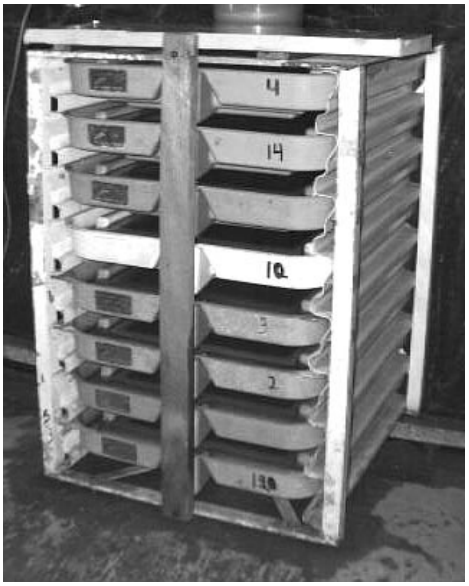
The Salmon Times

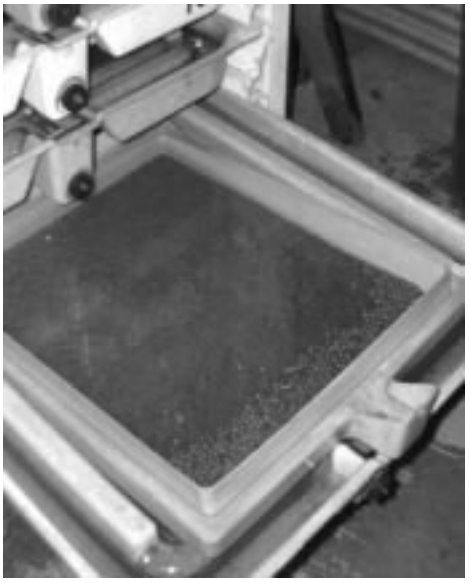
January *Number 4*

Salmon Eggs Ready For Classroom Incubators!

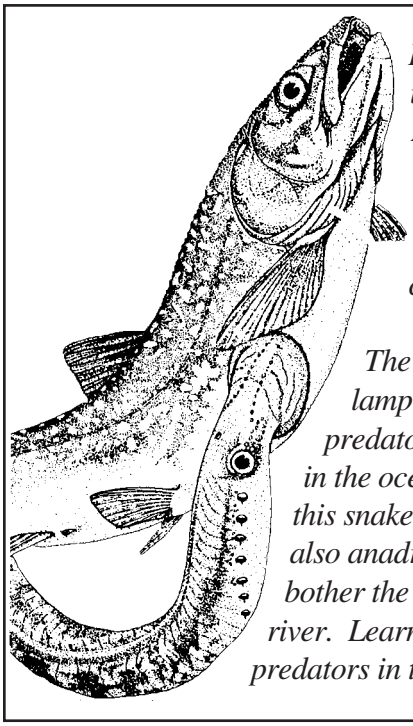
By now, the Atlantic salmon eggs that have been incubating at the fish hatchery since last fall have reached the "eye up" stage and are ready to be placed in your classroom incubator. Eyed eggs are hardier than newly fertilized "green" eggs and will stand a much better chance of successfully hatching.

If you look closely, you will notice a pair of small black dots within each egg. These are the actual eyes of the fish and are proof that a salmon embryo is developing within the egg. As time passes, you will gradually see more and more of the fish's body take form.





Though the hatchery incubator on the left can hold more than one million eggs, it operates in much the same way as your classroom incubator. At right, Atlantic salmon eggs in an incubator tray before being packed up for delivery to a school.



Like most creatures in the natural world, Atlantic salmon must deal with a variety of predators throughout their life cycle.

The parasitic sea lamprey is a significant predator of Atlantic salmon in the ocean. Interestingly, this snake-like fish, which is also anadromous, does not bother the salmon while in the river. Learn more about salmon predators in the following pages.

illustation from Great Lakes Fishery Commission

As you will soon see, raising Atlantic salmon is a big responsibility. It will also be a lot of fun! During a visit to the school, your facilitator will describe how the incubator works and explain how to properly care for the eggs...and the young fish to come. By raising a "salmon family," you and your classmates will become an official part of the effort to restore this magnificent fish to New England's rivers!

