

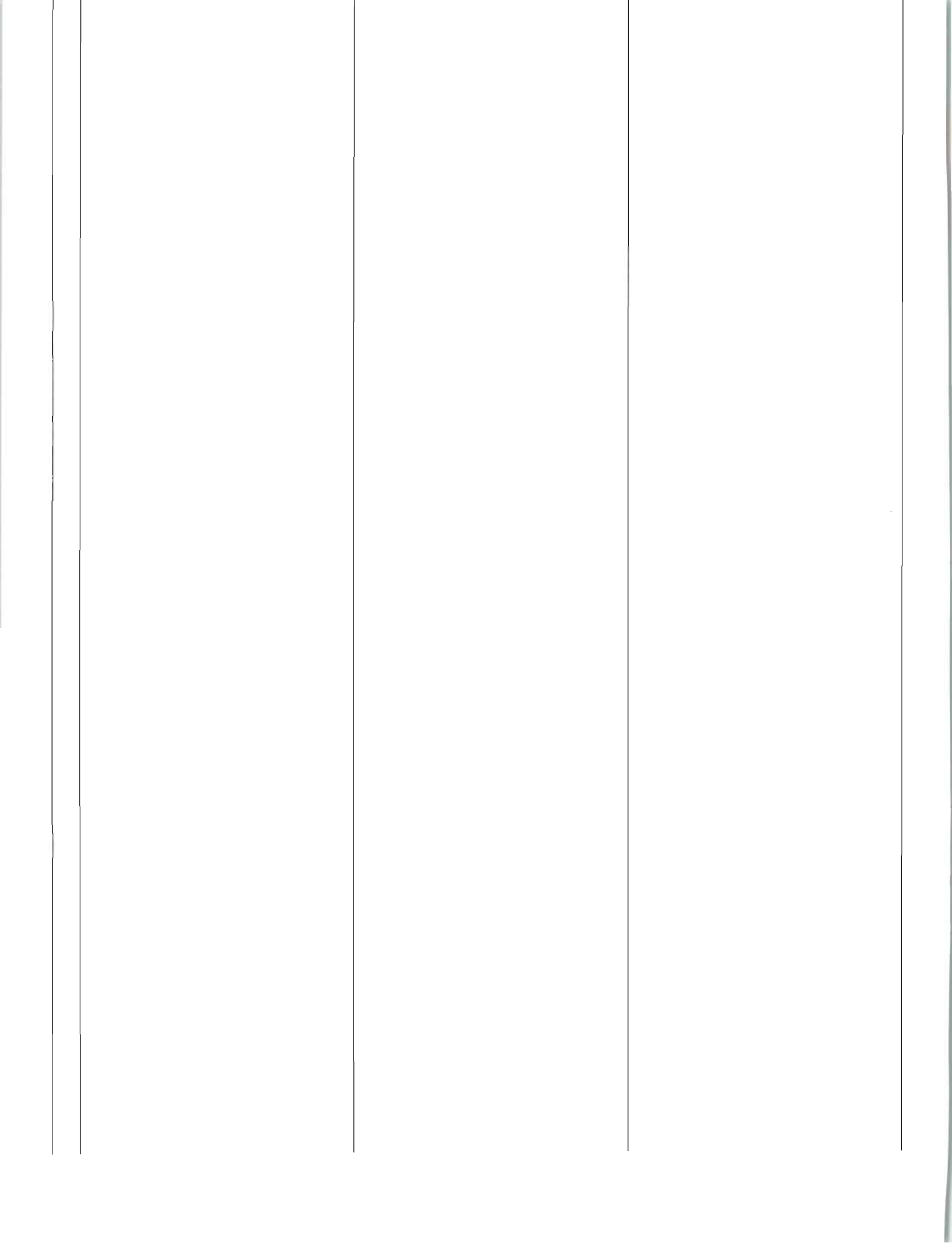
THE INCREDIBLE SALMONIDS



Fisheries
and Oceans

Pêches
et Océans





THE INCREDIBLE

Salmonids

DISTRIBUTION & MIGRATION

Pacific salmonids (six species of salmon, two of sea-run trout) are *anadromous* fish, spawning in fresh water, but spending part of their adult lives in the ocean.

In the ocean, they may range from the shores of Asia to the coast of North America, south as far as California and north into the Arctic Ocean.

