



a place of mind

FACULTY OF EDUCATION

Department of
Curriculum and Pedagogy

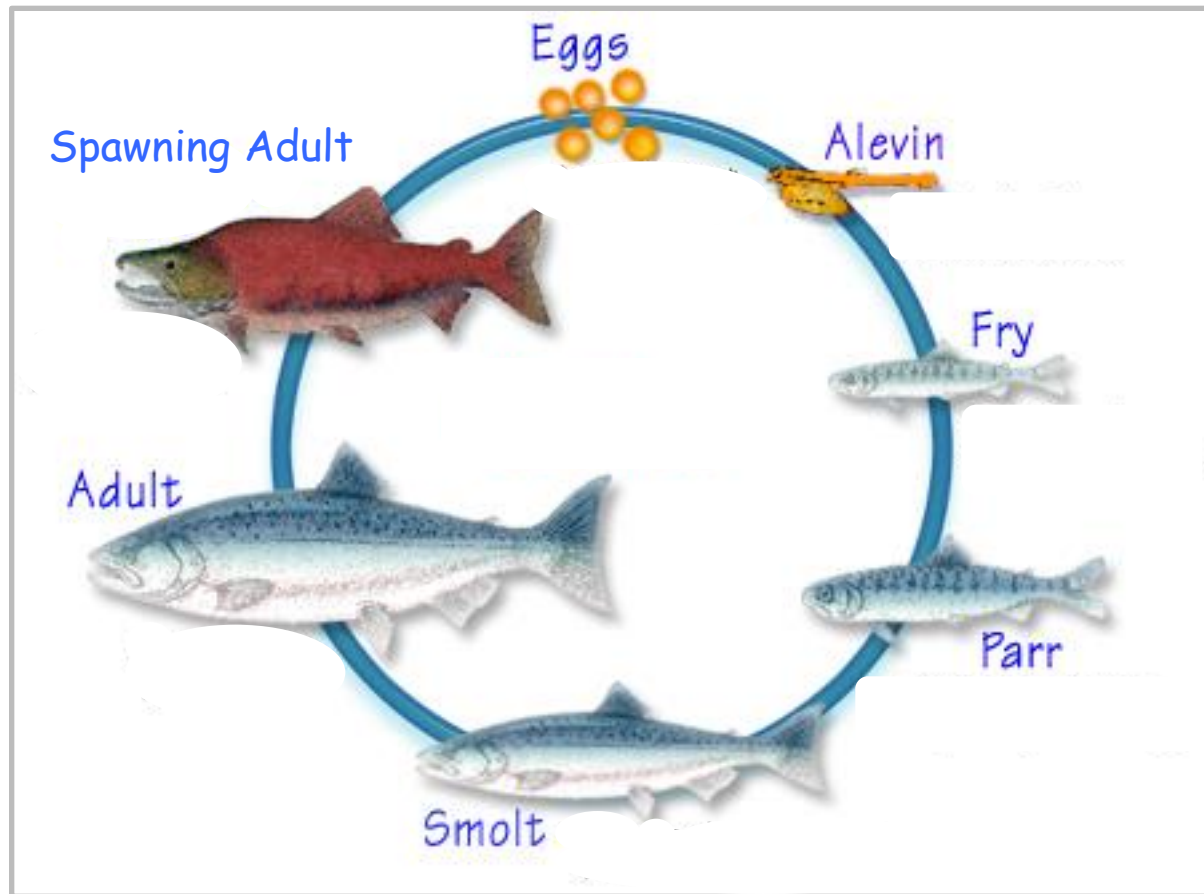
Life Science

Ecosystems: Life Cycles

(Salmon)

Science and Mathematics
Education Research Group

Salmon Life Cycle



Life Cycle I

Many organisms experience a life cycle (a series of changes an organism goes through in a life time). For example, humans go through these stages: birth, adolescence, adulthood, and death.

Looking at the images below, which other organisms also experience a life cycle?

A.



B.



C.



D. All of the above

Solution

Answer: D

Justification: All living organisms experience a life cycle because they go through multiple stages of growth.

The stages that organisms develop into are not all the same. But in this case, the chicken, the black bear, and the salmon will all experience these stages: birth, young adult, adult, reproductive adult, and death. Some of their life cycles differences include: a black bear like humans is a mammal, a chicken is a bird, and a salmon is a fish. The black bear mother's body develops an embryo giving a live birth and develops to a cub, while a chicken goes from a hard shell egg to a chick, and a salmon goes from aquatic egg to a parr.

Extend Your Learning: Resource

Explore the life cycles of other animals by clicking on the resources below.

