each team's ideas.

Research a Current Shorebird Management Plan

Select a shorebird in your area that is considered in need of special consideration. Have your class research what is being done for this bird. Is it working? Can they think of other ways to help?



It's A Tough Life

Record of Feeding and Survival

	Adult Plover #1		Adult Plover #2		Plover #1 Chick		Plover #2 Chick	
	# of beans	health	# of beans	health	# of beans	health	# of beans	health
Round 1 (undisturbed)		healthy		healthy		healthy		healthy
Round 2 (pedestrian disturbance)								
Round 3 (predator disturbance)								
Round 4 (kite disturbance)								
Round 5 (ORV disturbance)								

Dietary Standards (To be determined after Round 1)

Healthy Range: _____ beans

Unhealthy Range: _____ beans

Dangerous Range: _____ beans
(may result in death)



Migration and Migratory Stopover Sites

Concepts

- During each year of their lives, most shorebirds migrate between habitats located in different geographic areas.
- Shorebirds spend most of each year at their nonbreeding sites.
- Arctic-nesting shorebirds undertake some of the longest migrations of any animals.
- Migratory shorebirds depend on habitat in at least three areas: breeding, nonbreeding, and migratory stopover sites.
- Shorebirds concentrate in great numbers at their stopover sites.
- Because shorebirds fly together in large numbers, their populations are extremely vulnerable to threats along their migratory routes.
- Most important migratory stopovers are nutrient-rich habitats, like estuaries, that also provide resources desirable to humans, making them vulnerable to alteration, pollution, disturbance, and destruction.
- Shorebirds migrate between northern breeding areas and southern wintering areas to take advantage of seasonal food resources.

Activities

Migration Headache

*(lower elementary/
upper elementary)*

Students become “migrating shorebirds,” traveling between nesting and wintering habitats. Along their journeys they experience some of the threats affecting the survival of migratory shorebird populations.

Migration Math Madness

*(upper elementary school/
middle school)*

Students discover that shorebirds migrate long distances between their northern breeding grounds and southern breeding habitats, using five defined corridors or “highways” in the sky. By using the migration map provided, they measure and calculate the distances some shorebirds travel and come to understand why shorebirds must stop to feed and rest along the way.

The Incredible Journey

*(upper elementary school/
middle school)*

Through an active simulation game, students learn about the many threats shorebirds face on their migratory journeys.

Precarious Paths

(upper middle school/high school)

Students read clue cards to map the migration paths of their “mystery shorebirds.”

Bird's-eye View

(upper middle school/high school)

Students imagine that they are a migratory shorebird and design an illustration that conveys the length and difficulty of the trip, as well as the landmarks, habitats, and stopover sites they pass over along the way.



Migration Headache

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Council for Environmental Education. Reprinted with permission from Project WILD, "Project WILD K-12 Educator's Guide and Activity Guide." The complete guide can be obtained by attending a Project WILD workshop. For more information, please visit www.projectwild.org or contact the National Project WILD office at 713/520 1936.

Grade Level: lower elementary, upper elementary/lower middle school

Duration: one 40-minute class period

Skills: vocabulary, discussion, comparison, observation, data collection and interpretation; using technology (with additional activity)

Subjects: science, language arts, math, and physical education; technology and social studies (geography) (with additional activity)

Concepts:

- During each year of their lives, most shorebirds migrate between habitats located in different geographic areas.
- Shorebirds migrate between northern breeding areas and southern wintering areas to take advantage of seasonal food resources.
- Arctic-nesting shorebirds undertake some of the longest migrations of any animals.
- Migratory shorebirds depend on habitat in at least three areas: breeding, nonbreeding, and migratory stopover sites.
- Because shorebirds fly together in large numbers their populations are extremely vulnerable to threats along their migratory routes.
- Most important migratory stopovers are nutrient-rich habitats, like estuaries, that also provide resources desirable to humans, making them

vulnerable to alteration, pollution, disturbance, and destruction.

Vocabulary

- migration
- limiting factor
- habitat
- habitat loss
- breeding areas
- nesting site
- nonbreeding site
- wintering area

Overview

Students become "migrating shorebirds," traveling between nesting and wintering habitats. Along their journeys they experience some of the threats that affect the survival of migratory shorebird populations.

Objectives

After this activity, students will be able to:

- Define the term migration.
- List three limiting factors that can affect the populations of migrating shorebirds.
- Classify these limiting factors as natural or human-caused.
- Predict the effects of habitat loss and degradation on populations of shorebirds.

Materials

- Large playing field or gymnasium
- Two paper plates for every three students (Clearly mark the plates, perhaps with a large X on one side, to differentiate top from bottom.)
- Additional plates based on one-fourth of the total number of plates from calculation above.
- *Factors Affecting Survival Cards* or *Habitat Scenarios* listed below
- Flip chart and several colored markers

Introduction

Migration is a challenging task for migratory shorebirds. For many species it involves flying tremendous distances, facing

difficult weather, and depending on stopover habitats and food resources that have been available for many generations.

There are approximately 49 different species of shorebirds throughout North America. Most of these shorebirds spend their summers at northern *breeding areas* in the United States and Canada and migrate to *wintering areas* in the southern United States, Central America, and South America. The White-rumped Sandpiper, for example, migrates each year from the Arctic Circle to the southernmost tip of South America and back, a round trip of 20,000 miles! However, not all shorebirds migrate such long distances. Some, like the American Avocet, breed in the northern part of the United States and winter in the southern part of the United States.

There is a wide variety of *limiting factors*, both natural and man-made, that affect whether or not these birds reach their nesting or wintering grounds. Understanding what these factors are and how they affect shorebird populations is the key to shorebird conservation.

To learn more about shorebird migration and threats to shorebird survival, read *Magnificent Shorebird Migration and Threats to Migrating Shorebirds* found in the *Shorebird Primer*.

Activity Preparation

1. Photocopy one set of the game cards (included in this activity) on cardstock paper. Each card lists one factor (from the table below) affecting shorebird survival on one side and the number of plates lost or gained as a result of this factor on the other side. *Additional Habitat Scenarios that may be used along with, or in place of, the*

Factors Affecting Shorebird Survival are provided; however, the additional habitat scenarios are not laid out as game cards.

2. Select an area about 20 meters (about 70 feet) in length (indoors or out) where the students can race back and forth.

Habitat Scenarios

Educators may want to photocopy these scenarios before beginning the activity.

These scenarios can be used during the activity to assist educators with the factors that may reduce or enhance a wetland habitat.

- A marsh has been dredged to allow a marina to be built. Remove one habitat (plate) from the stopover habitat.
- A landowner has agreed to reflood fields after harvesting, increasing acreage for wintering birds. Add one habitat (plate) to the wintering habitat.
- A joint federal and state wetland restoration project involve the removal of drain tiles, allowing a former wetland to flood and return to its natural state. Add one habitat (plate) to the stopover habitat.
- A large increase in the number of cats, dogs, and raccoons has reduced the value of a marsh nesting area. Remove one habitat (plate) from the nesting habitat.
- Wintering habitat is reduced by the conversion of wetlands to cropland. Remove one habitat (plate) from the wintering habitat.
- New legislation restricts boat traffic on a number of lakes and large marshes, reducing the human disturbance to wildlife. Add one habitat (plate) to stopover habitat.
- Several years of sufficient rain and snow have replenished the water supply, thus increasing the food supply. Add one habitat (plate) to the nesting habitat.
- A timber company has agreed to preserve grassland with scattered wetlands in exchange for tax credits. Add one habitat (plate) to the stopover habitat.
- Wintering habitat is reduced

by the conversion of beach to condominiums. Remove one habitat (plate) from the wintering habitat.

Procedure

1. Select a large playing area about 70 feet in length. Place an equal number of bases in three areas on the playing field. (See illustration.) Choose the number of bases so that there is one base for each two or three students at each of the three areas on the field. Designate one of the end areas as the “wintering habitat,” the other end as the “nesting habitat,” and the area in the middle as “stopover habitat.”
2. Explain to the students that they are shorebirds and will migrate among these three areas at your signal. Tell the students that the bases represent suitable shorebird habitat such as wetlands and grasslands. At the end of each migration, the students will have to have one foot on a base in order to be

Factors Affecting Shorebird Survival

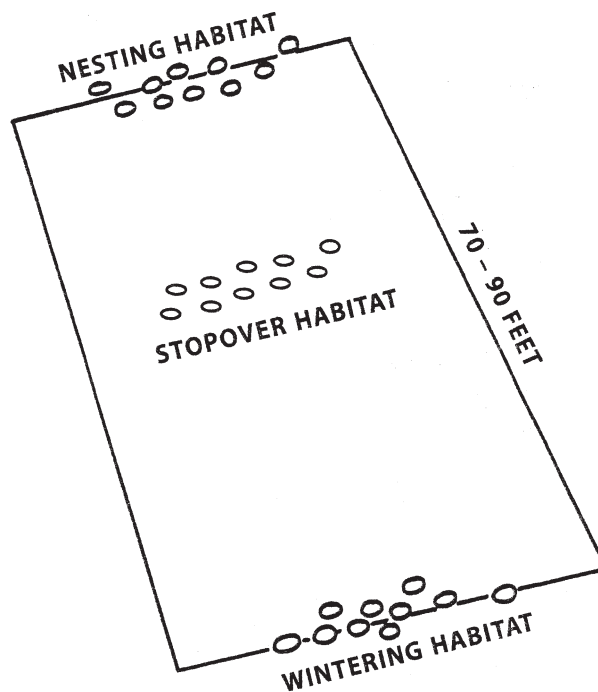
<i>Factors Reducing Survival</i>	<i>Number of plates lost*</i>	<i>Factors Favoring Survival</i>	<i>Number of plates gained*</i>
Urban expansion	5	Preservation of wetlands and grasslands	4
Wetland drainage	5	Dynamic balance with predators	4
Conversion of wetlands and grasslands to farmland	4	Improvement/addition of habitat	3
Pollution (e.g., oil or chemical spill or runoff)	3	Education about habitat for wildlife	3
Drought	3	Normal rainfall (i.e., neither drought nor flood)	2
Disturbance to resting and feeding shorebirds	2	Education about hunting	1
Pollution of food supply	1	Farm management for crops, cattle, and shorebirds	3
Illegal hunting	1		

* Number of plates lost/gained: These numbers are only suggestions and are not necessarily accurate or directly proportional to the size of the threat, percentage of change in survival, etc. This will vary between particular places or incidents.



allowed to continue (survive). Tell the students that only two (or three, as decided in Step 1) shorebirds can occupy a habitat (base) at one time. If they can not find a habitat that is not “filled,” that means they have not found any suitable habitat. They “die,” and have to move, at least temporarily, to the sidelines. During migration, the students may want to “flap their wings,” moving their arms like birds in flight.

3. Explain to the students that many factors will limit the survival of populations of migrating shorebirds. Some involve changes in the wintering, stopover, and nesting habitats. There will be periods of time in which food, water, shelter, and space are suitably arranged to meet the habitat requirements of the birds. There will be other times when the habitat is stressed, with many factors limiting the potential for the birds’ survival.

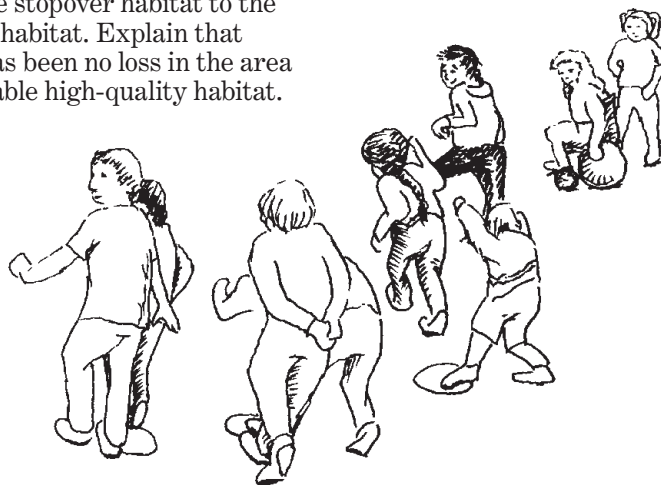


4. Begin the activity with all students at the wintering habitat. Announce the start of the first migration. Have the students migrate slowly until they become familiar with the process. Then they can speed up. On the first try, all the birds will successfully migrate to the stopover habitat.

5. Explain that most shorebirds need these areas to rest and eat before continuing the migratory journey. Then have them migrate from the stopover habitat to the nesting habitat. Explain that there has been no loss in the area of available high-quality habitat.

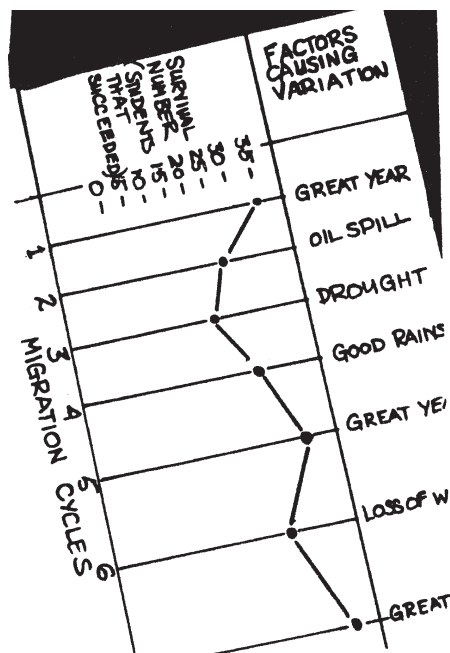
Thus, a successful nesting season is at hand.

6. Before the students migrate back “south,” turn over four plates in the breeding habitat. This represents a catastrophic loss. Tell the students that this is the result of a period of unusually heavy rain that flooded many of the nests. Instruct the students to migrate. This results in a large number of students waiting



on the sidelines to re-enter the nesting habitat. Tell the students that these birds died as a result of habitat loss. Remind any “deceased” birds that they will have a chance to get back into the activity. They can come back as surviving hatchlings when favorable conditions prevail and there is habitat available in the nesting ground.

7. Continue the migrations by reading the *Factors Affecting Survival Cards* or the *Habitat Scenarios*. Educators may want to appoint two students as monitors to remove and add bases (habitats) as required on the cards. Use your discretion to ensure that too many plates are not added or removed, and that “dead shorebirds” have an opportunity to re-enter the game.
8. Repeat the process for eight or ten migration cycles. Remember, overall the availability of suitable habitats for shorebirds are diminishing. The activity should end with fewer areas of available habitat than can accommodate all the birds. *The greatest long-term threat to the survival of populations of shorebirds is the loss and degradation of habitat.*
9. As you move through the game, chart the number of shorebirds that survive each round, using the flip chart and markers as shown below. Make a note on the chart indicating what caused serious shorebird deaths and what caused good breeding years for students to refer to later.



10. After the activity, ask the students to identify factors that caused shorebird populations to decline or increase. What are the short- and long-term effects of the decline or increase? Which factors reduced or enhanced the quality of the habitat? What are the benefits and liabilities related to these factors for the community?

- Have students summarize what they have learned about the factors that affect shorebird migration.
- Divide these factors into two lists-human-caused factors and environmental factors.

- Compare similarities and differences among these limiting factors. Which pose the most significant long-term threat to shorebird survival?

- What threats exist to your local shorebird habitat?

11. Have students study the graph you created during the game.

- What were the causes of the biggest population declines?
- Ask students to imagine how long these factors might affect a shorebird population (one breeding season, two....?).
- Distinguish between catastrophic effects and gradual changes.

- What kinds of things can be done to protect and restore habitats for migrating bird populations? Discuss potential trade-offs related to any recommendations for humans and other organisms (including shorebirds).

Additional Activities



Cultural Connections

- Facilitate a student discussion about what might be the culturally-influenced viewpoints of the peoples' actions in the "Affecting Shorebird Survival" and "Habitat Scenarios" towards the environment.
- Have students research the impact of the Exxon Valdez oil spill on the local communities affected and on the shorebirds migrating through.

Research a Species of Shorebird

Conduct this activity again with each student representing a specific kind of shorebird.

Research Habitat Loss

Causes in Your Community

Explore the major factors affecting habitat loss and alteration-or gain and restoration-in your area. Research the causes for long-term habitat loss, as well as any major efforts underway to prevent these increasing losses. Find out how wetlands have changed or remained the same in your community throughout the past 100 years. Are there wetland regulations or zoning laws in your community?

Research Other Migratory Animals

What other animals migrate? Are the problems they face similar to those of migratory birds?

Research Laws Protecting Migratory Species

There are national laws and international treaties protecting migratory species. Find out about some of these. What is their history? Are they effective? Are there problems enforcing them? What migrating species, if any, are unprotected by such laws?

Track Shorebird Migration Around the World

Use the Shorebird Sister Schools Website at <http://sssp.fws.gov> to monitor shorebird migration throughout the world. Look at the reports scientists and students are posting. Look for sightings of shorebirds in your area. Post your own shorebird observations on the Web site too!



Urban Expansion



Lose Habitat for 15 Shorebirds (Remove 5 Plates)



Wetland Drainage



Lose Habitat for 15 Shorebirds (Remove 5 Plates)



Conversion of Wetlands and Grasslands to Farmland



Lose Habitat for 12 Shorebirds (Remove 4 Plates)



Pollution



Lose Habitat for 9 Shorebirds (Remove 3 Plates)



Drought



Lose Habitat for 9 Shorebirds (Remove 3 Plates)



Disturbance to Nesting and Feeding Shorebirds



Lose Habitat for 6 Shorebirds (Remove 2 Plates)



Food Supply Is Polluted



Lose Habitat for 3 Shorebirds (Remove 1 Plate)



Illegal Hunting



Lose Habitat for 3 Shorebirds (Remove 1 Plate)



Preservation of Wetlands and Grasslands



Gain Habitat for 12 Shorebirds (Add 4 Plates)



Dynamic Balance With Predators



Gain Habitat for 12 Shorebirds (Add 4 Plates)



Habitat Is Improved or Added



Gain Habitat for 9 Shorebirds (Add 3 Plates)



Education About Habitat for Wildlife



Gain Habitat for 9 Shorebirds (Add 3 Plates)



Normal Rainfall (neither drought nor flood)



Gain Habitat for 6 Shorebirds (Add 2 Plates)



Education About Hunting



Gain Habitat for 3 Shorebirds (Add 1 Plate)



Farm Management for Crops, Cattle, and Shorebirds



Gain Habitat for 9 Shorebirds (Add 3 Plates)



Migration Math Madness

Adapted with permission from "Seasonal Wetlands." Santa Clara Audubon Society. "Salt Marsh Manual: An Educator's Guide." San Francisco Bay National Wildlife Refuge.

Grade Level: upper elementary/middle school

Duration: one 30-minute class period

Skills: collection, comparison, and interpretation of data; using technology (with additional activity)

Subjects: science, math, and social studies; geography and technology (with additional activities)

Concepts:

- During each year of their lives, most shorebirds migrate between habitats located in different geographic areas.
- Shorebirds migrate between northern breeding areas and southern wintering areas to take advantage of seasonal food resources.
- Arctic-nesting shorebirds undertake some of the longest migrations of any animals.
- Migratory shorebirds depend on habitat in at least three areas: breeding, nonbreeding, and migratory stopover sites.
- Shorebirds concentrate in great numbers at their stopover sites.

Vocabulary

- Central Flyway
- Atlantic Flyway
- Pacific Flyway
- isotherm
- flyway
- stopover site
- wintering area
- nesting area
- wetland
- migration

Overview

Students discover that shorebirds migrate long distances between northern breeding grounds and southern breeding habitats, using

five corridors or "highways" in the sky. By using the migration map provided, they measure and calculate the distances some shorebirds travel and come to understand why shorebirds must stop to feed and rest along the way.

Objectives

After this activity, students will be able to:

- Define the term isotherm.
- Describe the routes of the shorebird flyways that run along or through the continental United States.
- Calculate the migration distances of two shorebirds.
- Explain why wetland stopover sites are critical to shorebird migration.

Materials

- Twenty-centimeters pieces of string (one per student or group)
- One set of *Migration Math Map Worksheets* and the *Migration Madness* reading for each student
- Pens or crayons for each student

Introduction

Shorebird *migration* is perhaps one of the most spectacular wildlife events known to biologists today. It is now thought that the seasonal movement of shorebirds, from their warm, winter habitat world to the brutal environment of the Arctic tundra, is an adaptation for survival. Their migration to the Arctic allows them to take advantage of the abundant, seasonal invertebrate food resources in an area of the world relatively low in predators and competitors. In addition, the vast open space of the Arctic provides much more habitat for breeding and nesting than their wintering area, and there are many more hours of daylight to feed.

There would have to be an advantage to shorebirds for them to expend so much energy. Consider

the American Golden-Plover that flies 4350 miles nonstop, twice each year, between South America and Northern Canada and the Alaskan tundra. Physical feats like this are common in the world of shorebirds. Pectoral Sandpipers winter in Southern South America but breed as far west as Central Siberia. Some plovers, curlews, and tattlers fly nonstop from Hawaii and other Pacific Islands to Alaska in two or three days, a distance of over 3500 miles!

To migrate successfully, many shorebirds stop to rest and feed along the way at wetlands and grasslands. These *stopover sites* provide critical food resources that give the birds energy to continue the race to their northern breeding grounds.

To learn more about shorebird migration, read *Magnificent Shorebird Migration* found in the *Shorebird Primer*.

Activity Preparation

1. Review the *Migration Math Map Worksheets* provided. Decide which flyway(s) you will emphasize. You may choose to have each student complete all three worksheets or divide the class into three groups, each focusing on a different flyway.
2. Make photocopies so each student has at least one activity sheet.
3. Make one photocopy of the *Migration Madness* reading for each student.

Procedure

1. Have your class review *Migration Madness*.
2. Pass out one piece of string 20 centimeters long to each student. Instruct the student to place the end of the string at the start of one of the migratory paths drawn on the map. He or she

should lay the string along the path so that it follows it exactly. At the end of the path, mark the string with a crayon or marker.

3. This string is now marked at the same length as the line on the map. Instruct the students to compare this piece or pieces of marked string with the mileage scale to estimate how many miles the bird traveled.
4. Ask the students to convert the mileage into kilometers. Remember that 1 mile = 1.609 km. If you start with kilometers (km), 1 km = 0.621 miles.
5. Repeat steps 2 and 3 for the other paths shown on the map. Students should write their answers in the spaces provided.
6. Now have them calculate how long it would take these birds to reach their nesting habitat at 40 miles per day, at 72 miles per day, at 150 miles per day.

Additional Activity

Geography Along the Flyway

As students plot the migration of the birds on the migration map, have them also include what countries the birds fly through.

World Migration Map

While Migration Math Madness focused on the three flyways in the Western Hemisphere, there are actually five shorebird flyways. The two additional flyways are in the Eastern Hemisphere, but some of the shorebirds in those flyways breed in the North American Arctic of Canada and Alaska. Introduce these additional flyways to your students by referring to the map in this activity and flyway descriptions located on the Shorebird Sister Schools Web site at <http://sssp.fws.gov>.

Have students work together to draw a world map on butcher paper. Hang up the map on a classroom wall. Next divide the students into five teams. Assign each team to one of the five flyways. Instruct each team to select three to five shorebirds that use the flyway it is assigned and then research the migration routes of each shorebird and add to the world map.

*Note: Students who study shorebirds in the Eastern Hemisphere will have to do additional Web searches for information on those species because they are not included in the Shorebird Profiles. A short list of species that use the East Asian-Australasian and Central Pacific Flyways can be found in the flyway section of *The Shorebird Primer*.

Ask them to write a short biography of the bird that includes the following and add it to the wall.

- a picture or drawing of the shorebird
- the distance they travel during migration
- the critical stopover sites they use along the way (if known)
- its food preferences
- the types of wetland habitat they use

Resources Students

Can Use Include:

- Bird identification guides recommended in the Appendix of this guide
- Shorebird Sister Schools Web site <http://sssp.fws.gov>; go to the "Flyways" link
- Prairies to Patagonia Web site <http://www.manomet.org/WHSRN/Prairies/index.htm>
- USGS Biogeographical Profiles <http://www.mesc.usgs.gov/products/pubs/555/555.asp> (then scroll down and click on "species profiles.")

■ Australasian Wader Study Group Web site <http://www.tasweb.com.au/awsg/index.htm>

■ Birds of Australia Web site www.birdsaustralia.com.au

■ Shorebird Education of Australia Web site <http://www.wetlands.org.au/shorebirds/>

■ Japan's Shorebird Education Project Web site <http://www.chidori.jp/education/>



Migration Madness

Migrating birds travel long distances between wintering and nesting areas. Most birds do not fly nonstop between these areas, although many are capable of doing so. Timing of the migration is related to seasonal temperature changes but is first triggered by changes in the amount of daylight.

During the spring, most birds do not *migrate* north faster than the 35°Fahrenheit (F) *isotherm* moves. This isotherm is an imaginary, moving line that represents air temperature at any one specific time. The area north of this line is cooler than 35°F, and the area south of it is warmer than 35°F. Migrating behind the isotherm ensures that when the birds reach their nesting areas, the water and ground will not be frozen.

In the fall, temperatures affect the amount of food available to shorebirds. Insects and plants die off in cooler temperatures, so the birds keep moving south to where warmer temperatures mean abundant food.

The migratory routes of birds, referred to as *flyways*, are not specific, narrow “highways,” but general routes that most migrants tend to follow. Most shorebird flyways follow the shoreline habitat the birds prefer.

- In North America shorebirds also migrate inland along the *Central Flyway* that follows freshwater river systems.
- Many other shorebirds migrate on the *Atlantic Flyway*, traveling from the southernmost tip of Argentina, along the American Atlantic Coast up to Canada.
- One of the major routes used by Alaskan Arctic-nesting shorebirds is the *Pacific Flyway*, a path between South or Central American wintering areas and nesting areas in the Arctic regions of Alaska and Canada.
- The *Central Pacific Flyway* extends across the ocean from New Zealand to Pacific islands like Hawaii and up through the Alaskan Arctic.
- The *East Asian–Australasian Flyway* runs from Australia to Japan, China, and Korea, and to the Russian and the Alaskan Arctic.

Wetland stopover sites are important to shorebirds because they provide areas to feed and rest along their migration routes. If a bird flies between Argentina and Alaska, it will cover between 7000 and 8000 air miles. Without local wetlands, many birds would not get enough food energy to make the entire trip.

Birds, like fish, can move in three-dimensional space. This means that besides moving across the earth they also can change altitude. About 15 percent of shorebirds migrate at elevations below 10,000 feet. However, pilots have observed many shorebirds flying at about 29,000 feet!

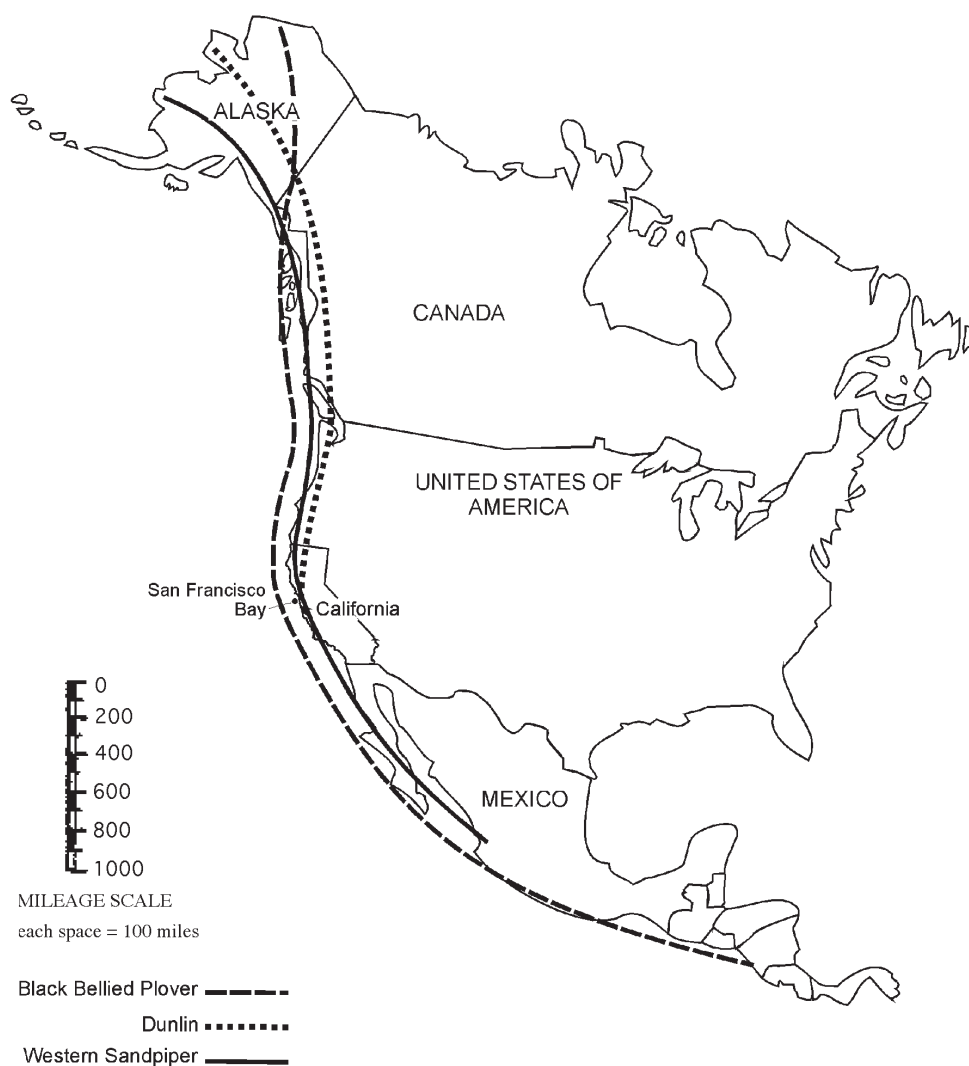
As they get closer to their northern nesting grounds, shorebirds begin to fly faster. Weather and timing become critical factors in getting nests built and young raised in the short two to three months of Arctic summer. Otherwise, migrating shorebirds generally fly for a few hours, rest and feed for one to three days, and then continue. Birds migrating along the Central Flyway have been recorded flying 23 miles per day (mpd) up the Mississippi Valley, 40 mpd across southern Canada, 72 mpd to northern Canada, 116 mpd to Arctic Canada, and those going on to Alaska-150 mpd!



Shorebird Migration Map Pacific Flyway

Directions:

Measure and record the number of miles traveled by each bird.



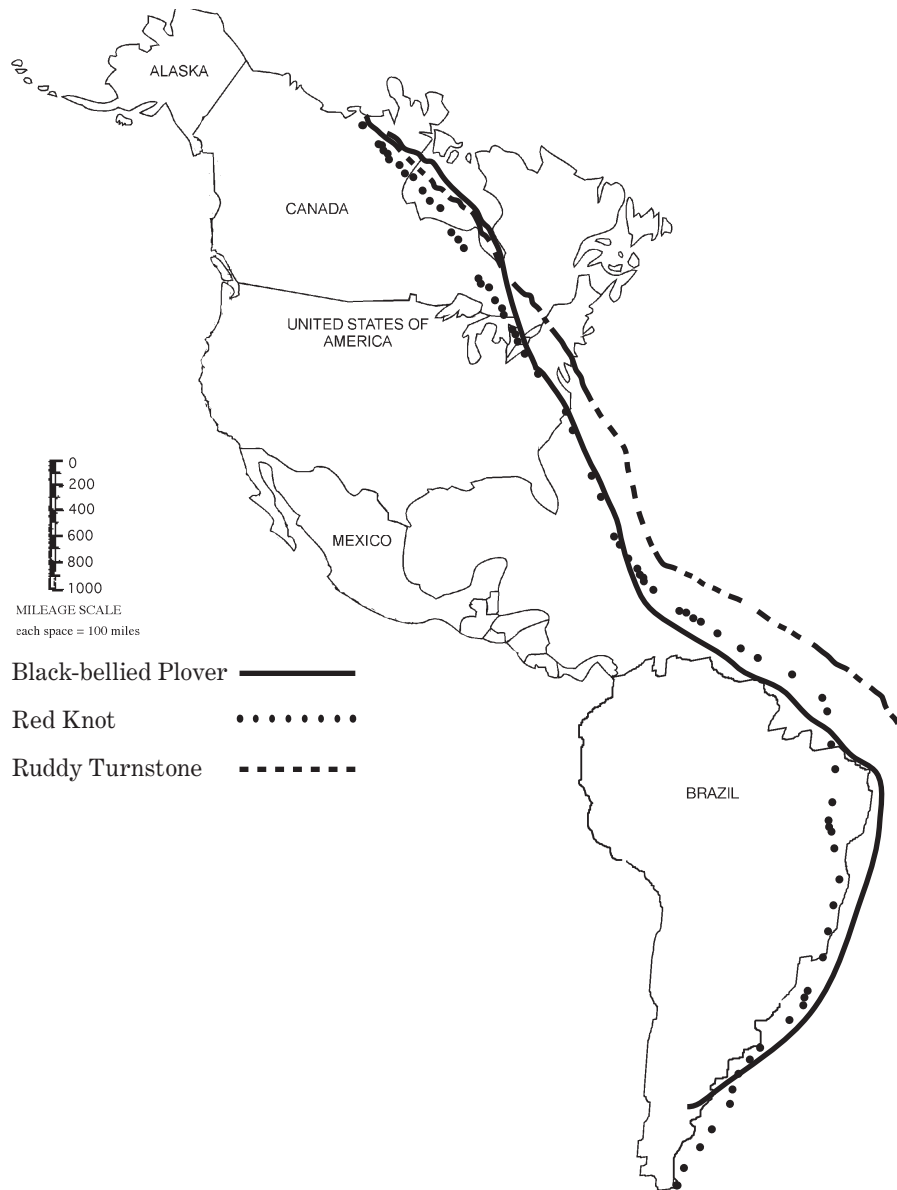
Pacific Flyway

	<i>Miles</i>	<i>Kilometers</i>
<i>Western Sandpiper</i>		
<i>Black-bellied Plover</i>		
<i>Dunlin</i>		



Shorebird Migration Map Atlantic Flyway

Directions:
Measure and
record the
number of
miles traveled
by each bird.



Atlantic Flyway

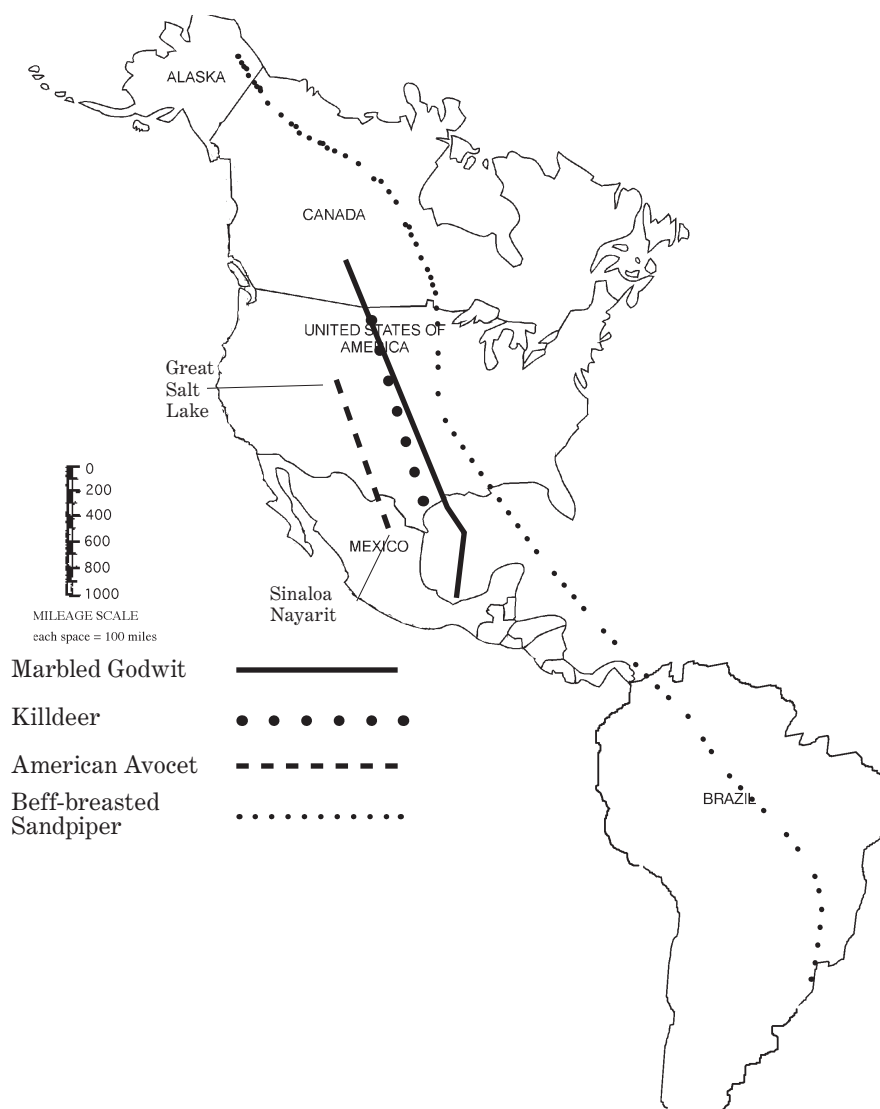
	<i>Miles</i>	<i>Kilometers</i>
<i>Black-bellied Plover</i>		
<i>Red Knot</i>		
<i>Ruddy Turnstone</i>		



Shorebird Migration Map Central Flyway

Directions:

Measure and record the number of miles traveled by each bird.



Central Flyway

	<i>Miles</i>	<i>Kilometers</i>
<i>Marbled Godwit</i>		
<i>Killdeer</i>		
<i>American Avocet</i>		
<i>Buff-breasted Sandpiper</i>		



The Incredible Journey

Adapted with permission from "Ecosystem Matters: Activity and Resource Guide for Environmental Educators," Rocky Mountain Region of the USDA Forest Service.

Grade Level: upper elementary/middle school

Duration: 1 hour to 1 hour and 30 minutes

Skills: comparison of similarities and differences, critical thinking, vocabulary, discussion, observation, and prediction; using technology (with additional activities)

Subjects: science, physical education, social studies, geography, history, and math; technology (with additional activities)

Overview

Through an active simulation game, students learn about the many threats shorebirds face on their migratory journeys.

Concepts:

- During each year of their lives, most shorebirds migrate between habitats located in different geographic areas.
- Arctic-nesting shorebirds undertake some of the longest migrations of any animals.
- Migratory shorebirds depend on at least three habitats: breeding, nonbreeding, and migratory stopover sites.
- Shorebirds concentrate in great numbers at their stopover sites.
- Because shorebirds fly together in large numbers, their populations are extremely vulnerable to threats along their migratory routes.
- Most important migratory stopovers are nutrient-rich habitat, like estuaries, which also provide resources desirable to humans, making them vulnerable to alteration, pollution, and destruction.

- Shorebirds migrate between northern breeding areas and southern wintering areas to take advantage of seasonal food resources.

Vocabulary

- aquatic habitat
- aquatic insects
- breeding grounds
- nonbreeding grounds
- body mass
- clutch
- fat loading
- fledging
- flyway
- foraging
- invertebrates
- juvenile
- migrate
- migration route
- nesting
- pesticide
- pothole
- predator
- probing
- shorebird
- species
- survivorship
- territory
- wetlands
- amphipods
- critical habitat
- Central Flyway
- Atlantic Flyway
- Pacific Flyway

Objectives

After this activity, students will be able to:

- List five characteristics unique to shorebirds.
- Locate the three main flyways in the United States.
- Name four hazards shorebirds encounter along their annual migrations.
- Explain why these birds migrate from the far north to the far south of the Western Hemisphere.
- Explain what "fat loading" is and why it is important to migrating shorebirds.

Materials

- Playing field or gymnasium
- Cones, string, rope, or hula hoops to mark breeding grounds, wintering grounds, and staging areas
- One classroom set of Northern, Southern and Staging Area Cards
- *Western Hemisphere Shorebird Reserve Network Poster* (included with the education guide)

Introduction

There are approximately 50 different species of shorebirds throughout North America. Most shorebirds spend their summers in the northern areas of the United States, Canada, and Alaska and *migrate* to southern United States, Central America, and South America to spend their winters where food is available. The White-rumped Sandpiper, for example, migrates each year from the Arctic Circle to the southernmost tip of South America and back, a round trip of 20,000 miles every year! However, not all shorebirds migrate such long distances. Some, like the American Avocet, breed in the north and winter in the southern part of the United States.

In North America, three primary flyways are heavily used as *migration routes*, connecting the shorebirds' *breeding grounds* in the north to their *nonbreeding grounds* in the south. The *Pacific Flyway* follows the coast from Alaska to the southern part of South America. The *Atlantic Flyway* runs along the Atlantic Coast from northwestern Canada to the very southern tip of South America. The *Central Flyway* stretches from north central Canada, down through the center of the United States into northern South America. The activity focuses on the Central Flyway.

To learn more about the spectacular migrations of shorebirds, read *Magnificent Shorebird Migration* found in the *Shorebird Primer*. To learn more about the threats shorebirds face along the way, as well as the ongoing efforts to protect them and their critical habitats, read *Threats to Shorebirds*, also found in the *Shorebird Primer*.

Activity Preparation

1. Read the background information *Magnificent Shorebird Migration* found in the *Shorebird Primer*. It is essential to understanding this activity. Read through the game cards as well in order to be aware of the situations presented to the students.

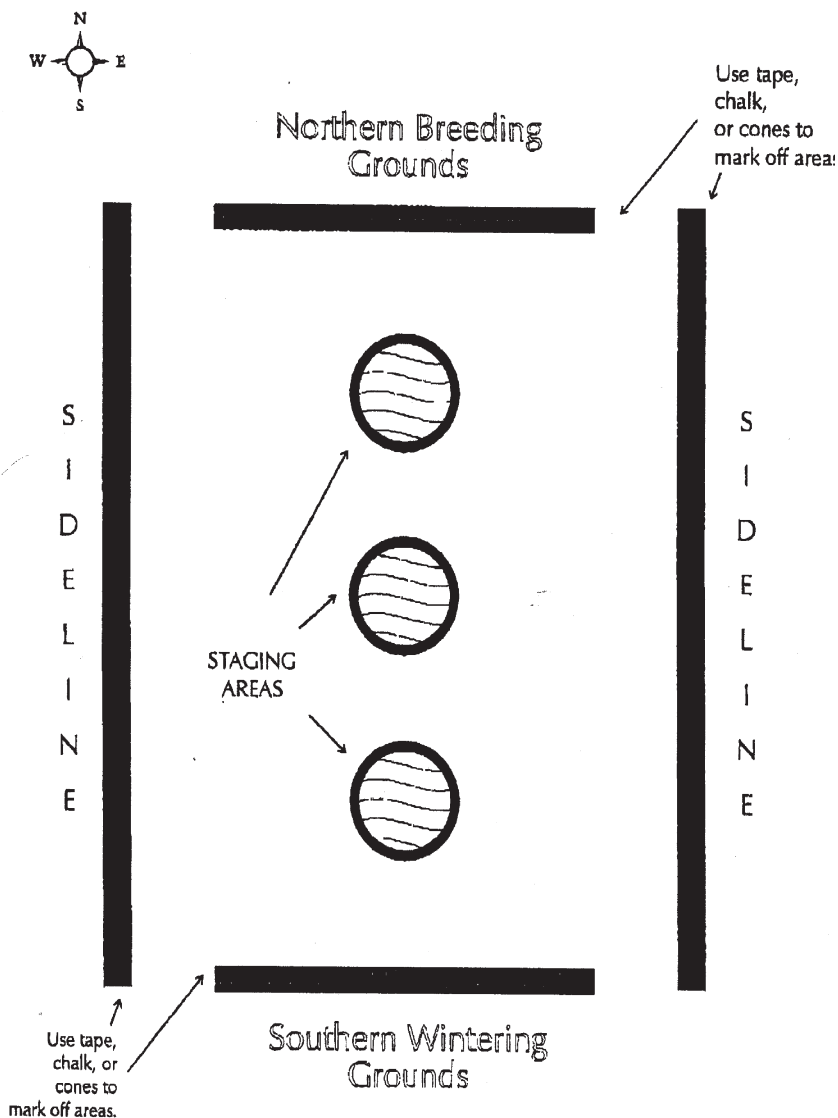
2. Photocopy and cut out the following game cards:
10-Northern Cards
10-Southern Cards
14-Staging Area Cards

3. Set up your playing field according to the directions and diagram below.

- Place a rope or other line across each end of the playing field and mark one end “the nonbreeding grounds” and the other “the breeding grounds.”

- Place three circles in the playing field, using rope or hula hoops. The circles represent staging areas.

4. Disperse the Staging Area Cards evenly among the three staging circles. Spread the Northern Cards in the breeding area and the Southern Cards in the nonbreeding grounds.



Procedure

1. Talk briefly about *migration*, *staging areas*, *breeding grounds*, and *nonbreeding grounds*. Explain that students will be migrating shorebirds. Locate the three main flyways on a map of North and South America, using the *Western Hemisphere Shorebird Reserve Network Poster* with the education guide. For purposes of this game, players are to imagine they have migrated on the Central Flyway.

2. Explain how the game works.

- Each player must pick up one card at the wintering ground, each staging area, and the breeding ground.
- Players must follow the directions written on the cards and return the cards to the pile before they continue their migrations. For example, a card from the breeding grounds may instruct its holder to take a person who has been labeled “dead” by another card and return him or her into the game as a young bird.

- Any player who picks up a card indicating death of the bird must drop out of the game and stand along the sidelines until there is an opportunity to rejoin the game.
- 3. Select one or two players to represent the Peregrine Falcon and/or the Merlin as predators in flight. Their job is to tag students as they move among the staging areas. They must escort each tagged victim to the edge of the playing field before tagging another migrating student.
- 4. As the players run to the other side of the playing field, they must stop at each of the staging areas to refuel (unless otherwise instructed). They collect one card at each staging area and follow the directions on the card.
- 5. Players must make four complete migrations (from south to north and back to south). Each migration (in one direction) will begin with a signal from the teacher.
- 6. Plot the survival rate of each migration. Discuss some of the following questions to identify what affected the survival rate.
 - What were some of the unexpected situations described on the cards? How did these things affect migration?
 - What events caused bird deaths? Which were “natural” and which were “human-caused?” List these on the chalkboard.
 - Discuss the list of “human-caused” deaths and evaluate the pros and cons of each situation. How do people’s actions affect other animals and each other? (DDT is an insecticide used to protect crops from damaging pests. It has been outlawed in the United States for over 20 years. Scientists discovered that DDT can be passed on from one animal to another, poisoning all the organisms it comes in contact with.)
 - What are some of the weather changes shorebirds experience during their migration?

Additional Activities



Cultural Connections

- After the activity, lead a discussion with students discussing cultural beliefs about the environment and their influence on survival of shorebirds.
- Students can pretend to be shorebirds migrating from Paraguay to Nunavut, Canada. They can research Spanish and Inuit or French words, phrases, or sentences to speak to each other when they arrive in those countries—phrases such as “welcome,” “I am hungry,” and “be careful.” Students can also work with the school’s Spanish or French teacher to come up with words and sentences.

Prairie Pothole/Playa Lake History Lesson

Ask each student to search for ten facts regarding the formation and history of the Prairie Pothole or Playa Lake Region in the central United States. Have them share the information they discovered and then assemble a class report based on the facts they uncovered.

Local Shorebird Migration

Working in small groups and using the <http://sssp.fws.gov>, have your students research local shorebirds, including the migration routes they take and the places where they stop to rest and feed. Ask them to draw migration maps to plot known and possible stopover sites. Have them report on what they learned.

Local Shorebird Threats

Invite a state wildlife officer to speak to the class about what impacts the migratory birds in your community. Find out how students can help to lessen the effects of these impacts.



The Incredible Journey Game Cards

Ten - Northern Cards

(Make one photocopy.)

<p>NORTHERN CARD Bad news! Unusually bad weather has limited your feeding time. You are too weak to make it to the first staging area. You die and must go to the sideline.</p>	<p>NORTHERN CARD Severe weather in the Arctic tundra kept you from laying eggs. You have difficulty finding a sufficient supply of invertebrate prey (animals you eat). You struggle to keep up with the flock. Hop on one foot to your first staging area.</p>
<p>NORTHERN CARD Yeah! Good weather and only a few predators have made it a great nesting season. Pick two people from the sidelines to migrate with you.</p>	<p>NORTHERN CARD Lost wetlands on the way to your breeding grounds made you late and weak. You do not have time to reproduce. Crane flies and bloodworms are abundant so you double your weight. Begin your migration.</p>
<p>NORTHERN CARD Hurrah! It's been a warm, wet summer. There was an abundance of shoreflies and danceflies to feed on. Your nesting is successful. Take one person from the sidelines with you. Begin migration.</p>	<p>NORTHERN CARD Yikes! It's been a good year for weasels and a bad year for eggs. None of your young survive. Food was abundant. Begin migration.</p>
<p>NORTHERN CARD Great! You have successfully hatched and fledged one of your young. Pick one person to migrate with you.</p>	<p>NORTHERN CARD You are young and are not able to put on a sufficient fat load before migration begins. You are not so strong as the adults. Skip to the first staging area.</p>
<p>NORTHERN CARD Bummer! A large fox population this year has increased fatalities. You are eaten. Go to the sidelines.</p>	<p>NORTHERN CARD Yum! There is an abundance of amphipods and snails this year. You have easily doubled your body weight. You have had a successful nest. Take two people to migrate with you. Begin migrating!</p>



The Incredible Journey Game Cards

Ten – Southern Cards

(Make one photocopy.)

<p>SOUTHERN CARD Yippee! It's been a good winter! A new wetland reserve area has been added to your winter grounds. There was plenty of food. Fly to your first staging area.</p>	<p>SOUTHERN CARD Yuck! You are feeding on aquatic insects contaminated with DDT from the runoff of agricultural lands surrounding your wetland habitat. You become sick and die. Go to the sideline.</p>
<p>SOUTHERN CARD How disappointing! You have had a rough nine months at your wintering grounds. Part of the wetland you have always returned to has been drained, causing more birds to compete for less food. You are weak. Hop on one foot to the first staging area.</p>	<p>SOUTHERN CARD Bang! Hunting of shorebirds is still legal in South America. A hungry hunter shoots you. Go to the sideline.</p>
<p>SOUTHERN CARD Too bad! Agriculture is spreading on your wintering grounds and, as a result, so is DDT. You die from pesticide poisoning. Go to the sideline.</p>	<p>SOUTHERN CARD You're starving! Overcrowding due to the loss of wetlands has increased competition for what little food there is. You do not have an adequate fat load and your migration is difficult. You may skip to your first staging area.</p>
<p>SOUTHERN CARD Oh no! More wetlands have been drained and turned into agricultural areas. You are unable to find enough food and eventually die. Go to the sidelines.</p>	<p>SOUTHERN CARD Moo! The cattle industry is booming in South America. Your winter habitat is severely overgrazed, making it difficult to eat enough to put on an adequate fat load for migration. You must skip to your first staging area.</p>
<p>SOUTHERN CARD Worms! Oodles of freshwater worms! It's been a great winter with lots of food. You easily increase your body weight from 20 grams to 40 grams for the long migration to the Arctic tundra. Migrate to the first staging area.</p>	<p>SOUTHERN CARD Good news! Educating people about the need to preserve wetlands has paid off. More wetlands mean more food. You begin your next migration in good health.</p>



The Incredible Journey Game Cards

Fourteen – Staging Cards

(Make one photocopy.)

<p>STAGING AREA Bye, bye! You did not find enough food to replenish your fat load, and the flock you were traveling with has left without you. You must wait one turn to continue on with another flock.</p>	<p>STAGING AREA This is unnerving! You are on the perimeter (outer edge) of the flock and must constantly be on the look-out for predators. You do not eat enough to put on an adequate fat load. Hop to the next staging area.</p>
<p>STAGING AREA Gobble, gobble! You have had warm weather and abundant food at this staging area. You have easily increased your weight by 100%! Begin your migration again.</p>	<p>STAGING AREA Yikes! Your usual staging area has been drained for farming. You must scrounge to find enough food for the next leg of your journey. Hop on one foot to the next staging area.</p>
<p>STAGING AREA Bad stuff! You find that this staging area has been contaminated with pesticides from surrounding agricultural lands. You become ill and die. Go to the sideline.</p>	<p>STAGING AREA WHEEEEEEEE! You've got a full stomach and a tail wind pushing you on to your next staging area. A predator can't even catch you! Arrive at your next staging area quickly and safely.</p>
<p>STAGING AREA Brrrr! Bad weather makes for a slow migration! Side step to your next staging area.</p>	<p>STAGING AREA Bad stuff! Bad weather makes for a slow migration! Side step to your next staging area.</p>
<p>STAGING AREA What? Your usual staging ground is swarming with people! A new recreation center has opened at your staging area. Being around so many people makes feeding difficult. You do not store enough energy. Walk to your next staging area.</p>	<p>STAGING AREA Hooray! The Western Hemisphere Shorebirds Reserve Network has done a great deal to preserve important shorebird sites along your migration route. You find a surplus of food and quickly refuel for your continued migration.</p>



The Incredible Journey Game Cards

Fourteen – Staging Cards

(continued)

(Make one photocopy.)

<p>STAGING AREA Gooney! You find one of your coastal staging areas covered in oil. You become covered with the thick goo and are unable to eat, fly, or maintain any body heat. You die. Go to the sideline.</p>	<p>STAGING AREA Ugh! You have run into a head wind (wind blowing against you) and you are burning up a lot of energy. Take two steps forward and one step back as you make your way along your migration.</p>
<p>STAGING AREA Whoopee! Education about wetlands has gained public support for the restoration of wetland areas. You have an abundance of snails and freshwater worms to feed on! You begin your migration in good health.</p>	<p>STAGING AREA ZAP! New radio towers have been built across your migration route. You are zapped and die. Go to the sideline.</p>
<p>STAGING AREA You find yourself feeding in the safety of the flock. Craneflies, danceflies, and shoreflies are abundant. You double your weight easily. Move on to the next staging area.</p>	



Precarious Paths

Adapted with permission from "New Jersey's Shorebirds: A Local and Global Perspective." New Jersey Audubon Society. 1998.

Grade Level: upper middle school/ high school

Duration: one class period

Skills: vocabulary, discussion, critical thinking, collection and interpretation of data, presentation, and comparison

Subjects: science, geography, and language arts; fine arts (with additional activity)

Concepts:

- During each year of their lives, most shorebirds migrate between habitats located in different geographic areas.
- Arctic-nesting shorebirds undertake some of the longest migrations of any animals.
- Shorebirds migrate between northern breeding areas and southern wintering areas to take advantage of seasonal food resources.
- Migratory shorebirds depend on at least three habitats: breeding, nonbreeding, and migratory stopover sites.
- Most migratory stopovers are nutrient-rich habitat, like estuaries, which also provide resources desirable to humans, making them vulnerable to alteration, pollution, disturbance, and destruction.

Vocabulary

- migration
- migration flyway
- Pacific Flyway
- Atlantic Flyway
- Central Flyway
- threat
- predator
- bird-banding
- stopover site
- distraction display
- incubate
- mate

Overview

Students read clue cards to map the migration paths of their “mystery shorebirds.”

Objectives

After this activity, students will be able to:

- Describe factors that affect shorebird migration.
- Label the three major migration routes of North American shorebirds.

Materials

- One copy for each student of the *Blank Western Hemisphere Map* measuring tool
- pencils or markers
- Copies of the *Shorebird Clue Cards* so each student has one to four cards
- Additional geography resources
- One overhead transparency of the *Western Hemisphere Migration Flyways Map*

Introduction

Shorebirds experience incredible *migration* journeys that follow the same general paths each year. Their migration is subject to weather, food availability, predators, changes in habitat, pollution, and other human-induced disturbances. Each species of shorebird has specific needs that dictate its selection of feeding, resting, and breeding sites.

For more specific information about shorebird migration, read *The Magnificent Shorebird Migration* and *Shorebirds Depend on a Chain of Healthy Wetlands* in the *Shorebird Primer*.

Activity Preparation

1. Photocopy the *Blank Western Hemisphere Map* so there is one for each student.
2. Make a transparency of the *Western Hemisphere Migration Flyways Map*

3. Decide which Shorebird Clue Cards you will use for the activity. Photocopy and cut the cards so each student will get between one to four cards.

Procedure

1. Pass out a *Western Hemisphere Map* to each student. Have the students identify the countries and bodies of water shown on the map by using additional geography resources.
2. Introduce the concept of migration flyways. Using the transparency of the *Western Hemisphere Migration Flyways Map*, show students the routes of the three flyways of North America. Ask each student to identify the flyway route of his or her shorebird.

Atlantic Flyway: Red Knot and Ruddy Turnstone

Central Flyway: Marbled Godwit

Pacific Flyway: Western Sandpiper

3. Now that each student has identified the flyway his or her shorebird uses, have students work together to assemble a six-piece shorebird migration story. (Note: the Marbled Godwit has eight cards in the story.)
4. Once the teams are confident they have pieced their entire story puzzles together correctly, ask them to mark the bird's location on their migration maps. If a team's bird is not clearly following one of the three flyways, have the team check its story cards against the master. Once all the teams are done, have each one read its shorebird's migration account to the class. Have teams use the migration map as a visual aid.
5. Ask the students to use additional resources (bird books,



the Internet, the Audubon Society, or the *Shorebird Profiles* located in the *Appendix* of this education guide, etc.) to find out about their shorebird's life history. Have them prepare a written, oral, or visual presentation about the shorebird that includes the following:

- the bird's migration route
- what challenges (threats) the bird encountered
- whether or not the bird had chicks and if not, why and what it did instead

6. Discuss some of the following questions with the class.

- Why do different types of shorebirds use different migration routes? Why do some use different routes in the spring and fall?
- Why do they stop along the way? What would happen to these birds if pollution or development changed the stopover sites they depend on?
- How are the habitat requirements different and similar for each bird on both their breeding and nonbreeding territories?
- Which habitats are important for resting and feeding as the make their migration flights?

Additional Activities



Cultural Connections

- Students can write additional precarious paths clue cards that describe the interactions among the shorebirds and the cultural groups along their migration paths.
- Students can research the Exxon Valdez oil spill and how it impacted the communities along the coast and the birds.

Salt Clay Migration Map

Create either a classroom-sized map of the Western Hemisphere or have each student create his or her own map using the recipe below. After the clay has dried thoroughly, use acrylic paint to color the map in order to identify landforms. For example, paint the rivers and lakes blue, the mountain ranges brown, and the prairie areas light green. Then use pins and string to chart out the migration route of each of the shorebirds described in this activity. Include a picture of the birds and a short biography of each to display below the map. Give students the choice of also researching the migrations of other shorebirds and adding them to the map.

Salt Clay Map

2 cups flour
1 cup salt
1 tablespoon alum (You must include this!)
1 cup water

Stir ingredients and then knead until smooth and blended. Use a 12" x 18" board or heavy cardboard to hold an individual map. If making a classroom map, double or triple the recipe as needed.



Precarious Paths Clue Card Red Knot (Atlantic Flyway)

(Make one photocopy.)

Precarious Paths Clue Card-Red Knot	Precarious Paths Clue Card-Red Knot
<p><i>January 8th</i> There are thousands of us feeding on the sandy beaches and mud flats at the southern tip of South America in Tierra del Fuego. I spend most of the day feeding in the mussel beds, devouring young mussels. The rest of the time I roost and preen with the rest of the flock.</p>	<p><i>March 14th</i> I arrived on the central coast of Argentina to feed again on the invertebrates living in the mud of the immense tidal sand flat. I need to increase my body weight by 80 percent and to do that I eat a lot of the small snails found here.</p>
Precarious Paths Clue Card-Red Knot	Precarious Paths Clue Card-Red Knot
<p><i>May 19th</i> After a nonstop flight to the northern coast of South America, then across the ocean, I arrived on the sandy beaches and tidal flats of the Delaware Bay. There are about 50 to 100,000 of us here with tens of thousands of other shorebirds. We are all here for one reason: food! Horseshoe crab eggs galore! We eat and eat and eat...that is unless we are sleeping or trying to stay away from people and other animals.</p>	<p><i>May 31st</i> I weigh so much that I don't think I can lift off the ground, but late in the afternoon, the incoming tide pushes me and the flock higher up on the beach. We all move away from the advancing water, moving as one. Someone jumps a certain way and we are all up in the air, flying north, knowing that we will not stop until we fly over Hudson Bay and reach the Arctic tundra.</p>
Precarious Paths Clue Card-Red Knot	Precarious Paths Clue Card-Red Knot
<p><i>June 3rd</i> As we fly over the northern Canadian tundra pools and hummocks of the Melville Peninsula, I leave the flock and fly down to a barren area scattered with vegetation. It is here that I will find my mate and we will spend the next six weeks establishing a nest, incubating the eggs, and raising our young.</p>	<p><i>July 18th</i> Leaving our young behind, I make it to James Bay. This is my favorite spot on my southward migration. The tidal mud flats are full of clams. From here I will follow the west winds to the Atlantic coastline where I will feed almost constantly until late August. The best places to stop along the coast are national and state refuges, parks, and forests. By September I'll be ready for the nonstop, four-day flight over the ocean to Suriname. I'll rest and feed before my return flight to Tierra del Fuego, Argentina.</p>



Precarious Paths Clue Card Ruddy Turnstone (Atlantic Flyway)

(Make one photocopy.)

Precarious Paths Clue Card-Ruddy Turnstone	Precarious Paths Clue Card-Ruddy Turnstone
<p><i>April 10th</i> I have been working my way northward for the past month or so, finding many sandy beaches and mud flats in coastal south Florida. Much of my time is spent looking for food by turning over stones and seaweed to look for and catch my preferred food – sand fleas. But I will eat anything I can scavenge, such as dead animals and bits of food left over from other animals feeding.</p>	<p><i>May 16th</i> For the last couple of years, I stop along the Delaware Bay to gorge myself on horseshoe crab eggs. I feed a little differently than the other shorebirds that join me – I dig up the eggs that are right under the surface, while they pick the eggs up off the surface. I guess in this way I am making more eggs available to everyone.</p>
Precarious Paths Clue Card-Ruddy Turnstone	Precarious Paths Clue Card-Ruddy Turnstone
<p><i>June 3rd</i> I thought I ate enough horseshoe crab eggs so I could fly directly to my breeding grounds, but I guess I didn't gain as much weight as usual. I stop at Churchill, on the Hudson Bay to feed along their jetties before continuing. I hope I will have enough time to select a mate and nest.</p>	<p><i>June 16th</i> I arrive on the breeding grounds north of Hudson Bay and look for the location I have used in the past. The boulder on the tundra is an ideal place for me to perch and call and watch for predators. As I touch down, I am immediately assaulted by another Ruddy Turnstone, driving me out of range.</p>
Precarious Paths Clue Card-Ruddy Turnstone	Precarious Paths Clue Card-Ruddy Turnstone
<p><i>July 8th</i> As much as I try, I am unable to find a suitable nest site and available mate. Leaving the breeding grounds early, I head south. Along the way I meet up with other Ruddy Turnstones and we form small flocks as we work our way down the Atlantic coastline, stopping at Parker River National Wildlife Refuge in Massachusetts, Pea Island National Wildlife Refuge in North Carolina, and Sapelo Island National Estuarine Reserve in Georgia.</p>	<p><i>September 4th</i> After we depart from the national wildlife refuges and sanctuaries at the southern tip of Florida, our small flock arrives in northern Argentina. This is the same beach I started out at last season when I migrated north. We spend most of our time feeding and preening. I hope that next year I can make it back to the Arctic with plenty of energy and plenty of time to breed.</p>



Precarious Paths Clue Card Marbled Godwit (Central Flyway)

(Make one photocopy.)

Precarious Paths Clue Card-Marbled Godwit	Precarious Paths Clue Card-Marbled Godwit
<p><i>April 15th</i> Well, I'm fattening up on worms and insect larvae in the mudflats of Humbolt Bay. I'll soon be ready for my journey to the Canadian grasslands to nest.</p>	<p><i>April 30th</i> I made it to the Great Salt Lake. I'll rest and eat here for a couple of weeks before I continue my long flight. I will stop once more at Benton Lake, Montana before reaching the breeding grounds.</p>
Precarious Paths Clue Card-Marbled Godwit	Precarious Paths Clue Card-Marbled Godwit
<p><i>June 4th</i> I've arrived at Quill Lakes in Saskatchewan, Canada. I quickly recognized my mate's call, the same male I have nested with for the past four years! We better hurry to choose a nest site and scrape a simple hollow in the grass so I can lay our eggs. We'll nest in the dry uplands of the grasslands not too far from the lake.</p>	<p><i>June 15th</i> This morning I had a frightening experience! When I was searching for grubs and insect larvae in the grass, a man grabbed me! He put these funny-looking bands on my legs—a silver one, bright red and orange ones, and a white one with an end sticking out. These odd bands don't bother me when I walk or fly, but they sure do look funny. I wonder what they mean?</p>
Precarious Paths Clue Card-Marbled Godwit	Precarious Paths Clue Card-Marbled Godwit
<p><i>June 30th</i> Our four spotted eggs hatched just when they were supposed to, about 24 days after I laid them. Our chicks are already pecking for insects in the grass. They surely are a hungry bunch!</p>	<p><i>August 14th</i> It's time to head south again before winter blows in. It's lonely migrating all by myself, but it will be good to get to those wonderful sand crabs—a change from my summer diet in the grasslands.</p>
Precarious Paths Clue Card-Marbled Godwit	Precarious Paths Clue Card-Marbled Godwit
<p><i>September 15th</i> I stop to rest and feed at Antelope Island State Park in the Great Salt Lake. It's a wonderful smorgasbord of food here! There's thousands of other birds here too!</p>	<p><i>November 10th</i> I made it! I completed another successful flight down to Humbolt Bay, California. Many of us Marbled Godwits continue even farther south to Bodega Bay or to the west side of the Gulf of California. Me, I'm satisfied to stay here and spend the winter resting and eating.</p>



Precarious Paths Clue Card Western Sandpiper (Pacific Flyway)

(Make one photocopy.)

Precarious Paths Clue Card-W.Sandpiper	Precarious Paths Clue Card-W.Sandpiper
<p><i>April 10th</i> Everyone's flocking up, getting ready for our long trip north to the breeding grounds. It's amazing having so many of us together at one time. We'd better hurry; we've got a long way to fly, starting way down here along the coast of Peru!</p>	<p><i>April 20th</i> After stopping at several locations to rest and refuel, we've made it to the United States at the national wildlife refuges in San Diego Bay. We'll rest and refuel in the mudflats before heading to our next stop-- San Francisco Bay National Wildlife Refuge.</p>
Precarious Paths Clue Card-W.Sandpiper	Precarious Paths Clue Card-W.Sandpiper
<p><i>May 10th</i> After leaving Oregon Island National Wildlife Refuge, we stopped at Nisqually National Wildlife Refuge before heading to the nutrient-rich Alaska coast!</p>	<p><i>May 20th</i> I bet there are one million of us here at Alaska's Copper River Delta. This is a wonderful stopover site along our way north. The endless mudflats give me a chance to probe the mud for tiny clams, worms, and sand fleas until I replace some of the body fat I used getting here. I'm going to need the energy to make it all the way up into northwestern Alaska.</p>
Precarious Paths Clue Card-W.Sandpiper	Precarious Paths Clue Card-W.Sandpiper
<p><i>June 1st</i> Looks like the males have beaten us here to the Alaskan Artic Tundra of the Arctic National Wildlife Refuge. Well, that's O.K. They've already selected nesting sites, so all I have to do is choose a mate and lay my eggs.</p>	<p><i>June 10</i> I'm so glad that my mate and I take turns incubating the eggs. That gives me a chance to feast on the large numbers of insects that are hatching now. I'd better watch out while I'm feeding. The Arctic fox is always looking to make a meal out of us shorebirds!</p>

Precarious Paths Clue Card Western Sandpiper (Pacific Flyway)

(continued)

(Make one photocopy.)

Precarious Paths Clue Card-W.Sandpiper	Precarious Paths Clue Card-W.Sandpiper
<p><i>June 24th</i> Here we go again! Those gulls are nasty predators and are after our chicks. Maybe I can distract them with the “broken wing act” while my mate leads our chicks to safety. Looks like they’ve seen this trick before and aren’t falling for it this time.</p>	<p><i>July 18th</i> Having left the young behind, I fly to Kachemak Bay at the Alaska Maritime National Wildlife Refuge, then to Stikine River Delta along the Canadian coast. This is my favorite spot on my southward migration because of the abundance of clams in the tidal mudflats. Then I will travel along the coast line, stopping every couple hundred miles. We take our time getting home.</p>
Precarious Paths Clue Card-W.Sandpiper	Precarious Paths Clue Card-W.Sandpiper
<p><i>August 30th</i> We have arrived at Marismas Nacionales near Tepic, Mexico. This is a great place to rest. In fact, some Western Sandpipers will stay here all winter. I will continue to Peru with one stop in Panama before arriving.</p>	<p><i>August 15th</i> I’m glad to be back in Peru for the winter. I need a rest! Every year the trip gets harder for me. There are so many people along the coast who disturb me when I try to rest and feed along the way. Sometimes the food has a strange, unfamiliar taste that makes me feel weak. Well, at least I can rest here for a few months and regain my strength.</p>



*Map provided
by New Jersey
Audobon Society*

Bird's-eye View

Adapted with permission from Quinlan, "Alaska Wildlife Week."

Grade Level: upper middle school/ high school

Duration: several 30-minute class periods

Skills: visualization, communication, vocabulary, and discussion; using technology (with additional activities)

Subjects: science, social studies, geography, fine arts; language arts and technology (with additional activities)

Concepts:

- During each year of their lives, most shorebirds migrate between habitats located in different geographic areas.
- Arctic-nesting shorebirds undertake some of the longest migrations of any vertebrates.
- Migratory shorebirds depend on at least three habitats: breeding, nonbreeding, and migratory stopover sites.
- Some shorebirds concentrate in great numbers at their stopover sites.

Vocabulary

- migration
- stopover site
- geography
- climate
- breeding grounds
- landmarks
- habitat
- flock

Overview

Students imagine that they are migratory shorebirds and design an illustration that conveys the length and difficulty of the trip, as well as the landmarks, habitats, and stopover sites they pass over along their way.

Objectives

After this activity, students will be able to:

- List at least three important landmarks to a migrating shorebird.
- Write a paragraph describing the migration of one type of shorebird, including where it starts and ends its journey, where it stops to feed, what it eats along the way, and the important landmarks it passes.
- Translate the paragraph into a picture that depicts the migration of the same shorebird.

Materials

- A roll of butcher paper
- One large sheet of drawing paper per student
- Drawing materials like charcoal and colored pencils, markers, crayons, or paints
- Shorebird research materials, including the Shorebird Profiles (found in the Appendix) and an assortment of resource books (located in the Appendix)

Introduction

There are approximately 49 different species of shorebirds throughout North America. Most shorebirds spend their summers in the northern areas of the United States and Canada and *migrate* to the southern United States, Central America, and South America to spend their winters where food is available. The White-rumped Sandpiper, for example, migrates each year from the Arctic Circle to the southernmost tip of South America and back--a round trip of 20,000 miles every year! However, not all shorebirds migrate such long distances. Some, like the American Avocet, breed in the extreme north and winter in the southern part of the United States.

In North America, shorebirds use three primary *migration routes* (flyways) that connect their *breeding grounds* in the north to their *wintering grounds* in the south. Each of these flyways is characterized by unique physical features, wetland habitats, and stopover sites. To learn more about the spectacular migrations of shorebirds, read *Magnificent Shorebird Migration* found in the *Shorebird Primer*.

Procedure

1. Ask students to remember what the world looks like from the view of an airplane, the top of a tall building, or the ridge of a mountain. Have they ever looked down on the tops of trees, clouds, a river, or a coastline? What was the purpose of their journeys? Did they look forward with anticipation to the sight of their destination? Did they anticipate a change in climate and geography?
2. Ask them to imagine what the world looks like to a migrating shorebird in the spring or in the fall. How high does the shorebird fly? What kinds of landmarks might be important to a shorebird? What kind of weather would it have to endure? What would it see? Make a class list of the answers your students provide.

Possible responses: the shoreline; estuaries, river deltas, or other types of wetlands; receding ice or snow; other shorebirds flying, landing, feeding, or roosting together, perhaps in large flocks; treetops; the height of the tide; storms; clouds; warm sunshine; people with binoculars; towns and cities; bare plowed fields where there used to be a marsh



3. Ask the students to select a species of shorebird for this activity. Have them learn all they can about the bird they select. What does it eat? Where does it breed? What flyway does it take to its nonbreeding grounds? Where does it spend its winters?
4. Ask the students to draw or paint a picture of the world from the viewpoint of the migrating shorebird. Encourage them to accurately portray the habitat the bird might pass over, the length of the journey, the altitude the bird is flying, and the feel of the air.
5. Have them use the butcher paper to sketch a layout of their picture and practice drawing in aerial perspective. When they are satisfied with their mock-up, they can transfer their ideas onto the final drawing paper.

Additional Activities



Cultural Connection

Students add information related to the cultural groups along the shorebirds' migration routes.

Shorebird Migration Stories

Ask students to write a story describing their shorebird's migration to accompany their drawing. What did it see and hear along the way? Where did it stop to rest and feed? What was it like at this stopover site? How long was the journey? How did it feel to finally reach the breeding ground?

Shorebird Migration Play

As a cooperative project, have the class select one of the shorebird migration stories and turn it into a dramatic play. Divide the class into teams to prepare costumes, design the set, write the dialogue, and act out the parts. Videotape the production and design special invitations to a live performance.



Shorebird Research and Technology

Concepts

- Research is vital for shorebird conservation.
- Through research we learn what shorebirds need and what we can do to conserve them.
- Some shorebirds concentrate in great numbers at their stopover sites, which provide large populations of birds for study.
- There are many tools researchers use to collect information about shorebirds.
- The Scientific Method of Inquiry is the method researchers use to develop a clear hypothesis and a strong study plan.
- Technology provides vital tools for research.
- There are still many unanswered questions about shorebirds and how we can conserve them best.

Activities

Banded Birds

*(upper elementary school/
middle school)*

Students conduct a banding simulation in which they attach colored construction paper armbands to a group of classmates and then observe and record its behavior over the course of a school day.

Bird Beans

*(upper elementary school/
middle school)*

Using beans and their desktops, students learn and practice techniques for estimating a population of shorebirds.

You Be the Scientist

(upper middle school/high school)

Students work in pairs to develop a study plan that will help them investigate a question about shorebirds.

Imaginary Mist Nets

(upper middle school/high school)

Students create a study plan to answer a research question, they “band” their fellow students and collect data to answer their question.

Shorebirds on the Web

(all levels)

Students use the computer as a resource tool to learn about shorebirds, ecology, wetlands, other cultures, and ecosystems, while at the same time they discover computer technology that will help them throughout their school years and beyond.



Banded Birds

*Adapted with permission from
“One Bird, Two Habitats.”
Wisconsin Department of Natural
Resources.*

Grade Level: upper elementary school/middle school

Duration: one 30-minute class period to one full day, depending on the option selected

Skills: vocabulary, discussion, collection and interpretation of data, formation of hypotheses, observation, communication/presentation, evaluation, and team building

Subjects: science and math

Concepts

- Research is vital for shorebird conservation.
- Through research we learn what shorebirds need and what we can do to conserve them.
- Some shorebirds concentrate in great numbers at their stopover sites, which provide large populations of birds for study.
- There are still many unanswered questions about shorebirds and how we can conserve them best.
- There are many tools researchers use to collect information about individual birds, as well as an entire population of shorebirds.
- Bird banding is one tool researchers use to collect information about individual birds, as well as entire populations of shorebirds.

Vocabulary

- banding
- population
- sample size
- individual
- mist net
- cannon net
- random sample
- color bands
- breeding ground
- migration flyway
- nonbreeding area

Overview

Students conduct a banding simulation in which they attach colored construction paper armbands to a group of classmates and then observe and record the students behavior over the course of a school day.

Objectives

After this activity, students will be able to:

- Give a general description of bird banding.
- Describe the two types of bird bands and the way they are used to provide research data.
- Explain why bird banding is an effective research tool.

Materials

- Ruler
- Colored construction paper
- Masking tape
- One copy of the *Banding Birds* reading for each student

Optional

- Clipboards or shorebird notebooks assembled as described in the *Activity Preparation* section

Introduction

Banding is an important method of capturing and marking animals for study. It allows close examination of live birds, which is often the only way of determining sex, age, race, and breeding condition. Because many members of a single shorebird species can look alike to people, banding allows biologists to tell shorebirds apart.

When banding and observations are carried out in many places around the world, important information can be gathered about migration routes, destinations, and behaviors. Banding individuals is one of the most important tools in studying many aspects of behavior and biology of birds in their natural habitat.

It is often impossible to capture and mark an entire *population*, be it a group of shorebirds that breeds locally, a group using the same migratory flyway, or other designated population. If a large enough *sample size* can be studied, it is not always necessary to study the entire population. Since scientists can seldom study every *individual* of a population, a *random sample* provides information that accurately represents the entire population.

Biologists use three methods of marking shorebirds: individual numbered metal bands, individual colored plastic bracelets, or a *color band* for an entire group.

For more information about what these bands mean, how biologists safely capture shorebirds, and how to report a dead banded bird, read the *Shorebird Primer* section *Shorebird Technology and Research*.

Activity Preparation

1. Make a photocopy of the *Bird Banding Reading* for each student.
2. Assemble shorebird notebooks by stapling several sheets of 8½ x 11 (or smaller) paper in the middle and then folding them in half.

Procedure

1. Give each student a copy of the *Bird Banding* student reading to review before conducting this activity.
2. Begin with a class discussion on bird banding.
 - Why is it important to be able to track where shorebirds or other animals migrate? (To learn what habitats they depend on; to learn how and where different sexes, age classes, or populations interact; etc.)

- How do biologists know the destinations of migrating birds?
 - Is it possible that a different population (in this case, groups made up of a single species of shorebird) of the same species can act separately, behave differently, or rely on different places during their lives? (Yes.)
 - How do biologists know which individuals go where, since most members of the same species look alike to us, at least at a distance?
 - How would marking birds facilitate the gathering of information?
 - What are some ways in which birds can be marked without interfering with or altering their behavior? (Banding, dyeing a patch of feathers, radio tagging)
 - Can you think of other important information to be gained from marking individual birds or being able to tell populations apart? (To learn how long birds live, how large their territories are, or how they interact; to find out whether they return to the same area to feed day after day or to the same area to breed year after year; to discover if juveniles return to the area where they were hatched; and to learn how quickly the population migrates from one habitat to another, etc.)
3. Explain that students will have the opportunity to see what it is like to be a bird-bander, as well as a banded bird. However, since it requires special equipment, special permits from the federal government, and a lot of training, they will not actually be banding birds—they will be banding each other!

Option 1 — Observing Banded Birds for a Class Period

4. Have the students make bands out of construction paper that are long enough to fit around their wrists or their ankles. Using as many colors as possible, pass out two pieces (mixing colors randomly) to each student. If you have a big class or not many colors, pass out three colors to each student. (This will allow for more combinations if students wear them in different orders.) Have the students measure and cut out one 1" x 7" strip of each of their colors. These are their "bird bands."
5. Have the students attach the strips around their "bird's" wrists, one strip above the other. Both bands must be visible, placed over any long-sleeved clothing. Secure them with tape. Each student should have a different color combination.
6. Now tell them that they are banded birds and will be known today by their color combinations—"blue over red," "red over blue," or (if three colors are used) "red-green-yellow." Explain that this is how a biologist tells birds apart when they might otherwise look alike.
7. After all the birds are banded, tell the "bird biologists" to observe their "birds" in their natural habitat—in this case, the classroom. Clear the desks away or lead the class to a large open area. Designate one end of the study area as the northern shorebird "*breeding ground*" and the opposite end as the southern "*nonbreeding area*," where shorebirds rest and eat. The middle of the study area is the "*migration flyway*," the flight path shorebirds take to travel between nesting and wintering sites.

8. Divide the "banded birds" into three groups and move each group to a different location in the study area. Instruct the "banded birds" in the nesting area to sit down on the floor as though they are on their nests. "Banded birds" located along the migration route must flap their arms or make eating motions. Those in the south must also make eating motions or pretend that they are resting by standing on one foot.
9. Give the "banded birds" a few minutes to act out their parts and for "bird biologists" to observe them. Ask the "bird biologists" questions like the following:
 - Is "yellow over white" migrating or nesting? Is "red over green" a male or female?
 - Which nesting birds (answer with band combination) have blonde feathers (hair)?
 - Which migrating shorebird is flying (flapping) fastest?
 - How many wintering birds are there with green bands?

After a few minutes, instruct the "banded birds" to "migrate" to the opposite habitat and continue with more questions. Repeat this a few times.

10. Now repeat the activity, reversing the students' roles: "bird biologists" become "banded birds" and previously "banded birds" are now "bird biologists."
11. When everyone has had a chance to play both roles, discuss their observations.
 - Did any birds lose their bands?
 - Do you think you could keep your bands on all day?
 - Were any colors hard to see?
 - Did any birds have exactly the same color combination or confusing combinations?



- Was it hard for everyone to see all of the birds all of the time?
- What would this be like if you were real birds and biologists? What problems might you have?

Option 2— Observing Banded Birds for a Day (or Two)

- Assign each student a partner. Designate one student the role of “banded bird” and the other of “bird biologist.” Explain that the job of the “bird biologist” is to locate and observe the “banded bird.” The role of the “banded bird” is to go about doing what it always does.
 - Explain that each “bird biologist” has five times (which occur during the remainder of the day or the next school day) to locate and observe his or her “banded bird.” In a real shorebird study, these times might be high or low tide or early versus afternoon hours.
 - Have the “bird biologists” take out a piece of paper, or a shorebird field notebook if they have one, and instruct them to draw up a data sheet similar to the example provided. Substitute the observation times to fit your class schedule. Divide the time you have available for this activity into two rounds so that
- each student has a chance to play both roles. “Banded birds” should not know the times they will be observed! Ask students to give the table an appropriate, descriptive name. This will encourage them to keep focused on the data question and practice the skill of clear labeling.
- At the times indicated on their data tables, “bird biologists” should record in words what their “banded birds” are doing. Explain to them that you will not announce when it is time to make an observation. This would alert the “banded birds” to the fact they are being studied and may cause them to change their behaviors. If their banded birds are not present at the observation times, students should also record that on their data tables.
 - After the five observation times, have the students reverse roles. The new “bird biologists” should secretly draw up their data tables and prepare to make their observations. Make sure you give the new “bird biologists” different *observation* times.
 - When all the students have had a chance to role-play as a “bird biologist,” have them report on their findings by:

- Pooling the data on a “flock” data sheet drawn on the board. Ask the “bird biologists” to work together to determine the most common activity, any pattern of activity according to the time of day, the most unusual activity, etc.

- Using a graph that shows their results in order to identify the most common activity. Make a bar graph comparing how often an activity was observed in each time period.

- Comparing percentages of the birds not observed at each time. Determine the percentage of “bird biologists” who did not observe birds at a designated time.

- Presenting the results in a paragraph describing what they learned about their “banded birds” or about their own observation techniques.

10. Discuss the results and the following questions with the class:

- Was it easy to find your bird at the appropriate time?
- How did your bird’s activities compare to that of other birds?
- Do you know what was going on (for example, lunch, math

Data Table Example

What My Banded Bird Is Doing at Certain Times of the School Day

<i>Time</i>	<i>Description of Activity</i>
10:15	
12:35	
1:00	
2:10	
2:30	



period, physical education, class break) in the school or class during each observation time. Do you think that might have a relationship to the data results (for example, was there more running during lunch or more talking during art)?

- Did you notice any differences in the activity patterns of males and females?
- Do you think you got an accurate picture of what your bird does during the day?
- Was the sample size sufficient to give an accurate picture of bird activity?
- Did you have a banded bird that was not present? What challenges would that create for researchers?
- How could the plan we followed be modified to learn something about the specific activities of all the birds in the school? (First, come up with a study question or hypothesis. Then decide when and where would be the best time and place to collect data.)

Additional Activities

Take a Field Trip to a Banding Station

Visit a bird bander in the field or invite one to come to your school to demonstrate the proper use of bird-banding equipment. Keep in mind that banders are busiest during spring and fall migration seasons. Your local state or federal wildlife agency's migratory bird department, a local Audubon chapter, or a nearby wildlife refuge should be able to direct you to someone who bands bird in your area.

Human Labels

Brainstorm or discuss with students ways in which humans are labeled or marked, whether for study or as an aid in daily life (for example, name, Social Security Number, library card, residency status, medical identification tags, "dog tags" for soldiers).

How Do You Report a Banded Bird

If you or your students see a banded bird, it is important to report it. Color bands are reported to a different organization than silver/metal bands. To learn more, go to the Shorebird Sister Schools Web site <http://sssp.fws.gov> and click on "Tracking."



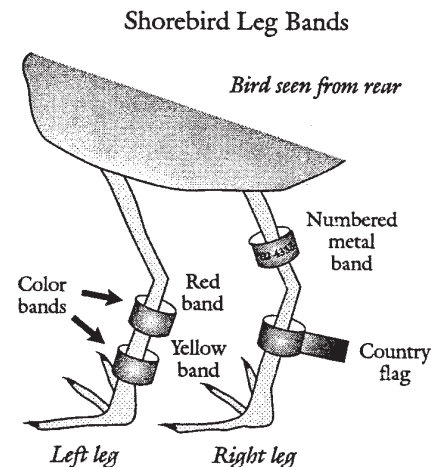
Banding Shorebirds

Scientists are still searching for answers to many questions about shorebird *survivorship*, *mortality*, and *behavior*. This information is critical to making decisions about shorebird management. We can help birds best if we understand where they live, what they need, and where they travel. *Bird Banding* is a technique to help answer many of these questions.

Whether scientists want answers about a group of local breeding shorebirds or a group using the same migratory stopover site, it is often impossible to capture and band every *individual* within the *population*. However, if a large enough *random sample* is banded, then scientists can assume that the data they collect accurately represents the entire population.

Bird banding involves attaching around the bird's leg a loose-fitting aluminum band that is coded ahead of time with a unique identification number. Biologists record the bird's age, sex, species, location of capture, and weight. If this same individual is captured somewhere else, the original data can be looked up using the bird's personal identification number. By comparing old data with current sightings, scientists can slowly piece together answers to a sort of question puzzle to create a picture of this bird's life. How far has it traveled? Where does it spend its winters? Where does it breed? How long does it live? What caused its death?

Sometimes a series of *colored bracelets* and *flags* are also attached to shorebirds. These may represent the country where the bird was banded, the banding year, and perhaps the age of the bird. The advantage of color-coded bands and flags is that it reduces the times a bird must be captured to gather information. With colored bands, researchers can observe shorebirds from a distance to gather the information they need. No matter how careful biologists are in capturing



birds, it creates stress on them and takes time away from feeding, a critical activity at their migration stopover sites.

Sometimes biologists will clip the feathers between a shorebird's shoulder blades and attach a small radio or satellite transmitter with glue. This technique allows scientists to study shorebirds in remote habitats that are difficult for researchers to get to, and it allows the birds to continue their natural behaviors that might be interrupted if people were nearby.

Bird researchers capture shorebirds with a delicate, almost invisible net called a *mist net* that is stretched across an area where birds are likely to fly at night. Another method for banding shorebirds is banding chicks that are not ready to fly. By banding birds in the year they hatch and recording their annual returns, biologists can see how long they live and if they are being replaced by a sufficient number of young. Another method, *cannon netting*, is used mostly in coastal areas. Here, a net is shot out over feeding shorebirds.

Not just anybody is allowed to capture and band birds. A special permit from the U.S. Fish and Wildlife Service is required for all bird banding in the

United States. This is to ensure that the birds are handled carefully and that the data is collected properly.

Many birds that have been banded disappear and die without the researchers knowing where, when, or why. If you find a dead bird with a band, please report it to the appropriate agency.

To Report a Metal-banded Bird

Notify your local state wildlife agency or the U.S. Fish and Wildlife Service Bird Banding Lab. Record the entire number on the band, the date you found the bird, the species (if you know it), and the exact location.

Send this information along with the band if possible, to:

Chief, Bird Banding Laboratory

Office of Migratory Bird Management
U.S. Fish and Wildlife Service
Laurel, MD 20810

Or call: 800/327 2263
or 800/327 2263

To Report a Color-banded or Flagged Bird

Describe each band: type (metal, color band, flag), colors (as exactly as possible — light green, dark blue), and location on bird (bird's left or right leg, upper or lower leg, above or below other bands). Note if you are unsure of any bands or if you did not see all parts of both legs clearly. Note species, location of sighting, date, and any other information such as behavior, other birds, etc.

Submit shorebird color band sightings by mail or the Web site:

PASP, Canadian Wildlife Service
115 Perimeter Road
Saskatoon, SK S7N 0X4
CANADA
Or
<http://www.mb.ec.gc.ca/nature/migratorybirds/pasp/dc29s01.en.html>



Bird Beans

Grade Level: upper elementary/
middle school

Duration: 30-40 minutes

Skills: critical thinking, comparison,
collection and interpretation of
data, vocabulary, discussion, and
visualization

Subjects: science and math

Concepts

- Research is vital for shorebird conservation.
- Through research we learn what shorebirds need and what we can do to conserve them.
- Some shorebirds concentrate in great numbers at their stopover sites, which provide large populations of birds for study.
- Because of this concentration, shorebird populations are extremely difficult to count.
- Estimating population trends helps alert biologists to potential problems within a habitat.

Vocabulary

- census
- population
- migration
- stopover
- sample
- bias
- camouflage
- transect

Overview

Using beans and their desktops, students learn and practice techniques for estimating a population of shorebirds.

Objectives

After this activity, students will be able to:

- Explain why biologists conduct shorebird population censuses at migration stopovers.
- Define the terms population, census, sample, and bias.
- Describe how camouflage might affect census numbers.
- Instruct another classmate on how to estimate, as accurately as possible, the population size of a

large group of moving shorebirds (or other organism).

Materials

- One copy for every two students of the *Sampling Populations* reading
- One *Bird Beans Student Worksheet* for every two students
- Large, dry beans (about two-thirds cup per pair)
- Measuring cups or paper cups
- String (about three feet per pair)
- One pair of scissors for every two students

Introduction

In their rush to get to the summer breeding grounds as soon as the weather allows, many Arctic-nesting shorebirds *migrate* almost simultaneously. They also tend to share the same important *stopover* wetlands along the migratory flyways. Flocks of shorebirds appear at these “rest stops” in the hundreds, thousands, hundreds of thousands, and even millions! Many shorebird flocks were even larger before nineteenth century market-shooters took their toll.

