

**Grade Level:**

4

Time:

105 Minutes

Season:

All

Objectives:

Students will be able to...

- Identify a variety of morphological adaptations in fish
- Determine why and how fish are adapted to life in water
- Describe the physical adaptations of salmon that allow them to survive through each life stage

Key Concepts:

- Fish have a variety of physical characteristics that are necessary for them to survive in their aquatic habitat

Salmon Anatomy – Survival Adaptations

Lesson 2 of 2

Background & Summary

This lesson continues to build on the concept of salmon anatomy and dives deeper in the anatomical adaptations that allow salmon to survive in their habitats. This activity will provide the students with the opportunity to recall what they have learned about general fish anatomy. Their knowledge will be further utilized to explore the adaptive details of different fish and then apply those details to salmon.

Procedure

Introduction: What is an “adaptation”?

1. Start a class discussion by asking students to give examples of or describe what they think of when they hear the word “adaptation”. The goal is to develop a collective definition of the word. (2 minutes)

Key message to share with students:

An adaptation is any physical, social, or behavioral characteristic that allows an organism to survive or reproduce in their habitat

2. Continue the discussion by asking students to share adaptations that some species use to survive. Below are examples that can be used to guide the discussion. (3 minutes)

- Tiger in a jungle
 - Stripes for camouflage to break up the shape of its body making them harder to detect
 - Strong jaw muscles for eating through flesh and bones
 - Sharp claws for attacking and killing prey
- Deer in the forest
 - Fur for insulation
 - Specialized stomachs for eating and digesting plant material
 - Large ears for detecting danger
- Raccoon in the city
 - Strong sense of smell for finding food
 - Nimble hands for opening up doors and containers
 - Omnivorous diet for eating both plants and animals



Procedure (Continued)

Fish Adaptations

Learning objectives:

- a. Fish have a variety of morphologies
 - b. Morphological characteristics are determined by habitat
3. Split students into groups of five. Each group should be assigned a morphology (body shape, tail shape, color patterns, mouth and teeth/gill rakers). There are only five tables so some groups may end up doing the same table if there are more than 25 students in a class. Each student in the group should be given a “Morphology Table Worksheet” that matches the morphology assigned to their group. Instruct students to use their computers to complete the table semi-independently (each student should complete their own table but can work together to discuss possible answers).

The “Morphology Worksheet Answer Key” is a resource for instructors to better assist students. (30 minutes)



Instruction Advice

Some students may not be comfortable using the internet to research a topic. Encourage those students to use sentence starters in the search engine to help get them started. See “Morphology Worksheet Answer Key” for specific search terms that will likely generate an answer

Examples of fish that have [insert morphological feature].

Description of fish that have [insert morphological feature]

4. Call on one or two students from each group to share with the class an adaptation, it’s description and the example. Students should share answers that they filled in, not ones that were already provided. Use the “Fish Morphology Presentation” to review the morphologies that students don’t present. (30 minutes)

Key messages to share with students:

Fish are adapted to their habitat and their morphologies play a critical role in their ability to live and survive in their habitat

The characteristics of plants and animals offer great insight to the physical and biological conditions of the ecosystem.

Time Saver

Save on time by having students complete the “Morphology Table Worksheet” the night before.

Salmon are Built for Survival

Learning objectives:

- a. Each salmon life stage has physical adaptations that help them survive
 - b. Physical adaptations are required for species survival
5. Tell students they will apply what they just learned about fish adaptations to the salmon life stages. Students will work in groups to research ways that each salmon life stage has adapted to survive in their habitat. They will present their findings in a poster and must provide a minimum of two survival adaptations for each life stage (eggs, alevin, fry, smolt, ocean adult and spawning adult). In addition to using their laptops, encourage students to identify adaptations they observe from the “Life Cycle Displays” and “Pacific Salmon Images”.



Procedure (Continued)

Examples of life state specific adaptations are listed on the “Life Stage Adaptation Cheat Sheet”. However, answers will vary, and the cheat sheet provided only has a limited number of answers that are meant to assist students who get stuck.

Below are suggested search engines terms:

How do salmon [insert life stage] survive?

How are salmon [insert life stage] adapted to their environment?

What type of adaptations do salmon have?

Students should draw knowledge from the list of survival adaptations they learned about in the previous activity and their understanding of fish-specific anatomy. (30 minutes)

6. Wrap-up the lesson by having students share out. Use the following prompts to facilitate the discussion. (10 minutes)

- What features stand out to you?
- Which adaptations are the same or similar between life stages?
- Which adaptations are unique to a specific life stage?

Work Smarter, Not Harder

Save time by having each student in a group tackle a different life stage. For groups of five, one student can do both adult stages. For groups of four, group together eggs/alevin and ocean/spawner.

Extensions

Additional Activities

Sound-Off Game

In this activity adopted from a lesson about animal adaptations, students play a game that illustrates the importance of communication as a form of adaptation. This activity can be used in addition to or instead of the warm-up activity described at this beginning of this lesson. Instructions for the Sound-Off game is included in the lesson plan.

Funky Fish Morphology Activity

Students learn about the connection between animal morphology and habitat by using clay to design a fish. The activity was developed by Oregon State University Extension Service. Instructions are included in this lesson plan

Vocabulary

See “Morphology Table Worksheet” for vocabulary that is relevant to this lesson plan.



Materials

Included:

Morphology Table Student Worksheet

Morphology Worksheet Answer Key

Life Stage Adaptations Cheat Sheet

Fish Morphology Presentation

(Optional) Sound-Off Activity. See “Extension” section.

(Optional) Funky Fish Morphology Activity. See “Extension” section.