Black Bear: North American Bear Centre www.bear.org

Moose: Moose Biology www.mnr.gov.on.ca

Western Honey Bee:

https://en.wikipedia.org/wiki/Western_honey_bee and
<http://www.pollinator.org/beeissues.htm>

Extend Your Learning: Compare and Contrast



Humans have life cycles, but robots do not. How do you know?

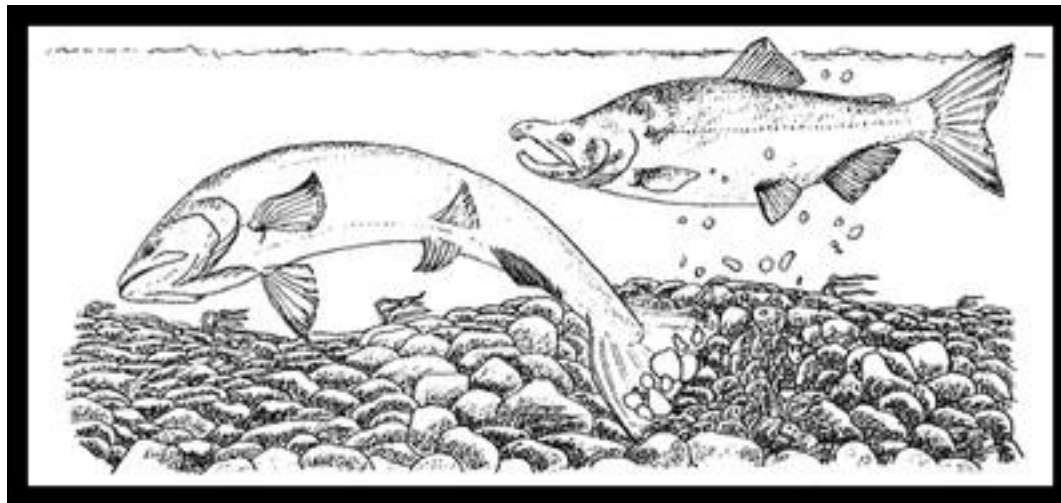
What are the differences between a robot and a human?

Can a robot have a life cycle?

Life Cycle II

Many animals make nests to protect their eggs. The different needs of animals result in different types of nests.

For example, salmon need their eggs to survive in fresh moving water. So their nest must protect the eggs from drifting down stream. The female fish digs in the gravel river bottom using her caudal fin (tail fin) to create a nest, which is called a redd.



Life Cycle II

Each set of pictures below shows an animal and a nest.

Which picture **does not** show an animal with the nest that it builds?

A.



B.



C.



D.



Solution

Answer: D

Justification: This pair shows a trout (a fresh water fish) and a tent caterpillar nest. Very different animals in all the answers and all these animals build nests to lay their young and protect them until hatching occurs.

Looking at an animal's body and habitat can aid us in identifying what type of nest it will build. For example, a sea turtle uses its large fins to build deep nests in sand along ocean shores.

In contrast, a salmon's habitat in a river means it must use its body to dig a redd in the gravel riverbed.

Extend Your Learning

A habitat is a specific place, such as an ecosystem, where organisms live. Below are three different habitats that support different species.

What are the difference you notice between each place?

How do you think an animals finds shelter and eats in this environment?



Extend Your Learning: Videos

Title: Sea Turtle Nesting, by
Brad Nahill



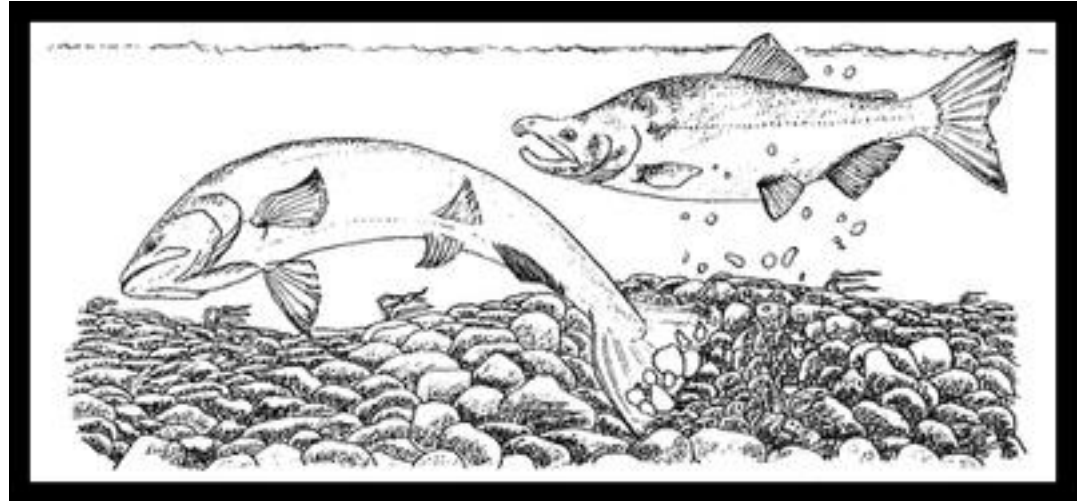
Title: BBC Home Making:
Weaver Bird



Extend Your Learning: Activity

Think making a nest is easy? Try making your own salmon redd at Science World!

