

article 1: Salmon Species and Life Cycle

This introductory article provides an overview to salmon species in your watershed and their life cycles (and salmon certainly exhibit a remarkable life cycle). This article provides only a brief introduction to these amazing creatures. Many other websites can provide additional information about salmon.

This article is divided into five sections:


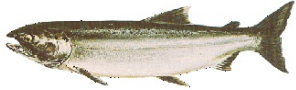


1. What salmon species are found in Anchor River, Deep Creek, Ninilchik River, and Stariski Creek systems?
2. What are the stages of a salmon's life cycle?
3. What goes on during each life stage?
4. What goes into creating the habitats needed by each salmon life stage?
5. Some details about the life stages of particular salmon species (in a summary table).

What salmon species are found in Anchor River, Deep Creek, Ninilchik River, and Stariski Creek systems?

Maybe the first piece of information most landowners want to know is which salmon species use their watershed. Table 1 summarizes that information. Images used to illustrate species are in their “ocean bright” phase. As they travel up freshwater streams towards their spawning grounds, salmon change color and shape. These changes are discussed in Section 3 of this article. Table 1 also provides a general idea of when adult salmon of each species travel upstream to spawn.

In this first section, we talk about when adult salmon return to their natal streams to spawn (the streams where their lives began). But **juvenile** salmon are in the river systems ALL times of year, including mid winter. They're found in many habitats depending on species: main channels, side channels, headwaters, lakes. Being aware of and salmon friendly to these little guys is EVERY BIT AS IMPORTANT as considering adults returning to spawn. A lot of folks forget to be careful of salmon eggs incubating in their gravel redds, or of juvenile salmon—some no bigger than a paper clip. These life stages are very small and much much harder to notice than adult salmon, but there'd be no adults without these juveniles.

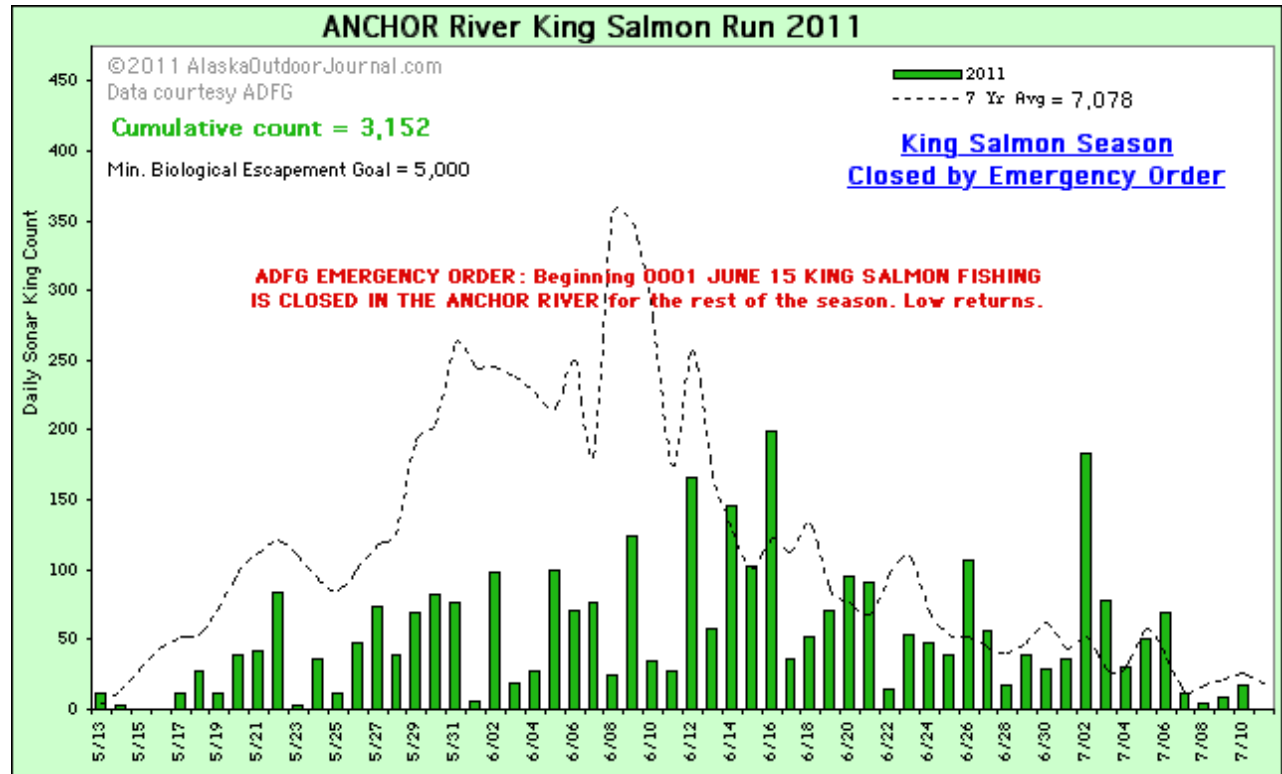
Table 1. Salmon species (and other anadromous fish) in lower Kenai Peninsula watersheds

	Chinook (king)	Coho (silver)	Pink (humpy)	Steelhead trout	Dolly Varden
Anchor River Deep Creek Ninilchik Creek Stariski Creek	 Spawning run late May to mid June	 Spawning run early August to mid-September	 Spawning run begins mid-July and continues into August	Spawning run mid-August to early November (catch and release only)	 early in July and continue throughout summer

Run timing information for salmon and steelhead is from <http://www.anglerinnovations.com/pages/kenairuntiming.pdf>; other timing run information is from http://visitsoldotna.com/fishing/fish_run_table.htm. Images are from <http://cybersalmon.fws.gov/csamfish.htm> (color) and <http://www.adfg.alaska.gov/index.cfm?adfg=educators.notebookseries> (b&w). For more information on which segments of these four stream systems are used by particular species, look at the watershedipedia entry [Anadromous waters catalog](#).

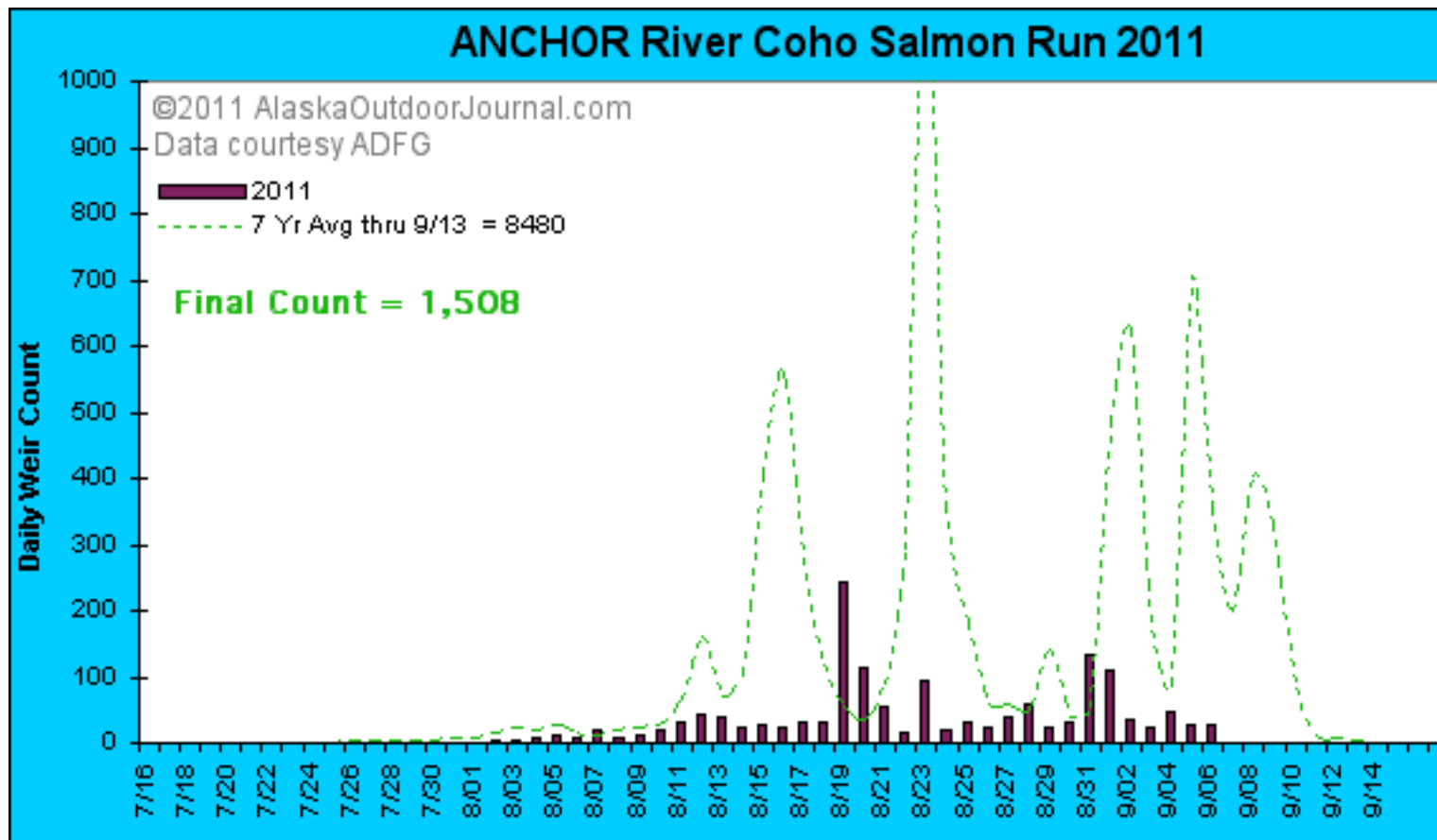
In some cases, more detailed charts of “run timing” for particular species in specific rivers are available. Three examples are included here, one for chinook in Anchor River, one for coho in Anchor River, and one for coho in Deep Creek. The daily count on the left of each graph reflects the number of fish counted; dates are shown along the bottom. Obviously, charts like this can only be developed where someone is counting fish heading upstream—as ADF&G does at their [weir](#) on the Anchor River and did for a few years on Deep Creek.

