

Library List:

These books are just a few possibilities. Use whatever you have on your shelves already or what you can get from your library. At minimum, you will probably want to get a life cycle book, a book that contains photographs of salmon, and maybe a book on migration.

Salmon Stream by Carol Reed-Jones (A picture book telling the life cycle through a cumulative rhyme and gorgeous pictures.) Lots of good information for the parent at the end. There is one remark that parents may wish to know about: "This is the rain that swells the rivers, and sends the message that nature delivers to salmon to send them home to spawn,...." We just used it to discuss instinct and how God created the salmon to know when it was time head back to their home stream. This was in-line with a couple references in the book to the fish instinctively knowing when it was time to head to the ocean and how they obey "the voice of instinct" when they head back home.)

Salmon Creek by Annette LeBox & Karen Reczuch (A picture book telling the life cycle of Sumi, a coho salmon. At the end, there is information on the many threats to salmon, a glossary, a reading list, and a list of some easy ways children can help.)

Swimmer by Shelley Gill (A picture book telling the life cycle of Swimmer, a Chinook salmon in Alaska; could be a unit study in itself! In addition to the story and beautiful illustrations, each page is filled with details relating to both the salmon and the Native Alaskans. Near the end of the story, some information at the bottom of the page refers to modern salmon having "evolved over 50 million years ago," etc. You could easily skip over this or use it as a spring board to discuss your beliefs.)

Sockeye's Journey Home: the Story of a Pacific Salmon (Smithsonian Institute) by Barbara Gaines Winkelman (A picture book of part of the life cycle of the sockeye salmon. This story begins when the salmon is about three years old and living in the ocean, getting ready to head back to the home stream. This book does <u>not</u> contain information on the early stages of the life cycle.) *The Magic School Bus Goes Upstream: A Story About Salmon Migration* by Joanna Cole

Come Back, Salmon: How a Group of Dedicated Kids Adopted Pigeon Creek and Brought it Back to Life by Molly Cone

A Salmon Story by Rita Ramstad. (beginning reader: 12 pages, with 10-12 words per page, and similar in size to a BOB book.)

Red Tag Comes Back by Fred Phleger. (A *Science I Can Read* book; a 64 page reader that tells the life cycle of the salmon.)

Atlantic Salmon by Bianca Lavies

Life Cycle of a Pacific Salmon (*Life Cycles* series) by Jason Cooper (24 pages, photographs of the various stages. Text is large print, and not too overwhelming. Key words are in bold print. Glossary in back.)

The Journey: Stories of Migration by Cynthia Rylant (Contains information on other migrating animals: locust, whale, eel, butterfly, caribou, and tern.)

Where Have all the Pandas Gone? Questions and Answers About Endangered Species by Melvin and Gilda Berger. (There is a reference on page 3, in the introduction, to dinosaurs having been "driven to extinction when an asteroid struck our planet some 65 million years ago" and giant mammoths that "died out about 10,000 years ago.")

<u>Lessons</u>

<u>Vocabulary</u>

adult salmon -- a stage in the life cycle of the salmon. Full grown salmon live in the ocean before they migrate back to their home stream to reproduce.

alevins (al uh vins) -- a stage in the life cycle of the salmon. A baby salmon newly hatched from the eggs--they have a yolk sac

anadromous -- fish that migrate from fresh water to salt water. Salmon are an example.

camouflage -- The ability of an animal to blend in with its surroundings because of its markings and coloring

estuary -- the coastal area where the salty waters of the ocean mix with the fresh waters of a river.

fingerling -- another name for a young salmon.

fresh water -- water that contains very little salt, usually found in rivers, lakes, and ponds

fry -- a stage in the life cycle of the salmon. Small salmon after they have used up their yolk sac.

juvenile salmon -- a stage in the life cycle of the salmon. Young salmon that have made the journey to the ocean, where they will grow until adulthood.

life cycle -- the stages and changes that an animal goes through from the beginning of its life to the end.

migrate -- to travel from one location to an area, periodically or seasonally.