Science World: Save Our Salmon provides a 45 min activity to try out building your own nest.



Here is a resource to make your own at home:

http://resources.scienceworld.ca/pdf/creatures/Salmon_redd.pdf
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Life Cycle III

Many animals begin life as an egg, but there are many different types, shapes and characteristics of eggs.

Which egg below is a salmon egg?

A.



B.



C.



D.



Solution

Answer: B

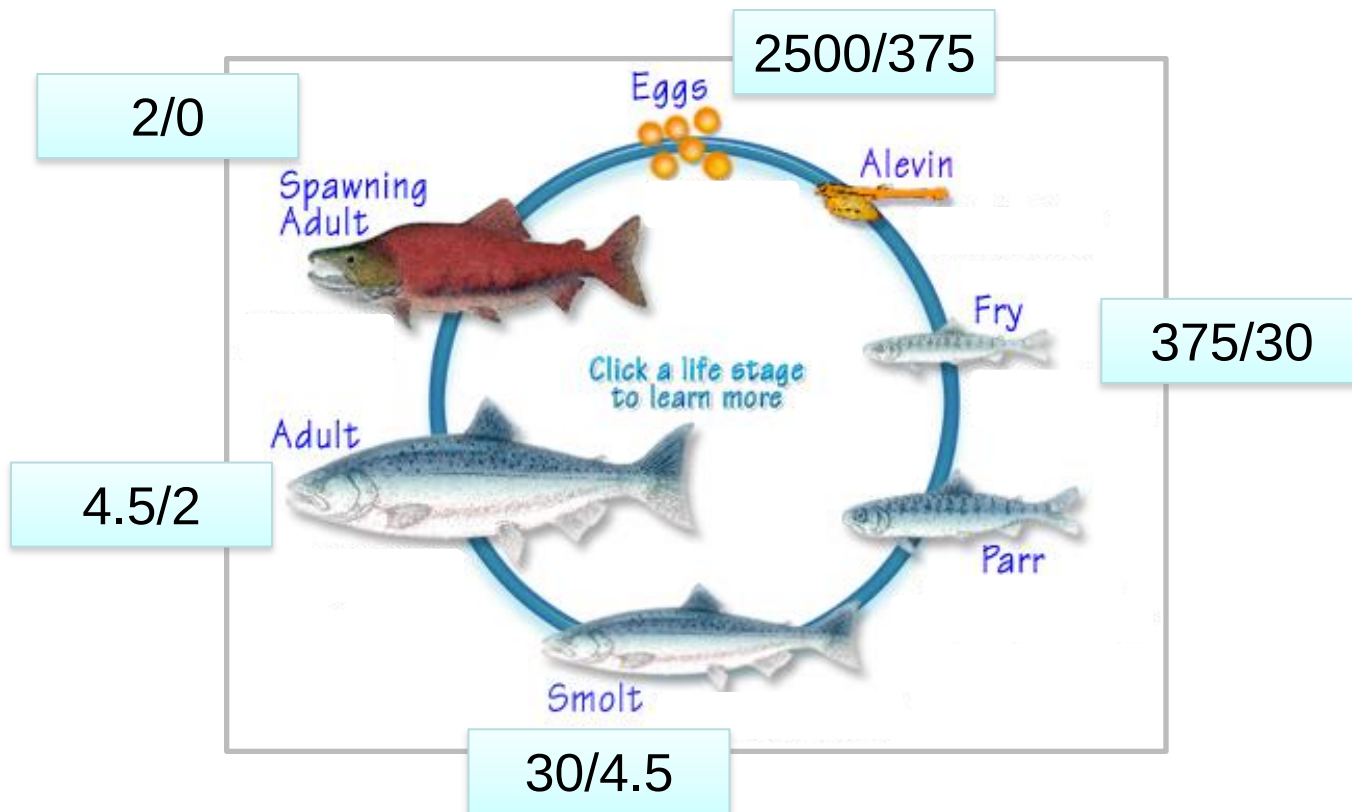
Justification: These are all images of eggs, but only one is of salmon eggs. To figure out which one is the salmon egg, consider what habitat a salmon egg needs to be able to survive in. This will give you a clue about the characteristics of the egg.

Salmon eggs are laid in moving fresh water and are pinkish red. Salmon eggs are softer than most eggs. They are also laid in a redd. All of these things help to prevent the salmon eggs from being carried away by the current. Bird eggs are different, and often have hard shells because they do not have to worry about the water current pulling them out of their nests.