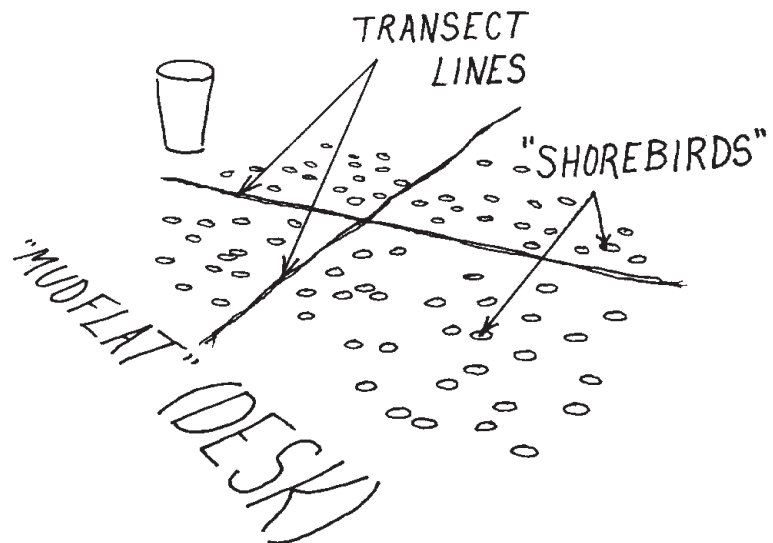
An accurate *census* (count) of these shorebirds is necessary each year,

or every several years, to note and understand any changes in the *population* sizes of these migrating birds. Significant changes in the population size may alert biologists to potential problems within the birds’ habitat.

However, counting such huge flocks before they fly away or split up is not an easy task. Working fast, yet gathering accurate numbers, is critical. Biologists have devised several methods that make counting large groups of wildlife easier.

Procedure

1. Discuss with students how large shorebird flocks can become during migration. Have older students read the *Sampling Populations* sheet. Are they ready to try counting big numbers, or do they want to learn some “tricks” to make it easier?
2. Divide students into groups of two and give each pair a Bird Beans Student Worksheet.
3. Have each pair measure and cut two pieces of string about 18 inches long.



4. Have each pair measure out two-thirds cup of beans. Tell them that each cup holds a “population of shorebirds” to estimate. If enough measuring cups are not available, or students are younger, give them each a five ounce paper cup nearly full of beans.

5. Ask them to write down quickly their best guess of how many “birds” they have in their cups. Each member of the pair may have a different guess.

6. Now have each pair spread their “birds” out on their desk which now represents a mudflat. Direct them to spread the beans in a single layer on the desk (mudflat) as evenly as possible without counting them out.

Optional: Set aside five beans. Concentrate on what five beans look like. Now try “dividing” the beans with your eyes into groups of five. Count those groups of five as best you can, either with or without using your fingers. In other words, count by fives. Do not worry about getting the exact number. Encourage students to race through this step. Repeat, using groups of ten instead of five.

7. Instruct them to divide their “birds” into two sections by laying the string across the center. Lay the other string at right angles to the first, dividing the beans into four sections of approximately equal areas.

8. Ask students to count all the “birds” in one square. Write down their answers on Line 3A and multiply this answer by four (the four quadrants).

10. Now have them count and record the number of “birds” in each of the other three squares. Follow

the directions on Line 4, add these four numbers together, and write down the result.

11. Look at the answers the students got. Compare and discuss the results as a class. Remind the students that when they look at a real flock of shorebirds, they will not be able to divide it with string or even fences. They will have to use their eyes to mentally divide either the flock (beans) or the beach (area of desk that encloses all beans) that the flock is on into equal groups of birds; then multiply to obtain the total.

■ Which was closer to the actual number — their guesses, the sum of the four counted areas, or the result of multiplying the birds found in one quarter of the area by four?

■ Who guessed high and who guessed low?

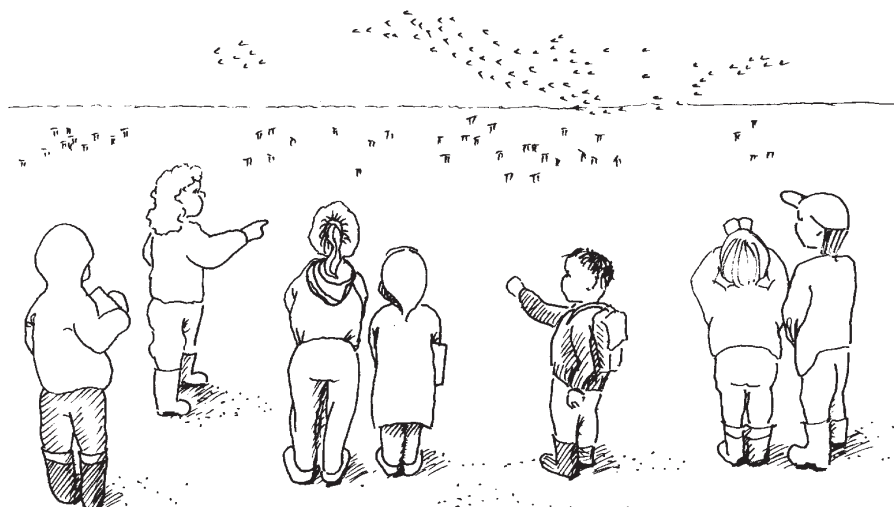
■ How can we determine how many bird beans the entire class has without counting any more beans? (Count the number of pairs of students,

and multiply that number by the number of beans your group has. This method works only if every pair has approximately the same number of beans, of course.)

12. After dividing the beans into four sections with two strings and multiplying, repeat the step using three strings to divide into six sections, and four strings to divide into eight sections.

13. For a more challenging and realistic experience, and to test for *bias*, use a mixture of three different kinds of beans (for example, kidney, pinto, and navy) as your “shorebird population.” Also try counting them against different colored paper backgrounds that match either the light or dark colored beans. How does this make population sampling an even greater challenge?

14. Practice this counting procedure on a shorebird observation field trip. If such flocks are not seen, have them practice by counting trees in a park or people in a field.



Additional Activities

Assemble and Use Transect Frames

In fieldwork (conducted in the natural habitat of the organism), *transects* are a way of dividing habitat into small, representative *samples* of the entire area. A study of the sample is far less time-consuming, and perhaps less expensive, than a study of the entire area or population. If we assume that the sample is very similar to the rest of the area, then anything we learn from the sample helps us understand the total.

Ask students to construct transect frames (“windows”) of approximately two inches using paper or cardboard squares.

Repeat the bird-bean counting activity, following these steps:

1. Measure the height and width of the spread beans.
2. Calculate how many two inch transects fit inside the spread of beans, or simply rotate the transect around the pile, counting how many times it fits.
3. Count how many beans are in one square.
4. Multiply the number from Step 2 by the bean count from Step 3.

Transects can also be used on field trips to examine the invertebrates on a beach or insects in the grass. Students can randomly toss their frames out three times and examine what is found within the sample. Compare the samples or average them together if they are all located in the same area.

Advanced Study of the Population Census Technique

Taking a population census is another commonly used method in wildlife biology and management. Discuss with students — or invite a wildlife biologist to the classroom to discuss — the reasons why censuses are important.

What does a census tell us? (The number present in one place at one time.) What it does not tell us is the significance of the census number. For instance, a census does not tell us whether a population is healthy or not. We need some baseline data to compare it with. How is census information useful to humans? Often it is most useful when compared to other information, like the number present in other areas or the number present in the same place in a different season, a different year or under different weather conditions.

Your discussion may include terms like:

- change over time
- population trends (declines or growth over time)
- inter-year variability (differences between years)
- intra-year variability (differences within one year)
- baseline data (initial or historical information often presumed to be taken at a time of typical environmental conditions and useful for future comparison should there be a major or catastrophic event like El Niño or an oil spill)



Bird Beans Student Worksheet

Directions: Pretend that the beans you spread on your desk are a flock of shorebirds. Follow your teacher's directions to try and "count the birds." Use this page to record your answers.

1. How many birds do you guess are in your cup?

Name: _____ Guess: _____

Name: _____ Guess: _____

2. How many groups of five birds do you have? _____

3. A. How many birds are in one (of the four) sections? _____

B. Multiply the above number by four:

$$\frac{\text{_____}}{\text{(Number in one section)}} \times 4 = \frac{\text{_____}}{\text{(Number of total birds)}}$$

4. Count the number of birds in the other three sections and add them together to get the total number of birds:

$$\text{_____} + \text{_____} + \text{_____} + \text{_____} = \frac{\text{_____}}{\text{(Total number of birds)}}$$

5. Was your guess too high or too low? _____



Sampling Populations

Estimates are more than a random guess made by researchers. Biologists watch and become familiar with the behavior of the species they are surveying, study photographs of a known number of birds at various concentrations, and practice making estimates via computer-generated models and exercises.

Why do biologists count birds and what do they do with this information?

Knowing the exact size of a population is less important to biologists than knowing how the population numbers of individual species change over time. Careful counts can alert biologists to serious population declines and justify management protection. Counts can also tell biologists whether or not their management efforts are helping a species to increase its population numbers.

What are some of the difficulties in counting birds?

The total size of a population is difficult to know for species with thousands or millions of moving individuals. Biologists therefore estimate the number of animals in a given population. Shorebird populations are most easily estimated when they congregate in large flocks at migratory stopover sites. When shorebirds are in their breeding or wintering habitats, they are much more spread-out, making them even more difficult to count.

Mistakes can occur when there is *bias* or *sampling error*. Bias occurs when some characteristic of a population causes it to be over or under-represented. For example, in an estimate of a flock of mixed species, the estimate would likely be less accurate for small, drab-colored, hard-to-see species (one that was well *camouflaged*) than for a brightly colored bird. One type of sampling error, observer variability, occurs when individual observers regularly make incorrect estimates. Look at the following numbers observers recorded while counting the same flock of birds:

Observer 1	246,000 birds
Observer 2	638,100 birds
Observer 3	638,900 birds
Observer 4	638,400 birds
Observer 5	1,452,800 birds

From this example, we can see that observers two, three, and four do not show much variability, but observers one and five show great variability when compared to other observers. Some observers regularly estimate too high, others too low. If you are making important counts, it is important to know what type of observer you are.



You Be the Scientist

Grade Level: upper middle school/ high school

Duration: one 40 to 50-minute class period.

Skills: critical thinking, communication/presentation, formation of hypotheses, vocabulary, discussion, and team building.

Subjects: science and language arts

Concepts

- There are still many unanswered questions about shorebirds and how we can best conserve them.
- The Scientific Method of Inquiry is the method researchers use to develop a clear hypothesis and a strong study plan.
- Some shorebirds concentrate in great numbers at stopover sites which provide large populations of birds for study.

Vocabulary

- hypothesis
- Scientific Method of Inquiry
- data
- procedure
- study plan

Overview

Students work in pairs to develop a study plan that will help them investigate a question about shorebirds.

Objectives

After this activity, students will be able to:

- Explain the *Scientific Method of Inquiry*.
- Rewrite a scientific question into a hypothesis statement.
- Develop a scientific study plan that includes a hypothesis, procedures, and materials list.

Materials

- One *Scientific Question Card* for each pair of students
- One copy of the student reading *The Scientific Method of Inquiry* for each student.

Activity Preparation

1. Photocopy and cut a set of *Scientific Question Cards*. Students can write their own questions or rewrite an existing question in the form of a hypothesis in the blank cards provided.

Procedure

1. Push desks aside; arrange the students and their chairs in a circle.
2. Form teams of two and give each pair a copy of the reading *The Scientific Method of Inquiry*. Ask them to carefully read the handout. Answer any questions about what they read before proceeding.
3. Have each team choose a *Scientific Question Card* without reading it first.
4. Give them ten minutes to prepare answers to the questions. Each team must develop a *study plan* that includes at least five procedures, how, when, and where (time of year, and possibly time of day or tide, etc.) they will conduct their observations or experiments and a list of materials they will need.

Note: Remind students that the object of this activity is to figure out how they would go about trying to answer their questions if they were biologists studying shorebirds. The answers to many of these questions are not yet known for many species. In fact, they may never be completely answered.

Here are just a few methods that students might use to gather information:

- Literature research/interviews (to find out what is already known)
 - Captivity experiments (on organisms brought into the laboratory rather than observed in the wild, natural habitat, or “field”)
 - Dissections
 - Banding or marking birds
 - Observations
 - Volunteer observations
 - Censuses (counting)
 - Transects (extrapolating from what is found in one area)
 - Averaging a number of observations
 - Comparing seasonal data or annual data to show changes or trends
 - Presenting results as a bar, line or pie graph (for example: comparing the diet of Dunlins and Western Sandpipers by graphing the percentage of worms in their diet as Y-axis and bird species as X-axis)
5. When all teams are ready, have each team read its card and present its study plan to the class.
 6. Each team should ask the rest of the class: Is this a good study plan? Why or why not? How could it be better?



Additional Activities:



Cultural Connection

Students can write a question to a shorebird scientist in another country, asking about the people's attitudes towards shorebirds and their habitats (wetland or grassland). Submit the question on-line: <http://sssp.fws.gov>, click on "References", go to "Ask a Biologist."

What Are Your Questions?

Have students brainstorm a shorebird question they want answered and develop study plans to find out the answer. Are any of their questions already the topic of scientific research? Go to the Shorebird Sister Schools Web site at <http://sssp.fws.gov>, and click on the "Tracking" or "Reference" links. Through the program's Web site, your students can meet real biologists and read about what they do, learn about current shorebird tracking projects, ask a question, and browse the Web site archives to read the questions other students have posted to biologists.

Develop Hypotheses

Instead of devising study plans, use this activity format to have students develop and present *hypotheses* or possible theories (answers) to the science questions.

Examples:

1. Why do shorebirds tend to be *circumpolar* in their breeding distribution (breed on more than one continent or in different hemispheres of the globe)?
2. Say Daniel counted 56,800 Western Sandpipers on the peak day (most birds) of spring migration on a beach in the Copper River Delta. In the fall he counted 783 on the peak day. How many were missing and where did they go?

You Be the Scientist, Part II

Have students conduct research projects designed to answer a question, or ask them to write a paper based on the research they do.



You Be the Scientist

Scientific Questions Cards

(Make one photocopy so every two students get a card.)

You Be the Scientist Question	You Be the Scientist Question
How could you prove if a species is territorial or not?	How could you find out if a shorebird's territory is three-dimensional (like a polygon) or two-dimensional (like a line along the beach)?
You Be the Scientist Question	You Be the Scientist Question
How could you devise a plan to find out if female shorebirds are territorial?	How could you measure the size of a home range or territory?
You Be the Scientist Question	You Be the Scientist Question
How could you find out what a shorebird eats?	If studying nests, how could you keep predators from following your scent trail to the nests you are observing?
You Be the Scientist Question	You Be the Scientist Question
How could you find out the percentage of breeders versus non-breeders in a shorebird population?	How could you find out if a population of shorebirds comes back to the same place every year?
You Be the Scientist Question	You Be the Scientist Question
How could you find out if there is a greater <i>diversity</i> of breeding shorebirds in tundra or in coastal marsh? If there is greater diversity of breeding in the tundra than elsewhere, why?	Scientists believe that shorebird eggs are slightly pointed at one end to minimize heat loss when the eggs are lying next to each other in the nest. How could you prove or disprove this theory?
You Be the Scientist Question	You Be the Scientist Question
How could you answer the question "Are shorebirds <i>sexually segregated</i> when feeding?"	How could you find out if plastic leg bands interfere with the bird's lifestyle (flying, walking, feeding, mate selection, etc.)?



You Be the Scientist

Scientific Questions Cards

(Make one photocopy so every two students get a card.)
(Write your own research questions in the blank cards provided.)

You Be the Scientist Question	You Be the Scientist Question
How could you find out how oil development in Arctic breeding grounds impacts the survivorship of shorebird chicks?	How could you find out why a population of migratory breeding shorebirds is declining?
You Be the Scientist Question	You Be the Scientist Question
Migrating shorebirds stop at the Delaware Bay by the thousands during spring migration. How can you find out why?	Shorebirds are breeding in nearby prairie grassland but not in one area that looks like good habitat. How can you find out why?
You Be the Scientist Question	You Be the Scientist Question
You Be the Scientist Question	You Be the Scientist Question
You Be the Scientist Question	You Be the Scientist Question
You Be the Scientist Question	You Be the Scientist Question
You Be the Scientist Question	You Be the Scientist Question



The Scientific Method of Inquiry

In science, if you want to answer, or propose a theory to answer, the questions “Why?” or “How?” it is important to have a good study plan. The *Scientific Method* is the framework that scientists use to form a study plan when they are trying to answer questions about our world.

The Scientific Method involves making observations and then forming a *hypothesis*, a statement that answers your question. For example, you watch shorebirds feeding and wonder if the males feed in different places than the females. You guess that they do not feed separately. Your hypothesis statement might read: “*Male and female shorebirds do not feed separately.*”

Unfortunately, you are not a shorebird and you cannot tell the males apart from the females by watching. Now, in order to prove or disprove your hypothesis, you need a plan. Whether you are right or wrong is not the point. You just want to know the answer.

A plan involves a list of *procedures* you are going to conduct to answer your question and a list of *materials* you will need in order to carry out the procedures. You also need to decide how to present the *results* of your plan — for example, by table, graph, or picture.

Now that you have a plan, it is time to put it into action. You carefully collect your *data* and come up with a *conclusion* that answers your hypothesis. Your method, or plan, must be something that can be repeated by another person in order to verify your work and determine if you indeed came to the correct conclusion.

You have hypothesized that there is no *sexual segregation* of shorebirds while feeding. Now what is your plan? First you have to tell the males and females apart. One way to do this is by *color-banding* individual shorebirds. This involves catching the birds in nets, determining whether each bird is male or female by taking certain measurements, and then attaching a color-coded leg bracelet that you can distinguish at a distance. To ensure that you do not injure the birds you are studying, you must have the proper training and permission to band birds. If you do not already have a bird banding license, this would be the first step in your procedure.

Let us say you decide to put green bands on female shorebirds and red bands on the males. Now you need a plan for observing the birds and recording which bird is eating where. Where, when, and how will you make these observations? How will you record your results?

After you have completed the study and gathered your data, you might find that you are not able to come to a conclusion based on your data because there were problems with your plan. Perhaps your data did not provide you with a clear answer. It might be necessary to redesign your plan and then try again.

Often, a scientific plan has to account for a variety of *variables*. This is especially true in the field of biology. Living organisms are part of an ecosystem and are affected by many living and nonliving components of their environment. Consider the *biotic* and *abiotic* factors in your environment that affect your life — air, pollution, kinds of food available, your parents or people you live with, etc. Some variables that might affect a shorebird experiment or a scientist’s conclusions include the time of year, the species of bird being observed, the weather, or the availability of food during the study.



Imaginary Mist Nets

*Adapted with permission from
"One Bird, Two Habitats."
Wisconsin Department of Natural
Resources.*

Grade Level: upper middle school/
high school

Duration: one 25-minute class
period for the introduction and
preparation; up to one full day of
regular activities during which one
or two 5-15 minute time periods
allow student "researchers" to
gather data on their classmates;
and then one 45-minute class period
for presentations and discussion

Skills: collection and interpretation
of data, discussion, vocabulary,
formation of hypotheses,
communication, and presentation

Subjects: science, math, and
language arts

Concepts

- There are still many unanswered questions about shorebirds and how we can best conserve them.
- Some shorebirds concentrate in great numbers at their stopover sites, which provide large populations of birds for study.
- There are many tools researchers use to collect information about shorebirds.
- Bird banding is one tool researchers use to collect information about shorebirds.

Vocabulary

- scientific method
- banding
- banding permits
- hypothesis
- population
- sample size
- random sample
- bias
- individual
- color band
- number band
- mist net
- fieldwork
- trends
- stopover site
- migration

Overview

Students create a study plan to answer a research question, then "band" their fellow students and collect data to answer their question.

Objectives

After this activity, students will be able to:

- Give a general description of bird banding.
- Explain why bird banding is an effective research tool.
- Explain what the *Scientific Method of Inquiry* is and how it is used.
- Outline the steps to designing an effective study plan.
- Present and explain the data collected to their class.
- List at least three variables that affected the collection of data in this activity.

Materials

- Colored construction paper
- Masking tape
- Scissors
- One copy per student of the *Banding Birds* reading
- One copy per student of *The Scientific Method of Inquiry* reading

Introduction

Banding is an important method of capturing and marking animals for study. It allows for close examination of live birds, often the only way biologists have of determining sex, age, race, and breeding condition. Because many members of a single shorebird species can look alike to people, banding allows biologists to tell them apart.

When banding and observations are carried out in many places around the world, important information can be gathered about migration routes, destinations, and behaviors. Banding individuals is one of the

most important tools in studying many aspects of bird behavior and biology in their natural habitat.

It is often impossible to capture and mark an entire *population*, be it a group of shorebirds that breed locally, a group using the same migratory flyway, or another designated population. If a large enough *sample size* can be studied, it is not always necessary to study the entire population. Sample size is the number of objects in a study. Since scientists can seldom study every member of a population, a random sample provides information that accurately represents the entire population.

For example, when a bird is captured and examined closely, a researcher can sometimes tell such things as its sex and whether it is a juvenile or adult. The researcher also records where and when the bird was captured. If that *individual* bird is marked with a unique *numbered band* and is captured again or recovered by a hunter, its number and all the original information can be looked up. Combining the first set of data with the new set can tell us such things as how far the bird traveled or how long it lived.

Large numbered markings, visible from a distance, can be used on big birds like geese. But to read the number on a shorebird band, the bird would have to be recaptured, which is often difficult. Another method of marking is to use *color bands* arranged in original combinations. This way individual shorebirds can be identified by observing them from a distance, without having to capture them.

A third scientific method of collecting data involves marking an entire group or population with one particular color of band or paint. For instance, if a population



of Black-bellied Plovers in Nome is marked with spots of red paint, and a red-spotted Black-bellied Plover is glimpsed later in Hawaii, one might determine that at least some of that species wintering in Hawaii migrate to the Nome area. If red-spotted Black-bellied Plovers are seen at several broad areas, we might assume that the Nome population winters over a large area. Refer to *Shorebird Technology and Research* in the *Shorebird Primer* for more information about banding.

Activity Preparation

1. Make one copy for each student of the *Banding Birds* and The Scientific Method of Inquiry readings.

Procedure

1. Pass out the copies of the *Banding Birds* reading and *The Scientific Method of Inquiry* to the students.
2. After each student has read the handouts, review the material with the class.
3. Together, have students brainstorm and select an interesting, fairly specific, research question designed to learn more about their fellow classmates. More than one question may be pursued during the data collection, as is often done in scientific research. Tell the students they will be collecting data to answer their question(s). Remember that students need to be available (that is, not in another teacher's physical education class) to collect the data at the appropriate times.

Example Research Questions

- How long do students spend eating lunch?
- Do girls or boys take longer to eat?

- Where are the students from this class during the last period of the day?
- What percentage of students leaves the building at the end of the day by way of the front door?
- How many students leave by the back door?

4. Divide the class into "researchers" and "migratory shorebirds" with a ratio of approximately one "researcher" to five "birds." All the "birds" in this class will be banded. The other students in the school will be thought of as non-banded "birds." Alternatively, all students in the school wearing red on their shirts, for example, could be considered "banded." Decide ahead of time what works best for your classroom situation, but remember that the banded birds should be a representative random sample of students. After the activity, discuss whether or not your assumption was truly a *random sample*. For example, if you choose hat-wearing students to be the "birds," will you be biasing your sample in favor of boys?
5. Ask "researchers" to decide on where they will set up their imaginary *mist nets* to best observe and catch "birds." At the same time, have the "shorebirds" write "banding permits" that give each "researcher" permission to band and observe "birds."

Mist Net Set-up Ideas

- "Researchers" can stand in a selected hallway to catch "birds" as they "*migrate*." Perhaps they can stand by the lunchroom and ask departing "birds" if they ate a vegetable or whether they had a brown-bag or hot lunch. Help them

to design and prepare data questions and actual data sheets.

- Because birds are not usually confined to hallways when they travel, they may fly over or round the mist net. Student "researchers" should agree to a "handicap," such as only stopping every fifth banded bird that passes them.

6. Have "researchers" band the "shorebirds" in their class, using masking tape to attach numbered construction paper anklets or bracelets. Instruct the "shorebirds" to go through the school day in their normal fashion.

Notes:

Decide ahead of time whether to band on the ankle or wrist, because all "birds" must be banded on the same place since the same team of "researchers" is banding them. In real life, several different researchers, even in different countries, may be banding, and they can more easily tell "their" birds apart at a distance if they are banded in a consistent place or with similar-looking bands.

If several classes are participating at once, use different colored bands for each class. If a large percentage of the students in the school is participating in the activity, the number of banded birds should be reduced to two out of every five, because in real life researchers can seldom band an entire population.

7. Have students set up their imaginary mist nets to "catch" migrating students and record the data at the time(s) appropriate to answer the research question(s). Emphasize

to the “shorebirds” that they should not change their daily activities because of the research project, or they will risk providing invalid (“bad”) data.

8. The next day, divide the class into cooperative groups with at least one researcher per group. Have the students organize the data, with “shorebirds” helping “researchers,” and then present their findings to the class. Have students: (1) refer to the original research question (2) present results, preferably using a table or graph (have students pool the data on the board) and (3) draw a conclusion that refers back to the original question or hypothesis.

Note:

This presentation can be a good opportunity to incorporate math skills such as fractions, probability, and graphing. Students can determine if a pie chart, bar graph, or line graph is the more appropriate way to clearly convey their comparisons, results and conclusions. Students can calculate the percent of “shorebirds” that migrated outside during lunch and the percent caught in the library — and then graph the results.

9. Some questions may require more *fieldwork* to collect data. If any new banding is required, “researchers” need to request a new banding permit.

10. Have students do a “fast-write” (allow ten minutes for writing up a page-length response to these prompts or questions) on what they learned about the “shorebirds” or about their own observation plan and skills. Here are some possible questions:

- Do they think results would differ on different days?

- Did they encounter any significant problems?
- What would they do differently?
- Did they collect enough data (Was *sample size* sufficient?) to answer the question?
- Did new questions arise?
- What other questions about student behavior could they answer this way?

11. Discuss the activity with the class.

- How did they use the Scientific Method of Inquiry to answer their research question?
- What were some of the problems they encountered in “banding birds”? Compare these to the problems bird-banders might face in the field.
- What were the benefits and limitations of obtaining data on banded birds? What are the similarities between this activity and what biologists actually do? What are the differences?
- What are some basic categories of data biologists collect on banded birds (date, time, age, sex)?
- Did the research answer the original question?
- Why is cooperation and sharing of data important in any study such as this? Who else might be interested in their findings?
- How could the study be improved to increase the accuracy of the findings?
- Do scientists know all that needs to be known about bird migration? Why is it that they do not know many exact details about where individual birds (or whales or walrus or certain insects or many other aquatic animals) or populations spend various parts of their lives?
- How many years do scientists have to band and catch birds

before they obtain sufficient information on bird population *trends* (declines or growth)? (At least two years so the data from each year can be compared.)

- Before participating in this activity, what would they have done if they found a dead bird with a band on its leg? What would they do now?

Additional Activities



Cultural Connection

Students discuss how different people with different cultural viewpoints might react to the idea that shorebirds are banded by scientists. Explain that when we work in other places, it is important to be aware of the variety of cultural viewpoints that may be different from our own so that we can learn how to work with them better.

Take a Field Trip to a Banding Station

Visit a bird-bander in the field or invite one to come to your school to demonstrate the proper use of bird-banding equipment. Banders are busiest during spring and fall migration seasons. Your local, state, or federal wildlife agency's migratory bird department, a local Audubon chapter, or a nearby wildlife refuge should be able to direct you to someone who bands birds in your area.

Human Labels

Brainstorm or discuss with students ways in which humans are labeled or marked, whether for study or as an aid in daily life (for example, name, Social Security Number, library card, medical identification tags, “dog tags” for soldiers).



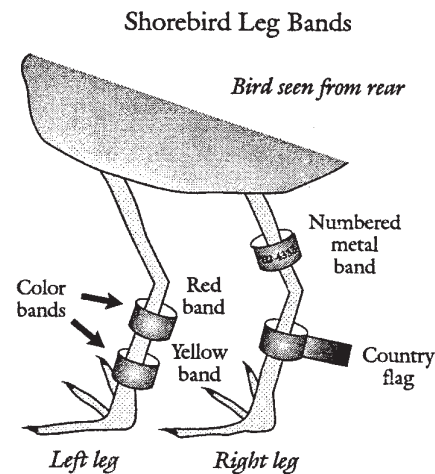
Banding Shorebirds

Scientists are still searching for answers to many questions about shorebird *survivorship*, *mortality*, and *behavior*. This information is critical to making decisions about shorebird management. We can help birds best if we understand where they live, what they need, and where they travel. *Bird Banding* is a technique to help answer many of these questions.

Whether scientists want answers about a group of local breeding shorebirds or a group using the same migratory stopover site, it is often impossible to capture and band every *individual* within the *population*. However, if a large enough *random sample* is banded, then scientists can assume that the data they collect accurately represents the entire population.

Bird banding involves attaching around the bird's leg a loose-fitting aluminum band that is coded ahead of time with a unique identification number. Biologists record the bird's age, sex, species, location of capture, and weight. If this same individual is captured somewhere else, the original data can be looked up using the bird's personal identification number. By comparing old data with current sightings, scientists can slowly piece together answers to a sort of question puzzle to create a picture of this bird's life. How far has it traveled? Where does it spend its winters? Where does it breed? How long does it live? What caused its death?

Sometimes a series of *colored bracelets* and *flags* are also attached to shorebirds. These may represent the country where the bird was banded, the banding year, and perhaps the age of the bird. The advantage of color-coded bands and flags is that it reduces the times a bird must be captured to gather information. With colored bands, researchers can observe shorebirds from a distance to gather the



information they need. No matter how careful biologists are in capturing birds, it creates stress on them and takes time away from feeding, a critical activity at their migration stopover sites.

Sometimes biologists will clip the feathers between a shorebird's shoulder blades and attach a small radio or satellite transmitter with glue. This technique allows scientists to study shorebirds in remote habitats that are difficult for researchers to get to, and it allows the birds to continue their natural behaviors that might be interrupted if people were nearby.

Bird researchers capture shorebirds with a delicate, almost invisible net called a *mist net* that is stretched across an area where birds are likely to fly at night. Another method for banding shorebirds is banding chicks that are not ready to fly. By banding birds in the year they hatch and recording their annual returns, biologists can see how long they live and if they are being replaced by a sufficient number of young. Another method, *cannon netting*, is used mostly in coastal areas. Here, a net is shot out over feeding shorebirds.

Not just anybody is allowed to capture and band birds. A special permit from the U.S. Fish and Wildlife Service is

required for all bird banding in the United States. This is to ensure that the birds are handled carefully and that the data is collected properly.

Many birds that have been banded disappear and die without the researchers knowing where, when, or why. If you find a dead bird with a band, please report it to the appropriate agency.

To Report a Metal-banded Bird

Notify your local state wildlife agency or the U.S. Fish and Wildlife Service Bird Banding Lab. Record the entire number on the band, the date you found the bird, the species (if you know it), and the exact location.

Send this information along with the band if possible, to:

Chief, Bird Banding Laboratory
Office of Migratory Bird Management
U.S. Fish and Wildlife Service
Laurel, MD 20810

Or call: 800/327 2263
or 800/327 2263

To Report a Color-banded or Flagged Bird

Describe each band: type (metal, color band, flag), colors (as exactly as possible - light green, dark blue), and location on bird (bird's left or right leg, upper or lower leg, above or below other bands). Note if you are unsure of any bands or if you did not see all parts of both legs clearly. Note species, location of sighting, date, and any other information such as behavior, other birds, etc.

Submit shorebird color band sightings by mail or Web:

PASP, Canadian Wildlife Service
115 Perimeter Road
Saskatoon, SK S7N 0X4
CANADA

Or

<http://www.mb.ec.gc.ca/nature/migratorybirds/pasp/dc29s01.en.html>



The Scientific Method of Inquiry

In science, if you want to answer, or propose a theory to answer, the questions “Why?” or “How?” it is important to have a good study plan. The *Scientific Method* is the framework that scientists use to form a study plan when they are trying to answer questions about our world.

The Scientific Method involves making observations and then forming a *hypothesis*, a statement that answers your question. For example, you watch shorebirds feeding and wonder if the males feed in different places than the females. You guess that they do not feed separately. Your hypothesis statement might read: “*Male and female shorebirds do not feed separately.*”

Unfortunately, you are not a shorebird and you cannot tell the males apart from the females by watching. Now, in order to prove or disprove your hypothesis, you need a plan. Whether you are right or wrong is not the point. You just want to know the answer.

A plan involves a list of *procedures* you are going to conduct to answer your question and a list of *materials* you will need in order to carry out the procedures. You also need to decide how to present the *results* of your plan — for example, by table, graph, or picture.

Now that you have a plan, it is time to put it into action. You carefully collect your *data* and come up with a *conclusion* that answers your hypothesis. Your method, or plan, must be something that can be repeated by another person in order to verify your work and determine if you indeed came to the correct conclusion.

You have hypothesized that there is no *sexual segregation* of shorebirds while feeding. Now what is your plan? First you have to tell the males and females apart. One way to do this is by *color-banding* individual shorebirds. This involves catching the birds in nets, determining whether each bird is male or female by taking certain measurements, and then attaching a color-coded leg bracelet that you can distinguish at a distance. To ensure that you do not injure the birds you are studying, you must have the proper training and permission to band birds. If you do not already have a bird banding license, this would be the first step in your procedure.

Let us say you decide to put green bands on female shorebirds and red bands on the males. Now you need a plan for observing the birds and recording which bird is eating where. Where, when, and how will you make these observations? How will you record your results?

After you have completed the study and gathered your data, you might find that you are not able to come to a conclusion based on your data because there were problems with your plan. Perhaps your data did not provide you with a clear answer. It might be necessary to redesign your plan and then try again.

Often, a scientific plan has to account for a variety of *variables*. This is especially true in the field of biology. Living organisms are part of an ecosystem and are affected by many living and nonliving components of their environment. Consider the *biotic* and *abiotic* factors in your environment that affect your life — air, pollution, kinds of food available, your parents or people you live with, etc. Some variables that might affect a shorebird experiment or a scientist’s conclusions include the time of year, the species of bird being observed, the weather, or the availability of food during the study.



Shorebirds on the Web

Using the Internet Students learn about Shorebirds and Connect with Others

Grade Levels: all levels

Skills: communication, use of technology, and interpretation of data

Subjects: science, technology, social studies, and language arts

Concepts

- There are still many unanswered questions about shorebirds and how we can conserve them best.
- Scientists are still learning where shorebirds migrate and the flight paths they follow.
- Some shorebirds concentrate in great numbers at their stopover sites, which provide large populations of birds for study.
- Technology provides vital tools for research.

Vocabulary

- Web site
- Web page
- modem
- Internet
- browser
- navigate
- listserve
- E-mail
- hypertext links

Overview

Students use the computer as a resource tool to learn about shorebirds, ecology, wetlands, other cultures, and ecosystems, while at the same time discovering computer technology that will help them throughout their school years and beyond.

Objectives

After this activity, students will be able to:

- Locate a species of migrating shorebirds using the Shorebird Sister Schools Web site.
- Describe the regions of the world one local shorebird species visits.
- Communicate with students in other states, provinces and

countries about shorebirds.

- Use the Internet to communicate with biologists and other students.
- Post questions on the Shorebird Sister Schools Website.

Materials

Access to a computer that satisfies the following requirements:

1. Monitor, keyboard, mouse, hardware computer, IBM clone or Apple/Macintosh with modem. Modem can be internal or external — the faster the modem the better. A 28.8 speed modem or faster is recommended.
2. Minimum computer speed of a “486” (preferably higher or the kids will lose interest because the pictures load too slowly).
3. Internet browser such as Netscape, Microsoft Internet Explorer, etc.
4. Dedicated phone line for your modem. If your school has a sophisticated phone system, you will need one phone line to the outside that is not part of that system. Perhaps you have a computer lab with that setup.
5. One copy of *Shorebirds on the Web Computer LINGO Crossword Puzzle* for each student.

Background

The Shorebird Sister School Program (SSSP) allows students, teachers, biologists, birders, parents to share shorebird observations as they migrate between their nesting and wintering grounds. By tracking the shorebird superhighway on the Internet, students will be engaged in learning about shorebird stopover locations, shorebird ecology, migration, ecology, and ecosystems while learning how to use computers.

By using the Internet to view the Shorebird Sister Schools Web,

participants will have the opportunity to exchange ideas and observations with others throughout the Western Hemisphere. Participants can share field trip information and data, report sightings of banded shorebirds, and learn about current shorebird research. Participants can also ask questions about what other classes are doing in the Shorebird Sister Schools Program, or direct shorebird ecology questions to other educators and shorebird biologists.

Participant can also join the Shorebird Sister Schools E-mail Network. The Network will provide monthly e-mail updates on upcoming activities and events for participants, as well as new features on the Website.

For complete details on how to get involved in the Shorebird Sister Schools Program and how to use the Web site, go to SSSP and Connecting to Cultures.

Activity Preparation

1. Find and Become Familiar with the Shorebird Sister Schools Web site
 - To get to the Shorebird Sister Schools Program Web site, type in the Web address <http://sssp.fws.gov> wherever it asks you for a location or address. Then hit “return/enter” and the Shorebird Sister Schools Program Web site will appear on your screen.
 - To *navigate* around the various pages, you will need to click with your mouse on the colored, underlined text (*hypertext links*). This will take you to another page. There are two methods to return to the previous page — click with your mouse on the “back” button on your browser or click on the hypertext that says “Shorebird Sister Schools Main Page.”



- To quit the *browser* program, click on the quit button or click on File, Quit/Exit in the menu bar at the top of the page.
2. Join the Shorebird E-mail Network
 - To join the network, you will need an *E-mail* address. An E-mail address may look something like this: sandpiper@western.flyway.net.
 - Depending on how your school is set up, you may already have an *Internet* connection or may need to sign up with an Internet provider. The computer support staff at your school can help you set up an E-mail address.
 - Once you have an E-mail address, join the E-mail Network by clicking on the “I want to join the Network” box on the Shorebird Sister Schools Registration page on the Website. You can also send your request directly to the Shorebird Sister Schools Program coordinator, sssp@fws.gov.

Procedure

1. Make sure your students are familiar with the computer terminology used throughout this activity. Use the Computer LINGO Crossword Puzzle for practice using and defining these terms. The answers are located on the last page of this activity.
2. Show your students how to log on to the SSSP Web site. Explore the different information categories together.
3. Ask the students to brainstorm how they could use the site individually and as a class. Write this list on the board. Refer to the suggestions provided in the box if the students did not come up with ideas. Go to the SSSP section of the guide for more Web ideas too.
4. Assign individual students, or student teams, to work on as many of their ideas as possible. Send home information about the Shorebird Sister Schools Program (including the Web address) so parents can log on too.

Field Trip Options:

1. During the Field Trip: Take a laptop computer to the field. At the end of the Field Trip, as a wrap-up activity, gather students in a circle around you with the open laptop. As a group, have the students write a posting for the SSSP Web site describing the Field Trip site, weather, birds seen, activities done, etc. When you return to the office, simply copy and paste the posting on the SSSP Web site “Report Shorebird Sightings” link located from the “Tracking” link on the main page.
2. Post Field Trip: At the beginning of the next class period after the field trip, have students use their field journals to write a class posting for the SSSP Web site. Follow the directions above posting the observations on the Web site.

Ideas for Using the Shorebird Sister Schools (SSSP) Web Site

- Get the students on the SSSP Website at least once a week to check on shorebird migration. Check more often during the spring migration. Those birds move fast!
- After a field trip, “publish” the students’ field data observations on the Website.
- Find pen pals through the Website. Share what you have learned about shorebirds with your pen pals.

- Have the students write a question to ask research biologists and send them through the “Ask a Biologist” form on the Website.

- Use a large wall map to track the shorebirds as migration routes are reported online. You may be able to use the poster included with this activity guide.

- During the Spring plan time to allow students to follow along on the Tracking Projects featured on the SSSP Web site.

Additional Activity

Build Your Own Web Page

Older students might be interested in building a Web page that highlights their shorebird projects, field trips, and activities. Include species lists, research projects, maps of local habitat, and information about a local threat. Once your Web page is complete and on-line, send an E-mail message to the SSSP coordinator at sssp@fws.gov and the U.S. Fish and Wildlife Service will make a link to your site.

Answers to Web LINGO

Down

1. Web page
2. browser
3. Internet
4. Listserve

Across

1. Web site
2. E-mail
3. modem
4. navigate



Shorebirds on the Web

Computer LINGO

Directions: Match the correct computer term with the sentences below to complete the crossword puzzle.

Vocabulary

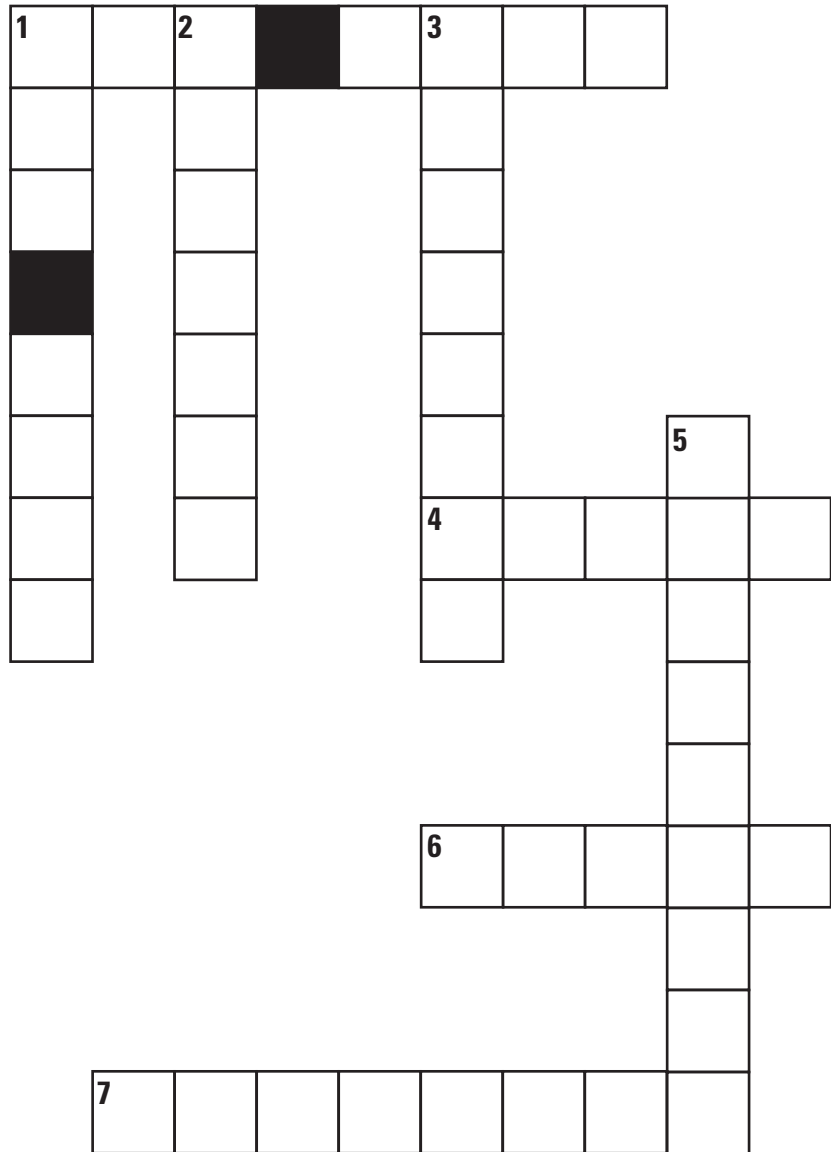
- Web site
- Web page
- modem
- Internet
- browser
- navigate
- listserve
- E-mail

Down

1. One page of a Website
2. Locates and displays Websites
3. A system that connects computers
5. Sends e-mail to everyone on a list

Across

1. A place on the Internet containing specific information and links
4. Electronic mail
6. Device that sends information by phone line
7. To find your way around the World Wide Web



The Big Shorebird Picture

Through the activities in *Explore the World with Shorebirds!*, students have discovered that shorebird habitat is also our habitat. They have observed and learned about other species that coexist with shorebirds and understand that all living parts of the habitat depend on clean water, air, and soil. In the Big Shorebird Picture, students share their knowledge with each other and their community in creative and thought provoking ways.

Concepts

- Taking an active role in shorebird conservation requires that we apply knowledge.
- Sharing our knowledge about shorebirds with others is one way we can help shorebird conservation.
- Environmental stewardship is vital for the long-term conservation of our shared natural resources.

Activities

Shorebird Poetry

(upper elementary/middle school, upper middle school / high school)

Students assemble accurate scientific information about shorebirds and create a poem to share their feelings and thoughts with others.

Shorebird Wax Museum

(lower elementary)

Students create a “living wax museum” by pretending to be shorebirds and give a few facts about themselves to visitors as they pass through.

Shorebirds on Display

(upper elementary/middle school, upper middle school / high school)

Students create a shorebird display to inform people in their community about local shorebird species, shorebird habitat, and shorebird issues.

Shorebird Fair

(upper elementary/middle school, upper middle school / high school)

Students have had the opportunity to learn about shorebirds and their habitat through a variety of activities in this educator’s guide. Now they will assemble their shorebird projects into a “Shorebird Fair.”

Shorebird News

(upper middle school/high school)

Students research what makes a good newspaper article and then write a story for their local paper about their involvement in the Shorebird Sister Schools Program.

Shorebird Decision Dilemmas

(upper elementary/middle school, upper middle/high school)

In this activity, students draw cards that describe a shorebird or habitat issue and decide how they would work to resolve the problem. Through discussion, students examine their own values and beliefs as well as those of their classmates’.

What You Can Do for Shorebirds!

(upper middle school/high school)

Students participate in a conservation project to improve the environment and help wildlife. The situation may involve “hands-on” experiences like planting or picking up litter, or a political campaign in which students participate in influencing the actions of others.

Shorebird Values on the Line

(upper middle school/high school)
Students rank to what degree they “agree” or “disagree with” a set of statements pertaining to shorebirds and shorebird habitat. They compare their rankings with those of their classmates, examine the reasons behind them, and discuss what factors influence a person’s values.



Shorebird Poetry

Adapted with permission from Quinlan, "Alaska Wildlife Week."

Grade Level: upper elementary/ middle school, upper middle school/ high school

Duration: one 30-minute class period

Skills: application, communication, critical thinking, spelling, vocabulary, and using technology

Subjects: science, language arts, and technology

Concepts

- Sharing knowledge about shorebirds with others is one way to help shorebird conservation

Vocabulary

- haiku
- cinquain
- limerick

Overview

Students assemble accurate scientific information about shorebirds and create a poem to share their feelings and thoughts with others.

Objectives

After this activity, students will be able to:

- Create a haiku, cinquain, or limerick poem incorporating accurate scientific knowledge learned about shorebirds.
- Describe the different characteristics of line length, syllable number, and rhyming pattern for the haiku, cinquain, and limerick styles of poetry.

Materials

- An assortment of shorebird pictures
- A shorebird video, slide show, or assortment of photographs to use as "inspiration"
- An assortment of example poems to read aloud to the class

Introduction

Poems are often described as "word pictures." Poems can also present an author's feelings and concerns and generate deeper thinking and understanding on the part of the reader.

The following are just three examples of poetry styles to consider using in this activity. There are many more to choose from. Encourage your students to research other styles of poetry and to write several different types of shorebird poems.

Procedure

1. Introduce your students to the three different types of poems described here: the haiku, cinquain, and the limerick. Discuss how poems can be like "word pictures."
2. Read the three example poems listed in the **Introduction** and any others you have collected. Ask the students which poem they like the best. Why? Which form of poetry do they like the best? Why? How do they think the author was inspired to write the poem? What might inspire them to write a poem?
3. Ask them to write a poem about shorebirds with the goal of giving accurate information, stirring up feelings, and creating

<i>Poetry/Rhyme Form</i>	<i>Example</i>
Haiku (pronounced hi-koo): This is an unrhymed Japanese verse consisting of three lines containing five, seven, and five syllables, respectively.	Sandpipers skitter Probing for tasty morsels Ah! A juicy clam
Cinquain (pronounced sin-kwan): A five line poem. The first line consists of 1 word, the second line two words, and so on until the fifth line which contains five words.	Flock Busy crowd Searches the shore Tiny creatures are fuel For the long journey north
Limerick: This is a light humorous rhyme consisting of five lines of verse. Lines one, two, and five consist of roughly three metrical feet while lines three and four contain two metrical feet. (A metrical foot consists of two short, not accented, syllables followed by one long, accented syllable). Lines one, two, and five rhyme with each other, and lines three and four rhyme together.	There once was a Dunlin named Willie, Who thought that to migrate was silly; So he stayed up in Nome; Planned to make it his home, But he left 'cause he found it too chilly.

a mental picture for the reader. It can be a very general poem that describes shorebird feeding, migration, habitat, and wildlife neighbors or a very specific poem that focuses on one type of shorebird. They may also choose the style of poem they write.

4. To inspire your students, ask them to recall a recent field trip to watch shorebirds or show them a shorebird video or slide show. For another option, offer them the chance to look through the assortment of photographs you collected of shorebirds and habitat for “inspiration.”
5. Display the finished poems on a bulletin board; use them as part of the *Shorebird Fair* activity (described later in this section); consolidate them into a class book; or ask your local newspaper to publish them throughout shorebird migration season. Do not forget to send your poetry to the Shorebird Sister Schools Website to share with others. To submit your poetry, go to <http://sssp.fws.gov>, click on the “Get Involved” link.

Additional Activities

If There Were No Shorebirds.....

Ask your students to finish this sentence. Then take all their answer and put it in a poem or rap. To aid in their creative answers you could have them ponder these questions: What would it mean to them if shorebirds disappeared from our world? What repercussions would there be to other wildlife, people, and the habitats shorebirds live in? Which cultures would be changed if shorebirds were no longer part of their stories, songs, and artwork? Adapted with permission from *One Bird, Two Habitats*. Wisconsin Department of Natural Resources

A Year in My Life as a Shorebird

Give your students the opportunity to do more creative writing with the classroom activity *A Year (a Day or a Month) in My Life as a Shorebird* (found in the *Introduction to Shorebirds* activities section.) In this activity, students use the *Shorebird Profiles* (located in the *Appendix*) to learn specific life history information about a shorebird that is found in their area, then create a first person (or in this case, “first bird”) account of its life.



Shorebird Wax Museum

Special thanks to Carrie Fennimore, Galena City School, Galena, AK 1996

Grade Level: lower elementary
Duration: three 30-minute class periods for preparation and practice, one 45-minute session to conduct the wax museum
Skills: communication and presentation; using technology (with additional activity)
Subjects: language arts, science, and fine arts; using technology (with additional activity)

Concepts

- Sharing knowledge about shorebirds with others is one way to help shorebird conservation

Vocabulary

Since this is a review and sharing activity, there are no specific vocabulary words.

Overview

Students create a “living wax museum” by pretending to be shorebirds and giving a few facts about themselves to visitors as they pass through.

Objectives

After this activity, students will be able to:

- List three distinguishing facts about one species of shorebird and its habitat
- Memorize a three-line description of this shorebird
- Create an advertising poster that answers the questions “what,” “when,” and “where”

Materials

- Drawing paper
- Large sheets (at least 18” x 24”) of butcher paper or newsprint to create advertisement posters
- Drawing/painting supplies
- String
- Tape

Optional

- Costume materials

Introduction

Since this is a review and sharing activity, there is no introductory material.

Activity Preparation

1. Arrange a 45-minute period to allow the class to present its living wax museum to the school or other classes.

Note: This is an excellent opportunity for younger students to learn by teaching older students. Invite middle or high school students, as well as parents, to attend. Also, young students can present their “living wax museum” to even younger children: Invite preschool, kindergarten, and first grade students to attend your class presentations. *Because the wax museum is a one-on-one experience, this should not be presented as an assembly.*

2. Advertise “The Shorebird Wax Museum” to the school and to parents ahead of time. Visiting classes need only 10 to 15 minutes to walk through the “museum” during the time it is open.

Procedure

1. Assign each student a different species of shorebird.
2. Have each student make a sign to wear around his or her neck with his or her shorebird’s name on it. Provide pictures of the shorebirds so the students can make drawings on their signs. Ask them to take special note of shorebird features such as color, feathers, legs, and bill type, and spots or other markings on the birds.

3. Give each student a large piece of paper. This will represent his or her shorebird’s habitat. Have students draw big, colorful pictures of where their shorebirds live. Students can also include drawings of other wildlife that live in the habitat too.
4. Provide each student with two to three sentences of information about his or her shorebird to memorize and recite in the wax museum. Allow time to help them memorize their sentences so that they can recite them easily.
5. Have students brainstorm and create simple costumes or costume elements to wear-- like paper beaks or wings, paper breast panel with appropriate colors or streaking, paper feathers, or camouflage clothing.
6. At least one day before the presentation date, have students make advertisement posters to hang around the school. Be sure the signs include the date, time, and location of the wax museum.
7. Make a couple of signs to be posted at the entrance of the wax museum with the following instructions to visitors: *Touch a shorebird softly on the shoulder to hear about the bird. Please touch only one bird at a time.*
8. Present the *Shorebird Wax Museum* in the following way.

Preparing for the Shorebird Wax Museum

- Space the student “shorebirds” evenly around the room, allowing plenty of room for visitors to pass in between.
- Have the students tape their paper “habitats” onto the floor or



wall behind each “shorebird.” Let them stand on or directly in front of their habitats.

- Ask the students to wear the costumes and identifying signs they created.
- “Shorebirds” should stand very still and silently in place. (Have them try standing on one foot while they roost!)
- Explain that when a visitor touches them on the shoulder, they “come to life” and recite their sentences. When they are done, they should fall silent again and stand still until the next visitor touches their shoulder.

Practicing for the Real Show

- Divide the class in half to practice taking turns being the “shorebirds” and the “visitors” so all students get to practice the technique and their lines.

Facilitating the Visitors on the Day of the Show

- Station an adult at the door of the wax museum to give each group the following directions and to control the pace to avoid bottlenecks.

Place a hand on a shorebird’s shoulder, stand back, and listen.

When the bird falls silent again, move on to the next shorebird.

Additional Activities

Create a Shorebird Event

Combine the Shorebird Wax

Museum with a Shorebird Fair.

Have the students set up their displays for the fair and then present their “wax museum” during the first opening 30 or 40 minutes.

Reach an Internet Audience

Use the information on shorebirds to make a posting on the *Shorebird Sister Schools Program* Web site. <http://sssp.fws.gov>, click on “Tracking”, then “Report Shorebird Sightings” or send an E-mail to the Shorebird E-mail Network: sssp@fws.gov.



Shorebirds on Display

*Adapted with permission from
Quinlan, Alaska Wildlife Week.*

Grade Level: upper elementary/
middle school, upper middle school/
high school

Duration: two or three 30 to 40-
minute class periods

Skills: communication/presentation
and team building

Subjects: language arts, fine arts,
and science

Concepts

- Taking an active role in shorebird conservation requires that we apply knowledge
- Sharing our knowledge about shorebirds with others is one way we can help shorebird conservation
- Environmental stewardship is vital for the long-term conservation of our shared natural resources

Vocabulary

Since this is a review and sharing activity, there are no specific vocabulary words.

Overview

Students create a shorebird display to inform people in their community about local shorebird species, shorebird habitats, and shorebird issues.

Objectives

After this activity, students will be able to:

- Identify local shorebird species and where they can be found.
- Create a visual display of information.
- Discuss local shorebird issues in their community.

Materials

- Drawings, photos, and written work produced and gathered during previous shorebird activity units

Introduction

Since this is a review and sharing activity, there is no introductory material.

Procedure

1. Locate a display or bulletin board in your school, local shopping center, government center building, library, or other central location with frequent visitors. Create a design to inform your community about the local shorebirds and shorebird habitat in your area. Decide on a theme for the shorebird information display. (some theme ideas are: shorebirds that migrate through the community, important shorebird habitats in your area, a local shorebird issue, or how people can help shorebirds and their habitat.)
2. Decide what written and visual information should be included in the display (for example, photographs, maps, student artwork, writing, or poetry). To accomplish this, have students brainstorm a “To Do List” and assign specific students to complete the work items.
3. Have each student research effective visual presentation techniques: simplicity, balance, letter size, and color. Have students incorporate what they learned into their display designs.
4. Have each student or student team complete its piece of the display by the class deadline. Decide if one student (with a parent’s help), the entire class, or just the teacher will assemble the entire display at the site where it will be located (if it cannot be done ahead of time in the classroom).

Additional Activities



Cultural Connection

As part of the display (outlined in the procedure), students can map the migration routes with pictures to help those viewing the display see some elements of the different cultures along the routes.

Community Shorebird Display Contest

If there are several places for shorebird displays in your community, arrange a contest between classes or schools. Ask community members to vote for the “best” display in a variety of categories (so everyone wins something, if possible). For example, categories could include “best overall design,” “most interesting information,” “best artwork, best photographs,” etc. Ask local businesses to donate prizes for each category. If possible, have this display contest coincide with the shorebird migration season.



Shorebird Fair

Grade Level: upper elementary/
middle school, upper middle school/
high school

Duration: 60-90 minutes for the fair,
several class period for planning
and set-up

Skills: communication, presentation,
and team building

Subjects: language arts, fine arts,
and science

Concepts

- Taking an active role in shorebird conservation requires that we apply knowledge.
- Sharing our knowledge about shorebirds with others is one way we can help shorebird conservation
- Environmental stewardship is vital for the long-term conservation of our shared natural resources

Vocabulary

Since this is a review and sharing activity, there are no specific vocabulary words.

Overview

Students have had the opportunity to learn about shorebirds through a variety of activities in this educator's guide. Now they will assemble their shorebird projects into a "Shorebird Fair."

Objectives

After this activity, students will be able to:

- Communicate with others what they learned about shorebirds
- Design an advertising poster that includes key event information--when, where, why, and how
- Outline the steps involved in planning an informational event

Materials

- Shorebird pictures from guidebooks, other resource materials, or copies of the *Shorebird Coloring Pages* (found in the *Appendix*)
- Tables

- Display boards
- Paper and drawing materials for constructing signs
- Completed shorebird projects (wetland models, shorebird illustrations, shorebird poems, habitat maps, stories, worksheets, paper bird bands, coloring pages, photos or video footage of students participating in activities and field trips, and audio tapes of shorebird calls)

Introduction

Since this is a review and sharing activity, there is no introductory material.

Activity Preparation

1. Decide on a time and date for the fair. If necessary, arrange to use the gym, multipurpose room, or library.

Procedure

1. Invite parents to the fair. Advertise the *Shorebird Student Fair* by creating advertising posters to hang around the school. Make sure they that include the location, date, time, and activity line-up for the fair. Have the students prepare parent invitations. Include an announcement in the school bulletin, inviting other classes to attend.
2. Develop a plan that outlines the organization and schedule of events for the fair. Have students gather all of their shorebird work together, decide how to organize it, and display it around the room. You may choose to group projects together according to themes. Theme possibilities are endless but can include local species, habitat, breeding information, threats, behavior, or how people can participate in shorebird conservation.

Shorebird Student Fair Ideas

Shorebird Gallery

Display shorebird drawings on 12" x 18" papers, hanging vertically as in a gallery. Include the name of each species and a caption, label, or statement with information about the bird's habitat. Arrange the drawings according to a theme such as location of breeding range, habitat, or shorebirds seen at your local wetlands.

Shorebird Wax Museum

Use this as an opportunity for students to create a shorebird wax museum or demonstrate shorebird calls and behavioral postures (directions found in *Shorebird Wax Museum* and *Behave Yourself!* classroom activities found earlier in this chapter).

Shorebird Questions/Answer Booth

Station students around the fair to play and narrate audio or video tape recordings or to answer questions on various themes.

Shorebird Games

Have students lead rounds of shorebird games such as *Build a Shorebird*, *What Can I Eat with This Beak?* *Behave Yourself!* or *It's a Tough Life* (classroom activities found earlier in this chapter).

Shorebird Arts and Crafts

Set up stations to make habitat models, color shorebird pictures, or create shorebird mobiles.

Shorebird Banding Station

Have students "band" visitors with paper bands as they pass a "banding station." Prepare a display or station students here to explain shorebird banding.

Shorebird News

Adapted with permission from Quinlan, "Alaska Wildlife Week."

Grade Level: upper middle school/ high school

Duration: two 40-minute class periods

Skills: application, communication, presentation, using technology

Subjects: language arts, science, and technology

Concepts

- Sharing our knowledge about shorebirds with others is one way we can help shorebird conservation

Vocabulary

- press release
- style manual

Overview

Students research what makes a good newspaper article and then write a story for their local paper about their involvement in the *Shorebird Sister Schools Program*.

Objectives

After this activity, students will be able to:

- Write a newspaper article using the standard press release format
- Correctly incorporate quotes into a news story
- Explain the Shorebird Sister Schools Program and how the class has participated in the program.

Materials

- classroom copies of model newspaper articles
- a copy of the *Press Release Guidelines*

Optional

- photographs taken during shorebird field trips or activities

Introduction

Since this is a sharing and review activity, there is no introductory material.

Activity Preparation

1. Collect short newspaper articles, preferably on natural history (biological science) or natural resource topics. Make copies for the class.
2. Collect an array of articles that clearly represent different formats such as news articles, human interest stories, and editorials.

Procedure

1. Have students read the articles you collect. Compare the newspaper articles with editorials, human interest, and news stories. Have students brainstorm a list of elements found in newspaper articles.
2. Give each student a copy of the *Press Release Guidelines* reading. Ask them to write a press release for the school, local, or statewide paper about your class participation in the *Shorebird Sister Schools Program*, a recent shorebird field trip, or what they have learned about shorebirds and the local habitats they use. Be sure to submit this article to the Shorebird Sister School Website at <http://sssp.fws.gov>
3. Hold a class contest in which all the students vote on each other's articles in as many categories as possible (best format, most interesting, best punctuation, grammar, etc.) Submit the article voted "best overall" to the intended publication.

Additional Activities



Cultural Connections

- Students can be international correspondents and report on the cultures of other communities where shorebirds spend part of their time breeding, migrating, or wintering.
- Students can write an editorial column on the importance of understanding cultures.

"Covering" Shorebirds Throughout the Year

Give students an opportunity to try their hands at writing different styles of articles on as many shorebird topics as they can find within their communities. Have students pick stories and formats that interest them. Here are some ideas.

- An interview with a local or nearby shorebird artist or shorebird enthusiast
- A calendar of shorebird events each season (migration peaks, breeding cycles, festivals, classes, shorebird viewing outings etc.)
- A full-length article addressing all opinions and facts surrounding a shorebird controversy in the community.
- A student editorial on a shorebird controversy.



Press Release Guidelines

1. Lead sentence tells “who,” “what,” “where,” “when,” and “why.”
2. Keep it short, no longer than one page (double-spaced and typed).
3. Put the most important parts of the story first, followed by less important information. (If the article must be shortened, the last paragraphs can be cut without losing critical parts of the story.)
4. Keep aware of the difference between fact and opinion on all points.
5. Know your audience! A middle school student reading the school newspaper will have different expectations than a businessperson reading the city news.
6. Include accurate quotes that are properly cited. Make sure that the quotes enhance your article by adding something in a fresh way, not simply repeating the same words appearing elsewhere in the article. If a quote represents an opinion, does it seem to reflect a majority or dissenting opinion? Either is acceptable, but the writer needs to be aware of the difference so the quote is properly placed and introduced.
7. Check your spelling and grammar!
8. A short news release accompanied by photos will have the best chance of being printed.
9. For more information on writing for newspapers, consult a writer’s style manual such as *A Manual of Style*, published by University of Chicago Press.



Shorebird Decision Dilemmas

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Guide and Activity Guide. The
complete Guide can be obtained
by attending a Project WILD
workshop. For more information,
please visit www.projectwild.org or
contact the National Project WILD
Office at 713-520-1936.

Grade Level: upper elementary/
middle school, upper middle school/
high school

Duration: one 45 to 60-minute class
period

Skills: critical thinking, application,
discussion, evaluation, problem
solving, team building, and
communication

Subjects: science, social studies, and
language arts

Concepts:

- Taking an active role in shorebird
conservation requires that we
apply knowledge
- Environmental stewardship
is vital for the long-term
conservation of our shared
natural resources

Vocabulary

- dilemma
- compromise
- stewardship
- mitigation
- Army Corps of Engineers
- Environmental Protection
Agency

Overview

In this activity, students draw
cards that describe a shorebird
or habitat issue and decide how
they would work to resolve the
problem. Through discussion,
students examine their own values
and beliefs, as well as those of their
classmates.

Objectives

After this activity, students will be
able to:

- Clarify their own values and
beliefs related to the shorebird
and habitat issues presented.
- Learn to identify different points
of view related to the shorebird
and habitat issue presented.

Introduction

The following activity is designed
to help students identify different
types of human concerns related
to decisions affecting wildlife and
wetlands and to practice making
responsible and appropriate
decisions. It is not intended to
designate “right” and “wrong”
answers for students. In fact,
students are encouraged to
understand that the real world is
a place of many needs, views, and
compromises based on the best
and most complete information.
The objective of this activity is to
give students the experience of
presenting and explaining their
views, taking responsibility for
their own reasoning, and teaching
them how to question and learn
about other points of view. The
activity is not meant for the
students to reach a consensus.

It would be beneficial for students
to do additional research about
each *dilemma* so that decisions are
based on the best facts available.
Habitat protection laws change.
Students might discuss potential
changes and research legislative
action.

For example, knowing more about
the agencies involved in wetlands
management, the *United States
Environmental Protection
Agency (EPA)* and the *Army Corps
of Engineers*, will help students
understand how and why decisions
are made. In reality, the decisions
to preserve or sometimes destroy
wetlands come after careful
consideration and consultation with

the public and state and federal
agencies. These agencies must
weigh and balance the concerns as
well as the benefits, often reaching
a *compromise* among interest
groups. Legally, they are required
to consider:

- **Environmental Concerns:**
conservation, economics,
aesthetics, environmental fish
and wildlife values, flood damage
prevention, welfare of the general
public, historic values, recreation
land use, water supply, water
quality, navigation, energy needs,
safety, and food production
- **Human Concerns:** religious,
cultural, political, social,
educational, survival/physical
health, scientific, personal history,
and personal use

Materials

- A classroom set of the Shorebird
Dilemma Cards

Activity Preparation

1. Copy and cut out a set of the
Shorebird Dilemma Cards so
that each group will have one
copy of each dilemma.
2. Consider writing your own
shorebird dilemma scenarios
specific to problems in your area.
Ask each student to research
a local shorebird or habitat
dilemma and then create a
dilemma card. Select the best
cards to include in this activity.

Procedure

1. Divide the class into groups of
four and give each group a stack
of *Shorebird Dilemma Cards*.
Place the cards face down in the
center of the group.
2. Instruct the first player in each
group to draw a card from the
top of the deck. Next, she or
he reads the situation out loud
to the group; he or she should
not read the “options” yet. Give



the first player two minutes to consider her or his situation, decide what to do, and formulate reasons for her or his decision. At the same time the other students in the group should contemplate the issue silently.

3. When the time is up, ask the first player to read the situation and options aloud to the rest of the group and then explain his or her decision to the group and the reasoning behind it.
4. This first player now leads the group in a discussion. Each of the other members of the group takes turns commenting on the dilemma and what he or she would do in the situation. The discussion of the dilemma by the group should be limited to five minutes. The group leader has the opportunity to ask questions of other members of the group and to offer clarification about their original decision to the dilemma. Have each group discuss the following questions:
 - What will the results of their decisions and related actions be in ten or twenty years?
 - If the dilemma involved a plot of land they owned, how will their decision affect neighboring land?
5. After the dilemma has been discussed, return the card to the bottom of the stack and the next player selects a card from the top of the deck. Continue this process until all students have had a chance to draw a card, express their decisions and rationales, and lead the group discussions.

Additional Activities

Wetland and Grassland Protection Agencies

Ask students to brainstorm a list of the types of information that would have helped them make their decisions. Urge them to consider gathering a wide array of information. When a group tries to make a decision together, everyone makes his or her decision based on an individual set of concerns and beliefs. How could they solve a problem if the players do, in fact, have conflicting concerns? How might they develop a common set of beliefs about the situation? Is consensus always a reasonable expectation? Discuss the process used by the Army Corps of Engineers and Environmental Protection Agency to decide whether or not to allow an activity to occur on wetlands. Which of the reasons given by students would the Army Corps of Engineers or EPA use to make their decision?

Plan a Public Information or Education Campaign

Have your students identify a shorebird or wetland issue within your community. Ask students to research the facts surrounding the issue and the points of view of those involved in the decision-making process. What are the benefits and costs involved? From here, develop a plan that will help the people in their community make an informed decision on this issue. Students may choose to write articles or editorials, make presentations, design information booths or kiosks, or put up posters about the issue. How will they know if their efforts made a difference? Discuss ways they can evaluate their plan.

You Be the Scientist

This activity, also found in this section, gives more ideas for formulating a study plan.

A Scientist's Perspective

Invite a representative from the Army Corps of Engineers, the Environmental Protection Agency, or your state's pollution control or natural resources agency into your classroom to explain how they make their decisions on wetland and wildlife issues.



Shorebird Decision Dilemma Cards

Shorebird Decision Dilemma One

You own land and would like to build a home on it. You will need to place a pad of gravel on the land to provide a stable foundation for the house. You find out that the land is legally classified as a wetland.

Possible Solutions

- Find out which part of your land is used by fish or wildlife or has other wetland functions and plan your home for the area that has lower use or fewer functions.
- Find out whether placing gravel on the wetland requires a permit.
- Apply for a permit.
- Build your house without getting any permits.
- Sell your land to someone else and buy another piece of land for your home.
- Learn as much as you can about this land that you are a *steward* of:
 1. Ask a local biologist (from the university, the government, private industry, etc.) for information and advice about the need to protect organisms or habitats on your land.
 2. Ask the same of local land-users or native elders.
 3. Inquire about low-impact land development options or ways to enhance wildlife habitat.

Shorebird Decision Dilemma Two

You are the owner of an oil company that has leased part of the North Slope of Alaska. You plan to construct a gravel pad and drill an oil well on tundra wetlands. When you apply for a wetland permit, you learn that the place you want to fill with gravel is very important to nesting shorebirds and waterfowl, and feeding caribou in the summer. The gravel will destroy the habitat.

Possible Solutions

- Study the area to find out if there is an area close by which is not as important to the birds and caribou and where drilling the well would cause less harm to wildlife.
- Find out whether it is possible to drill the well in a different location and how much more that would cost.
- Follow your original plan and apply for permits.
- Redesign the gravel pad to make it as small as possible.
- Follow your original plan but offer to improve the wetland habitat somewhere else (research the concept of *mitigation*).

Decision Dilemma Three

A plover, endangered in your state, is found to nest only on beaches that are open to recreational use of off-road vehicles (ORVs or ATVs). The few nests that shorebirds build are frequently destroyed by off-road vehicles. You own a four-wheeler and like to ride on that beach.

Possible Solutions

- Decide that many of the small, inconspicuous plovers would be protected by re-routing traffic if the public was *informed* about their nests and habitat needs. Take the initiative to begin a public information campaign, perhaps via the placement of signs on the beach, letters to the editor of local papers, or the Internet.
- Get involved with a committee made up of the public, users of ORVs, and wildlife protection agencies and groups to come up with a solution that protects the plover and allows for some recreational use, perhaps by building an alternative trail.
- Find other places to ride your four-wheeler.
- Retire your four-wheeler from recreational use and resolve to use it only for work or subsistence.
- Disregard the issue and continue to ride on the beach with an ORV/ATV.

Decision Dilemma Four

The state where you live has recently decided to open up a large tract of grassland to grazing and farming. Right now, several species of shorebirds are nesting in this area in fairly high concentrations. Many people in your community are concerned about the impact grazing and farming will have on the shorebirds. You have heard that grazing cattle often trample nests and young chicks and that haying equipment is often responsible for killing many young birds hiding in the tall grass. Those that avoid the machines are now easy targets for predators because the grass they hide in is gone. You are the son of a cattle rancher and understand that opening this land to grazing is critical to your family's business.

Possible Solutions

- Identify what areas of the grassland shorebirds are using for nesting and propose that those areas be considered "off-limits" to cattle and farming from the mid-April through mid-July breeding season.
- Establish a committee to look for other land options where grazing or haying would not impact nesting shorebirds--such as using rotational grazing methods or providing water troughs and fences to keep cattle out of wetlands and streams.
- Convince your family that it is time to go into a different business.
- Ignore the concerns about nesting shorebirds and move your cattle onto the new "open" area.



What You Can Do For Shorebirds!

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complete Guide can be obtained
by attending a Project WILD
workshop. For more information,
please visit www.projectwild.org or
contact the National Project WILD
Office at 713-520-1936.

Grade Level: upper middle school/
high school

Duration: varies, a long-term
project (generally one semester
or more) for older students but
perhaps just 30 minutes for younger
participants.

Skills: application, discussion,
problem solving, evaluation,
vocabulary, presentation, team
building observation, prediction,
using technology

Subjects: social studies, language
arts, science, and technology

Concepts

- Taking an active role in shorebird conservation requires that we apply knowledge
- Sharing our knowledge about shorebirds with others is one way we can help shorebird conservation
- Environmental stewardship is vital for the long-term conservation of our shared natural resources

Vocabulary

- problem
- projects
- responsibility
- authority
- compromise
- alternatives
- political action

Overview

Students participate in a conservation project to improve the environment and help wildlife. The situation may involve “hands-on” experiences, like planting or picking up litter, or a political campaign in which students participate in influencing the actions of others.

Objectives

After this activity, students will be able to:

- Identify a local wildlife or habitat problem.
- Suggest ways they can help solve or at least lessen the problem.
- Identify at least one other activity they can get involved in to help shorebird conservation.

Introduction

Perhaps one of the most powerful environmental lessons a student can learn is that he or she does have the power to make a difference. For some, all they need to understand this lesson is one positive experience. A good experience not only gives them the confidence to participate in conservation and stewardship projects, but it also teaches them the tools of planning, presentation, design, and follow through.

If your students have difficulty thinking of a local project, offer them some of the suggestions below to get them thinking. Check with your local land-use planners, natural resource agencies, volunteer organizations, or local environmental or hunting clubs for other ideas.

Conservation Project Examples

Initiate or Participate in a Wetland Water Quality Testing Program

There are several programs available:

- Adopt a Stream: <http://www.streamkeeper.org>
- Adopt a Wetland: There are numerous state and federal agencies involved in region-specific programs. Do a search on the World Wide Web for an Adopt a Wetland program in your state.
- Adopt a Watershed: <http://www.adopt-a-watershed.org>

Initiate a Recycling Program in Your School

Help preserve wildlife resources by reducing the demand for mineral resources often found in wildlife habitats.

Plan a Litter Clean-up Day

This might focus on your own school grounds or an important shorebird habitat. Advertise your efforts in your local school and community newspapers.

Create a Wetland or Grassland Plan

Map the wetlands and grasslands around your school or local community. Evaluate their functions. Are they being protected from polluting run-off, pesticide spraying, littering, disturbing recreation? If not, create a plan that offers solutions to these problems.

- Contact your local U.S. Fish and Wildlife Service office to learn more about the Schoolyard Habitats program or go to <http://partners.fws.gov/OurPartners/schools.htm>



Propose a Wildlife Enhancement Project

If there are no wetland or grassland habitats around your school or in your community, can you find areas where they might be created? Is there a stream or beach that needs improvement? Propose your suggestion for a wildlife enhancement project to the appropriate government agency. Grants may be available from local civic groups, government organizations, or sport-fishing organizations to help you. To get more positive publicity and support, develop your project around a theme such as Arbor Day, Earth Day, or International Migratory Bird Day.

Develop an Information Program

Educate others in your community about the danger litter is to local wildlife and shorebirds. Address local wetland problems. Bring attention to threats to the shorebirds of your area. Whatever the conservation topic, make sure you let people know what they can do to help. Create informational posters, flyers, displays and newspaper articles.

Develop a Wildlife Calendar

Focus on a local wetland or grassland, wildlife observation spot, or park. Interview people in the community; or make your own observations to determine when, and which, species of migratory birds migrate through, feed, nest, and roost in the area. Present this information in a wildlife calendar and post it at the site.

Materials

- This will vary with the project your class selects

Procedure

1. Have the class brainstorm a list of activities on the school grounds or in the community that may be negatively impacting wildlife or, more specifically, shorebirds. Some possible answers are: litter, spraying pesticides that kill the “pest” but perhaps affect other plants and animals too, and removing food and cover plants.

Note: It may also be appropriate to consider helping with habitat-improvement projects identified by the local community or participating in ongoing conservation projects.

2. Select one of the problems to work on--something the students think they could realistically handle and do something constructive about in the time they have available. If they have difficulty coming to a consensus, allow them an opportunity to speak in support of their choices. If necessary, have the class vote and select the project with the most support.

Note: Assist students in selecting a project that is realistic, constructive, and possible. If not, the students may experience an activity that contributes to their thinking that they “cannot do.” Encourage community involvement to help tackle a potentially large project, and give students an opportunity to learn from others and about other points of view. If adults take part, make sure that students are still allowed to take leadership roles and “own” their plans and actions. Through proper evaluation, students can learn from failures, as well as from successes.

3. Once the problem has been selected, ask the students to work alone or in small groups to generate ideas for possible solutions to the problem and ways to implement the project. Each individual or small group should come up with a plan, including written descriptions and sketches (perhaps in the form of a “flow chart” with arrows indicating the order of procedure) illustrating how to accomplish the project, step-by-step.
4. Have the groups present their plans to the rest of the students. Students may ask questions of the groups. Once all the plans have been presented, ask the students to select the plan that seems the most (a) constructive, (b) realistic, (c) helpful to wildlife and (d) likely to make a lasting contribution.
5. Have the students select one or more alternate plans in case their first choice is not acceptable to school or community leaders. Check that the selections are well thought out, include time lines, and are complete.
6. Once a plan and backup alternatives have been selected, have the students select a delegation to present their proposal to the school principal or the appropriate authority. Remember to include anyone who would be physically or officially involved (maintenance people, ground keepers, school board, etc.). Plan a “dry run” in front of a test audience and respond to any audience questions that might come up. Make adjustments in the presentations as needed.



7. Have the students make an appointment to present their proposal and then report back to their classmates. If their plan is accepted, they should know whom to contact next in order to successfully complete their project. Once they have all the necessary permissions, the students should begin work.
8. Once the project is complete, ask the students to analyze their results. Did things work out the way they wanted? Were there any surprises or unforeseen problems? How might the students or plans have been more effective?

Additional Activities



Cultural Connections

Through the Shorebird E-mail Network, your class can connect with another class along the flyway to share what it is doing to help conserve habitat for shorebirds and other wildlife species.

How To Do a Community Service Project

Document the entire process of developing and completing a community service project on video or photographs for other students. Include the mistakes you made, as well as the successes. Submit your video/pictures to the Shorebird Sister Schools Website <http://sssp.fws.gov>



Shorebird Values on the Line

Adapted with permission from "Values on the Line, Project Learning Tree Pre K-8 Activity Guide."

Grade Level: upper middle school/ high school

Duration: one class period

Skills: evaluation, discussion, critical thinking, comparison, and vocabulary

Subjects: science, social studies, and language arts

Concepts

- Taking an active role in shorebird conservation requires that we apply knowledge.
- Environmental stewardship is vital for the long-term conservation of our shared natural resources.

Vocabulary

- values
- beliefs
- facts
- opinion

Overview

Students rank to what degree they agree or disagree with a set of statements pertaining to shorebirds and shorebird habitat. They compare their rankings with those of their classmates, examine the reasons behind them, and discuss what factors influence a person's values.

Objectives

After this activity, students will be able to:

- Clarify the difference between a belief, a fact, and a value.
- Identify the need for balanced information when forming opinions.
- Explain to what degree they agree or disagree with environmental issues related to shorebirds.

Introduction

The process of searching for truth involves identifying and assessing facts; distinguishing substantial from insubstantial evidence; separating the search for truth from the acceptance of propaganda; and examining controversial subjects such as politics, ethics, and religion in a constructive and unbiased manner.

To make decisions, students need to resolve ambiguities, balance the advantages and drawbacks of alternative solutions, and project the likely consequences of a particular choice. By combining such a decision-making procedure with pertinent scientific and technological information, students move toward achieving scientific literacy.

Materials

- One copy of the *Shorebird Values Statements* handout (included here) for each student
- Large open space

Activity Preparation

1. Make a copy of the Shorebird Values Statements handout for each student.

Procedure

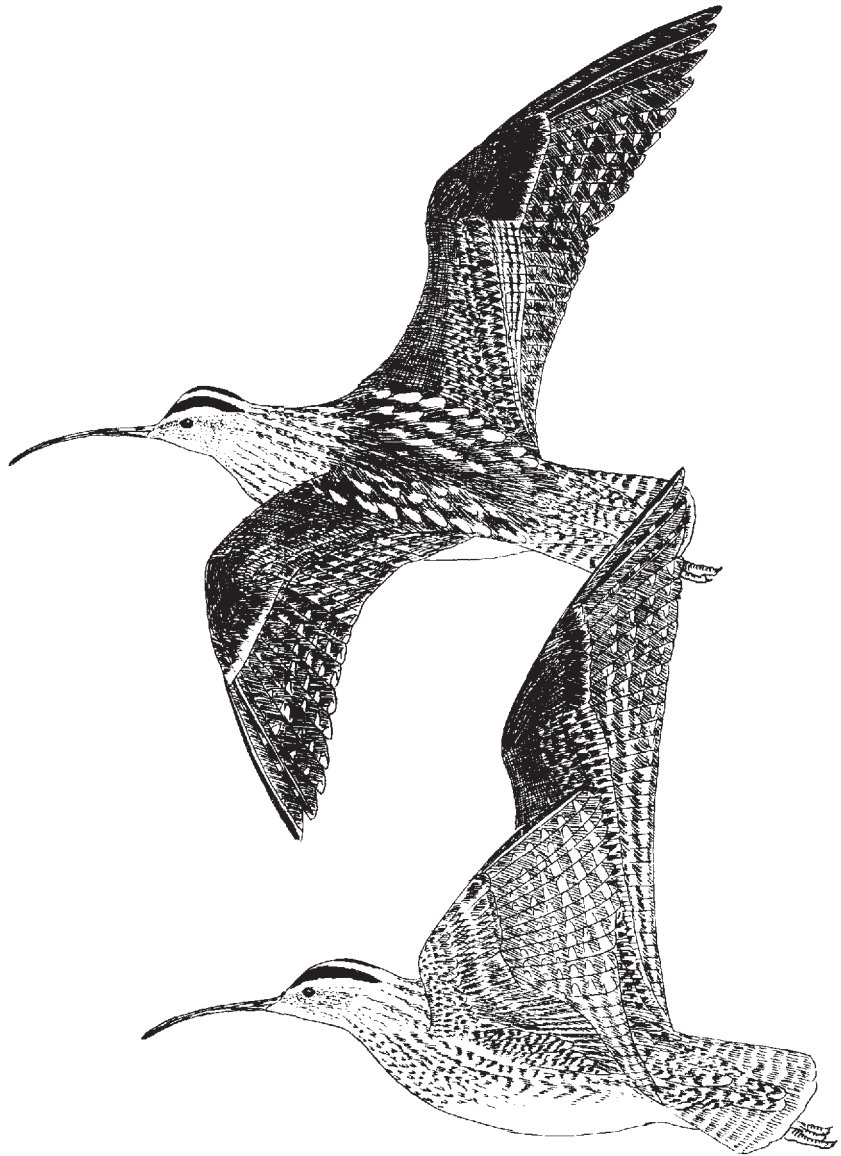
1. Pass out a copy of the *Shorebird Values Statements* handout to each student. Ask them to rank how much they agree or disagree with each statement by circling a number, under each statement. A "10" represents strongest agreement and "1" the strongest disagreement.
2. Find an open space and have the students stand in a line. Tell them that the line represents the scale of 1 to 10 that they used to rank the value statements (one end of the line being "strongly agree" and the other end "strongly disagree").

3. Read one of the value statements aloud and have students position themselves in line according to how they ranked the statement. They will need to communicate with each other to make sure everyone is in the right place. Once they are settled, point out how the line reflects the range of opinions in the class.
4. Next, break the line at midpoint, and have half the students stay in place while the other half moves down so each student has a partner.
5. Give each person in the pair one minute to explain to his or her partner the ranking he or she chose. Then give the other partner half a minute to paraphrase what was said. Have the partners switch roles, giving the other person a minute to explain his or her ranking and the partner half a minute to paraphrase what was said.
6. Repeat steps three through five for as many of the value statements as you like.
7. Discuss each value statement with the students, using the following questions as a guide:
 - What reasons did they have for the rankings they chose?
 - What reasons did their partners give for the rankings they chose?
 - Did any of them support their rankings using examples or specific information from real-life situations?
 - Did anyone feel like changing his or her ranking on a particular statement after pairing with someone else and hearing his or her opinion?
 - Did students feel they needed additional information to judge an issue? If so, what did they need?



- Where do people's values come from? What kinds of experiences change or strengthen people's values?

Alternative: Using chalk, string, or tape, create a scale of 1 to 10 on the ground. Make the scale 10 yards or meters long with the numbers one yard or meter apart. For a particular value statement, have the students place themselves as close as possible to the ranking they chose. When everyone is settled, make a diagram on the chalkboard or easel paper of how students are distributed on the scale. Have them do the exercises in steps three to five, and allow them to change their ranking based on what they learn. Have students once again position themselves on the scale. Draw another diagram showing their revised positions. Compare the diagrams and discuss the changes with the entire group.



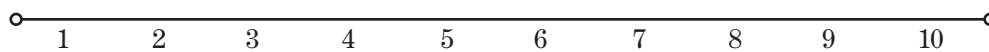
Shorebird Values Statements

1 (strongly disagree) – 10 (strongly agree)

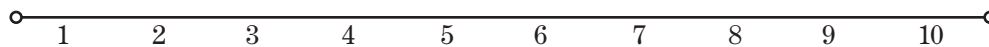
1. Beachfront property that is valuable shorebird habitat should not be protected if development would bring more jobs and tourist dollars into the community.



2. It is important to protect tundra wilderness areas even if most people will never visit them.



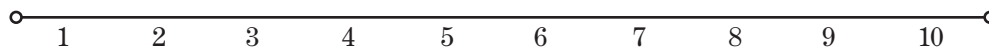
3. The world's natural resources exist for people to use. Preserving these resources for shorebirds is a luxury we cannot afford.



4. The loss and degradation of habitat is the biggest problem facing shorebirds today.



5. Shorebirds can always find another place to rest and feed if a traditional migration stopover site is lost to development.



6. People have a responsibility to protect all life forms on Earth, including shorebirds.



7. Protecting shorebirds and their habitat is primarily the responsibility of the government of the United States.



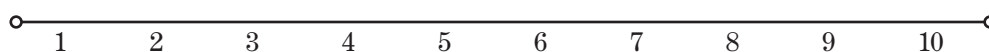
8. People should be able to use their own land in whatever way they want (that is farming, grazing cattle, housing, logging, wildlife habitat).



9. The fate of the human race is tied to the fate of other living things, including shorebirds. If people are to survive, we must protect all species and their habitats.



10. People will eventually develop alternative farming and grazing practices and machinery that will allow farmers and cattle ranchers to successfully coexist with grassland-nesting shorebirds.



Assessment

The following activities are to review and assess what students have learned. The activities provide opportunities for students to demonstrate their understanding of what they have learned in a fun way.

Concept

- Applying knowledge of the connections between shorebirds and the ecosystems they share with people and other plants and animals demonstrates understanding of the information and the ability to use it.

Activities

Wild Spellers

(lower elementary)

Students play a vocabulary-building game in which they match a word to its definition and then try to spell the word correctly.

Shorebird Jeo-Bird-Y

(upper elementary/middle school, upper middle school/high school)

Students review information they have learned in other shorebird activity units in this version of the popular game show “Jeopardy.”

Shorebird Speeches and Listening Tests

(upper elementary/middle school, upper middle school / high school)

Students design a shorebird speech to present to other students in their class, another class, or other audience.

Peeps and Predators

(lower elementary, upper elementary/middle school)

Students review shorebird information they learned on their field trip by pretending to be either a shorebird or a predator and alternately chasing each other in response to true or false shorebird statements.

Shorebird Bubble Map

(upper elementary/middle school, upper middle school/high school)

By creating a bubble or concept map, students explore the interconnectedness of the environmental factors within a shorebird’s habitat and the shorebird’s characteristics of behavior, adaptations, and breeding biology.



Wild Spellers

*Adapted with permission from
Quinlan, "Alaska Wildlife Week"*

Grade Level: lower elementary

Duration: time to review vocabulary words, then 30 minutes for the game

Skills: spelling, vocabulary, and team building

Subjects: language arts and science

Concept

- Applying knowledge of the connections between shorebirds and the ecosystem they share with people and other plants and animals demonstrates understanding of the information and the ability to use it.

Overview

Students play a vocabulary-building game in which they match a word to its definition and then try to spell the word correctly.

Objectives

After this activity, students will be able to:

- Accurately spell shorebird vocabulary words selected from the educator's guide glossary.
- Correctly define shorebird vocabulary words selected from the educator's guide glossary.

Vocabulary

Since this is a review and sharing activity, there are no specific vocabulary words.

Materials

- One set of shorebird vocabulary cards, made according to the instructions below.

Introduction

Since this is a review and sharing activity, there is no introductory material.

Activity Preparation

1. Select 30 words from the educator's guide glossary or those used in the shorebird activity units your class is familiar with.
2. Write each word and its definition on the same side of an index card. Or hand out an index card to each student in the class and ask students to make the selections and write the cards.

Procedure

1. Review the vocabulary words with the students or provide time for review before playing this game.
2. Divide the class into two teams and have them line up. Each team should pick a shorebird name for itself. In this example, the teams are identified as "Sanderling" and "Dunlin."
3. Shuffle the cards and place them in a drawing pile. Have one of the "Dunlins" pick up a card and read only the definition out loud.
4. The "Sanderlings" must try to guess the word that matches the definition within a time limit. Teammates should huddle together to confer. The first member of the team announces the team's answer. If correct, the team wins one point.
5. Now the team attempts to spell the word. If correct, the team wins one more point. This word is then placed in a discard pile. The person at the front of each line moves to the end of the line.
6. Now the second member of the "Dunlin Team" picks a card from the pile and reads the definition aloud.

7. "Sanderlings" guess again, and if correct, they try to spell the vocabulary word. The person at the front of the line moves to the back again. This process continues until an incorrect answer is given.
8. When a wrong answer or spelling is given, the team holding the card gives the right answer. Play then turns to the other team.
9. The first "Sanderling" draws a word card and reads the definition aloud for the "Dunlins" to guess.
10. The game proceeds until no word cards remain in the drawing pile. The team with the most points wins.