The chart at right shows the timing of the chinook (king) salmon run up the Anchor River (from www.alaskaoutdoorjournal.com/Sonar/-anchor.html). The chart shows data from 2011 (in green), as well as data averaged from 7 years of counts between May 13 and July 10 (dotted line). You can see that

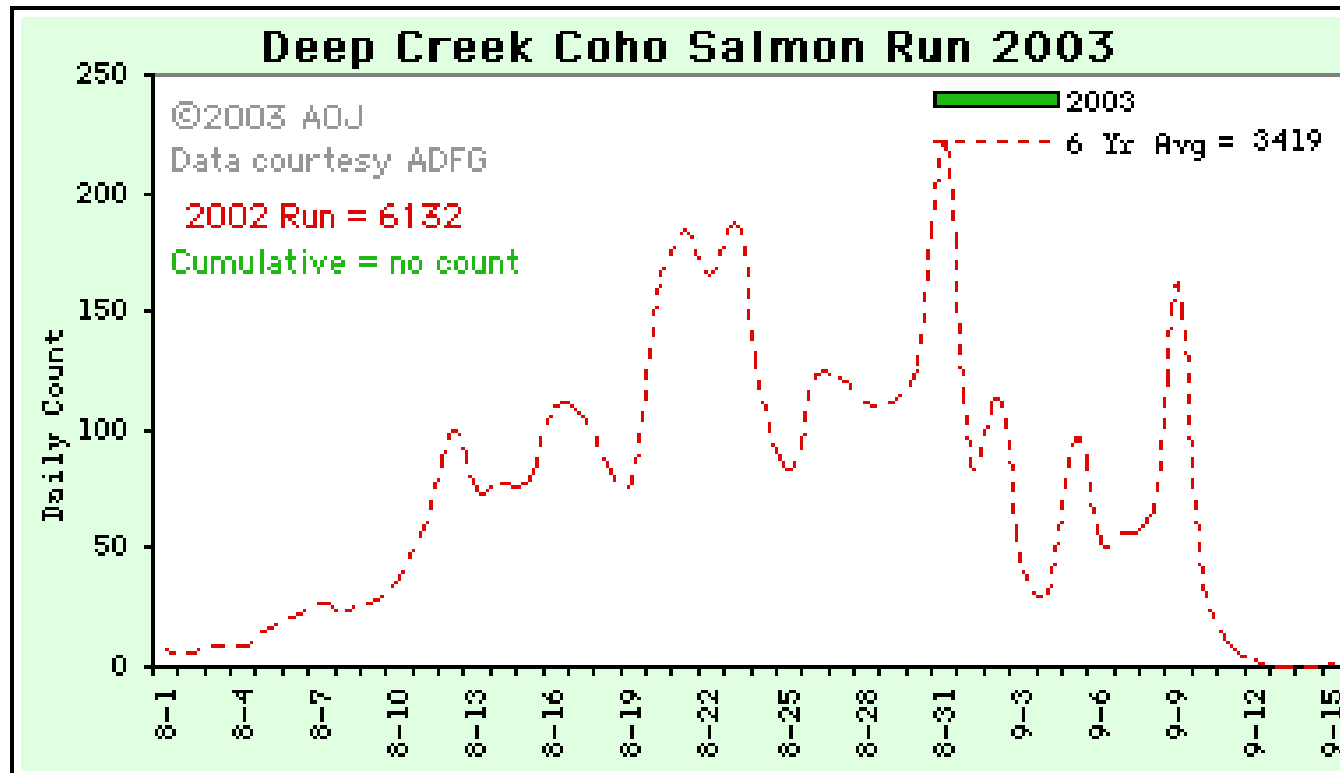


the 2011 run was below the 7-year average and was closed June 15 by emergency order. ADF&G now uses both sonar and a weir every year on the Anchor River to count salmon heading upstream (see watershedipedia entry [Weirs](#)).

The chart at right shows the timing of coho runs up the Anchor River (from <http://www.alaskaoutdoorjournal.com/Sonar/anchorcoho.html>). Salmon numbers shown in the black bar graph are from 2011; the dotted line shows a 7-year average of counts between late July and September 13. Like the 2011 chinook run, the 2011 coho run was below the 7-year average.



The chart below shows coho run timing up Deep Creek (from www.alaskaoutdoorjournal.com/Sonar/deepcreek.html). As noted on the source *Alaska Outdoor Journal* (AOJ) website, “the Deep Creek Coho Salmon Run is no longer counted by ADFG; the chart displays a 6 year average of the run's characteristics when it was counted through the middle of September, when it typically ended.