Female salmon also lay between 2,500 to 7,000 eggs and only 1 out of 10 survive.

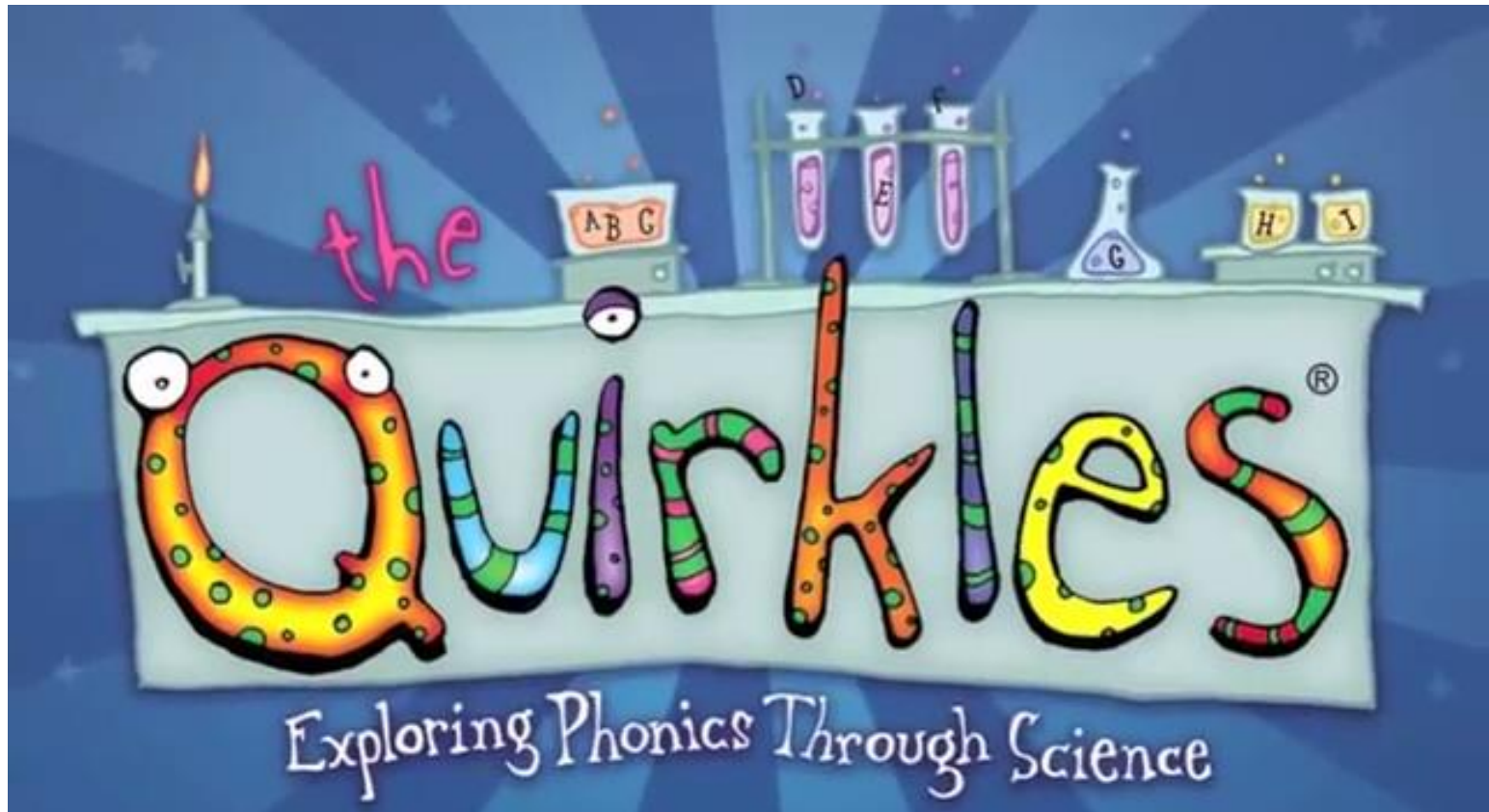
Extend your Learning: Activity

Salmon Survival Rate: $\text{Number at beginning of stage} / \text{Number at end of stage}$



Extend your Learning: Activity

Title: The Quirkles Floating Egg Experiment



Life Cycle IV

How does a salmon egg survive in a river?

- A. The egg has a sticky coating that allows the eggs to stick to rocks
- B. The eggs in a redd are covered with gravel to protect them from the environment
- C. The eggs are laid behind a large rock to protect them from the fast moving current
- D. The eggs are laid in a redd at the bottom of small lakes

Solution

Answer: B

Justification: Using her tail fin, the female digs a *redd* in the gravel river bottom, lays the eggs in the *redd*, and then covers them with gravel to protect from predators and sheltered from current.