milt -- the milky substance a male salmon squirts on the eggs to fertilize them.

parr -- a stage in the life cycle of the salmon. Small salmon fry that have developed camouflage markings called *parr marks*.

redd -- nests made by a female salmon

smolt -- a stage in the life cycle of the salmon. Salmon that's ready to make the

migration from the stream to the ocean. At this stage, a salmon's body has developed to allow it to make the change from fresh water to salt water.

spawn -- breed, reproduce

→ Complete Salmon Vocabulary Book

<u>Geography</u>

Atlantic Salmon -- Below is a list of just a few of many places where salmon live that you might locate on a map or choose to learn about. If you live near a salmon run, you may wish to learn more about it instead.

<u>Atlantic Ocean</u> <u>Ungava Bay</u> (Canada) <u>Bay of Fundy</u> (Canada) <u>Connecticut River</u> (New England) <u>Pawcatuck River</u> (Rhode Island/Connecticut) <u>Merrimack (Merrimac) River</u> (New Hampshire/Massachusetts) <u>Kennebec River</u> (Maine) <u>Penobscot River</u> (Maine)

Pacific Salmon -- A few places you might locate on a map or choose to learn about include: Pacific Ocean

<u>Columbia River</u> (British Columbia/Washington/Oregon) <u>Snake River</u> (Wyoming/Idaho/Oregon/Washington) <u>Fraser River</u> (British Columbia, Canada) <u>Copper River</u> (Alaska) <u>Skeena River</u> (British Columbia, Canada)

ightarrow Complete Where Can I Find Salmon Map

<u>Science Rabbit Trail</u>: As you discuss rivers and their flow into other rivers and/or ocean, you may also wish to introduce the concept of watersheds and drainage basins.

A watershed is the area of land into which water flows (or is "shed," hence the name). When it rains or snows, the waters gather into streams, rivers, and lakes. These often eventually flow into larger rivers, which in turn flow into even larger rivers, and eventually into the ocean.

For example, in the area where I live, we have small streams which flow into a larger river, so we are in that larger rivers' watershed drainage area. That larger river flows into the Ohio River, so we are in the watershed drainage area of the Ohio River Basin as well. The Ohio River eventually flows into the Mississippi River, and so we are also in the watershed drainage area of the Mississippi River Basin too.

The areas in which the Pacific salmon and the Atlantic salmon live have similar watershed and river basin systems. This may be a topic you wish to further explore.

You will likely find that you too are located in a similar system, and you may wish to learn more about it. You may wish to demonstrate the concept of your watersheds (or those of the salmon if you explored those), by using Venn diagrams where the circles are within one another.

Classification

Kingdom Animalia Phylum Chordata Class Osteichthyes (bony fish) Family Salmonidae (salmon, trout, and char)

ightarrow Complete Salmon Classification Side by Side Book

Types of Salmon

(Source: Gold Seal, All About Fishing, Northeast Fisheries Science Center, and Wiki)

Atlantic Salmon (Genus Salmo)

The genus name for the Atlantic salmon is *salmo*, and means "jumper."

Atlantic Salmon (salmo salar) is most prolific of all salmon. They are silvery in color with large black spots. They average 17 to 22 lbs. in weight, but can reach 65 lbs. After spawning, about 1 in 10 will once again make the migration back to the ocean and later return to their home streams to spawn again. They live in the North Atlantic Ocean from North America to England and the eastern coastline of Europe.

Pacific Salmon (Genus Oncorhynchus)

The genus name for the Pacific salmon is *Oncorhynchus*, and means "hooked snout." There are six species of eastern Pacific salmon. (Note some books refer to only five. After reading the lesson about Steelhead Trout, you'll understand why.)