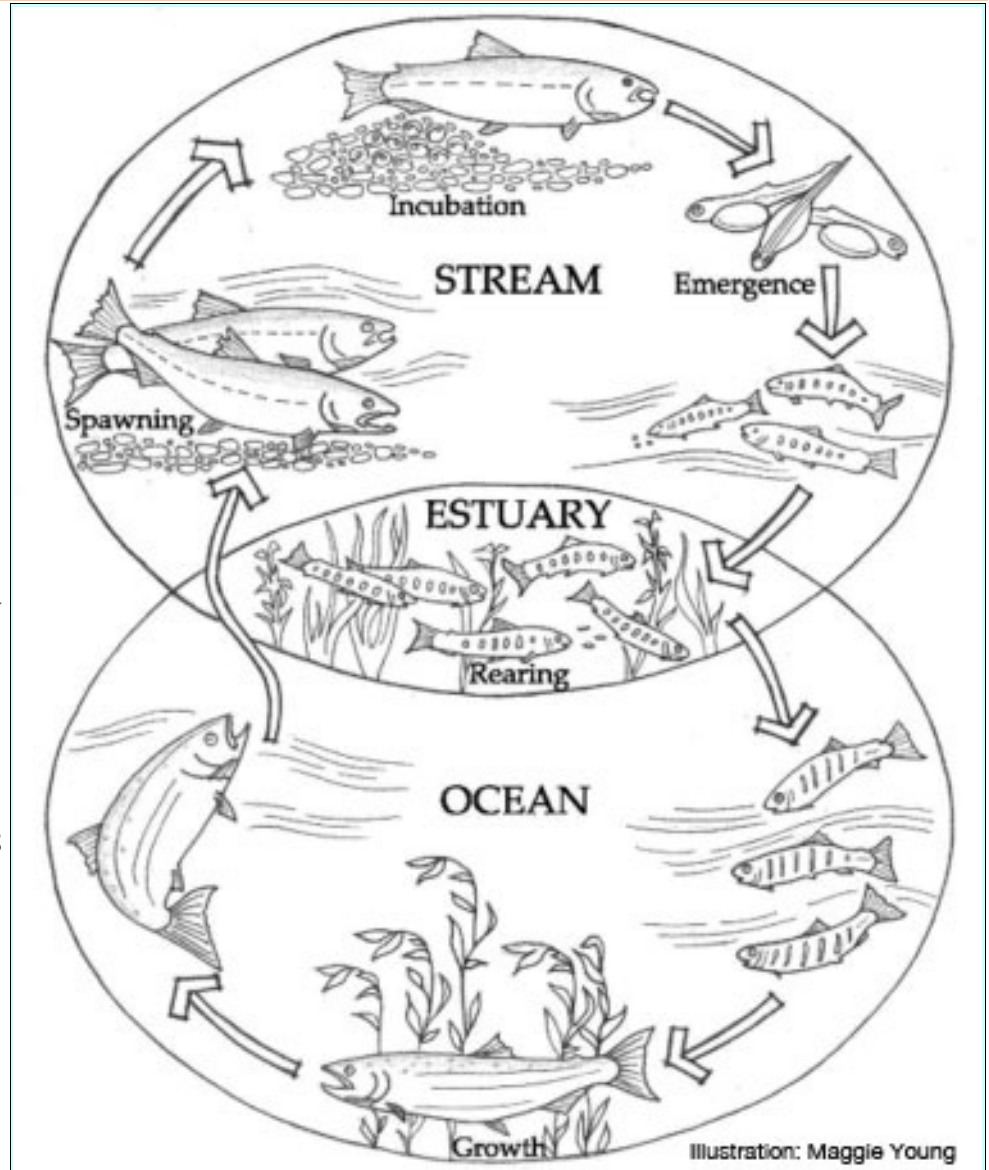
Following salmon friendly land use practices—as described throughout this landowner's guide (particularly in the watershedipedia)—is one way that everyone who lives, works, or plays along Anchor River, Deep Creek, Ninilchik River, and Stariski Creek (and other rivers throughout Alaska) can help maintain healthy salmon populations. Thousands of small, individual, salmon-friendly actions can add up to a big cumulative effect, and we can make that a **good** effect for salmon.

What are the stages of a salmon's life cycle?

Salmon go through a variety of stages during their life cycle. The main stages are: egg, alevin, fry, fingerling, smolt, ocean adult, and spawning adult. The drawing to the right illustrates these life stages, and each stage is described in more detail below. Salmon have established this exotic approach to survival and reproduction over a million years ago, adapting to environments shaped by earthquakes, volcanoes, glaciers advancing and retreating, and changing patterns of streamflow. (See the watershedipedia entry Glacial history of western Kenai Peninsula for more information.)

The life cycle of Alaskan salmon allows them to take advantage of different kinds of habitats for different purposes—oxygen-rich gravel beds, where pea-sized eggs can mature hidden among the stones; slow-moving side channels with undercut banks and overhanging plants, where fry can safely hide and feed; rich, soupy estuaries at the mouths of rivers, where smolts can eat voraciously and undergo physical and behavioral changes to get ready for life at sea; and the wide north Pacific, where adult salmon can grow rapidly in size and strength so as to maximize their chances of making it upriver to lay the greatest number of eggs in the gravel beds where their lives began.

Each salmon species spends different amounts of time in particular habitats. Pink salmon, for example, head towards sea as soon as they emerge from their gravel nurseries and return to spawn about 18 months later. Some coho spend up to 5 years traveling between summer feeding grounds in estuaries and wintering habitats in freshwater lakes before finally migrating out to sea for from 1 to 3 years. Chinook head seaward early in their second year and travel the oceans for 1 to 5 years before heeding the call to turn home to spawn. The table at the end of this article provides a summary of these kinds of details for each salmon species found in your watershed. Steelhead-trout (which are anadromous rainbow trout) and Dolly Varden are also included in that table.



What goes on during each life stage?

This section describes the life stages of salmon in general terms that apply to all species. Many websites provide more information if you want to learn about a particular species in more detail. For example, the Alaska Department of Fish and Game (ADF&G) maintains an excellent Alaska Wildlife Notebook series, and each salmon species (and all other fish in the state) has its own complete write-up (see <http://www.adfg.alaska.gov/index.cfm?adfg=educators.notebookseries>).

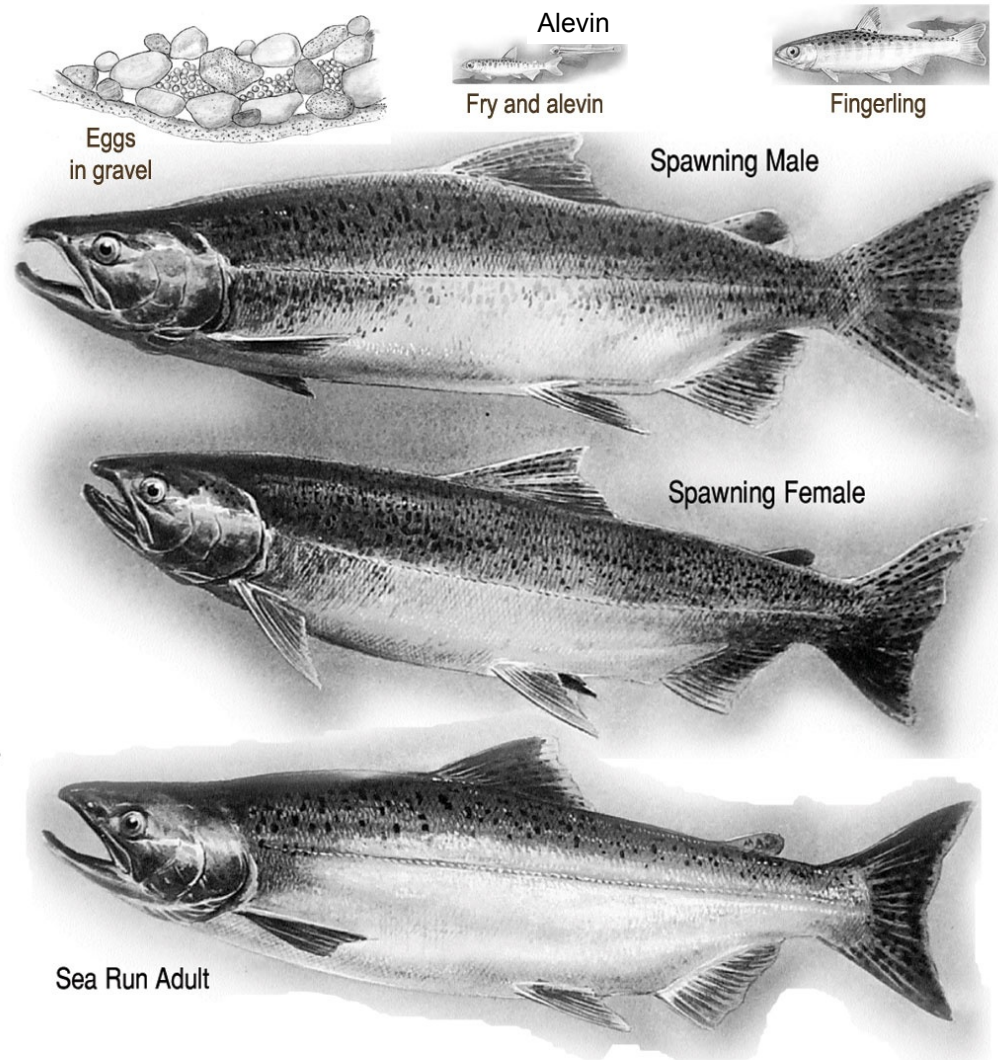
At the end of this article, you'll find a table that provides more detailed information about life stages of anadromous species found in the Anchor River, Deep Creek, Ninilchik River, and Stariski Creek.