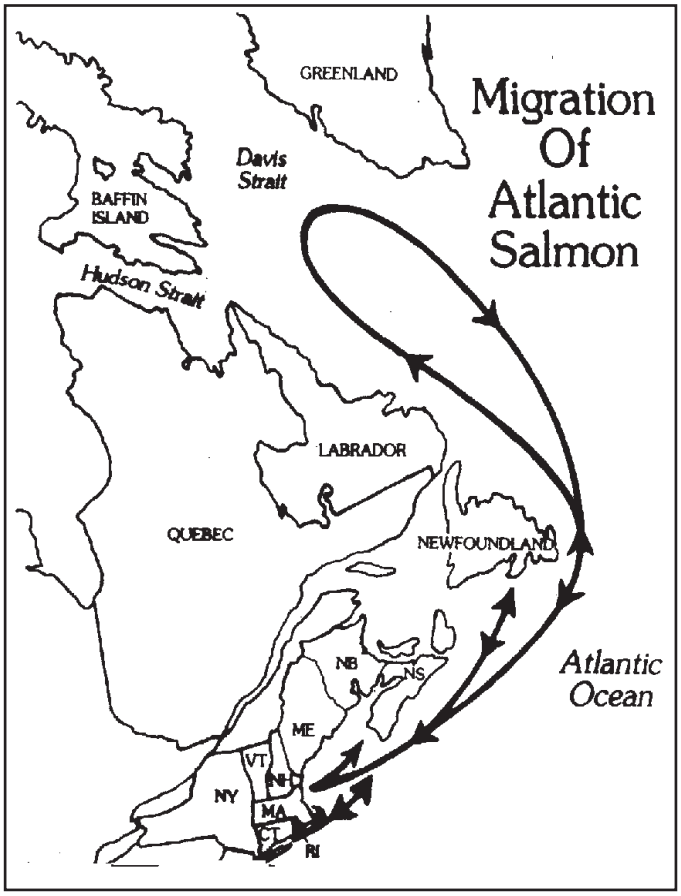
What's Inside? ☞☞☞☞

How does an incubator work? How do you tell the age of a salmon from a fish scale? What does a salmon eat? What eats a salmon? Using simple math, how do you predict when the salmon eggs will hatch? These are just some of the interesting things you will be learning about in this issue of *The Salmon Times*.

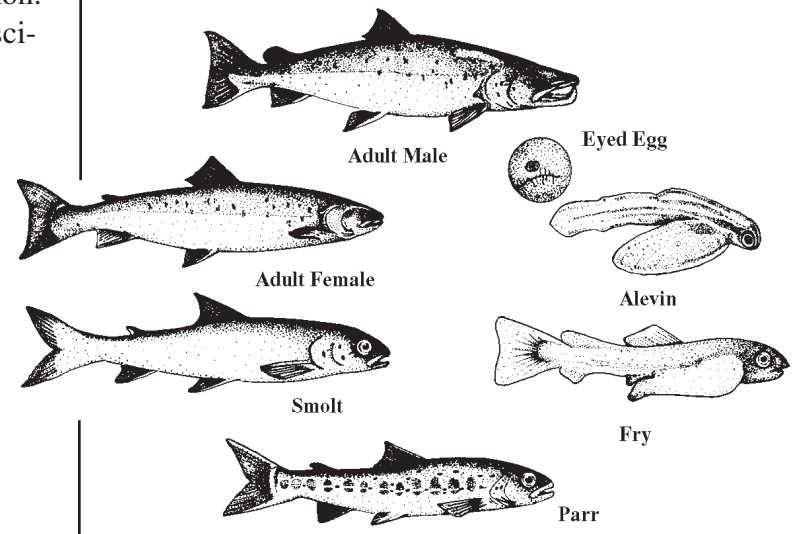
The Long Journey of the Atlantic Salmon

You already know quite a bit about Atlantic salmon. Let's take a closer look at the life cycle of this fascinating creature.