- <u>Chinook (Oncorhynchus tshawytscha)</u>: Chinook salmon are the largest of the Pacific salmon. They are lightly spotted on their back, which is bluish-green. They live 5 to 7 years and can weigh up to 120 lbs., but are usually around 30 lbs. They are prized game salmon (meaning they are the ones sport fisherman love to catch). Because they are the largest of the Pacific salmon, they are often called King Salmon. They are the least abundant of the pacific salmon.
- <u>Chum (Oncorhynchus keta)</u>: Chum or keta salmon have black spots and faint bars on their sides, which are silver. They live 3 to 5 years and weigh up to 10 lbs.
- <u>Coho (Oncorhynchus kisutch)</u>: Coho salmon are silver in color. They live about 3 years and weigh up to 15 lbs. They too are a popular game fish for sports fisherman.
- <u>Pink (Oncorhynchus gorbuscha)</u>: Pink salmon are the smallest of the Pacific salmon. They weigh up to 5 lbs. and live only two years. They have silver bodies and have many dark spots on their backs. Of the Pacific salmon species, the pink are the most plentiful.
- <u>Sockeye (Oncorhynchus nerka)</u>: The sockeye salmon are bluish-silver in color when they are in the ocean maturing. When they start the migration back to

their home stream, their bodies turn red and their head takes on a greenish color with orange eyes. For this reason, they are sometimes called Red Salmon. They weigh up to 7 lbs. They live about 4 to 5 years. They are thinner than other species of Pacific salmon. They are the most sought after of the Pacific salmon because of their flavor.

• <u>Steelhead Trout (Oncorhynchus mykiss)</u>. The Steelhead, or Rainbow, Trout was until recently classified as an Atlantic salmon (Salmo gairdneri). In 1988, modern technology allowed scientist to determine that the steelhead was more closely related to the Pacific salmon and so it was voted to change the genus and species name from *Salmo gairdneri* to *Oncorhynchus mykiss*.

These species of the Pacific salmon can be found in various places along the coastline of southern California to the Bering Sea.

As the salmon make their way back to their home stream to spawn, the male of some of the species of salmon change. They do not eat (they rely on what their bodies have stored up before the journey began). Their body colors change (for example, sockeye develop greenish colored heads and red bodies). Their mouth becomes more hook shaped. Their backs may develop a hump. These changes signal to the females that he is ready to spawn (reproduce).

Most Pacific salmon die within a week or two after they return to their home stream and spawn. This trait of dying after reproduction is called *semelparity*. The steelhead trout salmon is the exception of the Pacific salmon, having the ability to repeat spawning without dying.

→ Complete Types of Salmon Shutterflap Book

Anatomy (What's Inside?)

Use the diagram of the fish to discuss salmon parts and to help your student label the diagram provided in the lapbook printables.



Diet (What do salmon eat?)

Salmon are carnivores, meaning that they eat meat. They eat plankton, fish, squid, shrimp, etc.

→ Complete Salmon Diet Matchbook

Predators (What eats salmon?)

Salmon are eaten by man, bears, other fish, and birds like eagles and kingfishers. Because many salmon die after spawning, home streams are littered with decaying fish during spawning time. Bears, eagles, wolves, foxes, ferrets, and other animals take advantage of these easy and abundant meals.

→ Complete Salmon Predators Accordion

Life cycle of the Salmon:

A spawning female Pacific salmon digs a nest, called a *redd*, in the gravel of a

stream, where she lays hundreds of reddish *eggs*, each about the size of a pea. After the eggs are laid, a male salmon fertilizes them by squirting them with *milt*. After that, the female gently covers the eggs with gravel. The female and male repeats this in different areas of the stream (except for the sockeye salmon, which only makes one redd), until thousands of eggs (2,000 to 10,000) have been laid and fertilized. The male Pacific salmon soon dies after he fertilizes the eggs (except for the steelhead trout, which will once again migrate to the ocean and later return to spawn again.

The Atlantic salmon are similar, except (like the steelhead trout) the Atlantic salmon do not die and again migrate and return to re-spawn. This characteristic of dying after spawning is called *semelparity*.