How big is each salmon life stage compared to the others?

We've mentioned before that it's easy to forget about the tiny salmon life stages in the excitement over returning adults. But without the little guys, there'd be no big guys. And just surviving to adulthood is a HUGE accomplishment for any juvenile salmon.

Just how little are the littlest salmon? The drawing to the right gives a rough idea of the relative sizes of selected salmon life stages. The drawing shows chinook salmon, but similar size relationships are characteristic of other salmon species, as well as of steelhead (and rainbow) trout. (Adult chinook average roughly 36 inches and 30 lbs.)

Chinook salmon: sizes of life stages in relationship to each other



Modified from drawing by Harry Heine, Dept. of Fisheries and Oceans, Canada; from *Up the Creek, the Salmon Survival Game*, World Fisheries Trust, <http://www.worldfish.org/images-pdfs/Projects/game/guide.pdf>

General description of each life stage of a salmon

(with illustrations from Fisheries and Oceans, Canada)

<http://www.pac.dfo-mpo.gc.ca/education/lessonplans-lecons/sicprimary-secprimaire-eng.htm>)



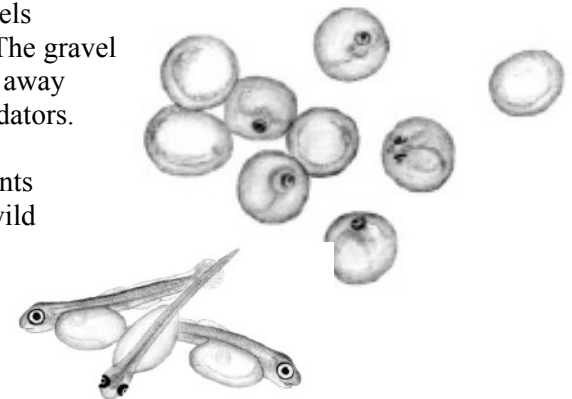
Eggs

Salmon begin their lives as eggs incubating in “redds,” which are shallow depressions in streambed gravels excavated by female salmon using their tails. Eggs develop over winter sheltered in these gravel beds. The gravel nest allows oxygen-rich water to flow freely around the eggs, providing oxygen to the eggs and carrying away wastes. At the same time, the eggs are protected from being washed away by the current or eaten by predators.

Redds are fragile and can easily be destroyed by people or animals crossing shallow rivers, or by sediments washed or pushed into the water, which can smother eggs. Anglers, ATVers, loggers, horseback riders, wild animals, even casual hikers can all accidentally destroy salmon redds by tromping on them.

Alevins

Late in winter or early in spring, tiny alevins emerge from the eggs. The alevin to the right are about life-size. Yolk sacs that fed growing salmon in their eggs during winter still hang from them like tiny pot bellies. Alevin can't yet swim, but they can swish their tails to move around slightly in the gravel.



Alevins remain tucked into the gravel for several weeks to a month or so, until the remaining yolk sac is consumed. While they have a yolk sac, alevins don't need to find food, but once the yolk sac is gone, they need to start searching for their next meal. At that point, they wriggle up out of the gravel. Tiny juveniles without their yolk sac are called fry. Alevin emerging from the gravel before their yolk sac is completely absorbed are sometimes called button-up fry. Many salmon are eaten when they emerge from the gravel.

Fry and fingerlings

After wriggling out of the gravel, fry stay close to the channel bottom where currents are slow enough not to wash them downstream, but they must immediately start searching for food. Carefully, they move through slow-moving currents, generally closest to streambanks. There they feed on plankton until they're large enough to hunt for aquatic insects, worms, small crustaceans, fish eggs, and smaller fish.

Fry generally feed in the shelter of undercut banks or under overhanging vegetation; well-vegetated streambanks with slow adjacent currents are critical to their survival. Plants along the banks also provide shade, which helps keep water temperatures cool throughout spring and summer. Cool, clear water can hold the high levels of oxygen that salmon need. Logs and branches that fall or hang into the water give salmon places to hide, while also providing the insects that growing salmon feed on. The roots of trees and bushes help bind soils, reducing sediment runoff. Because fry feed by sight, water clarity affects their hunting success.

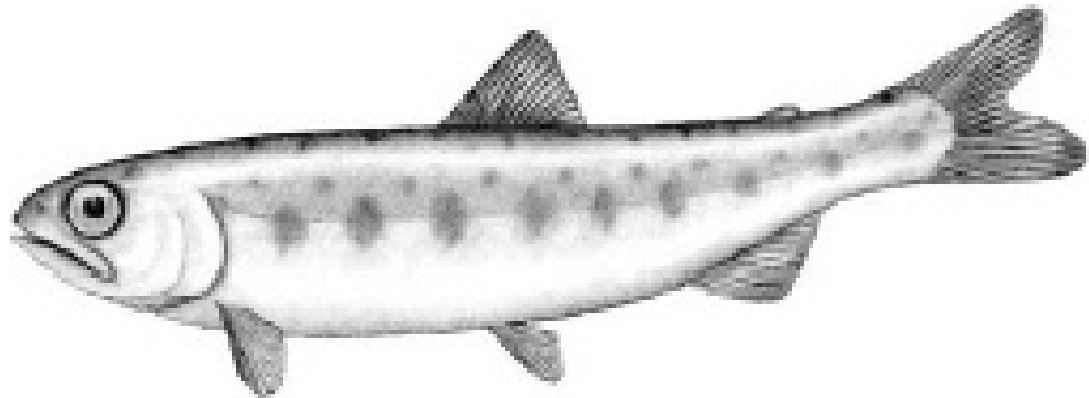
Fry begin to move in schools as they feed in the river. By summer, they have grown to the size of a finger and are now called fingerlings. Except for pink salmon, salmon fry and fingerlings have characteristic vertical stripes running down their sides, called parr marks, which help them blend in with their environments. Parr marks are more distinct on fingerlings, and these fish are also called “parr.” Even with this camouflage, many fry and fingerlings are eaten by predators like fish and birds.



The length of time that salmon stay in the fry stage differs among species. Pink fry begin moving downstream towards saltwater as soon as they emerge; coho spend from 1 to 5 years wintering in freshwater (though they may spend summers feeding in estuaries at the river's mouth). At some point, however, all fingerlings make their way downriver to begin their ocean journey.

Smolts

Juvenile salmon that have begun adapting for life in saltwater are called smolts. The changes caused by “smoltification” affect how salmon look and behave. The parr marks gradually disappear, and salmon gain the dark back and light belly coloration characteristic of salmon in the ocean. Bodies become sleeker and more hydrodynamically adapted for ocean currents. Gills and kidneys change so that they can process saltwater. Once they reach the estuary at the mouth of their parent river, smolts grow rapidly, putting on weight and gaining strength for what will usually be wide-ranging ocean travels.