Additional Activities



Cultural Connection

For extra points, add vocabulary word cards with words from different languages. Include on the card what place the word comes from. For example, Kōlea is the Hawaiian word for Pacific Golden-Plover.

Vocabulary Themes

Write the vocabulary words on the chalkboard. Have each student group these words (migration, breeding, food habit, habitat, etc.) into shorebird themes on his or her own piece of paper. They should use all the words. Did all the students group the words the same way? Could some words be placed under more than one category?

Shorebird Jeo-Bird-Y

Grade Level: upper elementary/
middle school, upper middle school/
high school

Duration: one or two 45-minute
class periods

Skills: team building, vocabulary,
and communication

Subjects: science and social studies
(geography)

Concept

- Applying knowledge of the connections between shorebirds and the ecosystem they share with people and other plants and animals demonstrates understanding of the information and the ability to use it.

Overview

Students review information they have learned in other shorebird activity units in this version of the popular game show “Jeopardy”.

Objectives

After this activity, students will be able to:

- Correctly answer a series of review questions on shorebird topics.

Vocabulary

Since this is a review and sharing activity, there are no specific vocabulary words.

Materials

- List of review questions (or use the ones included here)
- Watch with second hand or stopwatch

Introduction

Since this is a review and sharing activity, there is no introductory material.

Activity Preparation

1. Compose a set of shorebird review questions you feel your students should now be able to answer. Choose questions from the list included in this activity or write your own.
2. Decide on the order in which the groups will take their turns and if this will be an “open-book” activity.

Procedure

1. Divide the class into “flocks” of three or four students.
2. Tell the students that you will read a question about shorebirds aloud to the class. The first group will have 45 seconds (or whatever time limit you decide on) to come up with the correct answer. They should not shout out the answer but can quietly discuss it among the members of their team. When time is up, or when the group has the answer, the teacher will choose one person from the group to explain the answer.
3. If the answer is correct, “flock one” gets a point. The play then proceeds to “flock two” which has the same amount of time to answer the next question. If the first “flock’s” answer is incorrect, the second “flock” has 30 seconds to come up with the correct answer to the same question. If they are correct, they earn the point. If “flock two” cannot come up with the correct answer either, then “flock three” has ten seconds to earn the point by answering the question. If “flock three” is incorrect, start over by giving “flock four” 45 seconds to answer a new question.

Note: The teacher should always select the student to answer the questions. This ensures that all the members of the group are cooperating with each other, looking for the answer, or teaching each other the answer. Scramble the subject order of the questions. Mix simple questions with harder ones. When you read the questions out loud, write any key words up on the board.

4. Continue the game until the time is up. Consider adding “bonus rounds” to give “flocks” a chance to improve their scores.

Older Students: To make this more challenging, play the game like the traditional “Jeopardy” game by reading the answers and asking teams to tell you the question.

Additional Activities



Cultural Connection

From the cultural profiles, students write clue(s) that relate to places along a shorebird’s migration route. Have the students give the class an overview of the culture, with the understanding that when the class plays the Mystery Shorebird Jeo-Bird-Y, there will be at least one clue related to the culture.

Mystery Shorebird Jeo-Bird-Y

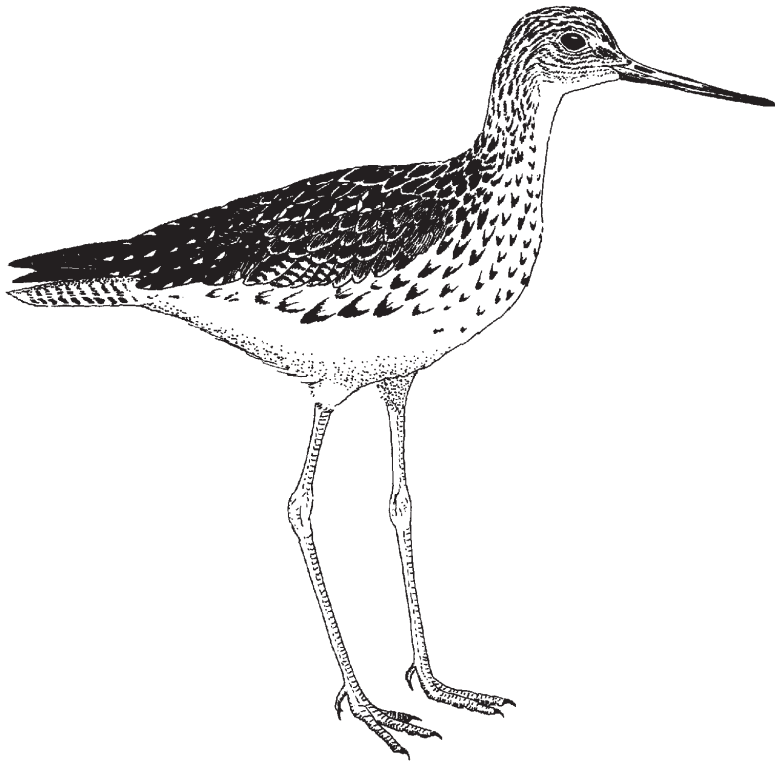
Select a set of local shorebirds to include in this game. You should have at least one shorebird for the number of classroom “flocks” you have assembled. Write five clues for each bird that will help the teams



guess the bird's identity. What kind of nest does it make? What type of wetland does it live in? What is the shape of the bill? Does it have a specialized feeding behavior? What countries does it pass through during migration? How have people treated this bird in the past? Does it play an important role in any cultures?

Start off with each bird being worth 60 points. Read aloud one clue at a time aloud. Give the first team an opportunity to guess the identity of the mystery shorebird. Deduct ten points from the bird's point value for every clue that does not produce a correct guess. It may take a team all five clues before it feels confident enough to guess the identity of the bird. If at the end of the round, they guess correctly but needed all five clues, they earn only ten points.

If the first team makes an incorrect guess, pass the play to the next team. It starts at the point value left off by the previous team. Since team members had the opportunity to hear all the previous clues, give them a chance to immediately guess the bird's identity.



Shorebird Jeo-Bird-Y Questions

Describe one important fact about the place where the ocean meets the land.

- Contains a great diversity of life
- Faces powerful natural forces: wind, waves, currents, erosion
- Species must adapt to the twice-daily changing tide--from a relatively cool, underwater or wet environment to a dry area where evaporation concentrates and rain or river flow dilutes salinity levels at low tide

Describe two important physical adaptations of shorebirds (what identifies a bird as a shorebird?)

- Long legs for walking and wading
- Specialized bill for collecting particular food items
- Long, pointed wings for rapid, long-distance flying
- Long toes for support in walking
- Plumage that is well camouflaged
- Most species have an erect posture

What kind of wings do most shorebirds have?

- Relatively long and pointed (although the Oystercatcher has relatively broad, rounded wings)

What type of habitat are most shorebirds found in?

- Open, often wetland habitat

Name a non-wetland habitat that some shorebirds use.

- Grasslands (or human-managed agricultural fields, lawns, golf courses, etc.)

Name one natural environmental cycle that is important to shorebirds.

- Seasons
- Tides (those that are found on the shore at some time of their lives)
- Precipitation (rainy season, dry season)

What do Europeans call shorebirds?

- Waders

About how many species of shorebirds are known in the world?

- 214

How many species of shorebirds breed in North America?

- 48

How many species of shorebirds breed in the North American grasslands?

- Eight (Killdeer, Spotted Sandpiper, Wilson's Snipe, Marbled Godwit, Wilson's Phalarope, Upland Sandpiper, American Woodcock, and the Piping Plover)

What does "morphology" mean?

- Shape, size, color, and other characteristics that describe what an organism looks like--generally morphology refers to external traits, while anatomy refers to either internal or external structure and appearance

Name three shorebird predators that are found in North America.

- Eagles, hawks, gulls, ravens, foxes, people
- Small mammals like weasels, river otters, and ground squirrels may take eggs

Describe two behavioral adaptations of shorebirds.

- They form large flocks during migration.
- They migrate long distances between non-breeding and breeding habitat.
- They have elaborate, ritualized displays associated with courtship and breeding.
- Some form leks.
- They may roost on one leg.

What does "roost" mean?

- As a verb—to rest or sleep.
- As a noun—group of resting birds, or the place where they flock to rest.

What is the purpose of roosting on one leg?

- Like tucking the bill under the feathers, roosting conserves body heat in open habitat
- Roosting also allows the shorebird to rest the other leg

Describe two things to look for when attempting to identify a species of shorebird.

- Size
- Color, any patches, or any spots or streaks on the breast
- Length, curvature, and color of bill
- Leg color
- Presence of any wing stripes or tail pattern
- Feeding behavior (for example picking, prying, running and stopping to probe, steadily probing like a sewing machine needle)
- Call notes heard as bird takes off in flight

What three areas do shorebirds depend on for habitat each year?

- Breeding or nesting
- Migratory stopovers
- Non-breeding

What habitat do most shorebirds spend the most time in?

- nonbreeding.

Do any shorebirds depend on more than three habitats in a year, and if so, what are the others?

- Yes, they often depend on several migratory stopover sites in the spring and in the fall.

Do all Arctic-nesting shorebirds migrate?

- Yes, because ice and snow blanket the Arctic in the winter months.
- Some species of other shorebirds, like Common Snipe and Black Oystercatcher, do remain in the southern parts of Alaska and Canada over the winter.



Name three places that Arctic-nesting shorebirds might be found during our winter months.

- Answers may include the lower 48 States, Hawaii, South Pacific Islands, Central and South American countries.

Describe one reason why shorebirds are important to people today.

- Because they are relatively large, visible organisms that are near the top of the food pyramid, shorebirds are good indicators of wetland health.
- Guano (droppings) returns nutrients to the environment. This is not true for human waste (for example large populations produce a large amount of waste; it is not concentrated and nutrient-rich like bird waste; and it may carry disease).
- People enjoy seeing shorebirds, whether discovering a lone one on a quiet walk or experiencing an awesome migratory flock.
- Shorebirds are predators of some organisms and prey for others, making them a natural part of the food/energy pyramid with their own unique place in the balance of nature and our local wetland ecosystems.

Give an example of what an indicator species can tell us.

- Examples are endless and need be only general. Look for answers that show an understanding that all organisms are affected by certain changes in other organisms (or abiotic factors) in their environment
- They may be affected through their food chain or by changes in their habitat. Any change in condition or numbers of the indicator species may indicate that, for example:
 1. Other shorebirds in the same place in the food chain may be expected to be similarly affected

2. Other shorebirds using the same habitat may be similarly affected
3. Other organisms feeding on the same prey may be similarly affected
4. Other organisms using the same habitat may be in jeopardy too
5. Something is wrong with the shorebird prey items
6. A necessary habitat has been disturbed or destroyed
7. Water quality or amount (as with droughts, floods, and damming) has been altered

Describe the Western Sandpiper (or other local, common shorebird or species students have studied)

- Answers may refer to size, coloration, behavioral characteristics, habitat use, global range, or factors covered in class. Look for answers that show recognition of the species, and that distinguish this species, or whichever one you choose to ask about, from others

Name three organisms that shorebirds feed on.

- Worms, insects, tiny clams, shrimp, ghost shrimp, isopods, amphipods, spiders, beetles, and numerous other invertebrates

Name two shorebird prey items found on the Arctic tundra.

- Adult and larval insects (like crane flies), midges, beetles, spiders, mosquitoes

Name the shorebird prey items that make the Delaware Bay a popular shorebird stopover site during migration.

- Horseshoe crabs and their eggs

Name one species in which the female seldom raises the chicks.

- Phalaropes (any of the three species), Dowitchers (either species), several species of Sandpiper (e.g., Least, Spotted, Purple)

What is the lower back of a shorebird's head called?

- Nape

Where is the flank on a shorebird?

- Side, underwing, and towards the tail (posterior half)

What does biodiversity mean?

- Variety of species and individuals (also generally implies that the number of these individuals will include a variety of traits, types)

Explain how scientists believe adaptations develop.

- All organisms have a certain set of traits (set of genes). Sometimes an individual is born with a trait that differs slightly from others of its species (a mutation). If that different trait gives the individual an advantage in surviving to breed, it may pass on the genes for that trait. The trait may then persist in the species as long as it gives individuals that have it an advantage—or at least the ability to successfully compete and breed. The helpful traits are called adaptations because they help an organism compete to survive long enough to breed successfully

What are three characteristics that define habitat?

- A place where organisms are adapted to find food, water, and protection from environmental elements or a place to breed

Describe one type of shorebird bill and how it works.

- Long, tweezer-like bills are for probing deep below the surface of water or the ground
- Short, tweezer-like bills are for probing right underneath the surface
- Long, curved bills are for sweeping through the water (American Avocet) or probing into the burrows of worms and clams (curlews)



- Relatively short bills are for picking up prey items on the surface (plovers) or snatching flying insects and hopping amphipods (sanderlings)
- Relatively short, sturdy bills are for flipping over rocks to search for prey (turnstones)
- Large, heavy “clothespin” bills are for prying up limpets and opening mussels (oystercatchers)

Describe one physiological adaptation that helps shorebirds make long, strenuous migrations.

- Efficient “fat-loading” (the conversion of food into a useful source of energy)
- Efficient burning of calories (burning few calories per kilometer)

Describe two things that an adult shorebird needs in its breeding habitat.

- Food
- A mate
- A safe place to nest and raise young

Describe two things that a shorebird depends on finding in a migratory stopover site.

- Rest from the long flight
- Food the body can convert into energy for the long flight
- Freedom from disturbance so that it can get all the food and rest it needs

Describe two things that a shorebird depends on finding in its non-breeding habitat.

- Food
- Rest
- Warm or temperate weather (as opposed to the freezing temperatures of the Arctic during these months)

Why are wetlands important shorebird habitat?

- Abundant, available, nutrient-rich food (prey items and vegetation thrive in areas enriched by shallow water)

Why are wetlands important to people?

- Wetlands purify water, are a nursery for wildlife, absorb flood waters, and mix nutrients

Describe two sources of the water in wetlands.

- Rivers, streams, springs, ocean tides, permafrost allowing melting snow or rainwater to pool at the surface

Name a wetland type found within grasslands.

- Prairie pothole or playa lake

Describe three types of wetlands that shorebirds use.

- Ocean beach, tundra, mudflat, freshwater marsh, saltwater marsh, intertidal zone, stream/river corridors (estuaries), prairie potholes

Explain three threats to wetland habitat.

- Draining for development or conversion into cropland
- Damming or diverting water for agriculture (crop irrigation), power source, drinking water, sewage treatment, use in industry, or recreation (artificial lakes or waterways)
- Pollution from agricultural chemical runoff, and runoff through storm drains from streets.
- Accidental oil (especially in coastal habitats) or other chemical spills
- Accidental or purposeful introduction of nonnative (“exotic”) species, some of which outcompete and overtake native (natural and local) species that are vital members of the food chain

Explain two threats to grasslands.

- Development of grasslands
- Over-grazing or farming grassland

Explain one reason why the Arctic is such a good breeding habitat for shorebirds (and waterfowl)

- Billions of insects hatch there each summer and are available as prey
- There is less competition for food and nesting spaces and relatively lower diversity of predators (The animals with which shorebirds share their environment in the winter are left behind in the south when shorebirds migrate.)
- Long daylight hours to feed and low Arctic sun to warm nests on the open tundra
- Besides insects, the tundra provides vegetation such as berries for food

What is the usual number of eggs (“clutch-size”) small shorebirds lay?

- Four

What is the major purpose of the elaborate displays shorebirds take part in early in the mating season?

- To attract a mate

Describe two methods of brood protection

- Nests, eggs, chicks, and brooding parent on the nest all have cryptic coloration (camouflage)
- Distraction displays by the parent (for example, feigning injury such as a broken wing or tail)

Describe one type of shorebird territory, or one common reason why shorebirds defend a territory.

- Mating territory (for example, a place for a male to breed with females or to build a nest)
- Feeding territory, or home range, where an individual defends his or her prey-hunting area

Describe the mating behavior of phalaropes.

- Phalaropes have a type of polygamy known as polyandry, in which the female attracts the male to her territory, may mate with more than one male, and leaves the male to raise the chicks

What is a typical shorebird nest like and what is it called?

- It is called a scrape and is a shallow, inconspicuous depression or nest located on the ground.

Name three important migration stopover sites on the flyway you live in.

- See the Western Hemisphere Shorebird Reserve Network List of Important Shorebird Sites in North and South America and flyway maps in Shorebird Migration Flyways

What is the most serious threat to shorebirds today?

- Loss of habitat

Why are shorebirds so vulnerable during migration?

- They concentrate in huge numbers, which is often a high percentage of the entire population of a certain species, at their migratory stopover sites
- They traditionally use the same sites each year, and if a vital estuary is destroyed, they will not find or stop at an alternative site (even if one is available), but they will fly on to the next traditional stop. They do not have the energy reserves to do this successfully.
- A single storm (which can easily occur in the spring) can wipe out large numbers of shorebirds
- A disturbance or oil spill where a large flock is present can kill many birds
- Wetlands are being degraded and destroyed. Populations of migratory birds are under more pressure each year to find suitable breeding habitat.

Why do shorebirds migrate?

- To take advantage of the abundant invertebrate food items and reduced competition in the Arctic
- Historically, migration probably developed as the ice from the last Ice Age receded

Why do we often see much larger flocks of shorebirds migrating in the spring than the fall?

The three following reasons are all part of the answer:

- In the spring, the shorebirds are in a hurry to take advantage of the short Arctic summers because they need to find a mate, lay eggs, and raise chicks to fledgling stage before the weather turns colder and the supply of invertebrate prey dies off.
- In the spring, the shorebirds are also in a hurry to arrive on the breeding grounds at about the same time as the rest of their species so that they have a good chance of finding a mate. Some species also need to establish territories before all the good sites are taken.
- The fall migration is staggered into different categories. In the fall, young birds take more time to prepare for migration. Parents leave early. Adults that failed at nesting or raising chicks may leave even earlier.

Describe how plants and animals are connected to soil, water, air, and sun.

- They are all connected in an ecosystem
- They are all linked and interdependent on each other
- They rely on nutrient flow
- They all rely on energy from the sun

Explain three ways people can help conserve wetlands and grasslands and the species that live there.

- Prevent pollution
- Keep habitats clean
- Protect important areas for wildlife
- Tell others about the importance of these places for people and wildlife
- Plan development projects carefully so as not to harm wildlife and their habitat



Shorebird Speeches and Listening Tests

Grade Level: upper elementary/middle school, upper middle/high school

Duration: at least two 45 to 60 minute class periods for research and speeches

Skills: communication, presentation, collection and interpretation of data

Subjects: language arts, science, and math

Concept

- Applying knowledge of the connections between shorebirds and the ecosystem they share with people and other plants and animals demonstrates understanding of the information and the ability to use it.

Vocabulary

Since this is a review and sharing activity, there are no specific vocabulary words.

Overview

Students design a shorebird speech to present to other students in their class, another class, or other audience.

Objectives

After this activity, students will be able to:

- List two elements of a good presentation
- Give at least two examples of research resources
- Write a summary paragraph on a shorebird topic of their choice

Materials

- Shorebirds research materials

Introduction

Since this is a review and sharing activity, there is no introductory material.

Activity Preparation

1. Arrange a time for the class to present speeches to its own class, a lower or higher grade level, parents, a school assembly, or some other group.

2. Prepare a list of suggested research materials (for example, books, magazines, Shorebird Profiles and other student readings found in the appendices, and the names of people willing to participate in phone interviews).

Procedure

1. Have each student research and prepare an informative speech on some aspect of shorebirds. The research can include use of class and field trip notes, library books, and interviews with knowledgeable people, newspaper or magazine articles, or films.
2. Discuss with the class what makes a good presentation. What kinds of presentations hold their interest? What makes information easier to understand? Write the following presentation guidelines on the board.

Presentation Guidelines

- Provide factual information in a clear, concise manner that is easily understood by people who know little or nothing about the topic.
 - Use graphics to help communicate and illustrate the messages (poster-sized drawings, slides, handouts, overhead transparencies, or the use of the chalkboard).
 - Write down three-five questions to answer in the presentation.
3. If students are presenting their speeches to the class or other audiences, have them practice before their own class, and get feedback. Be sure to put a time limit on speakers.

4. To determine how well students listened, combine the student-written questions into one quiz. At the end of all the presentations, hand out the quiz. Relative scores on the test will indicate how well each student listened.

5. To determine how well each presenter communicated, hand out “mini-tests” after each presentation, using the presenter’s self-written questions. Tabulate the score for each presenter and answer these questions:

- Were most people in the class able to answer the questions? What percent correctly answered each question? What percent incorrectly answered each question?
- Did many students not answer or incorrectly answer one or more of your questions?
- Did you provide the answer to the question(s) in your speech?
- How could you improve your speech to better communicate the point?

Additional Activities



Cultural Connection

As a speech option, allow students to research a culture in which a shorebird breeds, migrates, or winters, and present information on how that culture views and values shorebirds and/or birds in general.

Shorebird Research Report

Ask students to follow up their speeches with written reports. What are the differences between the amount and complexity of information in a speech and a research report? What information should they include that they left out of their speeches? What kind of supporting graphics would be appropriate here that would not be useful in a speech?



Peeps and Predators Game

Grade Level: lower elementary, upper elementary/middle school

Duration: 15 to 25 minutes

Skills: critical thinking and teambuilding

Subjects: science and physical education

Concept

- Applying knowledge of the connections between shorebirds and the ecosystem they share with people and other plants and animals demonstrates understanding of the information and the ability to use it.

Vocabulary: Since this is a review, there are not specific vocabulary words.

Overview

Students review shorebird information they learned on their field trip by pretending to be either a shorebird or a predator, and they alternately chase each other in response to true or false shorebird statements.

Objectives

After this activity, students will be able to:

- Differentiate between correct and incorrect information about the shorebirds they saw on their field trip.

Materials

- A large area where students can run
- A list of true and false statements about shorebirds (included here)

Introduction: Since this is a review, there is no introduction.

Activity Preparation

1. Review the list of true and false shorebird statements provided at the end of this activity. You may wish to edit the statements to be age-appropriate for your group.
2. Add a few statements of your own, in the spaces provided, that reflect the specific shorebird topics your students studied.

Procedure

1. Divide the class into two teams. Ask one team to pick the name of a local shorebird to represent their team. Ask the other team to select a predator to represent their team that would eat their “shorebird” classmates.
2. Line up the two teams, facing each other, about two feet apart. About 15 feet behind each team, draw another line for “home base”, an area where the teams are safe from each other.
3. Read one of the shorebird statements out loud. If the statement is true, the predators chase the shorebirds, trying to catch them before they reach their “home base”. If the statement is false, the shorebirds chase the predators. Anyone tagged by a member of the opposite team must join the other team.
4. If the answer is not obvious to the players, you will get some of the predators and shorebirds running toward each other, and others running to their “home bases”. During the pandemonium, remain silent and neutral. When the action has calmed down, reveal the correct answer and explanation.

Additional Activities



Cultural Connection

Add these value statements:

- To protect shorebirds and their habitat, we must work with other countries along shorebird flyways. TRUE!
- Understanding other cultures is important for our daily lives and environmental conservation. TRUE!
- We do not learn attitudes, beliefs, and behaviors from the culture we grow up in. FALSE!



Peeps and Predators Game

True Shorebird Statements

Here are true statements about shorebirds to get you started. Reword them to be age-appropriate for your group.

1. Shorebirds migrate the longest distances of all groups of birds.
2. Shorebirds nest on the ground.
3. Gulls are predators of shorebird eggs and chicks.
4. Many shorebirds nest in the Arctic tundra.
5. Shorebirds need a healthy chain of habitat to rest and feed when they migrate.
6. Shorebirds have long, pointed wings for flying fast and long distances.
7. The biggest threat to shorebird survival is the loss of habitat.
8. Some shorebirds are found in grasslands.
9. Shorebirds eat mostly aquatic invertebrates, insects, and insect larvae.
10. We can help shorebirds by not disturbing them and by protecting their habitat.
11. Shorebird migration routes are called flyways.
12. Shorebirds are part of an ecosystem linked to other species and nonliving parts.
13. Shorebirds are found in habitats with other wildlife species like gulls, mice, and mosquitoes.

Write additional true shorebird statements that reflect the shorebird topics your students studied.

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18.



Peeps and Predators Game

False Shorebird Statements

Here are false statements about shorebirds to get you started. Reword them to be age-appropriate for your group.

1. You can find shorebirds in almost any habitat.
(Shorebirds are found primarily in open areas—wetlands and grasslands near water. A few are truly upland species)
2. Shorebirds eat fish and small amphibians.
(Most shorebirds have bills designed for probing, picking, and gleaning invertebrates from soft mud, sand, or dirt.)
3. Shorebirds are solitary migrants.
(Shorebirds forms large flocks of thousands of birds during migration, though some shorebirds travel in small groups.)
4. Shorebirds build fancy nests in trees like forest songbirds do.
(Most shorebirds nest on the open tundra where there are no trees and very little cover. They nest on the ground in very basic nests called scrapes that might be lined with moss, grass, or lichen.)
5. It is easy to tell male and female shorebirds apart.
(In most cases, both the males and females are dull colored and similar looking. Their coloring and pattern of spots, speckles, and stripes helps to camouflage them in the open habitats where they live.)
6. Shorebirds have webbed feet for walking on the mud and sand.
(Webbed feet are a characteristic of ducks and geese, not shorebirds. Shorebirds tend to have long toes that stabilize them as they walk on slippery mud and sand. Phalaropes use

their partially webbed feet to spin on the surface of the water. The whirlpools they create flush invertebrate foods to the top of the water.)

7. Shorebirds are very tolerant of people coming close to them and their nests.
(Shorebirds are extremely wary of people and will move away from their nests and their feeding areas if people get too close.)
8. All shorebirds nest and winter on coastal wetlands in the southern areas of the United States.
(Shorebirds are long-distance migrants. They nest in extreme northern climates like the Arctic tundra to take advantage of the large number of insect, insect larvae, and aquatic invertebrate foods. After the breeding season, they fly thousands of miles south to wetland and grassland habitats in warmer climates.)
9. Generally, shorebird populations are on the rise.
(Actually, biologists believe that many species of shorebirds are declining due to loss of habitat, pollution, increase of predators, and disturbance from people.)
10. The Spotted Sandpiper, the Black Oystercatcher, and the Great Blue Heron are all shorebirds. *(Though they share the shore habitat, herons are considered wading birds not shorebirds.)*
11. Shorebirds are the only species of birds that use wetlands and grasslands.
(Many species of birds—including songbirds, waterfowl (ducks, geese,), waterbirds (herons, and egrets)— use wetland habitats.)

Write more false shorebird statements that reflect the shorebird topics your students studied. Include the correct information as review for your students.

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Shorebird Bubble Map or Concept Map

Grade Level: upper elementary/
lower middle school, upper middle
school/high school
Duration: one 30-minute class
period

Skills: vocabulary, discussion,
communication, presentation, and
visualization
Subject: science and language arts;
fine arts (with additional activity)

Concepts

- Applying knowledge of the connections between shorebirds and the ecosystem they share with people and other plants and animals demonstrates understanding of the information and the ability to use it.

Vocabulary

- interconnected
- habitat
- food web
- bubble map or concept map
- environmental factors

Overview

By creating a bubble or concept map, students explore the interconnectedness of the environmental factors within a shorebird's habitat and its characteristics of behavior, adaptations, migration, and breeding biology.

Objectives

After this activity, students will be able to:

- List at least five elements of the assigned topic.
- Describe how these elements are related to one another.
- Draw a bubble map to visually represent this information.

Materials

- Chalkboard
- Blank, unlined 8 ½" x 11" paper
- Copies of any student readings you want to use (available in a variety of activities in the educator's guide)

Introduction

Bubble and concept maps are visual representations of the interconnectedness of elements (terms) listed for a particular topic. The bubble drawn around each term represents a sphere to which many lines of connection can be drawn to other terms. It is similar to doing a food/energy web, but you can use any topic you have covered with your students.

The bubble map activity for younger students will demonstrate how well students understand the topic they have learned. For older, more advanced students, the concept map will demonstrate their knowledge of the connections among the terms in each bubble through words and phrases. It can also be done before and after your lesson to measure how much students have learned and understood.

Activity Preparation

1. Decide on the topic you will use for this activity.
2. Photocopy the handouts you choose to provide the students or student teams.

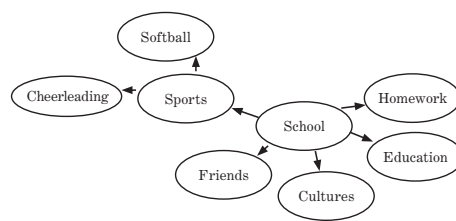
Procedure

Optional Demonstration

1. Have students choose a topic they know such as sports, music, or their school. Then have each student or groups of students provide a term (noun or verb) related to the topic. For example, if your topic is school, write "school" on the board with a circle (bubble) around it.

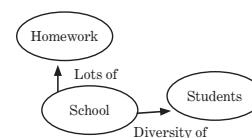


Students then brainstorm related terms that describe their topic. If it is 'school' then related terms might be "education", "friends", "sports", "homework". Write each of those terms in a separate bubble and draw lines to the main term "school". You could take it to the next step by asking students to relate more terms to the terms they just came up with such as "sports"= "baseball", "softball", "cheerleading" etc.



Bubble Map

Have older students demonstrate the relationship among the terms with a few words or phrases. For example, school→gives us a lot of →homework, or school→there is a diversity of→students. Students should continue until they have connected all the terms with words.



Concept Map



Activity

1. Choose your topic. Decide whether students will work alone or in groups.
 - For younger students, brainstorm with the entire class a list of terms related to the topic. Then have each student or team make a bubble map connecting the words.
 - For older students, assign the class a central topic. Have students, individually or in teams, brainstorm terms related to the central topic and connect them to the assigned topic. Then have each student or team demonstrate their understanding of the relationship among terms by connecting them with words.

Note: Remind students that each bubble map or concept map will be different. There is no one right map.

2. Write the instructions on the board for reference.

Instructions for Younger Students

- Start with one central bubble with the term inside.
- Include all the brainstormed terms on the board in your bubble map.
- Include at least three of your own terms in your bubble map.
- Each term must be connected to another term.

Instructions for Older Students

- Start with one central bubble with the assigned central term.
- Individually (or in a team) brainstorm at least five terms to connect to the central bubble.
- Write phrases or words to show the relationships among the terms.

Example: “Nest” is the central topic in this bubble map. This could be turned into a concept map by using words and phrases to demonstrate the connection among terms, such as “Nest” is for “eggs”. “Nest” needs “protection”. “Nest” is inside “territory.”

Additional Activities



Cultural Connection

Have students include aspects related to culture as part of the topic they depict through their bubble or concept map.

Translating Words into Pictures

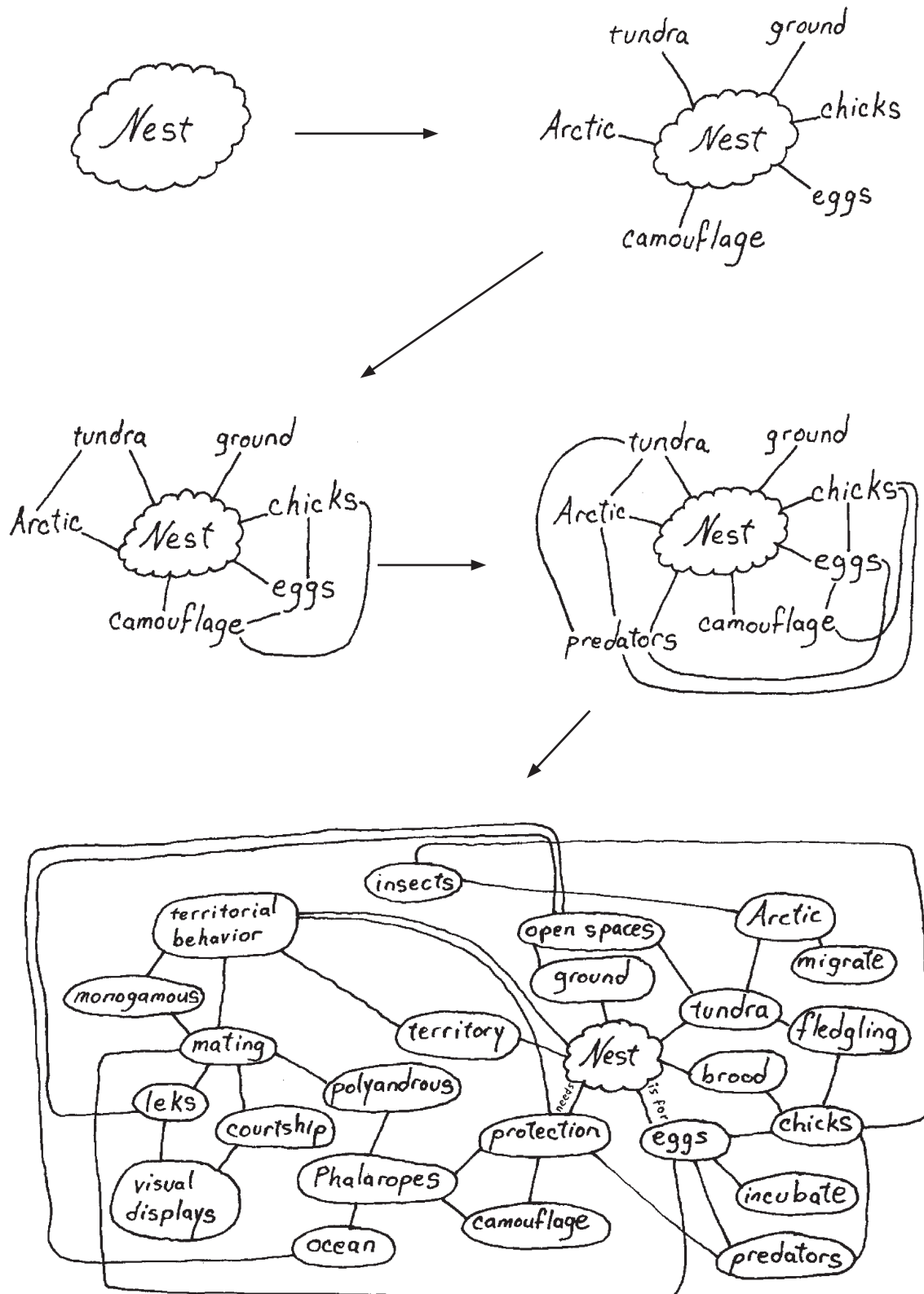
Ask each student to convert the ideas on his or her bubble map into a poster. Each item listed should be part of a shorebird scene. Let them select their own art materials (crayons, paint, charcoal pencil) and species that would be found there. Encourage them to include elements like rocks, grass, insects, other birds, and predators that identify the habitat.

Human Habitat Bubble Map

Have students draw another bubble map, this time based on brainstorming about “humans” and their habitat. Alternatively, the central circle (theme) can be their names.



Arctic Nesting Shorebird Sample Bubble Map



Field Trip Planning and Activities

Field Trip Planner	Page
■ Field Trip Checklist.....	407
■ Tips for a Successful Field Trip.....	409
■ Group Management Hints	410
■ Good Field Trip Etiquette	411
■ Field Trip Safety	413
■ Video Hints	414
■ Photo/Video Release Form (in-school use).....	415
■ Photo/Video Release Form (for submission to SSSP)	416
■ Field Trip Permission and Medical Information Form	417
 Field Trip Activities	 419
<i>Pre-field trip Activities</i>	
Using a Field Guide and Binoculars.....	420
Map and Miles Study.....	423
Making Field Sampling Equipment.....	424
Birding Code of Ethics	426
 <i>On-site Activities</i>	
Shorebird Field Study	429
Cast a Track	432
Mud Creatures Study	434
Sampling Local Shorebird Populations	440
<i>Classroom Activities for On-site Use</i>	
Migration Headache (Migration Activities Section)	286
The Incredible Journey (Migration Activities Section).....	327
Behave Yourself (Nesting and Breeding Activities Section)	267
It's A Tough Life (Nesting and Breeding Activities Section).....	279
Banded Birds (Research and Technology Activities Section)	346
Shorebirds On The Web (Research and Technology Activities Section)	366
 <i>Post-field trip Activities</i>	
Sharing Circle	442
Data Analysis.....	443
Shorebirds On The Web (Research and Technology Activities Section).....	366
 Field Trip Journals	 444
■ Field Trip Activity Sheets for Lower Elementary Students	445
■ Basic Shorebird Observation Journal Pages	449
■ Advanced Shorebird Observation Journal Pages.....	458
■ Advanced Invertebrate Observation Journal.....	464



Field Trip Checklist

- _____ **1. Decide on Field Trip Objectives.** What do you want the students to learn and experience? How will you integrate this field trip with classroom activities?
- _____ **2. Contact a Resource Person.** Locate someone in your area who is knowledgeable about shorebirds to visit your classroom, suggest good shorebird viewing sites, dates and times, and even accompany your class on the field trip. Check with your city or state natural resource agencies, a nearby wildlife refuge, universities, environmental education centers, or bird-watching clubs.
- _____ **3. Select the Site and Date** for your trip (with alternates). The date you choose is especially important because at most stopover areas, shorebirds are only found in large numbers for a period of one to three weeks, with a peak period of about five days. Check the section Shorebird Migration Flyways for a list of important shorebird sites and peak migration dates in your area. A successful field trip depends on your students being able to see birds!
 - _____ Are you visiting an intertidal area? If so, check a tide table. One hour after high tide is often the best time to see shorebirds, but consult local experts to be sure.
 - _____ Obtain permission for your field trip if the site is on private property.
- _____ Visit the site yourself before taking your students there. Ask if fees could be waived or reduced for educational groups. Are there restrooms? Can the bus park nearby or will it have to drop the class off and return at a predetermined time? Is there a shelter or building in case of bad weather? Where will the students eat lunch (if necessary)?
- _____ **4. Arrange Transportation.** Ask the driver to park nearby in case of bad weather at sites that do not have a shelter building.
- _____ **5. Select Pre- Post- and On-site Activities.** This educator's guide has suggestions for all these types of activities.
- _____ **6. Prepare the Field Trip Schedule.** Scheduling suggestions are included in this chapter. Consider small group divisions, distribution and use of equipment, travel time, timing of activities, and rainy day alternate activities.
- _____ **7. Recruit Assistants.** Invite teacher aides and parents to your field trip so that you have one adult to every five students. If possible, take the adults to the site before the field trip. Be sure they understand their duties, and have a copy of the schedule, trip rules, and activity explanations before the trip day.
- _____ **8. Explain Your Expectation to Your Students.** Let the class know where it is going and the behavior that is expected of the students (see Field Trip Etiquette).
 - _____ Ask students what their expectations are for the trip.
 - _____ Discuss etiquette and safety with the students.
 - _____ Give the students a list of what they need to bring along, including how to dress for the terrain and weather.
- _____ **9. Collect Permission Slips.** Be sure to get emergency medical information for all students. If you will be shooting video, be sure you have a signed parental release form, which is included at the end of this section for each student.
- _____ **10. Gather and Make Field Equipment.** Directions for making and using some suggested field equipment are included in this activity guide. Some students will be able to bring binoculars and field guides from home. Use the pre-field trip activity Using a Field Guide and Binoculars with your students before the field trip. Make sure, before leaving the school, that all binoculars and books are clearly marked with the students' names.



----- **11. Research and Discuss Your Local Shorebirds.**

What species do you expect to see on this field trip? What are the key identification features of these shorebirds? Using the Shorebird Profiles in the Appendix, have students learn the natural history of at least one of the shorebirds they are likely to see. Conduct as many of the classroom activities provided in this curriculum as you have time for before the field trip.

----- **12. Assign Responsibilities.**

Assign all students (either individuals, small groups, or the class as a whole) particular responsibilities for the field trip. This will ensure that all the students participate.

----- **13. Photocopy and Assemble the Field Journals.** Make sure students understand how to use the field journals.

----- Create a field journal that students can use to record field observations and data. Begin by selecting from the data sheets included in this activity book. Photocopy them on waterproof paper (if available). A stack of five blank sheets can be stapled in the middle and folded to form a ten-page book.

----- Provide each student (or student team) with a clipboard and a pencil mounted with string and tape.

----- **14. Conduct a "Dry Run."**

Ask students to bring appropriate clothes and birdwatching gear to school the day before the field trip. Take your class outside to simulate the field trip. Give students a chance to practice using the equipment and journals.



Tips for a Successful Field Trip

Adapted originally from Quinlan, "Alaska Wildlife Week."

The purpose of a field trip is to provide...

- An opportunity to *experience* shorebirds, particularly in their natural environment.
- An opportunity to practice methods of scientific inquiry while conducting "field research." (These methods include observation, data collection, and teamwork.)
- An opportunity to consider, through direct experience, the interactions between wildlife and humans, including enjoyment, disturbance, and education.

When planning your trip...

- Familiarize yourself with the field trip and classroom activities. Plan ahead to include as many pre-trip activities as you can.
- Check tide charts, best viewing days and times, and the site layout. How much room will students have to spread out or work? Are there safety issues at this location? Are there special rules for visitors in this habitat (like no "picking" vegetation, staying on designated trails, etc.)?

On the way to the field site...

If you cannot walk to the area, plan some activities or songs for the bus trip. This will help students burn off a little excess energy and concentrate on their discoveries once they reach the site.

- A good bus ride activity is a "scavenger hunt" for items (for example, stop signs or certain tree or animal species, wetlands, examples of recent habitat degradation) that the bus will pass along the route.
- Play a round of *Jeo-Bird-Y* (found in the classroom activities section of the curriculum).

When arriving at the site...

Before letting students off the bus, remind them of the trip rules and proper outdoor etiquette. Plan a quick observation activity to get started on as soon as they get off the bus. This will give you and your chaperones a chance to get organized.

- Five minutes for each student to draw a picture of the site in his or her journal
- Five minute list of the characteristics of the site (the sights, smells, and sounds) and to record them in their journals
- If you did not have a chance to do the *Birding Code of Ethics* activity, incorporate it after their journal observations and just before their field studies.

Close-up studies...

Have individuals or small groups conduct special investigations. Allow 45 minutes or so for each close-up study. You may choose to have all the groups conduct the same activity, or you may assign each group or student a different close-up study. You will find ideas in the *Shorebird Field Study* activity in this section.

Sharing...

Have each person (or group) give a short summary of what he or she learned or saw and point out or show things of interest. It is important to do this briefly at the site so that all the students have an opportunity to notice the items they did not examine closely. Tell students to add the observations they may have missed into their journals.

Pollution patrol...

Return any living creatures to the place where they were found. Have students collect any trash left behind by the class or by other people. You may want to award a pollution patrol prize to the group that collects the most.

Follow-up...

Wrap up the field trip with a follow-up activity included in this section of the curriculum. Compile and discuss the data collected back in the classroom. Include your resource person in this discussion.



Group Management Hints

Adapted originally from “Safety,” Salt Marsh Manual: An Educator’s Guide.

If you have apprehensions about leading a group of children away from the four-walled constraints of a classroom, relax! There are several techniques you can use to help keep the group’s attention and maintain the feeling of freedom and open exploration. Try the following:

- When you stop to look at something, gather the group in a semicircle with everyone facing inward.
- Speak loudly and clearly, facing the group. The wind will carry your voice away from anyone behind your back.
- Make eye contact with the students. You, not the students, should face the sun.
- Focus on something specific when you stop. Vague discussions will lose the group’s interest.
- Talk with, not at, the group.
- Stimulate imagination and excitement while delivering factual information about the organism.
- Be versatile. Recognize the magic of the moment. Use unexpected experiences to illustrate ecological concepts--or just enjoy it!
- Keep it simple. Demonstrate as an activity is being explained.
- Encourage thinking and group interaction by asking questions. Leave room for imagination.
- Consider assigning tasks to all students to get them involved.
- Bring an “emergency” supply pack with first-aid kit, pencil sharpener, tissues, and extra plastic baggies.
- Enthusiasm is contagious! It is a greater catalyst than knowing all the names. If you are not getting excited about it, will your students? Get down on your hands and knees to look at the plants or invertebrates. Study an animal by “being it” (move as it does, sound like it, or try to look like it), especially if you do not get to see the animal. Point silently at a feature you want to draw attention to.
- Keep the group together with creative ways of moving from one spot to another. For example, run like a mouse, wiggle like a snake, or fly like a shorebird.
- Remember, as the leader, you set the tone for the experience.



Field Trip Etiquette

Promote conservation!

Conservation is the protection and wise, sustainable use of natural resources. A visit to any natural area can be a very stimulating and exciting experience for students of any age. However, all of us must be careful to remember that natural areas are habitat for wild plants and animals, so we as visitors should act like guests visiting or sharing someone's home.

Teach important field skills.

A field trip is an excellent opportunity to teach students outdoor etiquette skills they can use all their lives and pass on to their own families and children. The site should be left as close to natural as possible so that future visitors will be able to enjoy the area's plants, wildlife, and beauty.

Discuss responsible environmental behavior.

Discuss the Rules for Observing Wildlife handout (found on the next page) with your students. Lead your class in a discussion of the following questions: How can you help take care of animals, plants, and other organisms you encounter in your field and classroom studies? How can you keep from disturbing them and their homes? How can you learn more about your environment by observing it in its natural state? What can you do to ensure that enjoyable camping and other outdoor recreational activities do not harm wildlife or habitats?

Establish clear field trip rules.

Discuss the Rules for Observing Wildlife with your class. Why are they important? Ask the class to develop a list of consequences for breaking these rules. Have them design a field trip contract and ask each student to sign it to signify that he or she understands the rules and promises to abide by them. Pass out a copy of the rules for students to refer to. Include them in their field trip journals.

Practice the right way to behave.

Use the Birding Code of Ethics Activity to role-play before actually going on a field trip. Designate some students as "shorebirds," others as "bird-watchers," and some as observers of the situation. Discuss what the "bird-watchers" did right and what they did wrong from the shorebird's and the observer's perspectives.

Practice social etiquette.

Look out for your buddies! Students can help keep each other safe. Be polite to guest speakers and trip leaders by listening and paying attention.



Rules for Observing Wildlife

Act Like a Guest!

Step softly and quietly while observing animals. Stay quiet. Yelling, shouting, and “roughhousing” will scare animals away and may cause some to abandon their nests or young or to avoid the area in the future. Also, it is more likely that you will see wildlife if everyone is quiet.

Put Things Back Where You Found Them.

Replace rocks and logs after looking underneath (to keep the roofs on animal homes, and to keep people from stepping in the depressions left by the rocks). Do not take live animals away from their homes. Feathers and nests need to be left where you found them.

Avoid Handling Animals.

Observe wildlife from a distance. If you are sampling invertebrate populations, be very gentle. They have different anatomies than our own, and we may be unaware of ways they can be hurt. There are animals in some areas of the world that secrete toxic liquids or can deliver a painful, sometimes deadly, bite or sting.

Leave the Area Cleaner Than You Found It.

Do not litter and pick up any litter you find. Carry a litter bag in your back pocket. This bag can also be used for any toilet paper you have to use. Bathroom stops should be made just before leaving on the trip and afterwards, but if it is necessary to “use the bushes,” never leave toilet paper scraps behind. Before leaving, ask yourself “Is this area as beautiful now as before my visit?”

Respect the Site and Everything That Lives There.

Minimize trampling of plants and fungi. Stay on designated trails as much as possible. Always watch where you are walking. Even if shorebirds are not nesting in your area, many other forest, meadow, and marsh birds nest on the ground. Keep pets at home or at least on leashes.

Observe Wildlife from a Distance.

Do not chase, repeatedly flush (cause to move away), or harass animals (whether on foot, in a car, boat, plane, all-terrain vehicle, or snow machine). Harassing animals is against the law in many states and may be punishable by a fine or jail sentence. Move slowly, allowing the animal to keep you in view. Avoid sneaking up on or surprising animals. Never touch a nest of eggs or chicks! Move away from the nest in the direction you were originally going. Do not leave a one-way or V-shaped scent trail to a nest that predators can follow easily. Watch for the following signs that you may be too close to birds:

- Head raised, looking at observers
- Skittish
- Excessive preening or pecking at dirt or foot; bill wiping
- Alarm calls--repeated chirping and chipping
- Distraction display--broken wing, tail spread, etc.

Respect State or Federal Rules.

Check the state and federal regulations regarding collecting plants or animals. In general, avoid collecting anything. Instead, make careful observations and detailed sketches in your field journals. Limit the number of bottom and core samples you take when sampling invertebrates. This is very disruptive to the area, especially where large numbers of people visit.



Field Trip Safety

Teach students about field safety (including what to do if they get lost), dehydration, and hypothermia before going into the field. Consider inviting a resource person in to teach a class in survival skills. Resources to contact include the Red Cross, a community safety officer, and the Coast Guard. Students and their adult leaders should know and understand the following safety rules before going out in the field:

- Stay together.
- Have a buddy, and understand the responsibilities of having a buddy. Know where he or she is at all times, and report to the teacher immediately if something happens to your buddy.
- If you become lost, stay where you are and call out periodically.
- Dress warmly and keep dry. Encourage children to carry an extra pair of socks in their backpacks when visiting potentially wet areas.
- Know the dangers of, and treatment for, hypothermia. Take extra clothes, rubber boots and rain gear. (Plastic bags will do in a pinch.)
- Know the dangers of and prevention of dehydration, sun stroke, and sunburn. Make sure everyone is drinking plenty of water throughout the field trip
- Step carefully around the water in wetlands. Because the ground is so mushy, you can get stuck. Always wear properly fitting life jackets in boats. Make sure each jacket is properly fastened.
- Observe animals from a safe distance. Use binoculars, spotting scopes, and telephoto lenses to get a closer look. If an animal shows sign of being crowded or disturbed, sit quietly or move away slowly.
- Do not taste any wild plants. Some plants are poisonous and some people are allergic to plants that are normally harmless.
- Carry a first-aid kit and emergency medical information for each student. Be aware of allergies or medical problems of all children and of adult participants.
- Learn and review any special hazards in your area such as poisonous plants, venomous animals, or dangerous terrain.
- Always know which students you have in your group. Carry a list of students and take frequent head counts. To prevent stragglers and explorers from getting lost, assign a leader and follow-up (“caboose”) person when traveling from one point to another.



Video Hints

Consider videotaping your class's field trip experience. Video records are fun to watch later, are useful learning tools (What can be done differently next time?), and are a great part of a comprehensive display or "wrap-up and share" activity (see Shorebird Fair classroom activity). Students learn technical skills by operating video equipment and later incorporating their videos into computer programs. Finally, students enjoy using and posing for the camera. This enjoyment may enhance their learning experience. Parental permission is required if you intend to send your video footage into the Shorebird Sister Schools Program for use on the Web site. A Shorebird Sister Schools Program permission form is included in this section.

- Become familiar with the video camera you will be using.
- Practice, practice, practice.
- Use a tripod and external microphone.
- Avoid external, distracting noises (cars, planes, wind, etc.)
- Plan ahead. What do you want to show?
- Use an outline to plan shots and sequences. Have a definite beginning and end.
- Plan your filming sequence to avoid editing hassles in the field.
- Use a variety of shots, angles, and distances.
- Mix close-ups with mid-distance and scenic shots.
- Pan slowly; do not repeat back and forth.
- Start with an empty tape.
- Have plenty of extra batteries.
- Slowly zoom both in and out, but avoid overuse.
- Start filming at least one second before talking.
- Include as many birds as possible.
- Have students make interesting title signs or plan verbal introductions ahead of time.
- Concentrate on getting good sound, especially from students.
- Include important people--all students, biologists, refuge personnel, teachers, and parents.
- Protect the camera body and lens from the weather.
- Show action close-ups--hands, feet, faces, and movement.
- Include mood shots like sunsets and sunrises.
- Explain habitat type and something about the location.
- Explain what is being seen.
- Tell a story. Present a message.
- Some filming can be done before and after the field trip.



Student Photo/ Video Release for In-school Use

Dear Parent:

As part of our shorebird unit, our class will be going on a field trip to observe shorebirds and learn more about their habitats. I would like to videotape their activities for other students to review in school and to post on the Shorebird Sister Schools Program's Web site. Please fill out the parental release form. If you have any questions or concerns, please give me a call at _____.

Photo/Video Release Form

I _____, give permission for my child
(parent's printed name)

_____ to be videotaped as part of their class
(child's printed name)

Field Trip to _____ on _____
(field trip location) *(field trip date)*

(parent's or guardian's signature)





United States Department of the Interior

FISH AND WILDLIFE SERVICE
Shorebird Sister Schools Program
698 Conservation Way
Shepherdstown, WV 25443



A signed release is required from Non-Service subjects in all photographs and videos. In the case of minors, the parents or guardian must sign the release. Please send completed release forms to the Shorebirds Sister Schools Program Coordinator with photos and/or video.

PHOTO/VIDEO TAKER:

OFFICE AND PHONE:

PHOTO CAPTION(S):

Photo and Video Release

I hereby grant permission to the U.S. Fish and Wildlife Service to use my, or my child's, photographic or videographic likeness in official Service publications and displays, and on its World Wide Web (WWW) site without further consideration, and acknowledge the Service's right to crop or treat the photograph at its discretion.

I also understand that the image can be downloaded by a computer user in or out of the Service. Therefore I agree to indemnify and hold harmless from any claims the following:

- U.S. Fish and Wildlife Service
- U.S. Department of the Interior
- All employees within the Department of the Interior

NAME:

DATE:

ADDRESS:

PHONE:

SIGNATURE:

Field Trip Permission and Medical Information Form

Dear Parent/Guardian:

Your child will be participating in a field trip as part of our study of shorebirds. This trip will involve outdoor activities. Please make sure your child is dressed for the weather. Hiking boots or sturdy gym shoes are recommended. We suggest that you send along the following items: _____

_____.

In order for your child to attend, please complete the form below.

PERMISSION

My child, _____, may attend the Field Trip to

_____ on _____.

Parent/Guardian Signature *Date*

MEDICAL INFORMATION

(Educator: If this information is on file, you may bring emergency cards from the office.)

Be aware that my child has the following limitations: _____

Medications my child is currently taking: _____

Responsible adult who can be reached on the day of the field trip

Name *Phone Number*

Doctor and/or Medical Provider: _____

Phone Number: _____



Field Trip Activities

Concepts

- Bridge the classroom and the local environment.
- Gain firsthand knowledge through an outdoor experience.
- Discover the ecosystem through multisensory experiences.
- View shorebirds, their habitats, and what they eat.
- Utilize the scientific method as a process for inquiry and discovery.
- Human behavior can affect wildlife and other people.

Pre-field Trip Activities

Using a Field Guide and Binoculars

(lower elementary, upper elementary/middle school)

In this pretend field trip, students work in pairs to practice using field guides and binoculars to identify a series of shorebird pictures.

Map and Miles Study

(lower elementary, upper elementary/middle school)

Students learn about the upcoming field trip site by studying three different types of maps.

Making Field Sampling Equipment

(lower elementary, upper elementary/middle school)

Students work in teams to create any of the four types of sampling equipment shown in the information sheets. They research how these tools are used by field biologists and then make presentations to the rest of the class.

Birding Code of Ethics

(upper elementary/middle school, upper middle school/high school)

Students role-play to identify appropriate and inappropriate behavior when observing shorebirds, then develop a Birder's Code of Ethics to guide their behavior while on their field trip.

Field Trip Activities

Shorebird Field Study

(all levels)

Using a Shorebird Journal, students collect an assortment of shorebird data and site information while on a field trip.

Cast a Track

(all levels)

Students look for shorebird tracks while on their field trip and then "collect" one that they find, using a plaster casting technique.

Mud Creatures Study

(all levels)

Students use the sampling equipment made previously in a pre-trip activity to count the numbers and identify the types of invertebrates found in the sand and mud at their field trip site.

Sampling Local Shorebird Populations

(upper middle school/high school)

Working individually, students design a shorebird observation study to determine how many shorebirds use a local stopover, breeding, or non-breeding site, then compare their results.

Additional Activities Excellent for Field Trips:

	Pages
Migration Headache (Migration Activities Section)	286
The Incredible Journey (Migration Activities Section)	327
Behave Yourself (Nesting and Breeding Activities Section)	267
It's A Tough Life (Nesting and Breeding Activities Section)	279
Banded Birds (Research and Technology Activities Section)	346
Shorebirds On The Web (Research and Technology Activities Section)	366

Post-field Trip Activities

Sharing Circle

(all levels)

Students discuss the field trip and share what new information they discovered and what they especially enjoyed about their experience.

Data Analysis

(upper elementary/middle school, upper middle school/high school)

Students analyze the invertebrate, shorebird, or environmental data they collected on their field trip, using a variety of mathematical calculations and observations.



Using a Field Guide and Binoculars

Adapted with permission from "Wetlands & Wildlife" and from Molly Brann, North Star Elementary. Nikiski, AK.

Grade Level: lower elementary, upper elementary/middle school
Duration: one 30 to 60-minute class period, depending on class size
Skills: teambuilding, comparison, and observing
Subjects: science

Concepts

- Bridge the classroom and the local environment.
- Gain firsthand knowledge through an outdoor experience.
- Discover the ecosystem through multisensory experiences.
- View shorebirds, their habitats, and what they eat.

Vocabulary

- field marks
- field guides
- binoculars

Overview

In this pretend field trip, students work in pairs to practice using field guides and binoculars to identify a series of shorebird pictures.

Objectives

After this activity, students will be able to:

- Explain to another person how bird field guides are organized.
- Use binoculars in the field to locate and focus in on shorebirds.
- Identify common shorebird field markings.
- Identify at least one local shorebird.

Materials

- A collection of ten to twenty bird pictures, including shorebirds you are likely to see on your field trip (and are found in the identification guide you use)
- Cardboard or poster board for mounting pictures

- Bird field guides (suggestions in the Shorebird Resources for Educators in the Appendix)
- Binoculars (one pair for every two students, if possible)
- Large room or playing field outside
- One copy of the How to Use Binoculars handout for each team of older students

Optional

- Mural paper
- Colored pencils, markers, crayons, or paint and brushes

Introduction

Using binoculars and field guides for the first time can be a frustrating experience for those who do not learn and practice some basic techniques before going into the field. Once mastered, they are wonderful tools for science exploration and outdoor recreation.

Students are usually very enthusiastic about using field equipment, especially when there is enough for everyone. Since shorebirds walk about in open habitat, they are a relatively easy group of birds to observe.

If you do not have access to field guides and binoculars, contact a local environmental education office, such as the U.S. Fish and Wildlife Service to inquire about borrowing materials. To obtain a set of binoculars for your own classroom, try contacting a military base excess equipment program, writing a grant, or requesting a local service organization or sportsman's club to donate the equipment.

For more specific information about how to observe and identify shorebirds in the field, read the section **How to Identify Shorebird Species** found in the Shorebird Primer.

Activity Preparation

1. Mount the color pictures of the shorebirds you will be identifying in the wild on cardboard or poster board. Number each picture on the front. The picture can be collected from old field guides, magazines, or calendars and, if possible, should show the natural habitat of the birds. Keep pictures hidden until you are ready to go on your practice field trip.
2. Prepare a list of birds that you might find on your field trip. Refer to the charts in Shorebird Migration Flyways or Shorebird Profiles for help.
3. Familiarize yourself with the How to Use Binoculars handout so you can instruct younger students directly. Make one copy of this handout for each team to read prior to the activity.

Procedure

1. Provide students with the list of local shorebirds. Have them find and highlight the birds in the field guides, using Post-It notes or tabs. Read the information about each bird and discuss the field marks. Identify what makes each bird unique, distinguishing it from other birds.
2. Demonstrate how to use binoculars carefully and safely. Begin by putting the binocular strap around your neck. Demonstrate how to focus the various lenses, and how to adjust for eye width and focus differences. Explain the magnification of each type.
3. Place your shorebird pictures around a large room such as a gym--or outside on a school wall. If time permits, have your class create a paper habitat mural of the field trip site. Then place the



pictures where you would expect to find the shorebirds.

4. Identify a safe place for the students to stand to “observe” the shorebirds. On a field trip, this would be an area where they will not get stuck in the mud, wet from surf, or run over by cars. It should be far enough away from the shorebird pictures that the students must use the binoculars to identify the birds.
5. Have the students work in pairs. Each team must correctly identify all of the shorebirds within the designated time limit. The first person with the binoculars identifies field marks such as color (“I see a black spot on the chest.”) and size (“It has longer legs than the other birds.”). The second team member looks in the field guide to find potential birds to show to his or her partner.
6. Remind your students to keep their voices very quiet, not to scare the birds (and not to give their answers away). Remind them to take turns with the binoculars.
7. If you have only a few pairs of binoculars, have several teams at a time take the practice field trip while the rest of the class works on another quiet activity. Invite parents who will chaperone the field trip to attend this practice too.

Additional Activities

Shorebird Morphology

Pass out a copy to each team of the **Shorebird Morphology: Flying** and **Shorebird Morphology: Standing** Worksheets found in the Appendix. Ask them to use their field guides to locate the names of the various parts of the shorebird’s anatomy. Once all the teams are done, display the same illustration with the answers (also found in the Appendix, so the teams can check and correct their work. Have them practice field identification using these terms in a second round of the binocular activity.



How to Use Binoculars

Step 1 Put the Binocular Strap Around Your Neck

This is very important to ensure that the binoculars do not fall.

Step 2 Adjust the Binoculars to Fit Your Eyes

Look through the binoculars in the normal viewing position. Grasp each barrel firmly, and adjust them until you see a single circular field. Many binoculars have rubber eye cups which can fold down for use with glasses or sunglasses.

Step 3 Adjust the Binoculars to Your Eye Strength

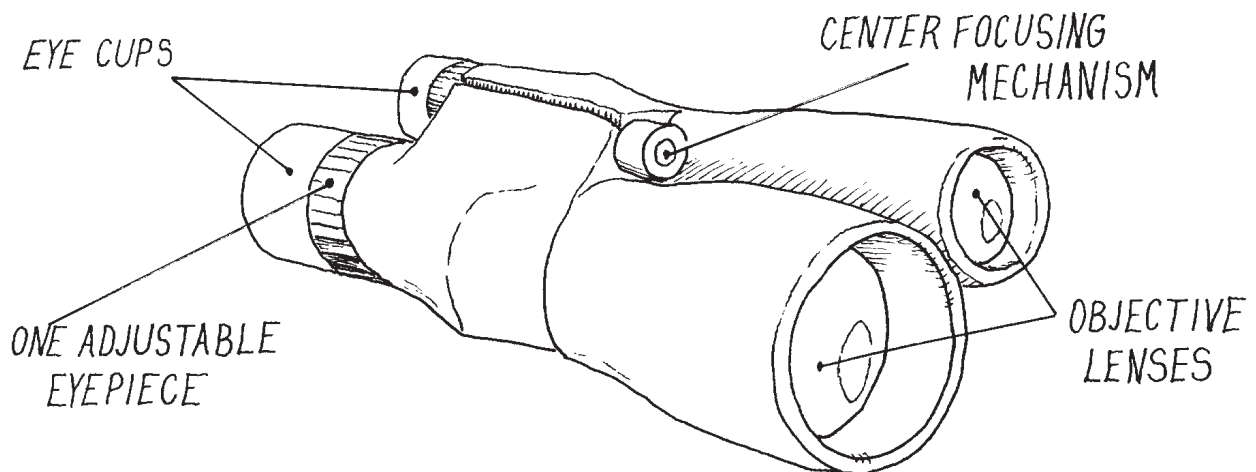
Set the right eye piece to zero and look at a distant object. Cover the right lens (the outer, big lens) with your hand. With both eyes open, look through the binoculars and turn the center focusing wheel until the object is sharp and clear. Now cover the left lens with your hand. This time, keeping both eyes open again, turn the adjustable eyepiece to focus on the same object until it is clear. Do not use the center focusing wheel. Your binoculars are now properly focused for your use. Check the number on the adjustable lens and be sure it is set to this number every time you use this pair of binoculars.

Step 4 Focusing on a Distant Object

Use the central focusing mechanism to focus for objects at various distances from you. Do not turn the adjustable eyepiece.

Step 5 Focusing on a Moving Object

Focusing on something that is about to fly or move out of view is a real challenge. Finding and focusing on objects in the sky is another challenge. Without trees in the background, there are no reference points to help you locate and then focus on your subject. Be patient and practice, practice, practice.



Map and Miles Study

Grade Level: lower elementary, upper elementary/middle school
Duration: one 60-minute class period

Skills: application, critical thinking, collection and interpretation of data, discussion and evaluation

Subjects: math and social studies (geography)

Concepts

- Bridge the classroom and the local environment.

Vocabulary

- natural resources
- nonrenewable resources

Overview

Students learn about the upcoming field trip site by studying three different types of maps.

Objectives

After this activity, students will be able to:

- Name three different types of maps.
- Describe the kind of information provided on each type of map.
- Use a map mileage scale to estimate travel distance.
- Distinguish between saltwater and freshwater wetlands.
- Convert miles driven into gallons of gas and then into dollar cost.
- Describe at least three environmental costs of using nonrenewable resources.

Materials

- Various maps of the field trip site (road map, topographic map, site trails map)

Introduction

There is no introductory material for this unit.

Procedure

1. Have students study a map of the site you will be visiting. What type of habitat is this? Is it a freshwater or saltwater wetland? In which direction does the water flow? Where do they expect to find the most shorebirds? Where might be a safe viewing location?
2. Now ask the students to determine, as closely as possible, the number of miles to the field trip site. Have older students convert the miles into kilometers, or vice versa.
3. Have students calculate how much gas (a nonrenewable resource) it will take to get to the field trip site and back. (They will need to know how many miles per gallon your field trip vehicle gets.) Ask them to calculate the cost of the gasoline. Are there other “costs” associated with using nonrenewable resources (air pollution, potential oil spills, destruction of habitat at oil drilling sites, etc.)?
4. Ask students to brainstorm how to get the most out of their field trip, considering the cost of nonrenewable resources.



Making Field Sampling Equipment

Reprinted with permission from Wetlands & Wildlife. Alaska Department of Fish and Game and U.S. Fish and Wildlife Service, 1990.

Grade Level: lower elementary, upper elementary/middle school

Duration: a total of 60 minutes to plan and build the equipment; another 30 minutes for presentations

Skills: application, communication, presentation, and team building

Subjects: science and language arts

Concepts

- Bridge the classroom and the local environment.
- Gain firsthand knowledge through an outdoor experience (with follow-up on-site activity).
- Discover the ecosystem through multi-sensory experiences (with follow-up on-site activity).

Vocabulary

- invertebrate
- sample
- bottom sampler
- core sampler
- bottom dredge
- underwater viewer

Overview

Students work in teams to create any of the four types of sampling equipment shown in the information sheets. They research how these tools are used by field biologists and then make presentations to the rest of the class.

Objectives

After this activity, students will be able to:

- Name four pieces of field sampling equipment that collect invertebrate populations
- Describe how to construct a simple Bottom Sampler, Core Sampler, Bottom Dredge, and Underwater Viewer
- Demonstrate how to use properly each piece of sampling equipment

Materials

- One copy of the handout Making Sampling Equipment for every team
- Items listed for each type of equipment to be built

Bottom Sampler

- Coat hanger
- Needle and thread
- Wire
- Twelve-inch wooden dowel, broom handle, or three-foot long wooden dowel
- Nylon stocking or lightweight nylon (1mm mesh or less)

Core Sampler

- Juice can

Bottom Dredge

- Coffee can
- Heavy string
- Heavy fishing weight

Underwater Viewer

- Large can or plastic container
- Clear, heavy-duty kitchen wrap or other clear plastic
- Large rubber band

Sorting tray

- Jar lid or flat piece of wood

Introduction

There is no introductory information for this activity.

Activity Preparation

1. Make one copy of Making Sampling Equipment for each team.
2. Divide the class into four teams. Let each team determine how it will collect the materials it needs by the designated “building date.”

Procedure

1. Assign each team the task of making four of one type of sampling equipment so that every team in the class will have one.
2. Provide the teams with time in class to build their samplers. Have them research what the sampler is used for and practice (in class) how to use it properly.
3. When all the teams are done, have team members take turns explaining their equipment, how it was built, and what biologists use it for. Have them demonstrate how to use it properly before passing one out to each team.

Additional Activity

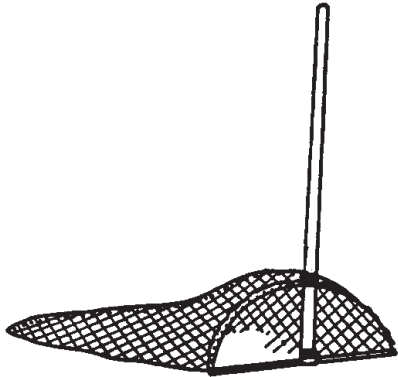
Research Other Sampling Techniques

Have the students work in teams to research what other sampling equipment and techniques biologists use in the field. Are any of these appropriate to this field trip? If so, have students plan how they can use what they learned during their upcoming field trip.

Mud Creature Study

Follow up with this on-site activity in which students sample the invertebrate population at their field trip site.

HOW TO MAKE A BOTTOM SAMPLER

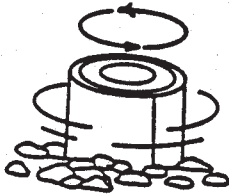


INFORMATION SHEET

Materials: coat hanger, needle and thread, wire, 12-inch wooden dowel, broom handle or 3-foot long wooden dowel, nylon stocking or lightweight nylon (1 mm mesh or less).

1. Constructing a net: cut off the top hook of a coat hanger and shape the triangle into a half circle, leaving the bottom wire flat.
2. Use a nylon stocking or a square of lightweight nylon material. Fold the square in half diagonally, then stitch up one of the open sides of the triangle forming a cone. Wrap the open end of this cone (or the nylon stocking) around the half circle of wire, then stitch in place.
3. Strengthen the straight edge of the half circle by wiring a 12-inch wooden dowel along it. Attach a wooden broom handle or long dowel to the center of this dowel and across the opening of the net.

HOW TO MAKE A CORE SAMPLER

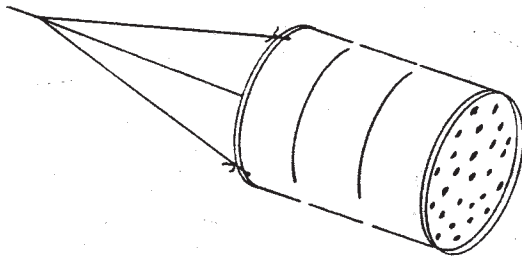


INFORMATION SHEET

Materials: juice or coffee can, jar lid or flat piece of wood, sorting tray.

Cut one end completely out of a tin can, then punch a hole in the other end with a large nail.

HOW TO MAKE A BOTTOM DREDGE



INFORMATION SHEET

Materials: coffee can, heavy string, heavy fishing weight.

1. Poke holes in the bottom of the coffee can with a nail and hammer.
2. Use the same method to poke holes at the rim of the can to attach a bridle with which to drag the can through the water.
3. Put a heavy fishing weight on the bridle and attach the bridle to a tow line.

HOW TO MAKE AN UNDERWATER VIEWER



INFORMATION SHEET

Materials: large can or plastic container, clear heavy-duty kitchen wrap or other clear plastic, large rubber band.

1. Cut out completely the top and bottom of a large round can or plastic container. Be sure there are no sharp edges.
2. Stretch a sheet of clear plastic across the bottom and hold tightly in place with one or more large rubber bands.

Birding Code of Ethics

Grade Level: upper elementary/ middle school, upper middle school/ high school

Duration: 60 minutes to plan and create props plus 30 minutes to role-play

Skills: observation, comparison, communication, presentation, critical thinking, discussion, and evaluation

Subjects: science and fine arts

Concepts

- Bridge the classroom and the local environment.
- Gain first hand knowledge through an outdoor experience (with follow-up On-Site Activity.)
- Discover the ecosystem through multi-sensory experiences (with follow-up On-Site Activity.)
- View shorebirds, their habitats, and what they eat (with follow-up On-Site Activity.)
- Human behavior can affect wildlife and other people.

Vocabulary

- responsible
- irresponsible
- novice

Overview

Students role-play to identify appropriate and inappropriate behavior when observing shorebirds, then develop a Birder's Code of Ethics to guide their behavior while on their field trip.

Objectives

After this activity, students will be able to:

- Give two or more examples of appropriate behavior when observing shorebirds.
- Give two or more examples of inappropriate behavior when observing shorebirds.

Materials

- One set of Birding Code of Ethics Role-Playing Cards
- 6 foot or longer piece of string

Introduction

There is no introductory information for this activity.

Props

- Three cardboard signs as described in Activity Preparation
- A large "nest"
- "Trailside plants"
- Bird-watching props for three actors (binoculars, field guides, cameras, bird calls, recorded songs, journal and pencil)
- Three backpacks with lunch wrappers, empty soda can, etc.
- A "pet" on a leash
- Trail markers of some sort
- A set of shorebird masks or puppets as described in Activity Preparation

Activity Preparation

1. Copy and cut out one set of the Birding Code of Ethics Role Playing Cards.
2. Divide students into teams to create props for this activity. Let them be creative in the selection of materials to use.
 - Cardboard or poster board signs: "Private Property," "Shorebird Nesting Area," "Shorebird Trail"
 - A lunch pack containing a collection of empty food wrappers and cans
 - A set of shorebird masks or puppets out of any materials available to you (paper plates, lunch sacks, illustrations on popsicle sticks, etc.)
 - A large shorebird nest--large enough for one student "chick" to sit in
 - Pretend pet on a leash
 - An assortment of mock-up plants to set up along a pretend trail
 - A trail within the classroom--designed and marked out by students

3. When all the props have been made, set up the scene in the classroom. Post the signs and stretch the string across an area to signify the safe-distance boundary. Place the shorebird nest behind the boundary string. Post the trailhead and lay down the trail path. Set vegetation props along side the trail.

Procedure

1. Discuss the vocabulary words with the class. What does it mean to be responsible versus to be irresponsible? What does it mean to be a novice?
2. Explain to your students that they will be participating in a role-playing activity as a shorebird, a bird-watcher, or a scene observer (audience member). Ask for six volunteers who feel comfortable acting out a specific role in front of the class.
3. Pass out one Birding Code of Ethics Role Playing Card to each volunteer before assembling the class. Have volunteers read the description on how they are to behave and then return the cards to you. They should not identify themselves to the audience. Give them a chance to ask any questions about their behaviors before the class assembles. Give them their props.
4. Have each actor take his or her place in the shorebird scene. Announce "action" to begin.
5. The scene observers should watch carefully and try to determine who these actors are representing. What are they doing? How are they behaving?



6. Announce “cut” to end the action. Ask the observers to try to identify what each actor was representing. Who were the birds? Who was a chick? In what ways were the bird-watcher’s behaviors different?
7. Now repeat the scene but allow only one bird-watcher to enter at a time. First, send in the “Bad Birder.” Ask the observers to describe the actor’s behaviors as they see them. List them on the chalkboard under the heading of Bad Birder.
8. Now send the “Good Birder” into the scene. How is this bird-watcher behaving? Make a list describing his or her behavior under the title Good Birder.
9. Lastly, send in the “Novice Birder.” How is this birder acting? Describe his or her behavior under the heading Novice Birder.
10. Lead a discussion on the effects of the “Bad Birder’s” behavior. How might this person influence a “Novice Birder”? Which type of bird-watcher would this class like to be more like? As a class, develop a birding code of ethics on a flip chart. Ask each student to come up and sign it. Post it in the classroom until the day of the field trip as a reminder to your students of what you expect of them. If possible, create a smaller version of the “contract” to include in the students’ shorebird field trip journals.

Additional Activities

Code of Ethics Sign

Have students turn their Code of Ethics contract into an informational sign to be displayed at the site. Let other visitors know how their behavior can hurt or help the wildlife of the area. Look for local community support to produce and install the sign on-site. Be sure to get prior approval from the managing agency.

Shorebird Field Study

Ask students to use what they learned in the Birding Code of Ethics activity on a local field trip to view shorebirds.



Birding Code of Ethics

Role Playing Cards

Good Birder

In this activity your role is to perform the responsible actions listed below while bird-watching. Play your role while observing the “birds” at each station.

Good Birdwatching Actions

- You respect “no trespassing” signs.”
- You enjoy birds, nests, and/or young while bird-watching from a proper distance that does not disturb birds.
- You leave no sign that you were there. You dispose of your trash properly when you break for lunch.
- You walk on the trail and do not trample vegetation.
- You leave your pets at home.
- You use tools designed to attract birds sparingly, such as “squeakers” or “pishing” or recorded calls.

Bad Birder

In this activity your role is to perform the following irresponsible actions while bird-watching. Play your role while observing the “birds” at each station.

Bad Bird-watching Actions

- You walk right past “no trespassing” signs.
- You get too close to birds, nests, and/or young while bird-watching so birds are disturbed.
- You leave trash when you eat your lunch.
- You ignore the trail marker and walk wherever you want to and trample vegetation in the process.
- You bring your pet bird-watching.
- You persistently use tools designed to attract birds, such as “squeakers,” “pishing,” or recorded calls.

Novice Birder

You are unaware of the birding code of ethics. You have new binoculars, a new bird identification book, and you are brimming with enthusiasm to see and identify birds. You are going with a bird group on your first trip and not sure what to expect.

Your role is to observe the other birders in the group and react to their behavior. Show agreement, confusion, or frustration depending on the behaviors you see.

Shorebird Chick

You are a shorebird chick. If an intruder crosses over the string (which marks a safe boundary) your parent becomes upset. You react to the situation by crouching down in the nest as low as possible, trying to blend in with the ground. You freeze but look very anxious.

Feeding Shorebird

You are a feeding shorebird. You are aware of the bird-watchers but continue to feed. If they cross over the string (which marks a safe boundary), you move a little farther away. You stop feeding to watch them more intently. The closer they get, the farther you move away from where you were feeding. Eventually you are so disturbed that you just fly away altogether (arms flapping!).

Shorebird

You are a nesting shorebird trying to protect your chick. If a bird-watcher passes over the string (which marks a safe boundary), then he or she is too close to you. You become anxious and squawk, stand up, and shake your wings, trying to scare the intruder away. If the intruder continues to come closer to you, then you leave your nest and your chick behind.



Shorebird Field Study

Grade Level: all levels

Duration: throughout the field trip

Skills: application, comparison, observation, collection and interpretation of data, discussion, evaluation, and using technology

Subjects: science, math, language arts, and technology; fine arts (depending on the Shorebird Journal Sheets selected)

Concepts

- Bridge the classroom and the local environment.
- Gain firsthand knowledge through an outdoor experience.
- Discover the ecosystem through multisensory experiences.
- View shorebirds, their habitats, and what they eat.

Vocabulary

- field marks
- binoculars
- spotting scope
- bird field guide

Overview

Using a Shorebird Journal, students collect an assortment of shorebird data and site information while on a field trip.

Objectives

After this activity, students will be able to:

- Record shorebird data as it applies to the journal sheets selected for this activity.
- Draw a shorebird seen in the field, noting key markings, physical characteristics, and coloration.

Materials

- **Shorebird Journals** (assembled as described in Activity Preparation)
- Pencils
- Binoculars
- Bird field guides

Optional

Spotting scope

Introduction

There is no introductory information for this activity.

Activity Preparation

1. Select an age-appropriate Shorebird Journal master at the end of this section. Make photocopies for each student or student team. Ask a parent volunteer to assemble and staple the booklets as described. Let students complete the pre-field trip pages a day or two before the trip.
2. Use the **Using Field Guides and Binoculars** pre-activity (found earlier in this section) to ensure your students are able to use their binoculars before observing shorebirds in the field.

Procedure

1. Pass out field journals to your students as they board the bus. Ask them to review the pages during the bus ride so they understand what types of information they are to collect on-site. Review the field journals when you reach the field site and discuss any questions they have.
2. Back in the classroom, have students share their observations and data. Refer to the post-activities, Sharing Circle and Data Analysis, for ideas on how to analyze the information or data they collected.
3. Post your field trip observations on the Shorebird Sister Schools Program Website <http://sssp.fws.gov>. Go to Tracking page.

Additional Activities

Field Study Task Cards

For younger students, especially pre-readers, create a set of field study task cards to use in place of data worksheets. To do this, make a copy of the Field Study Task Cards found at the end of this activity. Cut out and laminate the cards. Divide your class into teams of twos or threes. Read each card out loud and then give it to a team. Explain to each student that the card is his or her specific assignment and that each one of them will report on what he or she found after the field trip.

Back in classroom, use the **Sharing Circle** post-activity found later in this section to let each team explain its assigned task and what it discovered on the trip.



Field Study Task Cards

(Make one photocopy.)

Field Study Task	Field Study Task
<p>Task 1: Take a quick look around the habitats. How many birds do you see?</p>	<p>Task 2: Do you hear any sounds? Are any of these sounds birdsongs or calls? How many different sounds and birds do you hear?</p>
Field Study Task	Field Study Task
<p>Task 3: Use the binoculars or spotting scope. Can you see shorebirds? Describe them.</p>	<p>Task 4: Look for other signs of birds like feathers, tracks, or places birds probed in the mud.</p>
Field Study Task	Field Study Task
<p>Task 5: Watch the first bird that flushes when a shorebird flock takes off. Does that bird stay in the lead the whole time?</p>	<p>Task 6: Watch a shorebird probe in the mud. Can you tell when it finds food?</p>

Field Study Task Cards

(Make one photocopy.)

Field Study Task	Field Study Task
<p>Task 7: Make a map of the habitat showing where you saw the shorebirds or the signs of their presence.</p>	<p>Task 8: Write your own.</p>
Field Study Task	Field Study Task
<p>Task 9: Write your own.</p>	<p>Task 10: Write your own.</p>
Field Study Task	Field Study Task
<p>Task 11: Write your own.</p>	<p>Task 12: Write your own.</p>



Cast a Track

*Adapted with permission from
Wetlands & Wildlife*

Grade Level: all levels

Duration: throughout field trip, with at least 20 minutes for the cast to harden in the field, plus 35 minutes back in the classroom to finish the cast

Skills: application, comparison, observation

Subjects: science and fine arts

Concepts

- Bridge the classroom and the local environment.
- Gain firsthand knowledge through an outdoor experience.
- Discover the ecosystem through multisensory experiences.
- View shorebirds, their habitats, and what they eat.

Vocabulary

There is no specific vocabulary for this unit.

Overview

Students look for shorebird tracks while on their field trip and then “collect” one that they find, using a plaster casting technique.

Objectives

After this activity, students will be able to:

- Identify a bird track.
- Give examples of good locations to find shorebird tracks.
- Make a plaster cast of a shorebird track.

Materials

- Bird tracks in the field
- Copies of the Cast a Track handout (located here) for each student or student team or included in the Shorebird Field Journal your students use
- One plastic Ziploc bag with the pre-measured amount of Plaster of Paris to make one cast for each team

- Fresh water (approximately one liter, depending on size of class)
- One empty plastic jar

- One small, plastic soda bottle for each team, with the bottom cut out.
- Forceps
- Toothbrush or knife

In the Classroom

- Petroleum jelly
- Shellac

Optional

- Plaster of Paris for a “reverse” cast
- Dark-colored paint

Introduction

There is no introductory information for this activity.

Procedure

1. Fill a tin of sand and press your hand in it to make a “track.” Demonstrate the following procedures as you explain how to “collect” an animal track in the field.
 - Look for bird tracks. Good places to look are areas of damp mud near ponds and streams or along the beach at low tide.
 - Draw in your journal all wildlife tracks that you find, and try to identify the birds or animals that made them.
 - When you find a good track, carefully remove any sticks and leaves from it. In snow, spray the track with a fine mist of water and let it freeze.
 - Mix enough water with the pre-measured plaster to make a thick batter. If the track is in snow, mix snow with the water before you mix up the batter. This cold batter will be less likely to melt the snow and ruin your track.

- Press your soda bottle ring into the sand, soil, or snow surrounding the track.

- Pour the batter inside and on top of the track.

- Wait for the plaster to completely harden (at least 20 minutes). Then lift up the casting and carefully clean away dirt or sand with a toothbrush or knife. Remember to collect your ring to reuse or recycle later.

2. Have students work in teams of threes or fours to collect a track they find in the field.
3. Back in class, have each team shellac its original track to protect it from scratches and moisture. They can also create a reverse track. Coat the original plaster track with petroleum jelly or non-stick spray, then repeat the above steps as if the casting were a track. To make the reverse track easier to see, paint the inside with a dark color.

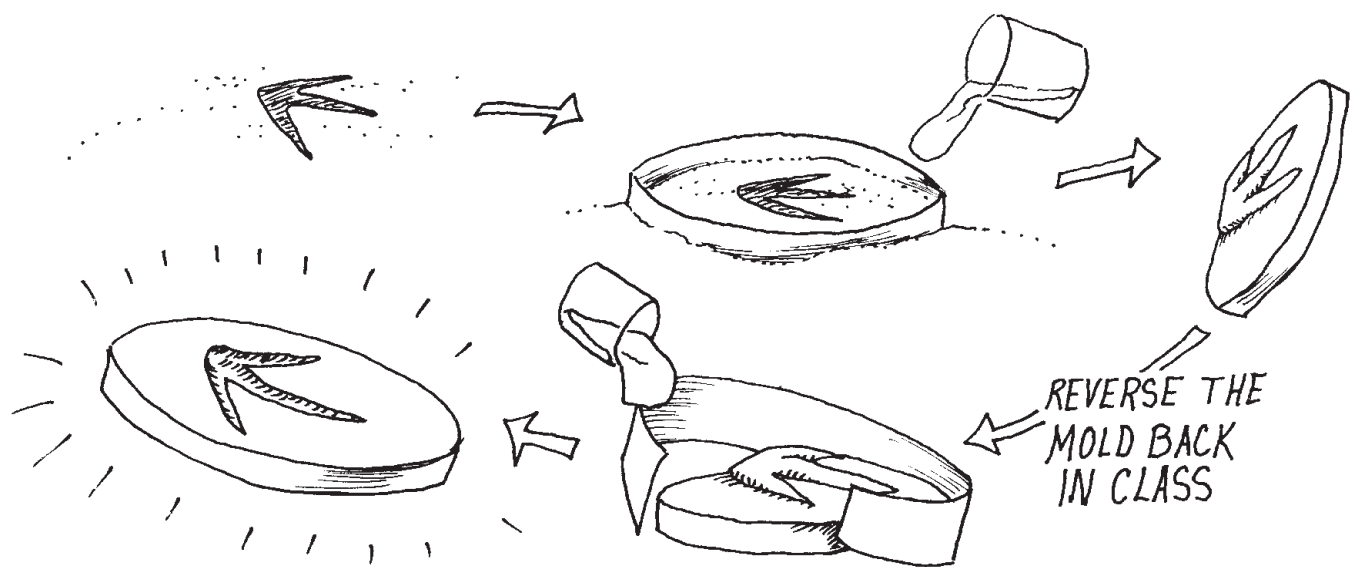
Additional Activity

More on Wildlife Signs and Tracking Techniques

Ask students to consider other “signs” animals leave behind other than tracks. What might they find in the field that tells them shorebirds are nearby? What might they hear? Invite a local outdoors person to give a classroom presentation on observing wildlife signs and tracking. Invite that person to accompany your class on your field trip.



Cast a Track



Mud Creatures Study

Adapted with permission from Salt Marsh Manual: An Educator's Guide, and Wetlands & Wildlife.

Grade Level: all levels

Duration: throughout the field trip

Skills: application, observation, collection and interpretation of data, comparison, discussion, evaluation, critical thinking, forming hypotheses, and teamwork

Subjects: science and math

Concepts

- Bridge the classroom and the local environment.
- Gain firsthand knowledge through an outdoor experience.
- Discover the ecosystem through multisensory experiences.
- View shorebirds, their habitats, and what they eat.
- Utilize the scientific method as a process for inquiry and discovery.

Vocabulary

- mudflat
- rocky-intertidal habitat
- invertebrate
- stopover site
- migration
- phytoplankton
- food pyramid
- autotrophs
- producers
- zooplankton
- bottom sample
- core sample

Overview

Students use the sampling equipment made previously in a pre-trip activity to count the numbers and identify the types of invertebrates found in the sand and mud at their field trip site.

Objectives

After this activity, students will be able to:

- Describe the life hidden in the water, mud, or wetland.
- Define the term invertebrate.
- Give three examples of invertebrates found in the habitat studied.
- Explain how shorebirds depend on invertebrate foods.
- Demonstrate the proper way to sample invertebrates in the field.
- Explain the connection between the numbers of invertebrates in a sample to the number of shorebirds observed at the site.
- Explain the connection between the type of invertebrates present and water quality.

Materials

- Hand lens
- Millimeter ruler
- Sieve
- String
- **Bottom sampler** (water) or shovel (exposed habitat)
- One copy of **Mud Creature Study** for each student or team
- **Core sampler**
- **Underwater viewer**
- One copy of the **invertebrate key** for each student
- **Invertebrate Identification Key** or **Marvey Mud Meals Diagram**

Shorebird Journal

- **Invertebrate Data Forms 1 and/or 2** (found in this section under journals)

Introduction

The viewing procedures described in this activity are for a water habitat. Modify the equipment and procedures for use in exposed mud or sand habitats where an underwater viewer would be unnecessary and a bottom sampler

would be replaced with a small shovel. For rocky intertidal habitat, simply turn over rocks for “bottom sampling” (remembering to carefully turn them back over) and watch for any changes apparently caused by the rise and fall of the tide. You can also compare tidepool animals with temporarily exposed animals.

Limit the number of bottom and core samples taken for this activity as these are very disruptive to habitat. This is especially true if the area you plan to visit receives a large number of visitors already.

Ask older students to identify the invertebrates they find-- if not by species, then at least by order or family (for example, crustacean, amphipod).

Activity Preparation

1. Refer to the pre-activity **Making Sampling Equipment**. Divide the class into teams and have the students make the sampling equipment they will need on the field trip.
2. Pass out the copies of the **Mud Creature Study** for students to review before the field trip. Answer any questions students may have about the handouts.
3. Include **Invertebrate Data Forms 1 and/or 2** in the Shorebird Journals you prepare for the class.
4. If you choose to use the **Invertebrate Identification Key** or **Marvey Mud Meals**, photocopy one for each team. Laminated the keys if students will be using them in the field.



Procedure

1. Decide on several sampling stations for student teams to rotate through at specified times, collecting different information at each station. For example, select one site for using underwater viewers and bottom samplers and another for taking core samples. Make sure each team has an adult chaperone to monitor the activities.
2. Lead the whole class to each site and explain what the students are to do there and how long they will have to work.

Station 1: Underwater Viewing

Examine the water surface carefully; then use your underwater viewer to look under the surface. How many different kinds of invertebrates are visible?

Station 2: Surface Sampling

With stakes and string, mark out a one-meter square area of shallow water along the wetland's edge. Move back for one minute.