The eggs remain hidden for up to 4 months before hatching as *alevins*. Alevins are tiny fish with a large *yolk sac* attached to their bellies. This yolk sac provides food as the baby fish grows, so it does not need to find food. Once the yolk sac is used, the small fish are called *fry*. Some kinds of salmon at this stage develop *parr marks*, and are so then called *parr* instead of fry. The parr marks help to camouflage them. Some Pacific salmon are in this fry/parr stage briefly before migrating to the ocean; others a year. Atlantic salmon stay in this stage for 2 to 6 years.

By the time the fry/parr are ready to migrate to the sea, their bodies start changing to allow them to make the move from the fresh waters of the stream where they were born to the salty waters of the ocean to where they will migrate. They are now called *smolts*.

One of the changes is in their coloring. Their bodies change from brownish-greens that help camouflage them in a stream to a more silver color to help them hide in the ocean. Their blood makes changes that will allow them to need less oxygen in the ocean (there is less oxygen in the ocean than in streams). The salt pumps in their gills also begin to change. In streams, the salt pumps act to keep too much salt from leaving the fish. In the ocean, the salt pumps act to remove the excess salt of the ocean. Isn't it amazing how God designed the salmon to be able to change at just the right times to allow them to spend part of their life in freshwater and part of their life in salt water! The changes the salmon go through would be like what it would take for us being able to breathe underwater!

Rain is often the signal to the smolts that it is time to make the long journey downstream. They travel at night, and rest by day. If the smolts are delayed (like at a dam), they may lose the urge to migrate and they do not complete the cycle by spawning.

Once the smolts arrive at the *estuary*, the land where the fresh water of the river meets the salty water of the ocean, they may linger to get used to the salty water. Their getting used to the salty water is called *smoltification*.

Once out in the ocean, they are considered *juvenile salmon*. They spend several years in the ocean, growing and maturing into adult salmon. They migrate hundreds or even thousands of miles during this time.

At some point (and scientists are unsure of what triggers it), the adult salmon know it's time for them to migrate back to their home streams where they were born. They make their way back to the estuary where they entered the ocean to begin the *salmon run*, the journey home. Once they start swimming back to their home stream, they do not eat. They rest in pools of water to regain strength for the upstream journey. They often have to jump over obstacles, such as waterfalls. The instinctive drive to return home is so strong that they are willing to risk all to go back, and some die trying.

Once they make it back to their home stream, they spawn and the cycle begins again.

→ Complete Salmon Lifecycle Simple Fold

Language Arts

<u>Diary</u>: Have your student to pretend he is either an Atlantic or a Pacific salmon and have him write a diary of his experiences growing up, traveling to the ocean, his life in the ocean, and his journey back to his home stream. Remind him to use proper names for the stages and to note various geographic locations.

Drawing: Have your student draw and label the stages of a salmon's life cycle.

Combination of Language Arts and Art

<u>Comic Strip</u>: Have your student to create a comic strip that depicts the life cycle of a salmon.

Migration

Many animals *migrate* each year, that is move from one place to another for an extended period of time and then later return. Often they migrate for breeding purposes, though some migrate to find food. Can your student think of different animals that migrate? Some birds (Canadian geese, loons, bald eagles, robins, whooping cranes, arctic tern), monarch butterflies, caribou (reindeer), some whales (humpback, gray), American silver eels, etc. The animal that migrates the furthest is the Arctic tern, a bird which lives at the North Pole during the summer but migrates all the way to the Antarctic in the fall!

As mentioned, many kinds of fish migrate. Fish that migrate can be divided into three categories: diadromous (die-ad-ruh-mus), potamodromous, and oceanodromous (oh-show-nod-ruh-mus).

1) *Diadromous fish* travel between salt and fresh water.

2) Potamodromous fish travel within fresh water only.

3) *Oceanodromous fish* travel within salt water only.

Diadromous fish can be further subdivided into three more categories, depending on what part of their life cycle they are in freshwater and salt water: anadromous (uh-nad-ruh-mus), catadromous (kuh-tad-row-mus), and amphidromous (am-fidruh-mus).