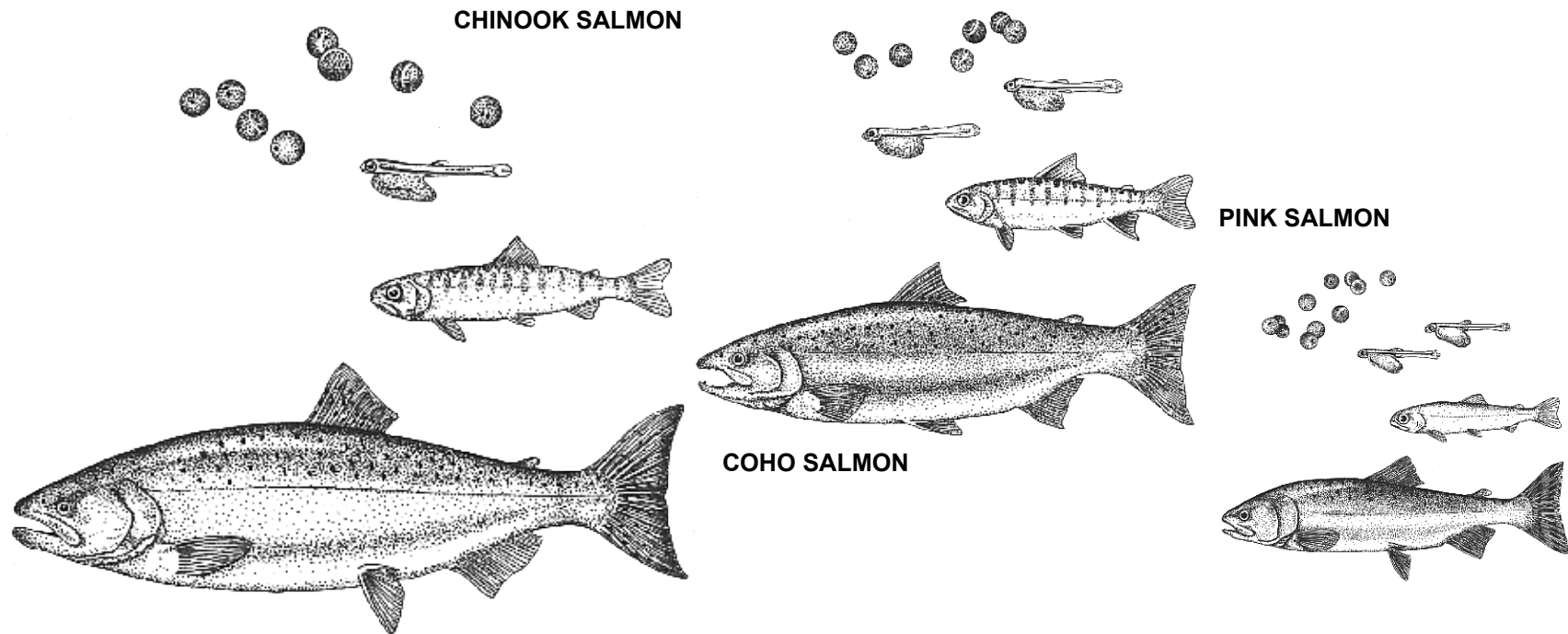
Ocean adults

Depending on the species, salmon grow to full adult size after 1 to 5 years in the ocean. Obviously, the longer the ocean life stage, the larger the salmon. Pinks, which stay at sea for about 18 months, generally reach mature weights of 3 to 4 lbs; chinook, on the other hand, who may feed in the ocean for up to 5 years before returning to spawn as 7-year-olds, can reach weights approaching 100 lbs. In the ocean, all salmon are silver colored and sleek, feeding primarily on fish and crustaceans.

Spawning adults

For each salmon species, the call to return to freshwater to spawn comes at a different age. As mentioned above, pinks spend only 18 months at sea before turning towards the stream in which they hatched, probably guided by chemicals in the water. Chinook head home after up to 5 years in the ocean. Returning salmon congregate at the mouths of their home streams waiting for incoming tides on which to begin their upstream journey.

Salmon need to be in prime condition to reach their spawning grounds because they will not eat again once they head upstream, instead metabolizing their own tissues. Each salmon travels back to the spot where it was born. There the female digs a redd and releases her eggs, while the male fertilizes them as they settle into the gravel nest. The female then covers the eggs with small- to pebble-sized gravel by pulsing her tail to fan the gravel into place, and the salmon life cycle begins again. (Illustrations below from http://www.fishbc.com/adventure/angling/game_fish/index.phtml).



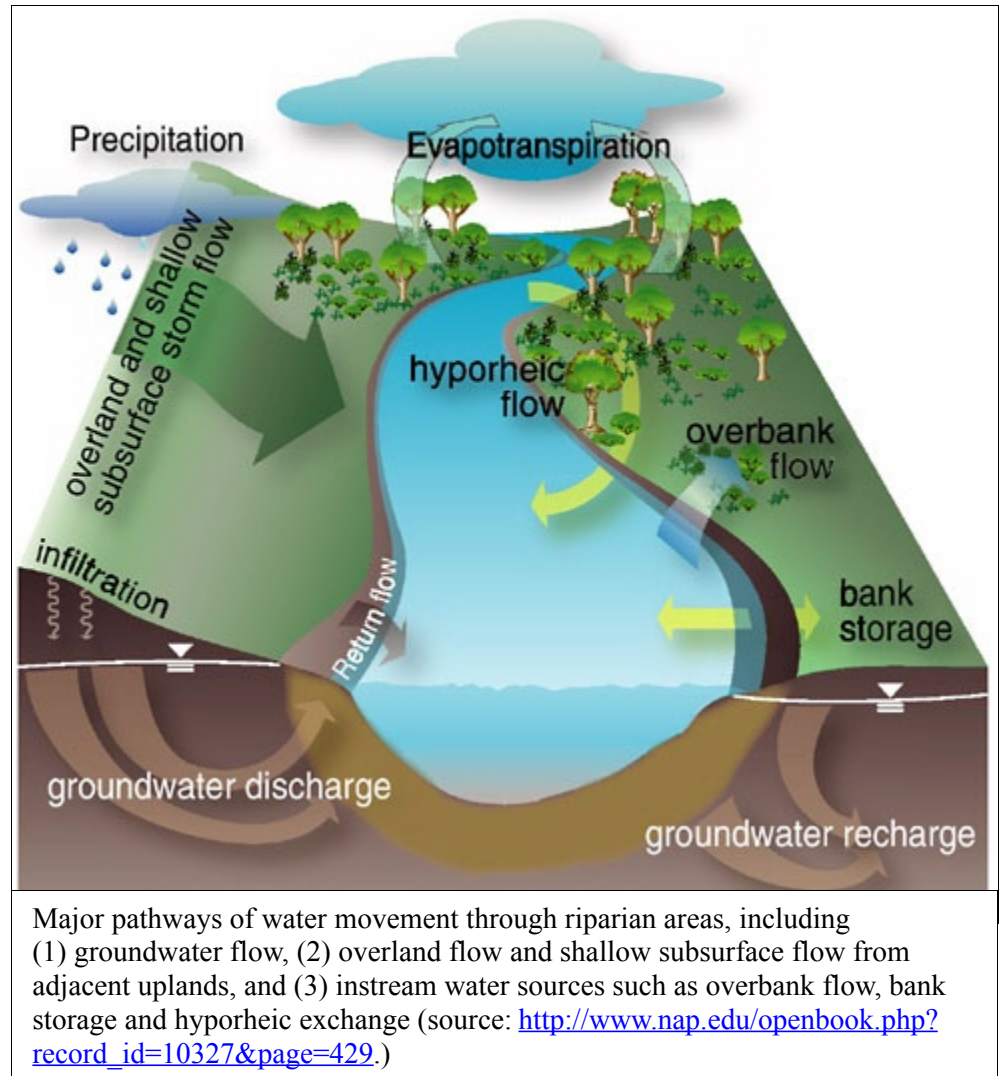
What goes into creating the habitats needed by each salmon life stage?

What does good salmon habitat look like?

That's a great question for landowners to ask, but not an easy one to answer because the answer is: "It all depends." As should be clear by now, what constitutes good salmon habitat depends on which salmon life stage and which salmon species you mean. Still, there are some generalizations that can be made. Basically, the conditions that create good salmon habitats in our watersheds are the conditions found "naturally" in and along our streams and rivers. These include:

- ❖ cool, clean, clear water flowing into streams from many sources (see image at right);
- ❖ dense native riparian plant communities, which help:
 - intercept and filter rainfall,
 - keep soils in place and protect them from erosion,
 - bind and hold together streambanks with their roots,
 - extend limbs and leaves over and into streams so plant parts and insects fall in and contribute to the food web,
 - shade streams with branches and foliage, helping cool water temperatures,
 - grow into large trees that eventually fall or blow over into streams, adding "large woody debris" to the channel, and
 - increase soil infiltration with stems, roots, and leaf litter;
- ❖ different kinds of instream habitats with different:
 - flow velocities and water depths (like "pools and riffles, undercut banks, slow side channels), and
 - streambed materials (including gravel bars good for spawning

On the following pages, we show photos of just some of the different areas that provide good salmon habitats.