Using Invertebrate Data Form 1
Are there any small animals (invertebrates) on the water surface? Take a close look at each animal. Assign each kind a number, and record the number of legs, wings, body segments, color, length, and type of mouth parts (if visible).

Using Invertebrate Data Form 2
Draw a detailed picture of the animal on a separate piece of paper. Be sure to number the picture so it matches the number on your data form. Then list the animals by number and record the number of each kind that you found in the "surface sample" column.

Station 3: Bottom Sampling

Collect a bottom sample with the bottom sampler, and assign each new animal a number.

Using Invertebrate Data Form 1
Record their characteristics on Invertebrate Data Form 1.

Using Invertebrate Data Form 2
Record the numbers you found of each kind of animal on Form 2 in the "bottom sample" column.

Station 4: Core Sampling

Using Invertebrate Data Form 2
Collect a core sample within the transect using the core sampler. Repeat the above steps using the "core sample" column on Form 2.

3. Have students conduct their study and collect data. Move through the stations as they work, answering any questions, providing feedback, and monitoring student progress. You may choose to incorporate the Invertebrate Identification Keys here (or back in the classroom).
4. Back in the classroom, analyze their data and share their experiences using the post-activities, Sharing Circle and/or Data Analysis.

Additional Activities

Invertebrate Species Identification Poster

A few weeks before the field trip, give your students copies of the Marvelous Mudflat Meals diagram. Note that on one page common names (local, nonscientific, or non-Latin names) for the species are given, while the other gives more general categories. Have your students search for pictures or illustration of these and other local invertebrates. Arrange them on a piece of poster board, and list their key identification features (number of legs, color, body segments, where they are found in the habitat, etc.) under each picture or illustration. Display this poster where the students can study it for several days before the field trip.



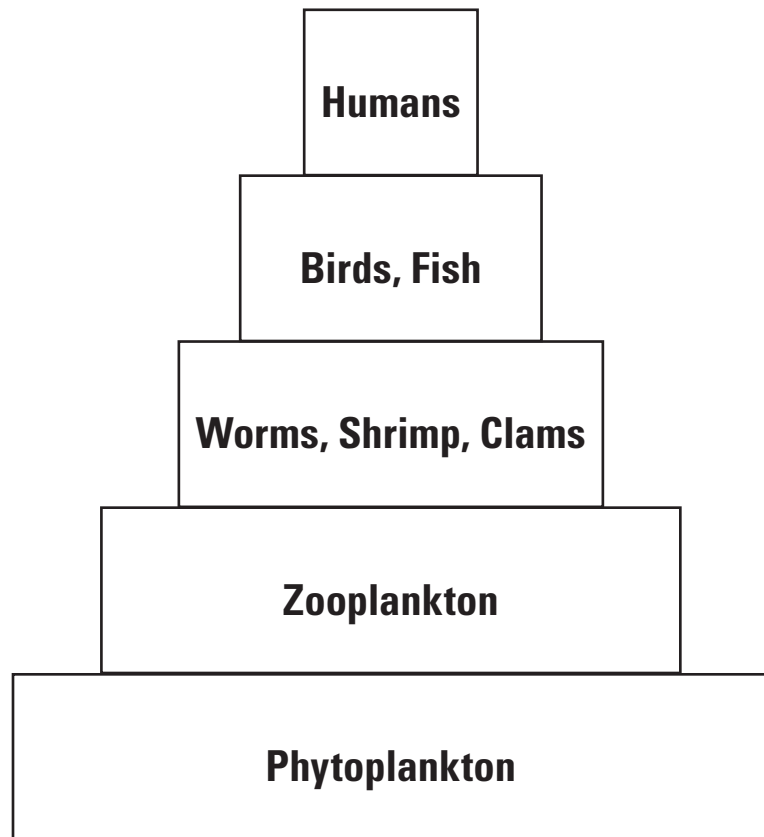
Mud Creatures Study

Wetland stopover sites, the areas where shorebirds stop to feed and rest on their migration flights, support an abundance of life--as many as 40,000 organisms per cubic inch of mud! Shorebirds depend on these invertebrates for the energy to continue on their long migratory journeys.

Phytoplankton and bacteria form the base of the food pyramid that shorebirds depend on. A group of organisms too small to see without a microscope, called autotrophs, use the sun's energy to make their own food. Although they are tiny, these food producers form the largest step of the pyramid because there are so many of them and all other living things depend on them for food energy. Simply put, there would be no animals if there were no plants!

Autotrophs are in turn eaten by zooplankton, microscopic animals that live in water. These tiny consumers are eaten by worms, clams, or crustaceans like crabs, amphipods, and shrimp. Birds and fish then eat these small animals. Humans, foxes, eagles, and other large omnivores and carnivores form the top of the food pyramid.

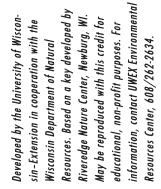
By studying invertebrates at your site, you can discover the types of food available to the shorebirds of your wetlands and uncover information about the health of the local ecosystem. Since any damage to the health of these critical stopover sites may hurt shorebird populations, invertebrate studies are an important part of shorebird conservation! After you take samples of the mud, sand, or soil, discuss the following questions with your classmates:



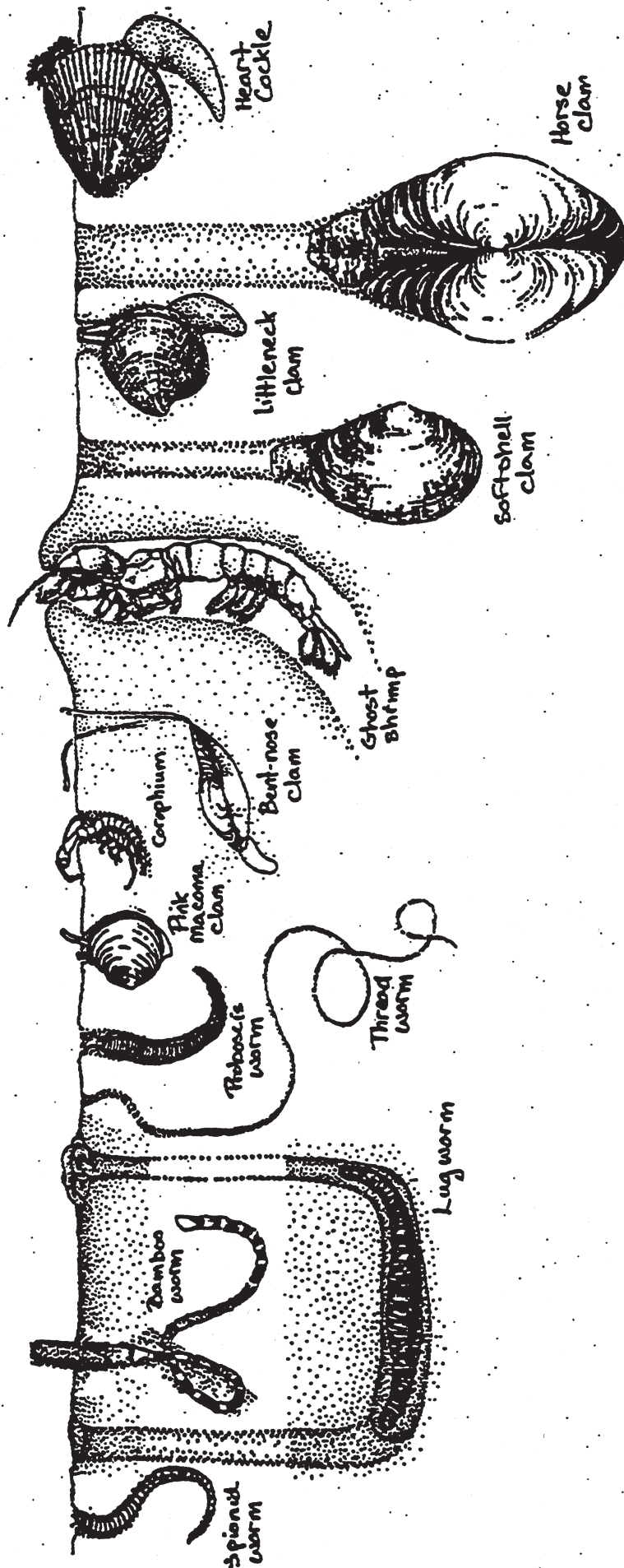
- Which layer contained the highest total number of animals?
- Which sample provided the most different kinds (species) of animals?
- Does the type of invertebrates present tell you anything about the water quality? For example, worms and clams may have different water quality requirements.
- How does the number of invertebrates collected compare to the number of shorebirds observed?
- How does the number of hawks and eagles observed compare to the number of shorebirds you saw?



(Sizes of illustrations are not proportional.)



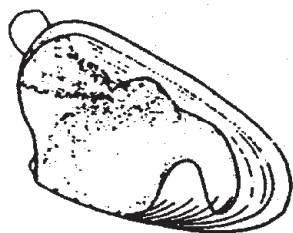
Marvellous MUDFLAT MEALS



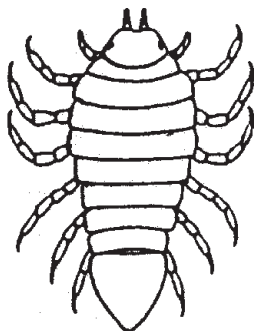
Source: from *Exploring Estuaries & Wondrous Wetlands – Teachers Resource Guide Supplement to "Discover Boundary Bay"*. More details can be obtained by writing FOBB, P.O. Box 1441, Station A, Delta, B.C., Canada. V4M 3YB. <http://www.bcwetlands.com>



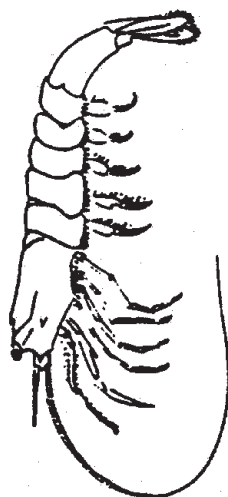
More Marvey Mud Meals



CLAM



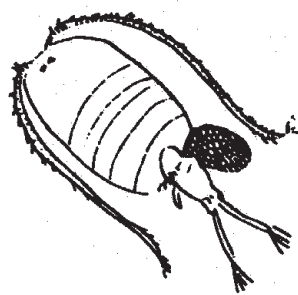
ISOPOD



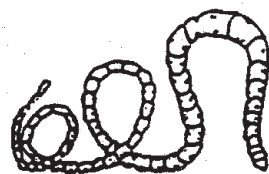
SHRIMP



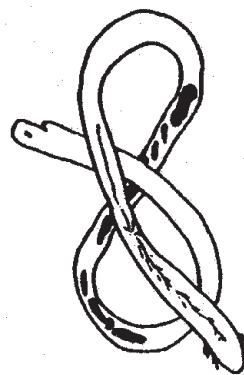
POLYCHAETE



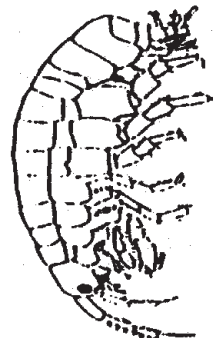
COPEPOD



OLIGOCHAETE



NEMATODE



AMPHIPOD

Sampling Local Shorebird Populations

Activity originally created by Rich Kleinleder and the Shorebird Sister Schools Committee, Alaska 1994-1995.

Grade Level: upper middle school / high school

Duration: regular counts over a 2 to 4-week period

Skills: application, observation, comparison, collecting and interpreting data, communication and presentation, forming hypotheses, discussion, evaluation, and using technology
Subjects: science, math, and technology

Concepts

- Bridge the classroom and the local environment
- Gain first hand knowledge through an outdoor experience.
- Discover the ecosystem through multi-sensory experiences.
- View shorebirds, their habitats, and what they eat.
- Utilize the scientific method as a process for inquiry and discovery.

Vocabulary

- transect sample plot
- sampling
- scientific method
- stopover site
- breeding habitat
- non-breeding habitat

Overview

Students work individually to design a shorebird observation study that determines how many shorebirds use a local stopover, breeding, or non-breeding site and then compare their results.

Objectives

After this activity, students will be able to:

- Explain the steps involved in the scientific method.
- Develop a procedure or protocol for collecting observation data.
- Correctly set-up a transect area.

- Use at least three mathematical calculations to analyze the data collected.

Materials

- one copy of the student readings *The Scientific Method of Inquiry* and *Sampling Populations* for each student
- field notebook
- graph paper or computer graphing program
- pencil
- watch

Optional

- stakes and flagging tape for marking the area

Introduction

This activity requires students to go to the shorebird viewing site on a regular basis, with or without teacher supervision, to count the number of birds in a small plot several times during the season. Parental involvement is encouraged, especially for younger students.

Sampling is the scientific method of measuring one or more variables on a small plot (a transect) and using those results to make assumptions about a larger area. Scientists are usually interested in making statistical comparisons that require they follow a series of specific procedures under standardized conditions. For more information about the scientific method see the student reading *The Scientific Method of Inquiry*.

While this activity was designed for use at a migration stopover site, students can make similar investigations at shorebird non-breeding or breeding habitats. This activity also gives them the opportunity to make hands-on, critical thinking discoveries about the scientific process. They will discover how important it is to collect sufficient data and attempt

to make more than the minimum number of counts. They will also discover the importance of choosing a truly representative sample plot.

Activity Preparation

1. Choose a sample plot or transect area.
It should be set up in typical shorebird habitat used on a regular basis by shorebirds during the time of this activity. Contact your local shorebird researcher, birdwatching club, or naturalist to find out the best time and place to begin this activity. Keep in mind that the sample plot does not need to be very large (25 meters is a suggested start). However, the observer should be able to see and count all of the birds in the plot within 30-60 seconds.
2. Mark the study boundaries.
You may or may not need to use artificial markers to define the boundaries of your plot. Natural topographic features like rocks, gravel bars, and well-defined clumps of vegetation may serve just as well. The shape of the plot does not need to be regularly geometric. The idea is to define the boundaries well enough so that you can return to and make counts in that exact same area repeatedly.
3. Mark the spot where the observer will stand every time he/she observes the shorebirds. This is important to ensure a consistent view of the sample plot (and eliminate the variable of any bias based on a changing view.)
4. Set up a counting protocol.
After setting up your sample plot, determine what the counting protocol will be. In order to compare activity on the plot from one day to another,



decide when, relative to the tide, counts will be made and for how long. This is important to standardize because most of the shorebirds will concentrate on the beach or mud flats as they are being exposed by the receding tide. Because the time of tide is different each day, counts can not be taken at the same time each day.

Sample Protocol

- Counts will be taken every sample day one hour following the time that the tide recedes enough to completely expose the plot.
- During each visit, all birds present will be counted within one hour.
- The plot will be counted at least three times for each sample, with a 3 minute break between counts.

5. Design a data log or chart. This log should include all elements of the predetermined protocol. A log for the sample protocol above would include a place for the date, time of the count, and number of birds counted each time. Also include the time of the tide and the name of the researcher (if a team is involved) doing the counts.

Procedure

1. Carry out the counts.
2. Present the results in a table. Create a table of results from the log notes to determine the average number of birds in the plot for each day birds were counted. Remember to include complete labels explaining the units (e.g. dates and the number of birds counted) See the table below showing the relationship between the number of shorebirds and date at one particular location.

Note: The actual log used in the field would probably contain space for more data than is shown in the final table of results. For instance, on each count day, record the times of the counts. Such data is important to have in the logs to look for other patterns relating behavior to the environment and to allow another researcher to exactly replicate, and therefore test, the work.

3. Present the results pictorially using the table of results to plot a data graph to show any patterns.

4. Use the data to ask questions about the shorebirds observed! Compare these results to other students who collected data.

- How do the graphs compare with other student “researchers”?
- Why do they look the same or different?
- When is the peak of the migration in your area?
- Was enough data collected to determine this?
- Does this exercise bring up more questions than you can answer with this set of data?
- What sort of things would you have to observe or measure to answer those questions?

5. Report your results on the SSSP Web site <http://sssp.fws.gov>.

Data Table Example

Number of Shorebirds Counted (All Species) at Alfred's Beach

Date	April 22	April 25	April 30	May 1	May 4
Count 1					
Count 2					
Count 3					
Count 4		(no count)		-----	
Average:					



Migration Headache

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Council for Environmental Education. Reprinted with permission from Project WILD, "Project WILD K-12 Educator's Guide and Activity Guide." The complete guide can be obtained by attending a Project WILD workshop. For more information, please visit www.projectwild.org or contact the National Project WILD office at 713/520 1936.

Grade Level: lower elementary, upper elementary/lower middle school

Duration: one 40-minute class period

Skills: vocabulary, discussion, comparison, observation, data collection and interpretation; using technology (with additional activity)

Subjects: science, language arts, math, and physical education; technology and social studies (geography) (with additional activity)

Concepts:

- During each year of their lives, most shorebirds migrate between habitats located in different geographic areas.
- Shorebirds migrate between northern breeding areas and southern wintering areas to take advantage of seasonal food resources.
- Arctic-nesting shorebirds undertake some of the longest migrations of any animals.
- Migratory shorebirds depend on habitat in at least three areas: breeding, nonbreeding, and migratory stopover sites.
- Because shorebirds fly together in large numbers their populations are extremely vulnerable to threats along their migratory routes.
- Most important migratory stopovers are nutrient-rich habitats, like estuaries, that also provide resources desirable to humans, making them

vulnerable to alteration, pollution, disturbance, and destruction.

Vocabulary

- migration
- limiting factor
- habitat
- habitat loss
- breeding areas
- nesting site
- nonbreeding site
- wintering area

Overview

Students become "migrating shorebirds," traveling between nesting and wintering habitats. Along their journeys they experience some of the threats that affect the survival of migratory shorebird populations.

Objectives

After this activity, students will be able to:

- Define the term migration.
- List three limiting factors that can affect the populations of migrating shorebirds.
- Classify these limiting factors as natural or human-caused.
- Predict the effects of habitat loss and degradation on populations of shorebirds.

Materials

- Large playing field or gymnasium
- Two paper plates for every three students (Clearly mark the plates, perhaps with a large X on one side, to differentiate top from bottom.)
- Additional plates based on one-fourth of the total number of plates from calculation above.
- *Factors Affecting Survival Cards* or *Habitat Scenarios* listed below
- Flip chart and several colored markers

Introduction

Migration is a challenging task for migratory shorebirds. For many species it involves flying tremendous distances, facing

difficult weather, and depending on stopover habitats and food resources that have been available for many generations.

There are approximately 49 different species of shorebirds throughout North America. Most of these shorebirds spend their summers at northern *breeding areas* in the United States and Canada and migrate to *wintering areas* in the southern United States, Central America, and South America. The White-rumped Sandpiper, for example, migrates each year from the Arctic Circle to the southernmost tip of South America and back, a round trip of 20,000 miles! However, not all shorebirds migrate such long distances. Some, like the American Avocet, breed in the northern part of the United States and winter in the southern part of the United States.

There is a wide variety of *limiting factors*, both natural and man-made, that affect whether or not these birds reach their nesting or wintering grounds. Understanding what these factors are and how they affect shorebird populations is the key to shorebird conservation.

To learn more about shorebird migration and threats to shorebird survival, read *Magnificent Shorebird Migration and Threats to Migrating Shorebirds* found in the *Shorebird Primer*.

Activity Preparation

1. Photocopy one set of the game cards (included in this activity) on cardstock paper. Each card lists one factor (from the table below) affecting shorebird survival on one side and the number of plates lost or gained as a result of this factor on the other side. *Additional Habitat Scenarios that may be used along with, or in place of, the*

Factors Affecting Shorebird Survival are provided; however, the additional habitat scenarios are not laid out as game cards.

2. Select an area about 20 meters (about 70 feet) in length (indoors or out) where the students can race back and forth.

Habitat Scenarios

Educators may want to photocopy these scenarios before beginning the activity.

These scenarios can be used during the activity to assist educators with the factors that may reduce or enhance a wetland habitat.

- A marsh has been dredged to allow a marina to be built. Remove one habitat (plate) from the stopover habitat.
- A landowner has agreed to reflood fields after harvesting, increasing acreage for wintering birds. Add one habitat (plate) to the wintering habitat.
- A joint federal and state wetland restoration project involve the removal of drain tiles, allowing a former wetland to flood and return to its natural state. Add one habitat (plate) to the stopover habitat.
- A large increase in the number of cats, dogs, and raccoons has reduced the value of a marsh nesting area. Remove one habitat (plate) from the nesting habitat.
- Wintering habitat is reduced by the conversion of wetlands to cropland. Remove one habitat (plate) from the wintering habitat.
- New legislation restricts boat traffic on a number of lakes and large marshes, reducing the human disturbance to wildlife. Add one habitat (plate) to stopover habitat.
- Several years of sufficient rain and snow have replenished the water supply, thus increasing the food supply. Add one habitat (plate) to the nesting habitat.
- A timber company has agreed to preserve grassland with scattered wetlands in exchange for tax credits. Add one habitat (plate) to the stopover habitat.
- Wintering habitat is reduced

by the conversion of beach to condominiums. Remove one habitat (plate) from the wintering habitat.

Procedure

1. Select a large playing area about 70 feet in length. Place an equal number of bases in three areas on the playing field. (See illustration.) Choose the number of bases so that there is one base for each two or three students at each of the three areas on the field. Designate one of the end areas as the “wintering habitat,” the other end as the “nesting habitat,” and the area in the middle as “stopover habitat.”
2. Explain to the students that they are shorebirds and will migrate among these three areas at your signal. Tell the students that the bases represent suitable shorebird habitat such as wetlands and grasslands. At the end of each migration, the students will have to have one foot on a base in order to be

Factors Affecting Shorebird Survival

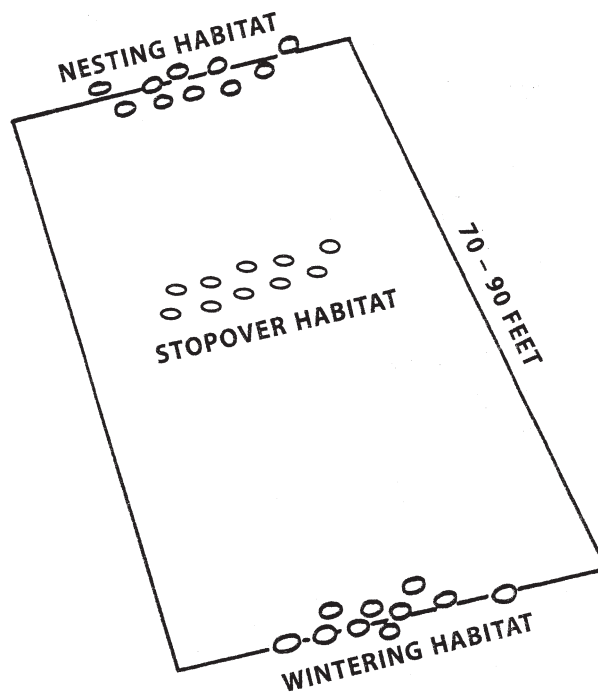
<i>Factors Reducing Survival</i>	<i>Number of plates lost*</i>	<i>Factors Favoring Survival</i>	<i>Number of plates gained*</i>
Urban expansion	5	Preservation of wetlands and grasslands	4
Wetland drainage	5	Dynamic balance with predators	4
Conversion of wetlands and grasslands to farmland	4	Improvement/addition of habitat	3
Pollution (e.g., oil or chemical spill or runoff)	3	Education about habitat for wildlife	3
Drought	3	Normal rainfall (i.e., neither drought nor flood)	2
Disturbance to resting and feeding shorebirds	2	Education about hunting	1
Pollution of food supply	1	Farm management for crops, cattle, and shorebirds	3
Illegal hunting	1		

* Number of plates lost/gained: These numbers are only suggestions and are not necessarily accurate or directly proportional to the size of the threat, percentage of change in survival, etc. This will vary between particular places or incidents.



allowed to continue (survive). Tell the students that only two (or three, as decided in Step 1) shorebirds can occupy a habitat (base) at one time. If they can not find a habitat that is not “filled,” that means they have not found any suitable habitat. They “die,” and have to move, at least temporarily, to the sidelines. During migration, the students may want to “flap their wings,” moving their arms like birds in flight.

3. Explain to the students that many factors will limit the survival of populations of migrating shorebirds. Some involve changes in the wintering, stopover, and nesting habitats. There will be periods of time in which food, water, shelter, and space are suitably arranged to meet the habitat requirements of the birds. There will be other times when the habitat is stressed, with many factors limiting the potential for the birds' survival.

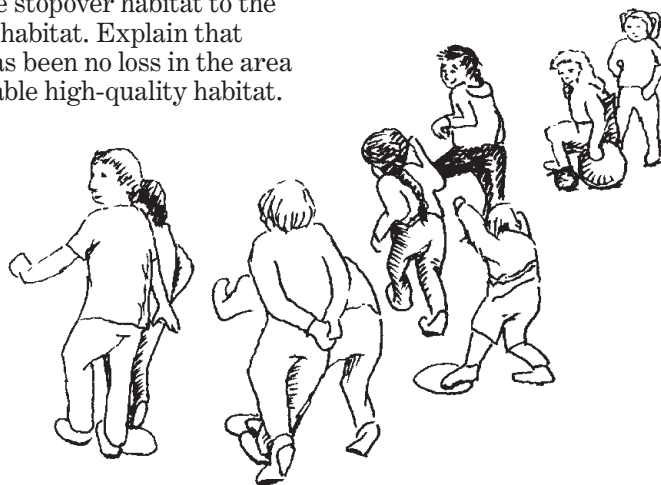


4. Begin the activity with all students at the wintering habitat. Announce the start of the first migration. Have the students migrate slowly until they become familiar with the process. Then they can speed up. On the first try, all the birds will successfully migrate to the stopover habitat.

5. Explain that most shorebirds need these areas to rest and eat before continuing the migratory journey. Then have them migrate from the stopover habitat to the nesting habitat. Explain that there has been no loss in the area of available high-quality habitat.

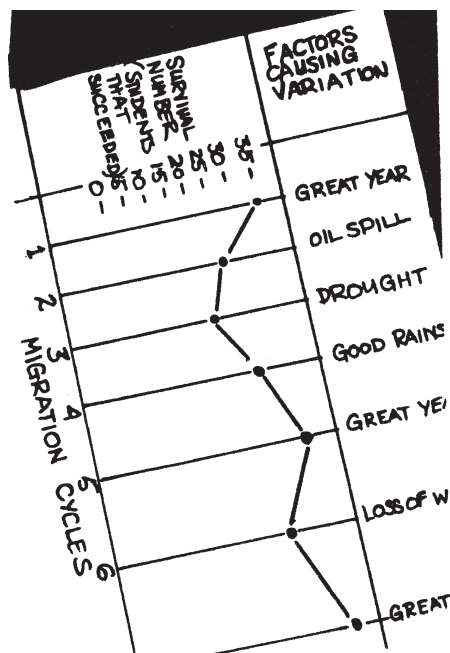
Thus, a successful nesting season is at hand.

6. Before the students migrate back “south,” turn over four plates in the breeding habitat. This represents a catastrophic loss. Tell the students that this is the result of a period of unusually heavy rain that flooded many of the nests. Instruct the students to migrate. This results in a large number of students waiting



on the sidelines to re-enter the nesting habitat. Tell the students that these birds died as a result of habitat loss. Remind any “deceased” birds that they will have a chance to get back into the activity. They can come back as surviving hatchlings when favorable conditions prevail and there is habitat available in the nesting ground.

7. Continue the migrations by reading the *Factors Affecting Survival Cards* or the *Habitat Scenarios*. Educators may want to appoint two students as monitors to remove and add bases (habitats) as required on the cards. Use your discretion to ensure that too many plates are not added or removed, and that “dead shorebirds” have an opportunity to re-enter the game.
8. Repeat the process for eight or ten migration cycles. Remember, overall the availability of suitable habitats for shorebirds are diminishing. The activity should end with fewer areas of available habitat than can accommodate all the birds. *The greatest long-term threat to the survival of populations of shorebirds is the loss and degradation of habitat.*
9. As you move through the game, chart the number of shorebirds that survive each round, using the flip chart and markers as shown below. Make a note on the chart indicating what caused serious shorebird deaths and what caused good breeding years for students to refer to later.



10. After the activity, ask the students to identify factors that caused shorebird populations to decline or increase. What are the short- and long-term effects of the decline or increase? Which factors reduced or enhanced the quality of the habitat? What are the benefits and liabilities related to these factors for the community?

- Have students summarize what they have learned about the factors that affect shorebird migration.
- Divide these factors into two lists-human-caused factors and environmental factors.

- Compare similarities and differences among these limiting factors. Which pose the most significant long-term threat to shorebird survival?

- What threats exist to your local shorebird habitat?

11. Have students study the graph you created during the game.

- What were the causes of the biggest population declines?
- Ask students to imagine how long these factors might affect a shorebird population (one breeding season, two....?).
- Distinguish between catastrophic effects and gradual changes.

- What kinds of things can be done to protect and restore habitats for migrating bird populations? Discuss potential trade-offs related to any recommendations for humans and other organisms (including shorebirds).

Additional Activities



Cultural Connections

- Facilitate a student discussion about what might be the culturally-influenced viewpoints of the peoples' actions in the "Affecting Shorebird Survival" and "Habitat Scenarios" towards the environment.
- Have students research the impact of the Exxon Valdez oil spill on the local communities affected and on the shorebirds migrating through.

Research a Species of Shorebird

Conduct this activity again with each student representing a specific kind of shorebird.

Research Habitat Loss

Causes in Your Community

Explore the major factors affecting habitat loss and alteration-or gain and restoration-in your area. Research the causes for long-term habitat loss, as well as any major efforts underway to prevent these increasing losses. Find out how wetlands have changed or remained the same in your community throughout the past 100 years. Are there wetland regulations or zoning laws in your community?

Research Other Migratory Animals

What other animals migrate? Are the problems they face similar to those of migratory birds?

Research Laws Protecting Migratory Species

There are national laws and international treaties protecting migratory species. Find out about some of these. What is their history? Are they effective? Are there problems enforcing them? What migrating species, if any, are unprotected by such laws?

Track Shorebird Migration Around the World

Use the Shorebird Sister Schools Website at <http://sssp.fws.gov> to monitor shorebird migration throughout the world. Look at the reports scientists and students are posting. Look for sightings of shorebirds in your area. Post your own shorebird observations on the Web site too!



Urban Expansion



Lose Habitat for 15 Shorebirds (Remove 5 Plates)



Wetland Drainage



Lose Habitat for 15 Shorebirds (Remove 5 Plates)



Conversion of Wetlands and Grasslands to Farmland



Lose Habitat for 12 Shorebirds (Remove 4 Plates)



Pollution



Lose Habitat for 9 Shorebirds (Remove 3 Plates)



Drought



Lose Habitat for 9 Shorebirds (Remove 3 Plates)



Disturbance to Nesting and Feeding Shorebirds



Lose Habitat for 6 Shorebirds (Remove 2 Plates)



Food Supply Is Polluted



Lose Habitat for 3 Shorebirds (Remove 1 Plate)



Illegal Hunting



Lose Habitat for 3 Shorebirds (Remove 1 Plate)



Preservation of Wetlands and Grasslands



Gain Habitat for 12 Shorebirds (Add 4 Plates)



Dynamic Balance With Predators



Gain Habitat for 12 Shorebirds (Add 4 Plates)



Habitat Is Improved or Added



Gain Habitat for 9 Shorebirds (Add 3 Plates)



Education About Habitat for Wildlife



Gain Habitat for 9 Shorebirds (Add 3 Plates)



Normal Rainfall (neither drought nor flood)



Gain Habitat for 6 Shorebirds (Add 2 Plates)



Education About Hunting



Gain Habitat for 3 Shorebirds (Add 1 Plate)



Farm Management for Crops, Cattle, and Shorebirds



Gain Habitat for 9 Shorebirds (Add 3 Plates)



The Incredible Journey

Adapted with permission from "Ecosystem Matters: Activity and Resource Guide for Environmental Educators," Rocky Mountain Region of the USDA Forest Service.

Grade Level: upper elementary/middle school

Duration: 1 hour to 1 hour and 30 minutes

Skills: comparison of similarities and differences, critical thinking, vocabulary, discussion, observation, and prediction; using technology (with additional activities)

Subjects: science, physical education, social studies, geography, history, and math; technology (with additional activities)

Overview

Through an active simulation game, students learn about the many threats shorebirds face on their migratory journeys.

Concepts:

- During each year of their lives, most shorebirds migrate between habitats located in different geographic areas.
- Arctic-nesting shorebirds undertake some of the longest migrations of any animals.
- Migratory shorebirds depend on at least three habitats: breeding, nonbreeding, and migratory stopover sites.
- Shorebirds concentrate in great numbers at their stopover sites.
- Because shorebirds fly together in large numbers, their populations are extremely vulnerable to threats along their migratory routes.
- Most important migratory stopovers are nutrient-rich habitat, like estuaries, which also provide resources desirable to humans, making them vulnerable to alteration, pollution, and destruction.

- Shorebirds migrate between northern breeding areas and southern wintering areas to take advantage of seasonal food resources.

Vocabulary

- aquatic habitat
- aquatic insects
- breeding grounds
- nonbreeding grounds
- body mass
- clutch
- fat loading
- fledging
- flyway
- foraging
- invertebrates
- juvenile
- migrate
- migration route
- nesting
- pesticide
- pothole
- predator
- probing
- shorebird
- species
- survivorship
- territory
- wetlands
- amphipods
- critical habitat
- Central Flyway
- Atlantic Flyway
- Pacific Flyway

Objectives

After this activity, students will be able to:

- List five characteristics unique to shorebirds.
- Locate the three main flyways in the United States.
- Name four hazards shorebirds encounter along their annual migrations.
- Explain why these birds migrate from the far north to the far south of the Western Hemisphere.
- Explain what "fat loading" is and why it is important to migrating shorebirds.

Materials

- Playing field or gymnasium
- Cones, string, rope, or hula hoops to mark breeding grounds, wintering grounds, and staging areas
- One classroom set of Northern, Southern and Staging Area Cards
- *Western Hemisphere Shorebird Reserve Network Poster* (included with the education guide)

Introduction

There are approximately 50 different species of shorebirds throughout North America. Most shorebirds spend their summers in the northern areas of the United States, Canada, and Alaska and *migrate* to southern United States, Central America, and South America to spend their winters where food is available. The White-rumped Sandpiper, for example, migrates each year from the Arctic Circle to the southernmost tip of South America and back, a round trip of 20,000 miles every year! However, not all shorebirds migrate such long distances. Some, like the American Avocet, breed in the north and winter in the southern part of the United States.

In North America, three primary flyways are heavily used as *migration routes*, connecting the shorebirds' *breeding grounds* in the north to their *nonbreeding grounds* in the south. The *Pacific Flyway* follows the coast from Alaska to the southern part of South America. The *Atlantic Flyway* runs along the Atlantic Coast from northwestern Canada to the very southern tip of South America. The *Central Flyway* stretches from north central Canada, down through the center of the United States into northern South America. The activity focuses on the Central Flyway.

To learn more about the spectacular migrations of shorebirds, read *Magnificent Shorebird Migration* found in the *Shorebird Primer*. To learn more about the threats shorebirds face along the way, as well as the ongoing efforts to protect them and their critical habitats, read *Threats to Shorebirds*, also found in the *Shorebird Primer*.

Activity Preparation

1. Read the background information *Magnificent Shorebird Migration* found in the *Shorebird Primer*. It is essential to understanding this activity. Read through the game cards as well in order to be aware of the situations presented to the students.

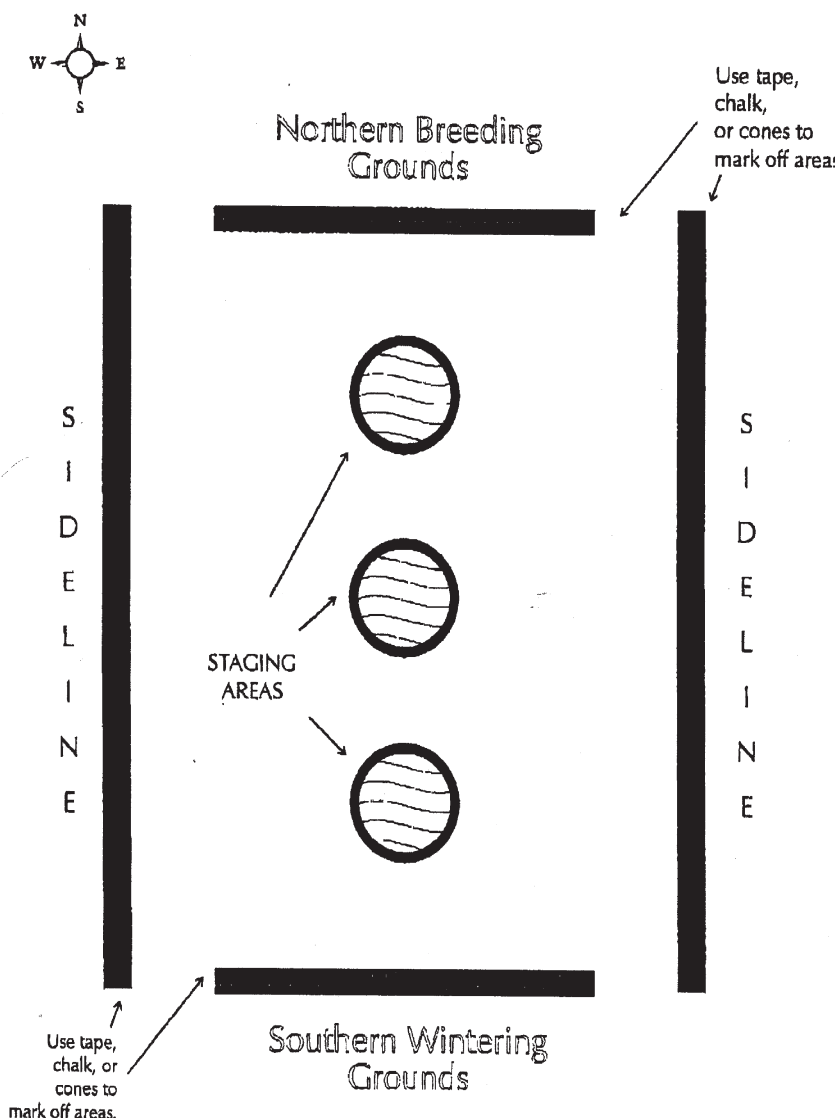
2. Photocopy and cut out the following game cards:
10-Northern Cards
10-Southern Cards
14-Staging Area Cards

3. Set up your playing field according to the directions and diagram below.

- Place a rope or other line across each end of the playing field and mark one end “the nonbreeding grounds” and the other “the breeding grounds.”

- Place three circles in the playing field, using rope or hula hoops. The circles represent staging areas.

4. Disperse the Staging Area Cards evenly among the three staging circles. Spread the Northern Cards in the breeding area and the Southern Cards in the nonbreeding grounds.



Procedure

1. Talk briefly about *migration*, *staging areas*, *breeding grounds*, and *nonbreeding grounds*. Explain that students will be migrating shorebirds. Locate the three main flyways on a map of North and South America, using the *Western Hemisphere Shorebird Reserve Network Poster* with the education guide. For purposes of this game, players are to imagine they have migrated on the Central Flyway.

2. Explain how the game works.

- Each player must pick up one card at the wintering ground, each staging area, and the breeding ground.
- Players must follow the directions written on the cards and return the cards to the pile before they continue their migrations. For example, a card from the breeding grounds may instruct its holder to take a person who has been labeled “dead” by another card and return him or her into the game as a young bird.

- Any player who picks up a card indicating death of the bird must drop out of the game and stand along the sidelines until there is an opportunity to rejoin the game.
- 3. Select one or two players to represent the Peregrine Falcon and/or the Merlin as predators in flight. Their job is to tag students as they move among the staging areas. They must escort each tagged victim to the edge of the playing field before tagging another migrating student.
- 4. As the players run to the other side of the playing field, they must stop at each of the staging areas to refuel (unless otherwise instructed). They collect one card at each staging area and follow the directions on the card.
- 5. Players must make four complete migrations (from south to north and back to south). Each migration (in one direction) will begin with a signal from the teacher.
- 6. Plot the survival rate of each migration. Discuss some of the following questions to identify what affected the survival rate.
 - What were some of the unexpected situations described on the cards? How did these things affect migration?
 - What events caused bird deaths? Which were “natural” and which were “human-caused?” List these on the chalkboard.
 - Discuss the list of “human-caused” deaths and evaluate the pros and cons of each situation. How do people’s actions affect other animals and each other? (DDT is an insecticide used to protect crops from damaging pests. It has been outlawed in the United States for over 20 years. Scientists discovered that DDT can be passed on from one animal to another, poisoning all the organisms it comes in contact with.)
 - What are some of the weather changes shorebirds experience during their migration?

Additional Activities



Cultural Connections

- After the activity, lead a discussion with students discussing cultural beliefs about the environment and their influence on survival of shorebirds.
- Students can pretend to be shorebirds migrating from Paraguay to Nunavut, Canada. They can research Spanish and Inuit or French words, phrases, or sentences to speak to each other when they arrive in those countries—phrases such as “welcome,” “I am hungry,” and “be careful.” Students can also work with the school’s Spanish or French teacher to come up with words and sentences.

Prairie Pothole/Playa Lake History Lesson

Ask each student to search for ten facts regarding the formation and history of the Prairie Pothole or Playa Lake Region in the central United States. Have them share the information they discovered and then assemble a class report based on the facts they uncovered.

Local Shorebird Migration

Working in small groups and using the <http://sssp.fws.gov>, have your students research local shorebirds, including the migration routes they take and the places where they stop to rest and feed. Ask them to draw migration maps to plot known and possible stopover sites. Have them report on what they learned.

Local Shorebird Threats

Invite a state wildlife officer to speak to the class about what impacts the migratory birds in your community. Find out how students can help to lessen the effects of these impacts.



The Incredible Journey Game Cards

Ten - Northern Cards

(Make one photocopy.)

<p>NORTHERN CARD Bad news! Unusually bad weather has limited your feeding time. You are too weak to make it to the first staging area. You die and must go to the sideline.</p>	<p>NORTHERN CARD Severe weather in the Arctic tundra kept you from laying eggs. You have difficulty finding a sufficient supply of invertebrate prey (animals you eat). You struggle to keep up with the flock. Hop on one foot to your first staging area.</p>
<p>NORTHERN CARD Yeah! Good weather and only a few predators have made it a great nesting season. Pick two people from the sidelines to migrate with you.</p>	<p>NORTHERN CARD Lost wetlands on the way to your breeding grounds made you late and weak. You do not have time to reproduce. Crane flies and bloodworms are abundant so you double your weight. Begin your migration.</p>
<p>NORTHERN CARD Hurrah! It's been a warm, wet summer. There was an abundance of shoreflies and danceflies to feed on. Your nesting is successful. Take one person from the sidelines with you. Begin migration.</p>	<p>NORTHERN CARD Yikes! It's been a good year for weasels and a bad year for eggs. None of your young survive. Food was abundant. Begin migration.</p>
<p>NORTHERN CARD Great! You have successfully hatched and fledged one of your young. Pick one person to migrate with you.</p>	<p>NORTHERN CARD You are young and are not able to put on a sufficient fat load before migration begins. You are not so strong as the adults. Skip to the first staging area.</p>
<p>NORTHERN CARD Bummer! A large fox population this year has increased fatalities. You are eaten. Go to the sidelines.</p>	<p>NORTHERN CARD Yum! There is an abundance of amphipods and snails this year. You have easily doubled your body weight. You have had a successful nest. Take two people to migrate with you. Begin migrating!</p>



The Incredible Journey Game Cards

Ten – Southern Cards

(Make one photocopy.)

<p>SOUTHERN CARD Yippee! It's been a good winter! A new wetland reserve area has been added to your winter grounds. There was plenty of food. Fly to your first staging area.</p>	<p>SOUTHERN CARD Yuck! You are feeding on aquatic insects contaminated with DDT from the runoff of agricultural lands surrounding your wetland habitat. You become sick and die. Go to the sideline.</p>
<p>SOUTHERN CARD How disappointing! You have had a rough nine months at your wintering grounds. Part of the wetland you have always returned to has been drained, causing more birds to compete for less food. You are weak. Hop on one foot to the first staging area.</p>	<p>SOUTHERN CARD Bang! Hunting of shorebirds is still legal in South America. A hungry hunter shoots you. Go to the sideline.</p>
<p>SOUTHERN CARD Too bad! Agriculture is spreading on your wintering grounds and, as a result, so is DDT. You die from pesticide poisoning. Go to the sideline.</p>	<p>SOUTHERN CARD You're starving! Overcrowding due to the loss of wetlands has increased competition for what little food there is. You do not have an adequate fat load and your migration is difficult. You may skip to your first staging area.</p>
<p>SOUTHERN CARD Oh no! More wetlands have been drained and turned into agricultural areas. You are unable to find enough food and eventually die. Go to the sidelines.</p>	<p>SOUTHERN CARD Moo! The cattle industry is booming in South America. Your winter habitat is severely overgrazed, making it difficult to eat enough to put on an adequate fat load for migration. You must skip to your first staging area.</p>
<p>SOUTHERN CARD Worms! Oodles of freshwater worms! It's been a great winter with lots of food. You easily increase your body weight from 20 grams to 40 grams for the long migration to the Arctic tundra. Migrate to the first staging area.</p>	<p>SOUTHERN CARD Good news! Educating people about the need to preserve wetlands has paid off. More wetlands mean more food. You begin your next migration in good health.</p>



The Incredible Journey Game Cards

Fourteen – Staging Cards

(Make one photocopy.)

<p>STAGING AREA Bye, bye! You did not find enough food to replenish your fat load, and the flock you were traveling with has left without you. You must wait one turn to continue on with another flock.</p>	<p>STAGING AREA This is unnerving! You are on the perimeter (outer edge) of the flock and must constantly be on the look-out for predators. You do not eat enough to put on an adequate fat load. Hop to the next staging area.</p>
<p>STAGING AREA Gobble, gobble! You have had warm weather and abundant food at this staging area. You have easily increased your weight by 100%! Begin your migration again.</p>	<p>STAGING AREA Yikes! Your usual staging area has been drained for farming. You must scrounge to find enough food for the next leg of your journey. Hop on one foot to the next staging area.</p>
<p>STAGING AREA Bad stuff! You find that this staging area has been contaminated with pesticides from surrounding agricultural lands. You become ill and die. Go to the sideline.</p>	<p>STAGING AREA WHEEEEEEEE! You've got a full stomach and a tail wind pushing you on to your next staging area. A predator can't even catch you! Arrive at your next staging area quickly and safely.</p>
<p>STAGING AREA Brrrr! Bad weather makes for a slow migration! Side step to your next staging area.</p>	<p>STAGING AREA Bad stuff! Bad weather makes for a slow migration! Side step to your next staging area.</p>
<p>STAGING AREA What? Your usual staging ground is swarming with people! A new recreation center has opened at your staging area. Being around so many people makes feeding difficult. You do not store enough energy. Walk to your next staging area.</p>	<p>STAGING AREA Hooray! The Western Hemisphere Shorebirds Reserve Network has done a great deal to preserve important shorebird sites along your migration route. You find a surplus of food and quickly refuel for your continued migration.</p>



The Incredible Journey Game Cards

Fourteen – Staging Cards

(continued)

(Make one photocopy.)

<p>STAGING AREA Gooney! You find one of your coastal staging areas covered in oil. You become covered with the thick goo and are unable to eat, fly, or maintain any body heat. You die. Go to the sideline.</p>	<p>STAGING AREA Ugh! You have run into a head wind (wind blowing against you) and you are burning up a lot of energy. Take two steps forward and one step back as you make your way along your migration.</p>
<p>STAGING AREA Whoopee! Education about wetlands has gained public support for the restoration of wetland areas. You have an abundance of snails and freshwater worms to feed on! You begin your migration in good health.</p>	<p>STAGING AREA ZAP! New radio towers have been built across your migration route. You are zapped and die. Go to the sideline.</p>
<p>STAGING AREA You find yourself feeding in the safety of the flock. Craneflies, danceflies, and shoreflies are abundant. You double your weight easily. Move on to the next staging area.</p>	



Behave Yourself!

Grade Level: lower elementary

Duration: one 30 to 40-minute class period.

Skills: communication, observation, application, and comparison of similarities and differences

Subjects: science, fine arts, and physical education

Concepts

- Shorebirds have elaborate behavioral adaptations for courtship display and protection of their nests and young.
- Elaborate courtship displays include vocalizations and gestures to attract mates.
- The elaborate behaviors of shorebirds for attracting mates and protecting young are some of the most spectacular and complex of all birds.

Vocabulary

- gestures
- breeding territory
- nonbreeding grounds
- mates
- aerial displays
- vocalizations
- polyandrous

Overview

Students participate in a game in which they attempt to communicate with each other by acting out shorebird gestures and vocalizations.

Objectives

After this activity, students will be able to:

- Give three examples of shorebird gestures or vocalizations.
- Explain why shorebirds make these gestures and vocalizations.
- Identify that males are most often the ones that perform vocalizations and gestures.
- Define the term polyandrous.

Materials

- One classroom set of *Shorebird Behavior Cards*
- One classroom set of *Shorebird Charades Cards*

Introduction

Shorebirds are renowned for elaborate mating *gestures*, *vocalizations*, and *displays*. Some of these displays are *aerial* (performed in the air), while others are performed on the ground. Shorebirds engage in these complex displays for a variety of purposes. The most spectacular displays sometimes involve plunging and hovering flights, accompanied by trilling, hooting, or buzzing sounds. They are used to attract and court *mates* and to protect nests and young. They are also performed as acts of aggression, particularly when defending *breeding territories*. Many shorebirds also defend their winter feeding territories on their *nonbreeding grounds*.

Gestures and vocal displays are vital forms of shorebird communication. Repeated, commonly understood rituals help shorebirds express their intentions quickly. This is especially important to tundra-breeding birds that are rushed by the short Arctic summer. Territorial displays allow birds to retreat from another's territory without risking a battle.

For more information about shorebird breeding and nesting, read *Elaborate Shorebird Mating Systems and Displays* in the *Shorebird Primer*.

Activity Preparation

1. Photocopy and cut out a set of *Shorebird Behavior Cards* (included in this activity). There should be one card for each student.
2. Photocopy and cut out a set of the *Shorebird Charades Cards* (included in this activity). There should not be duplicate cards. There should be one card per pair of students. To personalize your card set, write a few shorebird scenarios that are specific to your local species or issues on the blank cards provided.

Procedure

1. Have students stand in two lines facing each other. Join the line if there is an odd number of students. Students in one line are male shorebirds. These are the ones who will act like shorebirds trying to get the attention of a possible mate. The students in the second line represent female shorebirds.
2. Choose a pair of *Shorebird Behavior Cards* for each pair of students. Separate the cards into two identical decks. Shuffle each deck.
3. Take one of the decks and pass out a card to each "male shorebird." Let the students look at the cards, then collect them. Pass out the other deck to the "female shorebirds." The students can huddle with the shorebirds of their gender for help reading or understanding their cards. But male shorebirds cannot see the females' cards or vice versa.



4. Now explain to the “male shorebirds” that they must attract their mates by acting out the gestures listed on their cards. The female shorebirds must find their matches as quickly as possible. “Male shorebirds” need to exaggerate their gestures and sounds and repeat their actions until they are recognized.
5. Give a signal like “Behave Yourself!” to prompt the “male shorebirds” to begin.
6. End the round when all the students have found their mates.
7. Pick a shorebird pair to select a *Shorebird Charade Card* from the deck (maybe the last or the first pair to have found each other, the loudest “male shorebird”, etc.). Give them a few minutes to decide how they

can act out the scenario. After they perform their charade, ask the class to guess the sentence that was on their card. It is not necessary to guess the exact words—only the general meaning.

8. The pair that correctly guesses the charade can pass out the next round of cards.
9. Repeat the activity until all students have had a chance to perform displays and charades. Alter the roles by announcing that the class is now a flock of *polyandrous* shorebirds, and the “female shorebirds” must gesture to attract the males!

Additional Activities

Shorebird Simon Says

(good for younger groups)

Use the shorebird action cards to play “Simon Says” and follow up with a game of charades afterward.

Escalating Confusion

Increase the complexity of the game by asking the “male shorebirds” to make four to five different gestures at the same time. Add sound distractions into the game by playing background music. The “male shorebirds” will have to be even louder and gesture more wildly to be recognized.



Shorebird Behavior Cards

(Make one photocopy.)

Actions and Sounds	Actions and Sounds
Wing flash Bow Hoot	Wing flash Bow Hoot
Actions and Sounds	Actions and Sounds
Purr Stretch neck Walk stiff-legged	Purr Stretch neck Walk stiff-legged
Actions and Sounds	Actions and Sounds
Stamp feet Stretch/extend neck High trill	Stamp feet Stretch/extend neck High trill
Actions and Sounds	Actions and Sounds
Wing spread Hop Whistle	Wing spread Hop Whistle
Actions and Sounds	Actions and Sounds
Beat wings rapidly Open bill Call loudly and endlessly	Beat wings rapidly Open bill Call loudly and endlessly
Actions and Sounds	Actions and Sounds
Dip-shake Food exchange Purr	Dip-shake Food exchange Purr

Shorebird Behavior Cards

(Make one photocopy.)

Actions and Sounds	Actions and Sounds
Droop wings Scrape (kick backwards) Chatter gurgle (gargle)	Droop wings Scrape (kick backwards) Chatter gurgle (gargle)
Actions and Sounds	Actions and Sounds
Flutter wings Zig-zag chase Hoot loudly	Flutter wings Zig-zag chase Hoot loudly
Actions and Sounds	Actions and Sounds
Beat wings slowly Wing-vibration Hum	Beat wings slowly Wing-vibration Hum
Actions and Sounds	Actions and Sounds
Bow Lunge head first Laugh	Bow Lunge head first Laugh
Actions and Sounds	Actions and Sounds
Rear up Spread wings Hoot loudly	Rear up Spread wings Hoot loudly
Actions and Sounds	Actions and Sounds
Dance Jump Whistle	Dance Jump Whistle

Shorebird Charades Cards

(Make one photocopy.)

Shorebird Charade	Shorebird Charade
I am a wounded rabbit and you can catch me.	I am retreating (running away) from you.
Shorebird Charade	Shorebird Charade
My leg is broken and you can catch me.	You are in my territory (home) and I want you to stay.
Shorebird Charade	Shorebird Charade
I am a hungry chick.	Look at me!
Shorebird Charade	Shorebird Charade
Where do you want to build the nest?	My eggs are gone!
Shorebird Charade	Shorebird Charade
I am going to migrate now.	I am thirsty.
Shorebird Charade	Shorebird Charade
I see a fox.	Get out of here!

Shorebird Charades Cards

(Make one photocopy.)
(Write your own scenarios on the
blank cards provided.)

Shorebird Charade	Shorebird Charade
Get down, kids!	Come back here, kids!
Shorebird Charade	Shorebird Charade
I like you.	
Shorebird Charade	Shorebird Charade
Shorebird Charade	Shorebird Charade
Shorebird Charade	Shorebird Charade
Shorebird Charade	Shorebird Charade

It's a Tough Life!

Adapted with permission from "Plover Survival: A Simulation Game." U.S. Fish and Wildlife Service.

Grade Level: upper elementary/middle school

Duration: one 50-minute class period

Skills: vocabulary, critical thinking, discussion, visualization, and interpretation of data

Subject: science and physical education; language arts (with additional activity)

Concepts

- During a shorebird's breeding season, its habitat is where it courts, nests, and raises its young.
- Shorebirds nest on the ground.
- Some shorebirds defend breeding territories.
- Shorebirds have elaborate behavioral adaptations for courtship display and protection of their nests and young.
- Shorebird nests are well camouflaged. Chicks use both camouflage and behavior to stay concealed from predators.
- Your local environment may be important breeding habitat for many migratory shorebirds.
- Shorebirds face numerous threats in their breeding habitat.
- Disturbance from human activities, animals, and trash limit a shorebird's opportunity to feed and nest successfully.

Vocabulary

- invertebrates
- behavior
- threat
- human disturbance
- predator
- chicks

Overview

Students play a game that simulates the challenges shorebirds face when trying to feed along coastal beaches. Students begin to think about shorebirds' needs and what

threatens their survival.

Materials

- Outdoor or indoor playing field with enough room to move around freely
 - One rope at least 16 feet long
 - Four small brown bags or sandwich bags
 - One beach ball, Frisbee, or small ball
 - One additional 16-foot rope marked in four foot intervals or five orange goal cones or other markers to establish boundaries
 - Soda cans, candy wrappers, a couple of bags of chips (to simulate litter)
 - One to two bags of dried beans, the same color as the playing field
 - One copy of *It's a Tough Life! Record of Feeding and Survival Success* data chart
 - One large sheet of paper or flip chart for recording data
 - Markers for recording data
- ### Optional
- One large inner tube, tire, or ball
 - One kite

Introduction

Shorebirds face many *threats* and *disturbances* that can interfere with their ability to nest and feed. One of the biggest threats to beach-nesting shorebirds is *human disturbance*. As our population grows, so does our need for recreational space. This is especially true in rapidly growing coastal communities. Many times shorebird nesting coincides with the peak of our summer beach recreation season. Since shorebirds are naturally wary, they will move away from their nests and important feeding areas when disturbed, often before people even notice their presence. Of course, noisy beach activities such as personal water crafts and off-road vehicles scare shorebirds away; but so do more passive, seemingly unobtrusive activities like jogging or walking along the beach.

For more information about the threats shorebirds face, read *Threats to Migrating Shorebirds* in the *Shorebird Primer*. To learn more specific information about a sandy beach-nesting shorebird, read the *Snowy Plover Shorebird Profile* located in the *Appendix*.

Activity Preparation

1. Draw the *It's a Tough Life! Record of Feeding and Survival Success* data chart on a flip chart so you can record data as you play the game. You may also want to prepare a transparency of this data sheet for use in the classroom

Procedure

Set up the Scenario

1. Ask students to describe the wave action on a beach or lake. Is the water always at the same level or does it vary? Describe the area where a wave has just passed; is it wet or dry? Ask for two volunteers to move the rope to simulate gentle wave action. Have them demonstrate this motion.
2. Ask students if they have ever seen small birds along the water's edge. If so, what did they observe? Were the birds feeding? Did they move when the water approached? How? (If students have not observed these behaviors, explain that birds move back and forth with the advancing and retreating waves. They peck and poke with their beaks for small invertebrates in the mud.)
3. Ask for four volunteers—two to model the behavior of the adult shorebirds and two to model the behavior of the chicks. You may actually want to label these volunteers so you can distinguish between the adults and chicks.



4. Explain that in this game, or simulation, the birds (played by the students) will be feeding on beans (representing small *invertebrates* found in the mud). Spread the beans on the ground near the “water’s edge” and hand out small sacks or bags (a “stomach”) to each of your shorebirds. When the shorebirds find an “invertebrate,” they must pick it up with one hand and put it in their “stomach.” They can only pick up one bean at a time with one hand—the other hand must be holding their “stomachs.”

5. Have the shorebirds move with the waves. Model this feeding behavior for about 30 seconds. Count each bird’s beans at the end of this time and record the number on the *It’s a Tough Life! Record of Feeding and Survival Success* data chart.

Note: The range of beans collected during this first round will be your standard healthy diet. As the game progresses, if a shorebird collects only half of this amount, it will survive but be unhealthy. If a shorebird collects only one quarter of this number, it may eventually die.

6. Introduce students to the shorebird they will be representing. Select a shorebird that you might find at your local beach, lakeshore, or flyway from the list below.
- Atlantic Flyway: Piping Plover, Wilson’s Plover
 - Central Flyway: Piping Plover, Snowy Plover, Wilson’s Plover
 - Pacific Flyway: Snowy Plover, Wilson’s Plover
7. Explain that this activity will help them understand some of this bird’s *behaviors* and needs, as well as the things that are threatening its survival.

Add Human Disturbance to the Game

8. Ask students what a typical lakeshore or ocean beach looks like. Ask them to describe different types of people-related activities that take place there. Make sure their responses include some sort of game activities (playing Frisbee or catch, flying kites, etc.). What do you think shorebirds do if people or other animals come too close? Can shorebirds feed when they are constantly avoiding people?
9. Establish an area that will be a “safe haven” for the shorebirds. This should be located at least ten feet away from where they are feeding at the water’s edge. Mark off this area with the second rope, goal cones, or other objects. Establish four foot wide “corridors” through which the plovers will move from the water’s edge to the safe haven if any form of disturbance, like people, approaches. (See the diagram.)
10. Explain to the students that each shorebird will have a corridor in which to feed and move. If a person comes into the shorebird’s corridor, the shorebird has to be in the “safe haven.” This means that the shorebird must anticipate the approach of a human and run to the “safe haven” before the person is actually in its corridor. (In real life, most shorebirds will move long before people get too close.)
11. Ask for six new volunteers. Ask the plovers to resume feeding along the water’s edge. Tell the plovers they must “fly” to the “safe haven” when disturbed and go back to feeding when it is safe again. Then send two student volunteers to walk along the water’s edge at normal walking pace. When they are through, send another two students into

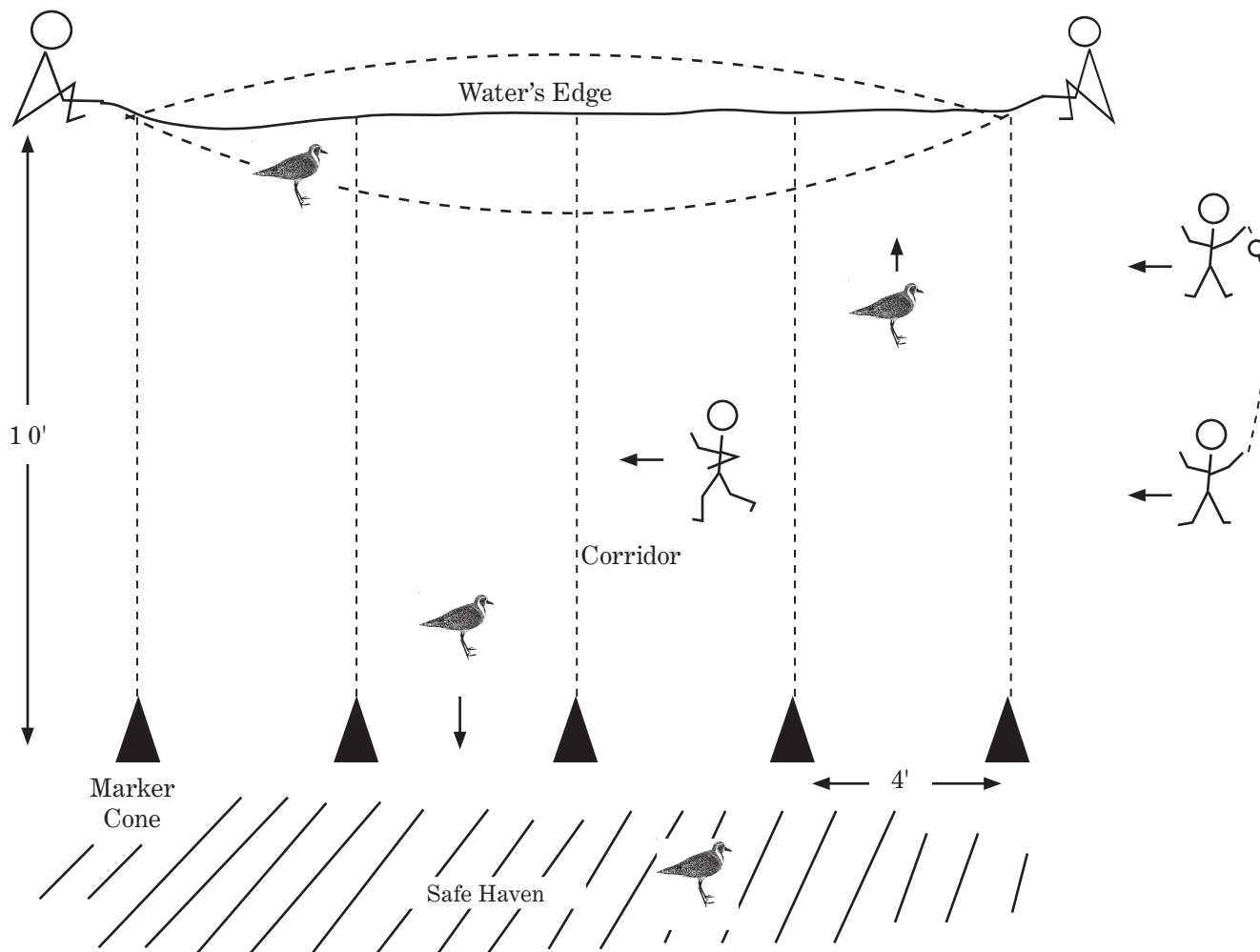
the game—this time playing ball or Frisbee for a few minutes. When they leave the area, send in another two students carrying soda cans, bags of chips, and other trash into the shorebird area. They should walk along, dropping some of their trash. Allow variable amounts of time between each pair of students to allow the plovers to attempt to return and feed.

12. Count and record the beans collected by the shorebirds in this round. Compare the results with those of the first round. Discuss the number of beans collected. Remind the class that more time was spent on this round but the birds still caught less food! Will these be healthy shorebirds? Will they even survive in this area? Ask the shorebirds how they feel physically. Are they tired? Given that real shorebirds will actually be running farther than the ten feet established in this game, what has the class learned about how much energy shorebirds use to get food? (Point out to students that with human interference, the shorebirds are using more energy to obtain less food.)

Add Predators to the Game

13. Ask students if the trash left by people in the last round affected the birds’ ability to feed. Explain to the students that when people leave trash in an area, it attracts other kinds of animals like dogs, cats, raccoons, skunks, foxes, and gulls.

Note: Gulls are fast-moving birds that prey on shorebird eggs and chicks. When a gull or other predator approaches a shorebird with its young, both the chicks and adult respond. The adult will move away, faking an injury like a broken wing in an attempt to lead the predator away from the



chicks. If both adults are present, the second parent will lead the chicks to safety. Because they are unable to fly, chicks are easy prey for predators.

14. In this round, instruct the chicks to squat on the ground and the adults to remain standing while they feed. Select a volunteer to be a gull or other predator. If the predator can tag a shorebird chick, this constitutes an attack—and the shorebird dies. The adult plover can fake an injury and/or lead the chick away to safety. Allow the predator to enter the area for 30 seconds.

15. Count and record the beans and living shorebirds at the end of the round. Discuss the impact this predator had on the shorebirds' ability to feed and survive.

16. **OPTIONAL:** Play additional rounds, rotating students into the roles of shorebirds. Add a round to introduce recreational disturbances with simulations like kite-flying, playing Frisbee, riding Off-road vehicles (ORVs) on the beach, or walking an unleashed dog. See options below to do these rounds.

Kite-flying: Kites look like large predatory birds to plovers. In

fact, plovers have been known to respond to the presence of a kite that was over 100 meters (109 feet) away!

- Ask two students to fly a kite. By running around, the students can keep the kite in the air for brief periods of time, assuming there is a little wind.
- Every time the plovers see the kite in the air, they must stop feeding and go to the "safe haven."
- Have the plovers feed and then let the students fly the kite for 30 to 60 seconds, depending on their success at getting it in the air.
- Count and record the beans the plovers picked up.



Off-road vehicles (ORVs): These vehicles include trucks, four-wheelers, dune buggies, etc. The deep tracks these vehicles create generally run parallel to the water's edge. The shorebird chicks sometimes get stuck in them and cannot feed. In addition, they frequently get run over because they are stuck in the track or their instincts cause them to freeze.

- Have two students "drive" the ORV which can be a large tire, inner tube, or ball. To "drive" it, the students must keep the ORV in between them with their hands on it at all times.
- The chicks should squat and not move in this round. If the tire touches the plover, it dies. However, all plovers should feed.
- Count beans when the round is over.

Discuss the following questions:

- What happened to the shorebird's ability to obtain food based on the number of beans recorded at the end of each round? How did they feel as it got harder and harder to feed? How might feeling tired or frustrated with the interference affect a shorebird's ability to feed?
- What happened to the size of the shorebird population on this beach? Will the plovers continue to nest here? If not, where will they go? What if the same problems occur on other beaches? What does this mean for the survival of this shorebird species?

Discuss Solutions

Plovers need space and so do people. Ask the class what can be done so that both the plovers' and people's needs can be met. Listen to all of their ideas and try to get the class to agree on one. This idea should involve some sort of beach management. Have the class think of what could prevent their idea from working. What happens if people do not want to go along with the management plan? What kinds of things can be done about this? You may want to do one more round, implementing their idea. Explain to students that people are implementing beach management programs to help protect the plovers. Their programs may be similar to the idea of the class.

Additional Activities



Cultural Connection

Students work in teams of two representing the following groups: generation of shorebirds that lived through the spill, generation of shorebirds after the spill, Alaska natives, the oil company, Prince William Sound fisherman, Coast Guard, local chamber of commerce, and U.S. Fish and Wildlife Service. Each team is to research how its group was impacted by the Exxon Valdez oil spill. All the groups then gather to outline what they learned from the oil spill and what they recommend should be done to protect their groups.

Arctic Breeding Challenges and Threats

Because of the relative remoteness and wilderness quality of the high Arctic, loss of habitat is generally not considered to be a major threat. However, other threats exist, including predators and potential over-harvesting by local peoples. Have students research what the threats are in the Arctic.

Develop a Shorebird Management Plan

Ask the class to brainstorm what might be done to meet the needs of shorebirds and people on the beach. Make a list of their ideas. Divide the class into teams. Ask each team to pick one of the management options and develop a management plan. Their plans should consider what might prevent success, including public opposition. Have each team present its plan to the entire class. Take a class vote on which plan to implement or give them the option of putting together a new class plan, selecting the best components of each team's ideas.

Research a Current Shorebird Management Plan

Select a shorebird in your area that is considered in need of special consideration. Have your class research what is being done for this bird. Is it working? Can they think of other ways to help?



It's A Tough Life

Record of Feeding and Survival

	Adult Plover #1		Adult Plover #2		Plover #1 Chick		Plover #2 Chick	
	# of beans	health	# of beans	health	# of beans	health	# of beans	health
Round 1 (undisturbed)		healthy		healthy		healthy		healthy
Round 2 (pedestrian disturbance)								
Round 3 (predator disturbance)								
Round 4 (kite disturbance)								
Round 5 (ORV disturbance)								

Dietary Standards (To be determined after Round 1)

Healthy Range: _____ beans

Unhealthy Range: _____ beans

Dangerous Range: _____ beans
(may result in death)



Banded Birds

*Adapted with permission from
“One Bird, Two Habitats.”
Wisconsin Department of Natural
Resources.*

Grade Level: upper elementary school/middle school

Duration: one 30-minute class period to one full day, depending on the option selected

Skills: vocabulary, discussion, collection and interpretation of data, formation of hypotheses, observation, communication/presentation, evaluation, and team building

Subjects: science and math

Concepts

- Research is vital for shorebird conservation.
- Through research we learn what shorebirds need and what we can do to conserve them.
- Some shorebirds concentrate in great numbers at their stopover sites, which provide large populations of birds for study.
- There are still many unanswered questions about shorebirds and how we can conserve them best.
- There are many tools researchers use to collect information about individual birds, as well as an entire population of shorebirds.
- Bird banding is one tool researchers use to collect information about individual birds, as well as entire populations of shorebirds.

Vocabulary

- banding
- population
- sample size
- individual
- mist net
- cannon net
- random sample
- color bands
- breeding ground
- migration flyway
- nonbreeding area

Overview

Students conduct a banding simulation in which they attach colored construction paper armbands to a group of classmates and then observe and record the students behavior over the course of a school day.

Objectives

After this activity, students will be able to:

- Give a general description of bird banding.
- Describe the two types of bird bands and the way they are used to provide research data.
- Explain why bird banding is an effective research tool.

Materials

- Ruler
- Colored construction paper
- Masking tape
- One copy of the *Banding Birds* reading for each student

Optional

- Clipboards or shorebird notebooks assembled as described in the *Activity Preparation* section

Introduction

Banding is an important method of capturing and marking animals for study. It allows close examination of live birds, which is often the only way of determining sex, age, race, and breeding condition. Because many members of a single shorebird species can look alike to people, banding allows biologists to tell shorebirds apart.

When banding and observations are carried out in many places around the world, important information can be gathered about migration routes, destinations, and behaviors. Banding individuals is one of the most important tools in studying many aspects of behavior and biology of birds in their natural habitat.

It is often impossible to capture and mark an entire *population*, be it a group of shorebirds that breeds locally, a group using the same migratory flyway, or other designated population. If a large enough *sample size* can be studied, it is not always necessary to study the entire population. Since scientists can seldom study every *individual* of a population, a *random sample* provides information that accurately represents the entire population.

Biologists use three methods of marking shorebirds: individual numbered metal bands, individual colored plastic bracelets, or a *color band* for an entire group.

For more information about what these bands mean, how biologists safely capture shorebirds, and how to report a dead banded bird, read the *Shorebird Primer* section *Shorebird Technology and Research*.

Activity Preparation

1. Make a photocopy of the *Bird Banding Reading* for each student.
2. Assemble shorebird notebooks by stapling several sheets of 8½ x 11 (or smaller) paper in the middle and then folding them in half.

Procedure

1. Give each student a copy of the *Bird Banding* student reading to review before conducting this activity.
2. Begin with a class discussion on bird banding.
 - Why is it important to be able to track where shorebirds or other animals migrate? (To learn what habitats they depend on; to learn how and where different sexes, age classes, or populations interact; etc.)



- How do biologists know the destinations of migrating birds?
 - Is it possible that a different population (in this case, groups made up of a single species of shorebird) of the same species can act separately, behave differently, or rely on different places during their lives? (Yes.)
 - How do biologists know which individuals go where, since most members of the same species look alike to us, at least at a distance?
 - How would marking birds facilitate the gathering of information?
 - What are some ways in which birds can be marked without interfering with or altering their behavior? (Banding, dyeing a patch of feathers, radio tagging)
 - Can you think of other important information to be gained from marking individual birds or being able to tell populations apart? (To learn how long birds live, how large their territories are, or how they interact; to find out whether they return to the same area to feed day after day or to the same area to breed year after year; to discover if juveniles return to the area where they were hatched; and to learn how quickly the population migrates from one habitat to another, etc.)
3. Explain that students will have the opportunity to see what it is like to be a bird-bander, as well as a banded bird. However, since it requires special equipment, special permits from the federal government, and a lot of training, they will not actually be banding birds—they will be banding each other!

Option 1 — Observing Banded Birds for a Class Period

4. Have the students make bands out of construction paper that are long enough to fit around their wrists or their ankles. Using as many colors as possible, pass out two pieces (mixing colors randomly) to each student. If you have a big class or not many colors, pass out three colors to each student. (This will allow for more combinations if students wear them in different orders.) Have the students measure and cut out one 1" x 7" strip of each of their colors. These are their "bird bands."
5. Have the students attach the strips around their "bird's" wrists, one strip above the other. Both bands must be visible, placed over any long-sleeved clothing. Secure them with tape. Each student should have a different color combination.
6. Now tell them that they are banded birds and will be known today by their color combinations—"blue over red," "red over blue," or (if three colors are used) "red-green-yellow." Explain that this is how a biologist tells birds apart when they might otherwise look alike.
7. After all the birds are banded, tell the "bird biologists" to observe their "birds" in their natural habitat—in this case, the classroom. Clear the desks away or lead the class to a large open area. Designate one end of the study area as the northern shorebird "*breeding ground*" and the opposite end as the southern "*nonbreeding area*," where shorebirds rest and eat. The middle of the study area is the "*migration flyway*," the flight path shorebirds take to travel between nesting and wintering sites.

8. Divide the "banded birds" into three groups and move each group to a different location in the study area. Instruct the "banded birds" in the nesting area to sit down on the floor as though they are on their nests. "Banded birds" located along the migration route must flap their arms or make eating motions. Those in the south must also make eating motions or pretend that they are resting by standing on one foot.
9. Give the "banded birds" a few minutes to act out their parts and for "bird biologists" to observe them. Ask the "bird biologists" questions like the following:
 - Is "yellow over white" migrating or nesting? Is "red over green" a male or female?
 - Which nesting birds (answer with band combination) have blonde feathers (hair)?
 - Which migrating shorebird is flying (flapping) fastest?
 - How many wintering birds are there with green bands?

After a few minutes, instruct the "banded birds" to "migrate" to the opposite habitat and continue with more questions. Repeat this a few times.

10. Now repeat the activity, reversing the students' roles: "bird biologists" become "banded birds" and previously "banded birds" are now "bird biologists."
11. When everyone has had a chance to play both roles, discuss their observations.
 - Did any birds lose their bands?
 - Do you think you could keep your bands on all day?
 - Were any colors hard to see?
 - Did any birds have exactly the same color combination or confusing combinations?



- Was it hard for everyone to see all of the birds all of the time?
- What would this be like if you were real birds and biologists? What problems might you have?

Option 2— Observing Banded Birds for a Day (or Two)

- Assign each student a partner. Designate one student the role of “banded bird” and the other of “bird biologist.” Explain that the job of the “bird biologist” is to locate and observe the “banded bird.” The role of the “banded bird” is to go about doing what it always does.
 - Explain that each “bird biologist” has five times (which occur during the remainder of the day or the next school day) to locate and observe his or her “banded bird.” In a real shorebird study, these times might be high or low tide or early versus afternoon hours.
 - Have the “bird biologists” take out a piece of paper, or a shorebird field notebook if they have one, and instruct them to draw up a data sheet similar to the example provided. Substitute the observation times to fit your class schedule. Divide the time you have available for this activity into two rounds so that
- each student has a chance to play both roles. “Banded birds” should not know the times they will be observed! Ask students to give the table an appropriate, descriptive name. This will encourage them to keep focused on the data question and practice the skill of clear labeling.
- At the times indicated on their data tables, “bird biologists” should record in words what their “banded birds” are doing. Explain to them that you will not announce when it is time to make an observation. This would alert the “banded birds” to the fact they are being studied and may cause them to change their behaviors. If their banded birds are not present at the observation times, students should also record that on their data tables.
 - After the five observation times, have the students reverse roles. The new “bird biologists” should secretly draw up their data tables and prepare to make their observations. Make sure you give the new “bird biologists” different *observation* times.
 - When all the students have had a chance to role-play as a “bird biologist,” have them report on their findings by:

- Pooling the data on a “flock” data sheet drawn on the board. Ask the “bird biologists” to work together to determine the most common activity, any pattern of activity according to the time of day, the most unusual activity, etc.

- Using a graph that shows their results in order to identify the most common activity. Make a bar graph comparing how often an activity was observed in each time period.

- Comparing percentages of the birds not observed at each time. Determine the percentage of “bird biologists” who did not observe birds at a designated time.

- Presenting the results in a paragraph describing what they learned about their “banded birds” or about their own observation techniques.

- Discuss the results and the following questions with the class:

- Was it easy to find your bird at the appropriate time?
- How did your bird’s activities compare to that of other birds?
- Do you know what was going on (for example, lunch, math

Data Table Example

What My Banded Bird Is Doing at Certain Times of the School Day

<i>Time</i>	<i>Description of Activity</i>
10:15	
12:35	
1:00	
2:10	
2:30	



period, physical education, class break) in the school or class during each observation time. Do you think that might have a relationship to the data results (for example, was there more running during lunch or more talking during art)?

- Did you notice any differences in the activity patterns of males and females?
- Do you think you got an accurate picture of what your bird does during the day?
- Was the sample size sufficient to give an accurate picture of bird activity?
- Did you have a banded bird that was not present? What challenges would that create for researchers?
- How could the plan we followed be modified to learn something about the specific activities of all the birds in the school? (First, come up with a study question or hypothesis. Then decide when and where would be the best time and place to collect data.)

Additional Activities

Take a Field Trip to a Banding Station

Visit a bird bander in the field or invite one to come to your school to demonstrate the proper use of bird-banding equipment. Keep in mind that banders are busiest during spring and fall migration seasons. Your local state or federal wildlife agency's migratory bird department, a local Audubon chapter, or a nearby wildlife refuge should be able to direct you to someone who bands bird in your area.

Human Labels

Brainstorm or discuss with students ways in which humans are labeled or marked, whether for study or as an aid in daily life (for example, name, Social Security Number, library card, residency status, medical identification tags, "dog tags" for soldiers).

How Do You Report a Banded Bird

If you or your students see a banded bird, it is important to report it. Color bands are reported to a different organization than silver/metal bands. To learn more, go to the Shorebird Sister Schools Web site <http://sssp.fws.gov> and click on "Tracking."



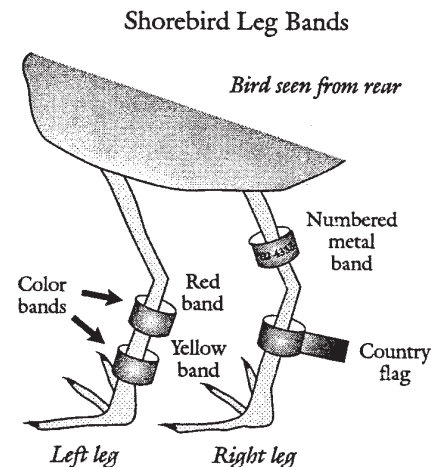
Banding Shorebirds

Scientists are still searching for answers to many questions about shorebird *survivorship*, *mortality*, and *behavior*. This information is critical to making decisions about shorebird management. We can help birds best if we understand where they live, what they need, and where they travel. *Bird Banding* is a technique to help answer many of these questions.

Whether scientists want answers about a group of local breeding shorebirds or a group using the same migratory stopover site, it is often impossible to capture and band every *individual* within the *population*. However, if a large enough *random sample* is banded, then scientists can assume that the data they collect accurately represents the entire population.

Bird banding involves attaching around the bird's leg a loose-fitting aluminum band that is coded ahead of time with a unique identification number. Biologists record the bird's age, sex, species, location of capture, and weight. If this same individual is captured somewhere else, the original data can be looked up using the bird's personal identification number. By comparing old data with current sightings, scientists can slowly piece together answers to a sort of question puzzle to create a picture of this bird's life. How far has it traveled? Where does it spend its winters? Where does it breed? How long does it live? What caused its death?

Sometimes a series of *colored bracelets* and *flags* are also attached to shorebirds. These may represent the country where the bird was banded, the banding year, and perhaps the age of the bird. The advantage of color-coded bands and flags is that it reduces the times a bird must be captured to gather information. With colored bands, researchers can observe shorebirds from a distance to gather the information they need. No matter how careful biologists are in capturing



birds, it creates stress on them and takes time away from feeding, a critical activity at their migration stopover sites.

Sometimes biologists will clip the feathers between a shorebird's shoulder blades and attach a small radio or satellite transmitter with glue. This technique allows scientists to study shorebirds in remote habitats that are difficult for researchers to get to, and it allows the birds to continue their natural behaviors that might be interrupted if people were nearby.

Bird researchers capture shorebirds with a delicate, almost invisible net called a *mist net* that is stretched across an area where birds are likely to fly at night. Another method for banding shorebirds is banding chicks that are not ready to fly. By banding birds in the year they hatch and recording their annual returns, biologists can see how long they live and if they are being replaced by a sufficient number of young. Another method, *cannon netting*, is used mostly in coastal areas. Here, a net is shot out over feeding shorebirds.

Not just anybody is allowed to capture and band birds. A special permit from the U.S. Fish and Wildlife Service is required for all bird banding in the

United States. This is to ensure that the birds are handled carefully and that the data is collected properly.

Many birds that have been banded disappear and die without the researchers knowing where, when, or why. If you find a dead bird with a band, please report it to the appropriate agency.

To Report a Metal-banded Bird

Notify your local state wildlife agency or the U.S. Fish and Wildlife Service Bird Banding Lab. Record the entire number on the band, the date you found the bird, the species (if you know it), and the exact location.

Send this information along with the band if possible, to:

Chief, Bird Banding Laboratory

Office of Migratory Bird Management
U.S. Fish and Wildlife Service
Laurel, MD 20810

Or call: 800/327 2263
or 800/327 2263

To Report a Color-banded or Flagged Bird

Describe each band: type (metal, color band, flag), colors (as exactly as possible — light green, dark blue), and location on bird (bird's left or right leg, upper or lower leg, above or below other bands). Note if you are unsure of any bands or if you did not see all parts of both legs clearly. Note species, location of sighting, date, and any other information such as behavior, other birds, etc.

Submit shorebird color band sightings by mail or the Web site:

PASP, Canadian Wildlife Service
115 Perimeter Road
Saskatoon, SK S7N 0X4
CANADA
Or
<http://www.mb.ec.gc.ca/nature/migratorybirds/pasp/dc29s01.en.html>



Shorebirds on the Web

Using the Internet Students learn about Shorebirds and Connect with Others

Grade Levels: all levels

Skills: communication, use of technology, and interpretation of data

Subjects: science, technology, social studies, and language arts

Concepts

- There are still many unanswered questions about shorebirds and how we can conserve them best.
- Scientists are still learning where shorebirds migrate and the flight paths they follow.
- Some shorebirds concentrate in great numbers at their stopover sites, which provide large populations of birds for study.
- Technology provides vital tools for research.

Vocabulary

- Web site
- Web page
- modem
- Internet
- browser
- navigate
- listserve
- E-mail
- hypertext links

Overview

Students use the computer as a resource tool to learn about shorebirds, ecology, wetlands, other cultures, and ecosystems, while at the same time discovering computer technology that will help them throughout their school years and beyond.

Objectives

After this activity, students will be able to:

- Locate a species of migrating shorebirds using the Shorebird Sister Schools Web site.
- Describe the regions of the world one local shorebird species visits.
- Communicate with students in other states, provinces and

countries about shorebirds.

- Use the Internet to communicate with biologists and other students.
- Post questions on the Shorebird Sister Schools Website.

Materials

Access to a computer that satisfies the following requirements:

1. Monitor, keyboard, mouse, hardware computer, IBM clone or Apple/Macintosh with modem. Modem can be internal or external — the faster the modem the better. A 28.8 speed modem or faster is recommended.
2. Minimum computer speed of a “486” (preferably higher or the kids will lose interest because the pictures load too slowly).
3. Internet browser such as Netscape, Microsoft Internet Explorer, etc.
4. Dedicated phone line for your modem. If your school has a sophisticated phone system, you will need one phone line to the outside that is not part of that system. Perhaps you have a computer lab with that setup.
5. One copy of *Shorebirds on the Web Computer LINGO Crossword Puzzle* for each student.

Background

The Shorebird Sister School Program (SSSP) allows students, teachers, biologists, birders, parents to share shorebird observations as they migrate between their nesting and wintering grounds. By tracking the shorebird superhighway on the Internet, students will be engaged in learning about shorebird stopover locations, shorebird ecology, migration, ecology, and ecosystems while learning how to use computers.

By using the Internet to view the Shorebird Sister Schools Web,

participants will have the opportunity to exchange ideas and observations with others throughout the Western Hemisphere. Participants can share field trip information and data, report sightings of banded shorebirds, and learn about current shorebird research. Participants can also ask questions about what other classes are doing in the Shorebird Sister Schools Program, or direct shorebird ecology questions to other educators and shorebird biologists.

Participant can also join the Shorebird Sister Schools E-mail Network. The Network will provide monthly e-mail updates on upcoming activities and events for participants, as well as new features on the Website.

For complete details on how to get involved in the Shorebird Sister Schools Program and how to use the Web site, go to SSSP and Connecting to Cultures.

Activity Preparation

1. Find and Become Familiar with the Shorebird Sister Schools Web site
 - To get to the Shorebird Sister Schools Program Web site, type in the Web address <http://sssp.fws.gov> wherever it asks you for a location or address. Then hit “return/enter” and the Shorebird Sister Schools Program Web site will appear on your screen.
 - To *navigate* around the various pages, you will need to click with your mouse on the colored, underlined text (*hypertext links*). This will take you to another page. There are two methods to return to the previous page — click with your mouse on the “back” button on your browser or click on the hypertext that says “Shorebird Sister Schools Main Page.”



- To quit the *browser* program, click on the quit button or click on File, Quit/Exit in the menu bar at the top of the page.
2. Join the Shorebird E-mail Network
 - To join the network, you will need an *E-mail* address. An E-mail address may look something like this: sandpiper@western.flyway.net.
 - Depending on how your school is set up, you may already have an *Internet* connection or may need to sign up with an Internet provider. The computer support staff at your school can help you set up an E-mail address.
 - Once you have an E-mail address, join the E-mail Network by clicking on the “I want to join the Network” box on the Shorebird Sister Schools Registration page on the Website. You can also send your request directly to the Shorebird Sister Schools Program coordinator, sssp@fws.gov.

Procedure

1. Make sure your students are familiar with the computer terminology used throughout this activity. Use the Computer LINGO Crossword Puzzle for practice using and defining these terms. The answers are located on the last page of this activity.
2. Show your students how to log on to the SSSP Web site. Explore the different information categories together.
3. Ask the students to brainstorm how they could use the site individually and as a class. Write this list on the board. Refer to the suggestions provided in the box if the students did not come up with ideas. Go to the SSSP section of the guide for more Web ideas too.
4. Assign individual students, or student teams, to work on as many of their ideas as possible. Send home information about the Shorebird Sister Schools Program (including the Web address) so parents can log on too.

Field Trip Options:

1. During the Field Trip: Take a laptop computer to the field. At the end of the Field Trip, as a wrap-up activity, gather students in a circle around you with the open laptop. As a group, have the students write a posting for the SSSP Web site describing the Field Trip site, weather, birds seen, activities done, etc. When you return to the office, simply copy and paste the posting on the SSSP Web site “Report Shorebird Sightings” link located from the “Tracking” link on the main page.
2. Post Field Trip: At the beginning of the next class period after the field trip, have students use their field journals to write a class posting for the SSSP Web site. Follow the directions above posting the observations on the Web site.

Ideas for Using the Shorebird Sister Schools (SSSP) Web Site

- Get the students on the SSSP Website at least once a week to check on shorebird migration. Check more often during the spring migration. Those birds move fast!
- After a field trip, “publish” the students’ field data observations on the Website.
- Find pen pals through the Website. Share what you have learned about shorebirds with your pen pals.

- Have the students write a question to ask research biologists and send them through the “Ask a Biologist” form on the Website.

- Use a large wall map to track the shorebirds as migration routes are reported online. You may be able to use the poster included with this activity guide.

- During the Spring plan time to allow students to follow along on the Tracking Projects featured on the SSSP Web site.

Additional Activity

Build Your Own Web Page

Older students might be interested in building a Web page that highlights their shorebird projects, field trips, and activities. Include species lists, research projects, maps of local habitat, and information about a local threat. Once your Web page is complete and on-line, send an E-mail message to the SSSP coordinator at sssp@fws.gov and the U.S. Fish and Wildlife Service will make a link to your site.