Eggs are laid in moving water because it provides more oxygen than still water environments like lakes and wetlands. It also holds less bacteria and pollutants.

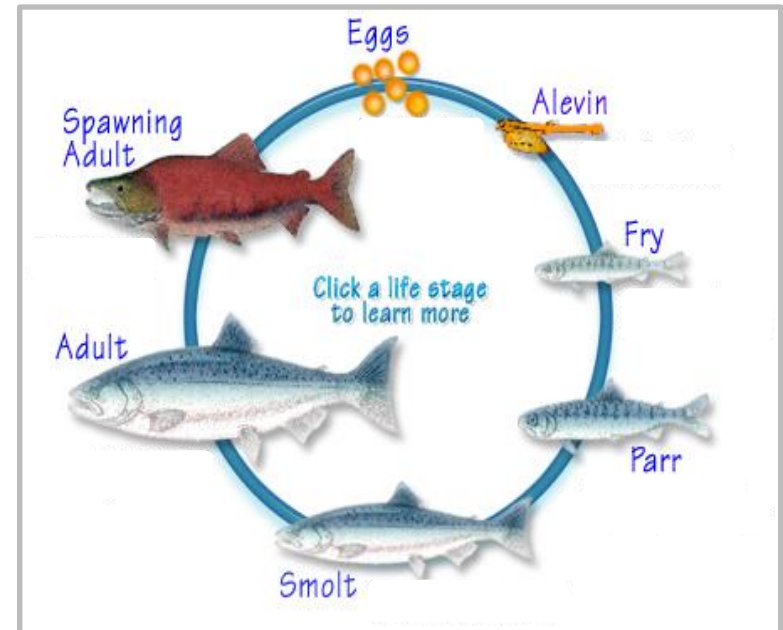
Eggs are laid in calm protected areas in rivers, if they are exposed to fast current eggs will float downstream and die. Some animals use other techniques to protect eggs in moving water. Sea snails for example lay eggs that stick to rocks.

Life Cycle V

When a salmon is in transition from living in fresh water to living in salt water, the salmon is called a *smolt*. During this time the salmon's body goes through two changes.

Firstly, it begins to get rid of extra salt through its gills and urine.

Secondly, the fish's body color changes from dark to light. This allows it to camouflage better in the ocean water.



Life Cycle VI

What image is of a smolt?

A.



B.



Solution

Answer: B

Justification: The **coho smolt** is a great example of how a salmon's body colour changes, camouflaging the fish in its new habitat in the ocean, and protecting the fish from predators.

The **coho fry** (A) is a great example of how the young salmon's body is camouflaged in a fresh water environment. The body is darker so it blends in with the low light and dark river bottoms.

Extend Your Learning: Discussion



Chinook



Chum



Coho



Pink



Sockeye



Steelhead

How many different kinds of salmon are there?

Why do they look different from each other?

What habitats do they live in?

How does their appearance help identify what life cycle they are in?

Extend Your Learning: Video

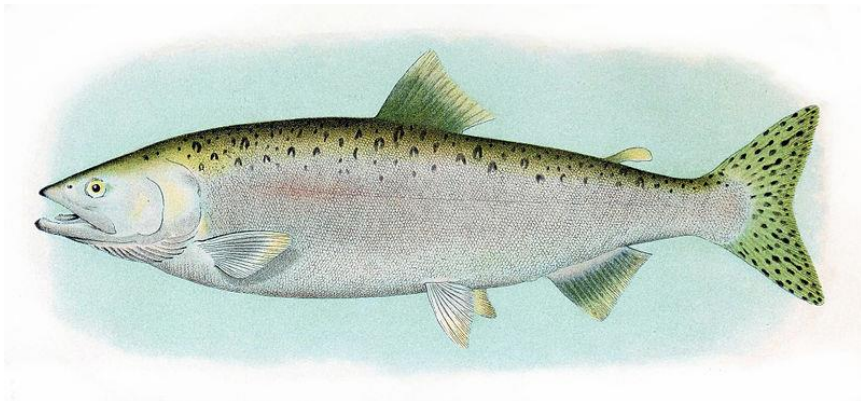
Title: Nature: “Salmon: Running the Gauntlet”



Life Cycle VII

Adult salmon look really different from spawning adult salmon because their bodies physically change when leaving the ocean and returning to the river environment.

Try to figure out which image below is the adult salmon and the spawning adult salmon before moving on to the question. Think about what environment each fish would be camouflaged in?



Life Cycle VII

What are the differences between the two images?