Salmon are born in a cold water stream. Here they will live for the next one to three years by finding food and avoiding predators. One early spring salmon parr lose their vertical bars and turn a silvery color. Now called smolts, the fish have undergone certain physical changes that allow them to survive in salt water. Migrating downstream, smolts must get beyond the many dams that lie between them and the ocean. In favorable conditions smolts use fish ladders and downstream bypasses to get around the dams. In some cases the young fish are drawn into electric turbines. Some survive this experience, many do not.



This diagram shows the great distance Atlantic salmon travel during their ocean migration.



Having left the mouth of the river, salmon begin a northerly journey that may cover 2000 miles. Though it is still a bit of a mystery, some biologists believe the salmon find their way by following the stars and the earth's magnetic field. Spending the warmer months in the coastal waters of New Foundland, Labrador, and West Greenland, Atlantic salmon head for deeper waters as winter approaches.

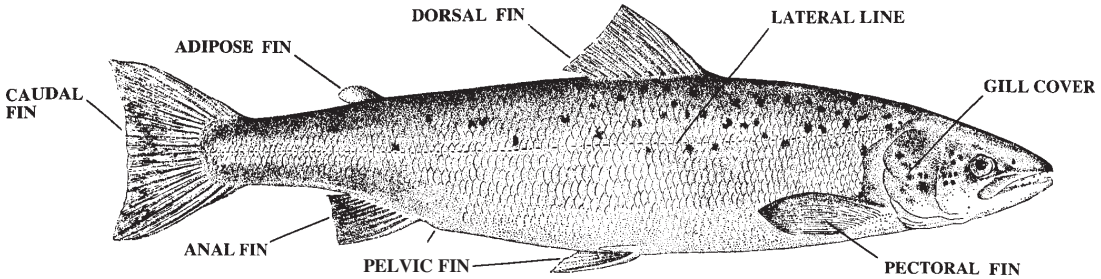
Salmon grow rapidly in the nutrient-rich marine environment. Feeding on shrimp and smaller fish, Atlantic salmon may gain ten to twenty pounds during their one to three year stay at sea.

Adult Atlantic salmon return to their native rivers to spawn in the spring and early summer. Some may not return until fall. They are able to locate these rivers by following a unique odor in the water. Once reaching their spawning beds, a redd is prepared, eggs are laid and fertilized, and the life cycle begins anew.

The odds of an adult Atlantic salmon returning to its native river to spawn are truly a longshot. Of the five to eight thousands eggs typically laid in a redd, about 50 fish will survive to reach to the ocean, with perhaps only two returning to the river to spawn. The fact that a salmon may spawn a second or third time is nothing short of remarkable!

Ever Wonder How A Fish Works?

Have you ever wondered how a fish breaths underwater? What all those fins are for? Why are fish slimy? Can a fish hear underwater?



Source: Atlantic Salmon Federation

First of all, a fish does breath underwater. Unlike marine mammals such as a dolphin or a seal, you will never see a fish at the surface of the water taking a "gulp" of air. Luckily for fish, water contains a certain amount of oxygen. The amount of oxygen in a water body can vary tremendously and is affected by such things as water temperature and the presence of aquatic plants, which produce oxygen. Fish breath through their gills. Water enters a fish's mouth, passes over the gills, and is expelled out into the water body. You can think of a gill as being a thin membrane. Small holes in this membrane allow tiny oxygen molecules in the water to pass through and into the fish's body. The larger water molecules cannot fit through the holes in the membrane. This process is called osmosis.

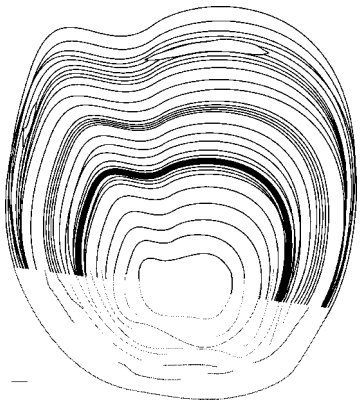
As you probably know, swimming requires a lot of energy. How does a fish make it look so easy? The bullet-like shape of a fish creates less drag as it passes through the water. Powerful fins provide the necessary propulsion. A typical fish may have as many as six different types of fins. The caudal or tail fin is the most important fin for propelling the fish through the water. The other fins are used to change direction (up, down, left, or right) and to maintain position in the the water.