Depending upon species, they spend from one to seven years in the Pacific before returning to freshwater streams to spawn. These spawning grounds can be found from San Francisco Bay, northward along the coast to the Arctic and southward down the Asian coast to the Japanese island of Honshu.

Most salmonids spawn in the autumn. Some travel hundreds of kilometres up raging rivers to reach the spawning grounds. There, the females dig nests, called redds, in the gravel and lay their eggs. As they do, the male partner releases milt which fertilizes the eggs. A few sea-run trout return to the ocean and may spawn again, but all Pacific salmon spawn only once, then die.

The eggs stay in the gravel until spring, when they hatch. The young, called alevins, remain in the gravel at first, living on nutrients in a yolk sac. After the sac has been absorbed, the young, now fry, must swim up into the water and hunt for food.

Some species (pink and most chum) migrate to sea at once. Others stay in fresh water for three years or more. All spend a period of time in river estuaries while they adapt to salt water. The estuaries are very rich in food and the young salmonids grow quickly during this time. Once they move out into the open ocean some travel thousands of kilometres before they return to spawn.

The length of time at sea varies by species and also within a given species. In general, pink, some coho and most masu (a Japanese salmon) spend one to one-and-one-half years in the ocean. Ocean periods of two, three, or four years are most common for other species. Thus the total life

span may vary from two years (for pink) to eight years (for some sockeye and chinook).

Each salmon returns to its own stream of origin to spawn. The groups of a given species which home on certain streams are known as "stocks." There are substantial differences between one stock and another. Each has a specific genetic make-up, and is thus adapted to its own waterway. Eggs from southern sockeye stocks, for example, do not incubate successfully in colder northern streams.

Man-made or natural disasters which wipe out a particular stock are devastating, since it takes tens of thousands of years for evolution to create the proper genetic program for a stock.

SPECIES

There are six species of Pacific salmon and two of sea-run trout. Five of the salmon reproduce in both North American and Asian waters; one, the masu, originates only in Asia. The scientific and common names of the salmon are:

Oncorhynchus keta
(Walbaum):

chum, dog, keta;

Oncorhynchus nerka
(Walbaum):

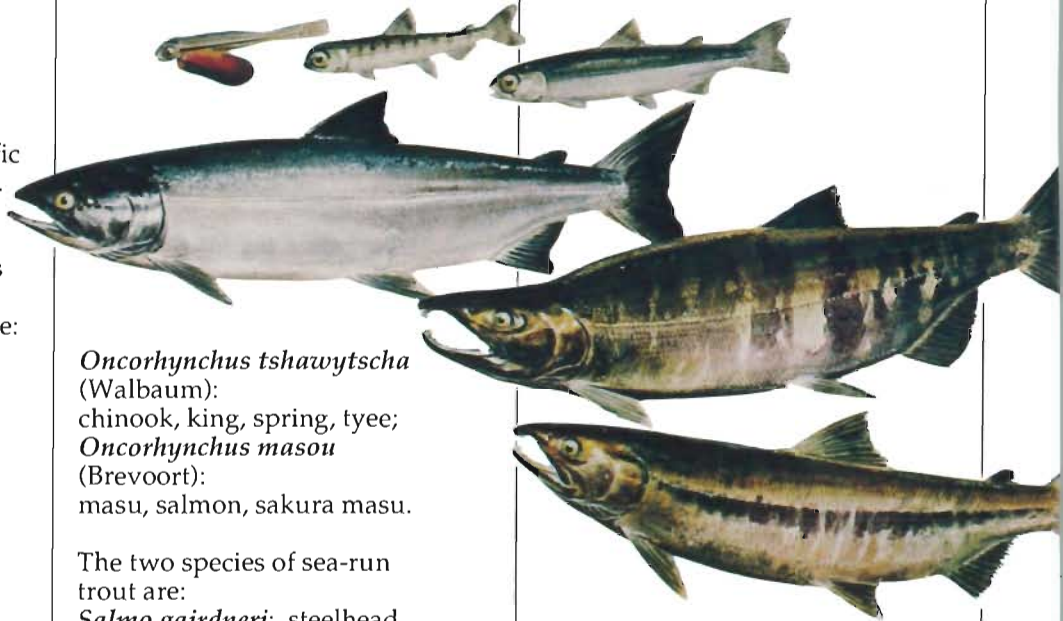
sockeye, red;

Oncorhynchus gorbuscha
(Walbaum):

pink, humpback;

Oncorhynchus kisutch
(Walbaum):

coho, silver;



Oncorhynchus tshawytscha
(Walbaum):

chinook, king, spring, tyeed;

Oncorhynchus masou
(Brevoort):

masu, salmon, sakura masu.