Answers to Web LINGO

Down

1. Web page
2. browser
3. Internet
4. Listserve

Across

1. Web site
2. E-mail
3. modem
4. navigate



Shorebirds on the Web

Computer LINGO

Directions: Match the correct computer term with the sentences below to complete the crossword puzzle.

Vocabulary

- Web site
- Web page
- modem
- Internet
- browser
- navigate
- listserve
- E-mail

Down

1. One page of a Website
2. Locates and displays Websites
3. A system that connects computers
5. Sends e-mail to everyone on a list

Across

1. A place on the Internet containing specific information and links
4. Electronic mail
6. Device that sends information by phone line
7. To find your way around the World Wide Web

[illegible]

Sharing Circle

Grade Level: all levels

Duration: one 15 to 30-minute class period

Skills: discussion and evaluation

Subjects: language arts, science, and fine arts (with additional activity)

Concepts

- Bridge the classroom and the local environment.
- Gain first hand knowledge through an outdoor experience (based on the field trip.)
- Discover the ecosystem through multi-sensory experiences (based on the field trip.)

Overview

Students discuss the field trip and share what new information they discovered and what they especially enjoyed about their experience.

Objectives

After this activity, students will be able to:

- Give a verbal summary their field trip activities.
- Describe their favorite part of the field trip.
- Give at least one example of something new they learned on the field trip.

Vocabulary

There is no specific vocabulary for this activity.

Materials

- large sheet of butcher paper
- markers

Optional

- **Shorebird Journal** (Basic journal pages found in the Field Trip Journals section)
- **Field Trip Activity Sheets** for Lower Elementary Students (found in the Field Trip Journal section)

Introduction

Since this is a summary activity, there is no introductory information for this activity.

Procedure

1. Gather the students in a circle to share what they experienced or observed during their field trip. This activity can be done on-site, on the bus ride back to school, or later in the classroom.
2. Have students finish the sentence: “My favorite thing today was....,” or “One thing I learned today was...” Then record their responses on a large piece of butcher paper to post in the classroom.
3. If you used a Shorebird Journal as part of the field trip, have the students complete the post-field trip pages. Pass out the Habitat and Memories Drawing Frames for younger students that did not use a Shorebird Journal (Field trip Activity Sheets for Lower Elementary Students found in the Field Trip Journal section) for younger students.

Additional Activity

Field Trip Mural

Hang a large white sheet or long piece of butcher paper in the hall outside your classroom. Brainstorm a list of field trip activities and experiences students could visually represent on a mural. Combine the list into “scenes” and assign teams to complete a “scene” in one section of the mural. Make sure everyone in the class signs their work. Take a class picture with the mural. Send the picture along with a thank you note to chaperones, site staff, and anyone else that helped with the field trip.

Field Trip Press Release

Refer to the classroom activity Shorebird News (located in The Big Shorebird Picture section of this activity chapter.) Guidelines for writing a press release are included with the Shorebird News activity. Be sure to include the picture of your field trip mural and a caption describing your class with your press release.



Data Analysis

Grade Level: upper elementary / middle school, upper middle school / high school

Duration: one 50-minute class period

Skills: critical thinking, interpreting data, discussion and evaluation

Subjects: science and math

Concepts

- Bridge the classroom and the local environment.
- Utilize the scientific method as a process for inquiry and discovery.

Vocabulary

- percentage
- average
- range
- mean

Overview

Students analyze the invertebrate, shorebird, or environmental data they collected on their field trip using a variety of mathematical calculations and observations.

Objectives

After this activity, students will be able to:

- Calculate percentage, average, range, and mean from a set of actual data.
- List at least three factors influencing data collection.

Materials

Any of the following:

- completed Shorebird Observation Record Sheets and Invertebrate Data Forms (from shorebird journals in Field Trip Journals section)
- other data collected on field trip by several individuals or groups

Introduction

Since this is a summary activity, there is no introductory information for this activity.

Procedure

1. During the field trip, have students collect data, using any of the Shorebird Observation Record Sheets and/or the Invertebrate Data Forms (part of the Shorebird Journal) or their own data sheets. Environmental data like water temperature, wind or water speed can also be used.
2. After the field trip, combine the information collected by individuals or teams. Interpret the data with as many calculations as you determine will provide valuable information: averages, ranges, means, percentages, etc.
3. Discuss why groups got different measurements or numbers. What sorts of things might have affected the measurements?

- Did everyone take measurements at the same time and place?
- Could the actual water temperature vary at different times of day, or on different days? Would weather affect the measurement?
- For numbers of birds, might the behavior of different groups of students (noisy versus quiet) have affected the visibility of animals?
- Did everyone count, or did some “researchers” guess?

- Does everyone see color or shape the same way?
- Is calculating an average of several people’s data the best way to determine a measurement?
- What else could you do to obtain an accurate measurement?

Additional Activities

Using the Scientific Method

If you have not introduced your students to the Scientific Method take a look at the following classroom activities: **Banded Birds**, **Bird Beans**, **Imaginary Mist Nets** and **You Be the Scientist** (found in the Shorebird Research and Technology section). Refer to the reading **The Scientific Method of Inquiry and Estimating Populations** for more information about sampling bias, error, and good technique.



Field Trip Journals

Shorebird, Habitat, & Invertebrate Field Study Journals

Select the design that best fits your group and your learning objectives. Or, mix and match the pages provided to design your own field trip journal.

The activity sheets for lower elementary students are designed to be copied on 8"x11" paper and stapled in the upper left corner.

All three journals are designed to be photocopied back-to-back on 8" x 11" pages, stapled vertically in the middle and folded to make a 5 ½" x 8" booklet.

- Field Trip Activity Sheets for Lower Elementary Students
- Basic Shorebird Observation Journal Pages
- Advanced Shorebird Observation Journal
- Advanced Invertebrate Observation Journal



Field Trip Activity Sheets for Lower Elementary Students

My Habitat Drawing	446
Field Trip Memories	448
Habitat Map	447



My Habitat Drawing

These are the plants, animals, birds, bugs, and other neat things I saw on my field trip.



Name: _____ Grade: _____

Field trip to : _____



My Habitat Map

Draw a map of your field trip site. Include roads, buildings, different habitats, and where you saw groups of shorebirds. Do not forget to make a key so others can understand your map.

Map Key

Name: _____ Grade: _____

Field trip to : _____



Field Trip Memories

I heard....

I saw....

I smelled.....

I felt....

Name: _____ Grade: _____

Field trip to : _____



Basic Observation Journal

(Most appropriate for elementary students and for field trips that emphasize observation)

Students record shorebird and habitat observations through drawings, poems, map illustrations, and matching exercises. This journal includes four pre-field trip pages and one post-field trip page.

Contents

Page 1

- Shorebird Field Journal Cover/Be a Good Bird-watcher!
- What Do I Know About Shorebirds/Field Trip Summary

Page 2

- Field Trip Memories/What Do I Want to Learn About Shorebirds
- Parts of a Shorebird (in flight)/Shorebird Drawings (blank page)

Page 3

- Shorebird Drawings/Parts of a Shorebird Standing
- Shorebird Habitat Information/Shorebird Beaks

Page 4

- Shorebird Feeding Styles/Habitat Map
- Shorebird Observation Data Sheet/Taxonomy Tree

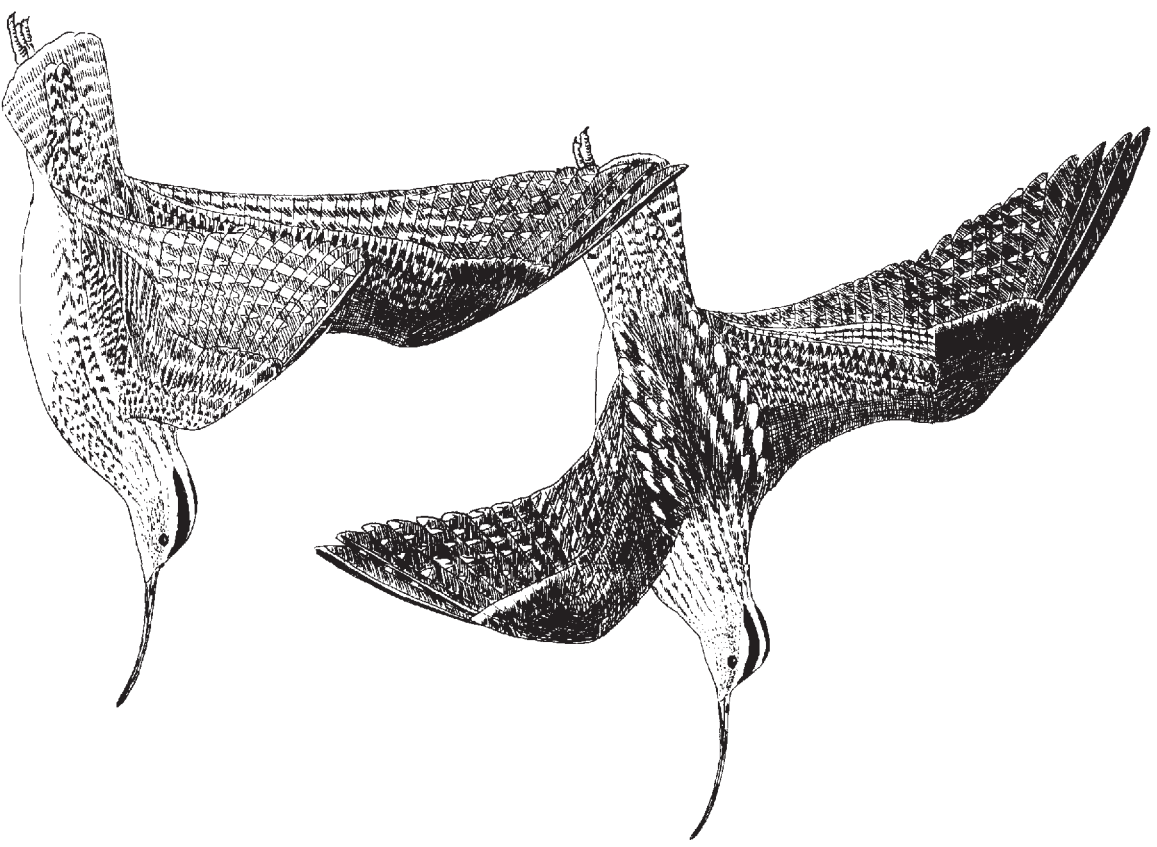


Be a Good Bird-watcher!

- Watch birds from a distance.
- Never chase birds!
- Stay on roads, paths, and walkways.
- Never pick or collect plants or animals.
- Do not leave trash behind.
- Respect No Trespassing signs and rules that apply to the area you are visiting.
- Let your words and actions be a good example to others.

Shorebird

Field Journal



Name: _____

What Do I Know About Shorebirds and Their Habitat?

Write down everything you know about shorebirds.
Use the questions below to help you get started.
What is a shorebird?

What do shorebirds look like?

What do shorebirds eat?

What habitat do shorebirds need?

Why are shorebirds important?

What other plants and animals do I expect to see living with shorebirds?

Other things I know about shorebirds....

Field Trip Summary

What did you like most about your field trip?

What new things did you learn about shorebirds and their habitat?

What other plants and animals did you see?

What new questions do you have about this place and the plants and animals that live there?

My Fieldtrip Memories

What do you want to remember about this place and the things you saw?
Draw a picture or write a poem that will remind you of your visit.

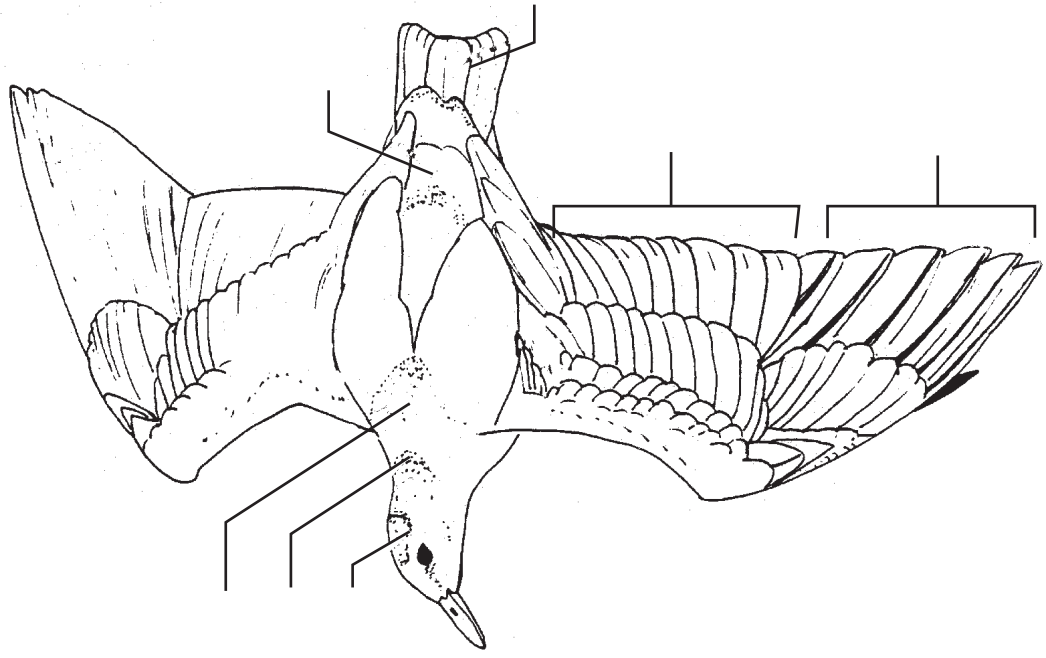
What Do I Want to Learn About Shorebirds?

Write at least one question to answer on your fieldtrip.

When you find the answer (s)...write it (them) below

The Parts of a Shorebird In Flight

Can you name all of the parts of this shorebird?



Shorebird Drawing

Draw at least two shorebirds you see. How do they look different? How do they look alike? Use the Taxonomy Tree on page nine and write the name of the families these shorebirds belong to.

The Parts of a Shorebird Standing

Can you name all the parts of this shorebird?



Shorebird Habitat Information

Date: _____ Time: _____
Weather: _____ Location: _____

What physical features are present?

Dry Mud____ Short Grasses____
Salt Water____ Wet Mud____
Shoreline____ Fresh Water____
Tall Grasses____ Pebbles or Gravel____

What types of vegetation are present?

Freshwater Marsh Plants____
Saltwater Marsh Plants____
Prairie Grasses____

What human-made structures are present?

Roads____ Buildings____
Inlets and Outlets____ Dikes or Dams____
Running Water____ Berms or Islands____
Agricultural Fields____

List sounds and smells you notice.

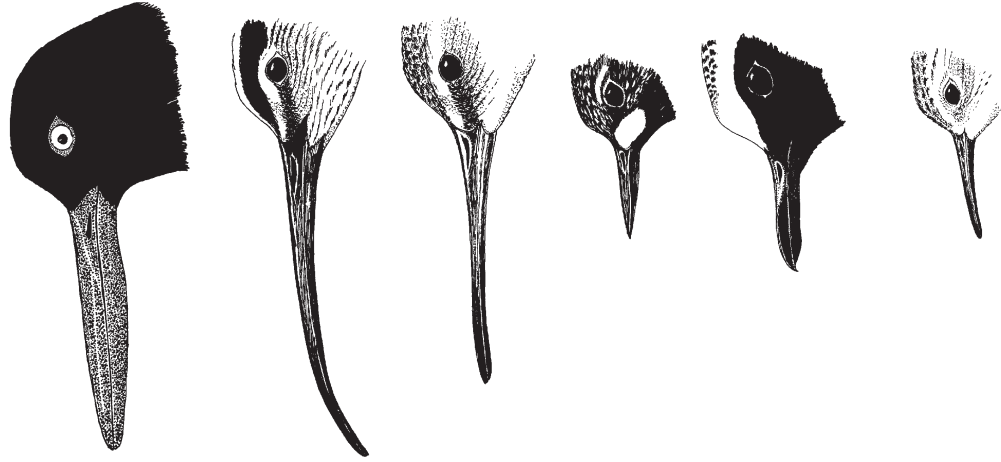
What is the source of water for this habitat?

Is this site protected?

List any potential threats to this site.

Shorebird Beaks

Designed for What They Eat
and How They Feed



Shorebird Feeding Styles

Watch the different ways shorebirds feed. Draw lines from the feeding techniques you see to the styles of beaks they have (shown across the page). Answers are in the Educator's Guide Appendix. Then take a guess at what types of foods they are after. Record the names of the shorebirds you are watching if you know them.

Shallow probing in the mud or sand

These shorebirds are looking for: _____

Species: _____

Deep probing in the mud or sand

These shorebirds are looking for: _____

Species: _____

Picking things off the surface

These shorebirds are looking for: _____

Species: _____

Breaking or crushing open shelled animals

These shorebirds are looking for: _____

Species: _____

Other types of beaks and feeding styles you notice:

Habitat Map

Draw a map of the field trip site. Create a key in the box below. Show the locations of different habitats, roads, buildings, and wildlife.

Key

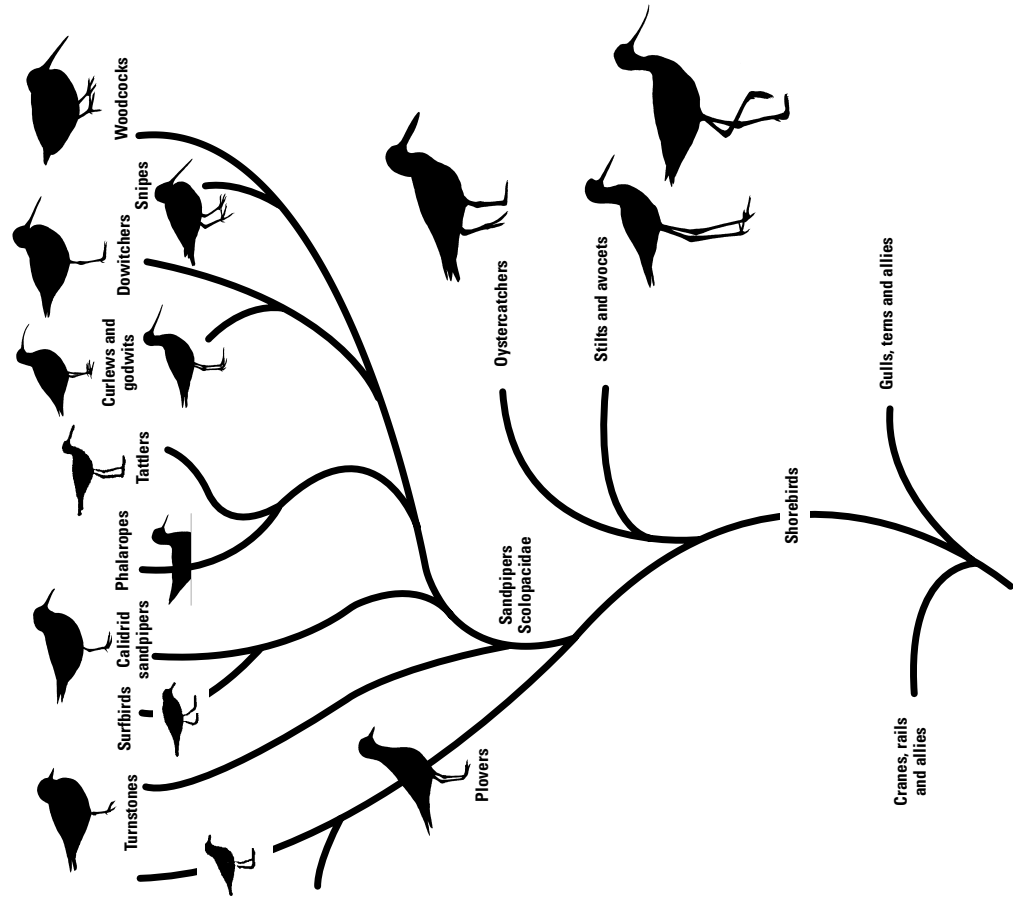
Shorebird Observation Data Sheet

Bird Type 1	Number 2	Behavior	Habitat Used 3

- 1. Family-- or species if you are really good at shorebird identification
- 2. What was it doing--feeding, sleeping, swimming, flying?
- 3. Where did you find it--beach, saltwater wetland, freshwater wetland, grassland?

Shorebird Taxonomy Tree

Try to match the birds you are seeing to one of the families on this tree. Write the name in the Bird Type column on the Observation Data Sheet.



Advanced Shorebird Observation Journal

*(Most appropriate for middle
school/high school students)*

This version emphasizes shorebird
data collection. Use this journal
with the field trip activity
Shorebird Field Study.

Contents

Pages 1 – 3 as described in the basic
observation journal, plus

Page 4

Your choice of :

1. Shorebird Field Study
Worksheet/Shorebird
Observation Record Sheet 1 (bill
shapes);
2. Shorebird Field Study
Worksheet/Shorebird
Observation Record Sheet 2
(comparison of lengths of bill,
legs, and tails)



Shorebird Feeding Styles

Watch the different ways shorebirds feed. Draw lines from the feeding techniques you see to the styles of beaks they have (shown across the page). Answers are in the Educator's Guide Appendix. Then take a guess at what types of foods they are after. Record the names of the shorebirds you are watching if you know them.

Shallow probing in the mud or sand

These shorebirds are looking for: _____

_____ Species: _____

Deep probing in the mud or sand

These shorebirds are looking for: _____

_____ Species: _____

Picking things off the surface

These shorebirds are looking for: _____

_____ Species: _____

Breaking or crushing open shelled animals

These shorebirds are looking for: _____

_____ Species: _____

Other types of beaks and feeding styles you notice:

Habitat Map

Draw a map of the field trip site. Create a key in the box below. Show the locations of different habitats, roads, buildings, and wildlife.

Key

Shorebird Field Study Worksheet

Observation Directions

1. Take a quick look around the habitat. Where do you see birds and about how many are there?
2. Do you hear any sounds? Describe them and what might be making them.
3. Use your binoculars or spotting scope and scan the area carefully. Describe what birds you see on the Shorebird Observation Record page. Refer to a field guide for bird names. (Record all the different types of birds you see.)
4. Now look closely for other bird signs--feathers, tracks, and places where birds have probed in the mud. Describe what you find.
5. Watch for the first bird that starts the flock off in flight. Does the leadership change during the flight? What happens when the flock lands?
6. Now focus on a single bird that is probing the mud or sand for food. How can you tell when the bird finds food and when it doesn't?

Shorebird Observation Record Sheet 1





bird no.	no. observed	size (see below)	bill type (see below)	bill color	leg color	bird names

Size:

- A. Larger than a raven
- B. Smaller than a raven, but larger than a robin (8 inches long)
- C. Smaller than a robin, but larger than a sparrow (5 inches long)
- D. Smaller than a sparrow

Type of Bill:

- A. Curves down (decurved)
- B. Curves up (recurved)
- C. Short and stout
- D. Long and thin


A

B

C

D

Shorebird Feeding Styles

Watch the different ways shorebirds feed. Draw lines from the feeding techniques you see to the styles of beaks they have (shown across the page). Answers are in the Educator's Guide Appendix. Then take a guess at what types of foods they are after. Record the names of the shorebirds you are watching if you know them.

Shallow probing in the mud or sand

These shorebirds are looking for: _____

Species: _____

Deep probing in the mud or sand

These shorebirds are looking for: _____

Species: _____

Picking things off the surface

These shorebirds are looking for: _____

Species: _____

Breaking or crushing open shelled animals

These shorebirds are looking for: _____

Species: _____

Other types of beaks and feeding styles you notice:

Habitat Map

Draw a map of the field trip site. Create a key in the box below. Show the locations of different habitats, roads, buildings, and wildlife.

Key

Shorebird Field Study Worksheet

Observation Directions

1. Take a quick look around the habitat. Where do you see birds and about how many are there?
2. Do you hear any sounds? Describe them and what might be making them.
3. Use your binoculars or spotting scope and scan the area carefully. Describe what birds you see on the Shorebird Observation Record page. Refer to a field guide for bird names. (Record all the different types of birds you see.)
4. Now look closely for other bird signs--feathers, tracks, and places where birds have probed in the mud. Describe what you find.
5. Watch for the first bird that starts the flock off in flight. Does the leadership change during the flight? What happens when the flock lands?
6. Now focus on a single bird that is probing the mud or sand for food. How can you tell when the bird finds food and when it doesn't?

SHOREBIRD OBSERVATION RECORD SHEET 2

[illegible]

Advanced Invertebrate Observation Journal

(Most appropriate for middle school/high school students)

This journal emphasizes invertebrate data collection. Use this journal with the field trip activity Mud Creatures Study.

Contents

Pages 1 – 3 as described in the basic observation journal, plus

Page 4

Your choice of:

1. Invertebrate Drawings/
Invertebrate Form No. 1
(characteristics)
2. Invertebrate Drawings/
Invertebrate Form No. 2 (number
found using different sampling
techniques)



Shorebird Feeding Styles

Watch the different ways shorebirds feed. Draw lines from the feeding techniques you see to the styles of beaks they have (shown across the page). Answers are in the Educator's Guide Appendix. Then take a guess at what types of foods they are after. Record the names of the shorebirds you are watching if you know them.

Shallow probing in the mud or sand

These shorebirds are looking for: _____

Species: _____

Deep probing in the mud or sand

These shorebirds are looking for: _____

Species: _____

Picking things off the surface

These shorebirds are looking for: _____

Species: _____

Breaking or crushing open shelled animals

These shorebirds are looking for: _____

Species: _____

Other types of beaks and feeding styles you notice:

Habitat Map

Draw a map of the field trip site. Create a key in the box below. Show the locations of different habitats, roads, buildings, and wildlife.

Key

Invertebrate Drawings

Make a drawing of each different type of invertebrate you find. Include details (like the correct number of legs and body parts) that will help you identify it. Assign each picture a number to use on the data table to the left.

INVERTEBRATES FORM NO. 1: TYPES OF INVERTEBRATES FOUND

Date: _____ Location Name: _____ Student(s) Name(s): _____

Time: _____ Time of Nearest Tide (if intertidal area): _____ (circle: high/low) Habitat Type: _____

Characteristics									
Animal No.	Number of Legs	Number of Wings	Number Body Segments	Describe mouth parts	Length (mm)	Color(s)	Where found	Other Info	Animal Name
1									
2									
3									
4									
5									
6									
7									
8									

Shorebird Feeding Styles

Watch the different ways shorebirds feed. Draw lines from the feeding techniques you see to the styles of beaks they have (shown across the page). Then take a guess at what types of foods they are after. Record the names of the shorebirds you are watching if you know them.

Shallow probing in the mud or sand

These shorebirds are looking for: _____

Species: _____

Deep probing in the mud or sand

These shorebirds are looking for: _____

Species: _____

Picking things off the surface

These shorebirds are looking for: _____

Species: _____

Breaking or crushing open shelled animals

These shorebirds are looking for: _____

Species: _____

Other types of beaks and feeding styles you notice:

Habitat Map

Draw a map of the field trip site. Create a key in the box below. Show the locations of different habitats, roads, buildings, and wildlife.

Key

Invertebrate Drawings

Make a drawing of each different type of invertebrate you find. Include details (like the correct number of legs and body parts) that will help you identify it. Assign each picture a number to use on the data table to the left.

INVERTEBRATES FORM NO. 2: INVERTEBRATES FOUND USING VARIOUS SAMPLING METHODS

Date: _____ Location Name: _____ Student(s) Name(s): _____
Time: _____ Time of Nearest Tide (if intertidal area): _____ (circle: high/low) Habitat Type: _____

Animal No. or Name	Number of Individuals Found in Sample				Total Number Individuals
	Surface Sample or _____ Sample	Bottom Sample or _____ Sample	Core Sample or _____ Sample	Other Sample: _____	
1					
2					
3					
4					
5					
6					
7					
8					

Appendix

Contents	page
Shorebird Profiles	472
Shorebird Coloring Pages	517
Shorebird Resources for Educators	544
Western Hemisphere Shorebird Reserve Network List of Important Shorebird Sites in North and South America	548
North American Shorebirds and the Habitats They Use	549
Western Hemisphere Migration Flyways Map	550
Map of Five Shorebird Flyways in the Shorebird Sister Schools Program	551
Shorebird Taxonomy Tree	552
Shorebird Morphology: Flying	553
Shorebird Morphology: Standing	555
Shorebird Beaks and Feeding Styles (answer to journal pages and overhead graphic)	557
Shorebirds, Wading Birds, Seabirds: Physical and Behavioral Characteristics	559
Evaluation of Educator's Guide	560

List of Shorebird Profiles

<i>Species</i>	<i>Pacific Flyway</i>	<i>Central Flyway</i>	<i>Atlantic Flyway</i>	<i>Page</i>
American Oystercatcher (<i>Haematopus palliatus</i>)			•	513
American Avocet (<i>Recurvirostra americana</i>)	•	•	•	499
Black-bellied Plover (<i>Pluvialis squatarola</i>)			•	488
Black-necked Stilt (<i>Himantopus mexicanus</i>)	•	•	•	501
Black Oystercatcher (<i>Haematopus bachmani</i>)	•			490
Buff-breasted Sandpiper (<i>Tryngites subruficollis</i>)		•		511
Dowitcher (<i>Limnodromus</i> spp.)	•	•	•	485
Dunlin (<i>Calidris alpina</i>)	•	•	•	483
Hudsonian Godwit (<i>Limosa haemastica</i>)		•	•	475
Killdeer (<i>Charadrius vociferus</i>)	•	•	•	492
Long-billed Curlew (<i>Numenius americanus</i>)	•	•		503
Marbled Godwit (<i>Limosa fedoa</i>)	•	•		505
Pacific Golden-Plover (<i>Pluvialis fulva</i>)	•			497
Red Knot (<i>Calidris canutus rufa</i>)	•		•	473
Ruddy Turnstone (<i>Arenaria interpres</i>)	•	•	•	479
Sanderling (<i>Calidris alba</i>)	•	•	•	477
Snowy Plover (<i>Charadrius alexandrinus</i>)	•	•		494
Spotted Sandpiper (<i>Actitis macularia</i>)	•	•	•	507
Upland Sandpiper (<i>Bartramia longicauda</i>)		•		509
Western Sandpiper (<i>Calidris mauri</i>)	•	•	•	481
Wilson's Phalarope (<i>Phalaropus tricolor</i>)	•	•		515

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Red Knot

(*Calidris canutus*)

Description

The Red Knot is a chunky, medium sized shorebird that measures about 10 inches from bill to tail. When in its breeding plumage, the edges of its head and the underside of its neck and belly are orangish. The bird's upper body is streaked a dark brown. It has a brownish gray tail and yellow green legs and feet.

In the winter, the Red Knot carries a plain, grayish plumage that has very few distinctive features.

Call

Its call is a low, two-note whistle that sometimes includes a churring "knot" sound that is what inspired its name. Generally, they are quiet fliers except for an occasional soft "kuret".

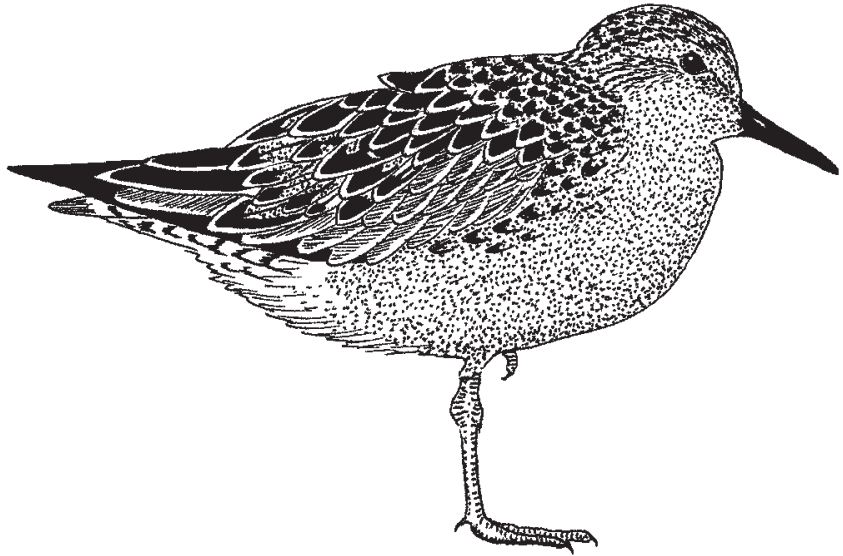
Non-breeding Habitat

Red Knots are mostly marine shorebirds in the nonbreeding season. They probe the mud and sand for mollusks, especially bivalves (small marine animals with a two-part shell) which they swallow whole!

Breeding

Red Knots breed from June through August in the high Arctic. Long days and massive numbers of insect foods make the arctic areas of Canada an ideal spot for raising their young. Males set up the territories and begin courtship display flights. After selecting a female, the pair mates and then quickly builds a nest from lichen, moss, and willow leaves. Red Knots usually nest on high, dry ground. It takes the female about 6 days to lay four camouflaged eggs that together weigh more than half her own body weight!

Both parents take care of the chicks during their first few days of life. Then the female leaves the male behind to continue caring for the brood. She prepares for her long migration flight south to Florida or South America.



Migration

Juvenile Red Knots begin their fall migration about two to three weeks after the adults have left. Many fly to rich stopover sites found along the Atlantic coast. Here they stop to feed on tiny blue mussels, worms, and other invertebrates. After resting and fattening up, many Red Knots continue over the Atlantic to South America finally stopping in Tierra del Fuego- the southern tip of Argentina. They stay here, in an area pockmarked with tidal pools, for several months dinning on local mussels.

In March and April, the Red Knots moves again, this time up the coast of South America toward their northern breeding grounds. When they arrive on the U.S. Atlantic Coast many Red Knots stop along the Delaware Bay to feast on horseshoe crab eggs. In only two weeks they double their bodyweight! This critical stopover site is what fuels the rest of their flight to the Arctic, a miraculous 20,000-mile round trip!

Today's Population

The Red Knot was once very abundant in North America. Today, scientists estimate that approximately 145,000 of these birds remain along the Atlantic flyway. About half of them stop at Delaware Bay.

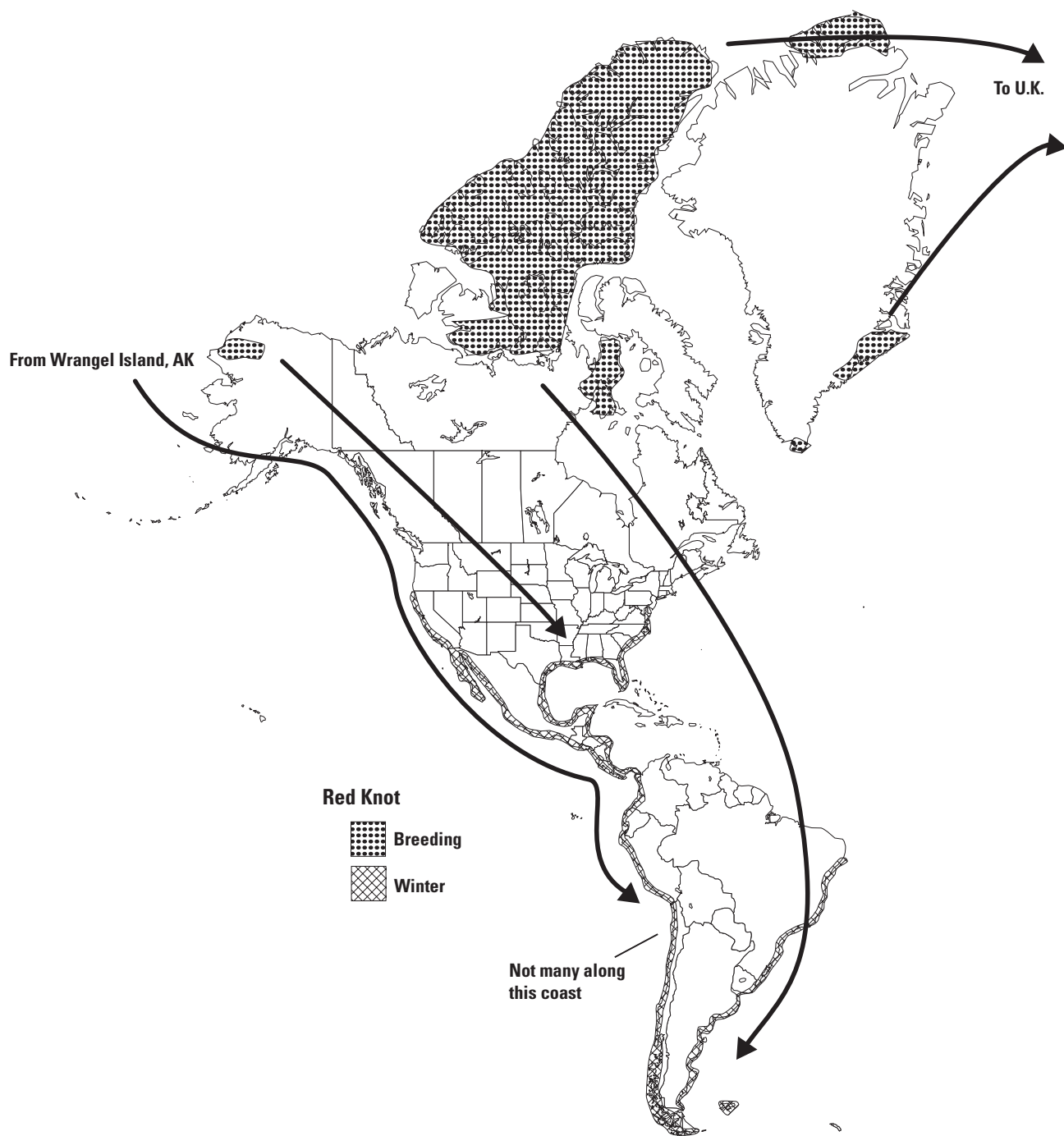
Potential Threats to Red Knots

Delaware Bay also happens to be the second largest petrochemical port in the eastern U.S. A major oil spill could seriously affect these birds and their food supply. Also, some local fishermen use horseshoe crabs, the Red Knot's main food source, as bait.

Something to Think About....

How might fisherman and shorebirds share the important Delaware Bay horseshoe crabs so there is enough for both?





Note: Arrows indicate general migration routes for both spring and fall.

Hudsonian Godwit

(*Limosa haemastica*)

Description

The Hudsonian Godwit is a large crow-sized bird with a long, straight or slightly upturned bill. It has a dark tail with a white patch on top. In breeding plumage, the male has a chestnut colored breast and the base of its bill is orange.

Behavior

These birds are gregarious and often seen in large flocks. They are also swift and powerful flyers.

Call

The call of the Hudsonian Godwit is a common “kaweeep kaweeep”.

Non-breeding Habitat

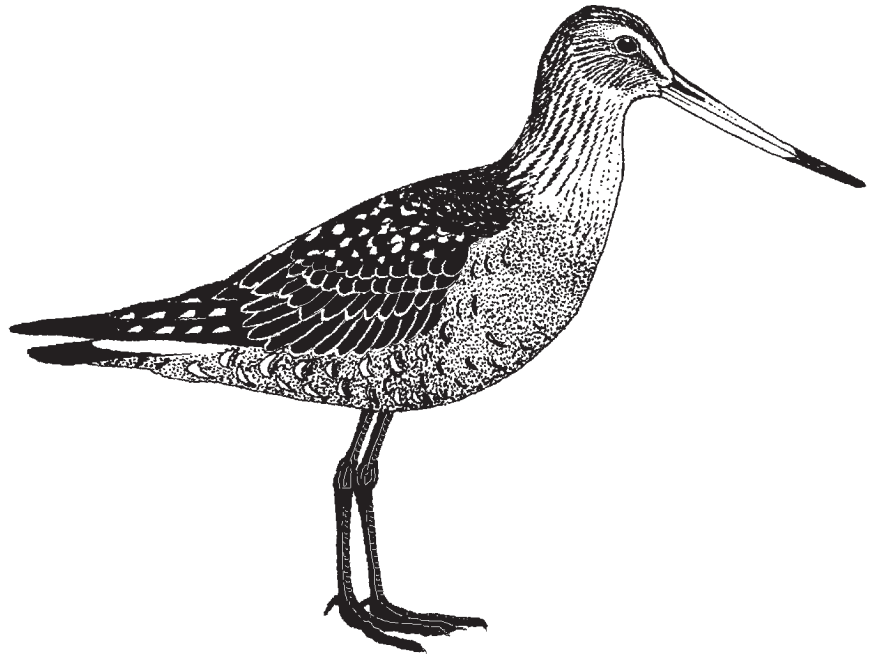
Hudsonian Godwits use a variety of inland and coastal wetlands including estuaries, mudflats, salt marshes, and sandy shores during the winter and migration. They feed mostly on invertebrates.

Breeding

The adults nest from late May through July in lowland marshes or near northern tundra coasts or rivers. Males make noisy flights to claim a territory. After mating, both the male and female incubate the four eggs. The female typically sits on the nest during the day and the male at night. The nest is a depression about 5 inches across under the edge of a dwarf birch tree that usually sits on the dry top of a sedge marsh. When the adults no longer need to guard their chicks, the young become secretive for about ten days, then reappear on nearby shorelines.

Migration

Most Hudsonian Godwits have an elliptical migration meaning that they use one migration route in the fall and another to return to their breeding grounds in the spring. After breeding in the low Arctic, Hudsonian Godwits gathers at Hudson Bay and James Bay in Canada. The young birds make this trip when they are only ten weeks



old! The Hudsonian Godwits then continue southeast, passing over the coast of the US, the Atlantic Ocean, the east coast of South America and finally to the tapering coast of Argentina and Chile. Here, they spend from October to April eating worms, mollusks, and insects along estuaries, grasslands and rice fields. Their spring migration is more westerly, using freshwater wetlands along the Central Flyway.

Since most people rarely see Hudsonian Godwits, they were once thought to be endangered. They hide nests far from people, in marshes and tundra. In addition, they only stop once or twice during the trip, making their migration truly amazing!

Today's Population

Scientists once thought that the Hudsonian Godwit was a rare shorebird. Today, about 11,000 birds use the Atlantic flyway, only one fifth of the total North American population. More than 10,000

Hudsonian Godwits pass through James Bay, Canada in late summer on their way south. Over 7,000 of these shorebirds spend their winter in Bahia, San Sebastian and Tierra Del Fuego in Argentina.

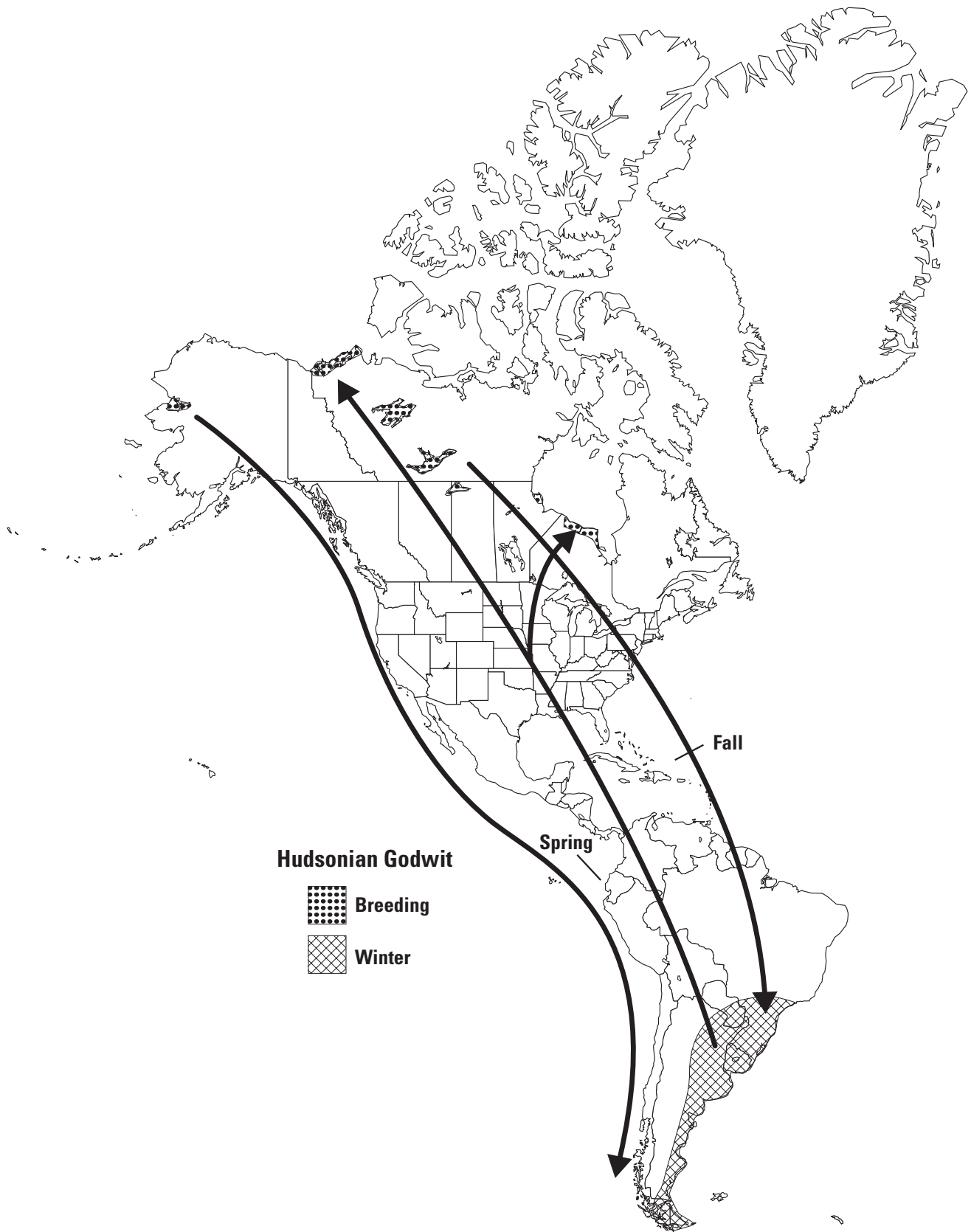
Threats to Hudsonian Godwits

Scientists aren't sure if agricultural chemicals affect Hudsonian Godwits. It is possible that many of these shorebirds could be affected by large oil production or shipping accidents when they concentrate at the tip of South America.

Something to Think About...

What is the advantage of elliptical migration (using one migration route in the spring and a different one in the fall)?





Sanderling

(*Calidris alba*)

Description

The Sanderling is a small sandpiper easily identified by the large amount of white on its feathers. In winter plumage Sanderlings are one of the palest sandpipers around and have a light gray back that blends into their white belly.

During breeding, both males and females are bright rusty-red on their backs and breasts. They have a white belly, and black legs and bill.

Behavior

A quick way to identify Sanderlings is watching their feeding behavior. At first glance they seem to be chasing the waves. They are really pecking for small food in the beach sand as the waves recede back from the ocean.

Call

Their flight calls are a “twick” or “kip”, and sometimes a short trill. Their song is a “churring” delivered in bursts during courtship.

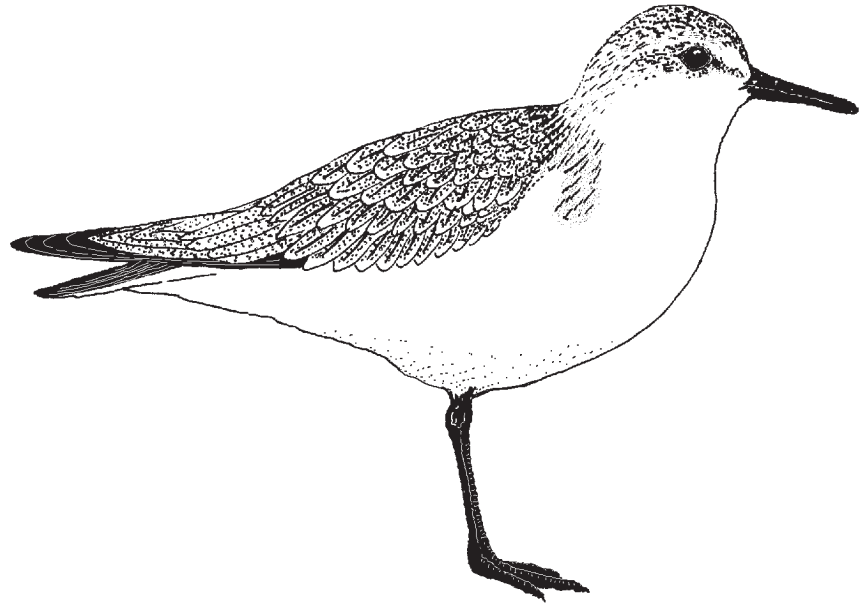
Non-breeding Habitat

Unlike other small sandpipers, the Sanderling is most commonly seen at beaches in the winter and during migration. Here it gets its nickname “wave chaser” from the way it runs after the ocean waves pecking for tiny invertebrates left behind on the surface of the sand.

Breeding

Sanderlings nest in the arctic. Here they eat the buds of dwarf trees and moss, and then later mosquitoes. Males are the ones to set up territories and begin courtship displays. After mating, the pair builds a nest of dried willow leaves in an open area. The female lays a clutch of 3-4 eggs for the male to protect and later raise.

In this species, the female may then lay a second clutch of eggs with the same male, termed double clutching. She takes care of this second family herself. Sanderlings are also



polyandrous meaning that the female may form another pair bond with a new mate and lay more eggs in his nest.

Migration

The Sanderling is one of the most widespread of all shorebirds. It is most commonly found in huge numbers on the east coast in Delaware Bay feeding with knots and turnstones. It also has a long migration route. Some of the Canadian nesters migrate south down both the Pacific and Atlantic Coasts as far as Tierra del Fuego in Argentina. Others choose to stay as far north as Alaska or Massachusetts during the North American winter. They return to their breeding grounds in late March and stay until late May.

Large flocks of Sanderlings fly between staging grounds to “refuel” their bodies by feeding on high-energy invertebrates. Some of non-breeding individuals remain south all year.

Today's Population

Currently, the population of Sanderlings is estimated to be about 300,000 birds. But, like many other

species of shorebirds, their numbers are declining. Based on population surveys, scientists believe that the Sanderling population along the Atlantic Flyway has shrunk a great deal in the past three decades.

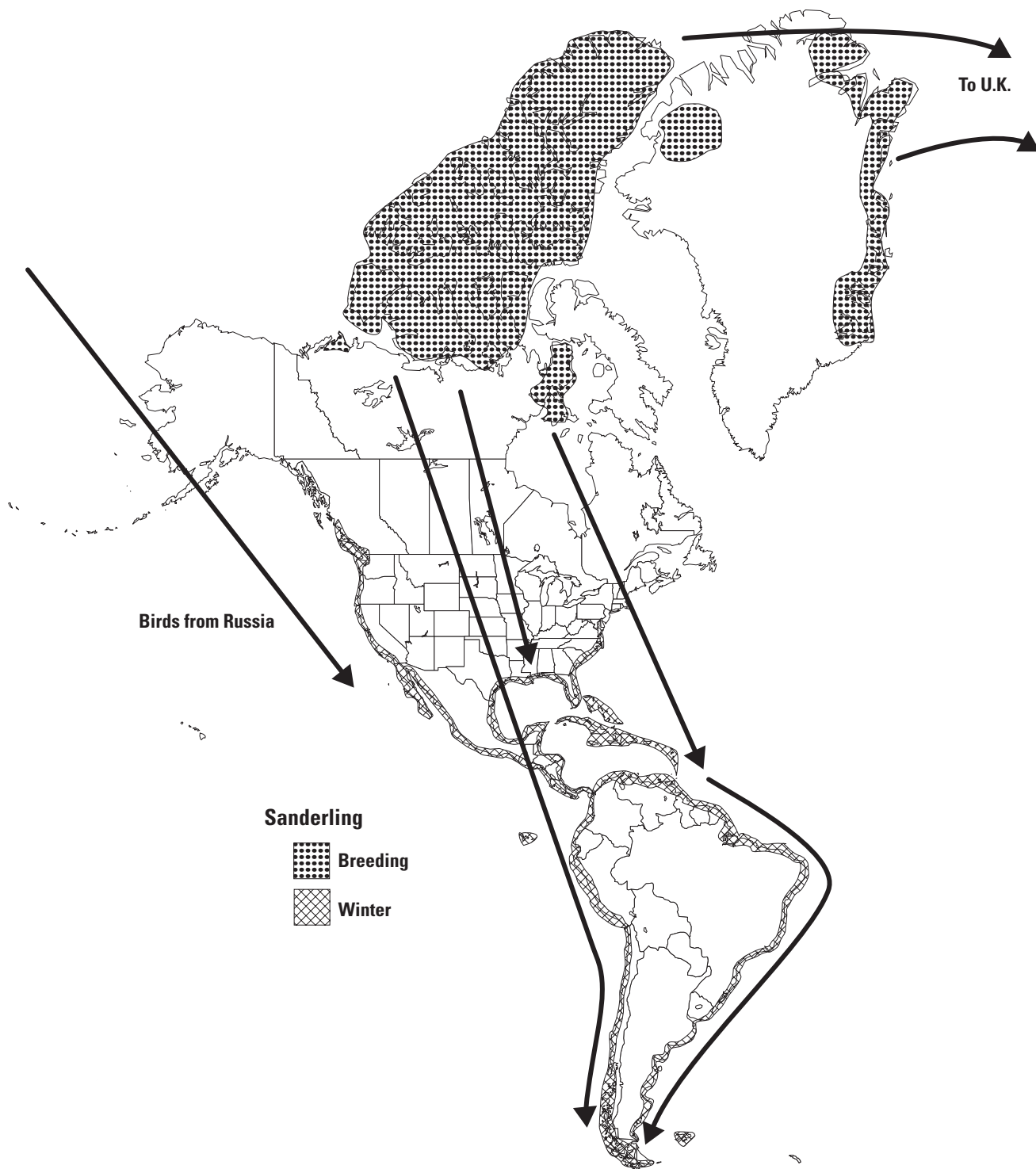
Threats to Sanderlings

What is effecting the population of Sanderlings? The loss of habitat and food is a serious problem. They winter along beaches where chances of conflicts with people are high. Human disturbances like boats, ATV's, cars, and even dog walking can scare nervous birds off their resting and feeding grounds. This causes them to waste valuable energy and time feeding. If the disturbance is great enough, some Sanderlings may not return to their feeding and resting grounds at all.

Something to Think About...

Polyandry, where a female forms pair-bonds with two or more males in one summer, and double clutching, are not common breeding traits among birds in general. What might be the advantage of this mating system to shorebirds?





Note: Arrows indicate general migration routes for both spring and fall.

Ruddy Turnstone

(*Arenaria interpres*)

Description

The Ruddy Turnstone is a stocky, medium-sized shorebird. Its striking breeding plumage has patterns of black, white and rust on its back. It also has a black bib, white belly, and short pinkish-orange colored legs. You can still see its black bib when it is carrying its duller winter plumage.

Behavior

Observing the behavior of the Ruddy Turnstone is key to identifying it in the field. This bird gets its name from the way it uses its strong neck and bill to flick seaweed sideways or to turn over small stones looking for food. In sandy areas, this bird also digs holes in search of buried prey like the horseshoe crab eggs on Delaware Bay.

Call

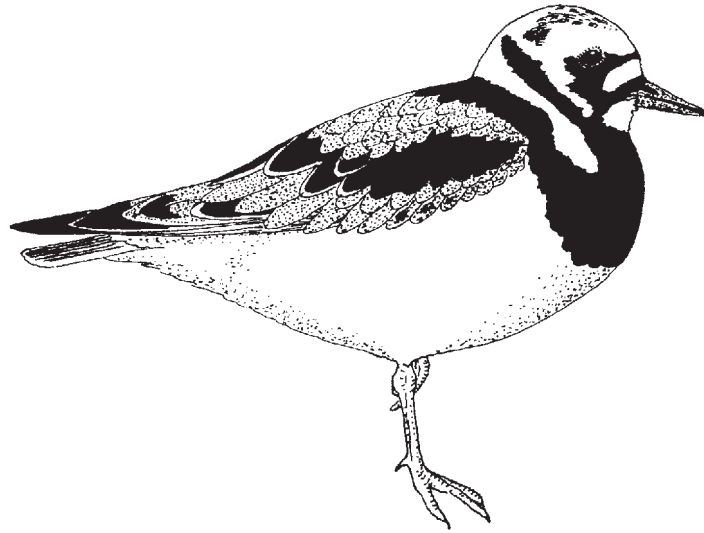
The Ruddy Turnstone has a distinctive call that sounds like a low-pitched rattle.

Non-breeding Habitat

The Ruddy Turnstone can be found on coasts south of their Arctic breeding grounds throughout the world. They also inhabit rocky shorelines and sandy and muddy areas. Here they eat mostly small crustaceans.

Breeding

These shorebirds nest on the drier ridges of coastal tundra that stays moist and provides food until late summer. Ruddy Turnstones first eat the plants that come up early in the season, before most animal foods are available. They switch to invertebrates as they slowly appear. Turnstones arrive on their breeding grounds in late May or early June.



Territorial behavior includes courtship flights and calls that begin from the time they form pair bonds until their chicks hatch. Turnstones will perch on rock outcrops to let females know that they are ready to mate. Pairing is completed by early to mid June.

Turnstones make their nests in wet areas that support small mounds of plant material. They don't mind the nests of other birds being close by. Both male and female help keep the eggs warm. Soon after hatching, the female leaves the male to care for the chicks.

Migration

Turnstones use both the Atlantic and Pacific Flyways to reach Mexican, Panamanian, and South American nonbreeding grounds. Flocks fly in tight groups when moving locally, but in loose lines when migrating long distances.

Today's Population

Scientists estimate through bird population surveys, that there are about 138,000 Ruddy Turnstones along the Atlantic Flyway. Like other shorebirds, the Turnstone population is also declining.

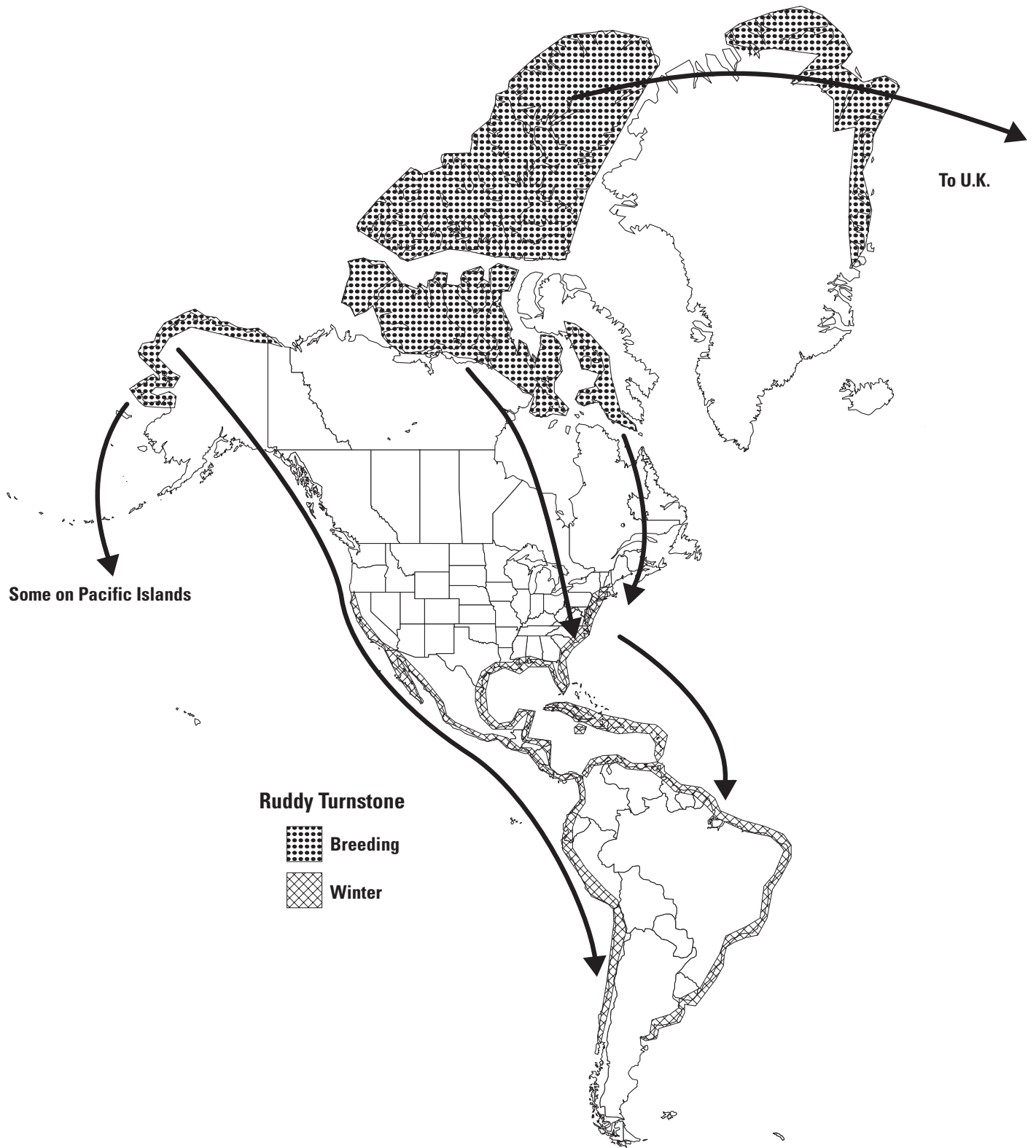
Threats to Ruddy Turnstones

The reasons for the decline of Ruddy Turnstones are the same as for many other types of shorebirds: habitat loss and human disturbances.

Something to Think About...

What other shorebirds have been named after a feeding behavior, the sound of their call, or a physical trait?





Note: Arrows indicate general migration routes for both spring and fall.



Western Sandpiper

(*Calidris mauri*)

Description

The Western Sandpiper is a very small shorebird, only 6 ½ inches from the tip of its bill to the tip of its tail. It has speckled rust and tan colors on its head and shoulders. Its belly is an off-white to light buff-color. You can see dark, arrow-shaped spots on the breast and sides. This coloration helps the little Western Sandpiper blend in very well with its background. Its toes are slightly webbed and its legs are black. The slender, black bill droops a little at the tip. Males and females look alike, but females are heavier with longer bills.

Behavior

Western Sandpipers are found in large flocks. They walk near the water's edge, constantly probing in the mud for tiny clams, worms, and sand fleas.

Call

This little shorebirds lets out a high-pitched, raspy "jeet".

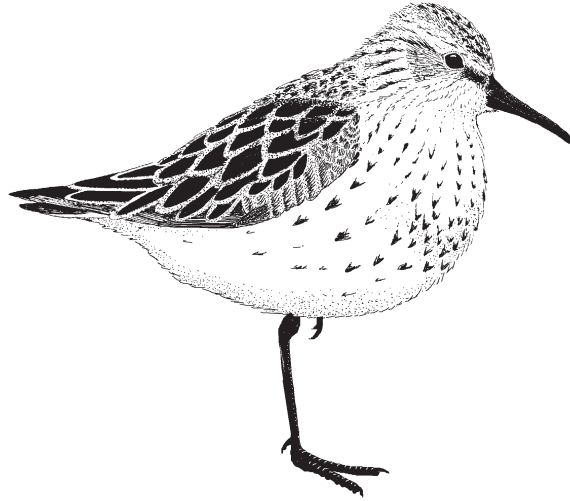
Non-breeding Habitat

Western Sandpipers are found mostly along the coast from California to Peru. They are also sometimes found in inland wetlands.

Breeding

The male Western Sandpiper usually arrives a few days before the female to breed in the tundra in mid-to late May. This vast, open, treeless habitat of the far north is covered with a layer of permafrost. This frozen ground doesn't allow for good drainage so the area is dotted with pools of water and small ponds.

The male selects a nesting site on the tundra and then defends it against other males. When the female arrives, she helps the male build a shallow, grassy nest. Western Sandpipers have very small territories and build their nests close together on small, grassy mounds. The nest is often hidden beneath a low shrub.



The female lays four spotted eggs and both parents take turns incubating them. The chicks hatch after 21 days. They are covered with soft, speckled down and begin searching for food right away. Like most other shorebirds that nest on the tundra, Western Sandpipers feed on large numbers of insects that hatch there each summer.

The Western Sandpiper has to watch for predators like foxes, weasels, and gulls. The parent will sometimes pretend to have a broken wing and drag itself away from the nest to distract a predator. This tactic works well because if a predator attacks the parents they can simply fly away. Another defense the chicks have is their instinct to "freeze", sitting perfectly still, when a parent gives an alarm call.

At first, both parents tend the young birds. A few days before the chicks are ready to fly the female leaves the male to stay with the chicks until they fledge, at about 19 days old.

Migration

Early in April, they form huge flocks and begin the long migration to breeding grounds in the far north. Most use the Pacific Flyway and travel to Northwestern Alaska. Some even fly across the Bering Sea to the

eastern tip of Russia!

Adult birds gather to begin the long flight south by the end of July. Young birds stay in the nesting area, gorging themselves on insects and exercising their young flight muscles. In mid-August, they too form large flocks and fly south for the winter.

Today's Population

Western Sandpipers are considered common and abundant shorebirds. About 3 ½ million Western Sandpipers are found globally. Biologists think about 80% of these shorebirds pass through the Copper River Delta in Alaska during spring migrations along the Pacific Flyway. Much smaller numbers of Western Sandpipers also use the Central Flyway.

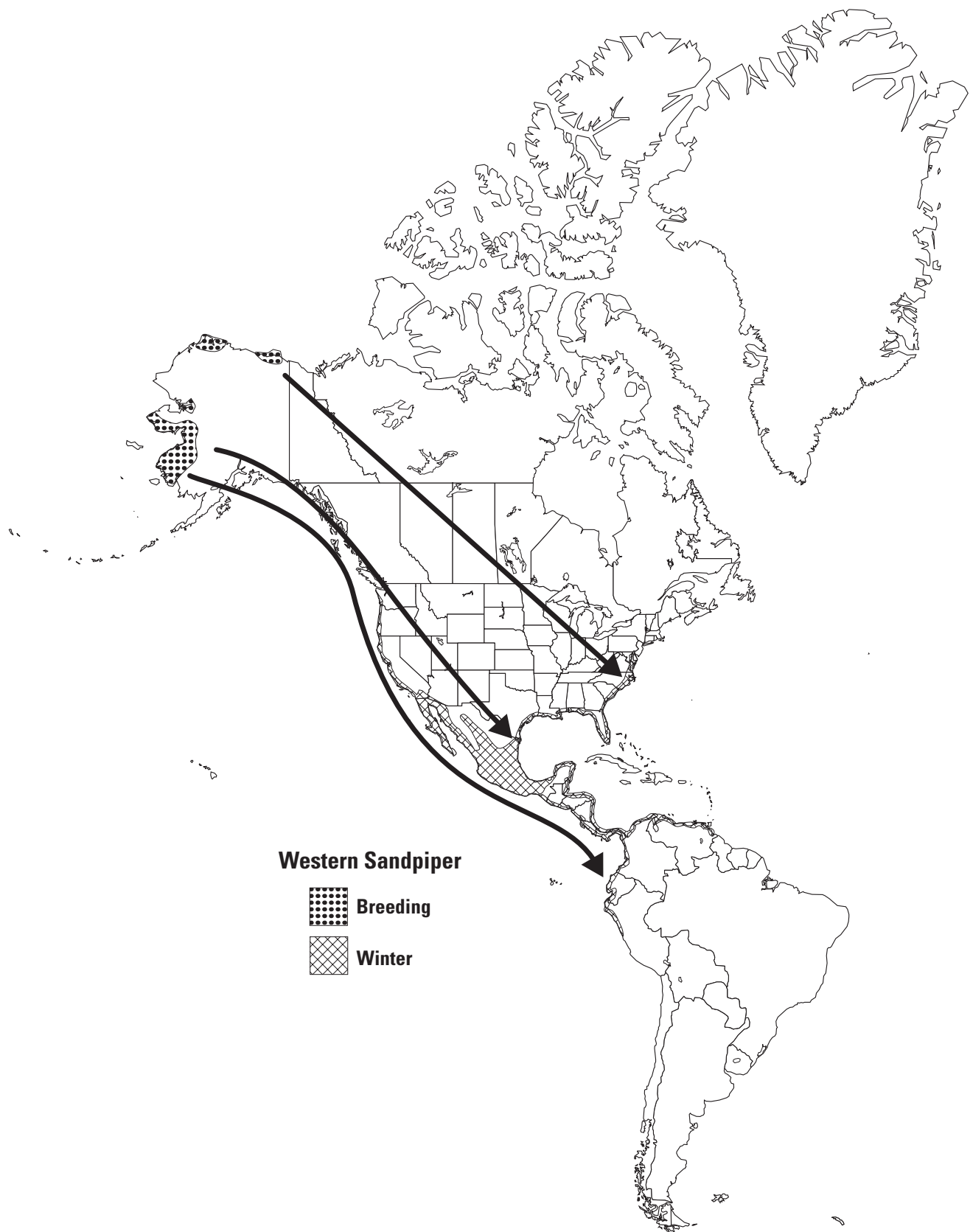
Threats to Western Sandpipers

Western Sandpipers rely on wetlands for feeding areas. Slowly, wetlands are being replaced by farm lands and urban sprawl. Some towns in the United States and Canada have passed laws to protect wetlands from destruction.

Something to Think About...

What are people, agencies, or local organizations in your area doing to help preserve wetlands?





Note: Arrows indicate general migration routes for both spring and fall.



Dunlin

(*Calidris alpina*)

Description

The Dunlin is smaller than a Robin – about 8 inches from the tip of its bill to the tip of its tail. The Dunlin has reddish speckled back feathers and a light-colored breast with dark streaks. It used to be called the red-backed sandpiper. It has black legs and a black bill that droops a little at the end.

The most distinctive trait of the Dunlin's plumage is seen during the summer breeding season, when it is the only shorebird, besides the Rock Sandpiper, with a black belly patch. Even in a giant flock of peeps (small shorebirds), a few of those tar-black patches will give away the presence of Dunlins!

Behavior

Dunlins are amazing to watch. They fly in large flocks with each bird flying at the same speed and in the same direction. In almost an instant they can all turn in unison and make you wonder how they do it. During migration and winter, Dunlins feed near the water's edge by probing with swift movements in the soft mud for tiny clams, worms, insect larvae and shrimp-like animals.

Call

Its call, heard during migration, is a harsh, slurred "kreee."

Non-breeding Habitat

Dunlins prefer muddy estuaries but are sometimes seen feeding on sandy coasts. In the winter, Dunlins live along the shore in warm climates from British Columbia to Mexico and in the east north to Massachusetts and New Jersey. Dunlins that breed in Alaska will fly to Japan, China and Korea. Some will even stay in Alaska for the winter. They are not found south of the equator.

Breeding

Dunlins have a circumpolar breeding distribution, meaning that they are found throughout the world in

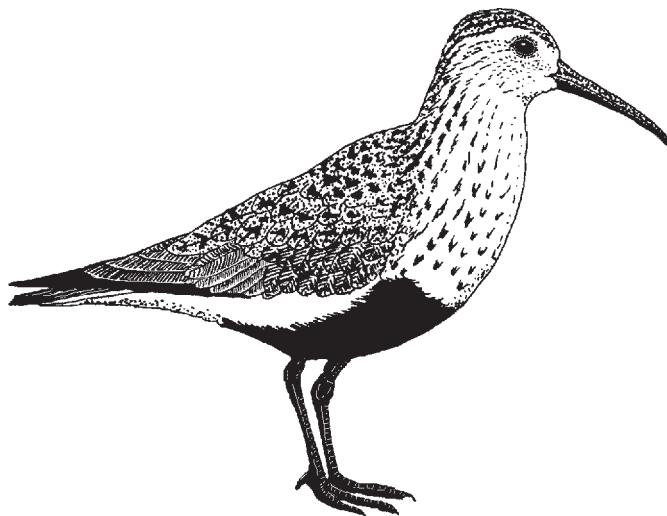
northern arctic areas. In April and May, they arrive at their breeding grounds of northern Alaska, Canada, Scandinavia, and Russia. The male sings in the air as a courtship display designed to attract a female and claim a nesting territory. The pair then makes a shallow, very hard to see nest that is lined with grass or willow leaves. The female lays four eggs that are greenish with green and brown splotches.

The parents take turns incubating the eggs for 22 days. While one parent is sitting on the nest, the other feeds nearby on spiders, beetles, earthworms, and adult and larval flies. After the chicks hatch, they grow very fast. They fledge in about 20 days. Adult birds leave the young and begin flying south in to mid-August.

Migration

Dunlins use all three migration routes within the United States, which keeps the west coast, central, and eastern populations separated.

Dunlins begin their spring migration north, first staging in large flocks, in late March or early April. They begin their fall migration much later than



other small sandpipers starting in mid- August. Some Dunlins stay in Alaska until October, a few will stay all winter. As they migrate, Dunlins stop at wetlands, especially coastal or estuarine mudflats, to feed.

Today's Population

Of the 3.1 million Dunlins found around the world, about 1.5 million are found in the United States. The largest populations of migrating Dunlins use the Pacific and Atlantic Flyways.

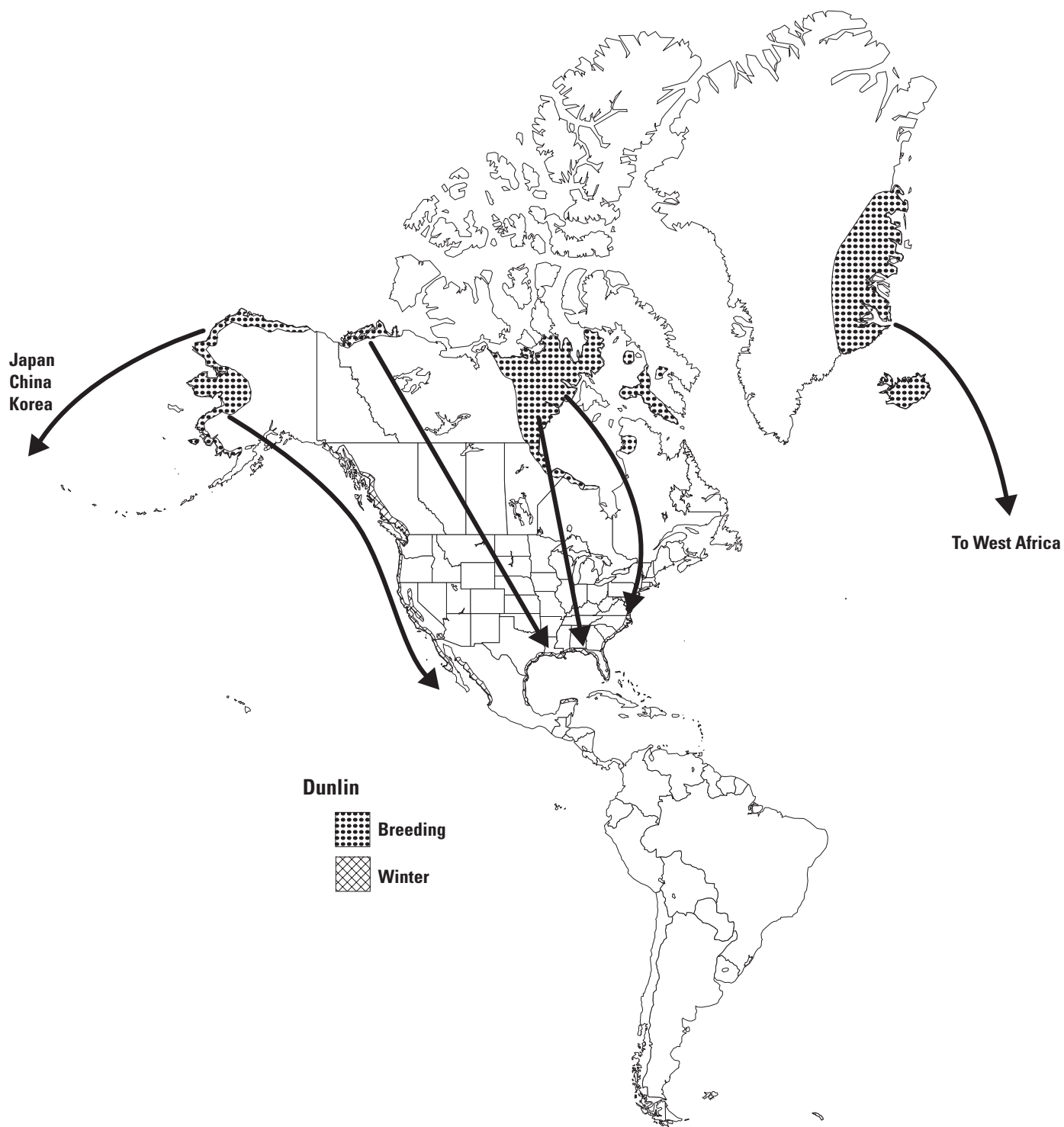
Threats to Dunlins

Like other shorebirds, Dunlins depend on clean, healthy wetlands for survival. Pollution is killing the life in some wetlands. Oil spills kill the tiny animals that shorebirds need for food. If oil covers a bird's feathers, it can't keep warm. Birds that accidentally eat oil may be poisoned, produce fewer eggs, or be generally less healthy which makes migration even harder for them.

Something to Think About...

What is being done in your area to protect your wetlands from oil spills?





Note: Arrows indicate general migration routes for both spring and fall.



Dowitchers

(*Limnodromus spp.*)

Description

Dowitchers are beautiful shorebirds. Overall they appear rusty-colored, with darkish, brown spotted backs and a rusty-brown breast and belly. They are much larger than Western Sandpipers and Dunlins – closer to the size of a Robin. They have long, black, snipe-like bills and green legs.

There are two species of Dowitchers found in North America, the Long-billed Dowitcher and the Short-billed Dowitcher. The one physical difference between them is the length of their bill. The Long-billed Dowitcher has a bill only slightly longer and heavier than that of the Short-billed Dowitcher. The best way to tell them apart is by their calls. During migration these shorebirds feed on worms, clams, snails, and sand fleas.

Behavior

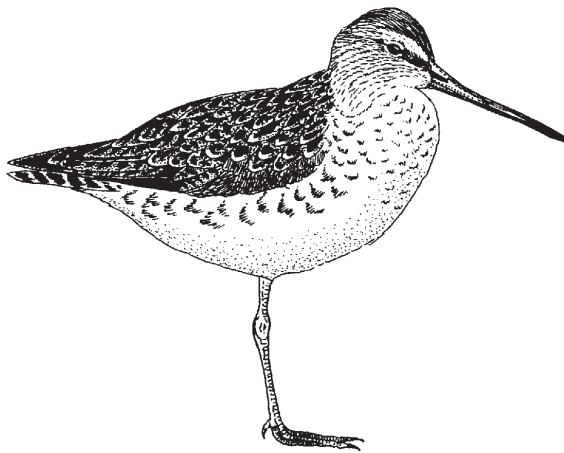
Dowitchers feed using their bills in an up and down motion of the head like a sewing machine. They often dip their entire heads into the water.

Call

The calls of the Long-billed and the Short-billed Dowitchers are quite different. The Short-billed Dowitcher makes a soft “tu-tu-tu” during migration. The Long-billed Dowitcher, on the other hand, makes a high-pitched “keek”. Their songs are different too. Although true songs of birds are heard only during their breeding season and on their breeding grounds, you might hear the song of the Short-billed Dowitcher during any time of the year.

Non-breeding Habitat

These shorebirds are essentially coastal in the winter. You will often find large flocks feeding on intertidal mudflats. Long-billed dowitchers will winter on all southern United States coasts and throughout Mexico. Short-billed dowitchers will winter along southern United States and northern South American coasts.



Breeding

Dowitchers nest in muskeg, tundra, and wooded marshes along the Alaskan and Russian coast or inland Canada. The male arrives at the breeding grounds first and chooses a nesting site. He claims his territory and courts the female by hovering over the nesting site and singing.

The female helps the male build a nest on the ground with grass and soft moss. Long-billed Dowitcher nests are often in such wet habitat that the bottom of the nests are wet! The female lays four green eggs that are spotted with a buff color. For 21 days, the parents take turns incubating the eggs. The female spends a very short time in the Arctic! As soon as the chicks hatch from their eggs, she leaves! The male is left to care for the chicks. Like other shorebirds, Dowitcher chicks can walk when they hatch, but they cannot fly for several weeks.

The male protects the chicks from predators and shows them how to look for insects, beetles, and the seeds of water plants. Once they are a few days old, the chicks begin exercising their tiny wing muscles by stretching them out as they walk. Soon they take short, flying steps as they run about looking for food.

As soon as the chicks can fly, the male gathers with other males to begin the flight south. The young birds stay

behind and practice flying for another week or so. Like most shorebird species, the Dowitcher young are left to find their own way south.

Migration

Long-billed and Short-billed Dowitchers will use all 3 migration routes. They begin migrating northward in small groups in early March. During the flight north, Dowitchers travel 2,500 miles at a time without stopping to rest and feed! When they do stop, migrating Dowitchers use a variety of inland and coastal wetland habitats to rest and feed.

Today's Population

Population counts suggest a larger population of Long-billed Dowitchers (about 500,000) than Short-billed Dowitchers (320,000). The largest number of Short-billed Dowitchers migrate along the Pacific Flyway, whereas more Long-billed Dowitchers use the Central Flyway.

Threats to Dowitchers

Dowitchers were once hunted in great numbers for North American markets. Today, the greatest threat to shorebirds, including Dowitchers, is the loss of the wetlands they depend on.

Something to Think About...

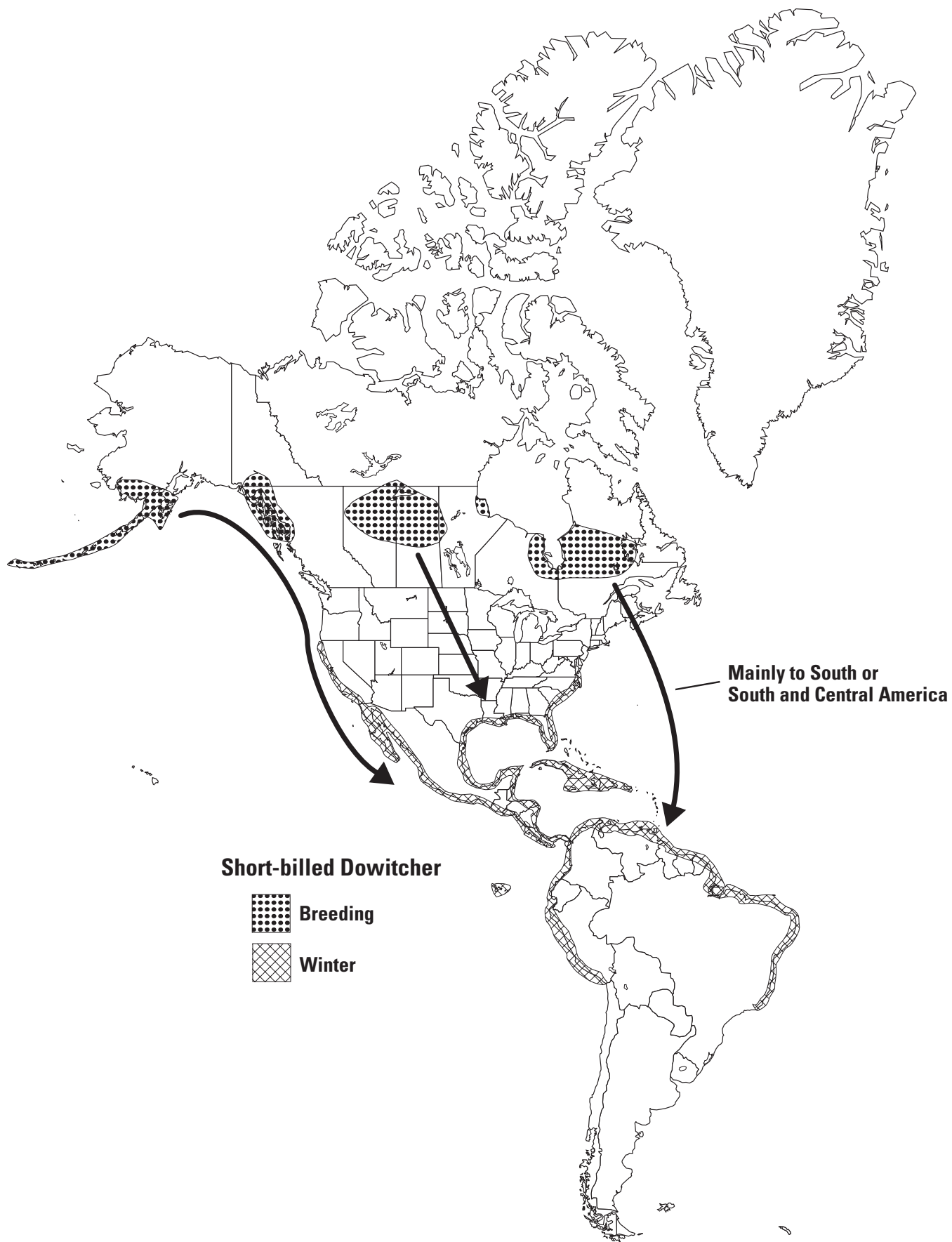
What other shorebird populations were hurt by the market hunting of the early 20th century?





Note: Arrows indicate general migration routes for both spring and fall.





Note: Arrows indicate general migration routes for both spring and fall.



Black-bellied Plover

(*Pluvialis squatarola*)

Description

The Black-Bellied Plover is a medium-sized, plump, handsome shorebird. It has a short but sturdy bill and large eyes. Its summer breeding plumage, is a stunning black and white speckled back with black face, neck and breast. It has white undertail feathers and a distinct white strip down each side of its neck. Notice how the black of its belly extends all the way to the face, unlike the Dunlin. The “under arms” (under the wing, close to the body) are always black. The legs and short bill are also black.

This plover is also known in Europe as the Grey Plover or Silver Plover named after its much duller winter coloring.

Behavior

This plover feeds by watching and then running toward the water’s edge to pick the food off the surface.

Call

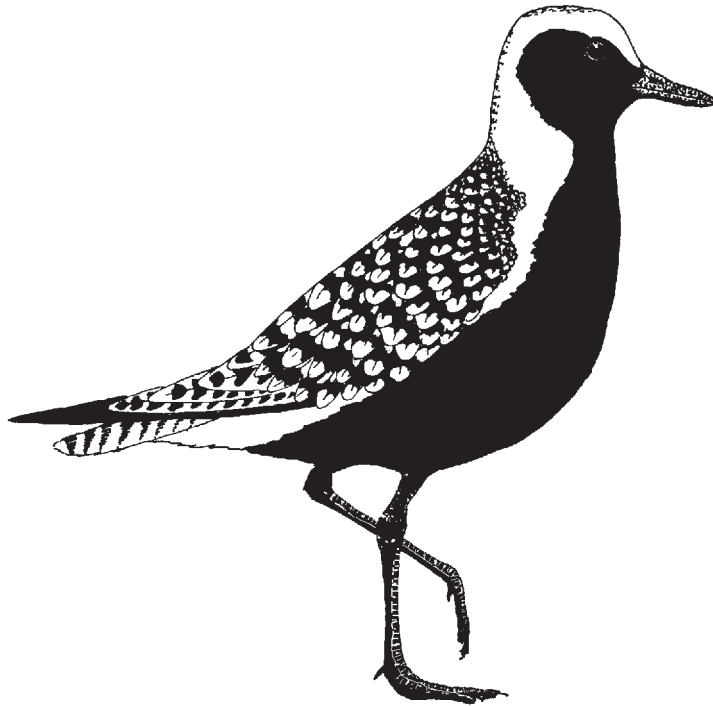
The call is a loud, sad 3-note whistle “tlee-oo-ee”, with the second syllable lower in pitch than the first or last.

Non-breeding Habitat

Black-bellied Plovers of the Western United States spend the winter in grasslands and beaches along the coast from British Columbia to Chile. They feed on earthworms, grubs, and beetles they find there.

Breeding

The male chooses a nest site that is usually on a grassy mound with a good view of the tundra. He defends the nest site, or territory, against other males and courts the female with a short, zigzag, or “butterfly,” flight. Because plovers are so alert on the breeding ground, some scientists believe other shorebirds nest near plovers to take advantage of their watchfulness.



Parents work together to build the nest. The male makes the scrape, the female lines it with grass or lichens and lays four pink, green, or brownish eggs speckled with dark spots. The parents take turns incubating their eggs for 23 days. Like other shorebirds, they may abandon their eggs if they are disturbed.

In the northern tundra, the land of the midnight sun, young Black-bellied Plovers eat a lot and grow fast. Both parents help care for the chicks. They show them how to hunt for insect larvae and beetles.

In July or August, the adults begin the long migration south. As soon as their wing muscles are strong, the young chicks head south too. During fall migration, Black-bellied Plovers often stop to feed in wetland areas, stopover sites, along their route.

Migration

Like many other shorebirds, these plovers are great long-distance fliers. In mid-April Black-bellied Plovers begin the long flight north to their breeding grounds in the tundra. They fly in small, mixed flocks all the way to the coast of the Arctic Ocean.

