

Grade Level: 3rd and 4th

Time:
110 minutes

Season: All

Objectives: Students will be able to...

- Name the life cycle stages
- Describe a fact about one or more life stages

### **Key Concept:**

- Salmon grow, change and reproduce in predictable cycles
- Life stages occur in a specific order

# Salmon Life Cycle

Lesson 1 of 1

## **Background & Summary**

Students investigate the life cycle stages of salmon. First, they examine preserved specimen and images of developmental stages. The introductory activity invites students to write down and share their observations in a small group. Depending on grade level and curriculum requirements, students may describe gross physiological characteristics, recall prior knowledge, or identify specific life stages. Diagrams, hands-on displays and images provide context for reinforcing key concepts. The extension activities offer more opportunities for group discussions about life cycles, in general.

Students expand their knowledge of the salmon life cycle by researching facts about an assigned life stage, working in a group to create an infographic poster and presenting their poster to the class.

The "Life Stage Cheat Sheet" is an instructor resource that lists facts about each life stage. Some student groups may struggle with staying on task or making progress when researching life stage facts. Instructors can modify the lesson by helping students brainstorm three to five life stage specific questions, and then directing students to use the answers to those questions as their facts. If time is an issue, it may be helpful to guide students towards asking questions that you (the instructor) know the answer to or are addressed on the cheat sheet.

### **Procedure**

### **Introduction: Writing Prompt**

- 1. Split students into 6 groups and provide each group with 1-2 magnifying glasses, a "Life Cycle Display" and "Life Cycle Images". Encourage the students to observe and examine the preserved specimen in the display and cutout images. Direct students to record their observations using words or illustrations. (10 minutes)
- 2. (Option A One instructor) As students are continuing to write, go around to each group and facilitate a discussion about the cutouts or display. Encourage students to share their thoughts and observations about the specimen and images in front of them. If there isn't an active discussion occurring at the table already, then pick from one of the questions below. (18 minutes, 2-3 minutes per group)

Courtesy of Columbia River FWCO Information and Education, 2022



## **Procedure (Continued)**

- How many stages do you see? What are the names of the stages?
- What order should the cutouts be in? Why?
- What do you notice about each specimen/cutout?
- What do the specimen or images in the cutouts have in common? How are they different?

(Option B – Multiple instructors) Divide the six groups between the instructors and engage with each student group as described in Option A.

**3.** Allow 4-6 students share their observations with the class. (5 minutes)

### Pacific Salmon Life Cycle

### **Learning Objectives:**

- a. Salmon Life Cycle has 6 stages
- b. Salmon are anadromous
- **4.** Use the "Labeled Life Cycle Images" to walk the class through the order and names of the stages. (10 minutes)

Key messages to share with students:

A life cycle is a series of stages an animal passes through over the course of their lifetime.

The displays and images show different stages of the Pacific Salmon

The salmon life cycles has 6 stages: Egg (Stage 1), Alevin (Stage 2), Fry (Stage 3), Smolt (Stage 4), Ocean Adult (Stage 5), Spawning Adult (Stage 6)

- **5.** Pass out two "Life Cycle Diagrams" to each group. Encourage students to work in pairs to complete the diagram using the pieces (life cycle stages) provided. (10 minutes)'
- **6.** Bring class back together and review the correct order. Allow students to lead review by asking them as a class where each piece should be placed. (5 minutes)

Key message to share with students:

Salmon are anadromous. This means the adults, who are born in freshwater, migrate to the ocean where they grow and mature. When they are ready to spawn (or reproduce) they return from the ocean to the freshwater streams they were born in.

### Life Stage Infographic Activity

### <u>Learning Objectives:</u>

- Each stage of the salmon lifecycle have unique physical and ecological characteristics
- b. Physical and ecological characteristics associated with each life stage can vary between species
- 7. Explain that each group will be assigned a life cycle stage, and they will work together to make an informational poster. Groups are free to decide how they design their poster. Each poster should include **at least** one drawing or illustration and three to five facts. Provide each group with markers, colored pencils and a 20" x 23" Post-it. Encourage student to use the "Life Cycle Displays" and "Pacific Salmon Images" as visual references (45 minutes)

(Option A) – Students use school supplied laptops to research three to five facts about their assigned life stage.



## **Procedure (Continued)**

(Option B) – Students complete the "Life Stage Student Worksheet" in advance of the lesson. Students will pick three to five facts from the information they gathered to include on the poster.

(Option C) – Pass out 2–3 "Salmon Facts Cards" to each group. There are cards for each life stage.

The "Life Stage Cheat Sheet" is an instructor resource that can be used to answer questions that students may have.

- 8. Groups share their posters with the class. Starting with the first stage, direct each group to recall the name of their stage, describe their drawing and share one interesting fact. For longer class periods, Students can spend more time presenting their work to the class. (12 minutes, minimum)
- **9.** Wrap up the lesson with a journal prompt. (5 minutes)
- -What are the stages of the salmon life cycle?
- -Recall a fact about any two of the six salmon life stages.

### **Extensions**

### **Additional Journal or Discussion Prompts**

### Life Cycle (In general)

The following questions can be used during the introductory activity to encourage a class discussion or journal entry:

- -How would you describe a life cycle?
- -What images come to mind, besides salmon?
- -Which animals have life cycles? What are the names of each stage?

### **Alternative Activities**

### Life Stage Infographic

Instead of each group making an infographic of a single life stage, direct groups to make an infographic about the entire life cycle. Depending on the grade level, groups can provide life cycle facts specific to different salmon species.

### **Additional Activities**

### Salmon Survival Board Game

The goal of this dice game is for salmon eggs to hatch and make their way through the entire salmon life cycle. This activity is included in the supplemental material for this lesson plan.

#### Salmon Survival Worksheets

Students calculate salmon survival rates at different life stages. This activity is included in the supplemental material for this lesson plan

### Vocabulary

Alevin: A recently hatched fish that is still attached to the yolk sac.



## **Vocabulary (Continued)**

**Anadromous:** An aquatic species that is born in freshwater and migrates to the ocean to mature before return to freshwater to reproduce (spawn)

Estuary: Bodies of water where rivers meet the sea.

Fry: A juvenile fish that no longer has a yolk sac. Fry are able to move around and swim well enough to leave the redd and feed itself.

Habitat: The natural home or environment of a plant, animal, or other organism.

**Migration:** The movement from one place to another, and in many cases, back again.

Natal Stream: The stream where a fish a born

Parr: A young salmon, older than a fry, that actively lives and feeds in freshwater.

**Redd:** A depression made in the gravel of a riverbed where a female salmon lays her eggs

**Smolt:** A juvenile salmon that is ready to migrate from freshwater to the ocean.

**Spawn:** The process of fish reproduction, fish deposit eggs or release sperm to fertilize eggs.

**Spawning Ground:** A place where fish lay their eggs for fertilization.

### **Materials**

**included:** You can request to borrow laminated versions of diagrams, images and cards

12 sets - Life Cycle Diagrams

6 sets - Life Cycle Images

1 set - Labeled Life Cycle Images

1 set - "Salmon Facts" cards

1 - Life stage cheat sheet



## **Materials (Continued)**

(Optional) Life Stage Student Worksheet for each student (Optional) Salmon Survival Board Game – See Extension section (Optional) Salmon Survival Worksheet – See Extension section

### Request to Borrow from Columbia River FWCO:

Note: Requests are pending availability and geographical location 6 sets - Life Cycle Displays 6 - Magnifying glass

### **Not Included:**

Pencils and Paper (Loose Leaf, Notebook or Journal)
6 sets – Markers and/or color pencils
6 to 12 computers connected to WiFi (1-2 for each group)
6 - 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

3-LS1-1: Develop models to describe that organisms have unique and diverse life cycles, but all have in common birth, growth, reproduction, and death.

### **Common Core Standards**

### **English Language Arts**

### **Reading: Informational Texts**

CCSS.ELA-LITERACY.RI.3.7: Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur).

### Speaking and Listening

CCSS.ELA-LITERACY.SL.3.1 and 4.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly.

CCSS.ELA-LITERACY.SL.3.3: Ask and answer questions about information from a speaker, offering appropriate elaboration and detail.



## **Common Core Standards (Continued)**

CCSS.ELA-LITERACY.SL.3.4: Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace.

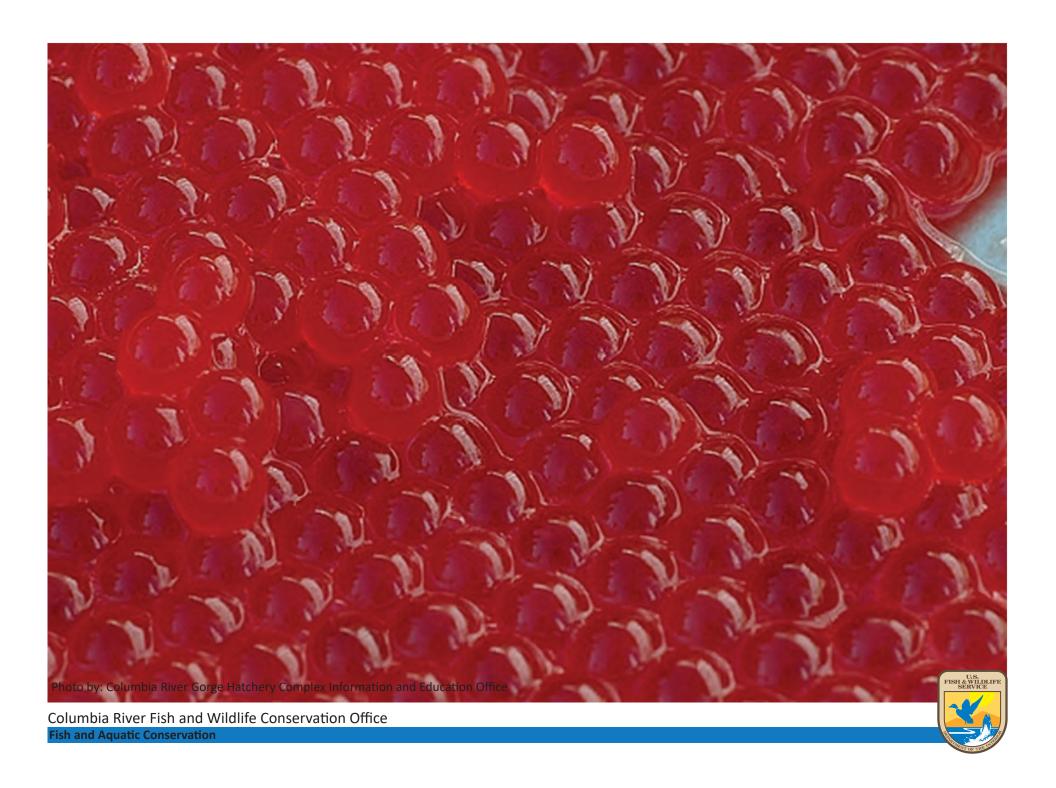
CCSS.ELA-LITERACY.SL.3.6: Speak in complete sentences when appropriate to task and situation in order to provide requested detail or clarification.