Like most animals, all fish have skin. Many fish have an outer covering of scales. Scales protect the fish, much like a suit of armor. All fish have a slimy covering of mucous. This substance allows the fish to swim through the water with very little drag and also makes it difficult for harmful organisms to attach to the fish. So mucous is also a protective feature.

A fish's sense of sight, hearing, and smell are excellent. If you've ever discovered how easy it is to scare a fish away when trying to catch it with a fishing pole, you know how good a fish's eye sight is! Using a group of sensory cells called a lateral line, a fish is able to maintain its sense of balance by "hearing" or detecting vibrations in the water.

One other interesting aspect of a fish is the air bladder. It uses this "bag of air" to adjust its buoyancy or how it floats. The amount of air in the bladder will determine at what depth in the water the fish will float. This is important because if a fish wanted to be at a certain depth in the water, and didn't have an air bladder, it would have to spend a lot of energy moving its fins to stay there. So an air bladder allows the fish to conserve energy.

Now you know a little more about "how a fish works."



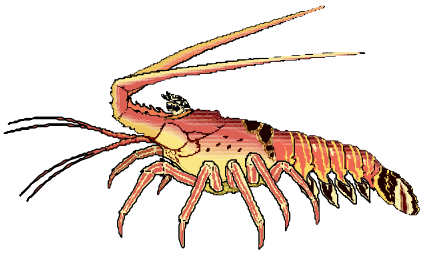
TALE OF A SCALE

Much like you can tell the age of a tree from counting the number of rings, biologists use fish scales to determine the age of Atlantic salmon. Other things that can be learned from a scale include the number of years a salmon has spent at sea and how many times it has spawned.

Illustration Source: Fish Friends, Atlantic Salmon Federation

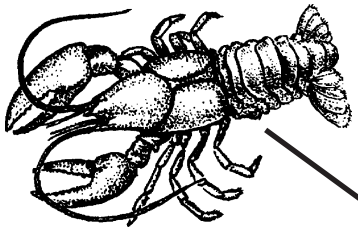
Eating...

Salmon eat different things at different phases in their life cycle. As "opportunistic feeders," they will generally eat whatever will fit in their mouths!

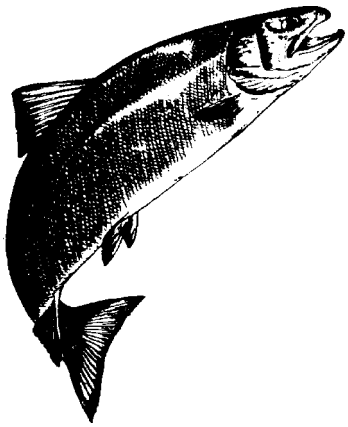


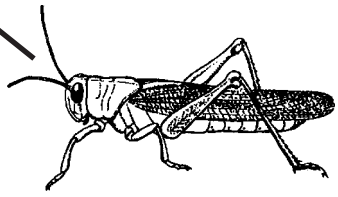
shrimp

caddisfly larva

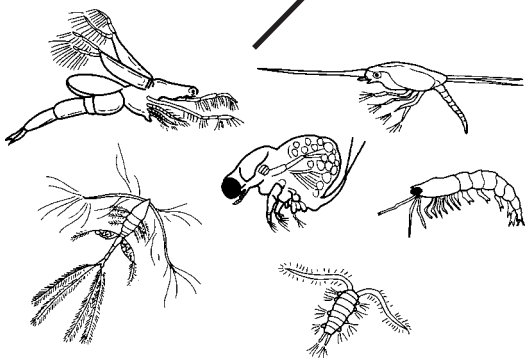


crayfish

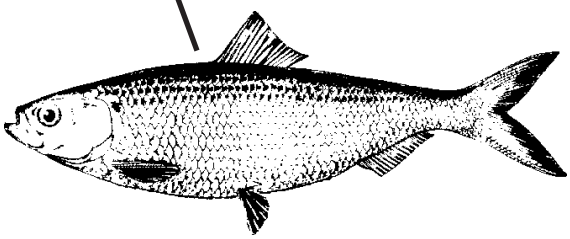




grasshopper (terrestrial insects)