<u>Art</u>

- Anadromous fish live mostly in the ocean, but return to freshwater to breed. Salmon are anadromous, hatching in freshwater streams, spending much of their lives in the ocean's salty waters, then returning to their home stream to spawn.
- *Catadromous fish* are opposite, they live in freshwater, but go to the ocean to breed.
- Amphidromous fish travel between salt water and freshwater regularly at some point in their lives, but not for breeding purposes.
 <u>Source: Wiki</u>

Salmon may travel thousands of miles before returning to their home stream.

Destruction of part of an animal's migratory route can lead to great numbers of the species dying. This has happened to the salmon and we will talk about endangerment and extinction later.

ightarrow Complete Migrating Fish Flap Book

Homing Instinct

Scientists are not sure how fish like salmon know how to return to the very stream in which they were born. Most agree that once the fish find their way from the ocean to the estuary for their river, that the salmon use their sense of smell, but how they find their way around the ocean is a subject of debate. Some of the different theories are how salmon might use celestial navigation (use the stars to tell which way to go), might follow food, or might be able to detect the earth's magnetic fields. This might be an interesting topic for a research paper for an older student.

The urge to return home is called "homing instinct." You may have heard stories of cats and dogs that move with their families hundreds of miles away, only to leave the new home and somehow find their way back to their original home. They were able to use their instincts to return home. Instinctual behavior is a trait that an animal is born with and is not learned. God designed animals to have instincts that tell them what to do and when to do it. An example of a natural instinct would be that a dog is born with the knowledge to lie down when tired. A learned instinct would be for the dog to learn to lay down when commanded to.

<u>Numbers</u>

For every 8,000 eggs produced, 4,500 alevin survive, from which 650 fry survive, from which 200 parr survive, from which 50 smolt survive, from which only 2 spawning adults survive (who produce thousands of eggs). <u>Source: Wiki</u>

For more numbers, see the Endangerment and Extinction section below.

→ Complete Numbers Flap Book

Endangerment and Extinction

Discuss with your student what it means for animals to be endangered or extinct.

Both the Atlantic and the Pacific salmon populations have declined drastically and steadily. Stream conditions have to be just right for the fish to lay their eggs and for the newly hatched fish to survive. The water especially needs to be fresh, clear, and cool. In most places where salmon spawn, conditions are now less than ideal. Streams have become polluted. Dams have been built on the rivers used by the salmon, thereby limiting the salmon's return to their native areas. People have cut down trees along the rivers, so that the trees no longer cool the river. Logging and other activities have allowed silt and sand to muddy and thicken the streams.

In the Snake River area of the Pacific Northwest alone, "not long ago, before any dams were constructed, up to 16 million salmon and steelhead would return in any given year.....Today, all runs of salmon and steelhead on the Snake River are either extinct or listed under the Endangered Species Act. Last year only three sockeye salmon returned to their spawning grounds in Idaho." <u>Source</u>

In the New England area of the United States alone, "Historic Atlantic salmon abundance in New England probably exceeded 30,000 returns annually. Overfishing and habitat destruction resulted in a severely depressed US population restricted to Maine and by 1950 with adult returns of just a few hundred fish in a handful of rivers. Hatchery-based stock rebuilding occurred from 1970-1990 reaching a peak of 5,624 fish in 1986. A widespread collapse in Atlantic salmon abundance started around 1990. In the past decade, US salmon returns have averaged 1,600 fish and returns in 2005 were 1,320 fish." <u>Source</u>

To say the least, these numbers are alarming!

At the end of the book, *Salmon Stream* by Carol Reed-Jones, there are addresses for several organizations to which your student could write to get more information on the conservation efforts to save the salmon.

ightarrow Complete Population Decline Simple Fold

Freshwater vs. Salt Water

What is the difference between freshwater and salt water? All water contains some salt. Freshwater, however, contains less than 1% salt and generally does not taste very salty. Have your student get a small cup of water and take a drink--does it taste salty? Probably not. Add a pinch of salt and take a sip--does it taste salty now? Perhaps a little. What about if you add a teaspoon? A tablespoon? Yuck!