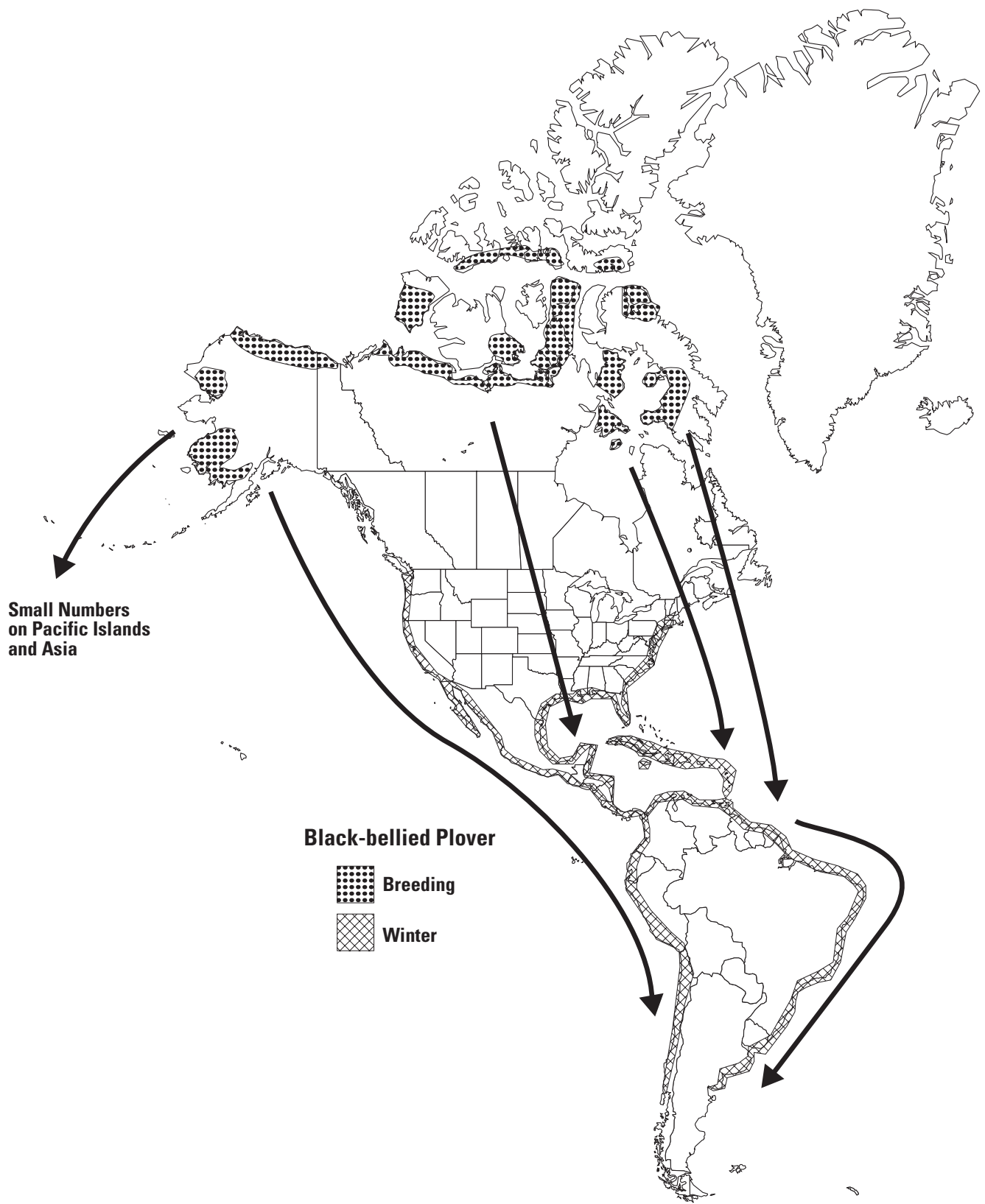
Today's Population

Bird Survey counts show that almost 500,000 Black-bellied Plovers are found globally. Almost 40%, about 200,000, are here in North America.

Something to Think About...

Does your community have healthy, clean wetlands where Black-bellied Plovers and other shorebirds can feed?





Note: Arrows indicate general migration routes for both spring and fall.

Black Oystercatcher

(*Haematopus bachmani*)

Description

The Black Oystercatcher is a large, dark, funny looking shorebird. It has dark grayish plumage year-round. It has a long and heavy orange-red bill, bright yellow eyes and large pink feet.

Behavior

Black oystercatchers use their laterally-flattened bills to pry open shellfish.

Call

The Black Oystercatcher makes loud, piping whistles that sound like “wheep, wheep.”

Habitat

Black Oystercatchers are shorebirds of American Ocean shorelines. More than half of the entire population lives on the sandy and gravel beaches and rocky shores of the Alaska coast and nearby islands.

Contrary to what its’ name implies, oystercatchers do not feed primarily on oysters. They prefer to eat other mollusks such as clams and mussels, limpets, whelks and chitons. They will also eat crabs, sea urchins, and barnacles. They use stabbing and hammering to pry open or crack shells to reach their prey. They are fun to watch!

Black Oystercatchers use their long bill to probe the mud for unsuspecting clams or mussels. When the oystercatcher finds one with its’ shell slightly open, it jams its’ bill into the opening and tears the soft flesh out of the shell. Oystercatchers also use their bills like a chisel to pry mollusks off the rocks.

Nonbreeding

Black oystercatchers spend the nonbreeding sites in flocks along mussel-rich habitats of the Pacific coast.

Breeding

Black Oystercatchers are monogamous breeders. They

establish and defend well-defined feeding and nesting territories and return to them year after year. They select a site above the tideline to build a nest of rock flakes, pebbles, or pieces of shell. The female usually lays 1-3 pear-shaped, buff-colored, speckled eggs. She will re-nest if weather or predators destroy the first clutch.

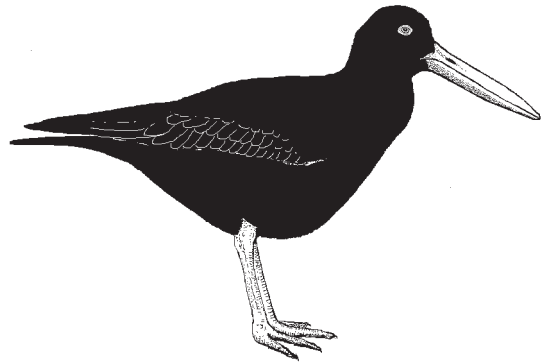
Both the male and the female Oystercatcher incubate the eggs for about 26-32 days until the eggs hatch. Unlike other shorebirds, adult Black Oystercatchers provide food for their young. One parent guards the chicks while the other goes off in search of a family meal. Parenting of young oystercatchers extends well beyond the usual 3 weeks when most other shorebird species stop taking care of their young. In fact, adults may care for the young more than a month and sometimes as long as six months. During this time, biologists speculate that the young are learning the very specialized feeding techniques to eat their tough prey from their parents.

Migration

Although some Black Oystercatchers are considered to be resident shorebirds, meaning they do not migrate for the non-breeding season, northern populations likely do fly south for the winter. However, most will regroup into post-breeding flocks and spend the winter near their nesting area.

Today’s Population

Biologists suspect that disturbance of shoreline habitat has been the primary reason for the low population levels of this West Coast shorebird. There are about 11,000 Black Oystercatchers worldwide today. More than half of the population is found along Alaska’s coast and



coastal islands. About 1,000 Black Oystercatchers are found in Prince William Sound.

Potential Threats to Black Oystercatchers

Because Black Oystercatchers feed and breed on shorelines, they are especially susceptible to oil spills. A big oil spill, like that of the Exxon Valdez in 1989, can contaminate shorebird nests, the feathers of chicks and adults, and contaminate the clam and mussels beds these birds depend on for food. When this happens, Black Oystercatchers are forced to abandon their nests and chicks in search of new feeding grounds.

Predators, like river otters, red foxes, glaucous-winged gulls, bald eagles, and common ravens, are a big threat to Black Oystercatchers. In fact, biologists think that the reason these shorebirds live and nest along rocky shorelines is to make it harder for predators to reach their eggs and chicks.

Something to Think About....

How can we protect Alaska’s rocky shoreline and the Black Oystercatcher from another big oil spill?

The news often reports of oil spills around the world. How could we protect wildlife species and habitats along the entire oil transportation corridor?





Note: Arrows indicate general migration routes for both spring and fall.



Killdeer

(*Charadrius vociferus*)

Description

The Killdeer is the most widespread and maybe the best-known shorebird in North America. At 10 ½ inches tall, it is about the same size as a Robin. Its beak is small compared to other sandpipers. It has two black bands that stretch across its chest and a pure white belly. When the Killdeer flies, you can see its beautiful reddish-orange tail feathers. Males and females look alike.

Behavior

Because Killdeers have short bills, they tend to pick insects from the surface of the ground, rather than probe into the mud looking for invertebrates or clams.

You usually see Killdeers alone or in pairs running in a “watch-run-peck” pattern.

Call

Their call is a loud “killdee, killdee” and it is often one of the first shorebirds you hear returning in the spring.

Habitat

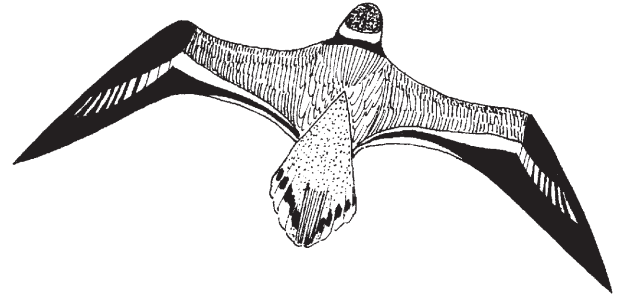
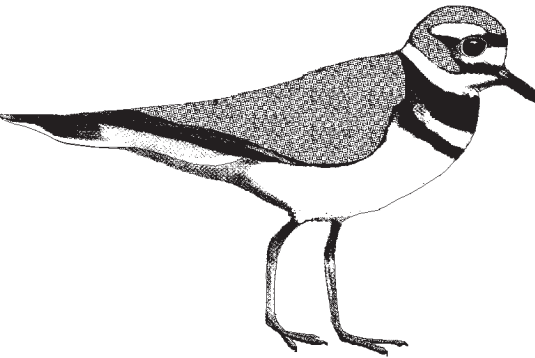
Killdeers are not shy birds. In fact, they seem not to be bothered by people. You can find them feeding in meadows, pastures, gravel beaches, and on the edges of freshwater rivers and ponds.

Nonbreeding

During the nonbreeding season Killdeer use a wide range of grassy and wetland habitats. They will also be seen more frequently in flocks.

Breeding

You often find Killdeer nesting in farm fields, on suburban lawns and even in gravel parking lots. A Killdeer nest is nothing more than a scrape in stones, gravel, or pebbles. The rocks are a sort of camouflage for the four speckled eggs the female lays. Perhaps one of the best-known shorebird displays is the “broken-wing act” of the Killdeer. When a predator threatens their eggs or



chicks, the adult Killdeer drags its wing in an attempt to lure it away. Of course, once fooled, the Killdeer quickly flies up to safety.

Migration

In the winter, many Killdeers stay in the southern United States. Others go to Mexico, Central America, or even South America. A few Killdeer will also travel to the Canadian Arctic and south Alaska to nest and breed, but most tend to nest and breed in the central United States and along the Pacific and Atlantic coasts. Take a look around and see if you can find one!

Today's Population

Once the target of market hunters the population of Killdeer dropped dramatically. Today Killdeer are more common than they ever were. Biologists estimate a population of 1 million birds in North America. Unlike most shorebirds, Killdeer seem to like many of the habitat changes brought on by people! Only in the west may their population be declining.

Threats to the Killdeer

Perhaps the most dangerous threat to the Killdeer is its tolerance for urban yards, parks, and gardens. Where there are people there are bound to be cats and dogs; domestic predators. Other urban predators like foxes, coyotes, and raccoons also do extremely well alongside people. They have learned to feast on the pet food and birdseed we leave outside and the kitchen scraps we throw in our garbage. These animals are very serious predators of Killdeer chicks and eggs.

Agricultural areas aren't much safer for the Killdeer either. Farm machinery may damage nests and eggs and can kill chicks.

Something to Think About...

What other shorebirds have developed behaviors, like the Killdeer's “broken wing act” that fool or scare away predators?





Note: Arrows indicate general migration routes for both spring and fall.

Snowy Plover

(*Charadrius alexandrinus*)

*A Federally Listed
Threatened Species*

Description

The Snowy Plover is a small shorebird with a thin bill and black legs. During breeding season, males have a black forehead, ear patch and partial neck-ring. These areas are all brown in females.

In winter plumage, both the males and females carry the female's duller summer plumage.

Behavior

Their short, slender black bills are used to pick a wide variety of insects and aquatic invertebrates. Their camouflage coloring allows them to seemingly disappear from sight because they blend so perfectly with their environment.

Call

Its call is a low "krut" and a soft, whistled "ku-wheet."

Nonbreeding

These birds primarily spend the nonbreeding season in coastal habitats, including beaches and other salt water wetlands

Habitat

The Snowy Plover is found primarily on barren sandy beaches and flats along the Pacific coast from southern Washington to southern Baja, California and into the Salt Lake area. A second population is located between the Gulf Coast and South Central United States. Snowy Plovers are uncommon at freshwater wetlands even during migration.

Breeding

The breeding season for Snowy Plovers starts in mid March and runs through mid September. Snowy plovers breed in loose colonies. You will find their nests in flat, open sandy beaches or by brackish or saline wetlands. The majority of snowy plovers are site-

faithful, meaning that they return to the same breeding spot year after year. In fact, Snowy Plovers often nest in the exact same location as they did the year before.

The usual clutch size is three eggs. For 27 days, male and female Snowy Plovers take turns incubating their eggs. Males incubate at night, females during the day. Plover chicks are precocial, and leave the nest and nesting territory within hours after hatching to search for invertebrate foods on the beach or in the sand dunes. Chicks fledge within 30 days.

Unlike other types of shorebirds, Snowy Plovers will renest after the loss of a clutch or brood or sometimes even when they have successfully hatched a nest. Female Snowy

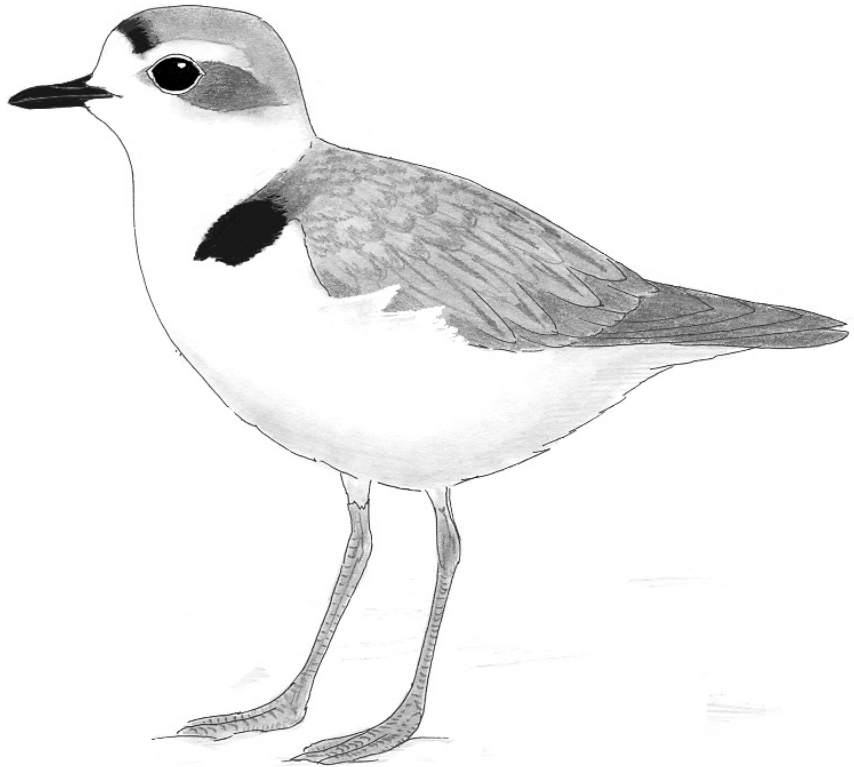
Plovers are polygamous meaning they will sometimes choose a new mate and start another nest. She may build this new nest in the same spot or move altogether, sometimes up to several hundred miles away.

Migration

Plovers that nest along the coast also spend their winter there. The coastal and interior group of Snowy Plovers will stay together along the California coast. However, the coastal population of the Western Snowy Plover does not, for the most part, breed with interior birds. Many Snowy Plovers on the Gulf Coast are year round residents.

Today's Population

Nesting Western Snowy Plovers were once found further along the



Pacific coast. California alone had 53 breeding sites before 1970. Today, only 20 nesting areas can be found. The largest colony of Snowy Plovers nests in the abandoned salt ponds and levees surrounding active salt ponds in San Francisco.

In Oregon, only 6 of the 20 original colony sites remain. On the southern Washington coast, only 2 of 5 colony sites are active. The number of Snowy Plovers breeding has also declined to less than 1,500 birds, most of which are now found in California.

Threats to the Western Snowy Plover

Unfortunately for the Snowy Plover, nesting season (mid March to mid September) is the peak summer recreation season along West Coast beaches: Memorial Day through Labor Day. People walking, jogging or running pets on the beach; riding off-road vehicles and horses; and beach raking all upset the Snowy Plover's breeding routine.

When people scare Snowy Plovers off their nests, chick mortality increases. To avoid intruders, adult Snowy Plovers will leave their chicks wet and unattended. A nest of eggs can quickly be buried by blowing sand or overheat on a sunny day. Plovers crouching down in depressions trying to hide have been found run over on their nests!

Another big problem for Snowy Plovers is beach raking. Throughout Los Angeles County and parts of Orange County, California, entire beaches are raked daily or weekly to remove trash and tidal debris. This makes it impossible for plovers to nest. Machinery crushes plover nests and chicks and the noise from these large machines scare the adults away. Raking beaches also removes the kelp and driftwood that invertebrate foods live on.

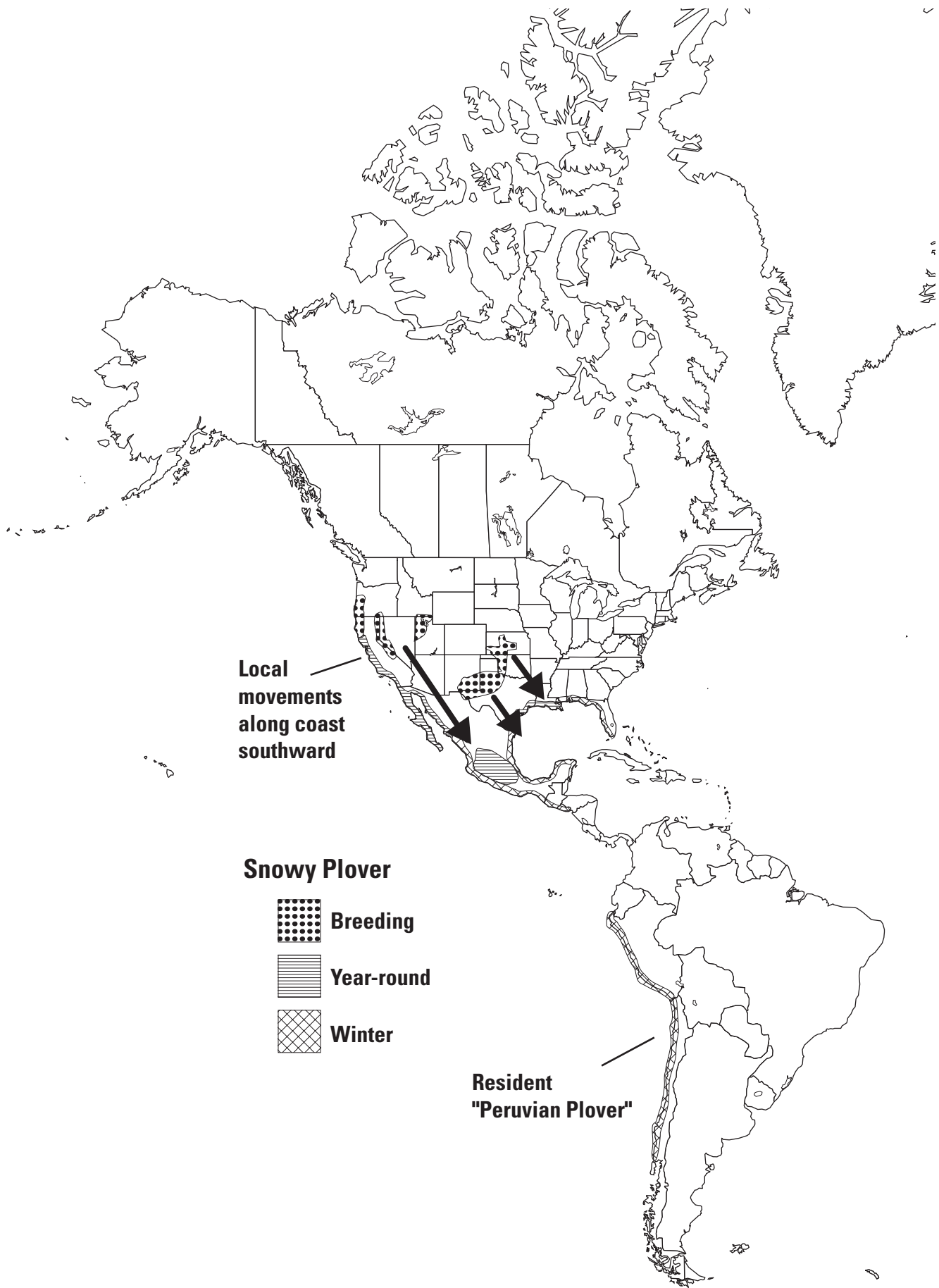
Habitat destruction also hurts snowy plover breeding sites. Residential and industrial developments, recreational facilities, roads, parking lots, and summer homes have wiped out valuable nesting habitat. European Beach Grass, introduced to the West Coast around 1898 to stabilize sand dunes, has spread up and down the coast. Snowy Plovers prefer to nest in unvegetated sandy areas. The introduction of this exotic plant has wiped out about 50% of the potential coastal nesting sites for the Snowy Plover.

Predators are also a threat to Snowy Plover eggs, chicks, and adults. Animals that do well around people, like the American crow, raven, and red fox, do the most damage.

Something to Think About...

How can the snowy plover and people share the Pacific Coast? Agencies responsible for protecting endangered species are dedicated to doing everything necessary to save the plover, but the work cannot be done by agencies alone. As caretakers of our environment, all of us can contribute to the protection of the plover. What can you and your friends do to help the Snowy Plover survive?





Note: Arrows indicate general migration routes for both spring and fall.

Pacific Golden-plover

(*Pluvialis fulva*)

Description

The Pacific Golden-Plover appears nearly identical to the American Golden Plover. In fact, scientists once thought these were both just subspecies of the Lesser Golden Plover.

The Pacific Golden-Plover is a medium-sized shorebird with a small black bill that is clearly shorter than its head. It has black legs.

In flight, the Pacific Golden Plover has uniformly dark underparts and a grayish underwing. Its black head, nape and back are spangled with gold and white markings. It has a black face and throat. A white stripe runs down both sides of its head and neck to the lower sides of its breast.

Behavior

The birds that feed in urban grasslands during the nonbreeding grounds seem to be unaffected by human activities. In fact, these birds can be seen roosting during the night on roof tops!

Call

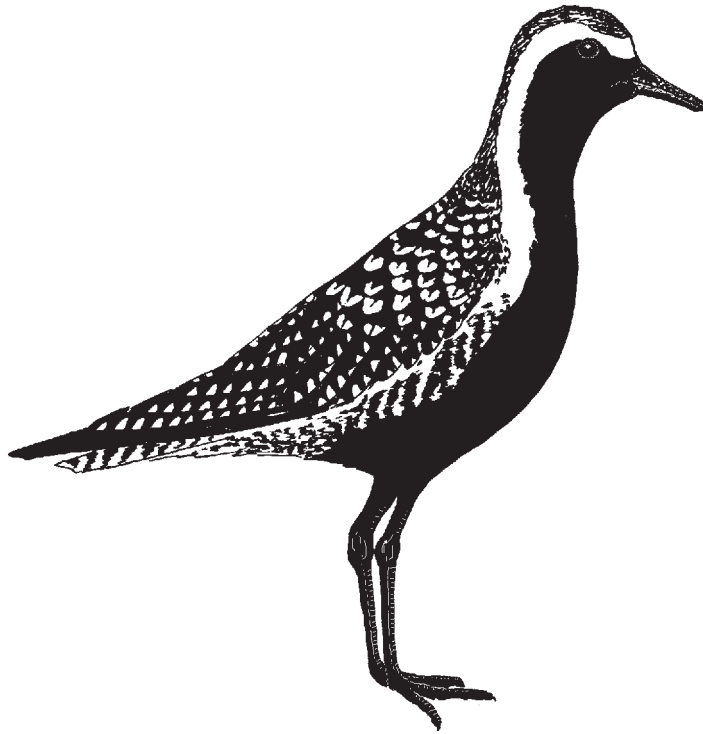
The Pacific Golden Plover has a two-to-three part whistle that sounds like “chuwi” or “chuweedle.”

Nonbreeding Habitat

These shorebirds will use mudflats and beaches found around Pacific islands. Many use plowed fields, pastures, lawns and golf courses in Hawaii islands, and other short-grass habitats where they eat grasshoppers, crickets, and grubs.

Breeding

Pacific Golden Plovers nest in Siberian and northwestern Alaskan tundra. They have many pair-bonding displays but perhaps the most spectacular is the male’s Butterfly Display Flight. Sometimes done alongside the female, the two birds fly up into the air and land together holding their wings up in a V and calling with a series of complex



whistles. Other courtship displays designed to catch a female’s attention are head-to-tail rocking, scraping the ground, and wing-stretching.

Both males and females guard the simple depression they make for a nest, incubate the eggs and tend to the chicks. Pacific Golden Plovers can be highly territorial and will use elaborate aerial displays, vocalizations, chases, and even fights to protect their nests and chicks.

Migration

The Pacific Golden-Plover and the American Golden-Plover have very different migration routes but both make some of the longest migrations in the world and undergo long nonstop flights over water. Pacific Golden Plovers winter in South East Asia, Australasia, or on the Pacific Islands. The birds that nested in Alaska migrate over the Pacific Ocean often choosing to winter in Hawaii.

Threats to Pacific Golden Plovers

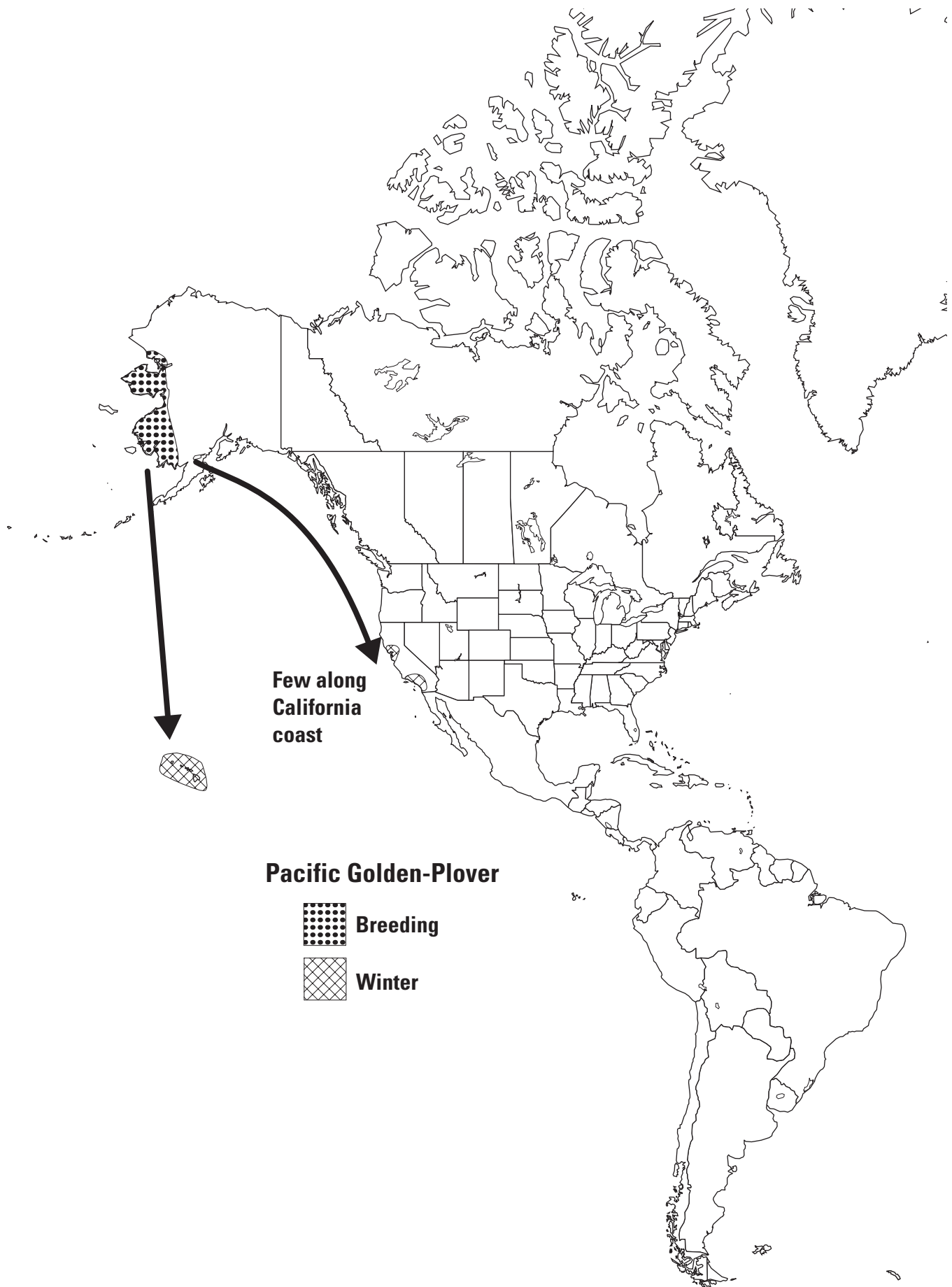
Like many shorebirds, market hunting of the 19th and early 20th centuries nearly wiped out the Pacific Golden-Plover. Today, contaminants, feral animals, roaming pets and bad weather during migration take their toll on these birds.

Thankfully, most of the breeding ranges of the Pacific Golden Plovers remain in tact today and they are relatively unexploited. Agriculture, ranching, and urbanization are putting their winter ranges and migratory routes under pressure. Those that winter on Golf Courses in Hawaii do come in contact with hazardous chemicals.

Something to Think About...

What prevents hunters today from shooting migrating shorebirds?





Note: Arrows indicate general migration routes for both spring and fall.



American Avocet

(*Recurvirostra americana*)

Description

This tall, graceful, beautiful bird has long, gray-blue legs and a long, slender, upturned black bill. The male and females look the same in all plumages except that the male's bill is a little longer and straighter than the female's. During the breeding season their grayish hood turns a rust color. American Avocets have wings that are black and white above. They have white underwings and a white belly.

Behavior

Avocets are easy to spot in a group by the way they sweep their slim, upcurved, sensitive bills side to side through the water straining out aquatic insects, crustaceans, tiny shrimp and fish. You can find them frequently swimming, like phalaropes, and tipping up to feed like marsh ducks.

Call

The call of the American Avocet is a loud "wheet."

Nonbreeding

Avocets will use a wide variety of habitats in the nonbreeding season. They may also gather and feed in large flocks.

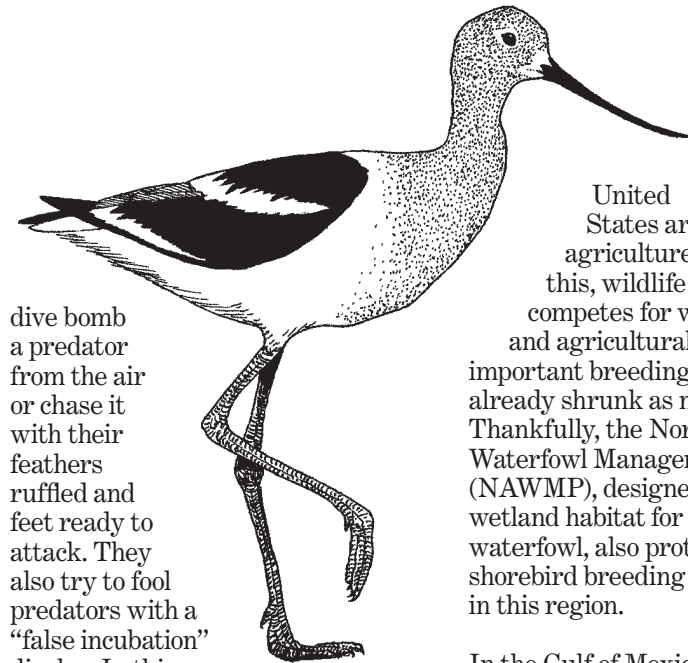
Habitat

These long-legged waders prefer shallow lakes, sloughs, and marshes year around. American Avocets are more commonly found in the West where they breed on sun-baked flats near saline lakes, North American prairies, lakes and marshes in the Great Basin, and at coastal estuaries and ponds.

Breeding

American Avocets are monogamous, semi colonial breeders found in especially large numbers in the marshes of the Great Salt Lake and the northern Great Basin.

American Avocets are well known for their aggressive displays. They will



dive bomb a predator from the air or chase it with their feathers ruffled and feet ready to attack. They also try to fool predators with a "false incubation" display. In this case, the bird crouches on the ground as if it is incubating its eggs. As soon as the predator gets close, the avocet gets up and runs away leaving a confused predator behind.

These shorebirds also have elaborate courtship rituals. For example, after copulation, the mating pair crosses bills and the male drapes his wing over the female's back. Together the male and female select a site and build a simple hollow lined with grass where the female lays 3 or 4 eggs. Avocets are known to rebuild flooded nests using sticks and feathers.

Migration

American Avocets are considered to be medium-range migrants flying about 2,000 miles to their wintering grounds on the shores of the Southern United States and Mexico.

Today's Population

There are about 450,000 American Avocets today. Most are found in western North America using the Central Flyway during migration

Threats to the American Avocet

Today, half of all upland grasslands in the prairie pothole region of the

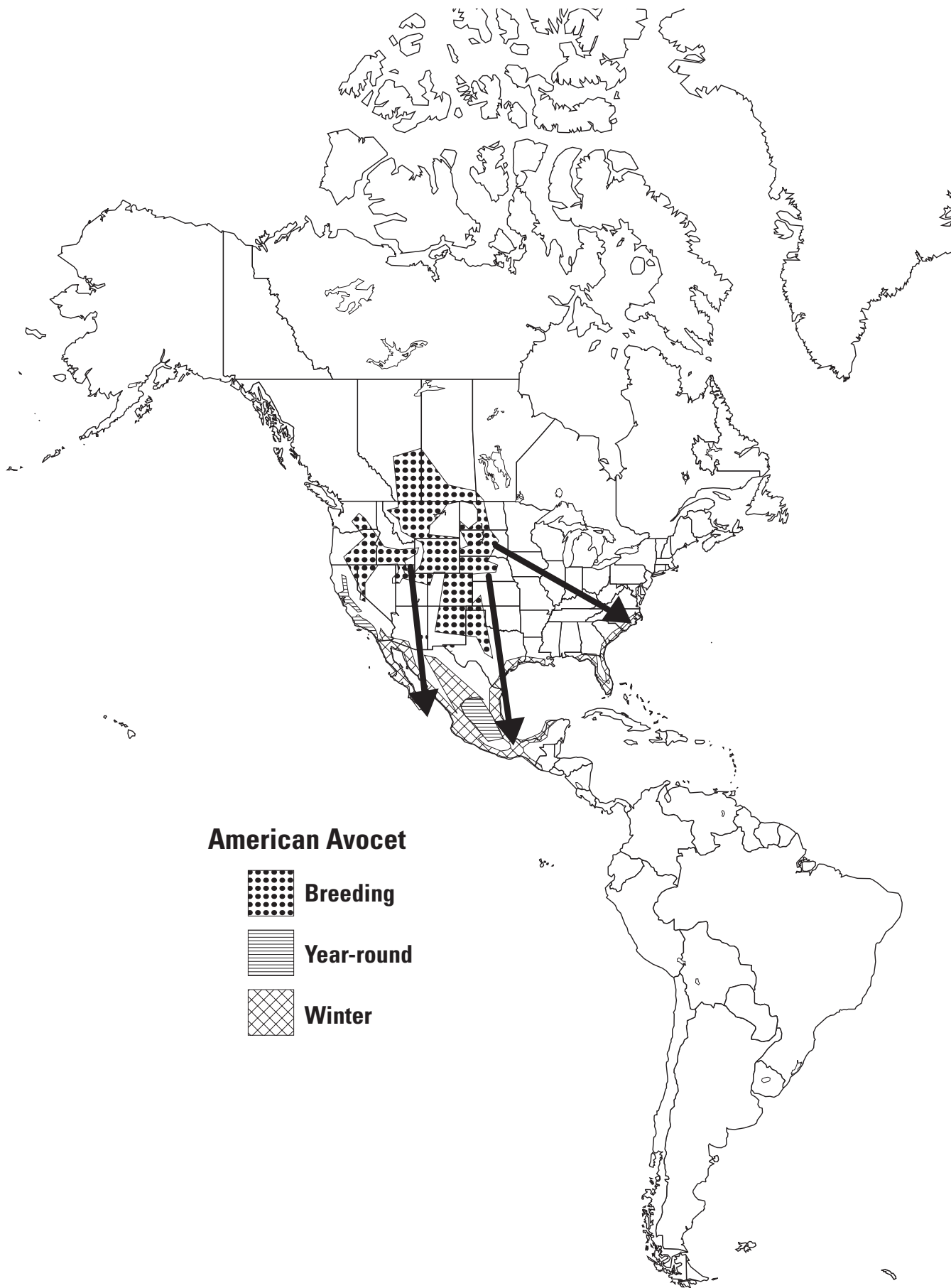
United States are now agriculture. On top of this, wildlife in the dry west competes for water with urban and agricultural areas. Some important breeding sites have already shrunk as much as 90%. Thankfully, the North American Waterfowl Management Plan (NAWMP), designed to protect wetland habitat for migrating waterfowl, also protects what shorebird breeding grounds are left in this region.

In the Gulf of Mexico, possible oil spills threaten avocets. The Houston Ship Channel, an Inter-Coastal Waterway with the largest oil port in the United States, runs right along Bolivar Flats Reserve, an important staging site and wintering area for avocets.

Another important wintering area on the Gulf of Mexico, Laguna Madre, has been drained to grow cotton and sorghum. Agricultural herbicides and pesticides runoff into this wetland poisoning the food chain. Scientists found that shorebirds in Laguna Madre had enough chemical residue in their bodies to make them unable to reproduce.

Something to Think About...

What other programs, besides the NAWMP, are in place to preserve shorebird habitat? You might want to check out the "conservation link" on the Shorebird Sister School Program to find out (<http://sssp.fws.gov>).



Note: Arrows indicate general migration routes for both spring and fall.



Black-necked Stilt

(*Himantopus mexicanus*)

*Subspecies Hawaiian Stilt (Ae'o in Hawaiian)
is a state and federally listed endangered bird.*

Description

The Black-necked Stilt is one of the largest shorebirds. Stilts measure 14-23 inches tall, about the size of a crow. The Black-necked still also has the reputation of having the longest legs of any of the shorebirds. In fact, its legs are so long, that the bird appears to walking on “stilts.”

Black-necked Stilts are tall, slim waders with bubble-gum pink or reddish-pink legs you can't miss. Their long, needle-like bills are built to feed in water and also on the shore. The males are glossy black above with white underparts. Females are brownish-black above. Both males and females have a white forehead and spot over the eye and carry the same plumage all year.

Behavior

Stilts are often seen wading in deep water in search of food. They can be very aggressive when defending their nest and young. This is to make-up for their flashy appearance that almost eliminates any chance of using camouflage for defense.

Stilts prefer to land and take off from the water. They also have a habit of shaking the mud off their feet when leaving the water.

Call

The Black-necked Stilt's call is a loud “kek “kek” “kek.”

Nonbreeding

Stilts will use coastal habitats during this time.

Habitat

You will find Black-necked Stilts on the edges of salt and sewage ponds and shallow inland wetlands. They eat aquatic invertebrates, fish, bugs, and brine shrimp and flies.

Breeding

Stilts always breed near water. In fact, they may even nest on wet ground! Their nest is a shallow

depression on an island or along the shores of a lake, pond, or stagnant pool. They sometimes line their nests with pebbles, bits of shells, and sticks. Black-necked Stilts lay 4 buff-colored eggs that are well camouflaged by brown or black marks.

Like avocets, parents are monogamous, semi-colonial nesters, known for their aggressive displays against predators. Male and female stilts take turns incubating the eggs. In the hot environments where these birds nest, stilts help cool their eggs and increase the humidity in the nest by soaking their belly feathers in water before sitting on their clutch. Belly soaking eventually covers the eggs in a muddy, salty crust.

Black-necked Stilts are tolerant of other shorebirds nesting nearby. You often see them in the company of other stilts and avocets. However, they can be very territorial and aggressive toward neighboring chicks. Parents carefully keep their broods separated. A chick that wanders into another family's territory may get severely pecked on the back of its head!

Migration

Found throughout the southern and western United States, Black-necked Stilts migrate to coastal areas in the Southern United States and Central and Northern South America. The most critical staging sites are central California, the Salton Sea, and the Great Salt Lake.

Today's Population

Biologists estimate that 850,000 Black-necked Stilts can be found globally. Of these about 150,000 are found in North America. Most Black-necked Stilts use the Central Flyway.

The Ae'o, a non-migrating Hawaiian subspecies of the Black-necked Stilt, was brought to the brink of extinction by hunting, habitat loss, and the invasion of non-native mammalian



predators like the mongoose. Today, thanks to a ban on hunting and intense predator management, there are more than 1,4000 Ae'os on 6 of the 8 major Hawaiian Islands.

Threats to Black-necked Stilts

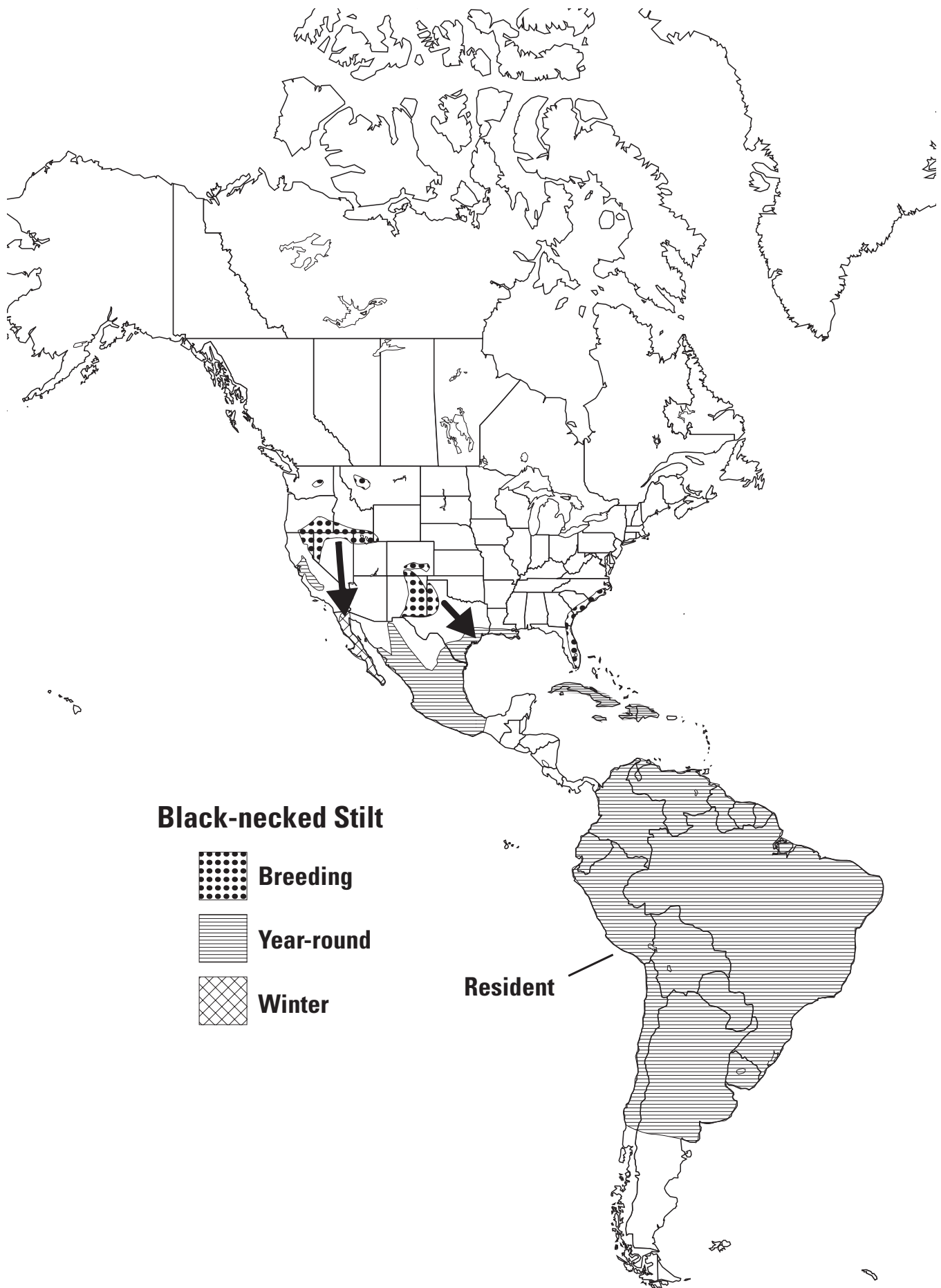
When water from wetlands is diverted to irrigate crops much runoff is often contaminated with residues of agricultural chemical and by products. High concentrations of selenium were found at Kesterson National Wildlife Refuge in California. Here, large numbers of stilts and other shorebirds were being poisoned by selenium.

Like many other shorebirds, habitat loss is always a threat. Yet, for Black-necked Stilts, this threat is counterbalanced in some areas by their use of salt and sewage ponds, agricultural evaporation ponds, and rice fields.

Something to Think About...

What North American shorebirds are on the federally endangered list?





Note: Arrows indicate general migration routes for both spring and fall.



Long-billed Curlew

(*Numenius americanus*)

Description

This is North America's largest sandpiper. It gets its name from its decurved bill, which may be as long as 9" in females.

Female Long-billed Curlews are larger than males, but their plumage are almost identical. They are cinnamon brown with black and buff-colored speckling above and cinnamon-buff below. They have grayish-blue legs and bright cinnamon buff wing linings.

The Long-billed Curlew is sometimes confused with the Whimbrel or the Marbled Godwit when it tucks its bill under its wing in a common shorebird resting pose.

Behavior

The tip of the curlew's upper mandible is actually soft and used to "feel" for prey as it probes the mud.

Call

The Long-billed Curlew also gets its name from their call that sounds like "cur-lee."

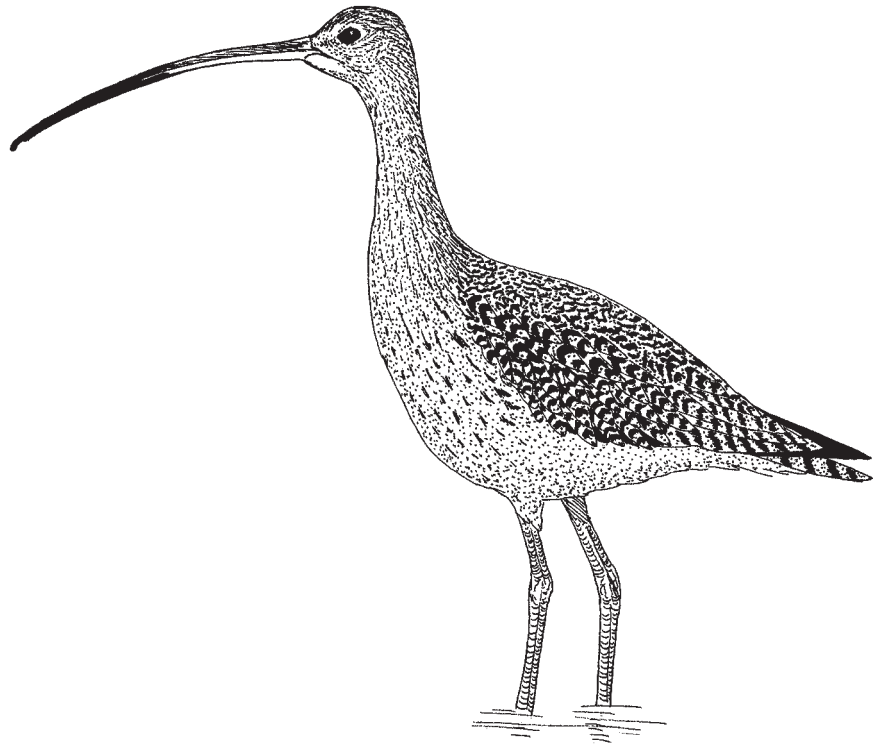
Nonbreeding Habitat

During the non-breeding season and during migration you'll find Long-billed Curlews on coastal beaches, salt marshes, and mudflats along estuaries, dining on fiddler crabs, crustaceans, small fish, and amphibians. Its bill is best adapted for capturing shrimp and crabs living in deep burrows on tidal mudflats.

Breeding

The Long-billed Curlew is one of only 9 species of shorebirds that breed on prairie and grasslands from West Central United States to the Prairie Provinces of Canada. Here they eat mostly grasshoppers, crickets, beetles, and earthworms.

Their nest is most often a bowl shaped grass-lined hollow on the ground. Sometimes the female Long-billed Curlew chooses to line her



nest with rabbit, goose, or livestock droppings! Once the nest is complete she lays four light beige to greenish or olive speckled eggs that are heavily speckled.

Both the male and female incubate the eggs and defend the young. About 2-3 weeks after the eggs hatch, the female abandons the male to care for the brood.

Migration

These medium- distance migrants, spend the winter on the coasts of California, Central America, and the Gulf of Mexico. While migrating, you might find Long-billed Curlews in plowed fields using their bills like tweezers to pull earthworms from their burrows.

Today's Population

These birds used to breed on U.S. prairies all the way to the Mississippi River. Unfortunately, market hunting and agricultural development has greatly reduced the Long-billed

Curlew's range to the West Central United States.

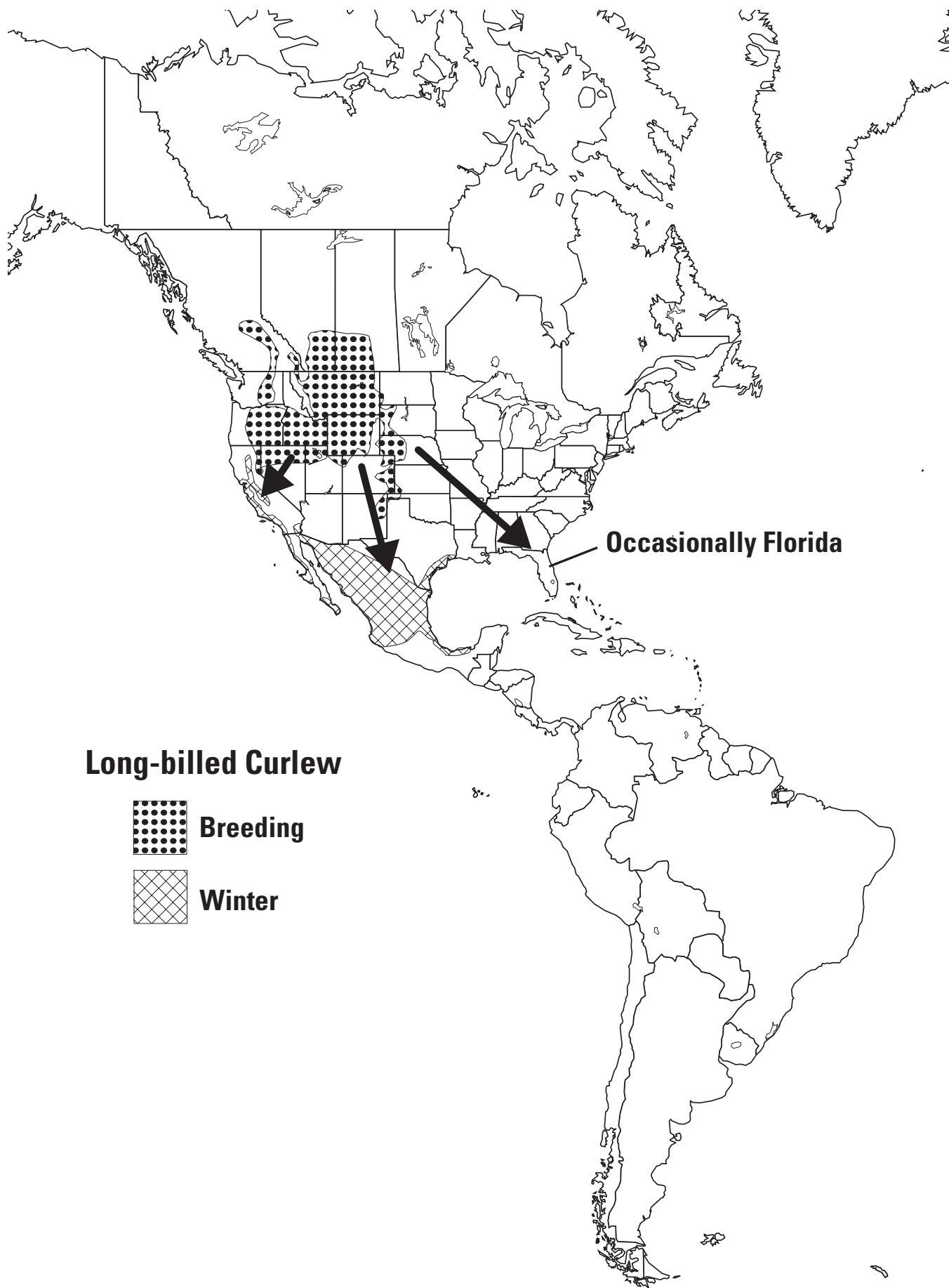
Threats to the Long-billed Curlew

Today, some of the most endangered wetlands in the United States are the prairie potholes of the American Great Plains. Already over half of these unique habitats are gone, drained for agriculture and urbanization. This has dramatically reduced the range and the breeding potential of many shorebirds including the Long-billed Curlew.

Fortunately, the North American Waterfowl Management Plan (NAWMP) is helping to bring back some of these critical wetlands. An emphasis on restoring marginal farmland that was once prairie pothole habitat should help the Long-billed Curlew.

Something to Think About...

What other shorebirds breed in prairie pothole habitat?



Note: Arrows indicate general migration routes for both spring and fall.



Marbled Godwit

(*Limosa fedoa*)

Description

This large shorebird is named for the marbled pattern of its upperparts which looks a lot like the patterns of the Long-billed Curlew. Like the curlew, Marbled Godwits are cinnamon-brown above speckled with black and buff coloration. Their plumage is cinnamon buff below with bright wing linings of similar color. They have medium length grayish-blue legs.

The key identification feature of the Marbled Godwit is its slightly upcurved, bi-colored bill. During breeding season the base of the godwit's bill is a brownish orange. The rest of the year it is pink at the base and blackish-brown toward the tip.

Call

The Marbled Godwit is also named for its call, a strong "ga weet ga weet." During the breeding season, Marbled Godwits often call in flight.

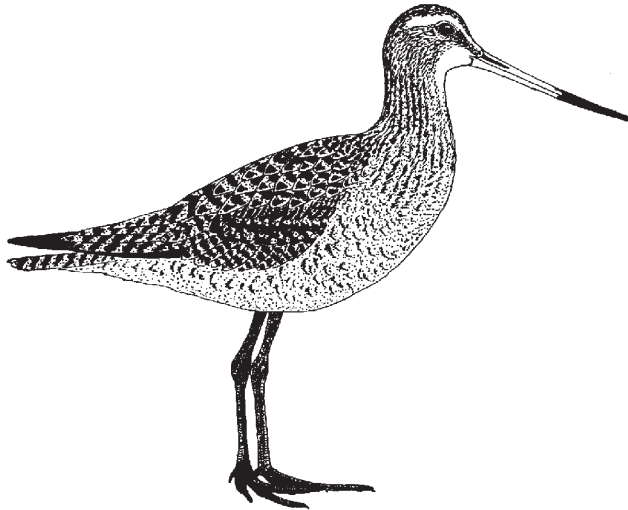
Non-breeding Habitat

In the non-breeding season, Marbled Godwits are essentially coastal birds. You will find them on intertidal flats of bays or rivers using their bill to probe deeply into the wet sand, mud, or soil.

Breeding

Western species of Marbled Godwits breed in grassy meadows of the northern interior of North America. Here they eat grubs, insect larvae, tubers, and the seed of aquatic plants.

Marbled Godwits perform many courtship displays intended to attract a female's attention. One of the most interesting is the Ceremonial Circling Flight. In this display, the male rises 20-90 meters from the ground and begins circling his territory with slow wingbeats and repeatedly calling "Ger-whit." When he's satisfied that he has a female's attention he glides with his wings spread out wide or makes a steep, impressive dive to the ground.



Like many shorebirds, Marbled Godwits are monogamous and lay 4 eggs in a simple hollow in the grass. Both male and female incubate the pale colored, spotted eggs and care for the brood. Marbled Godwits are so confident of their camouflage that they rarely flush from the nest if a predator approaches. In fact, biologists have discovered that adults can sometimes be picked up right from the nest!

The chicks are precocial, pecking and jabbing at insects and invertebrates in the grass from the very first day they hatch. Once the chicks are grown, male Marbled Godwits will leave their mate and flock together on the breeding ground.

Migration

This medium-distance migrant moves primarily along the Central and Pacific Flyways for wintering grounds on the West Coast. You can find them from Oregon to Central America feasting on sand crabs. Up to 200,000 Marbled Godwits stage at one time on the Great Salt Lake in the spring. They are less common but still regularly found along the East Coast from Virginia to Florida and on the Gulf Coast.

Today's Population

In the 19th century, many Marbled

Godwits were found along the northeastern Atlantic Coast and southward. But, market hunters nearly wiped out the population. Thanks to wildlife hunting laws that protect shorebirds, their numbers have increased. Still, it is fairly rare to see a Marbled Godwit north of Virginia today.

Threats to Marbled Godwits

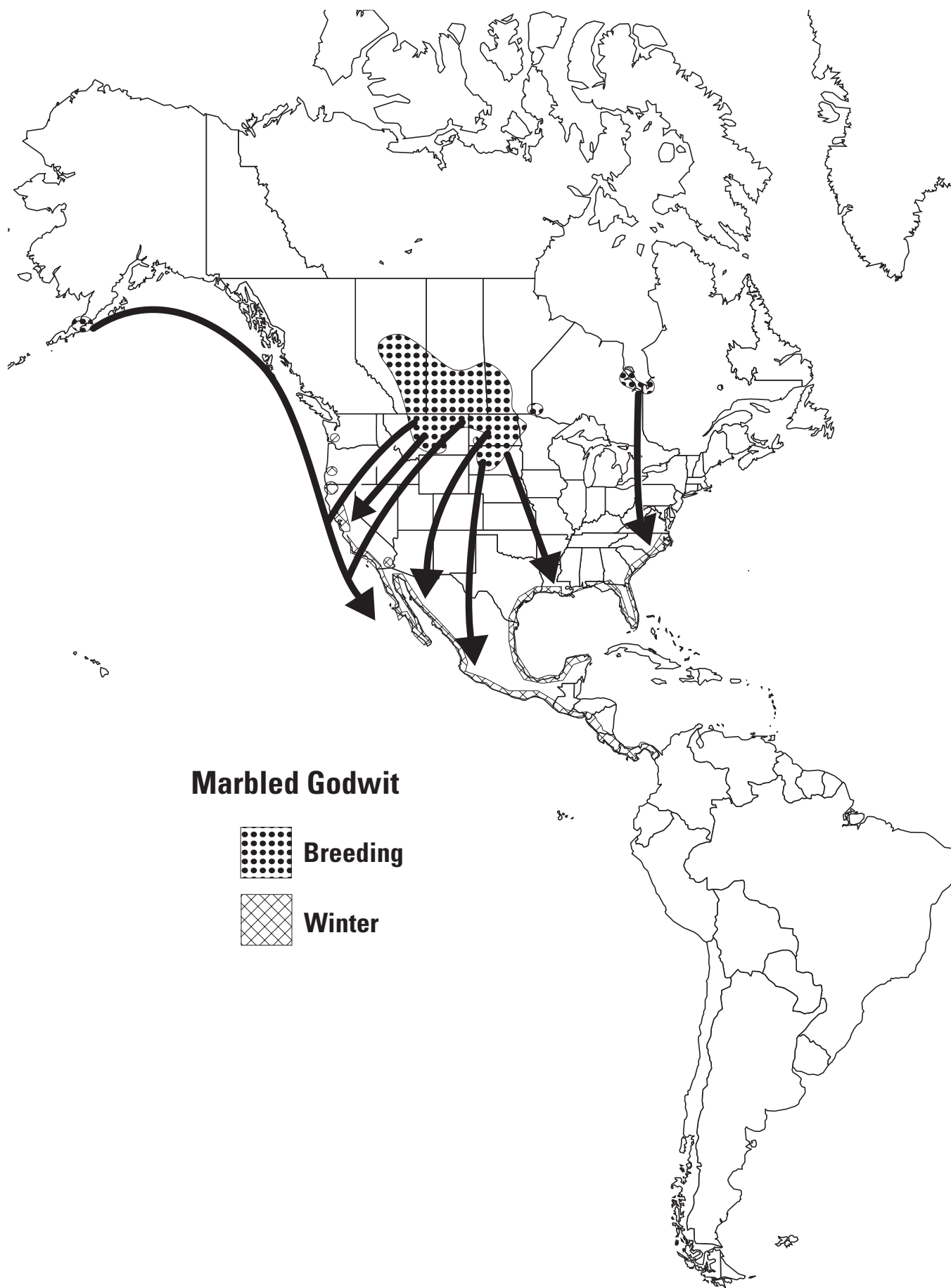
Today, some of the most endangered wetlands in the United States are the prairie potholes of the American Great Plains. Already 57% of these unique habitats are gone. In fact, 50% of the wetlands across in the United States have already been drained for agriculture and urbanization. This has dramatically reduced the range and the breeding potential of many shorebirds including the Marbled Godwit.

Fortunately, the North American Waterfowl Management Plan (NAWMP) is helping to bring back some of these critical wetlands. An emphasis on restoring marginal farmland that was once prairie pothole habitat should help the Marbled Godwit.

Something to Think About...

What other shorebird populations were severely affected by market hunting in the late 18th and early 20th centuries?





Marbled Godwit



Breeding



Winter

Note: Arrows indicate general migration routes for both spring and fall.



Spotted Sandpiper

(*Actitis macularia*)

Description

The Spotted Sandpiper is slightly smaller than a Robin standing 6-8" tall. It has a thin, short, pointed bill and small eyes. Its legs are usually green.

In non-breeding plumage, Spotted Sandpipers are grayish-brown above and white below and are missing the "spots" they were named for.

In breeding season however, they are mostly brown above with a heavily spotted underside.

Behavior

Spotted Sandpipers are sometimes called "bobbbers" after the way they constantly teeter, bobbing their tails up and down when standing on the sand or mud.

When flying, Spotted Sandpipers look as if they are "fluttering." On long distance migration flights they switch to more efficient deep wingbeats similar to that of other shorebirds.

You sometimes see Spotted Sandpipers snap an insect in midair.

Call

Spotted Sandpipers make loud, repeated whistles like "weet weet weet" or Peet weet."

Nonbreeding

They use a wide variety of habitat during this season including beaches, estuaries, ponds and riverbanks.

Habitat

The Spotted Sandpiper is the most widespread breeding sandpiper in North America because it eats many different kinds of wetland animal life. You will find Spotted Sandpipers in virtually any coastal or inland wetland across the continent except in the farthest southern and northern areas of the United States.

Breeding

Spotted Sandpipers are sexually



dimorphic, a more unusual breeding arrangement than most other shorebirds. Sex roles are reversed. It is the female that arrives on the breeding ground first, stakes out the territory, courts the male and then defends the nest. One the other hand, male Spotted Sandpipers tend the eggs and the chicks. Females are also sometimes polyandrous. They will mate and nest with more than one male within a single nesting season.

Migration

It is very common to see individual Spotted Sandpipers migrating south across the continent to the coastal southern United States. They also overwinter in the Caribbean and from Central America south to Northern Argentina and Chile.

While most shorebirds are known for their spectacular migratory flocks, Spotted Sandpipers migrate singly or in small groups.

Today's Population

Because the Spotted Sandpiper migrates singly or in small groups, population numbers are very hard to estimate. Biologists suspect that the population of Spotted Sandpipers lies within the 50,000 – 250,000 birds.

Threats to Spotted Sandpipers

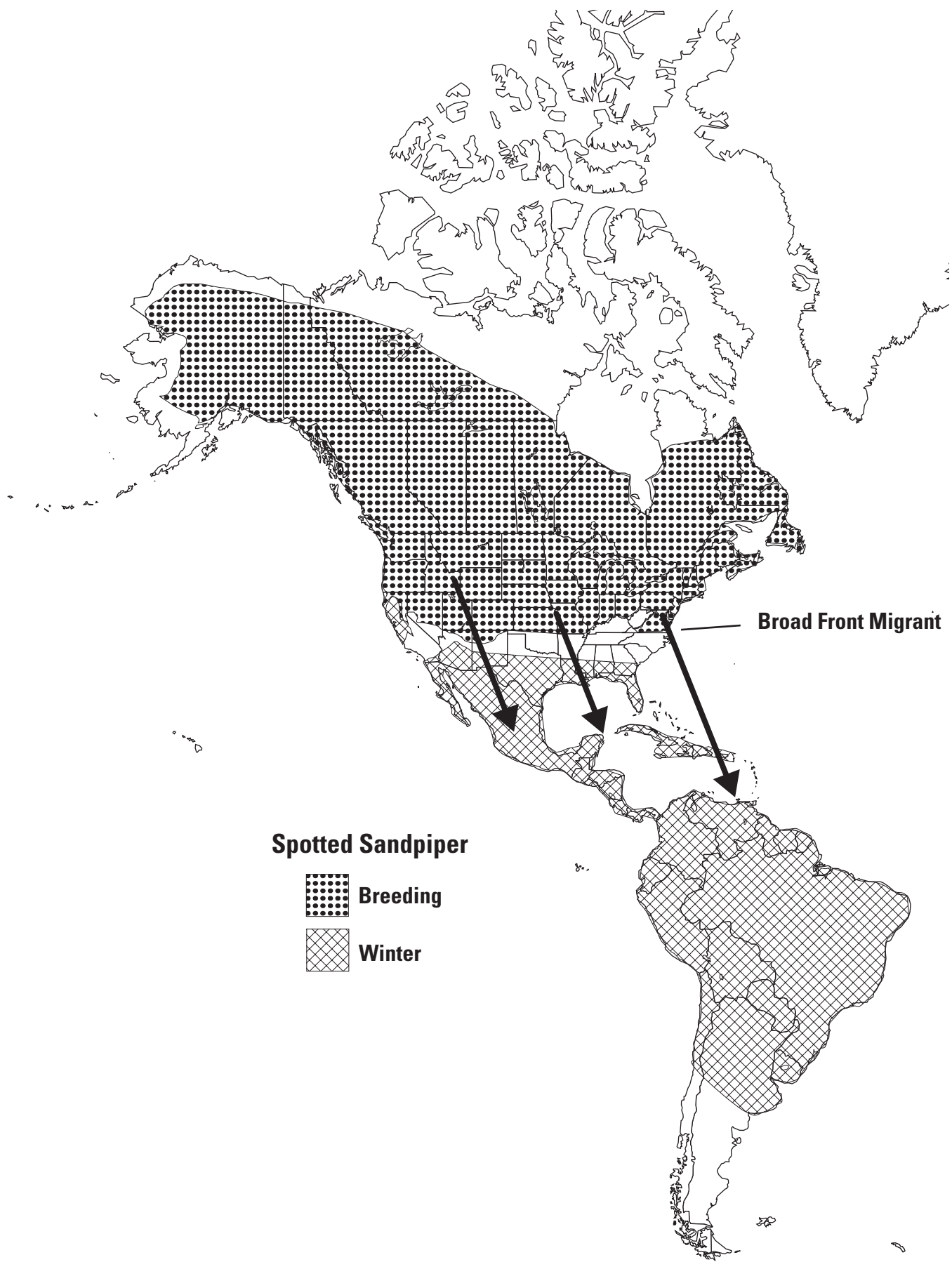
In Mexico, Central America, and Ecuador wintering sandpipers rely on a system of coastal mangrove swamps for food and shelter. Many parts of this habitat are being changed to meet the needs of commercial shrimp farms that also rely on the nutrient rich waters.

Another long-term threat to these and other shorebirds wintering in South America is the use of agricultural chemicals like DDT. While the use of DDT had been banned in the United States, shorebirds are picking up toxic levels of these chemicals when they feed on their wintering grounds. The highest levels of DDE (a toxic residue of DDT) were found in Spotted Sandpipers in Peru. This can make them unable to reproduce, weaken them for their migration back to breeding grounds, and cause death.

Something to Think About...

What other shorebirds have unusual mating systems like sexual dimorphism or polyandry? Why might these systems be an advantage in breeding?





Note: Arrows indicate general migration routes for both spring and fall.

Upland Sandpiper

(*Bartramia longicauda*)

Description

This odd-looking shorebird who almost never visits the shore is often seen with just its head and neck above the grass. The plumage of both the male and female look alike.

Upland Sandpipers has very long wings and a long thin neck. Their head is small which makes their eyes appear overly large. Their legs are long and yellowish.

Behavior

You sometimes see Upland Sandpipers perched on top of fence posts or telephone poles. They have a habit of stretching their wings up when they first land. Perhaps they are announcing their territory to other Upland Sandpipers nearby.

Call

Upland Sandpipers have what is described as a long, rolling “pulip, pulip” call.

Nonbreeding

These birds prefer similar habitat for nonbreeding as during the breeding season.

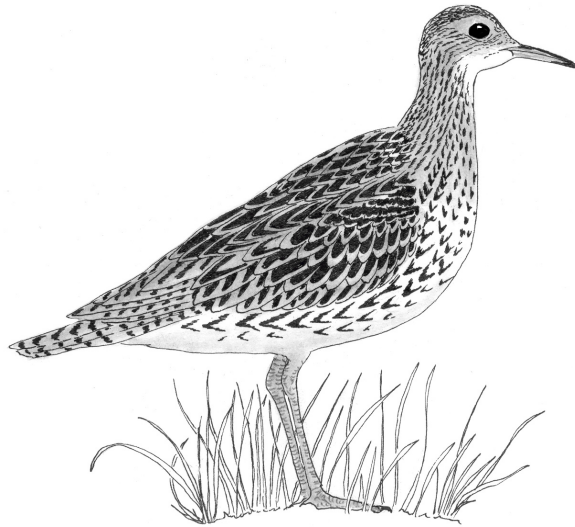
Habitat

The Upland Sandpiper gets its name from its preference for grassy habitats; pastures, prairies, alfalfa fields, golf courses, and even airports. They feed mostly on small invertebrates but also eat some weed seeds. In fact, unlike most other shorebirds, Upland Sandpipers spend most of their life away from water!

Breeding

The Upland Sandpiper is what biologists call a “widespread nester.” They are found nesting from southeastern Alaska to the Central Prairies and the Great Plains and then all the way to the northeastern United States.

Upland Sandpipers rarely nest alone. Loose colonies breed from the end of



April into August. Most are found in the Dakotas, Nebraska, and Kansas where there is prairie habitat. One the other hand, in the east where little prairie habitat remains, over ½ of the Upland Sandpipers nest on airport land!

Together the male and female build a typical shorebird nest, a scrape on the ground thinly lined with cow manure or grass. They may make up to 12 scrapes before finally deciding on one to use as their nest! Then the female lays 4 eggs evenly spotted with dark brown. Upland Sandpipers raise only one brood of precocial young in a season.

Migration

These shorebirds spend 8 months during the nonbreeding season in the pampas of South America. Most migrate through the interior of both the United States and South America using grassy fields as staging areas along the way. Most return to their nesting grounds using the same migration route.

Today's Population

The Upland Sandpiper was once found in great numbers throughout much of the United States. Early settlers collected their eggs and hunted the adults until their

population dropped. Farmers plowed the prairies for agriculture making the situation for the Upland Sandpiper even worse. Today, the numbers of Upland Sandpipers continue to decline in the northeast but appear to be climbing in the central United States.

Treats to Upland Sandpipers

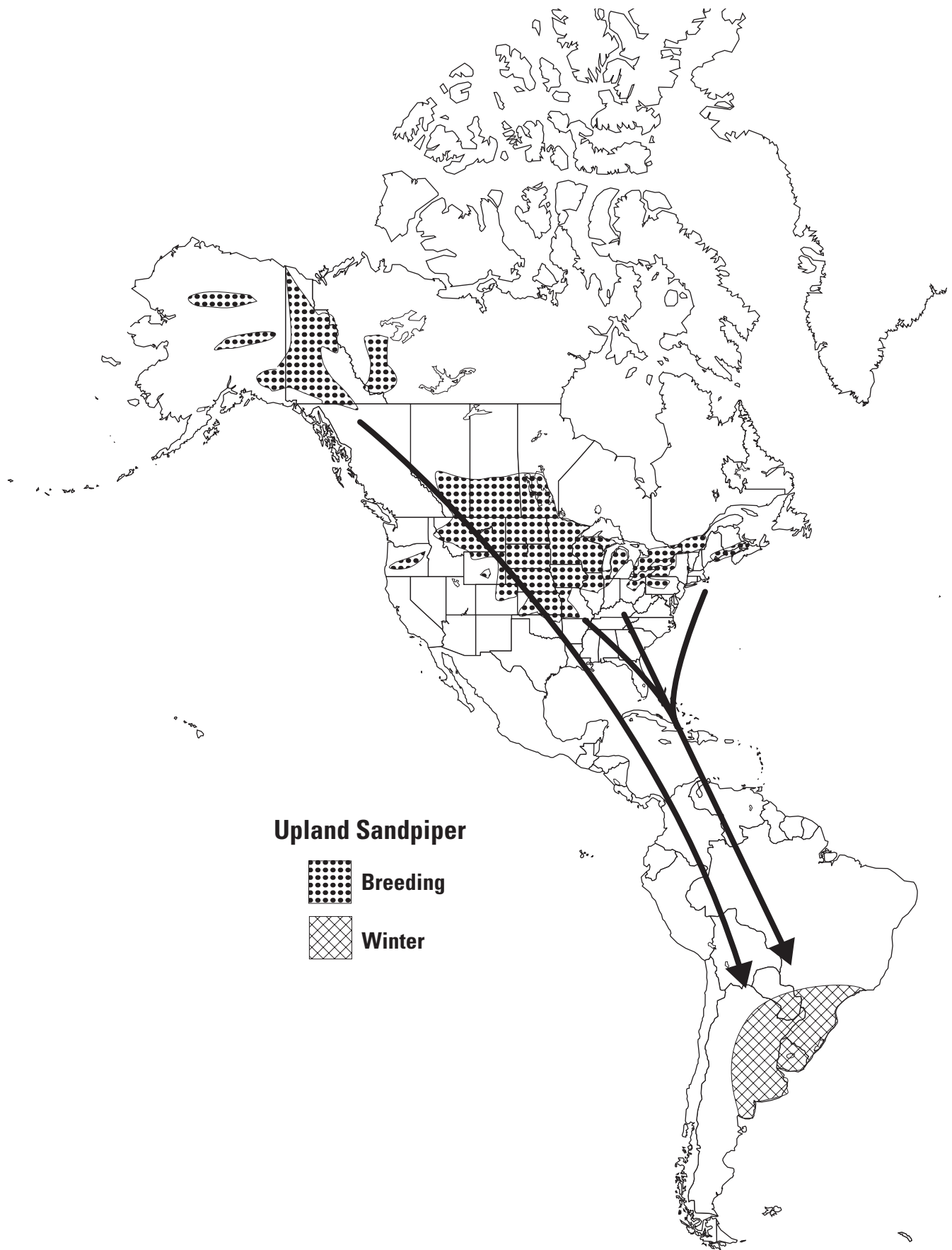
The greatest threat to this shorebird is loss of wintering ground in South America. Pampas, a sea-like plain of grassland habitat, is easily transformed to agriculture. This makes it one of the most threatened ecosystems in South America today.

Here in the United States, many Upland Sandpipers nest on privately owned ranch land. Their nests and young are disturbed, sometimes even trampled, by grazing cattle. Other potential nesting habitats have been lost to agriculture.

Something to Think About...

What is being done to protect the South American pampas and other important shorebird nonbreeding habitats?





Note: Arrows indicate general migration routes for both spring and fall.



Buff-breasted Sandpiper

(Tryngites subruficollis)

Description

The Buff-breasted Sandpiper is as an elegant and handsome shorebird. Its' small head makes this shorebird resembles a pigeon.

All the plumages of this medium sized shorebird are similar. It has a streaked brown crown and a buffy face and breast. It has a short, black bill and yellow-green legs.

Behavior

Male Buff-breasted Sandpipers are known for using the double wing breeding display when courting females. In this display, the male stretches out both of his wings, tips his bill toward the sky, and stands up tall on outstretched toes. Then he shakes his entire body moving his wings up and down making "tick" sounds. The females approach him as if they are inspecting the silvery-white linings of his wings.

Call

Buff-breasted Sandpipers are usually quiet birds. They sometimes make a low, growling "pr-r-r-reet" while in flight. These sandpipers also make clicking noises in the breeding season when doing courtship displays to attract females.

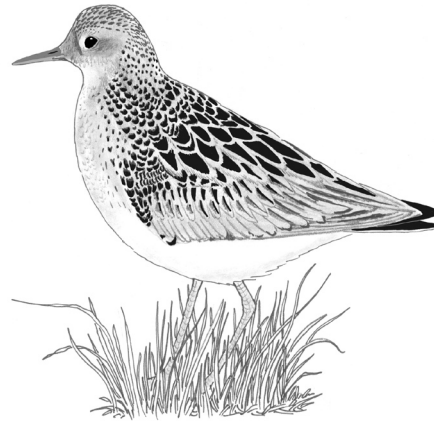
Non-breeding Habitat

The Buff-breasted Sandpiper is rarely found next to water. During the winter and migration you can find them on golf courses, airports, and the dry mud around rivers, inland lakes and reservoirs.

Breeding

Buff-breasted Sandpipers are known for their unique mating system. These shorebirds use leks, a gathering place where males make intense breeding displays to attract females. These leks are found on the drier tundra of the northern Alaska coast or on high arctic islands of Canada.

Once a male and female have formed a pair bond, the males will defend a



30-50 foot territory by chasing other males away or with wing-flashing and wing-waving displays. Flutter-jumping, where two males rise together up in the air as high as 20 to 40 feet, is also meant to intimidate other males.

Once the pair has mated, the male, who is promiscuous, begins looking for another mate. The female is left to build her nest, lay and incubate her eggs, and raises her chicks alone. She selects the nest site and digs a scrape on the ground. She lines her nest with lichens, dead willow leaves, or moss. She then lays four buff-colored eggs that are heavily camouflaged with dark spots and splotches. Buff-breasted Sandpiper chicks are very precocial and soon after hatching move quickly through the grass catching their own food.

Migration

Buff-breasted Sandpipers migrate south through the center of both North and South America stopping to winter on the grazed pampas of South America. They use the same route, perhaps veering a little more to the east, on their way back to their breeding grounds in the spring. During migration flights, Buff-breasted Sandpipers prefer to stop on short grass habitats to feed on fly and beetle larvae, other insects, and spiders. They rarely eat marine invertebrates.

Today's Population

Human activities like hunting and agriculture brought the Buff-breasted Sandpiper to near extinction in the early 1920s. Their extreme tameness and tendency to return to a wounded bird made them easy targets for hunters. Today, there are probably less than 25,000 of these grassland shorebirds left.

Threats to the Buff-breasted Sandpiper

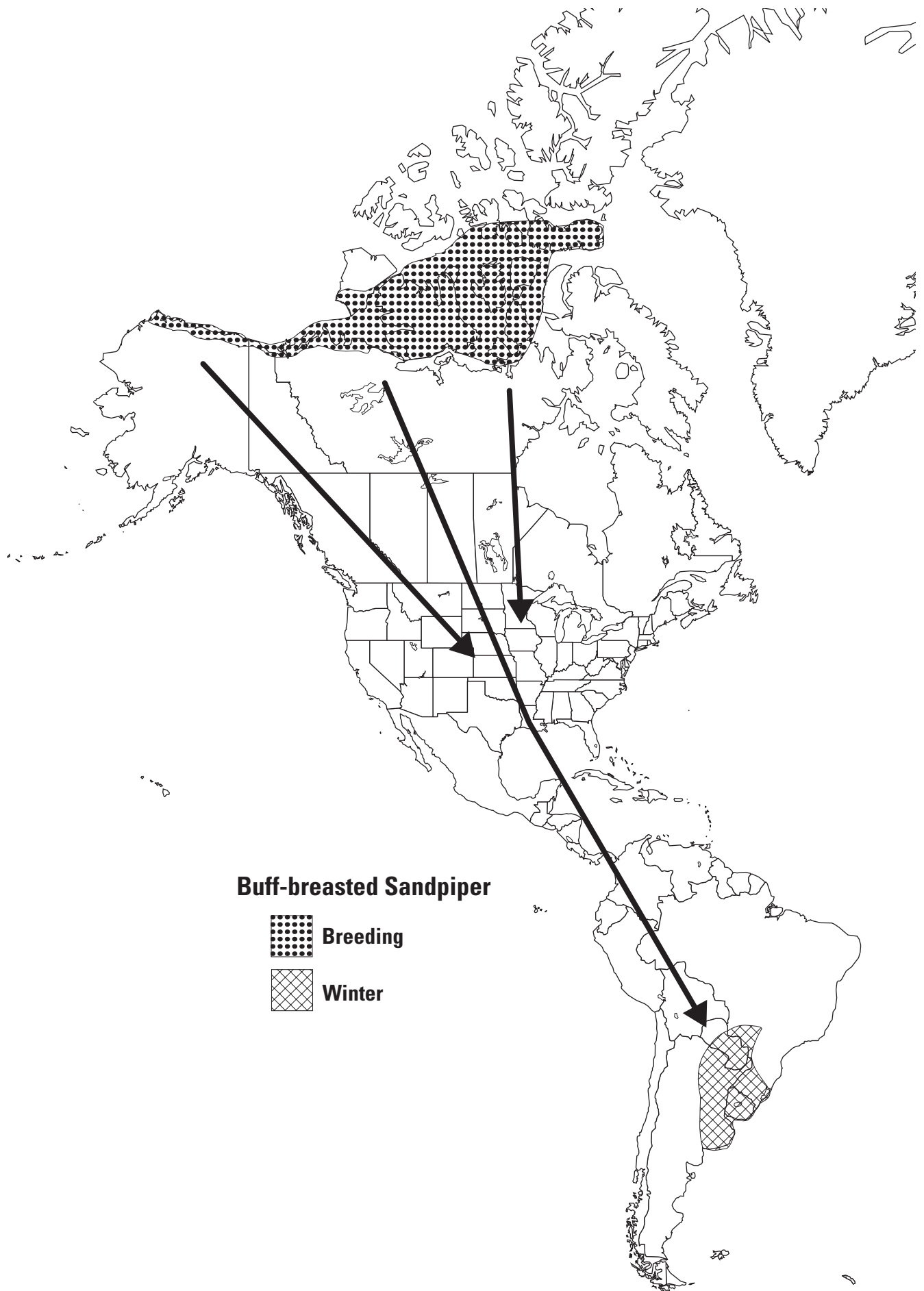
Biologists don't expect things to get any better for the Buff-breasted Sandpiper in the near future for several reasons. They are already a small population of birds. Very little of the habitat they need is left and much of the remaining grassland is privately owned. Buff-breasted Sandpipers also stage in large numbers at sites that are threatened by further development.

Perhaps the most critical threat to Buff-breasted Sandpipers today is the loss of their wintering grounds in South America. Pampas, a grassland habitat, is easily transformed to agriculture and is one of the most threatened ecosystems in South America today.

Something to Think About...

What other shorebirds use leks as part of their mating system?





Note: Arrows indicate general migration routes for both spring and fall.



American Oystercatcher

(*Haematopus palliatus*)

Description

Large and showy, and a bit funny looking, the American Oystercatcher is a common coastal salt marsh and sandy beach shorebird. Its bright red-orange bill is sturdy and laterally flattened, built for opening mussels and oysters. In young birds the bill is a pinkish brown and dusky black toward the tip. It has a yellow eye and an orange-red eye ring.

Breeding and non-breeding plumage is almost identical in American Oystercatchers. They have black heads and necks and dark blackish-brown underparts. They have white wing and uppertail patches. Their legs are a tan or sand color.

Males and females look alike but females are larger and heavier than males.

Behavior

Oystercatchers use their bill to probe the mud for soft-shell and razor clams. Once they have hold of their dinner, they have two techniques for removing clams and mussels from their shells. They might plunge their bill, which is a cross between a knife and a chisel, into the open shell of an unsuspecting clam. Or they “hammer” the shell with a few well-aimed blows.

Call

The American Oystercatcher makes a combination of loud rising and lowering whistles that sound like “weep weep.”

Nonbreeding

These birds use coastal habitats during this time. The largest flock of American Oystercatchers on the Atlantic coast spends the nonbreeding season at Cape Romain National Wildlife Refuge.

Habitat

These shorebirds are only found in marine waters on the east and west coasts. New, large coastal reserves

in Virginia and North Carolina are protecting critical habitat where the largest groups of oystercatchers now live.

Breeding

The eastern race of American Oystercatchers breed on the Atlantic and Gulf Coasts from New England south to Texas. The western race uses the shores of western Mexico and Central America. Since Oystercatchers are monogamous and most don't migrate, biologists think that these shorebirds may mate for life!

American Oystercatchers nest on marsh islands, upland dunes, or right on the beach. Their nest is a simple scrape lined with tiny pebbles, bits of shell and seaweed. A pair of oystercatchers may make up to five nests before deciding on which one to use! In marshy spots the oystercatcher may line its nest with reeds. The 1–3 eggs they lay are extremely well camouflaged. They are colored like the sand and marked with dark splotches that look like little bits of shell and stones.

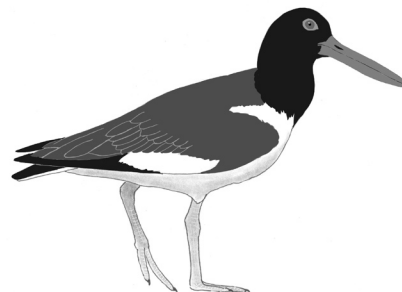
Oystercatchers are perhaps the most attentive of all shorebird parents. Without the rush to migrate, oystercatchers spend up to a year feeding and teaching their chicks how to find and open clams and mussels.

Migration

The American Oystercatcher is considered to be a resident shorebird. They will flock up in the fall and winter but only those birds from the middle and northern Atlantic regions migrate south in the winter.

Today's Population

Unlike other shorebirds, the numbers of American Oystercatchers along the Atlantic Coast has grown in the last two decades. In fact, this is one of the few shorebirds that has actually expanded its range northward. Their success may have



to do with the fact that they are such specialized feeders and attentive parents. It may also help that they are strictly coastal birds that migrate only short distances if at all! Still, today's population of American Oystercatchers is still less than 10,000 birds.

Threats to American Oystercatchers

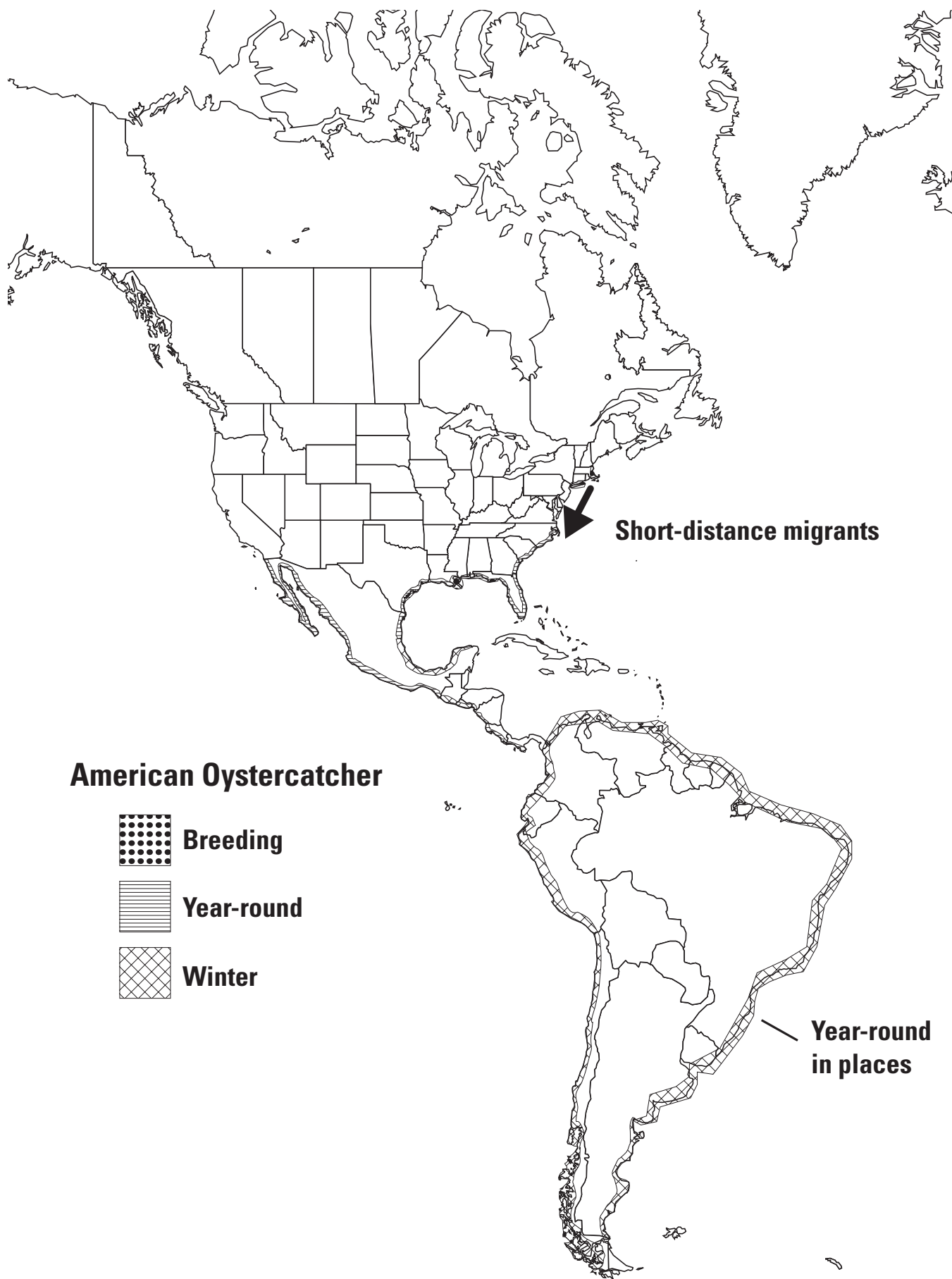
These shorebirds are shy and intolerant of people. Since coastal property is always in demand for recreation and development, people are perhaps the greatest threat to breeding American Oystercatchers.

The American Oystercatcher builds nests in open, sandy areas they are very vulnerable to predators like red fox, cats, dogs, or even other birds. Pollution is another threat to the oystercatcher population if the levels are high enough to affect the shellfish these shorebirds feed on.

Something to Think About...

Can you find another shorebird whose population has actually increased in the last decade? Why is this species doing better today than ever before?





Note: Arrows indicate general migration routes for both spring and fall.



Wilson's Phalarope

(*Phalaropus tricolor*)

Description

This medium-sized, swimming member of the sandpiper family has the longest and slimmest bill of all the sandpipers. Its black bill looks almost like a needle. It has a large body with a long neck and a small head.

Females are larger and more brightly colored than males. Their underparts are patterned pearly gray, rufous red, and black in the breeding season. The female's crown, nape and hindneck are a solid pearly gray. They have a black eye mask that continues down both sides of the neck.