Request to Borrow from Columbia River FWCO:

Note: Requests are pending availability and geographical location

5 sets – Life Cycle Displays (Laminated)

1 set – Pacific Salmon Images (Laminated)

Not Included:

Markers or color pencils

Projector

Computers connected to Wifi (1 for each student)

5 – 25” x 30” Post-It Notes (or any paper to make a poster)

Next Generation Science Standards

Life Science

LS1 – From Molecules to Organisms: Structures and Processes

4-LS1-1: Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

4-LS2-2: Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

Common Core Standards

English Language Arts

Reading Standards for Informational Texts

4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.



Common Core Standards (Continued)

4.4 Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a grade 4 topic or subject area.

4.7 Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, timelines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.

Writing Standards

4.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.

4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research

Speaking and Listening Standards

4.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.

4.4 Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

Acknowledgements

Fun with Fish Forms. Partnerships for Reform through Investigative Science and Math, University of Hawaii-Hilo

Morphology Table Worksheet



Body Shape Adaptation Chart

Body Shape	Description	Example
Fusiform		
Depressed	Flattened from back to belly like a pancake; use short bursts of speed to ambush prey; common in bottom dwelling fish	
Globiform		
Ribbon	Snake-like; slow swimmers but move easily through small cracks and crevices where they hide to ambush prey	Eels
Compressed		Flounders, sergeant majors



Tail Shape Adaptation Chart

Tail Shape	Description	Example
Lunate (fastest)		
Forked		
Squared		
Rounded	Very maneuverable, capable of bursts of speed for short distances	Goby
Tapered	Slow swimmers, use body undulations to swim	Moray eel



Color Pattern Adaptation Chart

Color Pattern	Description	Example
Camouflage		
Advertising	Warning to stay away from poisons or spines; attract mates, defend territories, clean other fish	Hawaiian cleaner wrasse
Disruptive		
Deceiving	Resembling an object or fish that is not of interest to a predator; markings that confuse predator	Butterfly fish, prettyfins
Countershading		



Mouth Shape Adaptation Chart

Mouth Shape	Description	Example
Superior		
Terminal	Middle of head; points forward; feed on organisms floating in water column	
Inferior	Downwards shape; suggests bottom-feeder; often have barbels that assist in locating food particles	
Protruding		Minnows, goldfish
Elongated		Gar; Needlefish



Teeth and Gill Raker Adaptation Chart

Teeth and Gill Raker Features	Description	Example
Pointed Teeth		
Tooth Plates		
Beak -like Teeth	Crush prey items; suggests it feeds items like on plants or coral	Parrotfish; pufferfish
Comb-like Gill Rakers		
Large, course Gill Rakers	Protects gills when they eat from large prey items	Lingcod



Morphology Worksheet Answer Key



Body Shape Adaptation Chart

Body Shape	Description	Example
Fusiform	<p><u>Search: description of fusiform body shape</u></p> <p><u>Streamlined and cylindrical; very fast and can swim continuously for long distances</u></p>	<p><u>Search: examples of fish with fusiform body shape</u></p> <p><u>Marlin, tuna, anchovy</u></p>
Depressed	<p>Flattened from back to belly like a pancake; use short bursts of speed to ambush prey; common in bottom dwelling fish</p>	<p><u>Search: examples of bottom dwelling fish with depressed body shape</u></p> <p><u>Halibut, rays (not technically a fish but still counts for the purpose of this exercise)</u></p>
Globiform	<p><u>Search: description of globiform body shape</u></p> <p><u>Rounded; slow swimmers; use light and lures to attract their prey</u></p>	<p><u>Search: examples of fish with globiform body shape</u></p> <p><u>Pufferfish, boxfish</u></p>
Ribbon	<p>Snake-like; slow swimmers but move easily through small cracks and crevices where they hide to ambush prey</p>	<p>Eels</p>
Compressed	<p><u>Search: description of compressed body shape</u></p> <p><u>Flattened from side to side; make sharp, quick turns; very maneuverable</u></p>	<p>Flounders, sergeant majors</p>



Tail Shape Adaptation Chart

Tail Shape	Description	Example
Lunate (fastest)	<p><u><i>Search: description of lunate tail shape in fish</i></u></p> <p><u>Crescent shape; fastest swimmers, maximum speed with minimum effort over long distances</u></p>	<p><u><i>Search: examples of fish with lunate tail shape</i></u></p> <p><u>Marlin, swordfish, mako shark (not technically a fish but still counts for the purpose of this exercise)</u></p>
Forked	<p><u><i>Search: description of forked tail shape in fish</i></u></p> <p><u>Moderately fast, continuous swimmers</u></p>	<p><u><i>Search: examples of fish with forked tail shape</i></u></p> <p><u>Striped bass</u></p>
Squared	<p><u><i>Search: description of squared tail shape in fish</i></u></p> <p><u>Very maneuverable, capable of bursts of speed for short distances</u></p>	<p><u><i>Search: examples of fish with squared tail shape</i></u></p> <p><u>Catfish, rockfish, salmon</u></p>
Rounded	Very maneuverable, capable of bursts of speed for short distances	Goby
Tapered	Slow swimmers, use body undulations to swim	Moray eel