CCSS.ELA-LITERACY.SL.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.

CCSS.ELA-LITERACY.SL.4.6: Differentiate between contexts that call for formal English (e.g., presenting ideas) and situations where informal discourse is appropriate (e.g., small-group discussion); use formal English when appropriate to task and situation. (See grade 4 Language standards 1 here for specific expectations.)

# Life Cycle Images







Fish and Aquatic Conservation

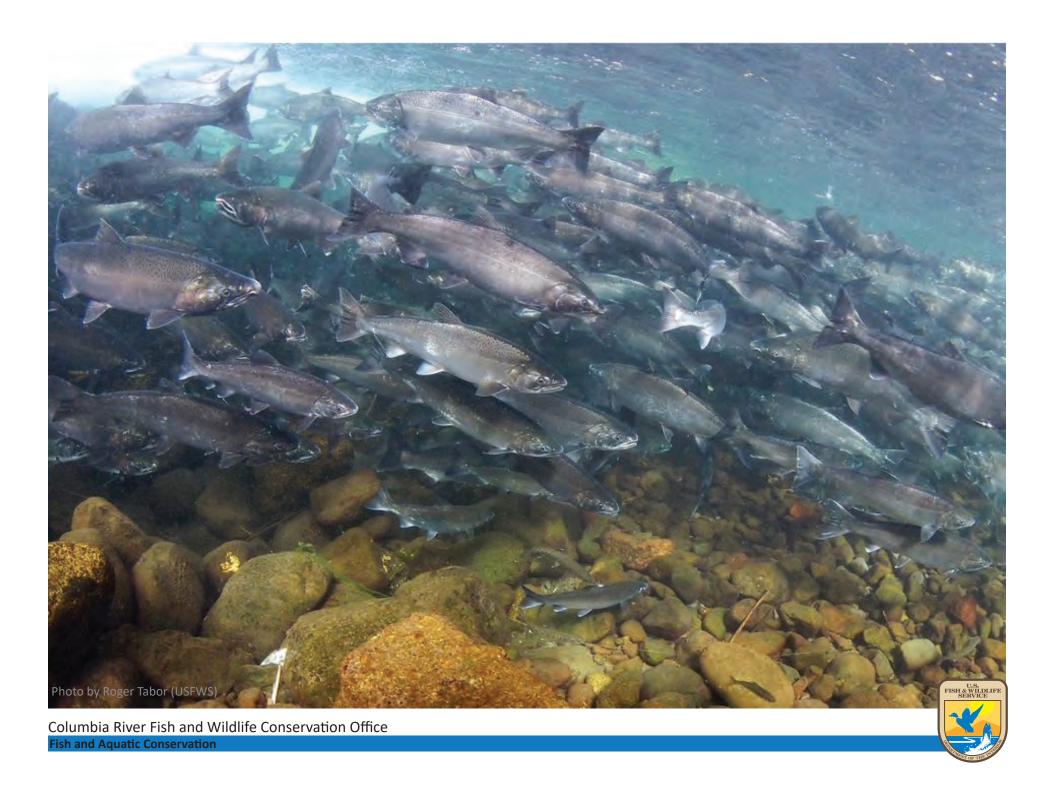














# Life Cycle Images (Labeled)



# Eggs



# **Eyed Eggs**



# Early Sac Fry



Columbia River Fish and Wildlife Conservation Office

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# Mid Sac Fry



# **Button Up Fry**



# Fry



Fish and Aquatic Conservation

# **Smolt**



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# Adult (Ocean)



# Adult (Spawning)

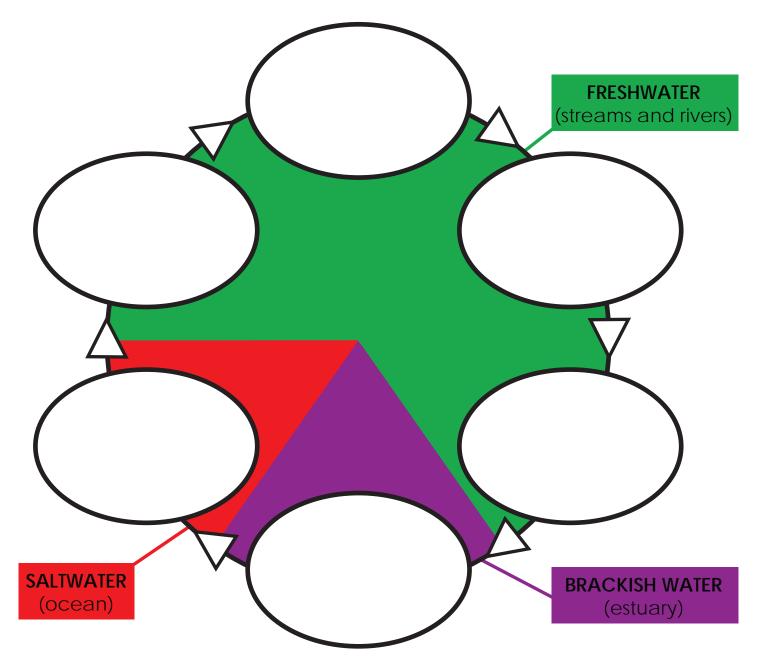


# Life Cycle Diagram

### Instructions:

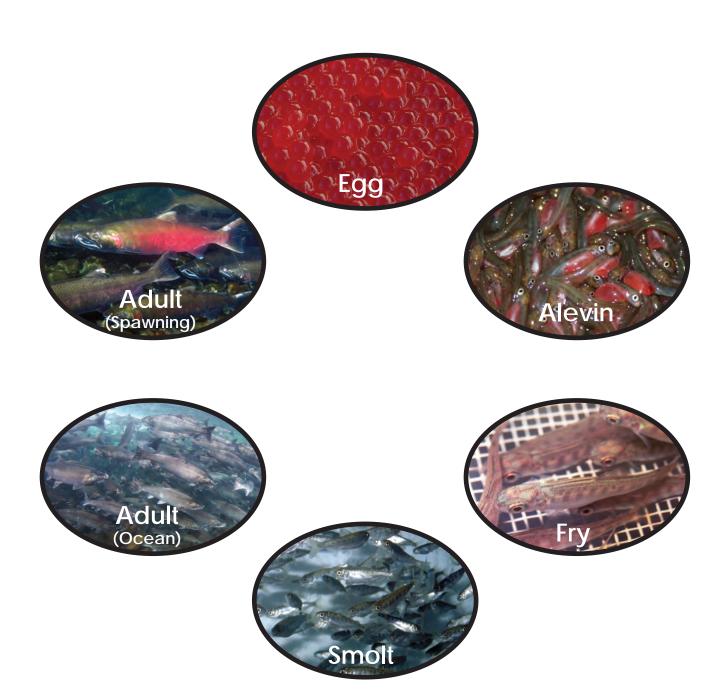
- 1. Print pages 2-3
- 2. On page 2, cut along black line on bottom of the page. Place a piece of velcro (loop side) in the center of the empty white ovals.
- 3. On page 3, cut out the ovals and place a piece a velcro (hook side) in the center.







Courtesy of Columbia River FWCO Science Communication and Outreach, 2022



# Life Stage Student Worksheet



# Pacific Salmon Life Stage Student Worksheet

Instructions: Fill out the column on the right with facts about the corresponding life cycle stage in the column on the left.

Life Cycle Stage	Facts
Egg	
Alevin	
Fry	
Smolt	
Adult (Ocean)	
Adult (Spawning)	



# Life Stage Cheat Sheet



### Life Stage Cheat Sheet for Pacific Salmon

### Egg Stage

### Physical Appearance

- Eggs, also known as roe, can range in size from ¼ inch (Sockeye Salmon) to ½ inch (Chum Salmon)
- The red color in eggs come from carotenoids, a class of pigment compounds, that female salmon get from their diet.

### Development

- Eyed eggs are fertilized eggs that have developed to the stage where the eyes and early nervous system of the fish can easily be seen through the translucent egg shell.
- Eggs hatch after 6-20 weeks. The timeline is dependent upon water temperature, dissolved oxygen and carbon dioxide levels, and species. Chinook eggs hatch around 12 weeks after fertilization; Sockeye after 8-20 weeks, Chum and Pink after 8-16 weeks; Coho after 7-6 weeks.
- During spawning, females use their tails to create depression in the gravel, called a redd. The redd acts as a nest for their eggs to incubate in.
- The female will use her tail to cover and protect the eggs with gravel after they are fertilized by a male.
- Female salmon can lay between 1,000 to 17,000 eggs, but only around 15% will survive long enough to hatch.