zooplankton

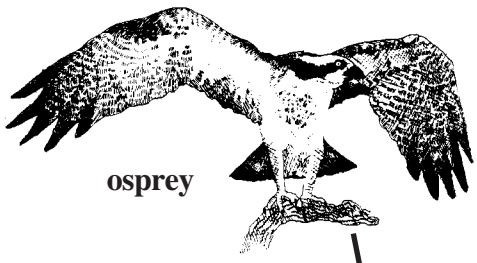


herring

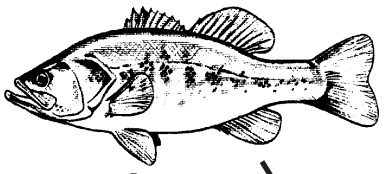
zooplankton from Living in Water, National Aquarium in Baltimore; crayfish, caddisfly and grasshopper from Pond and Stream Safari, Cornell Cooperative Extension

...And Being Eaten

Throughout their lives in fresh and salt water, Atlantic salmon face a host of predators. Until very recently, the predators having the biggest impact on salmon populations were people.

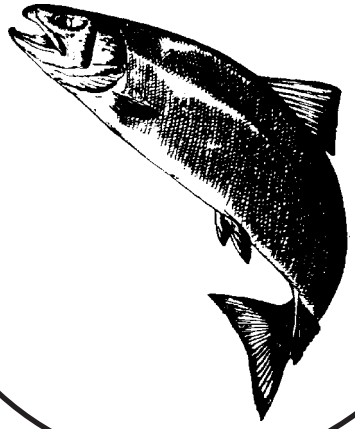


osprey

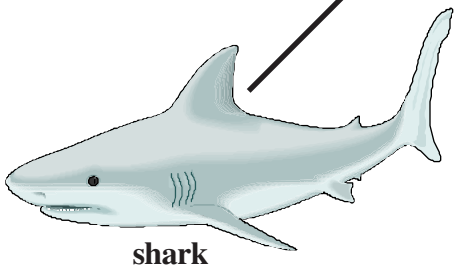


bass

otter

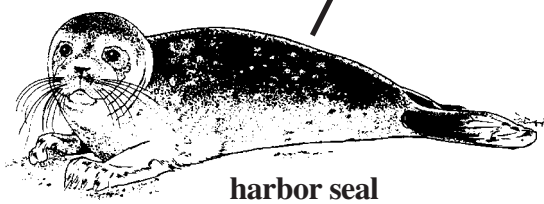


great blue heron



shark

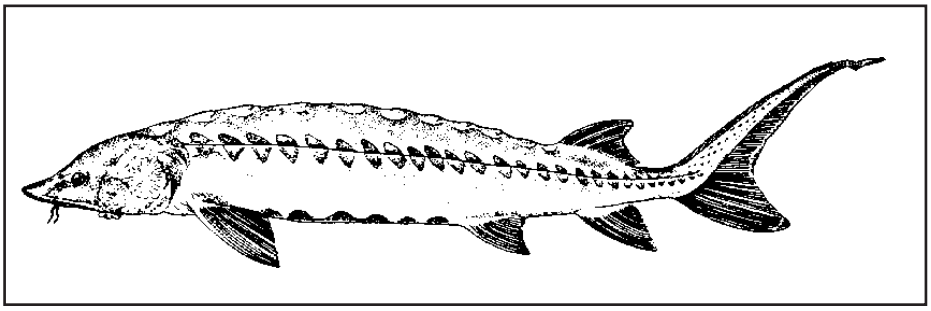
sea lamprey



harbor seal

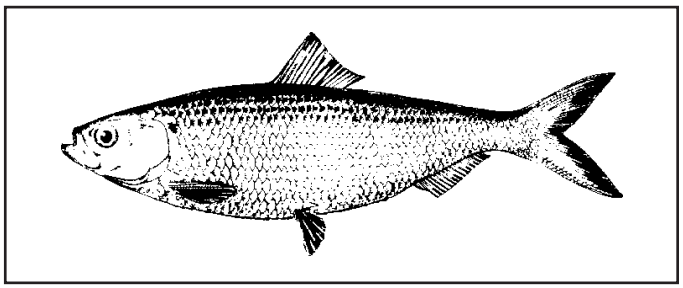
Not Just Salmon...

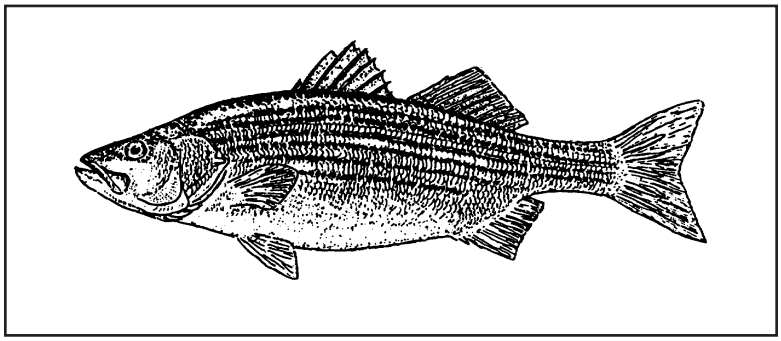
A variety of fish share the Atlantic salmon's anadromous life cycle. Many are found in New England's rivers, including the four species on this page.