	Adult Ocean Salmon	Spawning Adult Salmon
A.	Silver in colour, with a small mouth and snout	Not silver in colour, and have a longer jaw and body hump
B.	Not silver in colour, and have a longer jaw and body hump	Silver in colour, with a small mouth and snout
C.	Both fish are the same	

Solution

Answer: A

Justification: Salmon undergo many physical changes throughout their life cycle. This is partially due to the many changes in habitat that they have during their life cycle. Remember, salmon begin their lives in fresh water, then move into salt water until they are ready to reproduce and return to fresh water to lay their eggs, this process is called *anadromous*.

The transition from salt water to fresh water involves physical changes, which are different among all 5 species of salmon. The physical change occurs in body colour, body shape, jaw structure and more. When salmon return to fresh water they also no longer feed. They put all of their energy into returning to the original spawning ground they hatched from.

Life Cycle VIII

A salmon has to move from the fresh water environment where it is born to the salt water environment where it spends most of its life. An **estuary** is where the mouth of a river joins the ocean.

Which of the images shows an estuary?



A.



B.



C.

Solution

Answer: A

Justification: The three pictures show an estuary, a river, and an ocean. You can pick out the estuary because it has combined the physical characteristics of a river and an ocean – it has small streams of flowing water as well as a large open body of water.

An estuary is an amazingly rich ecosystem. It is often part of a large wetland environment, with diverse animal communities living in “**brackish water**” (meaning the mixture of fresh water draining from land and meeting the salty seawater).

Estuaries are one of the most productive ecosystems in the world because they provide sheltered waters for mating, feeding, and migration stopovers. Estuaries are also delicate ecosystems and sensitive to pollution contaminants.

Extend Your Learning: Teacher Tips

Would you like more background resources about salmon research and projects in British Columbia? Here are two additional resources that may provide additional local facts to bring into the classroom.

Think Salmon: Fish & Fisheries, Governance, Habitat & Water, Engagement.

- This site looks at salmon health in the Fraser Watershed

<http://www.thinksalmon.com>

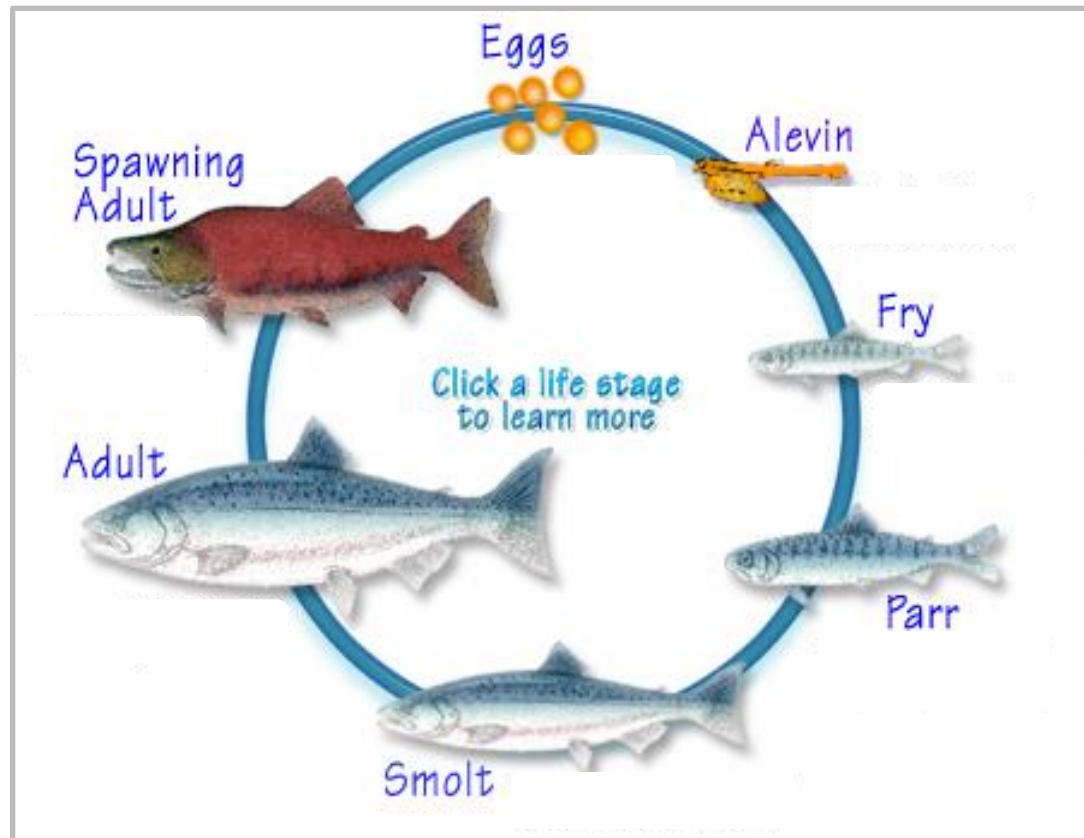
Fisheries & Oceans Canada: K-12 Education: Stream to Sea

- This site through Environment Canada offers lesson plans and activities about the salmon life cycle.