### **Ecology**

- Only about 1% of eggs live to adulthood.
- Eggs are an important food source for other fish, birds and insects.

### Alevin Stage

#### Physical Appearance

- 70% of the weight from Chinook Salmon alevins comes from the yolk sac, the other 30% comes from the embryo.
- Alevins are sometimes referred to as sac fry due to the yolk sac on their abdomen.



#### Development

- The growth and development of alevins are temperature and species dependent. Alevins in warmer water grow and develop faster than alevins in colder water. Chum spend around 8 weeks as an alevins; Sockeye around 3-5 weeks, Chinook and Coho around 2-3 weeks, Pink around 4-8 weeks.
- The yolk sacs attached to the abdomen of alevin contain protein, sugar, minerals and vitamins that sustain the alevin as they learn to swim and navigate their aquatic environment.

### Ecology

- Only about 1% of eggs live to adulthood.
- Alevins remain in the redd until they absorb their yolk sac. The gravel provides protection from predators.
- Alevins are fragile and their orange bellies stand out in the gravel. As a result, they avoid light and are generally more active at night.

### Fry Stage

### Physical Appearance

- Pacific salmon fry average 1-2 inches in length.
- Parr are salmon between the fry and smolt stage. They are named for the vertical marks on their sides called "parr" marks. Parr markings vary between fry of different species.

#### Development

• Pink and chum salmon salmon head directly to estuaries once they are strong enough to swim. While Chinook fry spend a few months in freshwater streams and rivers; Coho fry spend around 1-2 years; and Sockeye spend around two years but sometimes up to 3 or 4.

#### Ecology

- Fry eat larvae, plankton, insects, small bits of organic matter and even other fish eggs
- Many salmon fry are eaten by predators such as birds and larger fish.
- Fry may form schools to help protect them from predators. They also utilize rocks, logs and other aquatic features to hide from predators.

### **Smolt Stage**

### Physical Appearance

• Smolts develop a silver color to help camouflage themselves from predators



#### Development

- The time a smolt spends in an estuary adapting to saltwater depends on the species.
   Sockeye head directly to the ocean while Chum spend several months in estuaries;
   Chinook and Coho around 3 months; Pink salmon around 5 months.
- Smoltification is a series of physiological and morphological changes that allow juvenile salmon to transition from living in a freshwater to a saltwater environment

### Ecology

 Smolts feed on small fish, insects, crustaceans, and mollusks found in estuaries and tidal creeks.

### Adult (Ocean) Stage

### Physical Appearance

Ocean phase salmon are primarily silver in color

#### Development

- Salmon spend 1-8 years at sea growing and maturing, depending on the species. Chinook mature between 3-8 years old; Sockeye between 4-5 years; Chum between 3-5 years; Coho around 4 years; Pink around 2 years.
- Adults grown much faster in the ocean than in freshwater due to the increased abundance of food.

#### Ecology

- Adults travel an estimated 18 miles a day for food, but they can maintain an average of 34 miles per day over long distances.
- Adult salmon primarily feed on other fish, invertebrates, and crustaceans
- Chinook Salmon can be found in the Pacific Ocean from southern California up to Alaska; Sockeye from Alaska to Oregon or California; Coho and Chum from Alaska to as far south as California but most abundant between Alaska and central Oregon; Pink from Alaska to Washington State.

### Adult (Spawning) Stage

### Physical Appearance

Spawning adults undergo morphological changes when they return to fresh water.
 Depending on species, their body color changes from silver to shades of brown, green or red. The males of some species develop a hooded snout, humped back, and elongated teeth.



- Pink Salmon are the smallest species of Pacific Salmon in North America. They grow up to 30 inches long and average 3 to 5 pounds, although they can grow up to 12 pounds
- Chinook Salmon are the largest species of Pacific Salmon in North America. They have been reported to grow as long as 58 inches and weigh 126 pounds
- The red/pink color of salmon flesh is a result of carotenoids, the same class of pigment compounds that give carrots an orange color. Carotenoids are naturally found in the marine organisms that salmon feed on.

### Development

 Salmon do not feed once they leave the ocean and begin the migration to their freshwater spawning grounds. They spend all their energy navigating back to their natal streams to spawn.

### Ecology

- Salmon can migrate more than 1800 miles upstream through freshwater rivers and streams to spawn
- The majority of Sockeye Salmon spawn in areas adjacent to lakes.
- There are 5 species of pacific salmon in North America.
  - o Sockeye (*Oncorhynchus nerka*). Nickname: Red Salmon
  - o Chinook (*Oncorhynchus tshawytscha*). Nickname: King Salmon
  - o Coho (Oncorhynchus kisutch). Nickname: Silver Salmon
  - o Pink (*Oncorhynchus gorbuscha*). Nickname: Humpback Salmon
  - o Chum (*Oncorhynchus keta*). Nickname: Dog Salmon
- All pacific salmon die after spawning. Their decaying carcasses fertilize aquatic and terrestrial plant life and provides food for animals
- Most adults travel to spawning grounds in their natal streams (birthplace) to reproduce.
   A small percentage will spawn in non-natal streams, a behavior known as straying.
- Smells and memories of their journey to the ocean as a juvenile are thought to help guide spawning adults back to their natal streams
- Salmon can "jump" over obstacles in rivers. While Chum and Pink Salmon usually don't higher than three feet, Chinook, Coho and Sockeye can jump as high as eight feet.