Shortnose Sturgeon

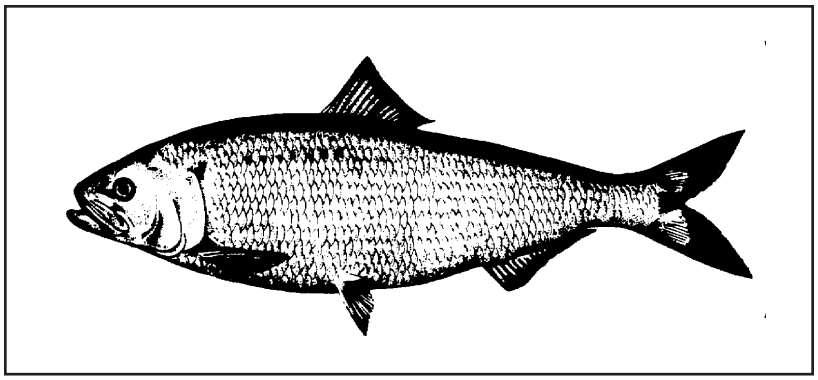
River Herring





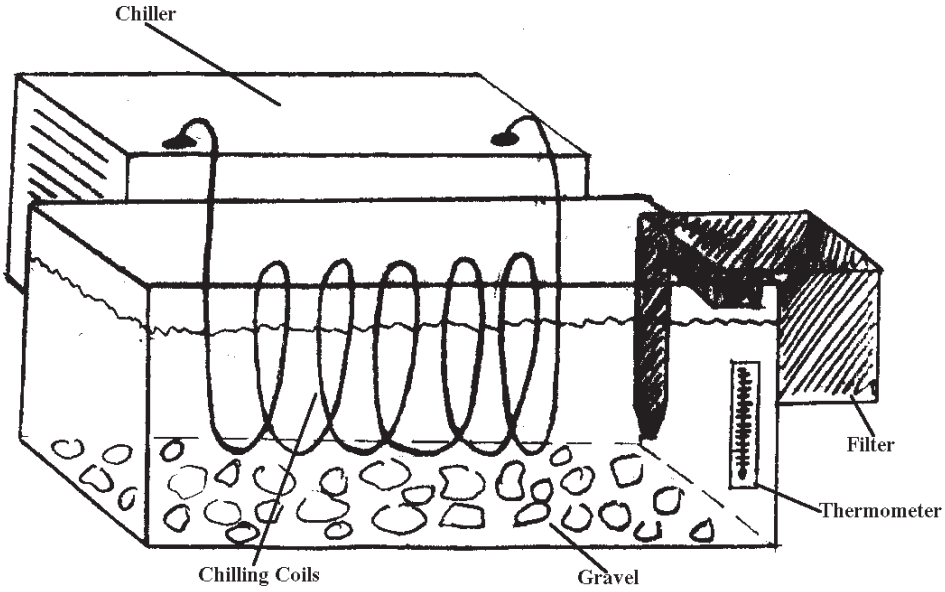
Striped Bass

American Shad



Anatomy of an Incubator:

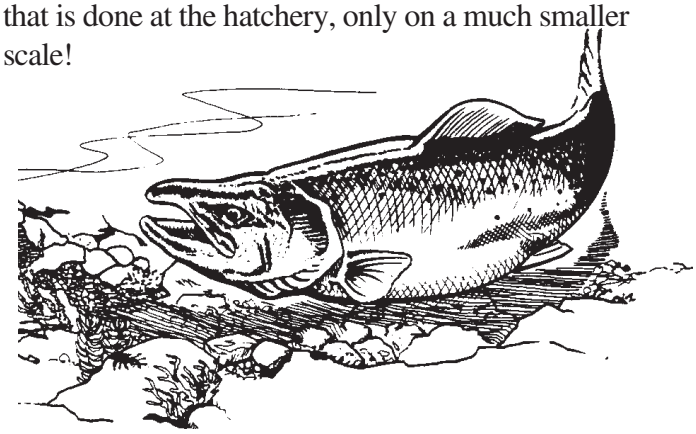
A salmon incubator is really an artificial habitat. In the wild, a female salmon lays her eggs in a clean gravel redd (or nest) on the stream bottom. The cold and swift moving water flows through the gravel, bringing a constant fresh supply of oxygen to the developing eggs. Later, this same current will bring food to the hungry fry.



The classroom incubator consists of an aquarium, chiller, water filter, thermometer, and gravel. It operates in much the same manner as the big hatchery incubators.

Your classroom incubator has many of the same features found in a natural redd. Eggs are placed among the gravel at the bottom of the tank. A chiller keeps the water cold, while a filter cleans and aerates (or dissolves oxygen in) the water. Finally, to simulate the darkness of a natural redd, the tank is wrapped in styrofoam. The foam also acts as an insulator, protecting the eggs in the event of a power failure. Because the correct water temperature is so important to proper incubation, the incubator is equipped with a thermometer so you can make sure the chiller is working correctly.