<http://www.pac.dfo-mpo.gc.ca>

Life Cycle and Habitat

This series of questions connects the salmon life cycle to their many habitats!



Life Cycle IX

Match the salmon's life cycle stage with the correct habitat:
The egg stage



A.



B.



C.

Solution

Answer: B

Justification: Salmon eggs need clean fresh water in order to survive and continue their development from an egg to alevin, fry, and parr. The fishes body is only adapted for a fresh water environment in these stages of life.

An estuary does provide protection from predators and calm water for young salmon, but it is also salty because of the mix of ocean and fresh water. In these early stages of life, salmon cannot survive in this salty water.

Salmon are limited to a specific life stages to enter different water environments.

Life Cycle X

Match the salmon's life cycle stage with the correct habitat:
The Adult stage



A.



B.



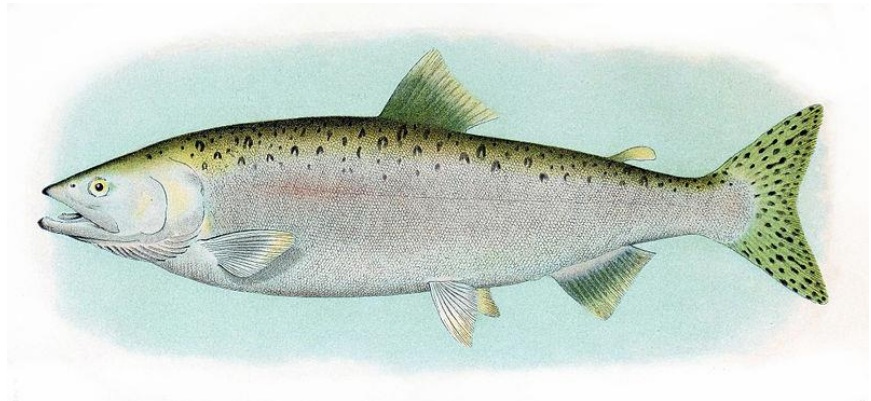
C.

Solution

Answer: C

Justification: As adults, salmon are living and eating in the ocean environment. Their physical appearance has changed from darker colors as parr in an estuary, to silver colors that match ocean colors. The salmon has also grown in size from the smolt stage.

How do you think size would be important in ocean environments?



Life Cycle XI

Match the salmon's life cycle stage with the correct habitat:
The Parr stage



A.



B.



C.

Solution

Answer: B

Justification: Parr still need to live in a fresh water environment. The parr is larger than when it was in the egg, alevin and fry stage so it begins to move to deeper water (6cm to 24cm in depth) but it remains in gravelly and stony rivers with strong current.

The parr's growth is influenced by the amount of food it eats. Once it reaches a sufficient size, in the spring the parr will undergo a physical transformation, similar to how a butterfly changes, and it will begin its travels to the estuary as a smolt.

Extend Your Learning: Video

Title: The Magic School Bus: Goes Upstream



Life Cycle XII

You already know that salmon go through a lot of physical changes between the adult and the spawning adult stages of life. But even within the spawning adult salmon stage there are many differences between the male and female salmon.

Spawning Female has a rounder body, no hump, and a slightly longer, lower jaw from living in the ocean.

Spawning Male has a flatter body with a hump, and a longer jaw with a hooked nose.

Life Cycle XII

Which image matches the description of the female fish?

A.



B.



Solution

Answer: A

Justification: The body shape of a spawning female is rounder than the male salmon because the body has changed shape to hold eggs for spawning. The color of the body has turned red and the mouth has become more hooked with a longer lower jaw. This unique adaptation is a sign that the fish's body is ready to return to fresh water and reproduce.

The females body is similar to the males body image B in color, but the male fishes body experiences some different changes than the female. The fishes back forms a hump and the lower jaw more hooked than the female.

Life Cycle XIII

The salmon is a predator because it consumes other animals. One trait of a predator are sharp teeth. The image below is of an adult salmon's mouth.

What do you think a salmon uses its teeth to eat?



- A. Eating Plankton
- B. Eating Small Fish
- C. Eating Squid
- D. All of the Above

Solution

Answer: D

Justification: Salmon eat a variety of things, so many in fact that they are considered an opportunist. An **opportunist** is an animal that takes advantage of a situation.

This means the salmon will prey on and eat any organism that is convenient for it at the time. For example, when in a freshwater river, the salmon eats caddis fly larva, grasshoppers, and crayfish. When a salmon migrates to the ocean it transitions to eating prey found in salt water such as small fish like herring, eels, and squid.

A unique trait of Sockeye salmon is they mostly eat zoo plankton.