Have or help your student make a list of general places that are freshwater. Included in this list might be streams, rivers, lakes, ponds. Can he name specific places? This list might include Grandma and Grandpa's Pond, the Mississippi River, Lake Erie, etc. Research and learn more about specific freshwater places. (Perhaps one on the list or others, such as the Great Lakes--which makes up 22% of the world's fresh water)

Now have your student make a list of general places that he could find salt water. This list will probably be short and list only oceans, though he might recall that the Red Sea and the Great Salt Lake of Utah are also salty. You may wish to take this time to review the name of the oceans--can your student name all of the oceans? They are: Atlantic, Arctic, Indian, Pacific, and the Southern Ocean. Some teach this last ocean as the Antarctic Ocean. However, in 2000, the name Southern Ocean was given to the waters surrounding Antarctica and north to 60 degrees' latitude.

A cubic foot of saltwater contains over 2 pounds of salt. So what makes oceans

salty? As rivers flow toward the sea, they pick up mineral salts and carry them along until they are emptied into the sea. Now, this river water is not very salty. However, as water from the oceans evaporate, the salt stays behind in the waters. The remaining waters get saltier with time.

Rivers and streams are not the only source of the ocean's salts, however. Hydrothermal vents in the floor of the ocean often spew out salt minerals into the waters.

Fun Fact: If all the salt from the ocean were removed and spread out over the land, it would form a layer more than 500 feet thick! <u>Source</u>

→ Complete Saltwater vs. Freshwater Simple Fold

Creation Science

The current saltiness of the sea is yet another bit of evidence for a young earth; creation scientists note that if the earth were indeed millions or billions of years old, it would be far saltier than it is today.

Salt from the ocean is comprised of over 80 chemical elements and is so complex that scientists cannot reproduce it exactly. <u>Source</u> How amazing our God is!

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Vocabulary Book

Directions: Cut on the solid lines. Write in definitions. Stack pages together with cover on top and staple on the left side.



Vocabulary Book

Directions: Cut on the solid lines. Write in definitions. Stack pages together with cover on top and staple on the left side.



Where Can I Find Salmon? Map

Directions: Mark the map. Cut out and fold in half. Paste cover piece (next page) to the front of the book.



Where Can I Find Salmon? Map



What's Inside (Salmon Diagram)



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What's Inside (Salmon Diagram Color Option)

Directions: Cut out and fold in half. Paste cover piece (previous page) to the front of the book. Label the diagram.

Salmon Diagram

Label the following:

- . Backbone . Intestine
- . Liver . Heart
- Kidney . Swim Bladder
- . Stomach



What's Inside (Salmon Diagram Black and White Option)

Directions: Cut out and fold in half. Paste cover piece (previous page) to the front of the book. Label the diagram.

Salmon Diagram

Label the following:

- . Backbone . Intestine
- . Liver . Heart
- Kidney . Swim Bladder
- . Stomach





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Salmon Classification Side by Side Book

Directions: Cut out books on the solid black lines. Fold on the dotted lines. Glue small books in to the larger book.

Phylum	Family
Class	Kingdom



Predators Accordion



Directions: Cut out shapes on solid black lines. Fold on dotted lines like an accordion (back and forth).

Glue back of last piece to your lapbook. Hint: You might want to tie a ribbon or string around your accordion before you glue the back to your lapbook.

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Salmon Survival Numbers Flap Book



Directions: Cut out book as one piece. Fold left side in. Fold right side in. Open book. Cut on dotted lines to form six flaps. Refold book. Add the numbers under the flaps.





Directions: Write in the life cycle stages: egg, alevin, fry, smolt, and adult. Fold in half. Paste cover piece to the front.

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Freshwater vs. Saltwater



Directions: Cut out book as one piece. Fold. Use the inside of the book to write about the differences between salt water and freshwater.

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Directions: Cut out books. Fold on lines (matchbook style).





Directions: Cut out book as one piece. Fold on left side under. Fold right side under. Open book. Cut on dotted lines to form three flaps. Refold.

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