# Pacific Salmon Images

- 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





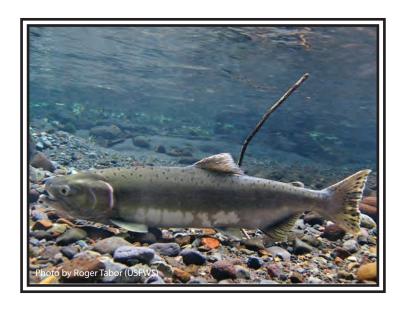








































































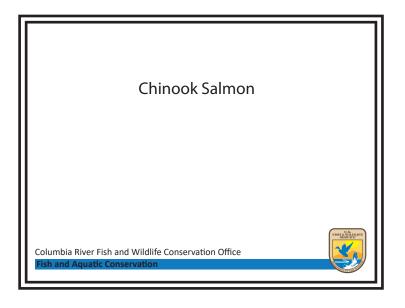


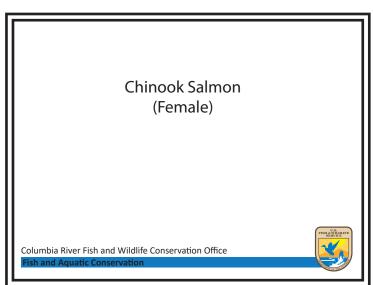


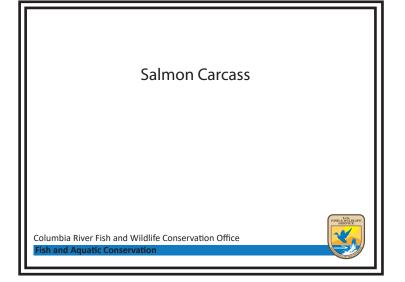


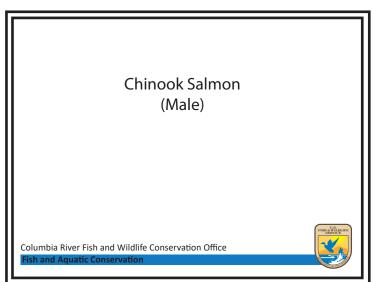


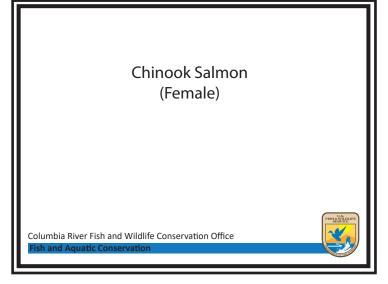


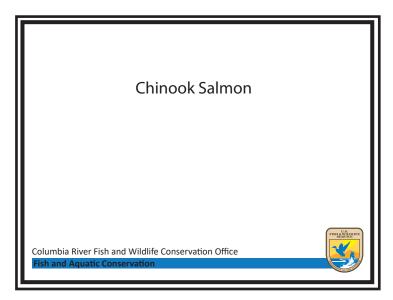


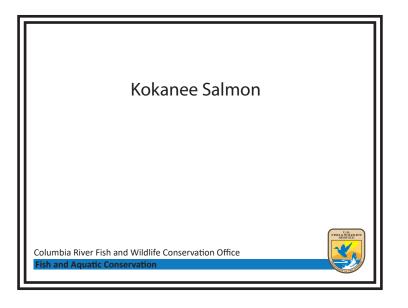


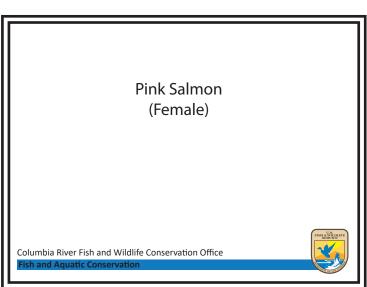


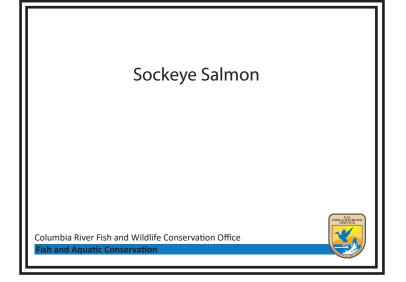


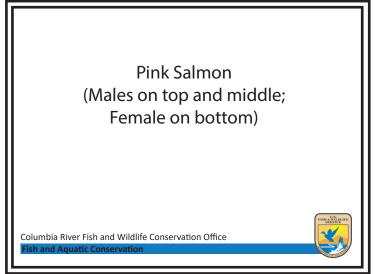


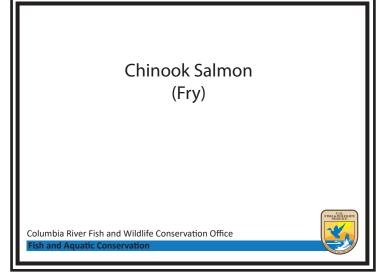


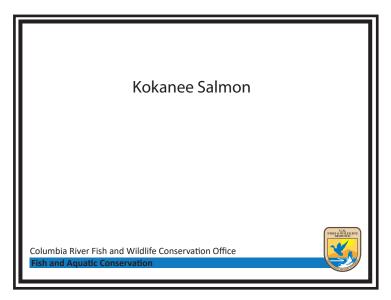


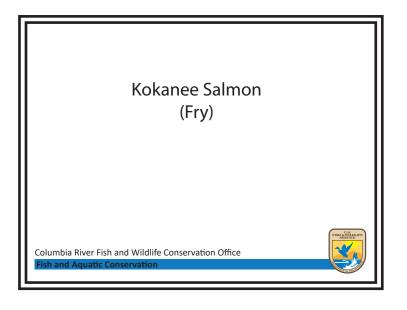


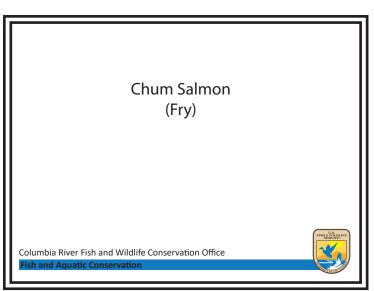


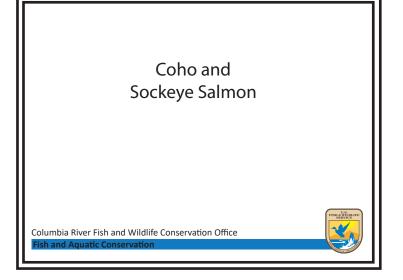


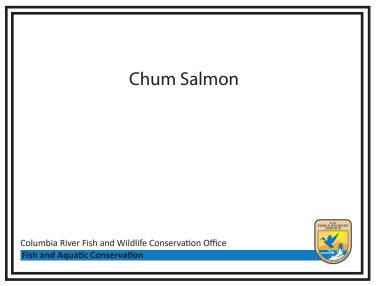


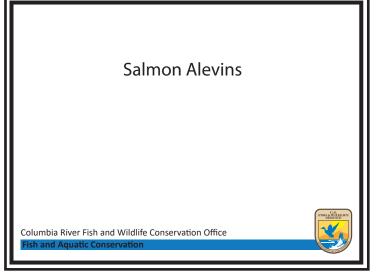


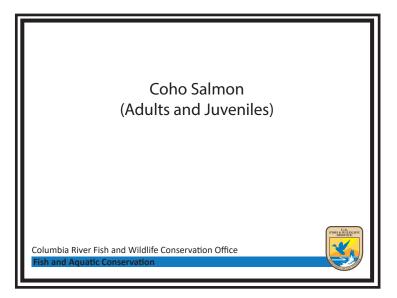


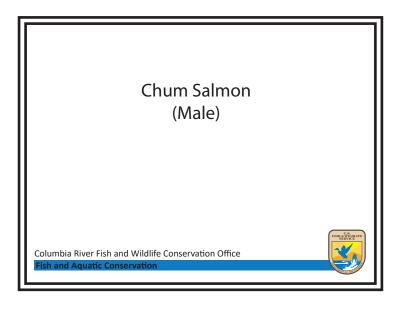


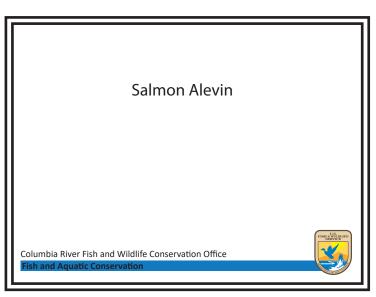


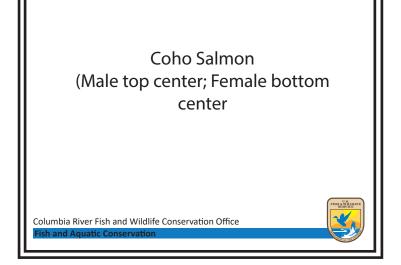


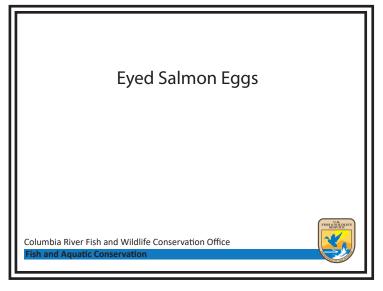


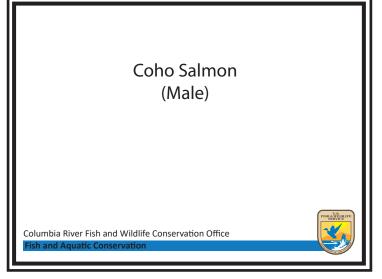


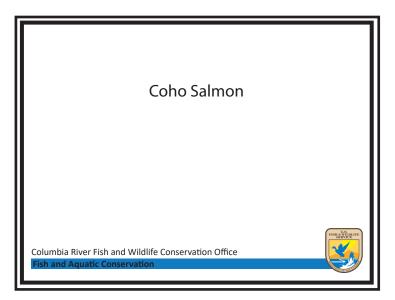


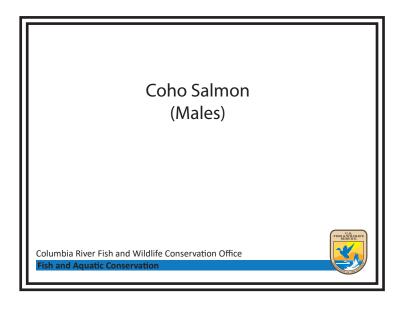


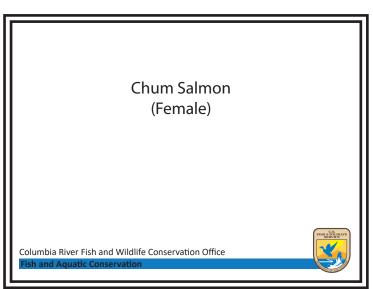


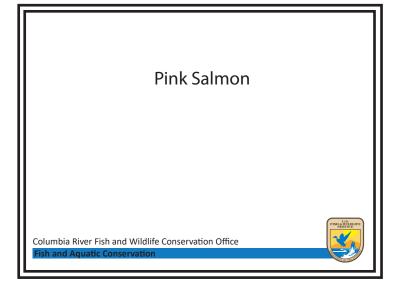


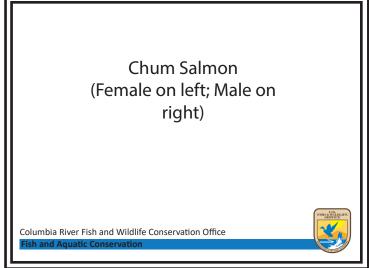


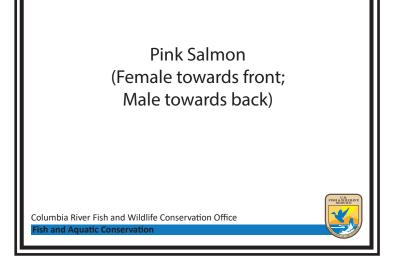


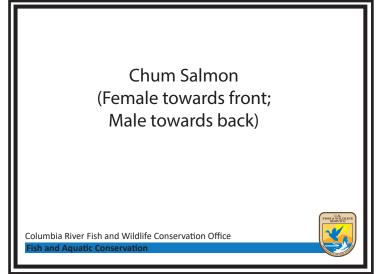


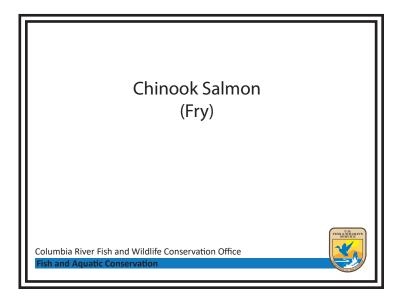


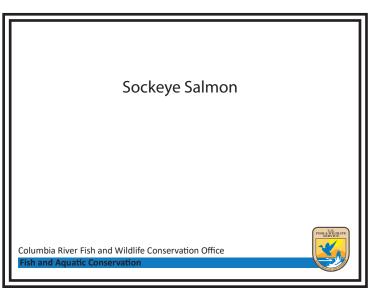


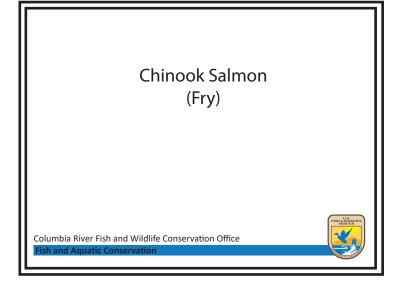


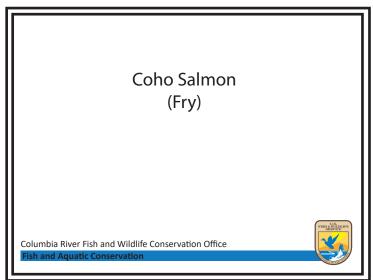


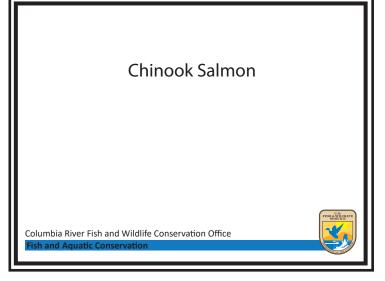


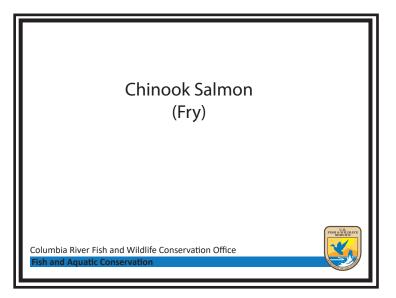


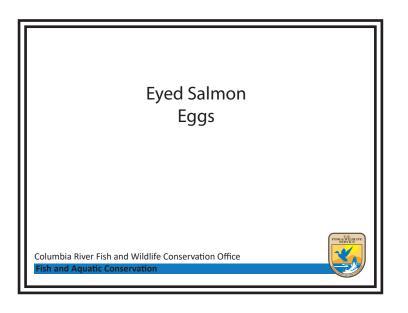


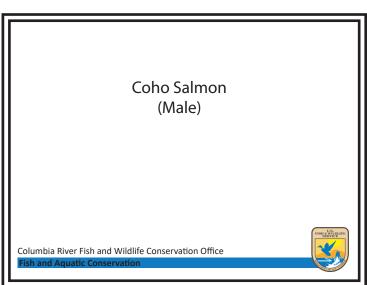


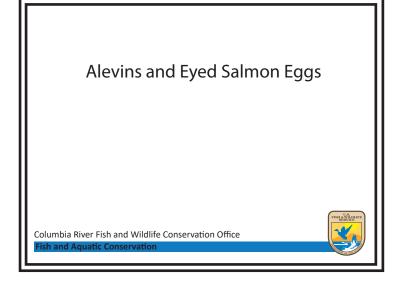


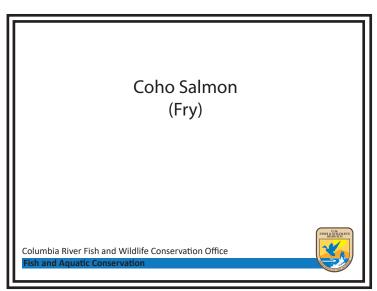


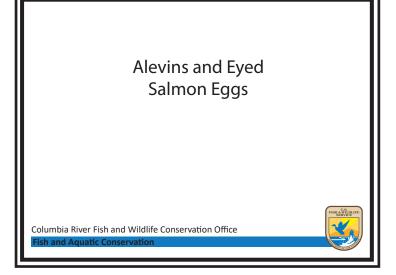


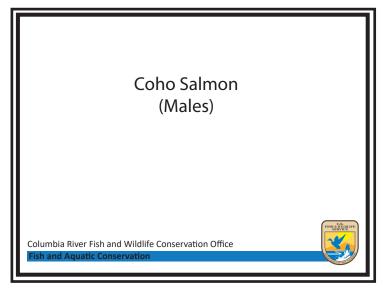








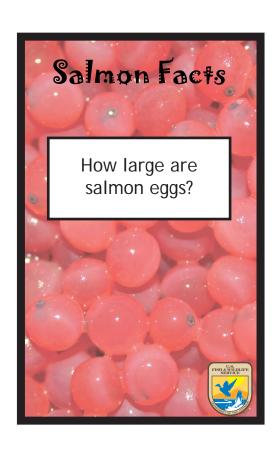


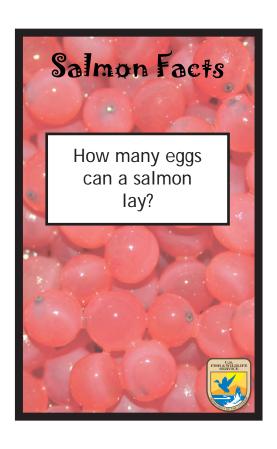


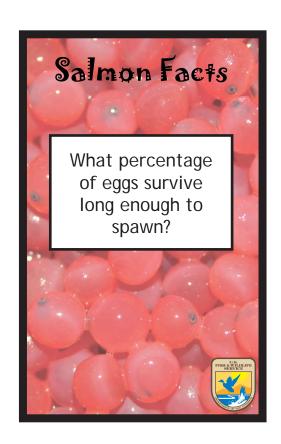
# Salmon Facts (Eggs)

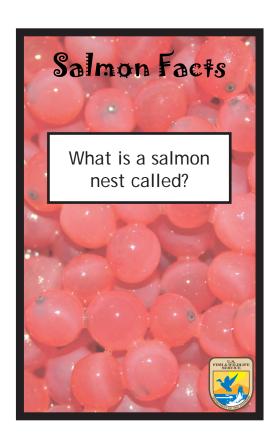
- 1. Print pages 2-3
- 2. With picture side up, reorganize stack in numerical order so the page 3 is on top and page 2 is on bottom