Color Pattern Adaptation Chart

Color Pattern	Description	Example
Camouflage	<u><i>Search: description of camouflage color pattern IN FISH. Note- see Wikipedia article on "Fish coloration"</i></u> <u>Match surroundings to blend in and hide</u>	<u><i>Search: examples of fish with camouflage color pattern</i></u> <u>Reef stonefish, cuttlefish</u>
Advertising	Warning to stay away from poisons or spines; attract mates, defend territories, clean other fish	Hawaiian cleaner wrasse
Disruptive	<u><i>Search: description of disruptive color pattern</i></u> <u>Spots, stripes, and patches of color breakup and diffuse the actual outline</u>	<u><i>Search: examples of fish with disruptive color pattern</i></u> <u>Jack-knife fish, sergeant-major</u>
Deceiving	Resembling an object or fish that is not of interest to a predator; markings that confuse predator	Butterfly fish, prettyfins
Countershading	<u><i>Search: description of countershading color pattern</i></u> <u>Dark back and lighter belly hides fish from predators as sunlight penetrates from above</u>	<u><i>Search: examples of fish with countershading color pattern</i></u> <u>Tuna</u>



Mouth Shape Adaptation Chart

Mouth Shape	Description	Example
Superior	<p><u><i>Search: description of fish with downward mouth shape</i></u></p> <p><u>Upward shape; suggests surface feeder; waits for prey to appear above them</u></p>	<p><u><i>Search: examples of fish with downward mouth shape</i></u></p> <p><u>Hatchetfish; Arowana</u></p>
Terminal	<p>Middle of head; points forward; feed on organisms floating in water column</p>	<p><u><i>Search: examples of fish with terminal mouth shape</i></u></p> <p><u>Tetras, cichlids</u></p>
Inferior	<p>Downwards shape; suggests bottom-feeder; often have barbels that assist in locating food particles</p>	<p><u><i>Search: examples of fish with inferior mouth shape</i></u></p> <p><u>Sturgeon, catfish</u></p>
Protruding	<p><u><i>Search: description of fish with protruding mouth shape</i></u></p> <p><u>Extends reach; creating a vacuum to suck in their prey</u></p>	<p>Minnows, goldfish</p>
Elongated	<p><u><i>Search: description of fish with elongated mouth shape</i></u></p> <p><u>Pokes mouth into small holes and crevices; can be used to dig for prey or scoop from surface</u></p>	<p>Gar; Needlefish</p>



Teeth and Gill Raker Adaptation Chart

Teeth and Gill Raker Features	Description	Example
Pointed Teeth	<p><u><i>Search: description of fish with pointed teeth</i></u></p> <p><u>Eats other fish; designed to puncture, hold or cut prey</u></p>	<p><u><i>Search: examples of fish with pointed teeth</i></u></p> <p><u>Barracuda; angler fish</u></p>
Tooth Plates	<p><u><i>Search: description of fish with tooth plates</i></u></p> <p><u>Feed on shelled animals; use tooth plates to crush shells to get the meat inside</u></p>	<p><u><i>Search: examples of fish with tooth plates</i></u></p> <p><u>Bat ray fish, redear sunfish</u></p>
Beak -like Teeth	Crush prey items; suggests it feeds items like on plants or coral	Parrotfish; pufferfish
Comb-like Gill Rakers	<p><u><i>Search: description of fish with comb-like gill rakers</i></u></p> <p><u>Efficient at filtering tiny prey</u></p>	<p><u><i>Search: examples of fish with comb-like gill rakers</i></u></p> <p><u>American shad; anchovy</u></p>
Large, course Gill Rakers	Protects gills when they eat from large prey items	Lingcod



Fish Morphology Presentation

The presentation contains links that will quickly navigate you through the different sections





Fish Morphology

Salmon Anatomy: Survival Adaptations



Select an adaptation below to learn more

[Body Shape](#)

[Tail Shape](#)

[Color Pattern](#)

[Mouth Shape](#)

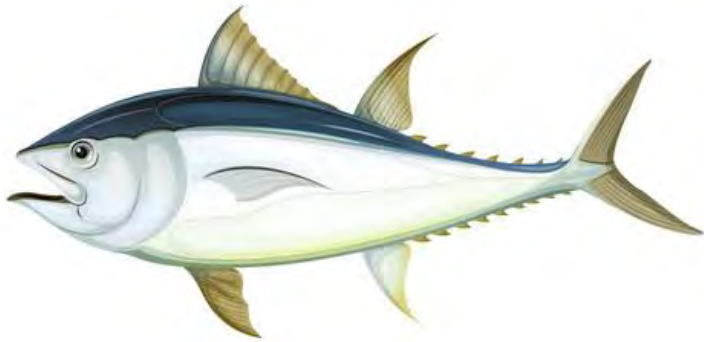
[Teeth and Gill Rakers](#)



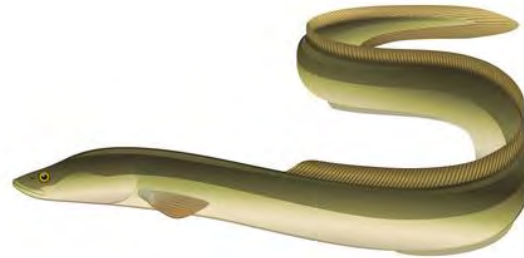
Body Shape Adaptations

Click on an adaptation below to learn more

Fusiform



Ribbon



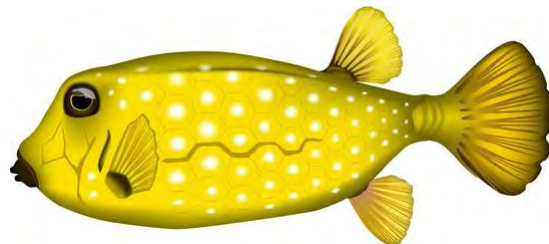
Depressed (Flat)