The male Wilson's Phalarope has similar but duller coloring. In the non-breeding season, both males and females have a gray back, crown, and eye mask. Their underparts are white.

Behavior

Phalaropes look almost frantic when they feed. Spinning like wind-up toys on top of the water, they create a small whirlpool that temporarily stuns the larvae, crustaceans, and insects they feed on. Then they use their needle-like bill to pick their prey off the upper layer of water.

Call

The call of the Wilson's Phalarope includes a hoarse "wurk" and other low croaking sounds.

Nonbreeding

This species of phalarope uses fresh and saltwater wetlands during the nonbreeding season.

Habitat

Wilson's Phalaropes are salt lake specialists, found almost entirely in western North America during migration.

Breeding

Wilson's Phalarope is the largest and the most terrestrial of the three phalaropes found in North America (the others are the Red-necked

Phalarope and the Red Phalarope which stay primarily in the ocean). Their partially lobed feet help them walk on aquatic plants and wetland grasses.

A primarily inland shorebird, the Wilson's Phalarope breeds exclusively in the Nearctic on the grassy borders of shallow lakes, marshes, reservoirs, and prairie wetlands.

Wilson's Phalaropes, like Spotted Sandpipers, are sexually dimorphic. Sex roles, like plumage, are reversed. Females court the male and will chase other females away from her territory. Once she has found her mate, the pair looks for potential nest sites. A few days before laying the eggs, the male begins building a grass-lined hollow that serves as their nest. After laying 3-4 buff-colored eggs with brown markings, the male chases the female away and takes over the job of incubating the eggs and caring for the chicks. Sometimes female phalaropes are polyandrous and may choose to mate again with another male.

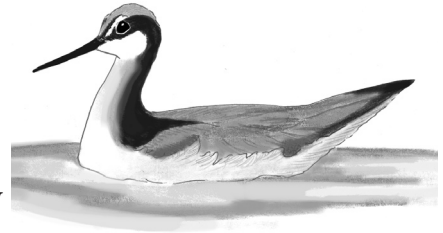
Migration

Wilson's Phalaropes begin their southern migration early in the summer, well before most other North American shorebirds. While the other two species of phalaropes winter at sea, the Wilson's migrates 3,000 miles to the fresh and brackish wetlands of South America. Females are often seen migrating as early as June.

Today's Population

Biologists think there are about 830,000 Wilson's Phalaropes in the United States and Canada with most along the Central Flyway.

One of the most well known and critical staging areas for Wilson's Phalaropes is Mono Lake in Northern California. Here as many as 90,000 of these shorebirds have been counted feeding and resting on the saline



mudflats, almost doubling their weight gorging on brine shrimp. This extra source of "fat fuel" prepares them for their non-stop, 60 to 70 hour migration flights to South America!

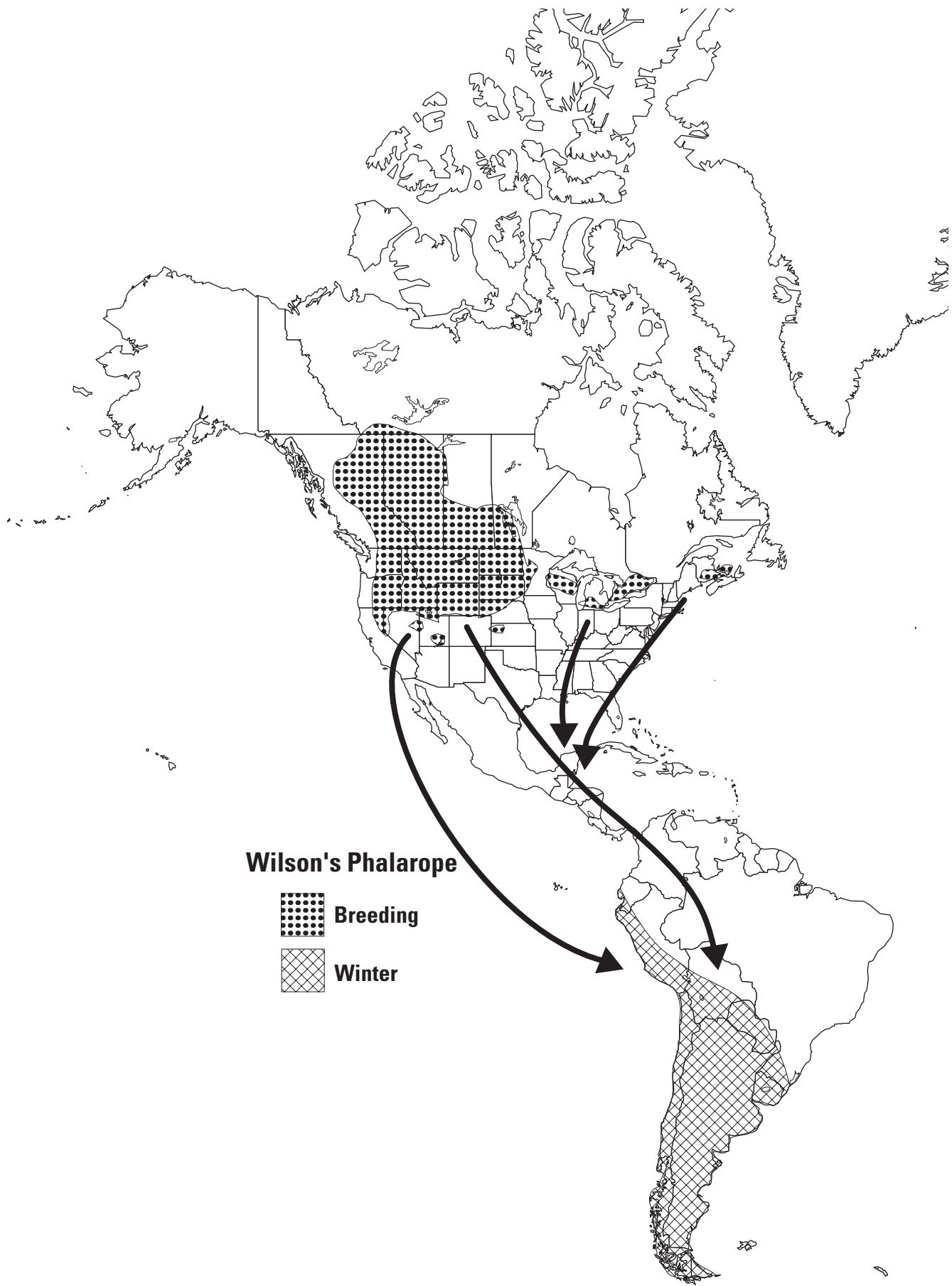
Threats to Wilson's Phalaropes

Many of the Wilson's Phalaropes that stop at Mono Lake are headed for Mar Chiquita, a wetland system in Argentina that is part of the Western Hemisphere Shorebird Reserve Network. Flocks of 500,000 of these birds, locally named Chorlo nadador grande (the "great swimmer plover"), are found on this nearly uninhabited region. Mar Chiquita, one of the largest salt lakes in the world is located in the central region of Argentina. A proposal to divert water from the country's Dulce River to neighboring states is under consideration in Buenos Aires. A water diversion project would dramatically change this vast wetland.

Something to Think About...

One of the greatest challenges in migratory bird conservation is the need to protect not only a bird's breeding habitat but also the critical staging areas and the habitats where they overwinter. What is the Western Hemisphere Shorebird Reserve Network and how does it work to meet this challenge?





Note: Arrows indicate general migration routes for both spring and fall.



List of Shorebird Coloring Pages

Avocets and Stilts (Family: Recurvirostridae)

American Avocet	519
Black-necked Stilt	520

Oystercatchers (Family: Haematopodidae)

American Oystercatcher	521
Black Oystercatcher	522

Plovers (Family: Charadriidae)

American Golden-Plover	523
Black-bellied Plover	524
Pacific Golden-Plover	525
Semipalmated Plover	526
Snowy Plover	527

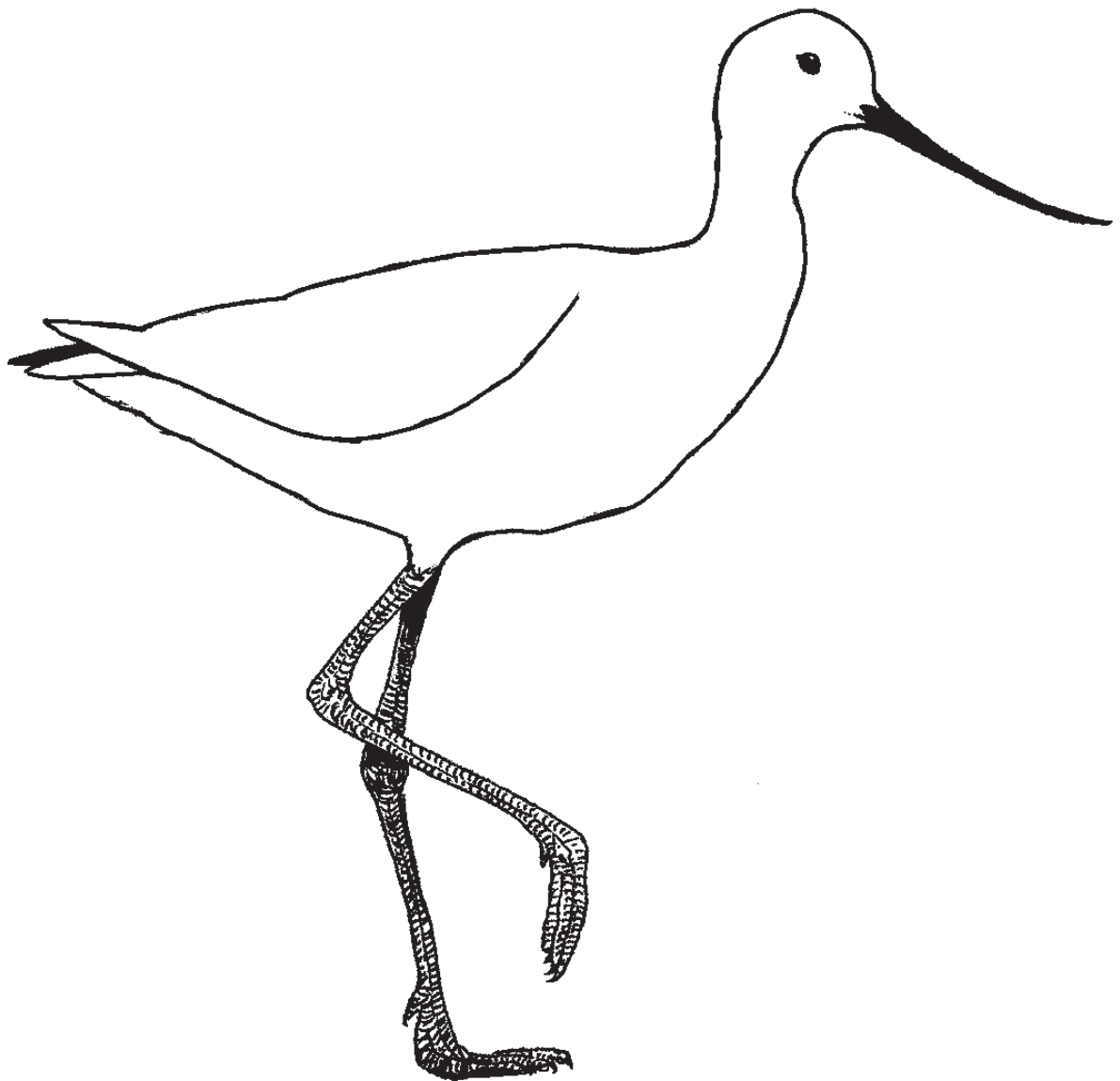
Sandpipers (Family: Scolopacidae)

Buff-breasted Sandpiper	528
Spotted Sandpiper	529
Upland Sandpiper	530
Western Sandpiper	531
Dunlin	532
Killdeer	533
Greater Yellowlegs	534
Red Knot	535
Sanderling	536
Wilson's Phalarope	537
Short-billed Dowitcher	538
Hudsonian Godwit	539
Marbled Godwit	540
Long-billed Curlew	541
Black Turnstone	542
Rudy Turnstone	543

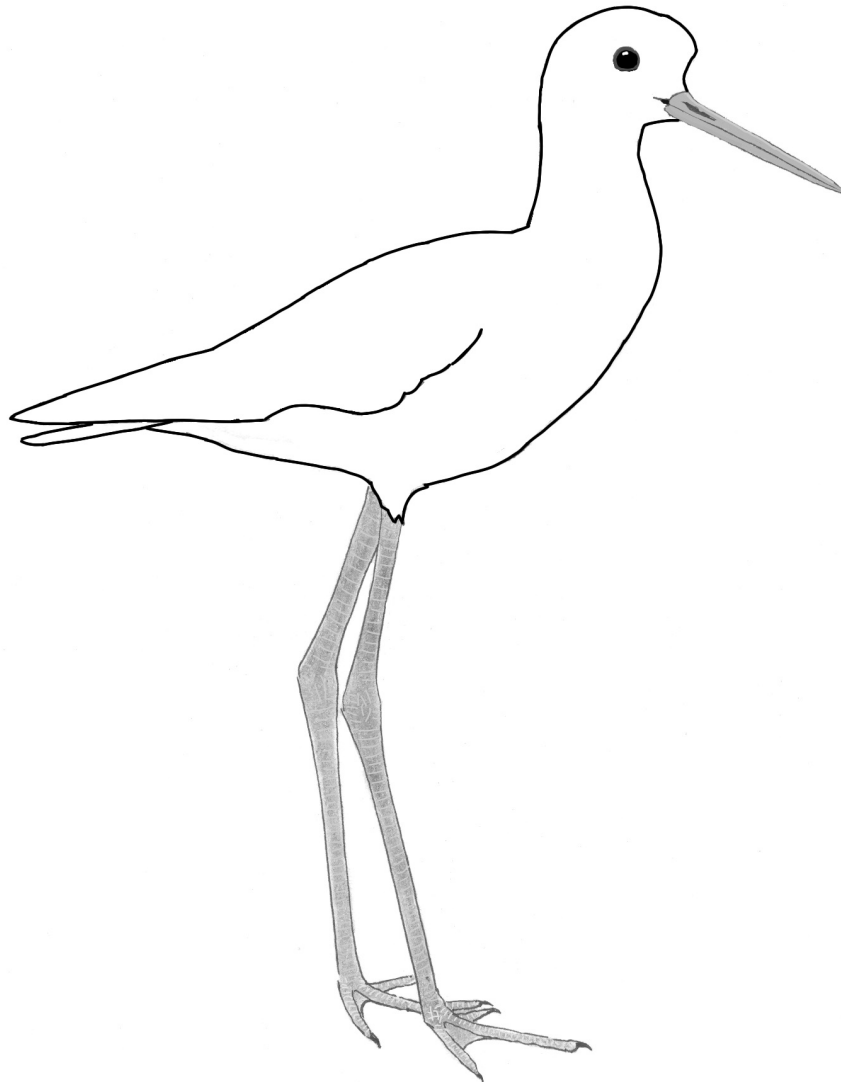
Shorebird Coloring Pages: All coloring pages are copyrighted © by George C. West, and used with permission. These pages may be reproduced without permission for educational use in conjunction with the activities contained within this guide. To view all his work go to <http://www.birchwoodstudio.com>.



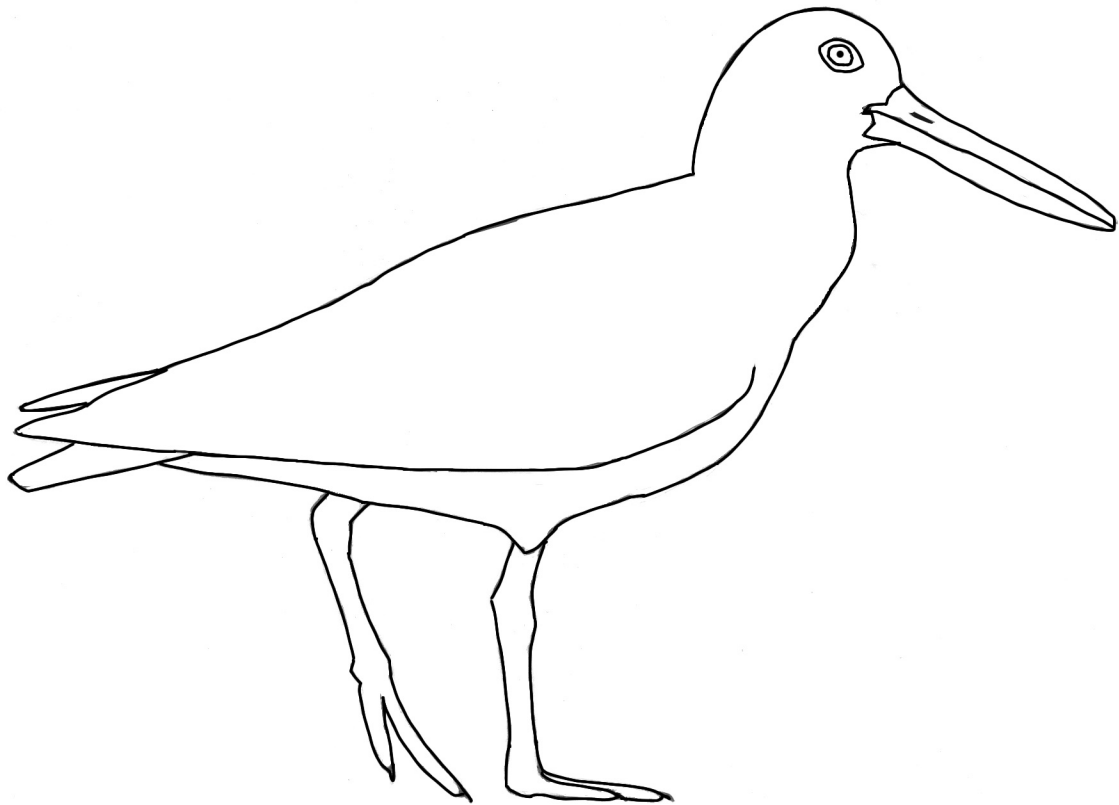
American Avocet



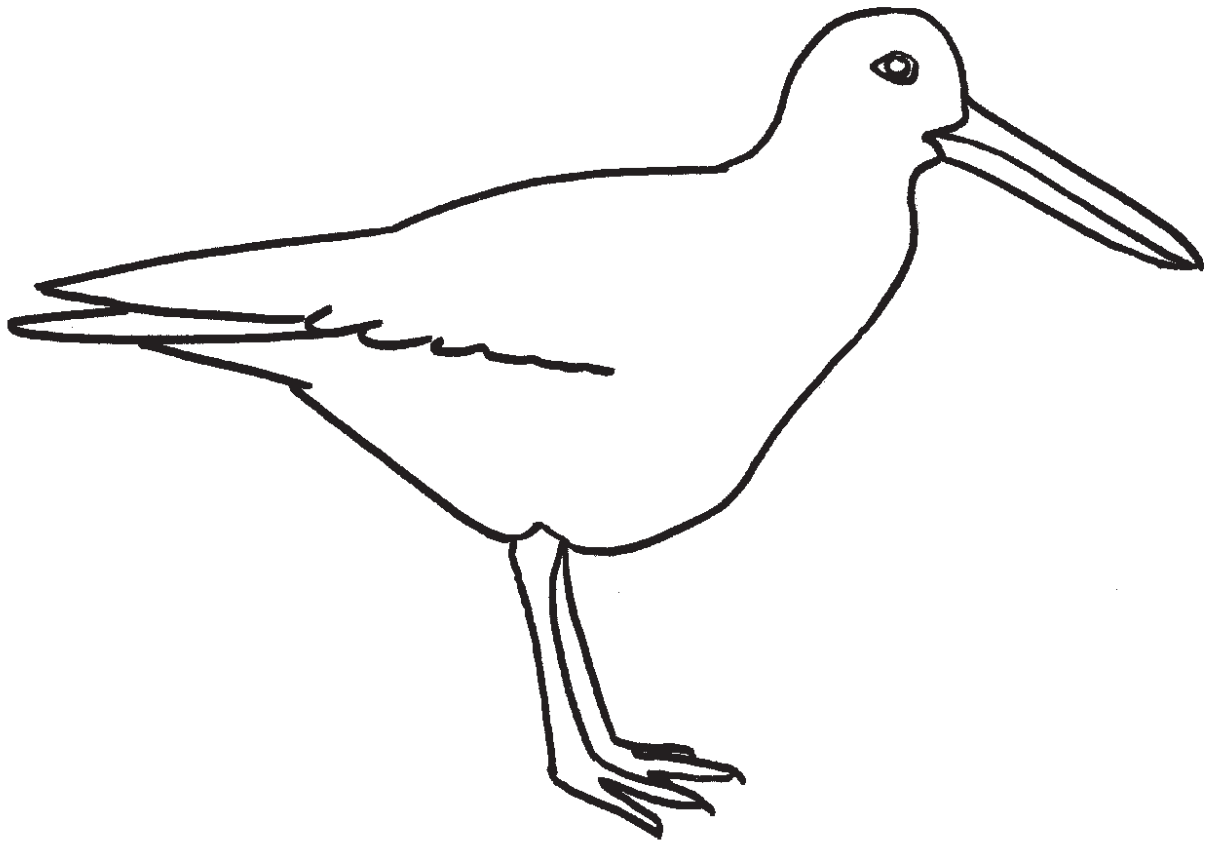
Black-necked Stilt



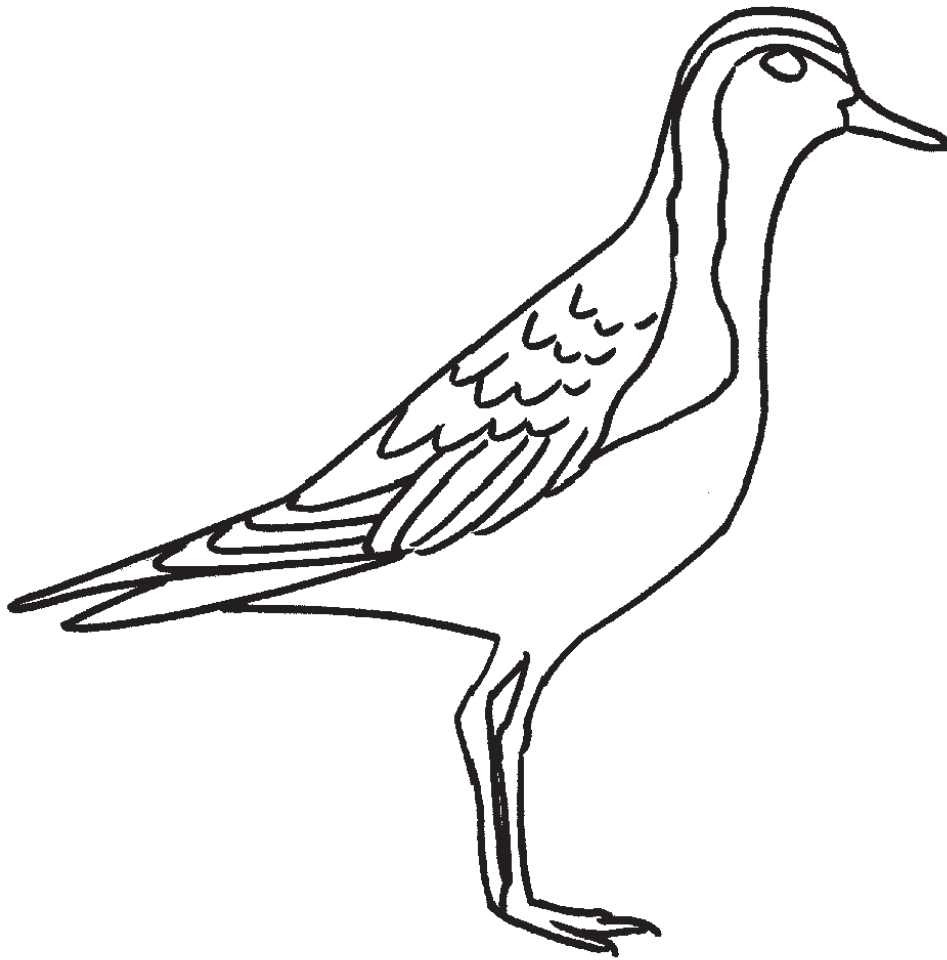
American Oystercatcher



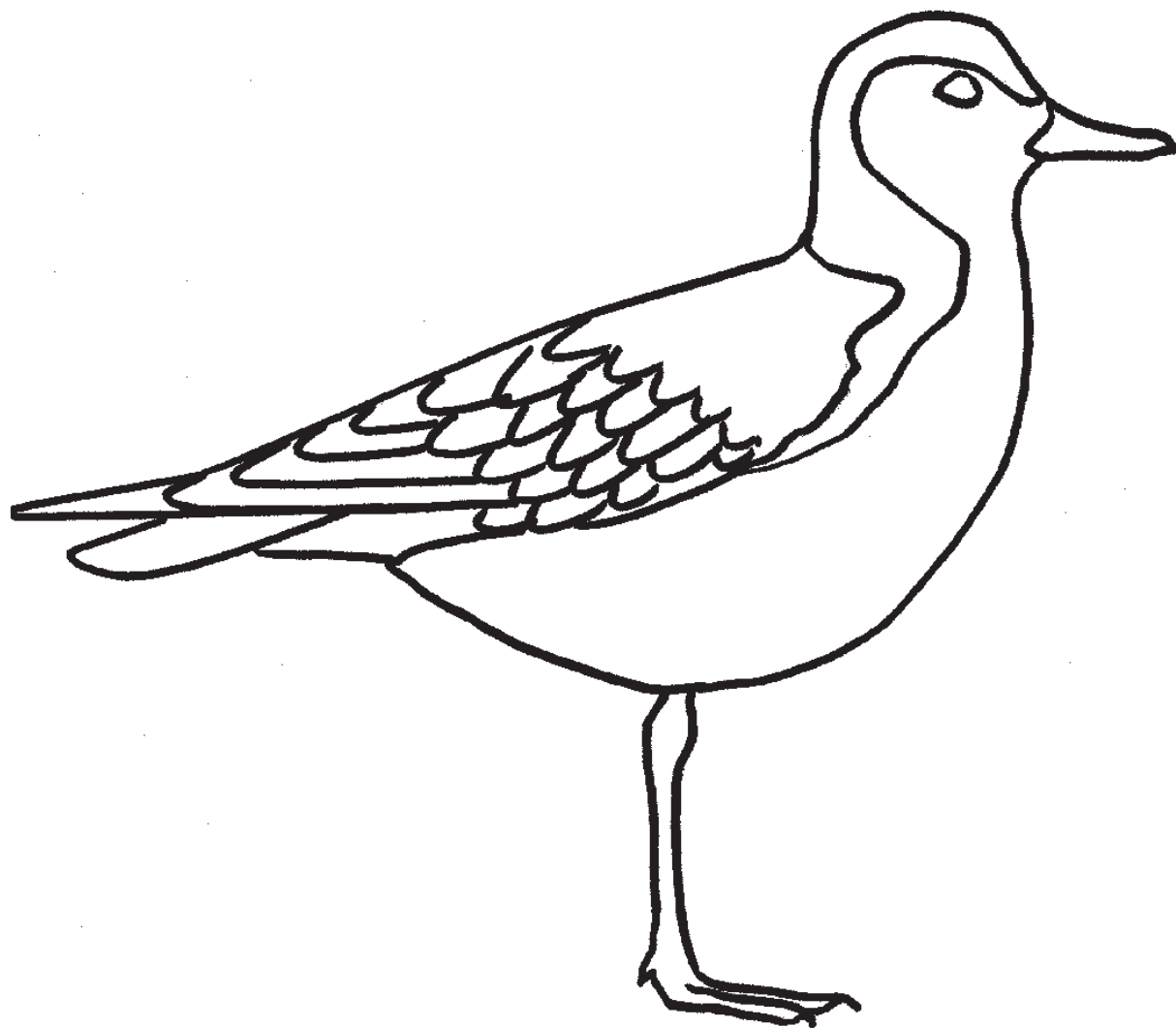
Black Oystercatcher



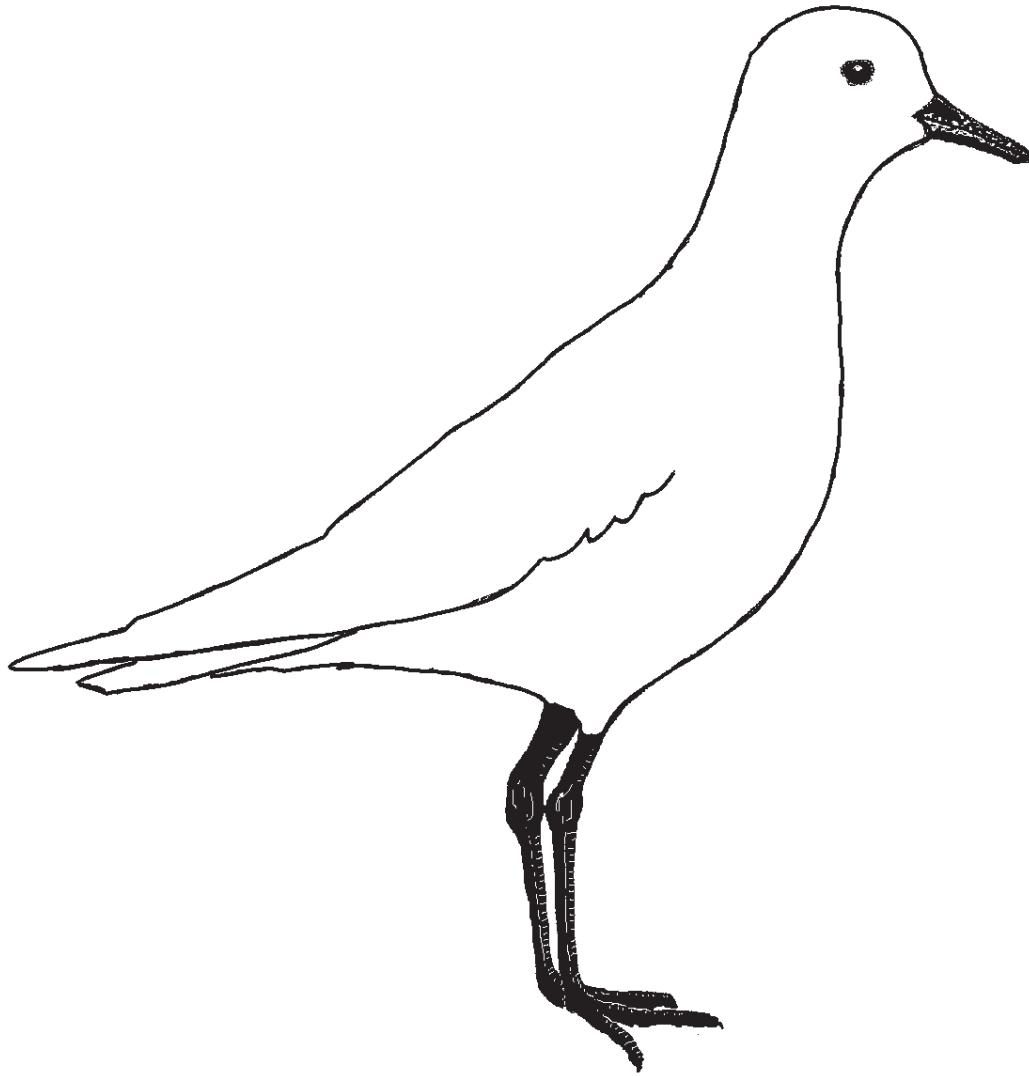
American Golden-Plover



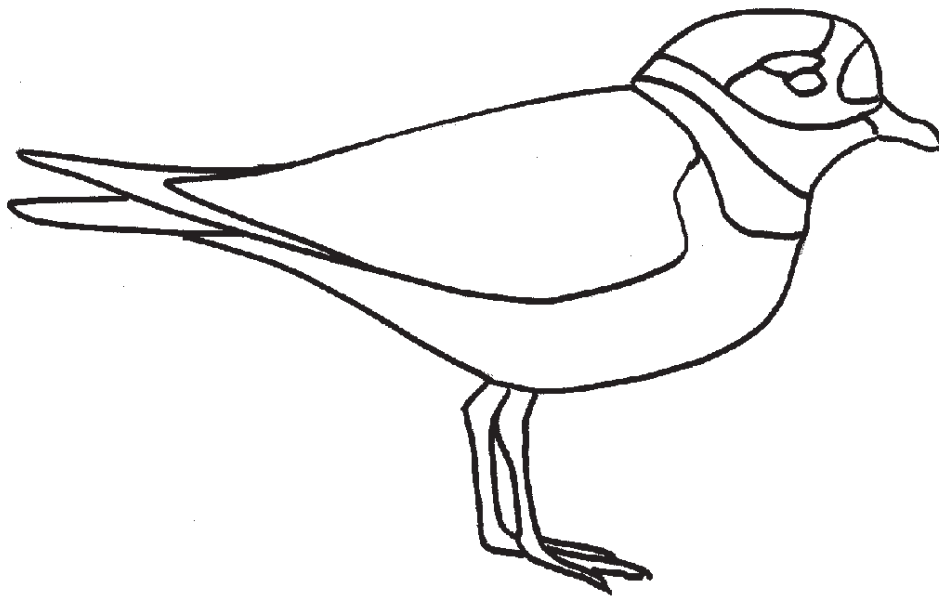
Black-bellied Plover



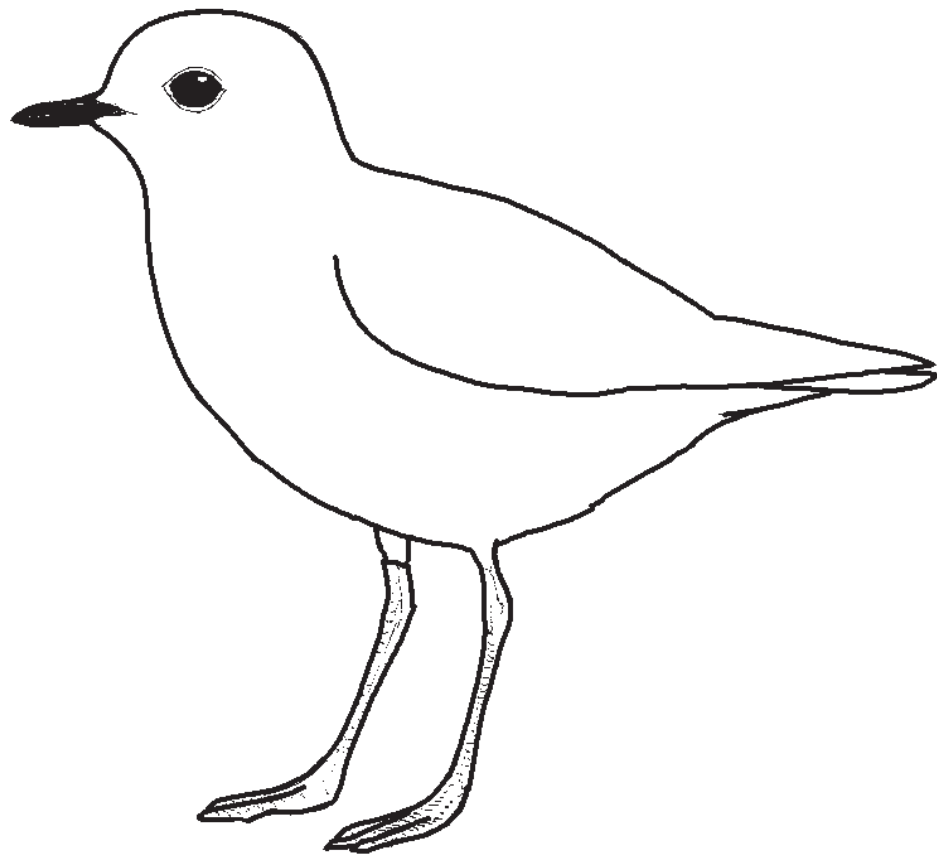
Pacific Golden-Plover



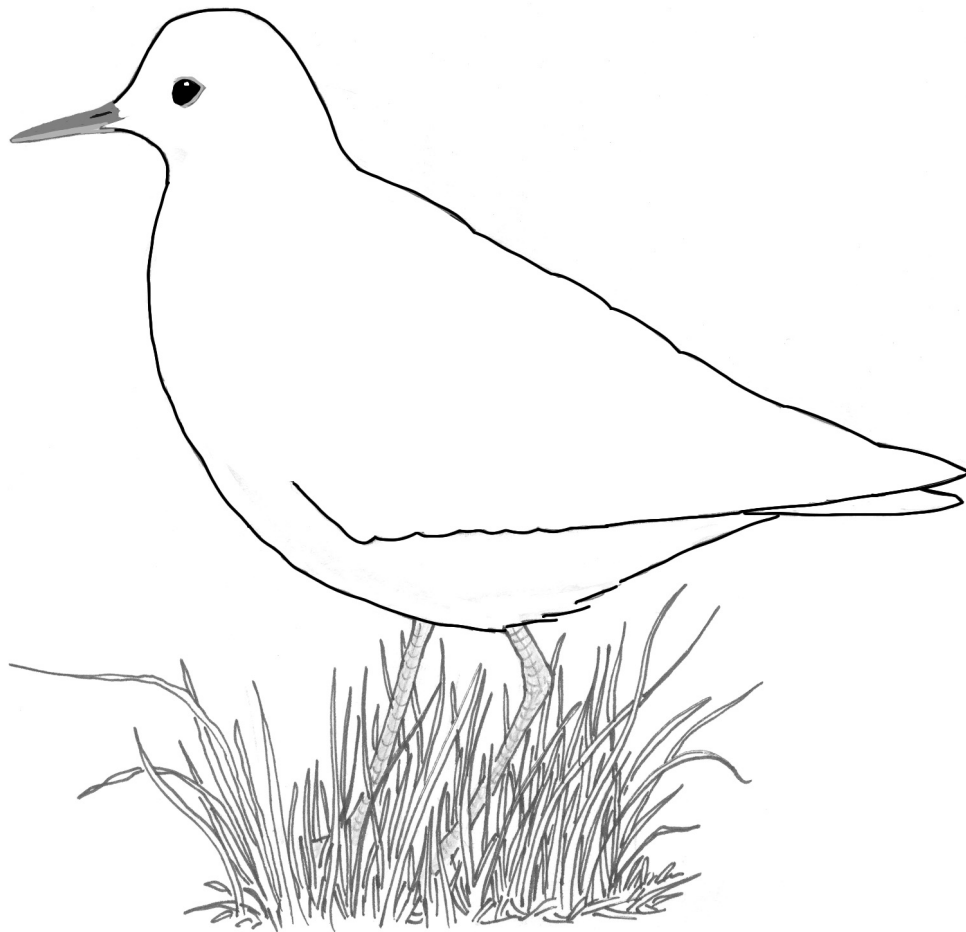
Semipalmated Plover



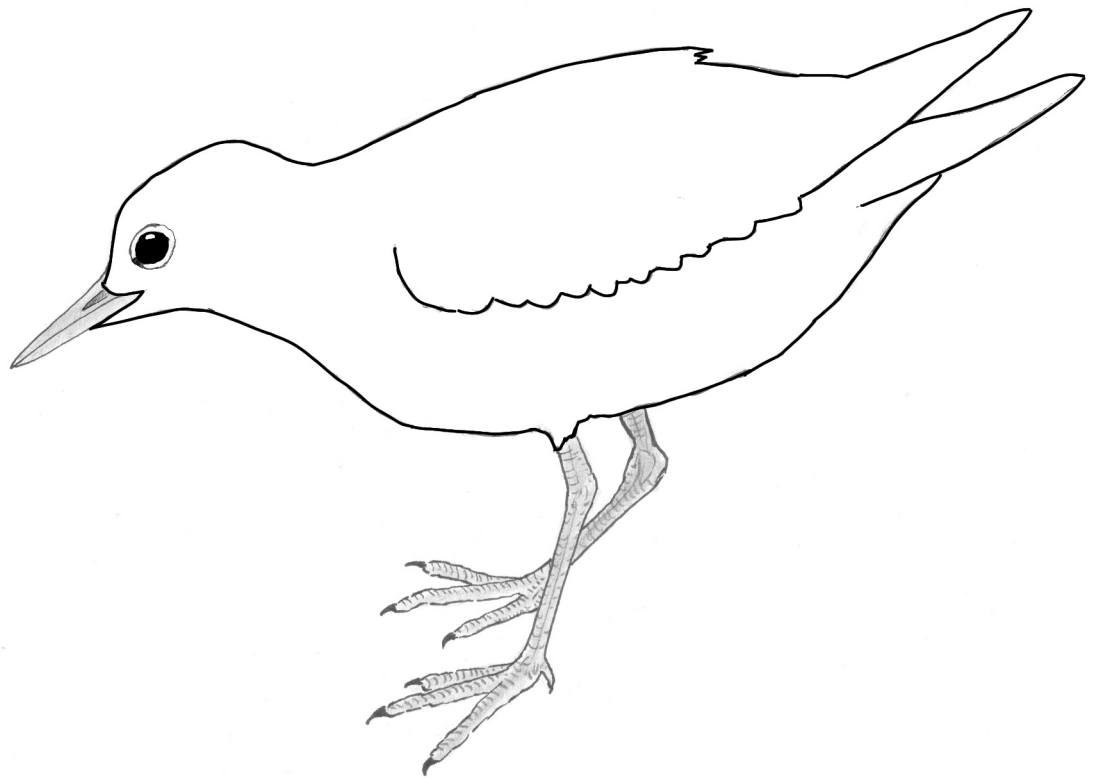
Snowy Plover



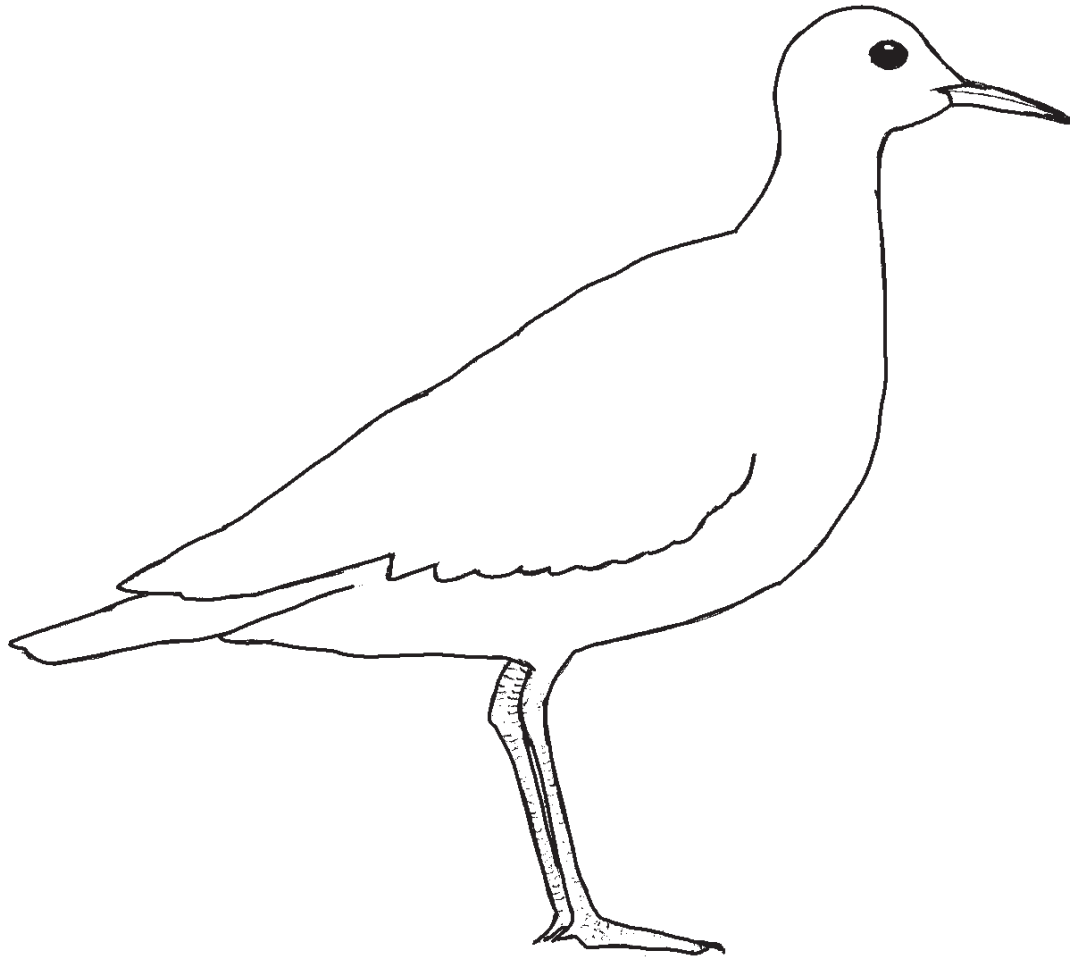
Buff-breasted Sandpiper



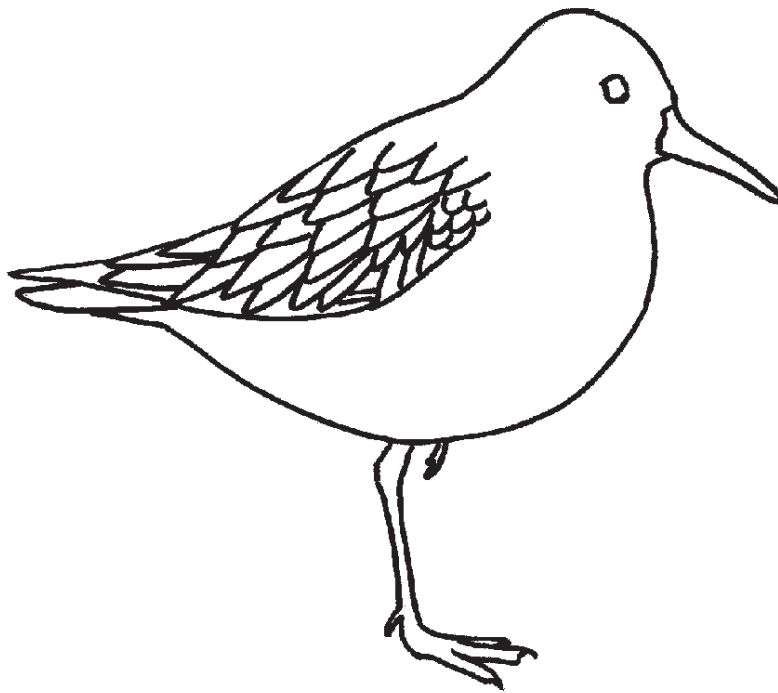
Spotted Sandpiper



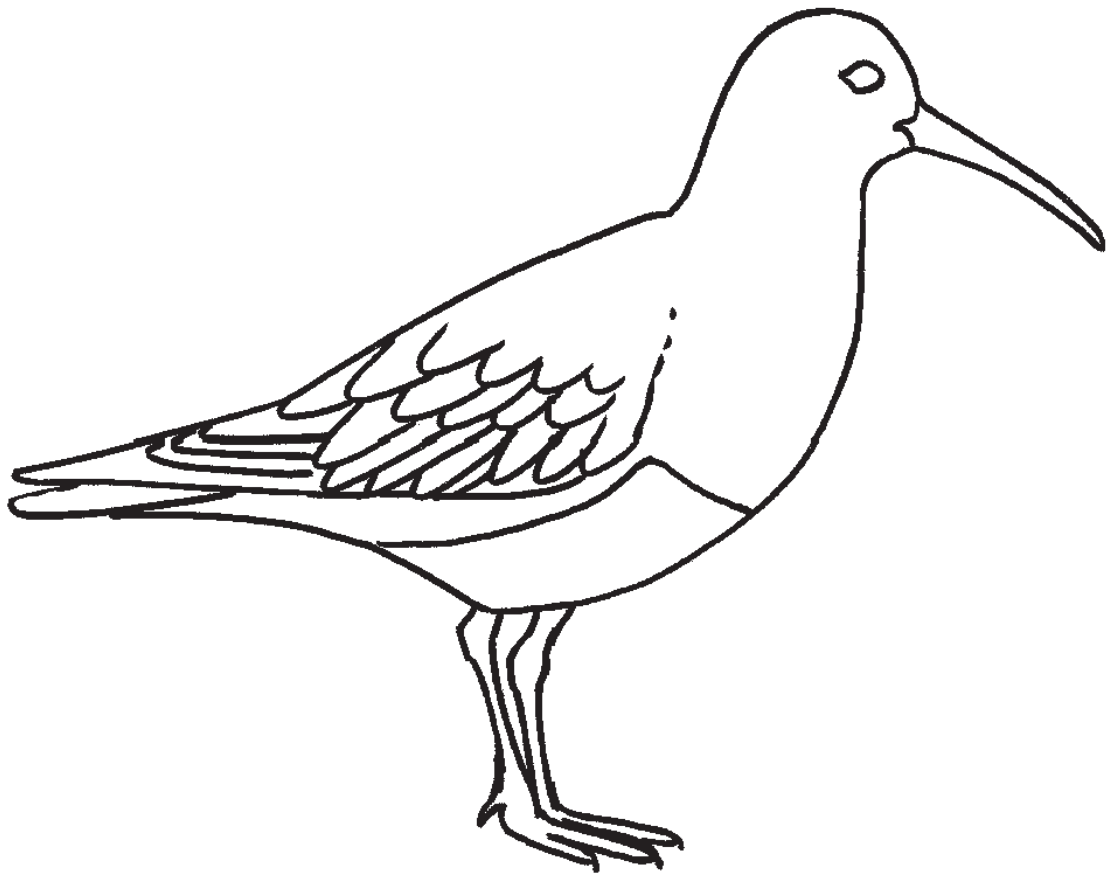
Upland Sandpiper



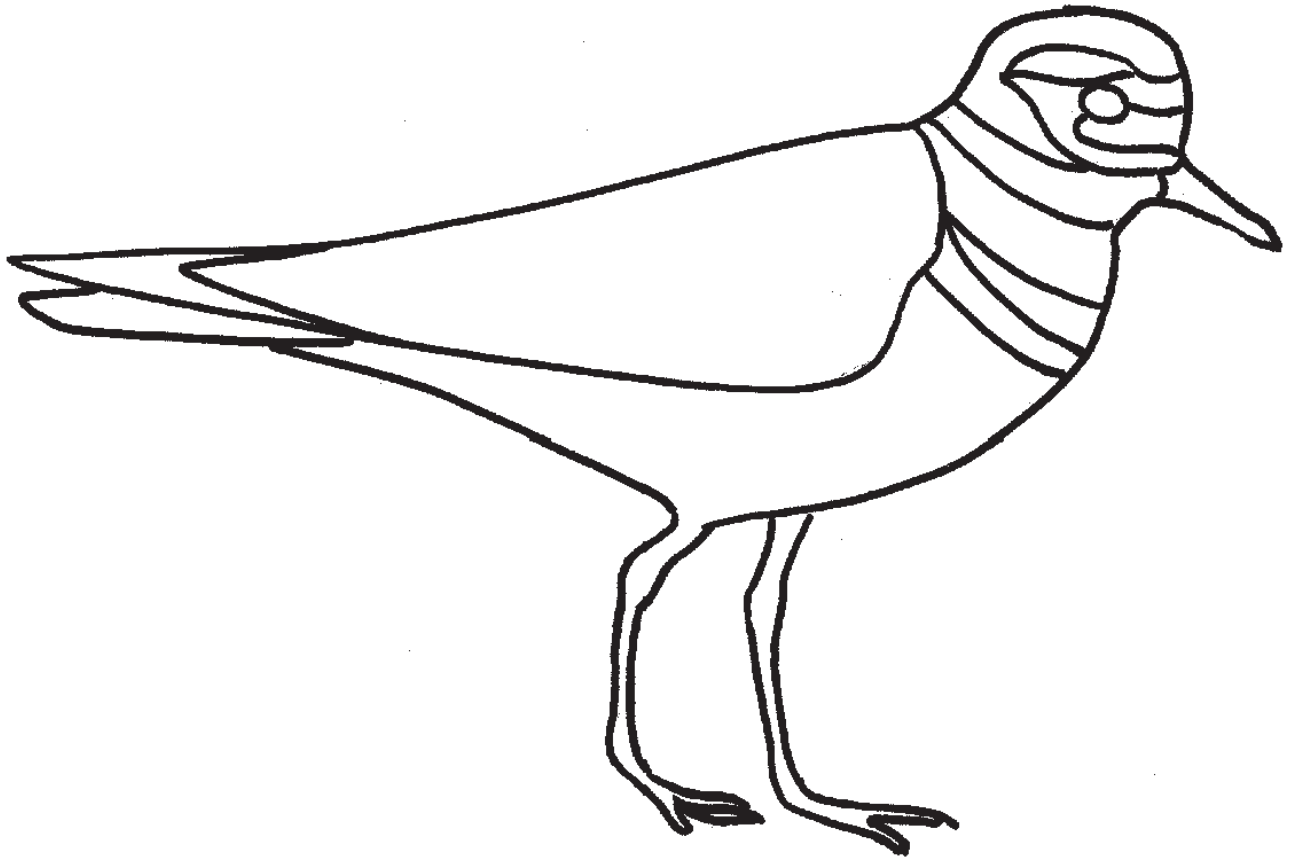
Western Sandpiper



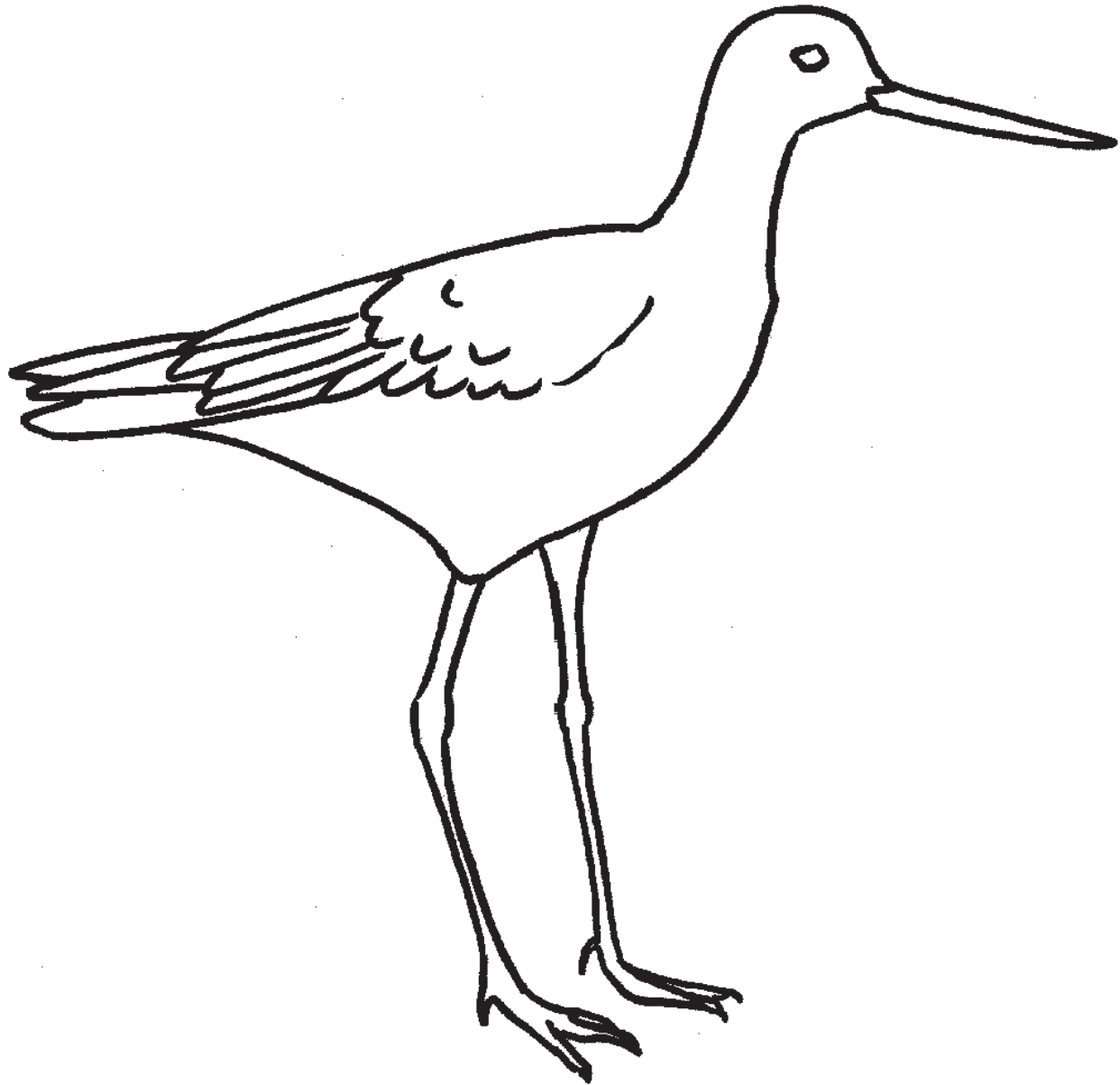
Dunlin



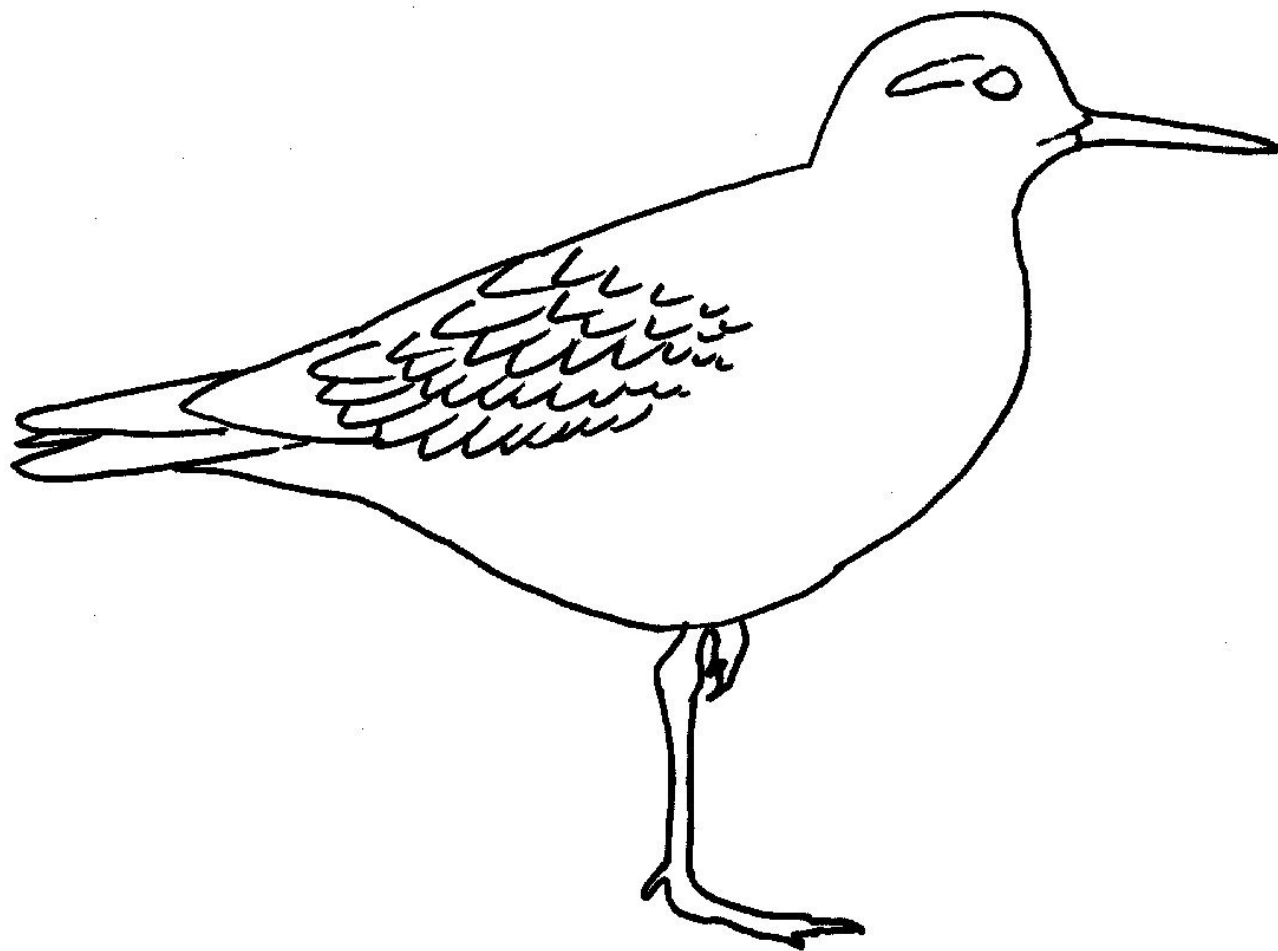
Killdeer



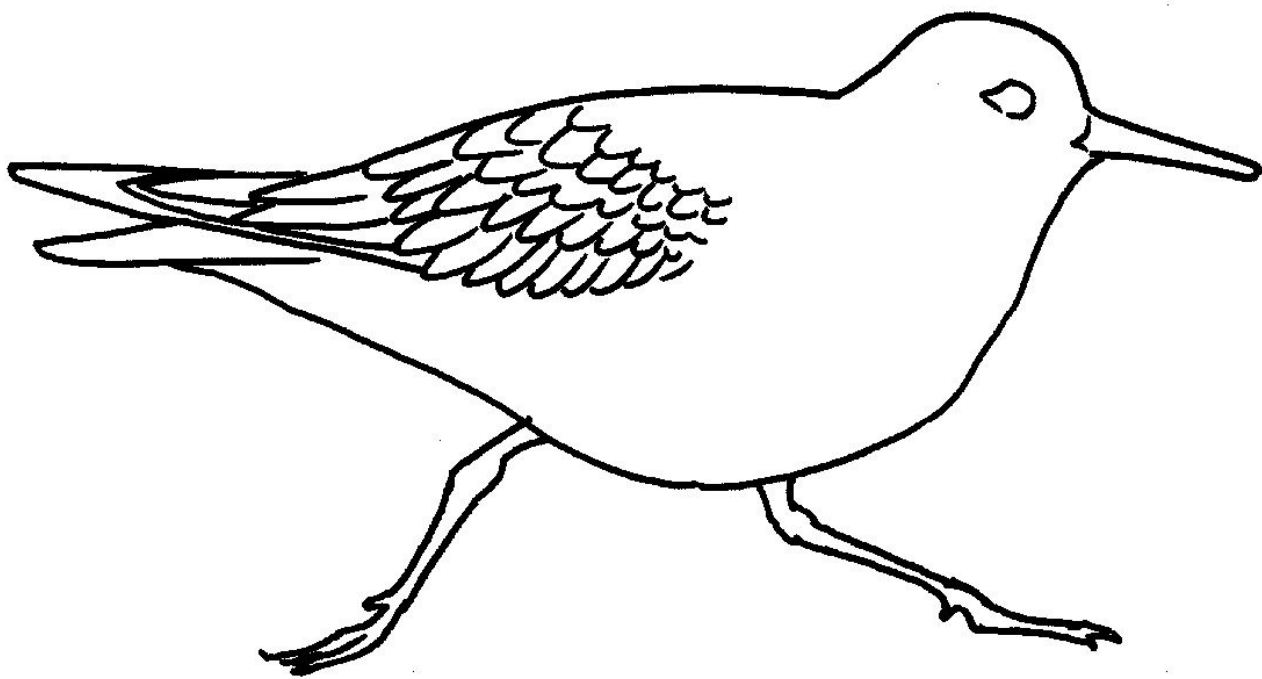
Greater Yellowlegs



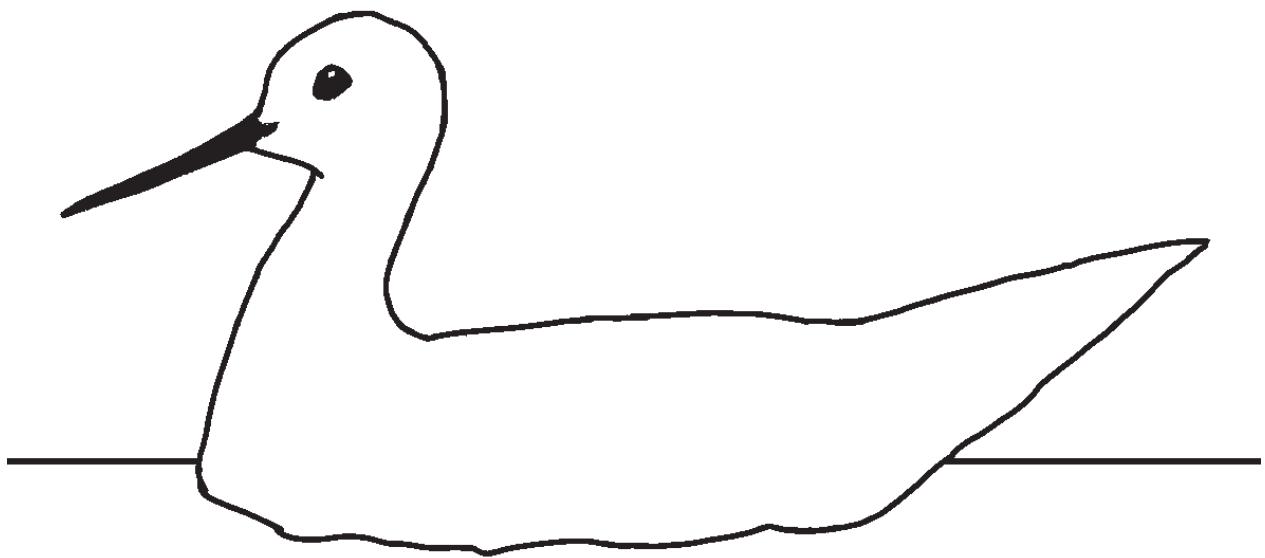
Red Knot



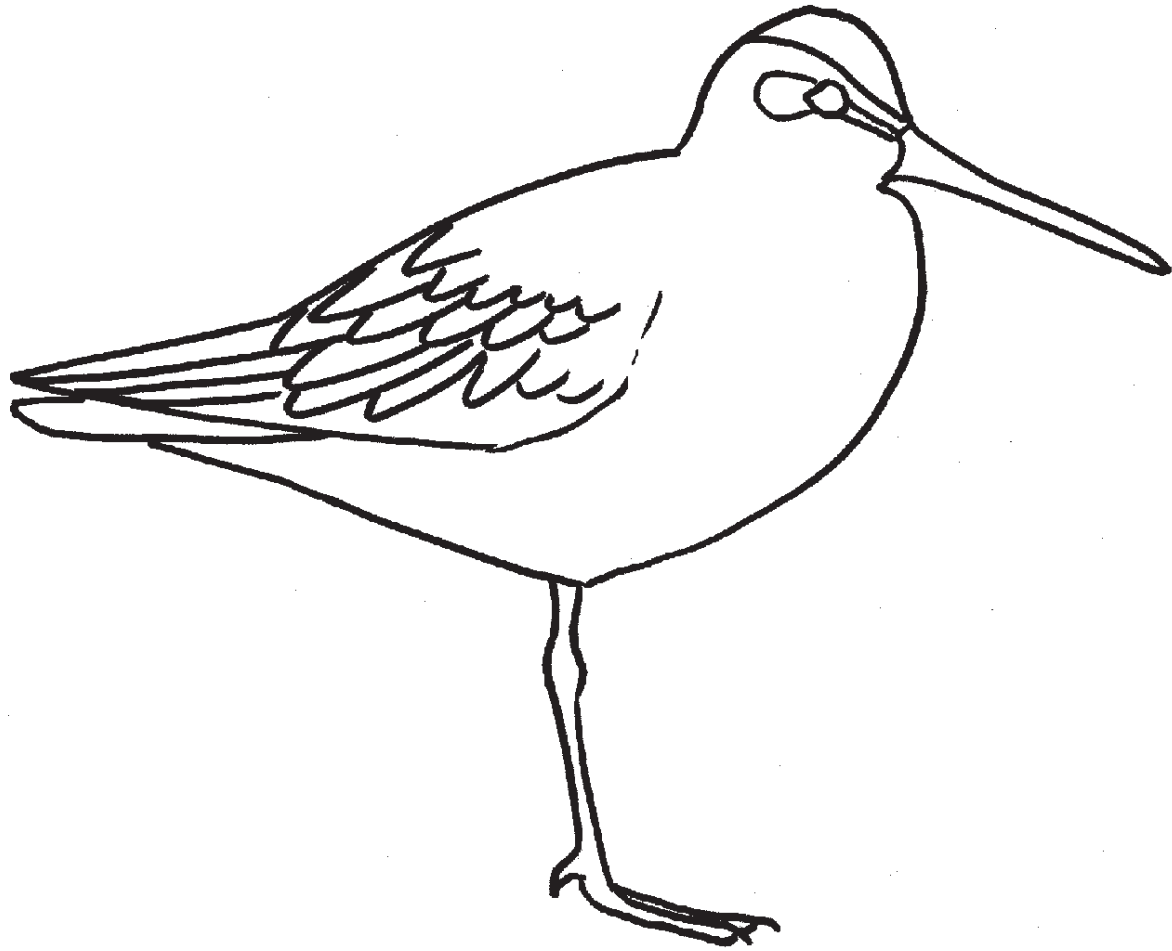
Sanderling



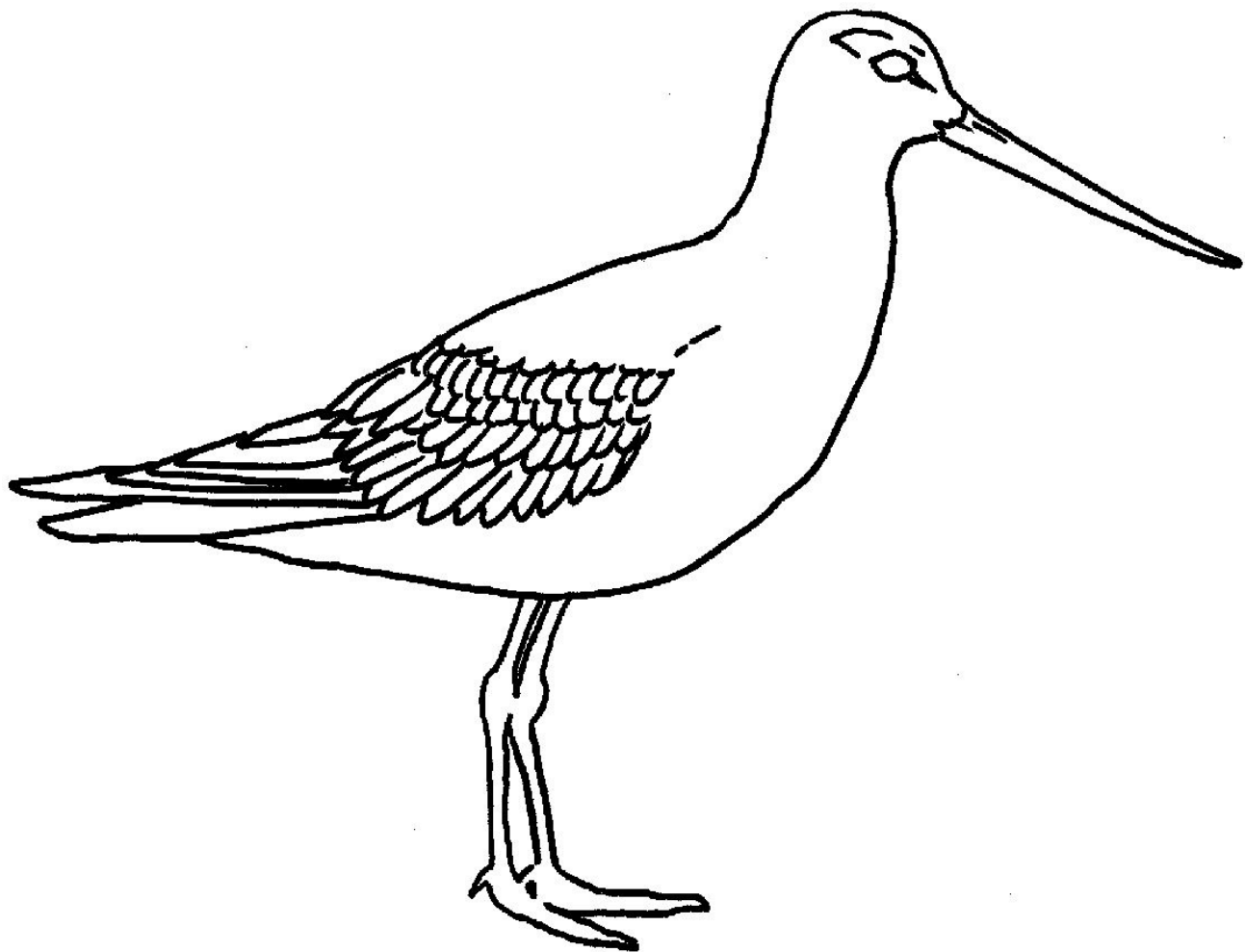
Wilson's Phalarope



Short-billed Dowitcher

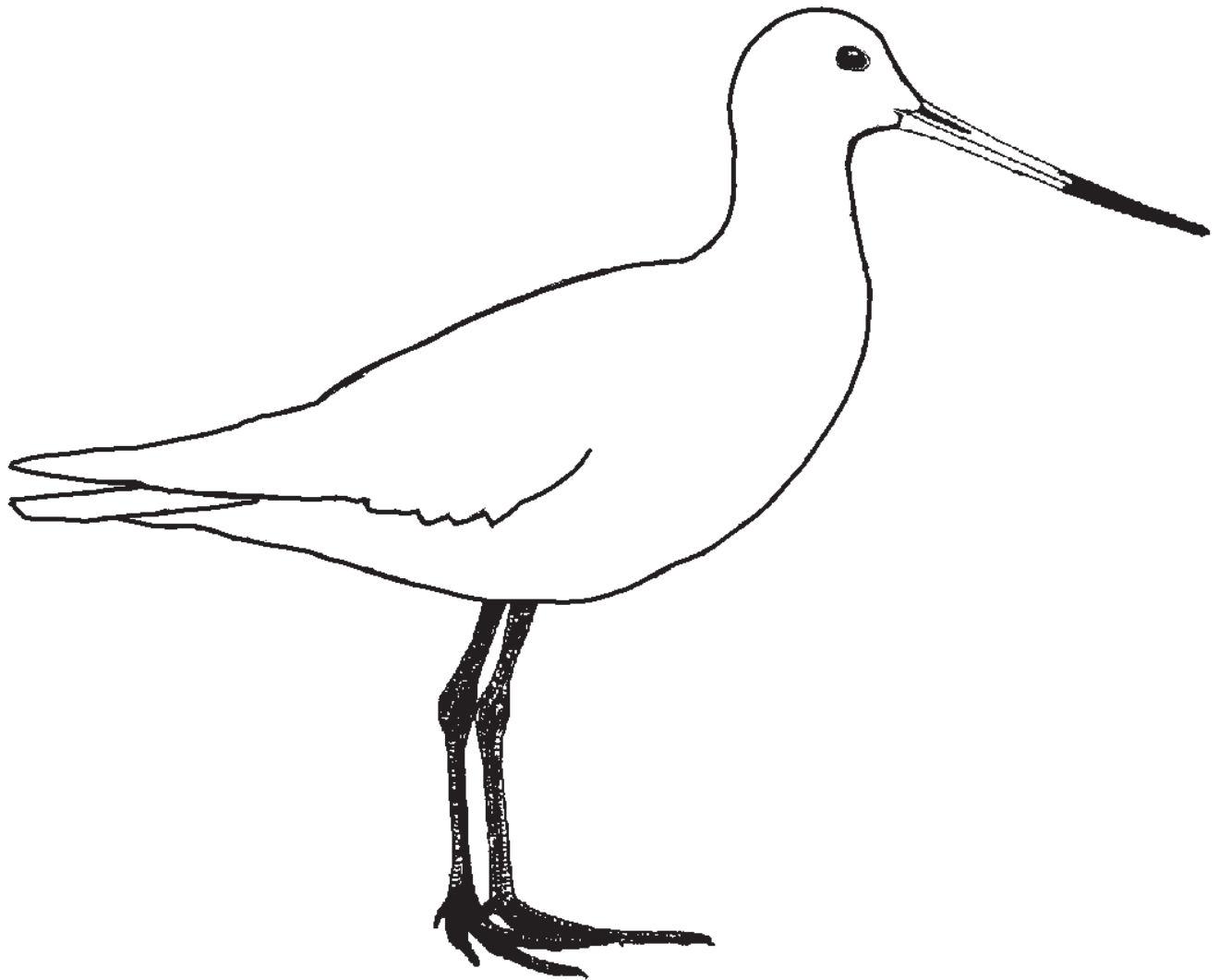


Hudsonian Godwit

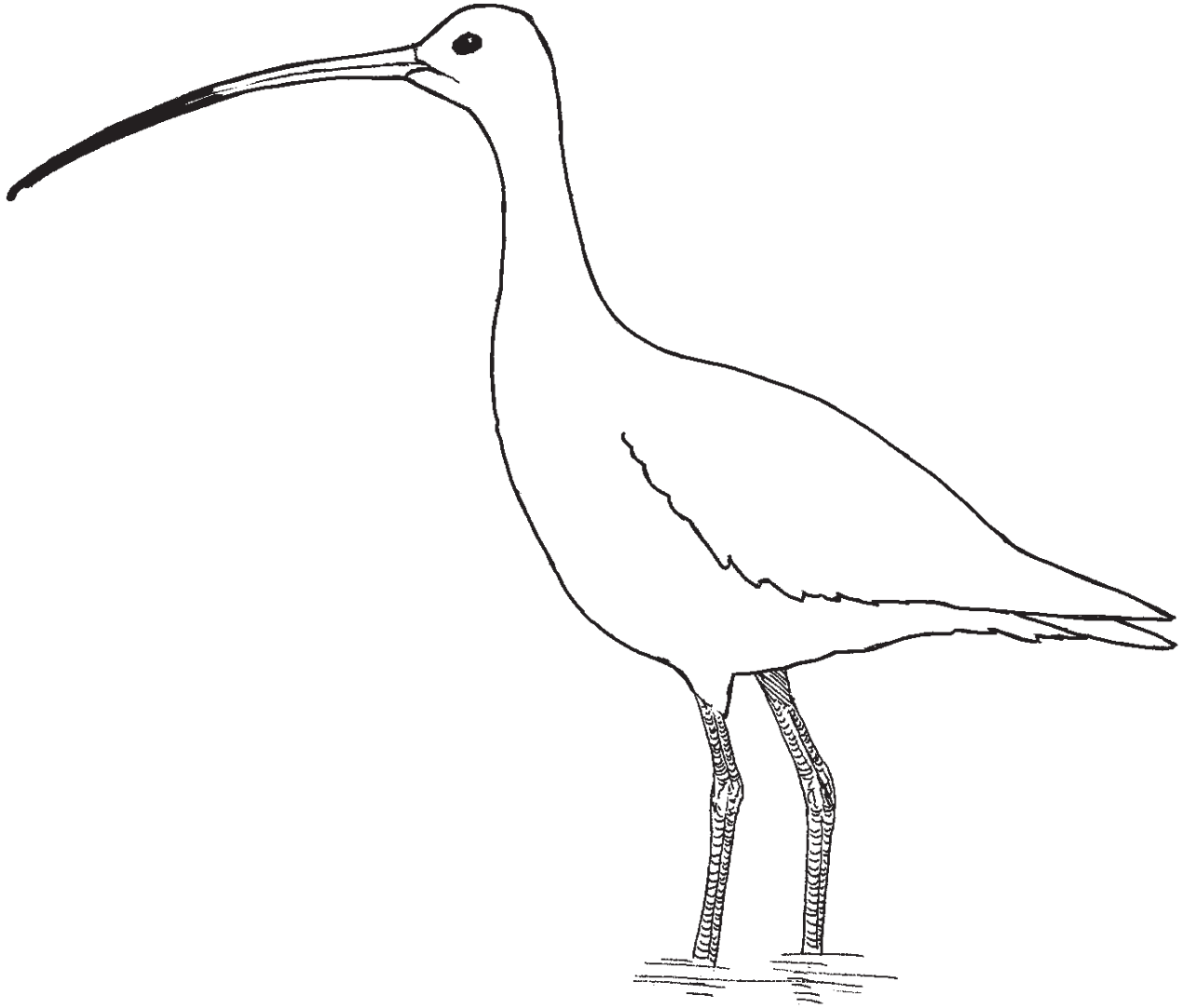




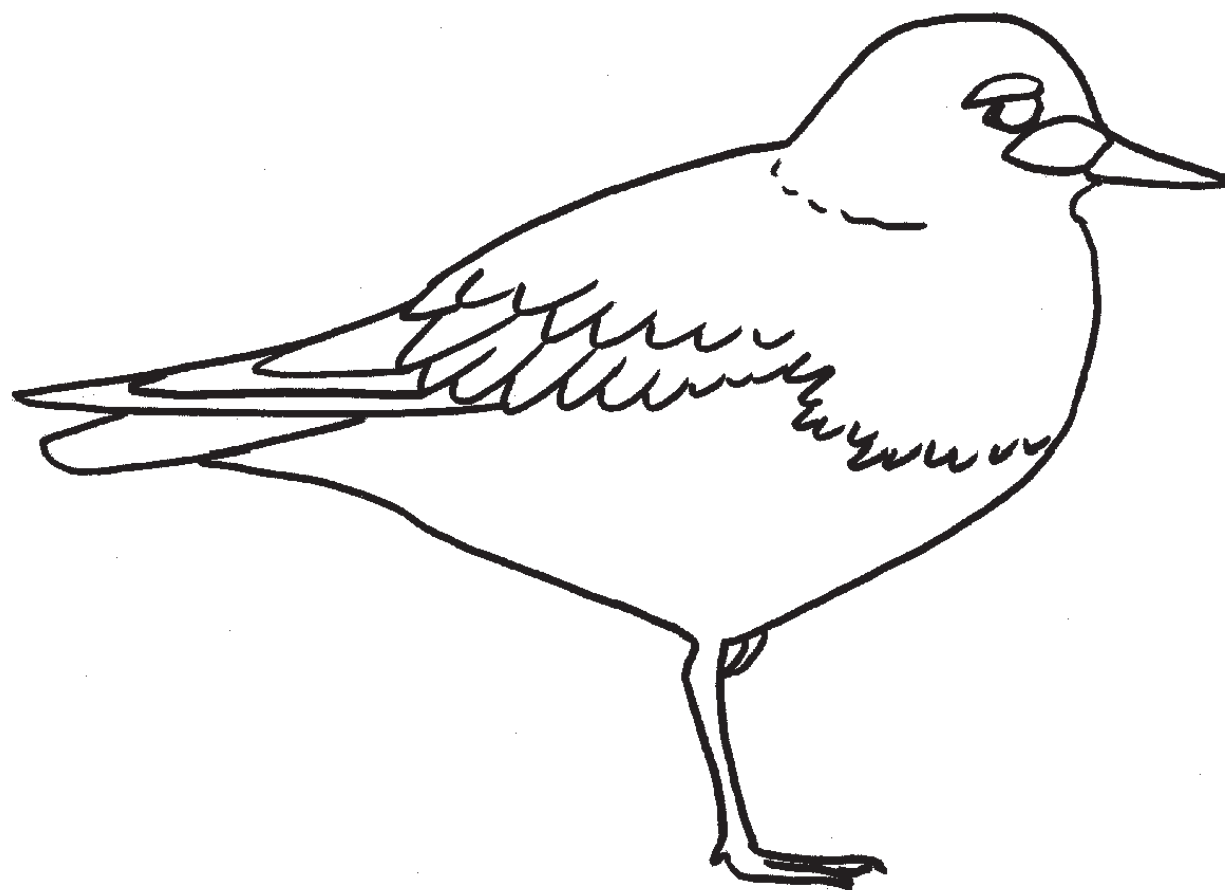
Marbled Godwit



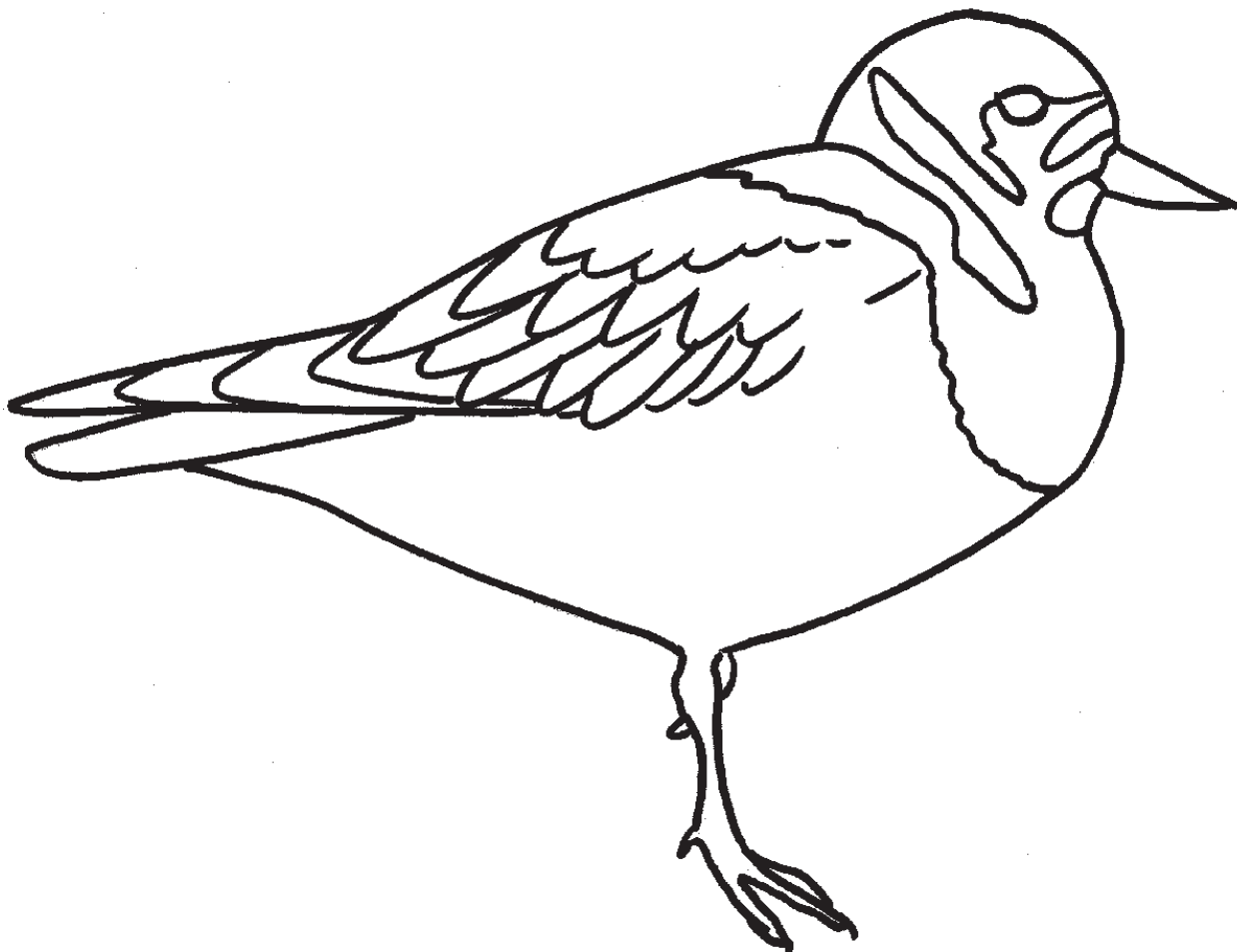
Long-billed Curlew



Black Turnstone



Rudy Turnstone



Shorebird Resources for Educators

Field Guides

Hayman, Peter; Merchant, John; and Prater, Tony. 1986. *Shorebirds: An Identification Guide to the Waders of the World*. New York: Houghton Mifflin Company.

Stokes, Donald and Lillian. 2001. *Beginner's Guide to Shorebirds*. New York: Little, Brown and Company.

Seavey, Jean. *Shorebirds of North America*. Jean Seavey's Nature Identification Guides. 32145 SW 202 Avenue, Homestead, FL 33030. <http://www.seaveyfieldguides.com>.

MacGowan, Craig. 1986. *Mac's Field Guide to Northwest Coastal Water Birds*.

MacGowan, Craig. 1996. *Mac's Field Guide: Waterbirds of the Northeast Coast*.

West, George C. 1996. *Shorebird Guide for Kachemak Bay and Homer, Alaska*. Homer, Alaska: Pratt Museum and Birchside Studios. Homer Society of Natural History.

General bird identification guides are wonderful resources. You can find an assortment of guides at any book store or bird-watching store. Example of general bird identification guides include:

The Sibley Guide to Birds by David Sibley (Eastern or Western guides also available)

Field Guide to Birds of North America by National Geographic

Peterson Field Guides for Eastern or Western United States by Roger Tory Peterson

Field Guide to Birds by Donald and Lillian Stokes (Eastern or Western regional guides)

Birds of North America by Kenn Kaufman

Books

Dunlap, Julie. 1999. *Extraordinary Horseshoe Crabs*. Minneapolis: Carolrhoda Books.

Ehrlich, Paul R.; Dobkin, David S.; and Wheye, Darryl. 1988. *The Birder's Handbook: A Field Guide to the Natural History of North American Birds*. New York: Simon & Schuster Inc.

Harrington, Brian. 1996. *The Flight of The Red Knot*. New York: W. W. Norton & Company.

Johnsgard, Paul A. 1981. *The Plovers, Sandpipers, and Snipes of the World*. Lincoln: University of Nebraska Press.

Manomet Center for Conservation Sciences. 1998. *Massachusetts Shorebird Project Book / El Libro para Estudiantes y Familias*. Massachusetts: Manomet Inc. (508-224-6521).

Miller, Debbie S. 1996. *Flight of the Golden Plover: The Amazing Migration between Hawaii and Alaska*. Anchorage: Alaska Northwest Books.

Morris, Arthur. 1996. *Beautiful Beachcombers Shorebirds*. Wisconsin: North Word Press, Inc.

Paulson, Dennis. 1993. *Shorebirds of the Pacific Northwest*. Seattle: University of Washington Press.

Richards, Alan. 1988. *Shorebirds: A Complete Guide to Their Behavior and Migration*. New York: Gallery Books.

Thompson, Des and Byrkjedal, Ingvar. 2001. *Shorebirds*. Minnesota: Stillwater Press.

Thurston, Harry. 1996. *The World of the Shorebirds*. San Francisco: Sierra Club Books.

Activity Guides

Alaska Native Knowledge Network/Alaska Rural Systemic Initiative. University of Alaska Fairbanks, P.O. Box 756730, Fairbanks, AK 99775-6730. (Information on Native Ways of Knowing). Internet address: <http://www.ankn.uaf.edu>

Alaska's Ecology. 1994. Anchorage: Circumpolar Press for Alaska Department of Fish and Game. (Series: *The Alaska Wildlife Curriculum*.) Grades K-12. To order, go to: <http://www.xyz.net/~wizard/instruct.htm>.