Some examples of good salmon habitats in the Anchor River watershed.

Photo upper left: Kachemak Bay Research Reserve (see headwater stream study discussed in introductory article 4),

Photos upper right and lower left: Homer Soil and Water Conservation District



Some examples of good salmon habitats in Ninilchik River watershed.

All photos: Cook Inletkeeper

The “work” of a stream creates instream habitats (and then plants improve these)

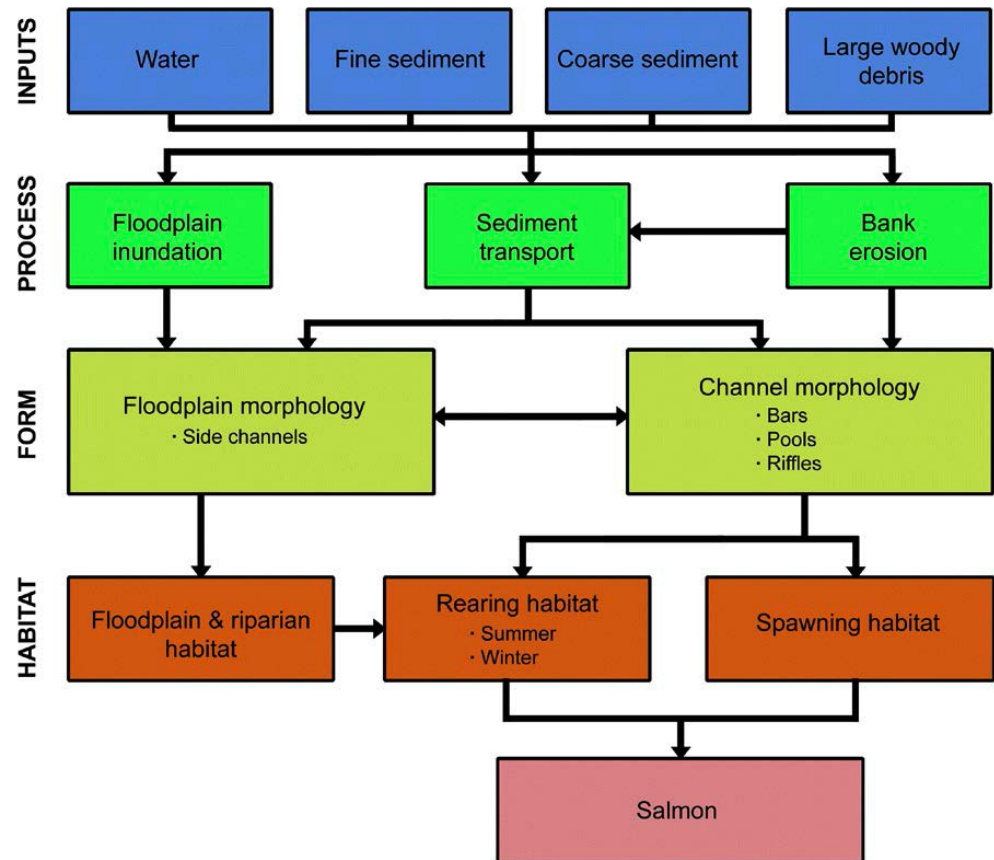
Streams and rivers “work,” and the work they do creates salmon habitats. Streams and rivers do three main kinds of work—how much depends on how much water flows in the stream channel and how fast that water moves (which depends largely on stream channel slope).

- (1) **Streams and rivers move water** (see, for example [stream discharge](#), [hydrographs](#), [stream channel “anatomy,”](#) and [stream channel processes](#) in the [watershedipedia](#));
- (2) **Streams and rivers move stuff**, both inorganic sediments of various sizes (from tiny [clay](#) particles to boulders; see [streamload](#)) and organic stuff of various sizes (from [large woody debris](#) (LWD) to microscopic [detritus](#));
- (3) **Streams and rivers shape their channels**, eroding them, depositing sand and gravel bars, scouring plunge pools, undercutting banks, etc.

The things that streams do create the habitats on which salmon depend, whether tiny alevins, outmigrating smolts, or large, robust adults returning to spawn. The chart at right (from David Montgomery...) shows some of the relationships that determine what kinds of habitats streams will create as they move water, carry organic and inorganic stuff, and shape their channels.

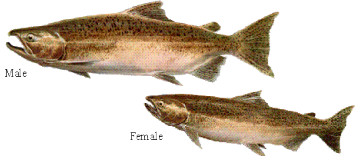



How specific the habitat needs of salmon can be is reflected in this summary from ADF&G:

Juvenile chinook salmon primarily inhabit areas with water velocities between 0.09 and 0.6 ft/sec and rarely use areas with velocities 2.1 ft/sec or greater... [I]n large rivers such as the Kenai River, an estimated 80% of the young chinook salmon are within 6 ft of the bank where water velocities are less than 1 ft/sec. In a habitat selection study, it was found that juvenile chinook salmon utilized habitat with water velocities less than 20 cm/sec, depths of 20-80 cm, and were closely associated with undercut banks... Even a small change to juvenile salmon habitat water velocities and depth may decrease habitat values and salmon survival... Survival of early life stages of salmon is imperative to productive returns of adults.







Some details about the life stages of particular salmon species


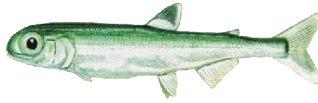


Chinook salmon (all images and much of the information is from <http://cybersalmon.fws.gov/csamfish.htm>)

species	Spawning	Fry to fingerling (rearing)	Smolt	Ocean
<p>Chinook (king)</p> <p><i>Oncorhynchus tshawytscha</i></p> <p>Largest Pacific salmon, often weighing over 30 pounds; largest on record was 126 lbs, taken in fish trap near Petersburg in 1949; largest sport-caught weighed 97 lbs, taken in Kenai River in 1986</p> <p>http://www.adfg.alaska.gov/static/education/wns/chinook_salmon.pdf</p>	 <p>Male</p> <p>Female</p> <p>Chinook reach their spawning areas between July and September. They spawn in streams that are shallow, clear, and cold with a strong upwelling of water through the gravel. Females dig a redd consisting of several pits in which she deposits between 3,000 and 14,000 eggs. Redds are excavated in relatively deep, fast moving water. In Alaska, eggs usually hatch in late winter or early spring, depending on time of spawning and water temperature.</p> <p>Chinook do not feed during freshwater spawning migration, so their condition deteriorates gradually during the spawning run as they use stored body materials for energy and gonad development. In many spawning runs, males outnumber females in all but 6- and 7-year age groups.</p>	 <p>Alevins, live in the gravel for several weeks until they gradually absorb food in the attached yolk sac. In early spring, juveniles wiggle up through the gravel, and are now called fry. While in streams, chinook are found primarily along sides of pools and near cover of overhanging banks. Initially they feed on plankton and later, on insects. As they grow, they increase their distance from cover and occupy greater water depths and velocities, but still seek shelter from strong currents.</p> <p>Juvenile chinook occupy different stream habitats in fall and winter. Fry move out of faster water and congregate at undercut banks where dense vegetation drapes into the water. They tend to hide among large stream cobbles during periods of cold temperatures. This is thought to be a way to avoid predators, reduce physical damage from ice scouring, and prevent downstream displacement.</p>	 <p>In the spring, 1 year after emerging from the gravel, chinook turn to smolts and migrate to the saltwater estuary of their home river system. Smolts remain in the estuary for a short time, adapting to saltwater and preparing for their ocean-going life stage; they then move farther offshore into marine waters.</p>	 <p>In spring, the 1-year-old chinook (now in their second year) disperse from estuaries and head out into the north Pacific and Bering Sea. Alaskan chinook remain at sea from 1 to 7 years. Some remain close inshore throughout their lives, but most undertake extensive migrations. Those that rear in inshore marine waters are available to commercial and sport fisheries all year.</p> <p>In the ocean, chinook eat a variety of organisms, including herring, pilchard, sandlance, squid, and crustaceans. Salmon grow rapidly in the ocean, often doubling their weight during a single summer season. A mature 3-year-old will generally weigh less than 4 lbs, while a mature 7-year-old may exceed 50 lbs. Females tend to be older than males at maturity. Small chinook salmon that mature after spending only one winter in the ocean are commonly called "jacks," and are typically male.</p>