Compressed



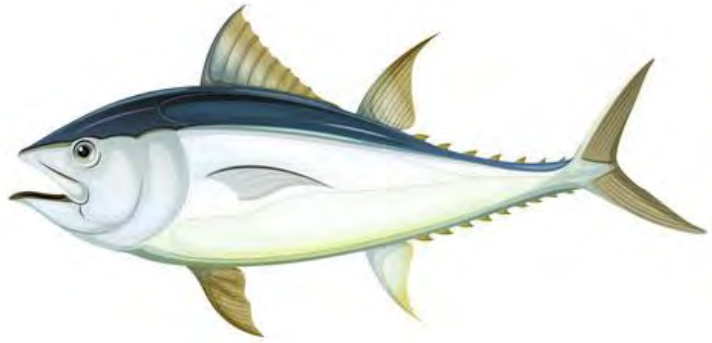
Globiform



Main
Menu



Body Shape - Fusiform

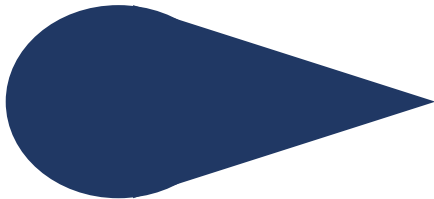


Atlantic Bluefin Tuna

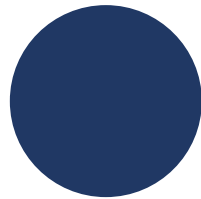
- Streamlined and torpedo shaped
- Fast swimmers

Examples

- [Marlin](#)
- [Anchovy](#)



Side
view



Front
view

Back



Body Shape - Ribbon



European Eel

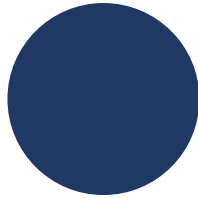
- Elongated; snake-like
- Hides in small cracks and crevices to ambush prey

Examples

- [Eels](#)
- [Sand lance](#)



Side
view



Front
view

Back



Body Shape – Depressed



Electric Ray

- Flattened (top to bottom)
- Common in bottom dwelling fish

Examples

- [Rays](#)
- [Halibut](#)



Side
view

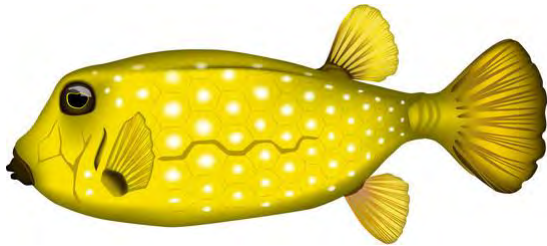


Front
view

Back



Body Shape - Globiform

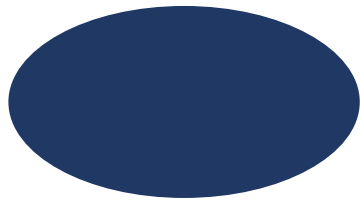


Yellow Boxfish

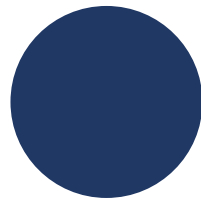
- Rounded
- Slow swimmers

Examples

- [Pufferfish](#)
- [Boxfish](#)



Side
view



Front
view

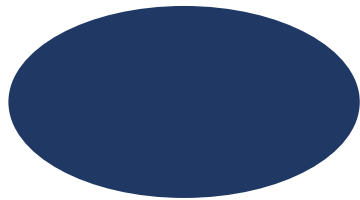
Back



Body Shape – Compressed



Blue Tang



Side
view



Front
view

- Compressed (side to side)
- Maneuverable; able to make quick, sharp turns

Examples

- [Tang](#)
- [Crappie](#)

Back



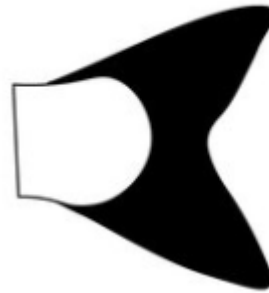
Tail Shape Adaptations

Click on an adaptation below to learn more

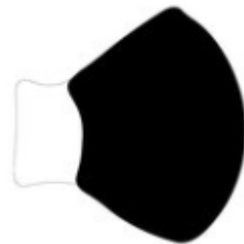
Lunate



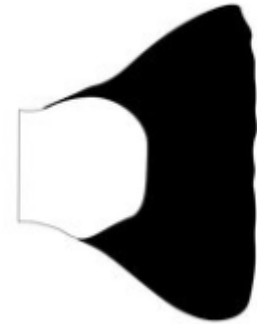
Forked



Rounded



Squared



Tapered



[Main
Menu](#)



Tail Shape – Lunate



- Crescent shape
- Fastest swimmers

Examples

- [Swordfish](#)
- [Mako shark](#)

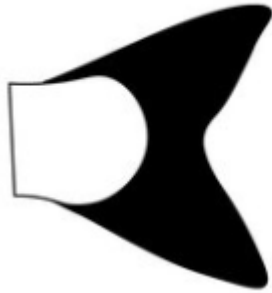


Sailfish

[Back](#)



Tail Shape – Forked



- Moderately fast swimmer
- Able to swim continuously over long distances

Examples

- [Menhaden](#)
- [Pilot fish](#)

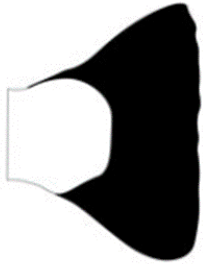


Atlantic Mackerel

[Back](#)



Tail Shape – Squared



- Maneuverable swimmer
- Bursts of speed over short periods of time to escape predators
- Less drag than “rounded” shape