The two species of sea-run trout are:

Salmo gairdneri: steelhead

Salmo clarki: cutthroat.

Columbia coast in early November indicates that at least some remain in coastal waters until late in the season. By their second summer in salt water chum are found throughout the Gulf of Alaska, North Pacific, and Bering Sea.

Little is known about the following winter and early spring distribution. Tagging studies indicate that Asian fish travel as far east as 174°W in the Bering Sea, and to 156°W in the North Pacific.

Chum originating in North America have been found as far west as 176°W in the North Pacific.

Most chum spend two to three

summers at sea before returning to their streams of origin to spawn. In May and June of their final year at sea, maturing chum are found throughout the eastern and western Pacific north of 42°N, and in the Bering and Okhotsk seas. Tagging indicates that maturing Asian fish extend eastward to 168°W in the Bering Sea and to 140°W in the North Pacific.

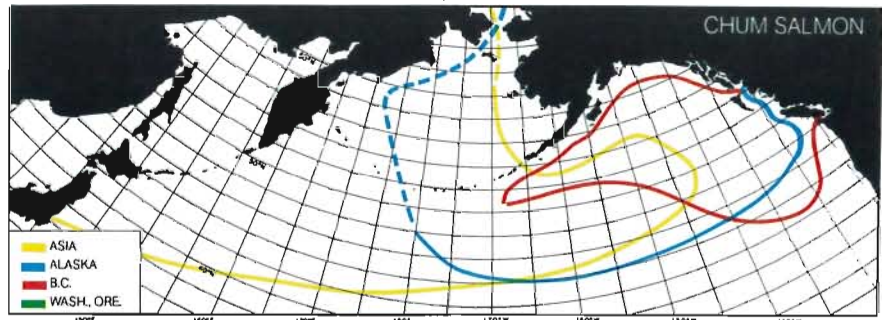
Chum originating in British Columbia occupy a wide area of the Gulf of Alaska, mingling extensively with northern Gulf stocks and, to a lesser degree, with fish from western Alaska and the Yukon.

CHUM SALMON

Chum salmon (*Oncorhynchus keta*) reproduce along the North American west coast from Oregon to the Mackenzie River with the major spawning grounds lying between Puget Sound and Kotzebue, Alaska. On the Asian side of the Pacific, chum salmon range from Japan and Korea to the Lena River in the Arctic area. The major chum spawning areas extend from the Amur River to streams of the Olyutor district in Siberia and on Sakhalin Island and Hokkaido.

In British Columbia, chum spawn in more than 880 moderate-sized streams. In short coastal streams, chum fry emerge from the gravel in the spring and move directly to sea. This migration is accomplished in a day or two. In larger river systems, the young may remain for long periods - up to several months - in fresh-water before reaching the ocean.

Many of the young chum salmon remain in coastal waters until mid or late summer before dispersing to more offshore regions. The discovery of young chum within 9 km of the British