- 3. Flip stack along long edge and place back into printer paper tray
- 4. Print pages 4-5

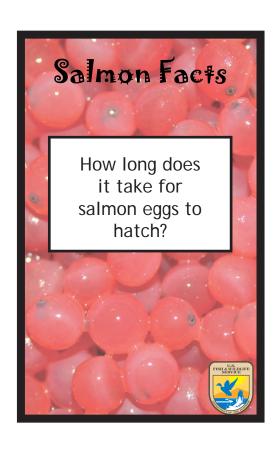


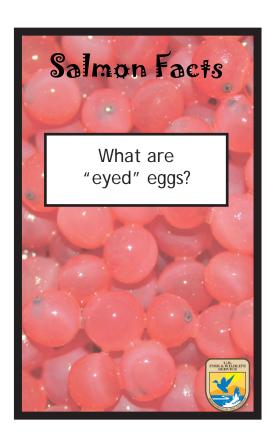


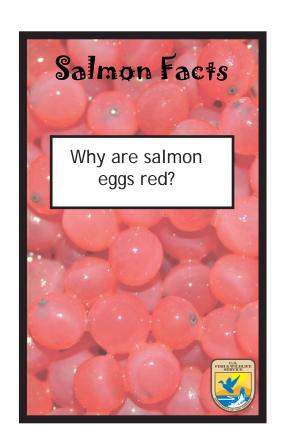


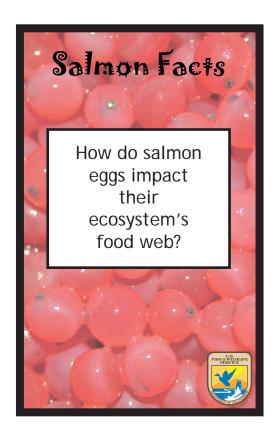












# Eggs

Female salmon can lay between 1,000 to 10,000 eggs but only around 15% will hatch.

# Eggs

Also known as roe, salmon eggs can range in size from 1/4 inch (Sockeye Salmon) to 1/2 inch (Chum Salmon)

# Eggs

A redd

# **Eggs**

Only roughly 1% of eggs live long enough to spawn

## **Eggs**

"Eyed" eggs are fertilized eggs that are developed enough to easily see the eyes and early nervous system of the fish through the translucent eggshell.

## Eggs

Eggs hatch after 6-20 weeks. The timeline depends on species, and water temperature and quality.

Chinook ~12 weeks Sockeye ~8-20 weeks Chum ~8-16 weeks Pink ~8-16 weeks Coho ~6-7 weeks

# **Eggs**

Salmon eggs are an important food source for other fish, birds and insects.

# **Eggs**

The red color in eggs comes from carotenoids, a pigment, that salmon get from their diet

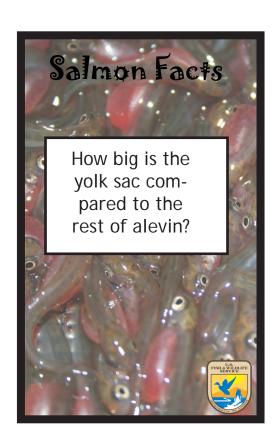
# Salmon Facts (Alevin)

- 1. Print pages 2-3
- 2. With picture side up, reorganize stack in numerical order so the page 3 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 4-5

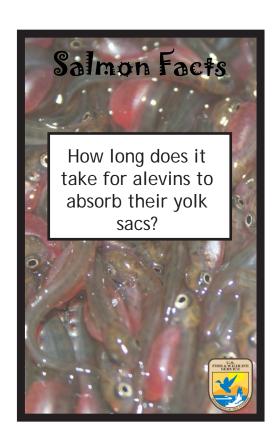














### **Alevin**

Alevins are fragile and their orange belles stand out in the gravel. As a result, they avoid light and are generally more active at night.

### **Alevin**

Alevins can be found in the redd, where they remain until they absorb their yolk sac. The gravel provides protection and camouflage from predators.

### **Alevin**

"Sac fry" is another term for alevins due to the yolk sac on their abdomen.

### **Alevin**

In Chinook Salmon, 70% of the weight comes form the yolk sac, the other 30% comes from the embryo.

### **Alevin**

The yolk sac attached to the abdomen of alevins contain protein, carbohydrates, minerals and vitamins that provide the young fish with food as they learn to swim and navigate their aquatic environment.

### **Alevin**

The rate of growth and development for alevins depends on temperature and species.