Brown Trout

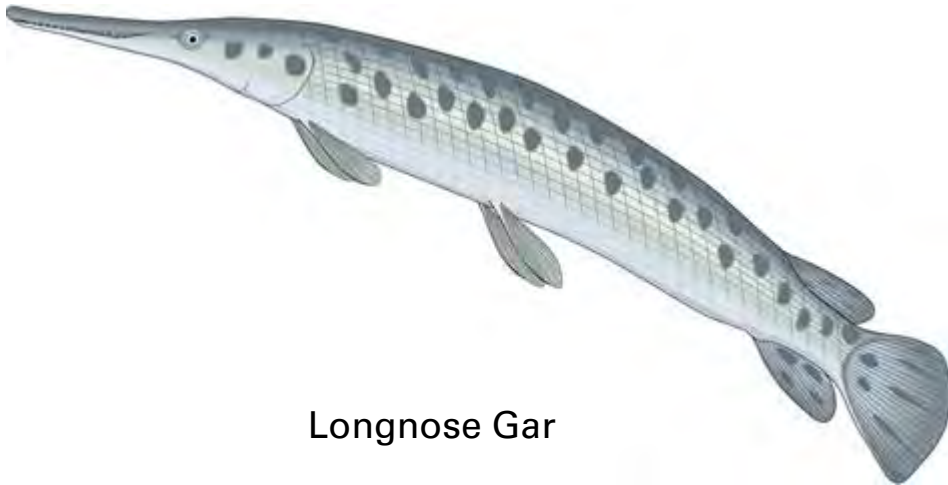
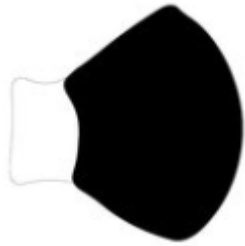
Examples

- [Salmon](#)
- [Rockfish](#)

[Back](#)



Tail Shape – Rounded



Longnose Gar

- Sharp turns and quick starts to evade predators
- Creates drag causing fish to tire easily

Examples

- [Clownfish](#)
- [Goby](#)

[Back](#)



Tail Shape – Tapered



- Slow swimmers
- Swims by making a wave-like motion with its body



Moray Eel

Examples

- [Grenadiers](#)
- [Large-eyed rabbitfish](#)

[Back](#)



Color Pattern Adaptations

Click on an adaptation below to learn more

Camouflage



Advertising



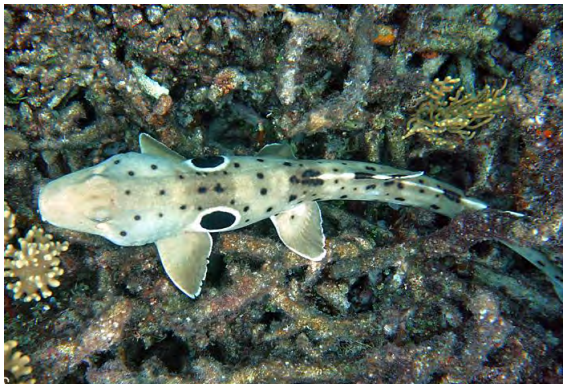
Disruptive



Countershading



Deceiving



Courtesy of Columbia River FWCO Information and Education, 2022

Main
Menu



Color Pattern – Camouflage



Painted frogfish

- Match surroundings to blend in and hide
- Used by both prey fish and ambush predators

Examples

- [Green Clown Goby](#)
- [Large-eyed rabbitfish](#)

[Back](#)



Color Pattern – Advertising



Mandarinfish

- Warning to stay away from poisons or spines
- Attract mates, defend territories, clean other fish

Examples

- [Hawaiian Cleaner Wrasse](#)
- [Squarespot Anthias](#)

[Back](#)



Color Pattern – Disruptive



Clown Triggerfish

- Spots, stripes, and patches of color breakup and diffuse the actual outline
- Irregular patterns with contrasting colors

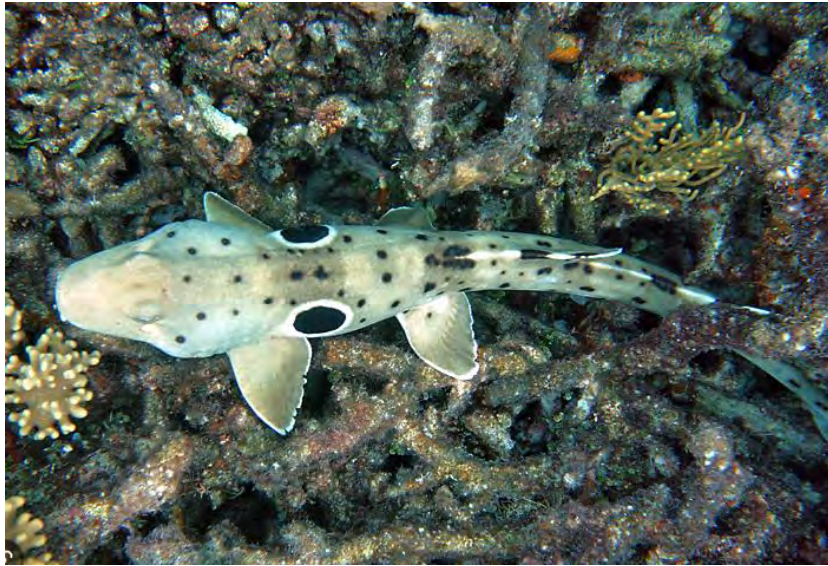
Examples

- [Moorish Idol](#)
- [Blackbanded Sunfish](#)

[Back](#)



Color Pattern – Deceiving



Epaullette Shark

- Resembling an object or fish that is not of interest to a predator
- Markings that confuse predator

Examples

- [Ambon Damselfish](#)
- [Saddle Butterflyfish](#)

[Back](#)



Color Pattern – Countershading



Atlantic Tarpon

- Resembling an object or fish that is not of interest to a predator
- Markings that confuse predator