Life Cycle XIV

In the same way that salmon eat other living things (making them predators), other living things eat salmon (making them prey)! A salmon has many different predators in the Pacific Ocean.

Look at the pictures below, which one is a predator of the salmon?

A.



C.



B.



D.



E. All the above

Solution

Answer: E

Justification: The salmon has a variety of predators. The orca, black bear, bald eagle, and fisherman are all reliant on salmon. These predators rely on salmon to migrate upstream from the ocean to rivers in late summer. They use this information to catch salmon as a food source.

This relationship between predator and prey shows how interconnected different animals are, and how they depend on other animals to survive.

Extend Your Learning: Video

Title: BBC Brown Bear Hunting

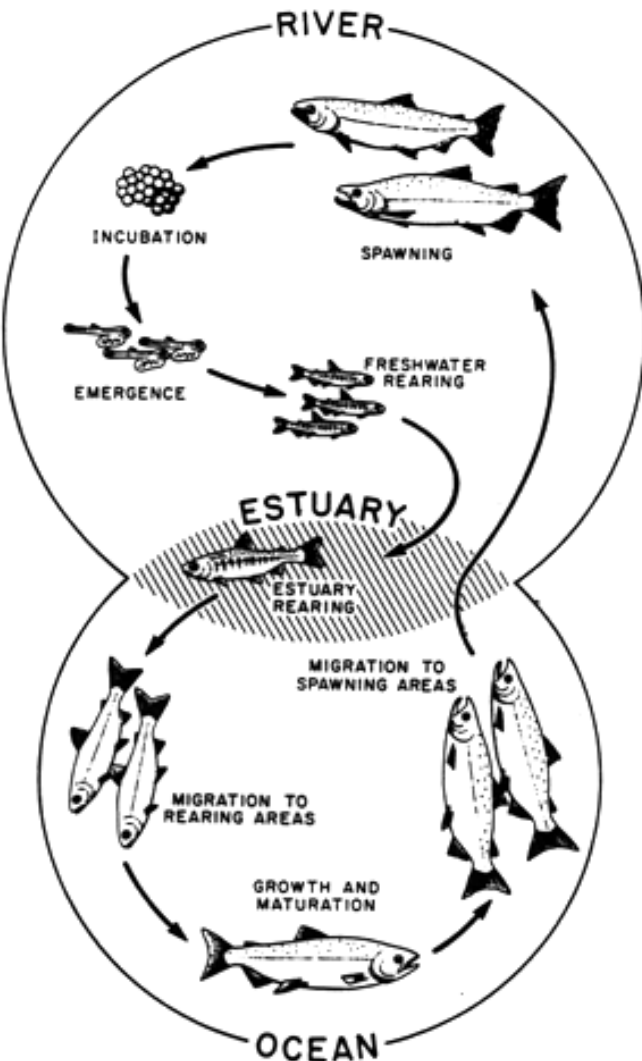


Extend Your Learning: Video

Title: BBC Brown Bear Catching Salmon



Life Cycle XV



Identify **ALL** the roles the Sockeye Salmon plays in the food chain at the different stages (and in the different habitats) of its life.

River ----- Estuary ----- Ocean

A.	Prey	Prey	Predator
B.	Prey & Predator	Prey & Predator	Prey & Predator
C.	Prey	Predator	Prey & Predator
D.	Prey & Predator	Predator	Predator

Solution

Answer: B

Justification Amazingly, salmon are both a prey and predator throughout their life cycle.

As a fry, they eat insects, nymphs and larva in rivers. While in the river their predators are birds and larger fish like trout.

When the salmon enters the estuary and ocean they continue to share a prey and predator role. They are predators to small fish like, herring and are preyed on by larger mammals like seals, sea lions, humans and orcas.

Extend Your Learning: Teacher Tips

Below are three resources that may be useful when teaching about humans relationship to salmon.

Salmon Hunting and Capturing Technics.

- Aboriginal Fisheries in British Columbia

<http://indigenousfoundations.arts.ubc.ca/?id=1072>

- Rivers of Canada: Fraser River-Troubled

http://www.cgeducation.ca/resources/rivers_of_canada/fraser_river/troubled_waters.aspxsources

- Fishing Vessels: Seiners, Trawlers, Longline Boats

http://en.wikipedia.org/wiki/Fishing_vessel

Extend Your Learning:

Teacher Tip

These two sites provide additional information of different human and animal relationships with salmon.

Environmental Impacts Over Fishing Resources

- World Wildlife Foundation: Overfishing

<http://worldwildlife.org/threats/overfishing>

Residential and Transient Ocra Populations

- Port Townsend Marine Science Center

http://www.ptmsc.org/resident_transient_orcas.html

Extend Your Learning: Video

Title: Salmon Confidential