Chinook ~2-3 weeks Coho ~2-3 weeks Sockeye ~3-5 weeks Pink ~4-8 weeks Chum ~8 weeks

# Salmon Facts (Fry)

- 1. Print pages 2-4
- 2. With picture side up, reorganize stack in numerical order so the page 4 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 5-7

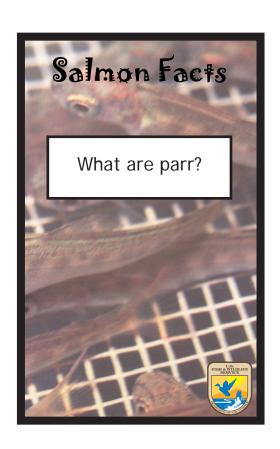


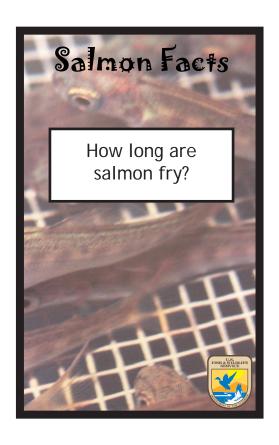






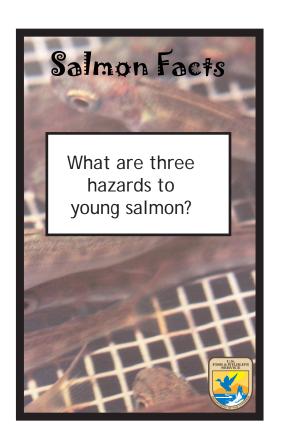














### Fry

Young salmon use trees for a source of colder water, nutrients and protection/shelter

### Fry

Fry may form schools to help protect themselves. They also utilize rocks, logs and other aquatic features to hide from predators.

## Fry

A fish screen is a device that supplies debris-free water without harming aquatic life. Fish screens are used to prevent fish from swimming into dangerous waterways such as water intakes, dams or aqueducts.

### Fry

Fry

### Fry

Pacific salmon fry average 1-2 inches in length.

### Fry

Parr are salmon between the fry and smolt stage. Their name comes from the vertical marks on their sides called 'parr marks'. Parr marks vary by Pacific Salmon species.

### Fry

Fry eat larvae, plankton, insects, detris (small bits of organic matter), and even other fish eggs.

### Fry

Pink and Chum Salmon migrate directly to estuaries once they are strong enough to swim. Chinook fry spend a few months in freshwater streams and rivers; Coho fry spend around 1-2 years; and Sockeye spend around 2 years but sometimes up to 3 or 4.

## Fry

Young steelhead need cold water with adequate dissolved oxygen. The water should be clean and free of excessive silt and pollution.

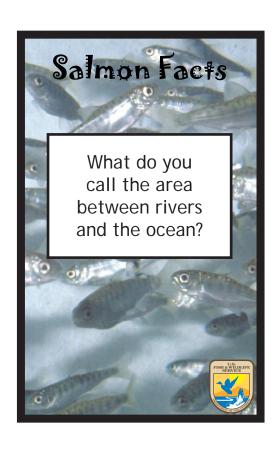
# Fry

- 1. Dams increased nitrogen at spillways can cause tissue-damaging gas bubbles
  - Pollution light, noise and/or poor water quality
- 3. Predators fry are an important food source in their ecosystems.

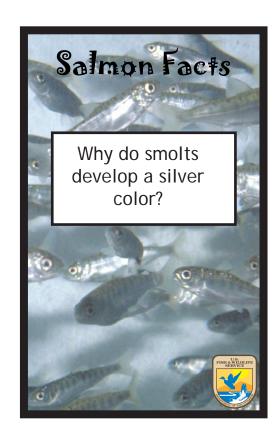
# Salmon Facts (Smolts)

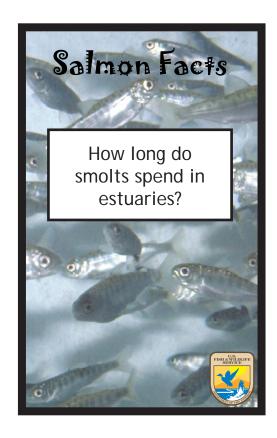
- 1. Print pages 2-3
- 2. With picture side up, reorganize stack in numerical order so the page 3 is on top and page 2 is on bottom
- 3. Flip stack along long edge and place back into printer paper tray
- 4. Print pages 4-5

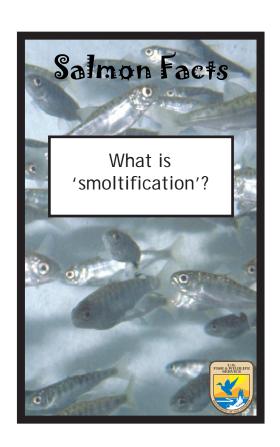














### **Smolt**

**Smolts** 

## **Smolt**

An estuary

### **Smolt**

The time a smolt spends in an esuary adapting to saltwater depends on the species. Sockeye head directly to the ocean while Chum spend several months in estuaries; Chinook and Coho ~3 months; Pink Salmon ~5 months.

### **Smolt**

Smolts develop a silver color to camouflage themselves from predators.

## **Smolt**

Smolts feed on small fish, insects, crustaceans, and mollusks found in estuaries and tidal creeks.

## **Smolt**

Smoltification is a series of physiological and morphological changes that allow juvenile salmon to transition from living in a freshwater to a saltwater environment.

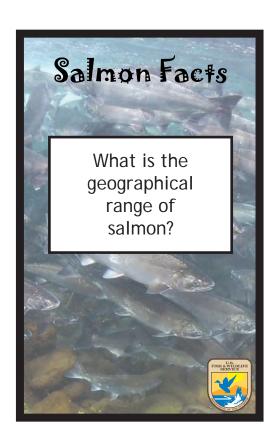
# Salmon Facts (Ocean Adult)

### **Printing Instructions**

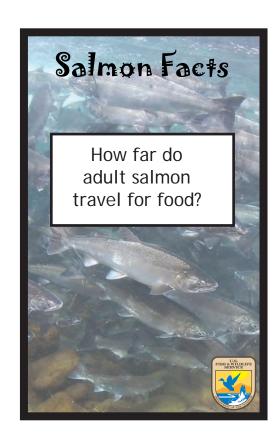
- 1. Print pages 2-3
- 2. With picture side up, reorganize stack in numerical order so the page 3 is on top and page 2 is on bottom
- 3. Flip stack along long edge and place back into printer paper tray
- 4. Print pages 4-5







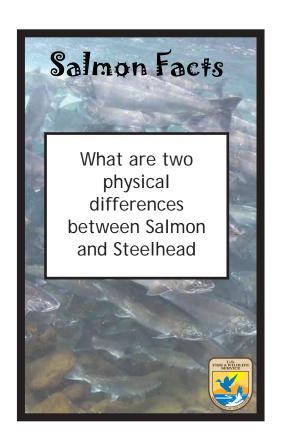












## Adult (Ocean)

Chinook Salmon are distributed from S.
California up to Alaska; Sockeye from Alaska to Oregon or California; Coho and Chum from Alaska to California but most abundance between Alaska and central Oregon; Pink from Alaska to Washington

## Adult (Ocean)

Salmon spend 1-8 years at sea growing and maturing, depending on the species.

Pink ~2 years Coho ~4 years Chum ~3-5 years Sockeye ~4-5 years Chinook ~3-8 years

## Adult (Ocean)

Adults travel ~18 miles a day for food in the ocean and are able to maintain an average of 34 miles per day over long distances.

## Adult (Ocean)

The abundance of food allow adult salmon to grow faster in the ocean than in freshwater

# Adult (Ocean)

Adult salmon primarily feed on squid, shrimp, and small fish such as herring and anchovies.

## Adult (Ocean)

Most ocean phase salmon are silver

# Adult (Ocean)

Steelhead Trout are slimmer than salmon and their tail fins have a square profile.

## Adult (Ocean)

Chum Salmon - Dog Salmon

Pink Salmon -Humpback Salmon

Sockeye Salmon - Red Salmon

Chinook Salmon - King Salmon

Coho Salmon - Silver Salmon

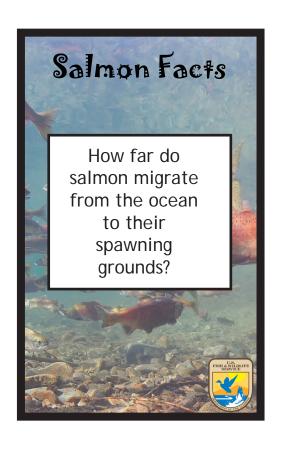
# Salmon Facts (Spawning Adult)

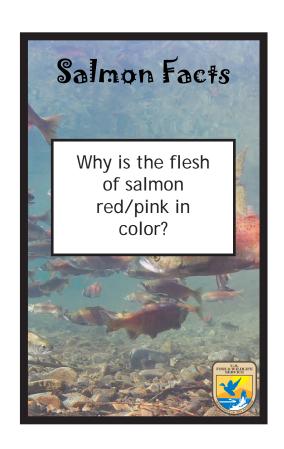
### **Printing Instructions**

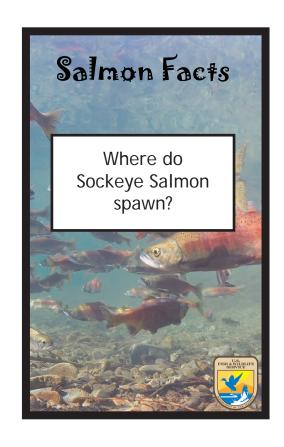
- 1. Print pages 2-5
- 2. With picture side up, reorganize stack in numerical order so the page 5 is on top and page 2 is on bottom
- 3. Flip stack along long edge and place back into printer paper tray
- 4. Print pages 6-9