Atlantic Coast Piping Plover Lesson Plans. USFWS, New England Field Office, 22 Bridge St., Unit#1, Concord, N.H. 03301.

Birds and Wetlands of Alaska. King, James G. and King, Mary Lou. Revised by Belle Mickelson and Peggy Cowan. 1988. Fairbanks: Alaska Sea Grant College Program at University of Alaska Fairbanks. (*Alaska Sea Week Curriculum Series: Vol. V*.) Grade 4. To order go to: http://www.uaf.edu/seagrant/Pubs_Videos/edu.html.

Bridges to the Natural World. New Jersey Audubon Society. To order, go to <http://www.njaudubon.org/Education/bridges.html>.

Bridges to Birding. This booklet offers ideas on organizing a program with 16 activity stations that help youth and adults learn about birds. Especially useful for parks, zoos, nature centers, bird clubs, and scout groups looking for a variety of hands-on activities. To order, go to <http://www.birdday.org>

Discover Boundary Bay. 1994. Canada: The Friends of Boundary Bay. FORE, P.O. Box 1441, Station A, Delta, B.C., Canada, V4M 3YB. <http://www.bcwetlands.com>.



Shorebird Resources for Educators

Continued

Ecosystem Matters: Activity and Resource Guide for Environmental Educators. U.S. Forest Service

Rocky Mountain Region. Available for free. For more information, go to: http://na.fs.fed.us/spfo/ce/content/for_teachers/curriculum/.

Getting to Know Bluebirds: Teachers Education Package (K-8). North American Bluebird Society. The Wilderness Center. P.O. Box 244, Wilmot, OH 44681-0244. Tel: (330) 359-5511 or visit <http://www.nabluebirdsociety.org/parkrec.htm>

Green Eggs and Sand. (Middle School/High School). 2002. Tri-State Horseshoe Crab/Shorebirds Education Project. Delaware Aquatic Resource Education Center. Contact Gary Kreamer at gkreamer@state.de.us.

Habitats Nature Scope Curriculum Supplements (grasslands, endangered species). National Wildlife Federation. <http://www.nwf.org/schoolyardhabitats/natureactivities.cfm>

Learn About Seabirds. 1995. Grades 4-6. Anchorage: Circumpolar Press for U.S. Fish and Wildlife Service. To order, go to <http://www.xyz.net/~wizard/instruct.htm>.

O.B.I.S. (Outdoor Biology Instructional Strategies). Published by Delta Education, Box M, Nashua, New Hampshire 03061. Phone: (608) 889-8899.

One Bird - Two Habitats: A Middle School Environmental Education Curriculum on Migratory Birds. Wisconsin Department of Natural Resources. 1350 Semrite Drive, Monona, WI 53716.

Prairie Curriculum (and teaching trunk). Education Trunks Program. The National Wildlife Federation. 11100 Wildlife Center Drive, Reston, VA 20190. (703) 438-6001

Project Learning Tree Pre K-8 Activity Guide. 1111 19th St. NW, Suite 780, Washington, D.C. 20036. (202) 463-2475 or go to www.plt.org to locate your state coordinator.

Project WILD. Grades K-12. 1987. 5555 Morningside Drive, Suite 212, Houston, TX 77005. (713) 520-1936. Go to www.projectwild.org to contact your state coordinator.

Project WILD Aquatic. Grades K-12. 1987. 707 Conservation Lane, Suite 305, Gaithersburg, MD 20878. (301) 527-8900. Go to www.projectwild.org to contact your state coordinator.

Salt Marsh Manual: An Educator's Guide. 1989. Johnston, Debby; Dreyfuss, Kim; and McTananey, Fran. eds. San Francisco Bay National Wildlife Refuge. For more information contact: Newark Slough Learning Center in Fremont. (510) 792-0222 or Environmental Education Center in Alviso: (408) 262-5513

Save Our Migratory Birds: Bringing Awareness of Birds Shared throughout the Americas. A Resource Guide for Middle School Teachers / Salven a Nuestros Pajaros Migratorios. 1996. Massachusetts: Manomet Center for Conservation Sciences. 81 Stage Rd. P.O. Box 1770. Manomet, MA 02345.

Seasonal Wetlands. Santa Clara Audubon Society. <http://www.scvas.org/index.shtml>.

Shorebird Migration Game/El Juego de la Migracion de Aves Playeras. Date. Massachusetts: Manomet Inc. (508) 224-6521.

Teach About Geese. Grades K-12. 1988. Anchorage: Circumpolar Press for U.S. Fish and Wildlife Service. To order, go to <http://www.xyz.net/~wizard/instruct.htm>.

Water, Wetlands, and Wildlife. Quinlan, Susan E. 1984. Fairbanks: Alaska Department of Fish and Game. (*Alaska Wildlife Week. Unit 2.*)

Note: The "Alaska Wildlife Week" series was revised to form the basis of the "Alaska Wildlife Curriculum." To order, go to <http://www.xyz.net/~wizard/instruct.htm>.

Wetlands & Wildlife. Grades K-12. 1993. Anchorage: Circumpolar Press for Alaska Department of Fish and Game and U.S. Fish and Wildlife Service. (Series: *The Alaska Wildlife Curriculum.*) To order, go to <http://www.xyz.net/~wizard/instruct.htm>.

Pamphlet/Poster/Activity Booklets

Shorebirds! On Delaware Bay (viewing guide and pamphlet) New Jersey Department of Fish, Game and Wildlife. 1998. P.O. Box 400, Trenton, N.J., 08625.

Shorebird Superheroes: An educational fact sheet/newspaper promoting bird and habitat conservation. 1998. Published by Manomet Center for Conservation Sciences and the Prairie Pothole Joint Venture.

Shorebirds – Migratory Superheroes! A Student Activity Guide U.S. Fish and Wildlife Service, Shorebird Sister Schools Coordinator, 698 Conservation Way, Shepherdstown, WV 25443.

The Short-Grass Prairie (16-page activity booklet) The Rocky Mountain Bird Observatory. To order, go to: <http://www.rmbo.org/education/materials.html>.



Shorebird Resources for Educators

Continued

The High Plains-Land of Extremes. 1996. Bureau of Land Management. http://www.blm.gov/education/high_plains/high_plains.html. This is a booklet on the high plains prairie. It comes with a poster.

Wildlife of the Wetlands: Faces of the Great Plains

This poster is published by Great Plains Nature Center in Wichita, Kansas. It is a full-color poster that features wildlife that inhabits wetlands of the Central Flyway. Featured on the poster are five shorebird species! On the back are species profiles, information on wetlands, a glossary, and a wetlands puzzle. To order, call the U.S. Fish and Wildlife Service Publications Office at 800-344-WILD (9453).

The Amazing Journey of Migratory Shorebirds

A 20-minute video (approximately) with a color poster/map, brochure, and companion booklet to the video (educational packet published by Manomet Center for Conservation Sciences and the Prairie Pothole Joint Venture. \$12.00. To place an order, send an E-mail to WHSRN@manomet.org.

Fragile Coastal Wildlife: The Southeastern Gulf and Atlantic Coastal States. U.S. Fish and Wildlife Service Publications Office. Order by calling 1-800-344-WILD.

Videos/Slide Shows

The Shorebirds of Kansas. 2000. Kansas Wildlife and Parks. Available in video and DVD. To order, call 620-672-5911.

A Guide to Shorebirds of Eastern North America. 2003. Walton; Richard and Dodge, Greg. Brownbag Productions. Available in DVD. To order, go to: <http://brownbagproductions.com>.

Crabs, the Birds, the Bay. Describes shorebird migration along Delaware Bay and how dependent the birds are on the horseshoe crab eggs. Bullfrog Films. To order, call (800) 543-3764.

The Living Tidal Marsh. This series and guide explores the tidal marsh of the northeastern United States and the animals associated with it, including shorebirds. New Jersey Video, CNN 777, Trenton, N.J. 08625-0777. (609) 777-5093.

Wild Things '98 – Shorebirds: Running on Empty. This video provides an electronic field trip experience to the Bombay Hook National Wildlife Refuge during migration. A Teacher's Guide and poster accompany the video. U.S. Fish and Wildlife Service, NCTC, 698 Conservation Way, Shepherdstown, WV 25443. (304) 876-7203.

Arctic Nesting Shorebirds Slide Show. Shorebird Sister School Program. Shorebird Sister Schools Program Coordinator. U.S. Fish and Wildlife Service, 698 Conservation Way, Shepherdstown, WV 25443-9713. (304) 876-7783 (phone), (304) 876-7321 (fax) or E-mail to sssp@fws.gov.

The Amazing Journey of Migratory Shorebirds. A 20-minute video (approximately) with a color poster/map and brochure and a companion booklet to the video (educational packet published by Manomet Center for Conservation Sciences and the Prairie Pothole Joint Venture. \$12.00. To place an order, send an E-mail to WHSRN@manomet.org

Celebrating Alaska's Amazing Shorebirds. This video chronicles this amazing migration against the spectacular background of Alaskan scenery. \$19.95 (US), Runs: 26 minutes. To order or for further

information, call: (907) 586-1670 or (800) 870-5866, or go online to <http://www.ktoo.org/videos.cfm>.

Internet Sites

Compilation of Education Resources, U.S. Shorebird Plan <http://shorebirdplan.fws.gov>, click on "U.S. Shorebird Plan and Council"

International Shorebird Survey – Citizen Monitoring Project www.manomet.org/ISS.htm

Biogeographical Shorebird Profiles (Midcontinental North America) <http://www.fort.usgs.gov/products/Publications/555/555.asp>

Northern Prairie Research Center, <http://www.npwrc.usgs.gov>

Rocky Mountain Bird Observatory, <http://www.rmbo.org>

Playa Lakes Joint Venture, <http://www.pljv.org>

Shorebird Sister Schools Program, <http://sssp.fws.gov>

Western Hemisphere Shorebird Reserve Network (WHSRN) provides numerous resources for learning more about shorebirds and important shorebird sites. <http://www.manomet.org/WHSRN/>

Shorebirds: Prairies to Patagonia provides wonderful information about shorebirds in the Central Flyway. <http://www.manomet.org/WHSRN/Prairies/index.htm>

The Shorebird Watcher (includes a shorebird photo quiz, recording of calls, a list of shorebird festivals, and shorebird identification workshops). <http://pw1.netcom.com/~djhoff/sbvoice.html>

The Virtual Birder (birding trips to places like the Delaware Bay and Monomoy NWR) www.virtualbirder.com/vbirder



Shorebird Resources for Educators

Continued

*Western Atlantic Shorebird
Association (of NOAA)*
www.vex.net/~hopscotch/shorebirds

The U.S. Fish and Wildlife Service
To get specific information on a
refuge you would like to visit, click
first on “refuges,” then on “refuge
locator,” and then follow the prompts.
www.fws.gov

The U.S. Fish and Wildlife Service:
Information on Migratory Birds
<http://migratorybirds.fws.gov/>

The U.S. Fish and Wildlife Service.
More Information on Birds.
<http://birds.fws.gov/>

The U.S. Fish and Wildlife Service
Jr. Duck Stamp Program
<http://birds.fws.gov/>

International Migratory Bird Day
<http://birds.fws.gov/imbd.html>

Ecology of Shortgrass Prairie Birds
[http://www.suttoncenter.org/
espb.html](http://www.suttoncenter.org/espb.html)
George M. Sutton Avian Research
Center

*Shorebird Species of the Canadian
Prairie*
[http://www.mb.ec.gc.ca/nature/whp/
pcscp/df10s04.en.html](http://www.mb.ec.gc.ca/nature/whp/pcscp/df10s04.en.html)
Canadian Wildlife Service.

Teaching Kits

*Shorebird Sister Schools
Educational Trunks*
The trunks contain a wealth of
information and ready-to-go
activities for educators or shorebird
enthusiasts to use when visiting
classrooms. It includes books, videos,
bird identification guides, slide
show, puppets, activities from the
curriculum, and more. To learn about
borrowing a trunk, check out the
Web site (<http://sssp.fws.gov>) and
click on “Educators.” There will be a
list of whom to contact for your area
to borrow a trunk.

*Prairie Trunk
(and curriculum guide)*
Education Trunks Program. The
National Wildlife Federation.
11100 Wildlife Center Dr., Reston VA
20190. (703) 438-6000

Periodical Articles

*The Birds of North America
Life Histories for the 21st Century*
The Academy of Natural Sciences.
Published bimonthly by the American
Ornithologists' Union and Academy
of Natural Sciences. Biderman, John
O. “Fuel for Flight.” *Audubon*. May
1983. This article describes Red
Knot shorebird migration along the
Atlantic Flyway.

Corven, Jim. “Shorebird Odysseys.”
Natural History. 107:4. May 1998.

Figuro, Benny. “Beach Bird
Buddies.” *Ranger Rick*. 28:6. June
1994.
Children help to protect the Piping
Plover and Least Tern nests.

Harrington, Brian. “Knot
Your Ordinary Migrant.” *Bird
Conservation*. Late winter/early
spring 1998.

Connor, R.A., Seidl, Andrew; Van
Tassell, Larry; and Wilkins, Neal.
2001. U.S. Grassland and Related
Resources: An Economic and
Biological Trends Assessment.
<http://landinfo.tamu.edu>.



The Western Hemisphere Shorebird Reserve Network List of Important Shorebird Sites in North and South America*

Refer to the *Shorebirds Across the Americas* poster included in your curriculum binder, or request a copy by sending an e-mail to sssp@fws.gov

Hemispheric Sites

A minimum of 500,000 shorebirds use these sites each year.

United States

Yukon Delta, Alaska (P)
Copper River Delta, Alaska (P)
Grays Harbor, Washington (P)
Lahontan Valley, Nevada (P)
Great Salt Lake, Utah (C)
San Francisco Bay, California (P)
Delaware Bay, Delaware, New Jersey, Maryland (A)
Cheyenne Bottoms, Kansas (C)

Canada

Chaplin/Old Wives/Reed Lakes, Saskatchewan, Canada (C)
Bay of Fundy, Nova Scotia (A)

Suriname

Bigi Pan, Paramaribo (A)
Wia Wia Nature Reserve, Commewijne (A)
Coppename, Saramacca (A)

Brazil

Reentrancias Maranhenses, Maranhao (A, C)

Argentina

Mar Chiquita, Cordoba (A, C, P)
Tierra del Fuego (A, C, P)

International Sites

A minimum of 100,000 shorebirds use these sites each year.

United States

Kachemak Bay, Alaska (P)
Humboldt Bay, California (P)
Mono Lake, California (P)
Grasslands, California (P)
Barrier Islands, Maryland and Virginia (A)
Cape Romain NWR, South Carolina (A)
Bolivar Flats, Texas (C)
Brazoria NWR, Texas (C)
Laguna Madre (bi-national), Texas and Mexico (C)

Canada:

Quill Lakes, Saskatchewan (C)

Mexico

Estero Rio Colorado, Sonora/Baja (P)
Guerrero Negro, South Baja California (P)
Laguna Madre, (bi-national) Texas and Mexico (C)
Marismas Nacionales, Tepic/Sinaloa (P)

Brazil

Lagoa do Peixe, Rio Grande do Sul (C, P)

Argentina

San Antonio Oeste, Rio Negro (P)

Regional Sites

A minimum of 20,000 shorebirds use these sites each year.

United States

Nushagak Bay, Alaska (P)
Kvichak Bay, Alaska (P)
Springfield Bottoms, Idaho (P)
Benton Lake NWR, Montana (C)
J. Clark Slayer NWR, North Dakota (C)
Chautauqua NWR, Illinois (C)
South San Diego Bay NWR, California (P)
Quivera NWR, Kansas (C)
Salt Plains NWR, Oklahoma (C)
Altamaha River Delta, Georgia (A)
Swan Lake NWR, Missouri (C)
Elkhorn Slough, California (P)
Edwin B. Forsythe NWR, New Jersey (A)
Monomoy Island NWR, Massachusetts (A)
Lake Erie Marshes, Ohio and Michigan (A, C)
Sacramento Valley, California (P)
Sonny Bono Salton Sea NWR, California (P)
Long Lake NWR, North Dakota
Bowdoin NWR, Montana
Yukon Delta NWR, Alaska

Mexico

Playa Ceuta, Sinaloa (P)

Canada

Beaverhill Lake, Alberta (C)
Last Mountain Lake National Wildlife Area, Saskatchewan (C)

Peru

Paracas, Ica (P)
North American Shorebirds and the Habitats They Use

KEY

A=Atlantic Flyway
C=Central Flyway
P=Pacific Flyway
NWR=National Wildlife Refuge (managed by U.S. Fish and Wildlife Service)

For a detailed description of these sites, go to the WHSRN Web site at: <http://www.manomet.org/WHSRN>.



North American Shorebirds and the Habitats They Use

<i>Species</i>	<i>Scientific Name</i>	<i>Breeding</i>	<i>Migrating</i>	<i>Habitats</i> <i>Wintering</i>
Black-bellied Plover	<i>Pluvialis squatarola</i>	T	FM	SM, FM, SB
American Golden-Plover	<i>Pluvialis dominica</i>	T	G	SM, FM, G
Pacific Golden-Plover	<i>Pluvialis fulva</i>	T	Nonstop	G
Snowy Plover*	<i>Charadrius alexandrinus</i>	SB, SM	SB, SM	SB, SM
Wilson's Plover	<i>Charadrius wilsonia</i>	SB	SM, FM	SM, FM, SB
Semipalmated Plover	<i>Charadrius semipalmatus</i>	SM, FM	SB	SM, FM
Piping Plover**	<i>Charadrius melodus</i>	SB	SB	SB
Killdeer	<i>Charadrius vociferus</i>	G	G	G
Mountain Plover***	<i>Charadrius montanus</i>	G	G	G
American Oystercatcher	<i>Haematopus palliatus</i>	SM, RIW	SM	SM
Black Oystercatcher	<i>Haematopus bachmani</i>	RIW	SM, RIW	SM, RIW
Black-necked Stilt	<i>Himantopus mexicanus</i>	FM	SM, FM	SM, FM
American Avocet	<i>Recurvirostra americana</i>	SM	SM, FM	SM, FM
Greater Yellowlegs	<i>Tringa melanoleuca</i>	FM	SM, FM	SM, FM
Lesser Yellowlegs	<i>Tringa flavipes</i>	FM	SM, FM	SM, FM
Solitary Sandpiper	<i>Tringa solitaria</i>	FM	FM	FM
Willet	<i>Catoptrophorus semipalmatus</i>	SM	SM, SB	SM, SB
Wandering Tattler	<i>Heteroscelus incanus</i>	FM, SR	RIW	RIW
Spotted Sandpiper	<i>Actitis macularia</i>	SR	SR, SM	SR, SW
Upland Sandpiper	<i>Bartramia longicauda</i>	G	G	G
Eskimo Curlew****	<i>Numenius borealis</i>	T	G	G
Whimbrel	<i>Numenius phaeopus</i>	T, SR	FM, G	SM, SB
Bristle-thighed Curlew	<i>Numenius tahitiensis</i>	T	G, SB, SM	G, SB, SM
Long-billed Curlew	<i>Numenius americanus</i>	G	FM	FM
Hudsonian Godwit	<i>Limosa haemastica</i>	FM, SR	FM, SM	FM, SM
Bar-tailed Godwit	<i>Limosa lapponica</i>	T	FM, SM	FM, SM
Marbled Godwit	<i>Limosa fedoa</i>	G, FM, SM	SM	SM
Ruddy Turnstone	<i>Arenaria interpres</i>	T	SB, RIW	SB, RIW
Black Turnstone	<i>Arenaria melanocephala</i>	SM	RIW, SB	RIW, SB
Surfbird	<i>Aphriza virgata</i>	T	RIW	RIW
Red Knot	<i>Calidris canutus</i>	T	SM, SB	SM
Sanderling	<i>Calidris alba</i>	T	SB	SB
Semipalmated Sandpiper	<i>Calidris pusilla</i>	T	SB	SB
Western Sandpiper	<i>Calidris mauri</i>	T	SB, SM	SB, SM
Least Sandpiper	<i>Calidris minutilla</i>	T	SM, SB, FM	SM, FM
White-rumped Sandpiper	<i>Calidris fuscicollis</i>	T	SB, SR, SM	SM
Baird's Sandpiper	<i>Calidris bairdii</i>	T	SM, FM	SM, FM
Pectoral Sandpiper	<i>Calidris melanotos</i>	T	SM, FM	SM, FM
Purple Sandpiper	<i>Calidris maritima</i>	T	RIW	RIW
Rock Sandpiper	<i>Calidris ptilocnemis</i>	T	RIW	RIW
Dunlin	<i>Calidris alpina</i>	T	SM, FM	SM, FM
Stilt Sandpiper	<i>Micropalama himantopus</i>	T	FM	FM
Buff-breasted Sandpiper	<i>Tryngites subruficollis</i>	T	G	G, FM
Short-billed Dowitcher	<i>Limnodromus griseus</i>	FM	SM	SM
Long-billed Dowitcher	<i>Limnodromus scolopaceus</i>	T	FM	FM
Common Snipe	<i>Gallinago gallinago</i>	FM	FM	FM
American Woodcock	<i>Scolopax minor</i>	FM	FM	FM
Wilson's Phalarope	<i>Phalaropus tricolor</i>	FM	SM, FM	FM
Red-necked Phalarope	<i>Phalaropus lobatus</i>	FM	SM, FM	Open Sea: These two species of shorebirds have lobed toes that allow them to swim. They are the only shorebirds that have this adaptation.
Red Phalarope	<i>Phalaropus fulicarius</i>	T	FM, SM	

Shorebird species with asterisks are federally-threatened, endangered, or under consideration for listing.

* Only the Pacific Coast population of the Snowy Plover is federally-listed as threatened.

** The Piping Plover is federally-threatened except for a population of Great Lakes birds that are considered endangered.

*** The Mountain Plover is under consideration for listing as threatened across its Pacific and Central Flyway ranges.

**** Biologists suspect that the Eskimo Curlew is extinct; however, it is listed as endangered across its Central Flyway range.

Please Note: Many shorebirds use a wide variety of wetland or grassland habitats. This list only identifies the habitats in which you will most often find a particular shorebird.

Key

T = Tundra

SB = Sandy Beaches

SR = Streams and Rivers

RIW = Rocky Intertidal Wetlands

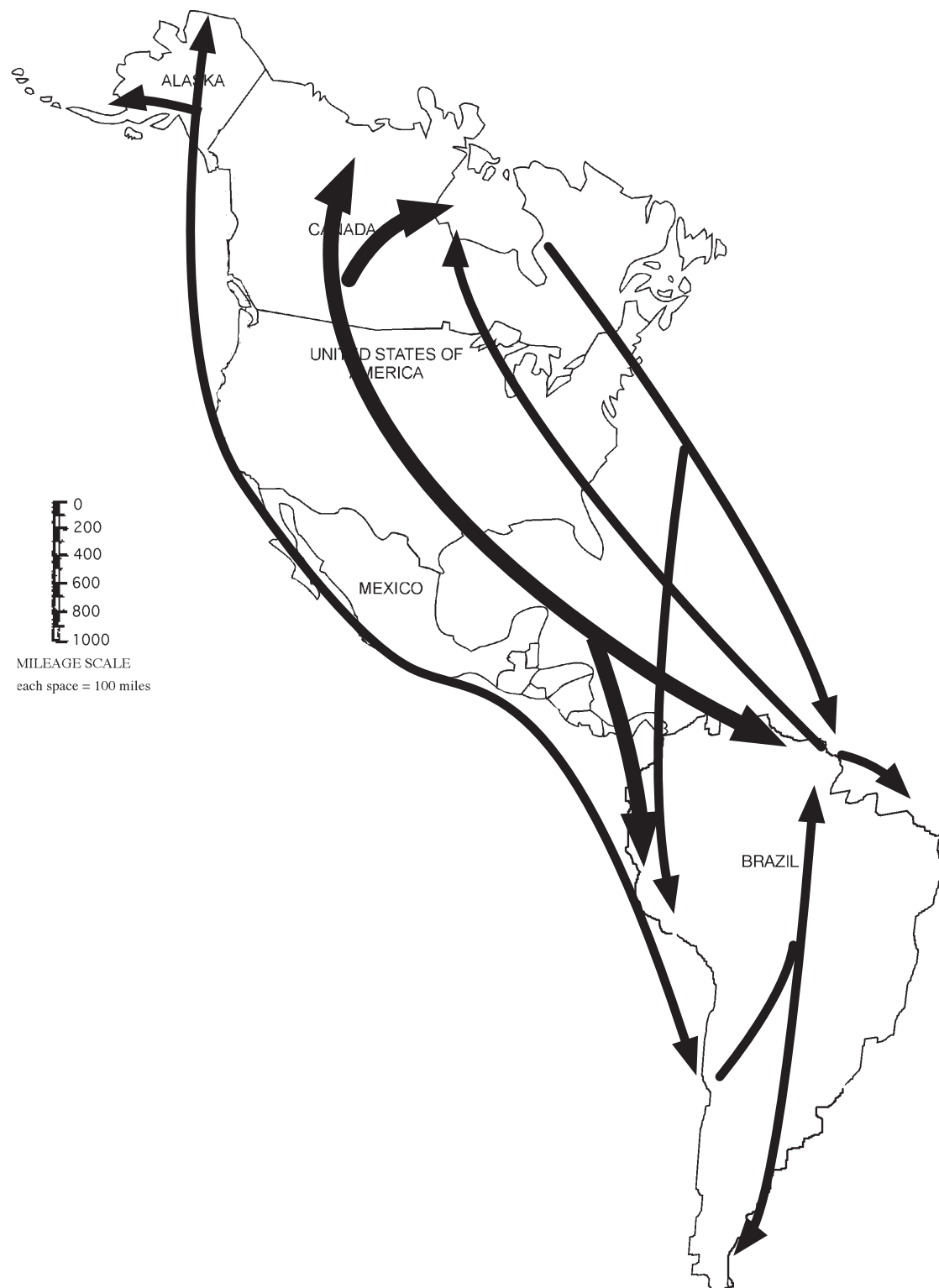
FM = Freshwater Marsh (includes freshwater lakes, streams, mudflats)

G = Grasslands (includes habitats that mimic grasslands, such as fields, yards, golf courses)

SM = Saltwater Marsh (includes saline lakes and mudflats)

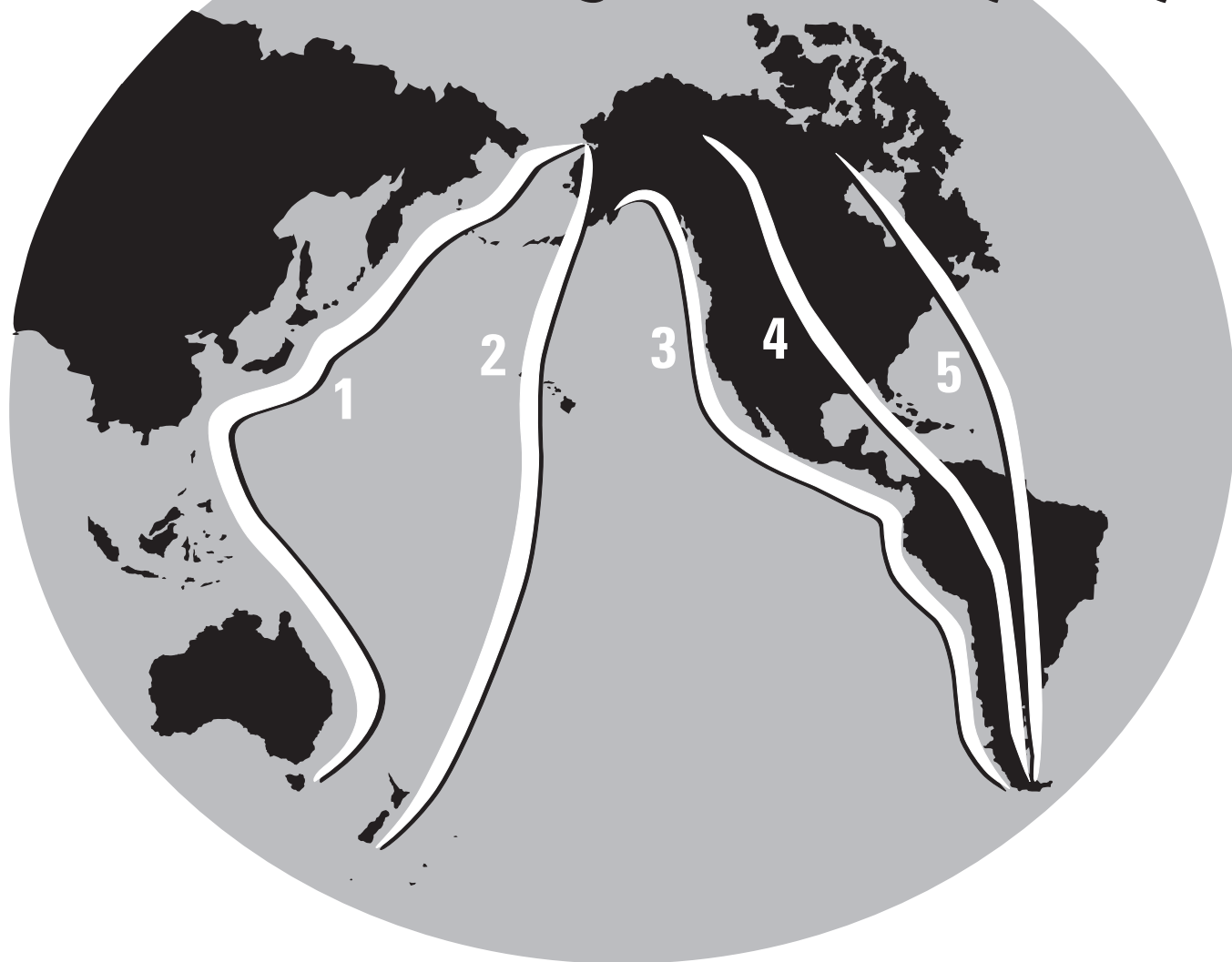


Western Hemisphere Migration Flyways Map



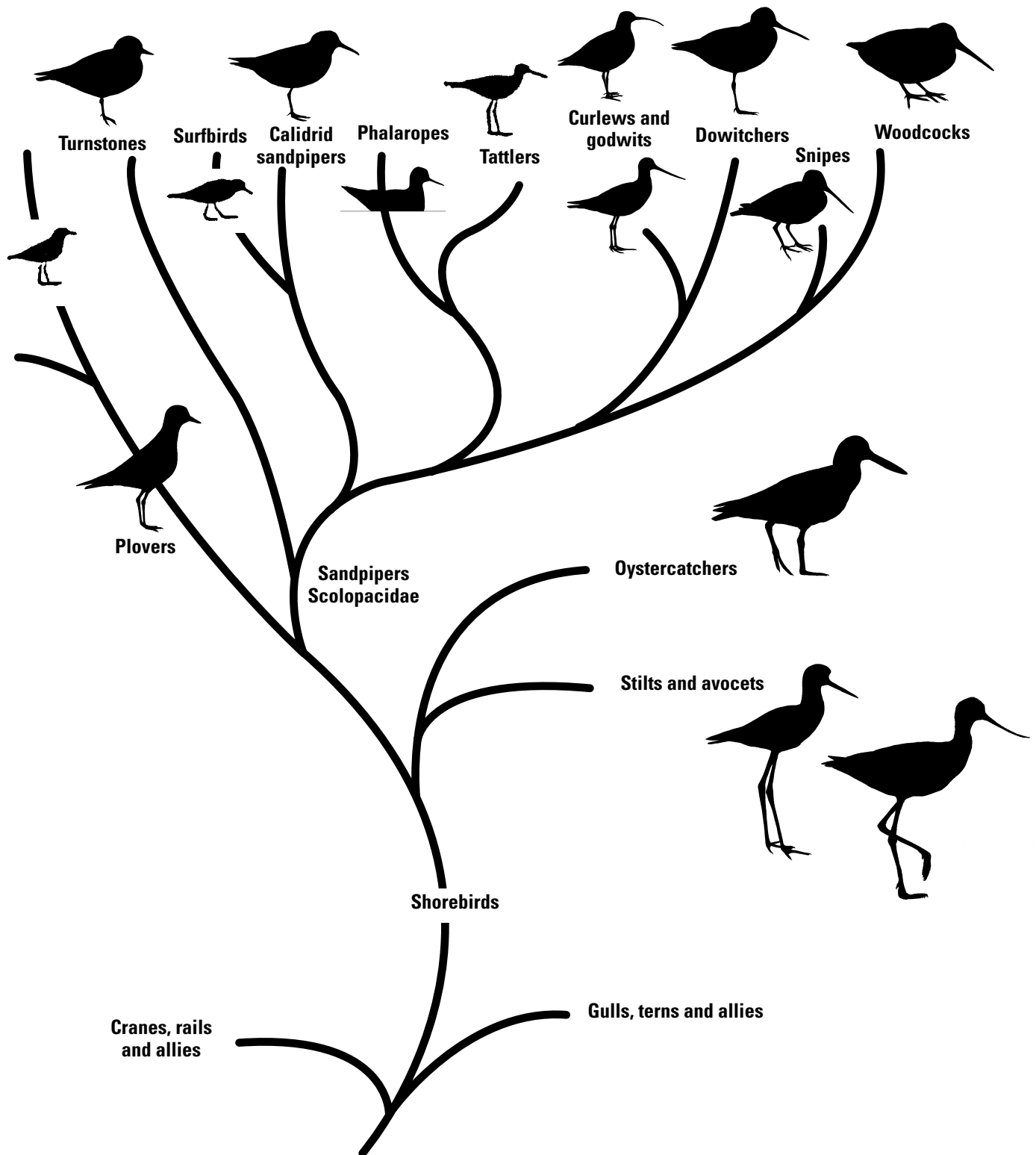
Educators, biologists, students, and shorebird enthusiasts are participating in the Shorebird Sister Schools Program from the 5 flyways below.

Shorebird Migration Flyways



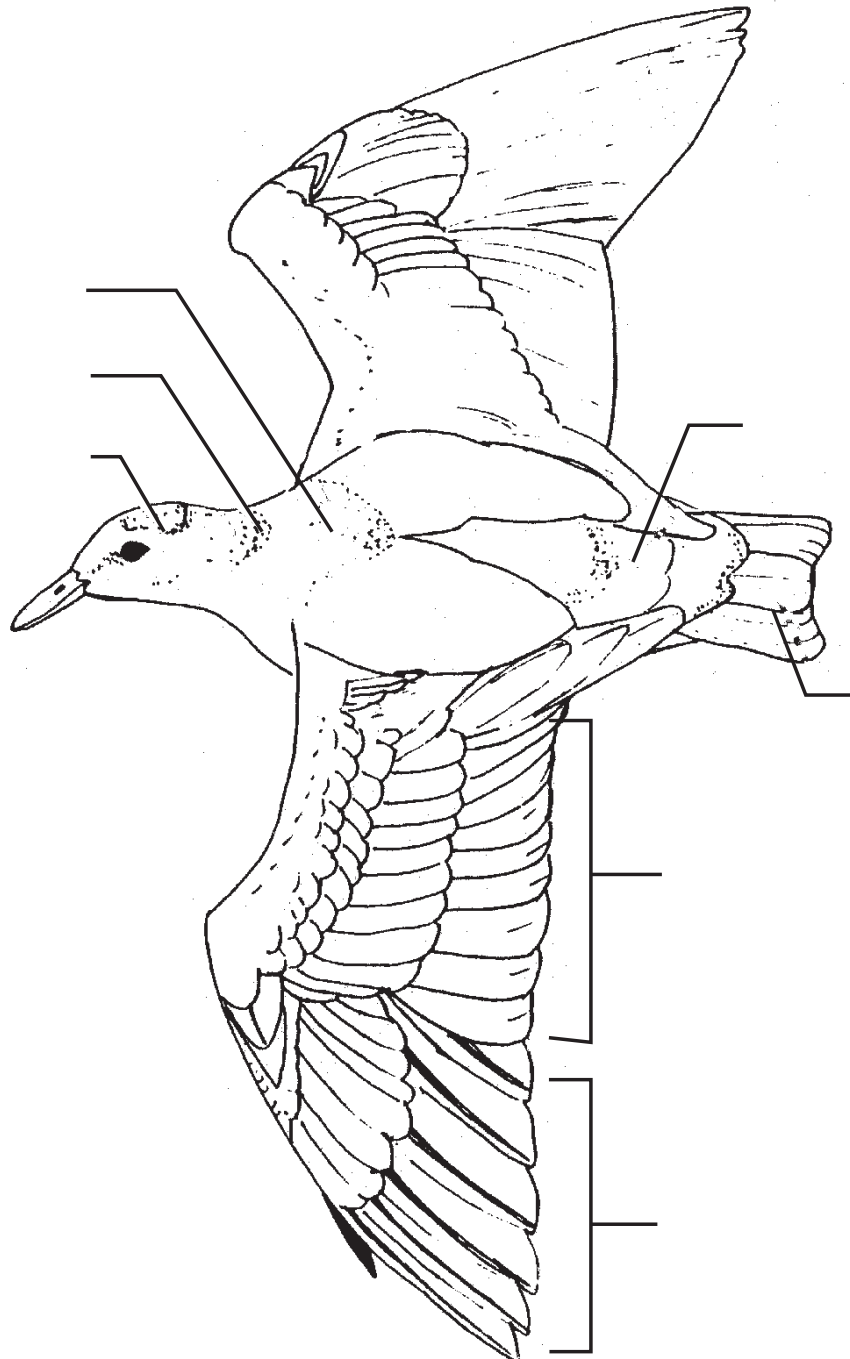
1. East and Asian-Australasian Flyway
2. Central Pacific Flyway
3. American (Eastern) Pacific Flyway
4. American Central Flyway
5. American (Western) Atlantic Flyway

North American Shorebird Taxonomy— An Aid to Identification

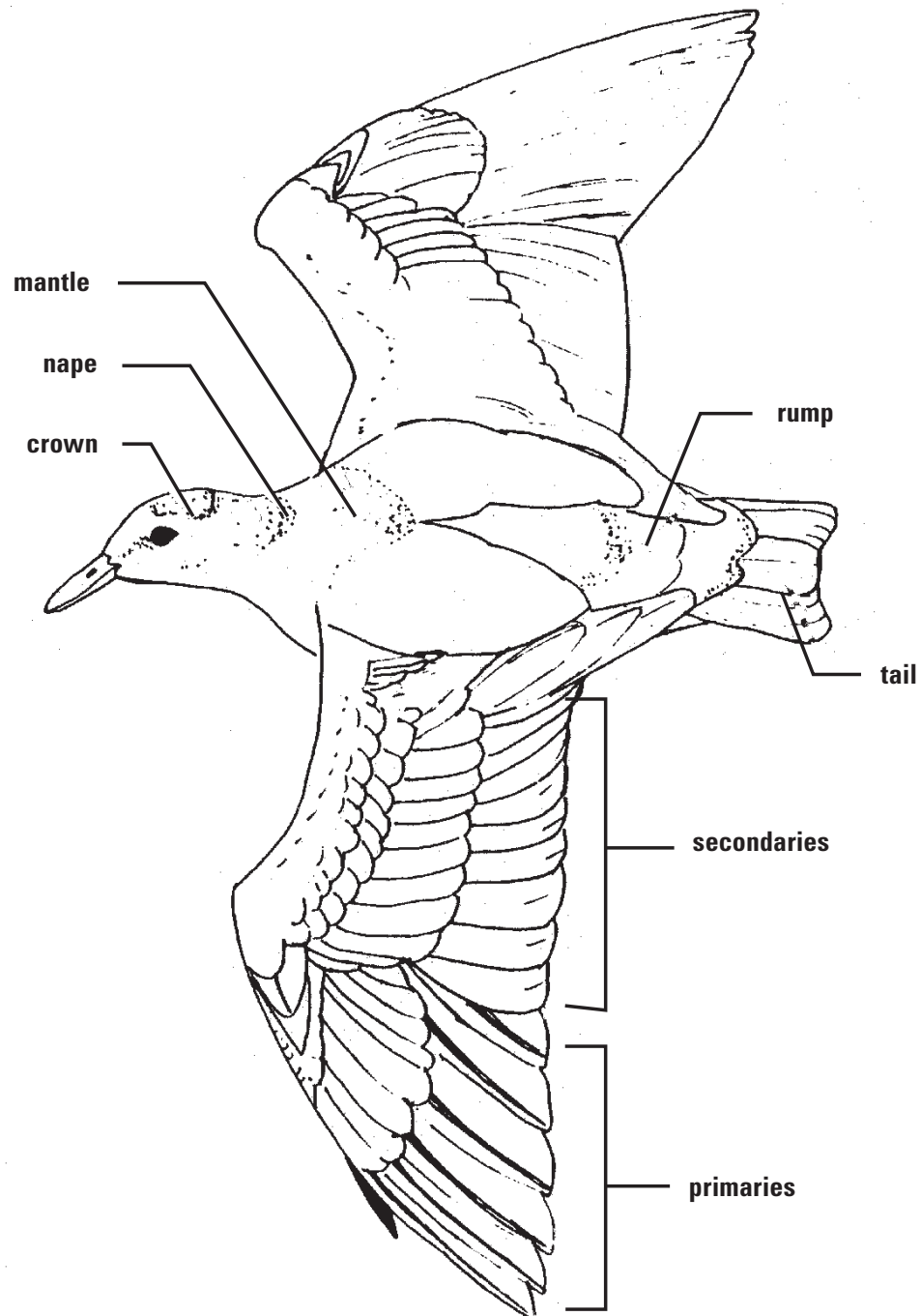


Shorebird Morphology: Flying

Directions: Fill in the blanks with the names of the correct body part.

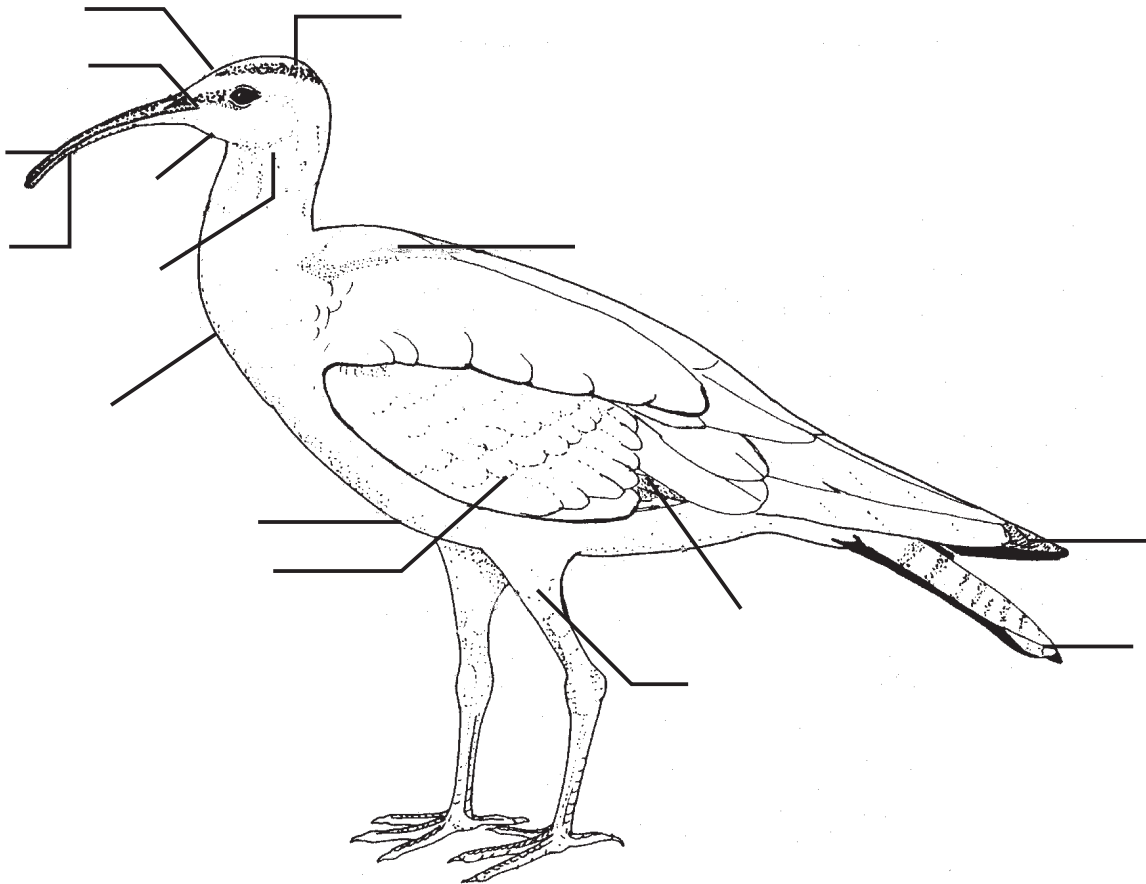


Shorebird Morphology: Flying

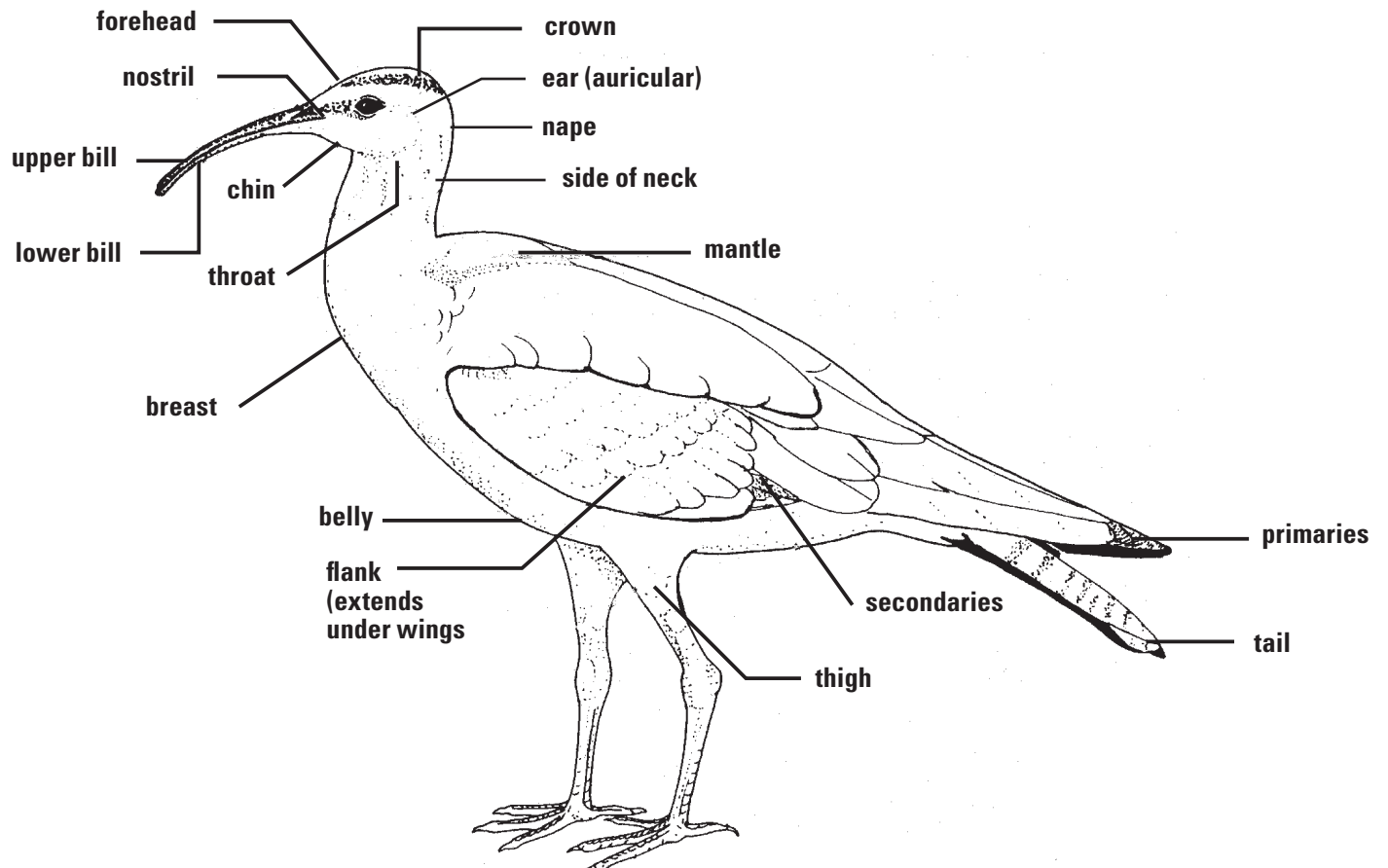


Shorebird Morphology: Standing

Directions: Fill in the blanks with the names of the correct body part.

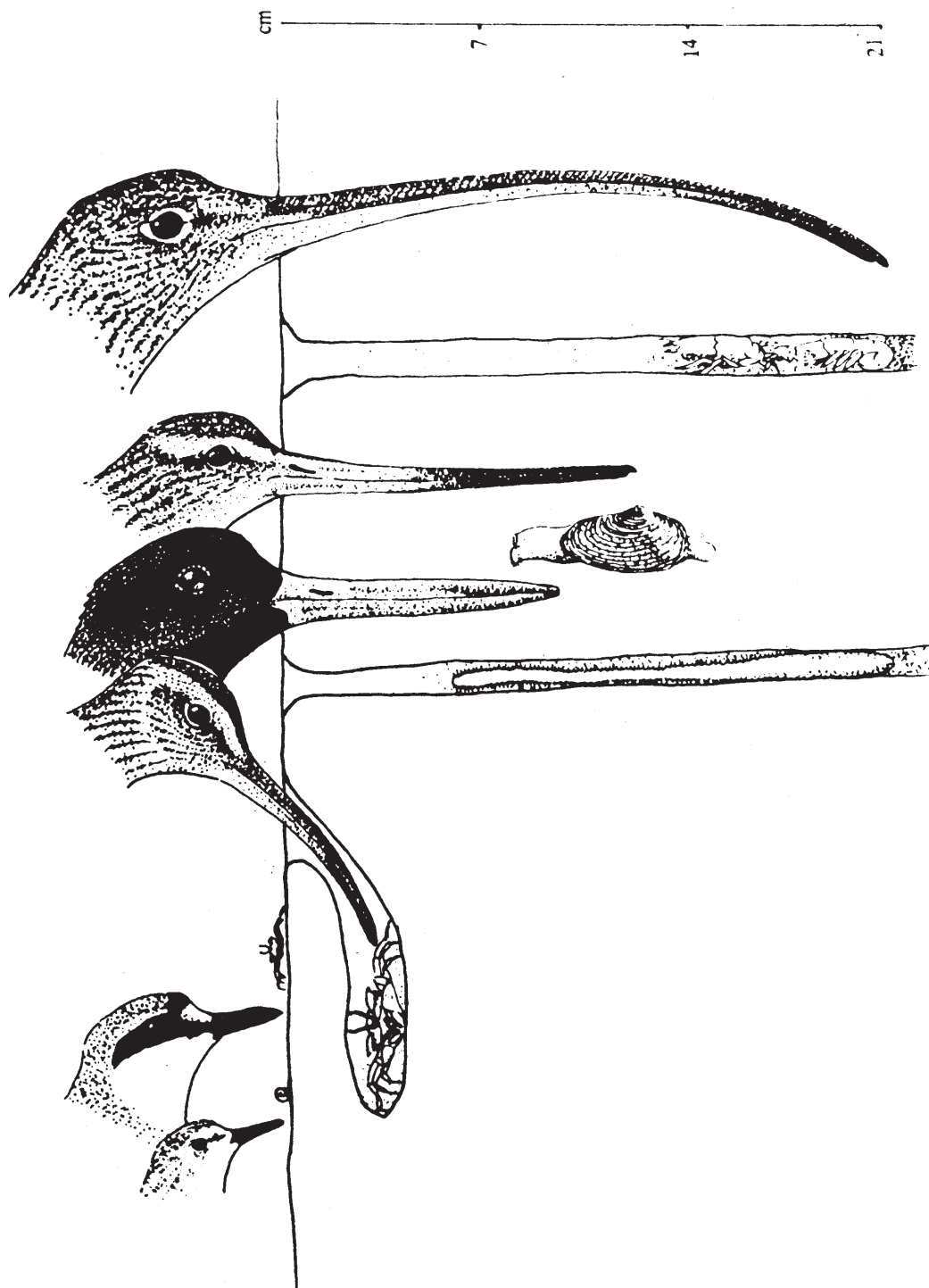


Shorebird Morphology: Standing



Shorebird Beaks

*Designed for What
They Eat and How
They Feed*



Shorebird Feeding Styles Answers to Journal Pages

Watch the different ways shorebirds feed. Draw a line from the feeding techniques you see to the style of beaks they have (shown across the page). Then take a guess at what types of foods they are looking for (or “they eat”). Record the names of the shorebirds you are watching, if you know them.

■ **Shallow probing in the mud or sand**
These shorebirds are looking for insects and crustaceans.
Species: sandpipers

■ **Deep probing in the mud or sand**
These shorebirds are looking for aquatic worms, snails, and crustaceans.
Species: curlews, avocets, stilts, godwits,

■ **Picking things off the surface**
These shorebirds are looking for insects, crustaceans, horseshoe crab eggs.
Species: plovers, killdeer, turnstones

■ **Breaking or crushing open shelled animals**
These shorebirds are looking for mollusks and clams
Species: oystercatchers

Shorebird Feeding Styles

Watch the different ways shorebirds feed. Draw lines from the feeding techniques you see to the styles of beaks they have (shown across the page). Then take a guess at what types of foods they are after. Record the names of the shorebirds you are watching if you know them.

Shallow probing in the mud or sand
These shorebirds are looking for: _____

Species: _____

Deep probing in the mud or sand
These shorebirds are looking for: _____

Species: _____

Picking things off the surface
These shorebirds are looking for: _____

Species: _____

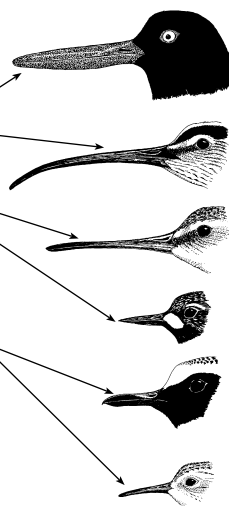
Breaking or crushing open shelled animals
These shorebirds are looking for: _____

Species: _____

Other types of beaks and feeding styles you notice:

Shorebird Beaks

Designed for What They Eat
and How They Feed



Shorebirds, Wading Birds, Seabirds

General Physical and Behavioral Characteristics

	<i>Shorebirds</i> (sandpipers, plovers, stilts, oystercatchers, avocets)	<i>Seabirds</i> (gulls and terns)	<i>Wading Birds</i> (herons and egrets)
Physical	Description	Description	Description
Size	Small to medium	Small to large	Large
Color	Brown or gray above; pale or white below	Gray, white above with some black; white below	Color varies (blue, white, etc.)
Toes	Long	Webbed	Long
Legs	Long Color important in identification	Short Color important in identification	Long Color important in identification
Beak	Long, slender	Robust to slender; in gulls, color important in identification	Long, pointed
Neck	Short	Short	Long
Tail	Short, square	Short and square (gulls) or long and forked (terns)	Short and square
Breeding plumage	Red or orange in plumage	Black usually on head, bill may become red	Long “plumes” often present on head and/or throat
Behavioral	Description	Description	Description
Nest Location	Ground	Ground, cliffs	Trees near wetlands
Nest	Independently	Colonial	Colonial
Nesting Habitat	Wetlands, grasslands, beaches, open areas, tundra	Shore, lakes, oceans, islands, tropics to arctic	Wetlands in temperate areas
Prey	Invertebrates, worms, insects	Fish, eggs, chicks, garbage	Fish, frogs, crabs, insects
Feeding Behavior	Gregarious and solitary, feed by probing in mud, water, sand	Gregarious and may form interspecies flocks; feed by diving into water	Solitary and may stalk or actively chase prey in shallow water.
Vocalizations	Peeps, whistles, short trills	Raucous cries	Croaks, grunts, trumpeting
Migration	Long distance	Long distance, short distance, & non-migratory	Short distance or non-migratory
Wintering Habitat	Coasts, wetlands, ponds, primarily in tropics	Shore, lakes, oceans, islands, landfills, urban areas	Wetlands, coasts, rivers
Summary	The 48 species have relatively long legs and thin bills and are common in shoreline habitats. They may be seen running in and out with ocean waves, probing for food on beaches, or feeding in pastures and other open areas. THINK QUICK AND SMALL!	There are 27 gull species and 18 tern and skimmer species. Gulls are conspicuous and usually gregarious. Terns are smaller, more slender, and have straighter, pointed bills. They are not as raucous as gulls. Seabirds are often seen and heard in flight. THINK AERIAL, GRAY & BLACK!	The 20 species of waders are all long-legged, most with long necks and long, pointed bills for spearing fish or other prey. They often stalk slowly, with head thrust forward. THINK LONG!

Explore the World with Shorebirds!

Educator's Guide Evaluation

We want to know what you think. Please complete the following survey and fax or mail it to:

Shorebird Sister Schools Program Coordinator

U.S. Fish and Wildlife Service

698 Conservation Way

Shepherdstown, WV 25443-9713

Fax 304/876 7231

You may also send us your comments via email: sssp@fws.gov Thank You!

Tell Us About Yourself

1. Your Name and Job Title: _____

2. Name of your School/Organization/Agency: _____

3. May we contact you for additional feedback? Yes No

If yes, please provide your contact information

Email address _____

Mailing address _____

4. What is the primary group you work with?

___ Classroom students: grades _____ ___ Nature center audiences
___ Home school students ages: _____ ___ Forest, park, or refuge visitors
___ Youth groups ages: _____ ___ Other: _____

5. How did you hear about Explore the World with Shorebirds! Educator's Guide?

___ Website ___ Workshop
___ Listserve ___ Another educator
___ Other _____

6. In what format did you receive Explore the World with Shorebirds! Educator's Guide?

___ Hard-copy curriculum guide ___ CD Rom

7. Which sections of the guide did you use? (Check all that apply)

___ Entire Curriculum (Connecting Cultures, Shorebird Primer, Classroom Activities,
Field Trip Planner, Field Trip Activities, Appendix)
___ Connecting Cultures ___ Shorebird Primer ___ Classroom Activities
___ Field Trip Planner ___ Field Trip Activities ___ Appendix



8. How did you use the guide? (Check all that apply)

___ Used entire curriculum to support participation in the Shorebird Sister Schools Program

___ Used as a resource/reference guide to support other curriculum/program

___ Selected activities to support participation in the Shorebird Sister Schools Program

___ Selected activities to support other curriculum/program

___ Other _____

Your Evaluation

Overall Educator's Guide

Please give the guide a grade on

Organization	A	B	C	D	F
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Ease of use	A	B	C	D	F
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Background information	A	B	C	D	F
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(Shorebird Primer)

Supporting information	A	B	C	D	F
------------------------	---	---	---	---	---

(Appendices)

Comments: _____

Which section(s) of the guide did you find *most useful*? Why?

Classroom Activities

Which classroom activities did you use? Were they age/grade appropriate?

What were your reasons for selecting these classroom activities?

Did your students/group find the activities interesting?

Other comments?



Can you suggest any additional classroom activities or subject areas to consider for the next guide revision?

What additional supporting materials like student readings, overhead transparencies, activity sheets, and handouts would have been useful to you in the classroom?

Shorebird Sister Schools Web site

Did you incorporate the Shorebird Sister Schools Program Web site into your lesson plans and/or program activities? If yes, please tell us how.

Shorebird Observation Field Trips

Did you take your class on a field trip to view shorebirds? Yes No
If yes, which materials from the Planning a Shorebird Field Trip did you use?

Which field trip activities did you use? Were they age/grade appropriate?

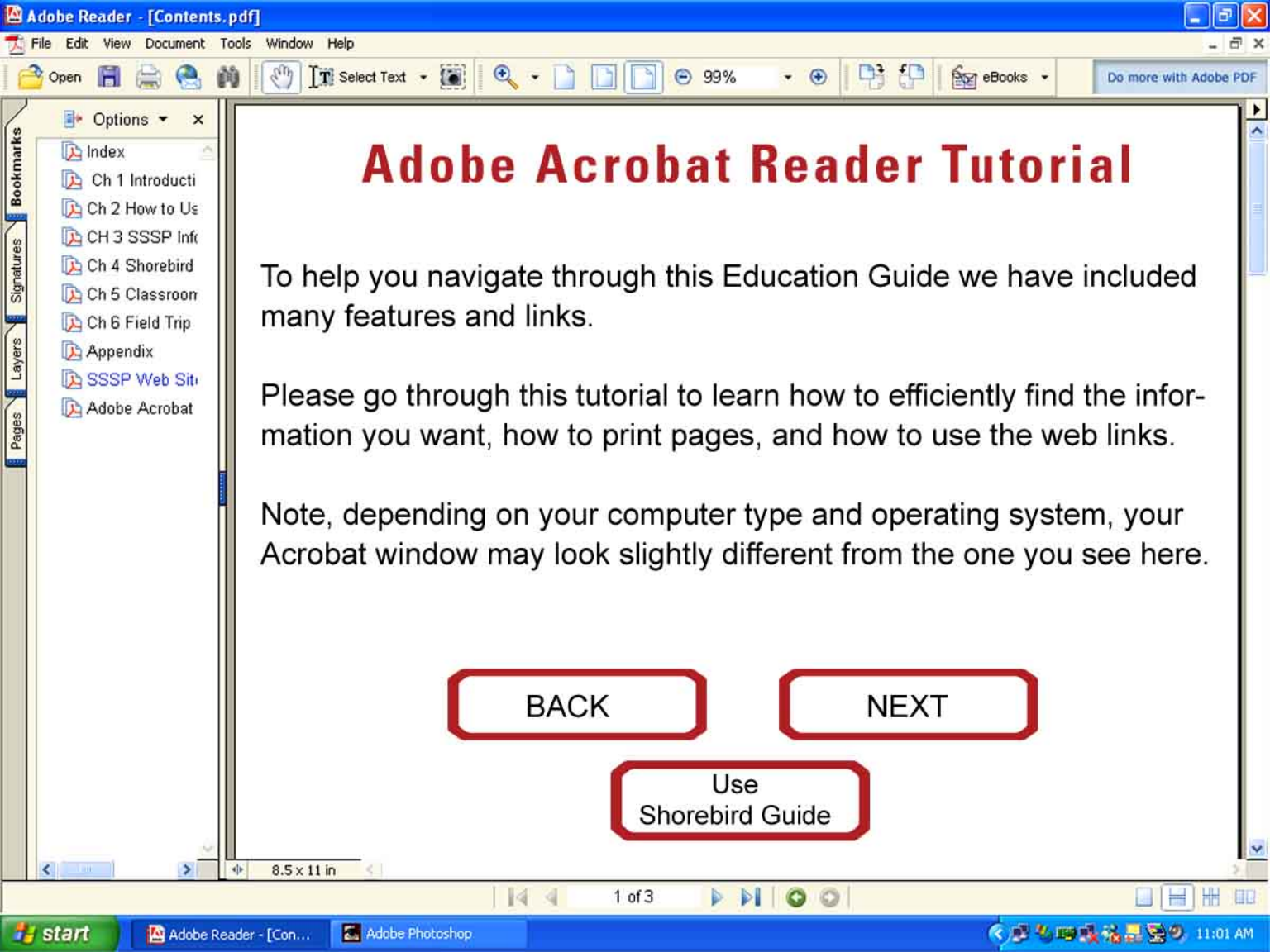
What were your reasons for selecting these field trip activities?

Did your students/group find the activities interesting?

Other comments?

What additional field trip data sheets or journal pages would have enhanced your field trip experience?

Did your students post their shorebird observations on the website. If not, why?



Adobe Acrobat Reader Tutorial

To help you navigate through this Education Guide we have included many features and links.

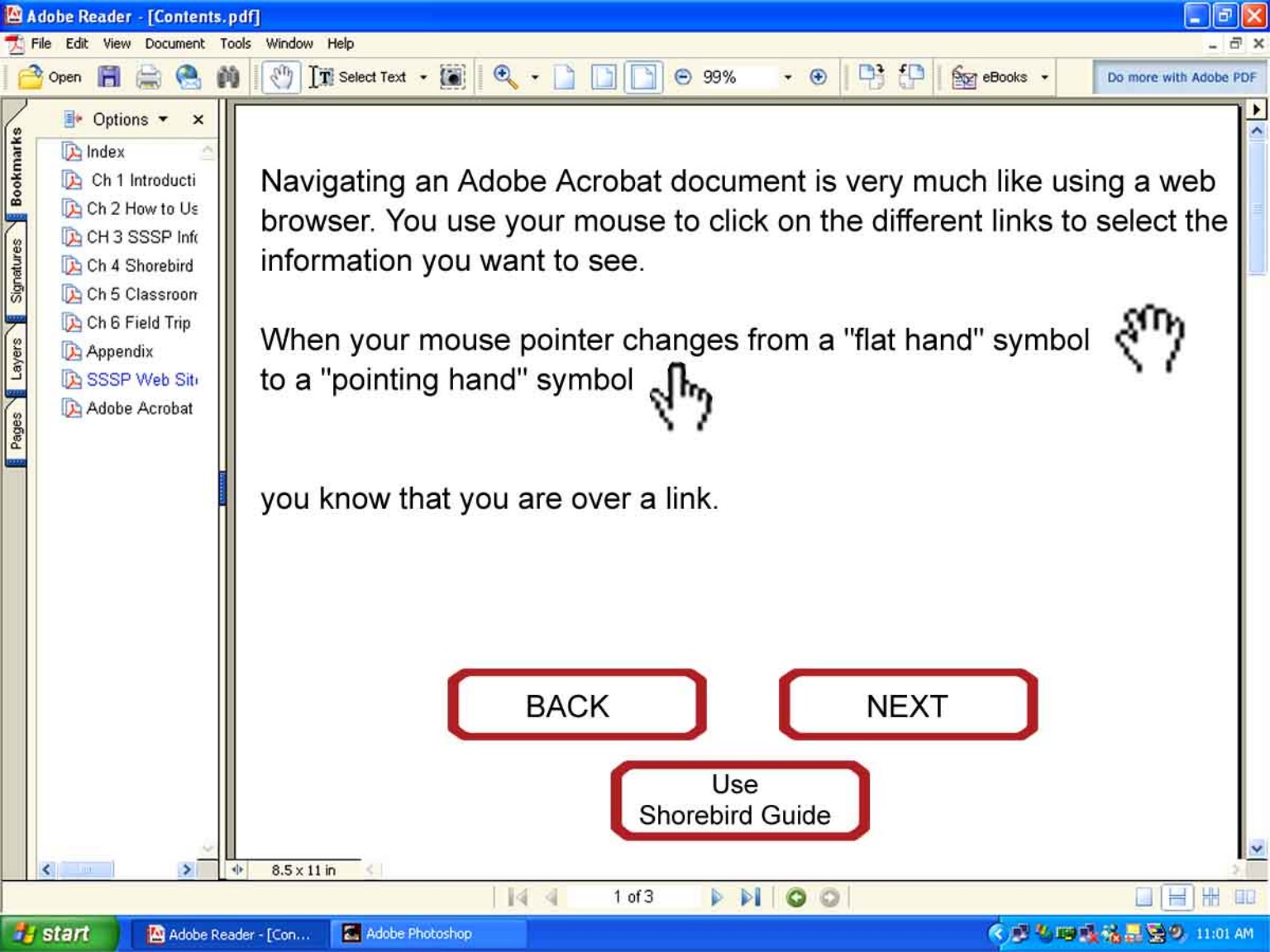
Please go through this tutorial to learn how to efficiently find the information you want, how to print pages, and how to use the web links.

Note, depending on your computer type and operating system, your Acrobat window may look slightly different from the one you see here.

BACK

NEXT

Use
Shorebird Guide



Navigating an Adobe Acrobat document is very much like using a web browser. You use your mouse to click on the different links to select the information you want to see.

When your mouse pointer changes from a "flat hand" symbol to a "pointing hand" symbol

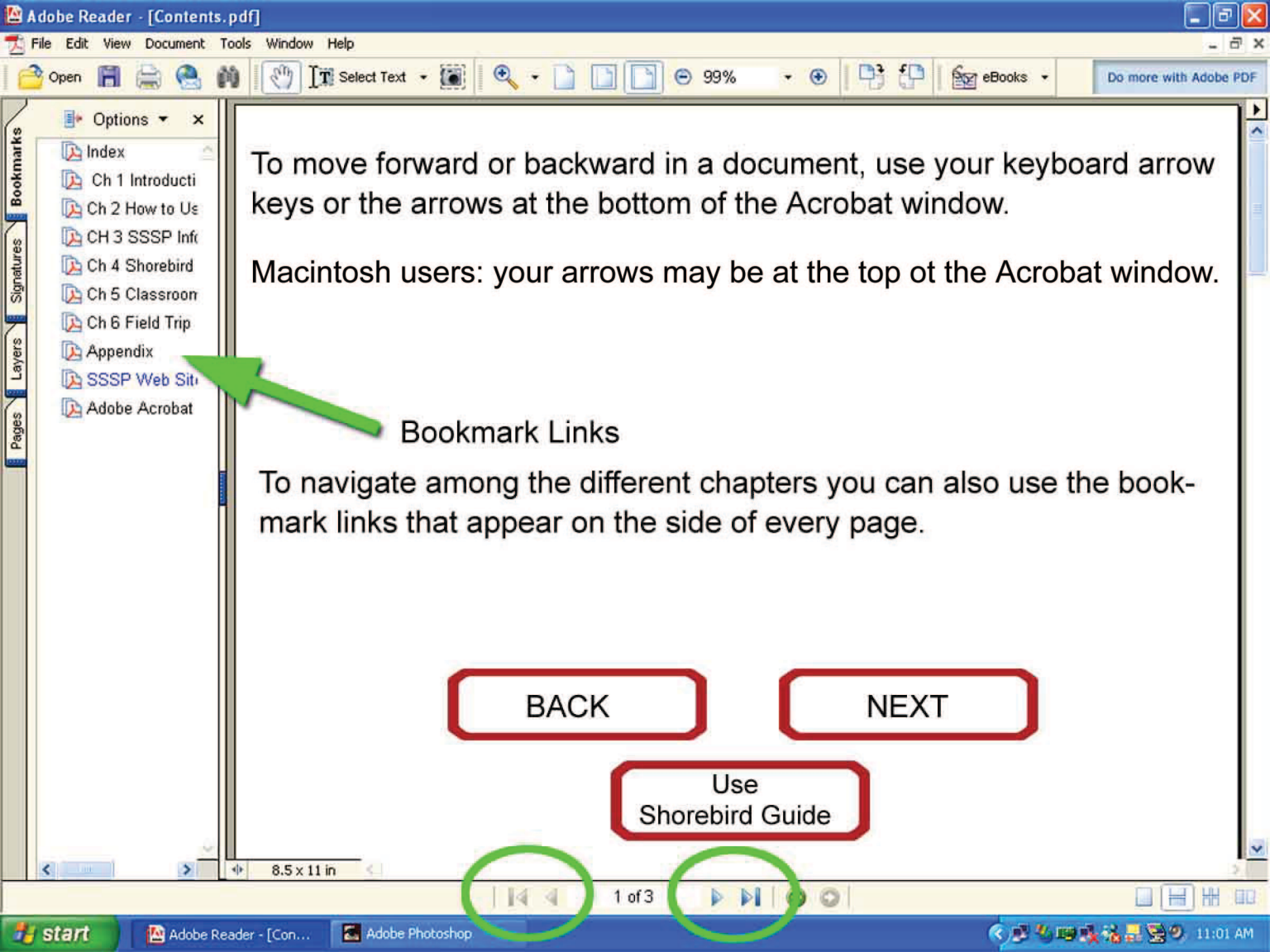


you know that you are over a link.

BACK

NEXT

Use
Shorebird Guide



To move forward or backward in a document, use your keyboard arrow keys or the arrows at the bottom of the Acrobat window.

Macintosh users: your arrows may be at the top of the Acrobat window.

Bookmark Links

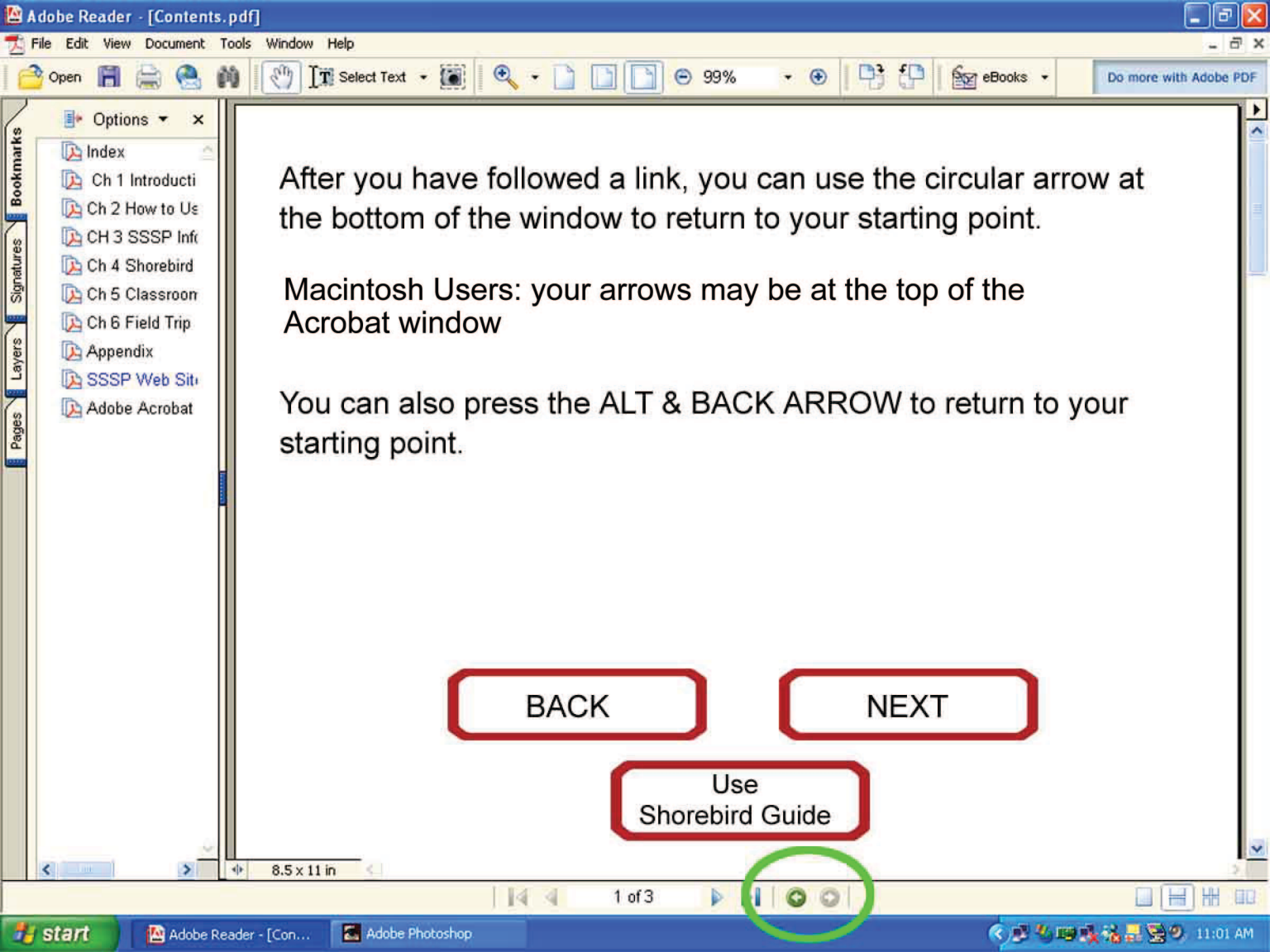
To navigate among the different chapters you can also use the bookmark links that appear on the side of every page.

BACK

NEXT

Use
Shorebird Guide

1 of 3



After you have followed a link, you can use the circular arrow at the bottom of the window to return to your starting point.

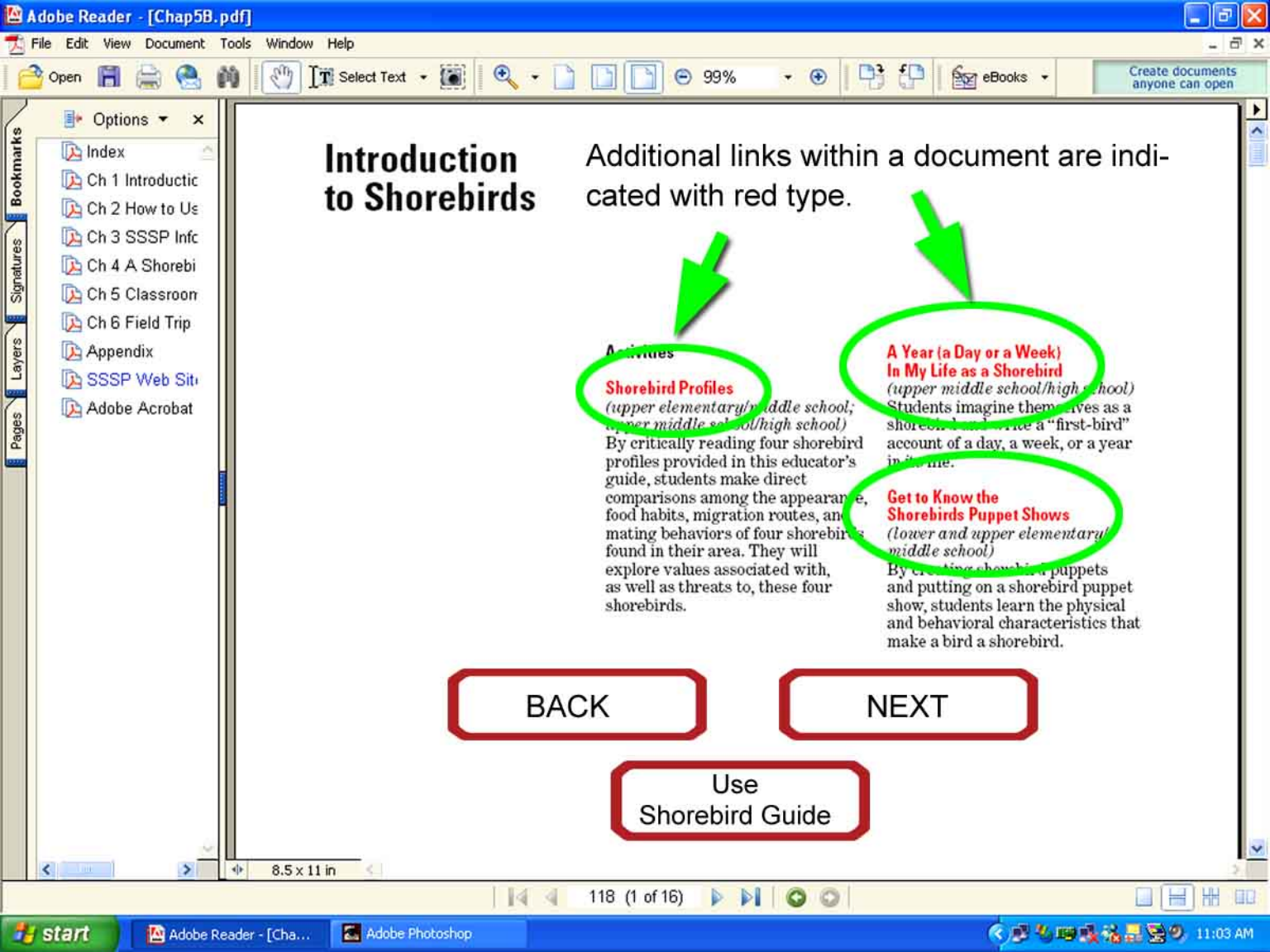
Macintosh Users: your arrows may be at the top of the Acrobat window

You can also press the ALT & BACK ARROW to return to your starting point.

BACK

NEXT

Use
Shorebird Guide



Introduction to Shorebirds

Additional links within a document are indicated with red type.

Activities

Shorebird Profiles

(upper elementary/middle school; upper middle school/high school)
By critically reading four shorebird profiles provided in this educator's guide, students make direct comparisons among the appearance, food habits, migration routes, and mating behaviors of four shorebirds found in their area. They will explore values associated with, as well as threats to, these four shorebirds.

A Year (a Day or a Week) In My Life as a Shorebird

(upper middle school/high school)
Students imagine themselves as a shorebird and write a "first-bird" account of a day, a week, or a year in its life.

Get to Know the Shorebirds Puppet Shows

(lower and upper elementary/middle school)
By creating shorebird puppets and putting on a shorebird puppet show, students learn the physical and behavioral characteristics that make a bird a shorebird.

BACK

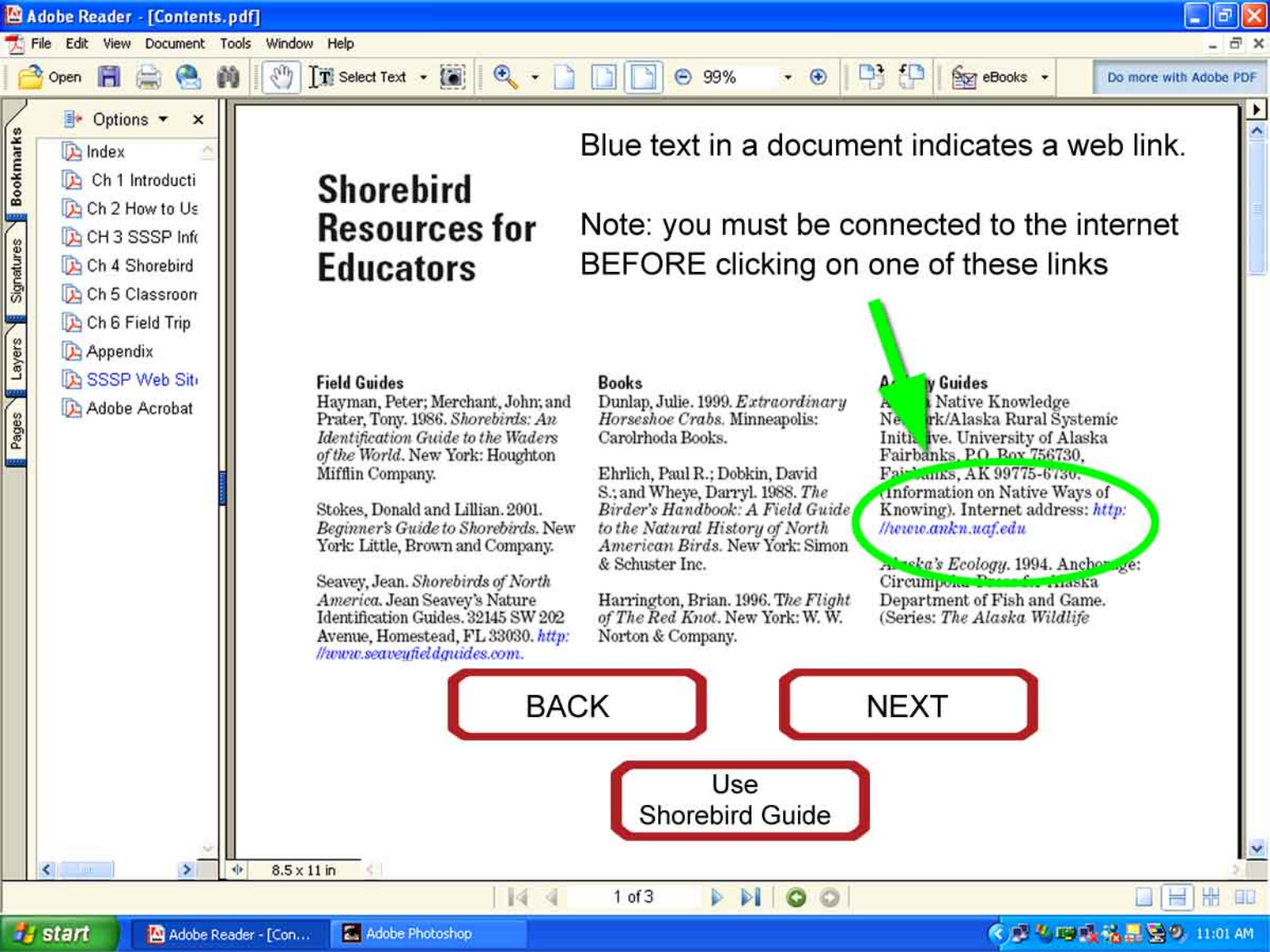
NEXT

Use
Shorebird Guide

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118 (1 of 16)

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Shorebird Resources for Educators

Blue text in a document indicates a web link.

Note: you must be connected to the internet BEFORE clicking on one of these links

Field Guides

Hayman, Peter; Merchant, John; and Prater, Tony. 1986. *Shorebirds: An Identification Guide to the Waders of the World*. New York: Houghton Mifflin Company.

Stokes, Donald and Lillian. 2001. *Beginner's Guide to Shorebirds*. New York: Little, Brown and Company.

Seavey, Jean. *Shorebirds of North America*. Jean Seavey's Nature Identification Guides. 32145 SW 202 Avenue, Homestead, FL 33030. <http://www.seaveyfieldguides.com>.

Books

Dunlap, Julie. 1999. *Extraordinary Horseshoe Crabs*. Minneapolis: Carolrhoda Books.

Ehrlich, Paul R.; Dobkin, David S.; and Wheye, Darryl. 1988. *The Birder's Handbook: A Field Guide to the Natural History of North American Birds*. New York: Simon & Schuster Inc.

Harrington, Brian. 1996. *The Flight of The Red Knot*. New York: W. W. Norton & Company.

Additional Guides

Alaska Native Knowledge Network/Alaska Rural Systemic Initiative. University of Alaska Fairbanks, P.O. Box 756730, Fairbanks, AK 99775-6730. (Information on Native Ways of Knowing). Internet address: <http://www.ankn.uaf.edu>

Alaska's Ecology. 1994. Anchorage: Circumpolar Program for Alaska Department of Fish and Game. (Series: *The Alaska Wildlife*

BACK

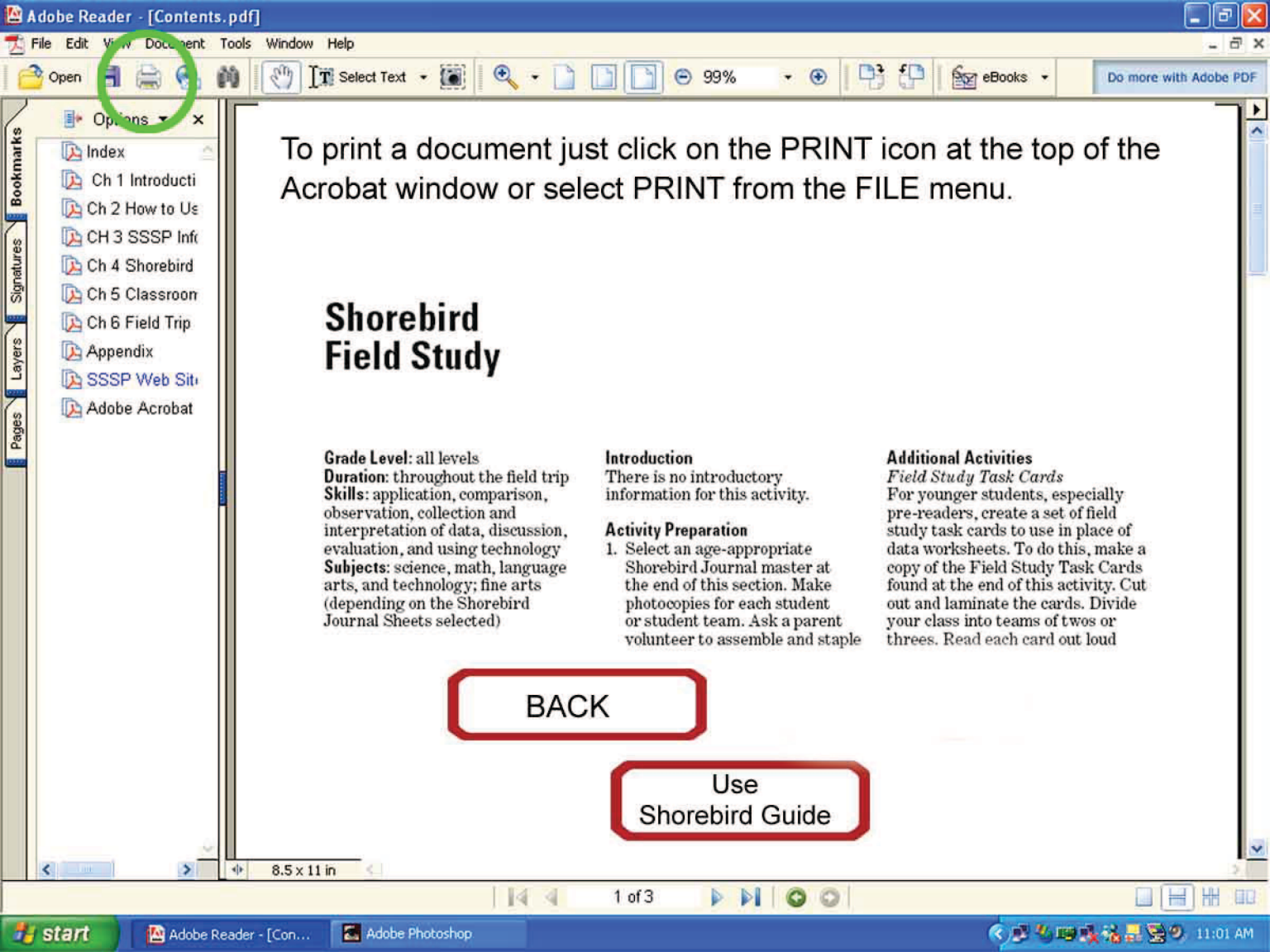
NEXT

Use
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1 of 3

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To print a document just click on the PRINT icon at the top of the Acrobat window or select PRINT from the FILE menu.

Shorebird Field Study

Grade Level: all levels

Duration: throughout the field trip
Skills: application, comparison, observation, collection and interpretation of data, discussion, evaluation, and using technology

Subjects: science, math, language arts, and technology; fine arts (depending on the Shorebird Journal Sheets selected)

Introduction

There is no introductory information for this activity.

Activity Preparation

1. Select an age-appropriate Shorebird Journal master at the end of this section. Make photocopies for each student or student team. Ask a parent volunteer to assemble and staple

Additional Activities

Field Study Task Cards

For younger students, especially pre-readers, create a set of field study task cards to use in place of data worksheets. To do this, make a copy of the Field Study Task Cards found at the end of this activity. Cut out and laminate the cards. Divide your class into teams of twos or threes. Read each card out loud

BACK

Use
Shorebird Guide