Examples

- [Whale Shark](#)
- [Atlantic Herring](#)

[Back](#)



Mouth Shape Adaptations

Click on an adaptation below to learn more

Superior



Terminal



Inferior



Elongated



Protruding



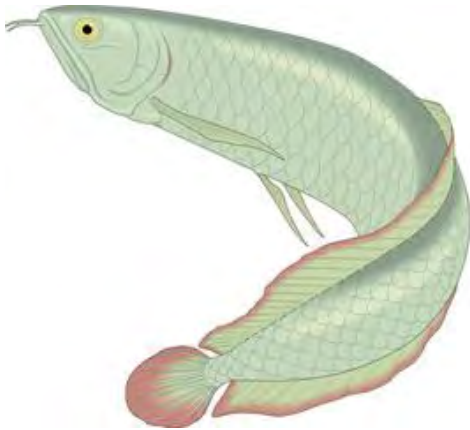
Main
Menu



Mouth Shape – Superior



- Upturned
- Suggests surface feeder; waits for prey to appear above them



Arowana

Examples

- [Lionfish](#)
- [Stonefish](#)

[Back](#)



Mouth Shape – Terminal



- Middle of head; points forward
- Feed on organisms floating in water column



Humphead Wrasse

Examples

- [Blue Spotted Jawfish](#)
- [Blue Gourami](#)

[Back](#)



Mouth Shape – Inferior



- Downturned
- Suggests bottom-feeder

Examples

- [Honeycomb Cowfish](#)
- [Channel Catfish](#)



Gray Atlantic Sturgeon

[Back](#)



Mouth Shape – Protruding



- Extends reach
- Creates vacuum to suck up prey

Examples

- [Slingjaw Wrasse](#)
- [Carp](#)



Tilapia

[Back](#)



Mouth Shape – Elongated



- Elongated jaws can reach into crevices and holes
- Can be used to dig for prey or scoop from surface



Alligator Gar

Examples

- [Butterfly Fish](#)
- [Atlantic Needlefish](#)

[Back](#)



Teeth and Gill Raker Adaptations

Click on an adaptation below to learn more

Pointed Teeth



Comb-like Gill Rakers



Tooth Plates



Beak-like Teeth



Large, Course Gill Rakers



Courtesy of Columbia River FWCO Information and Education, 2022

Main
Menu



Teeth Shape and Size – Pointed



Payara

- Eats other fish
- Designed to puncture, hold or cut prey

Examples

- [Anglerfish](#)
- [Lingcod](#)

[Back](#)



Teeth Shape and Size – Tooth Plates



Sheephead Wrasse

- Feeds on shelled animals
- Uses tooth plates to crush shells to get the meat inside

Examples

- Freshwater Drum
- Bat Ray

[Back](#)



Teeth Shape and Size – Beak-like Teeth



Bumphead Parrotfish

- Crush prey items
- Feeds on organisms such as plants or coral

Examples

- [Pufferfish](#)
- [Parrotfish](#)

[Back](#)



Gill Raker Size and Shape – Comb-like



Gill Rakers from American Shad

- Efficient at filtering tiny prey

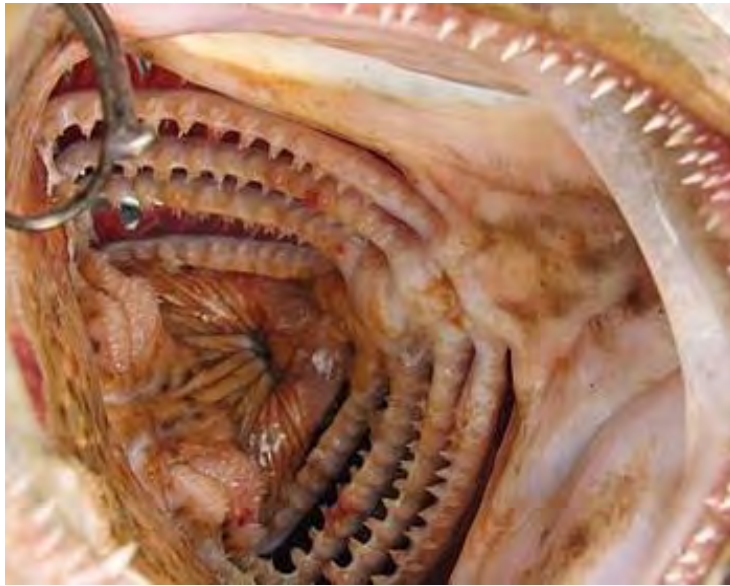
Examples

- [Candy Darter](#)
- [Sardine](#)

[Back](#)



Gill Raker Size and Shape – Large, Course



Gill Rakers from Orange Spotted Grouper

- Protects gills when they eat from large prey items

Examples

- [Grouper](#)
- [Bowfin](#)

[Back](#)

Pacific Salmon Images

Printing Instructions

1. Print pages 2-8
2. With picture side up, reorganize stack in numerical order so the page 8 is on top and page 2 is on bottom
3. Flip stack along long edge and place back into printer paper tray
4. Print pages 9-15









Photo by Roger Tabor (USFWS)



Photo by Roger Tabor (USFWS)



Photo by Roger Tabor (USFWS)



Photo by WSFR-Alaska (USFWS)



Photo by Roger Tabor (USFWS)