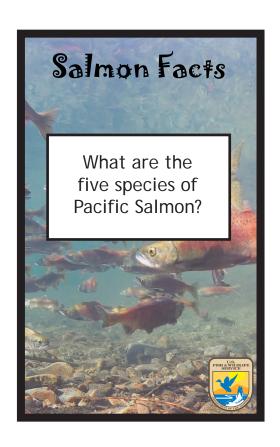


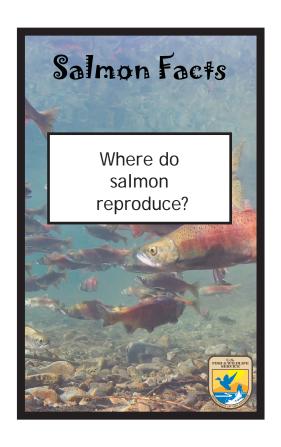




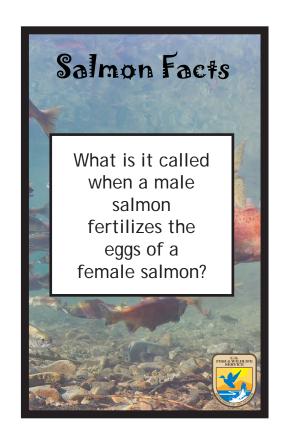




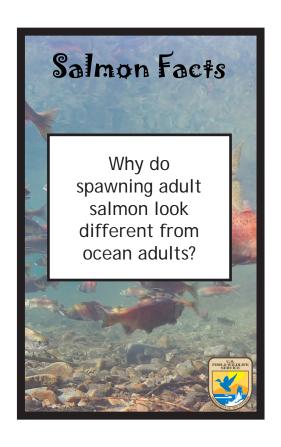


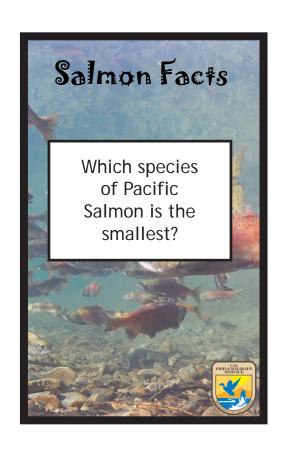


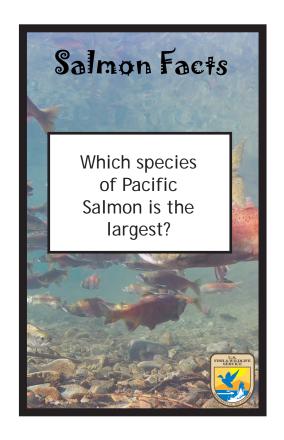


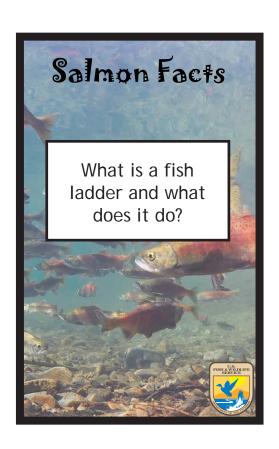












Salmon can migrate more than 1800 miles upstreams through freshwater rivers and streams to spawn.

## Adult (Spawn)

Salmon can "jump" over obstacles in rivers. While Chum and Pink Salmon usually don't jump higher than three feet, Chinook, Coho and Sockeye can jump as high as eight feet.

## Adult (Spawn)

The majority of Sockeye Salmon spawn in areas adjacent to lakes.

## Adult (Spawn)

The red/pink color of salmon flesh is a result of carotenoids, the same class of pigment compounds that give carrots an orange color. Carotenoids are naturally found in the marine organisms that salmon feed on.

Most adults travel to spawning grounds in their natal streams (birthplace) to reproduce. A small percentage will spawn in non-natal streams, a behavior known as straying.

## Adult (Spawn)

Chinook (*Oncorhynchus tschawytscha*)

Coho (*Oncorhynchus kisutch*)

Chum (*Oncorhynchus keta*)

Pink (Oncorhynchus gorbusha)

Sockeye (Oncorhynchus nerka)

## Adult (Spawn)

Spawning

## Adult (Spawn)

All Pacific Salmon die after spawning. Their decaying carcasses fertilize aquatic and terrestrial plant life and provide food for animals

Spawning adults undergo morphological changes when they return to freshwater. Depending on species, their body color changes from silver to shards of brown, green or red. The males of some species develop a hooded snout, humped back, and elongated teeth.

## Adult (Spawn)

Smells and memories of their journey to the ocean as a juvenile are thought to help guide spawning adults back to their natal streams.

## Adult (Spawn)

Chinook Salmon are the largest species of Pacific Salmon in North America. They have been reported to grow as long as 58 inches and weight up to 126 pounds.

# Adult (Spawn)

Pink Salmon are the smallest species of Pacific Salmon in North America. They grow up to 30 inches long and average 3-5 pounds; although some can weight up to 12 pounds

A fish ladder is a structure that allows migrating fish passage over or around an obstacle on a river.

# Salmon Survival Board Game







### **Audience**

General public, elementary school, middle school

### **Required Materials**

- □ Board game (English, español)
- 1 die (longer, harder version) or a pair of dice (shorter, easier version)
- □ A token for each player (e.g., small figurines, coins, etc.)
- □ A whiteboard or large piece of paper
- Whiteboard markers or pens

### **Optional Materials**

- □ I'm Counting on You brochure (English, español)
- □ Salmon survival pyramid
- Good Salmon Habitat,
   Bad Salmon Habitat
   (English, español)
- □ An Incredible Journey children's book (English, español)

## Salmon Survival Board Game

### **Overview**

The goal of this dice game is for salmon eggs to hatch and make their way through the entire salmon life cycle. Along the way, participants will discover human-made challenges, (e.g., passage barriers, urban runoff, warming waters, etc.) natural challenges (e.g., predators, drought, disease), and salmon stewardship actions (e.g., rain gardens, water conservation, salmon ladders, etc.).

### Learning objectives

Participants will learn that:

- Salmon face many human-made and natural challenges throughout their lives.
- Most salmon will die before they return to their natal (home) stream to spawn.
- There are many ways that people can help salmon.

### **Preparation**

1. Recreate the following table on a whiteboard, piece of paper, or spreadsheet.

Life Cycle Stage	Number of Deaths			
Egg				
Alevin				
Fry				
Smolt				
Ocean Adult				
Migrating Adult				
Spawner		man and a	<b>通</b>	



### **Vocabulary**

Anadromous—Fishes that migrate as juveniles from freshwater to saltwater and then return as adults to spawn in freshwater.

Fry—Salmon become fry when they have absorbed their yolk sac and emerge from their gravel nest (redd).

Natal stream—A salmon's home stream; where a salmon hatched.

**Redd**—A gravel nest made by a spawning female salmon.

Run—Seasonal migration undertaken by fish, usually as part of their life history.

Smolt—A young salmon that assumes the silvery color of the adult and is ready to migrate to the sea.

**Spawner**—A mature salmon that is migrating back to its home stream to reproduce.

#### **Additional Resources**

For additional marine science activities and lesson plans, please visit: http://go.usa.gov/xv6ut.

#### **Questions or Comments?**

For questions or comments about this activity, please email: wcr.education@noaa.gov.

### Instructions

- Tell participants that during the game they will experience the salmon life cycle, including some of the human-made and natural challenges that salmon might face.
   The goal of the game is to complete the salmon life cycle so that they can spawn the next generation of salmon.
- 2. Each player begins at the space labeled "egg."
- 3. One player rolls the die or dice and moves the corresponding number of spaces. Each player should take a turn before the rotation starts again.
  - a. If a player lands on a space with a +, they move forward the corresponding number of spaces.
  - b. If a player lands on a space with a -, they move backward the corresponding number of spaces.
  - c. If a player lands on a space that says "start over," they die and begin again from "egg."
- 4. Players work their way around the board game until they die or reach the space labeled "spawner."
  - a. Option: Give participants a set number of turns to become a spawner.
- 5. When participants "die," record the corresponding life cycle stage on the table.
- 6. Share that the majority of salmon will not live to become spawners. A single female salmon can lay thousands of eggs, but only a handful survive to become spawners.

### **Discussion Questions**

Lead a discussion using one or more of the following prompts:

- 1. How could low spawning numbers be problematic?
- 2. How could low salmon numbers affect the larger ecosystem?
- 3. How could low salmon numbers affect people?
- 4. How can endangered salmon populations recover with low spawning numbers?
- 5. What can individuals do to help salmon?

### **Extensions**

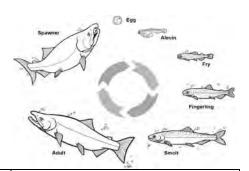
- 1. Walk participants through the salmon life cycle pyramid and the data from the board game. Talk about the distribution of this data and compare it to real data.
- 2. Discuss how games and models can be used to help simulate or illustrate real data. In the field, scientists collect data about many different plants, animals, and environmental conditions. For example, they might count the number of salmon returning to their home stream; the temperature of the ocean in different locations and seasons; the amount of fish being caught by commercial fishers; etc.
  - a. How is the game data is similar and different to what happens in real life?
  - b. How could the game data be made more accurate? Answers may include: complete more rounds and/or have a bigger sample sizes/more participants

# Salmon Survival Worksheet



## **ONLY THE STRONG SURVIVE - CHINOOK**

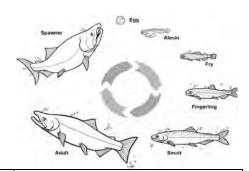
Chinook salmon spawn in large streams. A single female may lay as many as 5000 eggs, but the salmon life cycle is full of threats and perils. Use the numbers below to figure out how many chinook adults will survive to spawn.