Coho salmon (all images and much information is from <http://cybersalmon.fws.gov/csamfish.htm>)

species	Spawning	Fry to fingerling (rearing)	Smolt	Ocean
<p>Coho (silver)</p> <p><i>Oncorhynchus kisutch</i></p> <p>Coho are extremely adaptable and occur in nearly all accessible freshwater bodies, including lakes and tiny headwater tributaries.</p> <p>Known as spectacular fighters, coho are the most acrobatic of the Pacific salmon.</p> <p>http://www.adfg.alaska.gov/static/education/wns/coho_salmon.pdf</p>	 <p>Coho enter spawning streams from July to November, usually during periods of high runoff. Return timing reflects requirements of specific stocks. For example, in some streams with barrier falls, adults arrive in July when water is low and the falls are passable; in other streams, coho wait until August or September when higher flows from fall rains allow passage into small streams not normally passable at low flows. Run timing is also regulated by water temperature at spawning grounds: where temperatures are low and eggs develop slowly, spawners return early to compensate; where temperatures are warm, adults are late spawners.</p> <p>Adults hold in pools until they ripen, then move onto spawning grounds; spawning generally occurs at night. The female digs a nest, called a redd, and deposits 2,400 to 4,500 eggs. As the eggs are deposited, they are fertilized with sperm, known as milt, from the male.</p>	 <p>Eggs develop during winter and hatch in early spring. Alevins remain in gravel, utilizing their egg yolk, until they emerge in May or June. Emergent fry occupy shallow stream margins, quiet backwaters, and side channels with overhanging vegetation. As they grow, they establish territories that they aggressively defend from other salmonids.</p> <p>Coho live in ponds, lakes, and pools within streams and rivers, usually among submerged, woody debris-in quiet areas free of current, from which they dart out to seize drifting insects. Streams with a complex structure of boulders, logs, and brush in the water can support the most coho salmon fry. As coho fry grow into larger, stronger fingerlings, they move into more open, higher velocity water.</p> <p>Juvenile coho occupy different stream habitats in fall and winter. The fry move out of faster water into side channels and streams with deeper pools and undercut banks where dense vegetation drapes into the water. During fall, they may travel miles before locating off-channel habitat where they can pass the winter free of floods.</p>	 <p>Alaskan coho spend one to three winters in streams, and may spend up to five winters in lakes, before migrating to sea as smolts. Some fish leave freshwater in spring and rear in brackish estuarine ponds through summer, migrating back into freshwater in fall.</p> <p>Coho salmon smolts usually begin to form small schools and migrate to the ocean in mid to late May. They remain in nearshore areas near the mouth of their home streams for several months before migrating further out to sea.</p>	 <p>Some fish migrate only a short distance into good feeding areas and stay there; others travel extensively. Most Alaskan coho travel a counter clockwise path, following the currents in the north Pacific Ocean. As ocean temperatures increase in summer, the fish move north throughout the north Pacific and into the Bering Sea. Most of these fish winter well south of the Gulf of Alaska. They later disperse towards shore and migrate along the shoreline until they reach their streams of origin.</p> <p>Time spent at sea varies. Some males (called jacks) mature and return after only 6 months, at a length of about 12 inches. Most coho stay at sea 18 months to 3 years before returning as full size adults. Adults weigh 8 to 12 lbs and are 24 to 30 inches long, but individuals weighing over 30 lbs have been landed. The record sport caught coho weighed 26 lbs.</p>

Pink salmon (all images and much information is from <http://cybersalmon.fws.gov/csamfish.htm>)


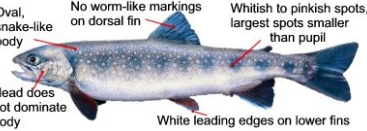

species	Spawning	Fry to fingerling (rearing)	Smolt	Ocean
<p>Pink (humpy)</p> <p>Oncorhynchus gorbuscha</p> <p>Pinks are called the "bread and butter" fish in many Alaskan coastal fishing communities because of their importance to commercial fisheries and local economies.</p> <p>One of the easiest salmon to catch on rod and reel, pink salmon are often the first salmon species caught by children or other beginning anglers.</p> <p>http://www.adfg.alaska.gov/static/education/wns/pink_salmon.pdf</p>	 <p>Pinks enter Alaskan spawning streams between late June and mid-October. Various runs (or races) of pinks have a range of spawning times; different races may share the same river or spawn in adjacent rivers. Most pinks spawn within a few miles of the coast, and spawning within an intertidal zone or mouth of a river is very common. By the time males enter spawning streams, they have developed the hump and hooked jaws characteristic of spawning pink males.</p> <p>Favored spawning areas are shallow riffles where flowing water breaks over coarse gravel or cobble-sized rock, as well as downstream ends of pools. The female pink carries 1,500 to 2,000 eggs depending on her size. She digs a nest, or redd, with her tail and releases eggs into the nest. Eggs are immediately fertilized by one or more males and then covered by further digging action of the female. The process is commonly repeated several times until all eggs are released. Pinks usually die within 2 weeks of spawning.</p>	 <p>Eggs hatch early to mid-winter; alevins feed on the attached yolk sac material and continue to grow and develop. In late winter or spring, the fry swim up out of the gravel and immediately begin to migrate downstream towards saltwater. Pinks that hatch in coastal streams might reach the estuary in a single day. Fish from farther inland hide in stream gravels during the day and travel downstream at night. Emergence and outmigration of fry is heaviest during hours of darkness and usually lasts for several weeks before all the fry have emerged. Predation is heavy on the very small, newly emerged fry, but growth is rapid.</p>	 <p>Following entry into salt water, pink salmon smolts remain in estuaries and tidal creeks for several months, feeding on plankton, larval tunicates, and occasional insects. Young pinks move along the beaches in dense schools near the surface, gradually moving into deeper, saltier water but remaining near shore..</p> <p>By fall, juvenile pinks are 4 to 6 inches long and are moving out into ocean feeding grounds in the Gulf of Alaska and around the Aleutian Islands.</p>	 <p>Pink salmon spend 18 months in saltwater. Alaskan pinks can be found in most of the northeast Pacific, ranging from the Bering Sea, out the Aleutian chain, and as far south as the California coast. High seas tag-and-recapture studies show that pinks originating from specific coastal areas have characteristic distributions at sea, which are overlapping, nonrandom, and nearly identical from year to year. The range of Alaska pink salmon overlaps ranges of pink salmon from Asia, British Columbia, and Washington.</p> <p>Pink salmon mature at 2 years old, reaching an average weight of about 3.5 to 4 lbs and an average length of 20-25 inches. The record sport caught pink weighed 12 lbs 9 oz. Odd-year and even-year populations are essentially unrelated. Frequently in a particular stream the odd-year or even-year cycle will predominate, although in some streams both odd- and even-year pinks are about equally abundant. Occasionally cycle dominance will shift, and the previously weak cycle will become most abundant.</p>