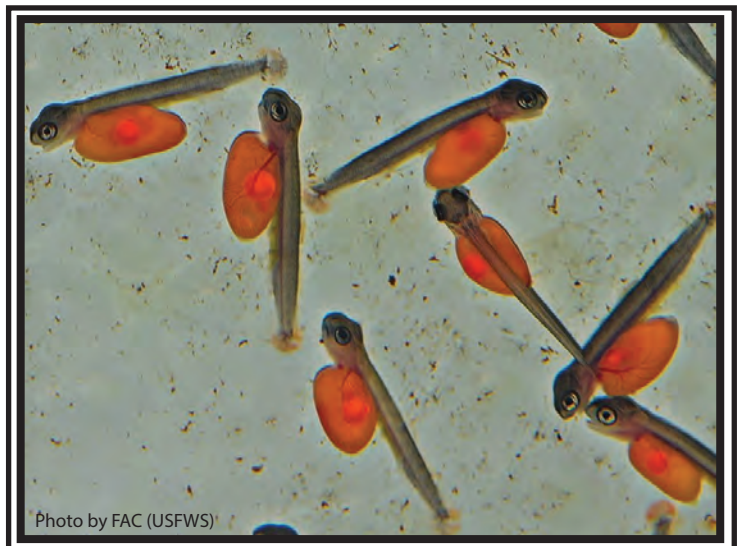


Photo by FAC (USFWS)









Photo by Roger Tabor (USFWS)



Photo by Nicole Hams (USFWS)



Photo by Roger Tabor (USFWS)



Photo by FAC (USFWS)



Photo by Roger Tabor (USFWS)



Photo by Nicole Hams (USFWS)

Chinook Salmon

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Chinook Salmon (Female)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Salmon Carcass

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Chinook Salmon (Male)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Chinook Salmon (Female)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Chinook Salmon

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Kokanee Salmon

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Pink Salmon (Female)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Sockeye Salmon

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Pink Salmon (Males on top and middle; Female on bottom)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Chinook Salmon (Fry)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Kokanee Salmon

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Kokanee Salmon (Fry)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Chum Salmon (Fry)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Coho and Sockeye Salmon

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Chum Salmon

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Salmon Alevins

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Coho Salmon (Adults and Juveniles)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Chum Salmon (Male)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Salmon Alevin

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Coho Salmon (Male top center; Female bottom center)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Eyed Salmon Eggs

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Coho Salmon (Male)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Coho Salmon

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Coho Salmon (Males)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Chum Salmon (Female)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Pink Salmon

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Chum Salmon (Female on left; Male on right)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Pink Salmon (Female towards front; Male towards back)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Chum Salmon (Female towards front; Male towards back)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Chinook Salmon (Fry)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Sockeye Salmon

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Chinook Salmon (Fry)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Coho Salmon (Fry)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Chinook Salmon

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Chinook Salmon (Fry)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Eyed Salmon Eggs

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Coho Salmon (Male)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Alevins and Eyed Salmon Eggs

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Coho Salmon (Fry)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Alevins and Eyed Salmon Eggs

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Coho Salmon (Males)

Columbia River Fish and Wildlife Conservation Office
Fish and Aquatic Conservation



Life Stage Adaptation Cheat Sheet



Life Stage Adaptation Cheat Sheet

Eggs

- Eggs are buried in gravel to protect them
- Translucent color helps them blend in with the gravel sediment

Alevin

- Gills extract oxygen from water allowing them to “breathe” underwater
- The yolk sac provide alevin with food as they learn to swim and navigate their aquatic environment
- Avoid light so they are not detected by predators

Fry

- Scales provide salmon with protection against predators, pathogens, and their environment
- Most active at night to avoid being detected by predators
- Develop par marks (disruptive coloration) to help them avoid detection from predators
- Use camouflage (tan, brown, gray) to avoid detection from predators
- Rely on logs, gravel, boulders and other stream features for shelter and protection from predators
- Eat insects and small macroinvertebrates that are found in the stream
- Lateral line helps them detect movements and vibrations in the water

Smolt

- Undergo “smoltification” which allows them to be able to survive the transition from fresh water to salt water
- As they start spending time in the ocean they develop a silvery color to avoid detection from predators
- Take advantage of the food and shelter provided by estuaries
- Their tongues have “teeth” they use to catch and hold their prey
- Terminal-shaped mouth allows them to feed on organisms floating in the water column

Ocean Adult

- Salmon use their sense of smell to find food in the open ocean
- Fast swimmers- salmon have a fusiform shape, powerful muscles, and a large caudal fin. Can swim up to 20 miles per hour and swim thousands of miles
- Depending on the species, salmon spend 2-7 years in the open ocean in order to grow big and strong
- Adapt a countershading coloration to avoid detection from predators



Spawning Adult

- Female salmon lay between 3000-7000 eggs because only ~0.1% reach spawning age
- Salmon use their sense of smell to find their way back to their natal streams
- Fusiform shape and strong muscles enable them to swim upstream against strong currents and jump over obstacles
- Change color and develop features that help them attract a mate



Sound Off Activity



Sound Off Activity

Time: 20 minutes

Introduction

Have students imagine that they are animals with poor vision or are active at night. What senses would you use? (*hearing, smelling*). How would you communicate? (*sound*). The ability to communicate is a very important one. Can you name some animals that communicate with sound? (*crickets chirp, frogs ribbet, whales sing, wolves howl, crows caw, etc.*). What do you think these calls communicate? Frogs and crickets call during mating; Crows call often as an alarm signal triggered by the sighting of a predator; the rattlesnakes rattle warns possible predators to stay away; a wolf's howl may communicate the location of the pack's members or that a prey has been found.

Directions

1. Explain to students that they are going to pretend to be animals that communicate by sound. They will be wearing masks so they will have to rely on their sense of hearing. Most of the participants will be — “prey” but one or two people will be — “predators”. Discuss the meaning of predator and prey.

A **Predator** is an animal that captures and eats other animals.

A **Prey** is an animal that predators eat.