Unlike a redd in a stream, the incubator does not have a constant supply of fresh water. As a result, changing the water in the tank will become a routine part of incubator care once the eggs have hatched. Also, because your young fish will not be in a stream where there is normally an abundance of food, you will need to feed them. You will be doing everything for your salmon family that is done at the hatchery, only on a much smaller scale!



Looking Into The Future

Stream flow levels and water temperatures determine when salmon fry can be stocked in the spring. Because stocking dates differ slightly every year, a hatchery manager tries to time the hatching of fry so the fish are ready to go when the habitat is ready. Fry kept in a hatchery longer than necessary still have to be fed and that costs money.

Predicting stages of salmon development

Water temperature effects the rate at which salmon eggs develop. The colder the water, the slower the eggs develop. To speed up egg development, simply turn up the thermostat! This is how the rate of salmon egg development in a hatchery is controlled.

At a certain water temperature an egg will develop a certain amount (or percent) within a 24 hour period. By keeping a daily record of incubator water temperatures in your classroom and adding up the daily growth or development you will be able to predict dates for egg hatch and when the alevin (or sac fry) will begin to feed. Don't worry if this sounds complicated. It really isn't. Your teacher will be helping you with all of this.

Directions: Now that you know all about the biology of Atlantic salmon, see if you can draw the different stages of its life cycle. Good luck.

FUN WITH FINS!