Steelhead-trout (images from sources identified)

species	Spawning	Fry to fingerling (rearing)	Smolt	Ocean
<p>Steelhead trout</p> <p>Oncorhynchus mykiss</p> <p>A steelhead is a rainbow trout that has spent part of its life at sea. There are no major physical differences between the two, however, their differing lifestyles have resulted in subtle differences in color, shape, and appearance; generally speaking, steelhead are more slender and streamlined than resident rainbow.</p> <p>http://www.adfg.alaska.gov/static/education/wns/steelhead_trout.pdf</p> <p>Steelhead fishing on the Anchor River is catch-and-release only. These stocks are limited and easily overexploited.</p>	 <p>(image: http://www.troutfishingalaska.net/-/steelhead/pic/alaskasteelhead.jpg)</p> <p>“Fall” run steelhead are much more common than “spring” or “summer” run fish. Fall run steelhead enter freshwater systems as adults in August, September, October, and on into the winter. The Anchor River supports good runs of fall run steelhead.</p> <p>Adult steelhead like fast, deep, running water. Once they enter fresh water, the silvery sheen gradually fades, and steelhead become difficult to differentiate from resident rainbow trout. The distinct and beautiful coloration during the spawning period is apparently important to mating and reproduction. Spawning begins about mid-April and usually occurs throughout May and early June. A male may spawn with several females, and more males than females die during the spawning period.</p> <p>Unlike salmon, steelhead commonly spawn more than once, and fish over 28 inches are almost always repeat spawners. The ragged and spent spawners move slowly downstream to the sea, and the spawning, rainbow colors of spring return to a bright silvery</p>	 <p>(image: http://www.blevinsphoto.com/blog/-/archives/26)</p> <p>Steelhead eggs are deposited deep in the gravel during the spring and quickly develop into alevins or “sac-fry.” These tiny fish gradually absorb the yolk sac and work their way to the surface. By mid summer fry emerge from the gravel, minus the yolk sac, and seek refuge along stream margins and in protected areas. Tremendous numbers of eggs and fry are killed or washed from the stream each year, but by fall 2- to 3-inch steelhead populate habitat that, hopefully, will carry them through the first winter. Generally, juvenile steelhead will remain in their parent streams for about 3 years before outmigrating to salt water.</p>	 <p>(image: http://www.slocity.org/naturalresources/-/images/steelhead-smolt-for-web.jpg)</p> <p>In the spring 6-inch steelhead smolt leave their parent streams to begin their ocean journeys. Juvenile steelhead are identical to rainbows until the period prior to their ocean migrations, when like other salmon, they become more sleek and silvery.</p>	 <p>(image: http://www.blackwaterfishreplicas.com/-/site/gallery.html)</p> <p>Within 1, 2, or sometimes 3 years from outmigrating, Alaska steelhead will have moved hundreds of miles from their parent streams. We have little information about the ocean migration of Alaska steelhead; however, large numbers are intercepted in high seas fisheries, and undoubtedly many of these fish are of Alaskan origin. Steelhead migrate to areas west of the Aleutian Islands and are routinely caught in net fisheries off the coast of Japan.</p> <p>Steelhead from the ocean are much more silver than resident rainbow. On steelhead the typical colors and spots of the trout appear to come from beneath a dominant silvery sheen. The silvery sheen and streamlined shape of ocean-bright steelhead is essential to their survival in the ocean environment.</p>

<p>An interesting website with a lot of information about steelhead, by an obviously passionate Oregon angler, is: http://gormanflyfishing.com/the_steelhead_life_cycle.htm.</p>	<p>hue. Lost fats are restored and adults again visit the feeding regions of their first ocean migration. On rare occasions a fish will return to the stream within a few months, but most repeat spawners spend at least one winter in the sea between spawning migrations.</p> <p>If all steelhead left their streams at the same age, returned after the same length of time at sea, and died after spawning, the adults in a given stream would be of similar age. They don't. Perhaps nature has conspired to make steelhead life history complicated so that a harsh flood, winter, or drought does not destroy all of a given population.</p>			
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Dolly Varden (images from sources identified)

species	Spawning	Fry to fingerling (rearing)	Smolt	Ocean
<p>Dolly Varden</p> <p><i>Salvelinus malma</i></p> <p>Dollies belong to a group of trout-like fish called char (<i>Salvelinus</i> sp). The primary visual distinction between char and trout and salmon are that char have light spots on their dark body sides while trout and salmon usually have black spots on their light colored sides.</p>	 <p>(image: http://www.alaskafishingrecipe.com/images/stories/species/dollyvarden.jpg)</p> <p>Dollies usually spawn in small headwater streams between September and November. They find their natal stream without randomly searching (though random searching appears to be how they find their first overwintering area—see Overwintering). The female, depending on her size, may lay from 600 to 6,000 eggs (2,500 to</p>	 <p>(image: http://www.alaskan-adventures.com/-/alaska-dolly-var-den.htm)</p> <p>Eggs develop slowly and hatch in March, 4 to 5 months after fertilization. After hatching, young Dolly Varden absorb the food from their yolk sac and generally do not emerge from the gravel until this food is used up. Emergence from gravel usually occurs in April or May for the southern form and in June for the northern form.</p> <p>Young Dolly Varden rear in streams for 2 to 4 years before beginning their first migration</p>	<p>Prior to their seaward migration Dolly Varden (like salmon) go through a series of physical changes, called smoltification, which allows them to survive in saltwater, and during this process the fish lose their parr marks and become silvery in color. Dolly smolts are about 5 inches long. Seaward migration usually occurs in May or June, although significant but smaller numbers have been recorded migrating to sea in September and October.</p> <p>Most southern forms of Dolly Varden reach maturity at age 5 or 6. At this age they may be 12-16 inches long and weigh from 1/2 to 1 lb. Northern Dolly Varden reach maturity at age 5 to 9 after having spent 3 or 4</p>	 <p>(image: http://www.gotmyfishon.com/files/-images/fish/dolly-var-den.png?0)</p> <p>Some forms or subspecies of Dolly Varden are anadromous, but others are not and remain in fresh water their entire lives. The northern form is primarily anadromous, occupying both sides of the Alaska Peninsula and north and eastward around the Alaska coast to the Canadian border, as well as in the Susitna River Basin in Southcentral Alaska. The southern form is</p>

<p>http://www.adfg.alaska.gov/static/education/wns/dolly_var-den.pdf</p> <p>Wikipedia has a charming account of how this fish came to be named after a character in Charles Dickens' 1841 novel, <i>Barnaby Rudge</i> (http://en.wikipedia.org/wiki/Dolly_Varden_trout)</p>	<p>10,000 in the northern form) in nests, or redds, which she constructs in streambed gravel by digging with her tail fin. The male usually takes no part in nest building and spends most of his time defending the redd by chasing, biting, or threatening intruders. When the female is ready to deposit her eggs, the male moves to her side and spawning begins. Sperm and eggs are released simultaneously into the redd. After spawning the female forces exposed eggs into crevices by undulating her body and tail before covering the eggs with gravel.</p> <p>Mortality after spawning varies depending on sex and age. Males suffer much higher mortality after spawning, partly due to damage inflicted in fights. Dollies of the southern form that survive the rigors of spawning return to a lake to spend the winter, while northern form fish usually overwinter in the river system in which they spawned. Probably no more than 50% of Dollies live to spawn a second time, but a few may spawn more than twice.</p> <p>Few southern Dolly Varden appear to live longer than 8 years, while northern Dollies may live as long as 16 years, though fish over age 10 are uncommon..</p>	<p>to sea, but some may rear as long as 6 years. During rearing, their growth is slow, which may be attributed to their somewhat inactive habits. Young Dollies often remain on the bottom, hidden from view under stones and logs, or in undercut areas along streambanks, and appear to select most of their food from the stream bottom.</p> <p>Annual overwintering During fall, the southern form migrate into lakes, where they spend the winter, most northern Dollies migrate into rivers to overwinter. Fish hatched and reared in a lake system typically perform annual spring migrations to saltwater seeking food before returning to a lake or river each fall to overwinter. However, southern Dolly Varden originating in non-lake systems must seek a lake in which to winter, and research suggests that they find lakes by random searching, migrating from one stream system to another until they find one with a lake. Once a lake is found, these fish typically conduct annual seaward migrations in the spring, sometimes entering other freshwater systems in their search for food.</p>	<p>summers at sea, and may be 16 to 24 inches long. Maximum size for southern Dolly Varden is between 15 and 22 inches and up to 4 lbs, but an occasional 9- to 12-lb fish has been reported, especially in northern populations.</p>	<p>found from the Aleutians to the southern tip of Southeast Alaska including Kodiak Island, and on the south side of the Alaska Peninsula. The southern form primarily resides in perennial mainland and island streams, and exhibits a variety of life history forms including, stream resident, lacustrine (lake dwelling) and anadromous.</p> <p>After Dollies of the anadromous form migrate to sea, they usually spend the rest of their lives migrating to and from fresh water in an interesting and often complicated pattern of migration.</p> <p>Dolly Varden are known to follow salmon during upstream spawning migrations, where there are lots of nutritious salmon eggs for the Dolly Varden to feed on</p>
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