	Do the math in this space.
A female chinook salmon deposited her <b>5000</b> eggs in a series of nests, called redds, and a male fertilizes them.	5000
2. <b>800</b> eggs were not fertilized. How many were fertilized?	
3. <b>600</b> eggs were uncovered by other salmon competing over limited nest sites in good gravel and were washed away. How many fertilized eggs were left?	
Cutthroat trout and raccoons ate <b>450</b> eggs and alevin. How many survived?	
5. <b>1200</b> alevin were washed out of the gravel by a heavy rainstorm and flooding. How many remained?	
6. Mud and silt from a construction site washed into the stream and suffocated <b>900</b> alevin. How many were left?	
7. <b>300</b> more alevins died because their redd was downstream from a parking lot where several old cars leaked toxic fluids. How many remained?	
8. <b>120</b> fry died when students let soapy from a car wash run into the stream through a storm drain. How many survived?	
9. <b>570</b> fingerlings died because trees in the watershed had been cut down and the stream didn't have enough shade to keep the water cool. How many fingerlings were left?	
10. As they neared the ocean, kingfishers and herons ate <b>51</b> smolts. How many smolts were left?	
11. In the ocean, <b>4</b> were eaten by orca whales. How many were not eaten by orcas?	
12. Someone fishing caught 1 adult. How many were left?	
13. As the salmon neared their spawning stream, sea lions ate <b>2</b> of them. How many salmon were left to spawn?	

## **ONLY THE STRONG SURVIVE - CHINOOK**

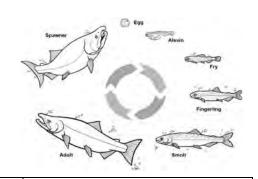
Chinook salmon spawn in large streams. A single female may lay as many as 5000 eggs, but the salmon life cycle is full of threats and perils. Use the numbers below to figure out how many chinook adults will survive to spawn.



	Do the math in this space.
	Do the math in this space.
A female chinook salmon deposited her <b>5000</b> eggs in a series of nests, called redds, and a male fertilizes them.	5000
2. <b>800</b> eggs were not fertilized. How many were fertilized?	4200
3. <b>600</b> eggs were uncovered by other salmon competing over limited nest sites in good gravel and were washed away. How many fertilized eggs were left?	3600
Cutthroat trout and raccoons ate <b>450</b> eggs and alevin. How many survived?	3150
5. <b>1200</b> alevin were washed out of the gravel by a heavy rainstorm and flooding. How many remained?	1950
6. Mud and silt from a construction site washed into the stream and suffocated <b>900</b> alevin. How many were left?	1050
7. <b>300</b> more alevins died because their redd was downstream from a parking lot where several old cars leaked toxic fluids. How many remained?	750
8. <b>120</b> fry died when students let soapy from a car wash run into the stream through a storm drain. How many survived?	630
9. <b>570</b> fingerlings died because trees in the watershed had been cut down and the stream didn't have enough shade to keep the water cool. How many fingerlings were left?	60
10. As they neared the ocean, kingfishers and herons ate <b>51</b> smolts. How many smolts were left?	9
11. In the ocean, <b>4</b> were eaten by orca whales. How many were not eaten by orcas?	5
12. Someone fishing caught 1 adult. How many were left?	4
13. As the salmon neared their spawning stream, sea lions ate <b>2</b> of them. How many salmon were left to spawn?	2

## **ONLY THE STRONG SURVIVE - CHUM**

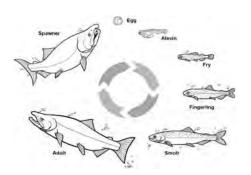
A single female chum salmon may lay as many as 3000 eggs in a large stream near salt water, but the salmon life cycle is full of threats and perils. Use the numbers below to figure out how many chum adults will survive to spawn.



	Do the math in this space.
A female chum salmon deposited her <b>3000</b> eggs in a series of nests, called redds.	3000
2. A male fertilized all but <b>480</b> eggs. How many did he fertilize?	
3. <b>360</b> eggs were uncovered by other salmon competing over limited nest sites in good gravel and were washed away. How many fertilized eggs were left?	
Cutthroat trout and raccoons ate <b>270</b> eggs and alevin. How many survived?	
5. <b>720</b> were washed out of the gravel by a heavy rainstorm and flooding. How many remained?	
6. Mud and silt from a construction site washed into the stream and suffocated <b>540</b> eggs and alevin. How many were left?	
7. <b>180</b> alevins died because their redd was downstream from a parking lot where several old cars leaked toxic fluids. How many remained	
8. <b>72</b> fry died when students let soapy from a car wash run into the stream through a storm drain. How many survived?	
9. <b>340</b> fingerlings died because trees in the watershed had been cut down and the stream didn't have enough shade to keep the water cool. How many fingerlings were left?	
10. As they neared the ocean, kingfishers and herons ate <b>31</b> smolts. How many smolts were left?	
11. In the ocean, <b>2</b> were eaten by orca whales. How many were not eaten by orcas?	
12. Someone fishing caught 1 adult. How many were left?	
13. As the salmon neared their spawning stream, sea lions ate <b>2</b> of them. How many salmon were left to spawn?	

## **ONLY THE STRONG SURVIVE - CHUM**

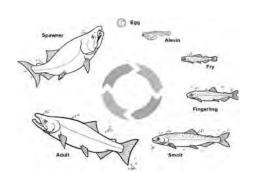
A single female chum salmon may lay as many as 3000 eggs in a large stream near salt water, but the salmon life cycle is full of threats and perils. Use the numbers below to figure out how many chum adults will survive to spawn.



	Do the math in this space.
A female chum salmon deposited her <b>3000</b> eggs in a series of nests, called redds.	3000
2. A male fertilized all but <b>480</b> eggs. How many did he fertilize?	2520
3. 360 eggs were uncovered by other salmon competing over limited nest sites in good gravel and were washed away. How many fertilized eggs were left?	2160
Cutthroat trout and raccoons ate <b>270</b> eggs and alevin. How many survived?	1890
5. <b>720</b> were washed out of the gravel by a heavy rainstorm and flooding. How many remained?	1170
6. Mud and silt from a construction site washed into the stream and suffocated <b>540</b> eggs and alevin. How many were left?	630
180 alevins died because their redd was downstream from a parking lot where several old cars leaked toxic fluids. How many remained	450
8. <b>72</b> fry died when students let soapy from a car wash run into the stream through a storm drain. How many survived?	378
9. 340 fingerlings died because trees in the watershed had been cut down and the stream didn't have enough shade to keep the water cool. How many fingerlings were left?	38
10. As they neared the ocean, kingfishers and herons ate <b>31</b> smolts. How many smolts were left?	7
11. In the ocean, <b>2</b> were eaten by orca whales. How many were not eaten by orcas?	5
12. Someone fishing caught 1 adult. How many were left?	3
13. As the salmon neared their spawning stream, sea lions ate <b>2</b> of them. How many salmon were left to spawn?	2

## **ONLY THE STRONG SURVIVE - COHO**

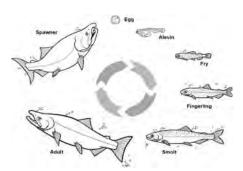
A single female coho salmon may lay as many as 2500 eggs in a medium-sized inland stream, but the salmon life cycle is full of threats and perils. Use the numbers below to figure out how many coho adults will survive to spawn.



	Do the match in this space.
A female coho salmon deposited her <b>2500</b> eggs in a series of nests, called redds.	2500
2. A male fertilized all but <b>400</b> eggs. How many were fertilized?	
3. <b>300</b> eggs were uncovered by other salmon competing over limited nest sites in good gravel and were washed away. How many fertilized eggs were left?	
Cutthroat trout and raccoons ate <b>225</b> eggs and alevin. How many survived?	
5. <b>600</b> were washed out of the gravel by a heavy rainstorm and flooding. How many remained?	
6. Mud and silt from a construction site washed into the stream and suffocated <b>450</b> eggs and alevin. How many were left?	
7. <b>150</b> alevins died because their redd was downstream from a parking lot where several old cars leaked toxic fluids. How many remained?	
8. <b>60</b> fry died when students let soapy from a car wash run into the stream through a storm drain. How many survived?	
9. <b>283</b> fingerlings died because trees in the watershed had been cut down and the stream didn't have enough shade to keep the water cool. How many fingerlings were left?	
10. As they neared the ocean, kingfishers and herons ate <b>25</b> smolts. How many smolts were left?	
11. In the ocean, <b>2</b> were eaten by orca whales. How many were not eaten by orcas?	
12. Someone fishing caught 1 adult. How many were left?	
13. As the salmon neared their spawning stream, sea lions ate <b>2</b> of them. How many salmon were left to spawn?	

## **ONLY THE STRONG SURVIVE - COHO**

A single female coho salmon may lay as many as 2500 eggs in a medium-sized inland stream, but the salmon life cycle is full of threats and perils. Use the numbers below to figure out how many coho adults will survive to spawn.



	Do the match in this space.
A female coho salmon deposited her <b>2500</b> eggs in a series of nests, called redds.	2500
2. A male fertilized all but <b>400</b> eggs. How many were fertilized?	2100
3. <b>300</b> eggs were uncovered by other salmon competing over limited nest sites in good gravel and were washed away. How many fertilized eggs were left?	1800
4. Cutthroat trout and raccoons ate 225 eggs and alevin. How many survived?	1575
5. 600 were washed out of the gravel by a heavy rainstorm and flooding. How many remained?	975
6. Mud and silt from a construction site washed into the stream and suffocated <b>450</b> eggs and alevin. How many were left?	525
7. 150 alevins died because their redd was downstream from a parking lot where several old cars leaked toxic fluids. How many remained?	375
8. <b>60</b> fry died when students let soapy from a car wash run into the stream through a storm drain. How many survived?	315
9. <b>283</b> fingerlings died because trees in the watershed had been cut down and the stream didn't have enough shade to keep the water cool. How many fingerlings were left?	32
10. As they neared the ocean, kingfishers and herons ate <b>25</b> smolts. How many smolts were left?	7
11. In the ocean, <b>2</b> were eaten by orca whales. How many were not eaten by orcas?	5
12. Someone fishing caught 1 adult. How many were left?	4
13. As the salmon neared their spawning stream, sea lions ate <b>2</b> of them. How many salmon were left to spawn?	2