2. Explain that every prey will have a secret partner, who is the same animal. The object of the game is for the prey to make their animal sound and find their partner before being caught by a predator.
3. Pass out masks. If none are available, students can use one hand to cover their eyes. Point out the boundaries of the game zone and select areas along the edge to serve as CAPTURED and SAFE areas. Go over the rules with the group:
 - a. Everyone may move freely, but no running is allowed!
 - b. No peeking!
 - c. If the predator tags you, take off your mask and move to the captured area.
 - d. Predators must be sure the prey knows that they have been tagged.
4. Prey that successfully find their secret partners should take off their masks and go to the SAFE area to watch the rest of the game.



5. Have students form a large circle and pass out animal cards with animal calls. Give one or two students a — “predator” card.
6. When everyone has their mask on, (or eyes covered) shout — “Sound Off!” to start the first game.

Play a couple rounds if time permits.

Discussion

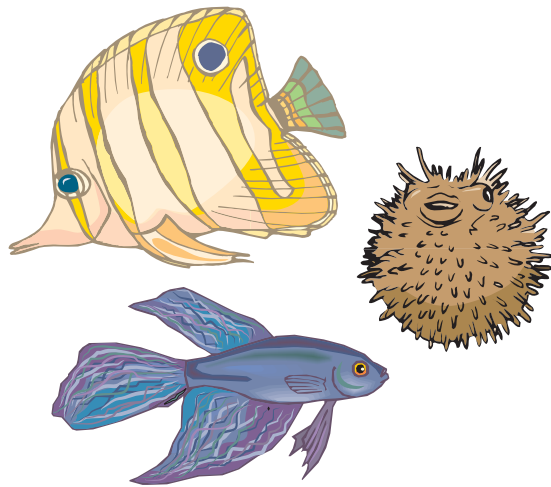
- Was it difficult/easy to find your partner using only your hearing? Why?
- What two things does communication involve to be effective? *Giving and receiving of information.*
- What could you do to communicate more effectively? *Call less frequently, so you can hear the other person. Set a pattern of calls that could be more easily identified by the other person.*
- Was it difficult/easy for the predator to locate his prey? Why?
- What methods did the predator use to locate and catch his prey?
- What other ways do animals communicate without using sound? (*freezing, tail flash, body gesture, odor, mimicry/warning colors*)

Communication whether by sound or another method, is an important adaptation that helps animals survive. It can help them avoid being eaten by another animal, it can help them to find prey, and it can help them to reproduce by establishing territory, finding a mate, and protecting young.



Funky Fish Morphology Activity





Funky Fish Morphology

Lesson Plan
Habitat Cards



LESSON PLAN

FUNKY FISH MORPHOLOGY

Note: Italicized words are potential script for the teacher.

Objectives

- Students will be able to explain the connection between animal morphology and habitat.

Materials

- Colored clay
- Fish habitat cards (following this lesson plan)
- Examples of fish morphology (preserved fish, photos, illustrations, etc.) and other animals

Introduction (10 minutes)

- While showing examples of salmon morphology, briefly explain why certain morphologies are advantageous given the fish's native habitat and predator-prey relationships. Leading question: What effect might habitat, potential predators, and prey types have on fish morphology?
Examples: A sea horse's unique shape allows it to live in seagrass or on reefs. A flounder hides from prey by burying itself in the sand. A puffer fish avoids predators by becoming too big to eat.
- Make sure each student understands the relationship between form and function in the animal world.

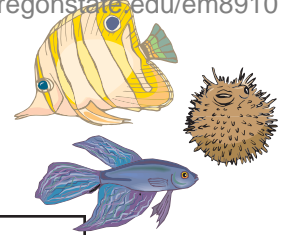
Activity (30 minutes)

- Explain that the goal of this activity is to design the best adapted fish possible.
- Give each student or group a large glob of clay.
- Give one habitat card to each student or group.
- Instruct students to use the clay to shape their fish, giving special attention to mouth morphology. Mouth morphology should be clearly represented in detail.
- Show more examples of animal morphologies. This time include nonaquatic animals as well. Help the class compare and contrast several of their fish designs with other creatures that inhabit similar habitats.

Closing activity/Assessment (10 minutes)

- Ask students or groups to show their models in front of the class, indicating how certain features will benefit and/or inhibit the fish's survival in its habitat.





HABITAT CARDS

<p>Your fish lives in cold, fresh water. It is a carnivore, but relies on camouflage rather than speed to catch its prey.</p>	<p>Your fish lives in cold, fresh water. It is a carnivore, but relies on camouflage rather than speed to catch its prey.</p>
<p>Your fish must travel long distances from its spawning grounds to its feeding grounds. It prefers to eat meat, but will also eat plants when they are available. Your fish is a very fast swimmer and lives in salt water.</p>	<p>Your fish must travel long distances from its spawning grounds to its feeding grounds. It prefers to eat meat, but will also eat plants when they are available. Your fish is a very fast swimmer and lives in salt water.</p>
<p>Your fish is very large, but eats very tiny animals called krill. Krill are found in large groups in the ocean, numbering in the millions.</p>	<p>Your fish is very large, but eats very tiny animals called krill. Krill are found in large groups in the ocean, numbering in the millions.</p>
<p>Your fish lives in freshwater lakes. It has no natural predators and spends most of its time munching on plants found at the bottom of lakes.</p>	<p>Your fish lives in freshwater lakes. It has no natural predators and spends most of its time munching on plants found at the bottom of lakes.</p>
<p>Your fish is an aggressive carnivore that lives in fresh water. It eats other fish, amphibians, mammals, and even its own kind.</p>	<p>Your fish is an aggressive carnivore that lives in fresh water. It eats other fish, amphibians, mammals, and even its own kind.</p>