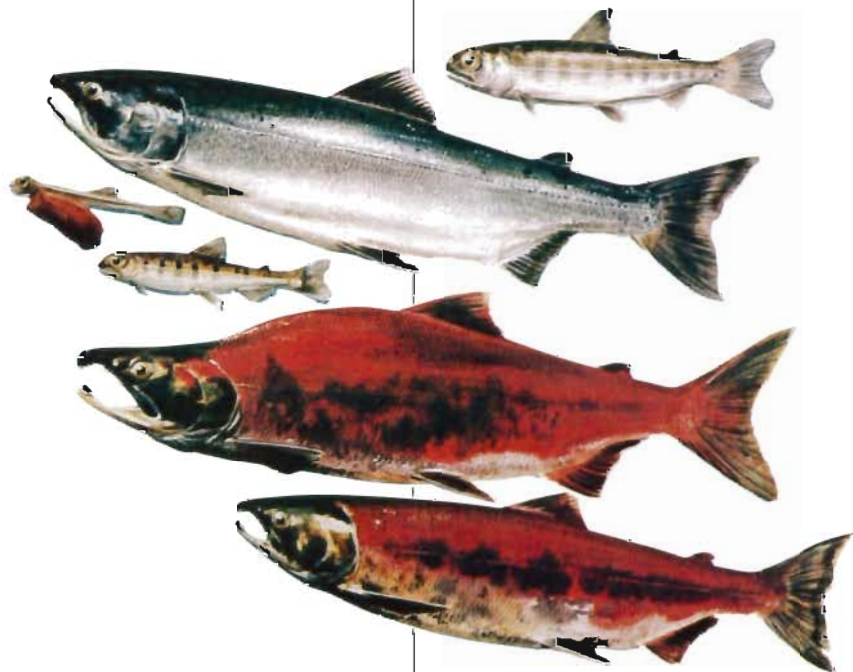
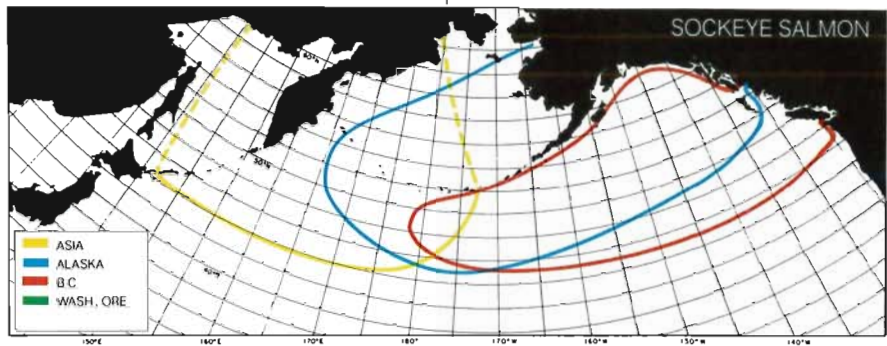
SOCKEYE SALMON

Sockeye salmon (*Oncorhynchus nerka*) of North America originate in freshwater habitats from the Columbia River in the south to the Bering Sea coast of Alaska. The main spawning area extends from the Fraser River to the rivers draining into Bristol Bay. Asian stocks of sockeye begin in waters of the Kuril Islands and extend north to the Bering Sea coast of Siberia. The major spawning grounds are on Kamchatka Peninsula.

Most sockeye in British Columbia spawn in the late summer or fall at outlets to lakes, or in streams that drain into lakes. Major spawning runs of sockeye are found in the watersheds drained by the Fraser, Skeena, and Nass rivers, and those of Rivers and Smith inlets. The young spend their first year of life in nearby lakes before migrating to the sea as smolts. They return to the spawning grounds as three- (jacks), four- or five-year-old fish after one, two, or three winters at sea, respectively.

Young sockeye may remain in their freshwater nursery lake longer, waiting for the second or even third year to make the seaward journey. Little is known of their early ocean travels, but once in salt water British Columbia sockeye juveniles seem to move northward and northwestward along the coast. Their maturing years find them feeding in a huge area of the Pacific extending westward to the Aleutian Islands, northward into northern Gulf of Alaska, and southward to about 40°N.

Fraser River sockeye tend to be distributed more to the south and west than the more northern British Columbia stocks. Sockeye returning to spawn enter their rivers of origin from May to October, with southern stocks tending to arrive later than those in the north.



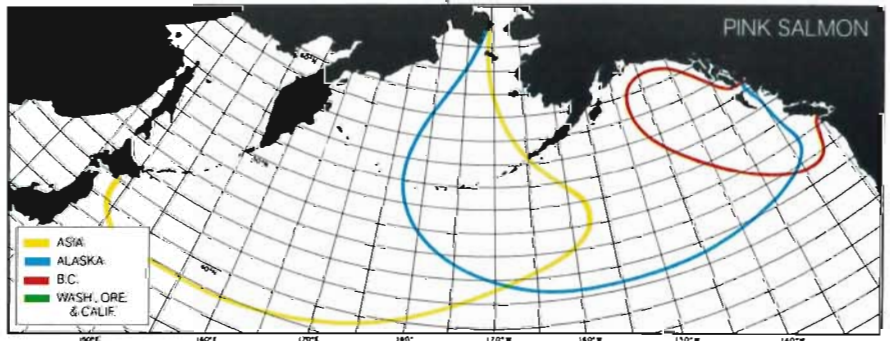
PINK SALMON

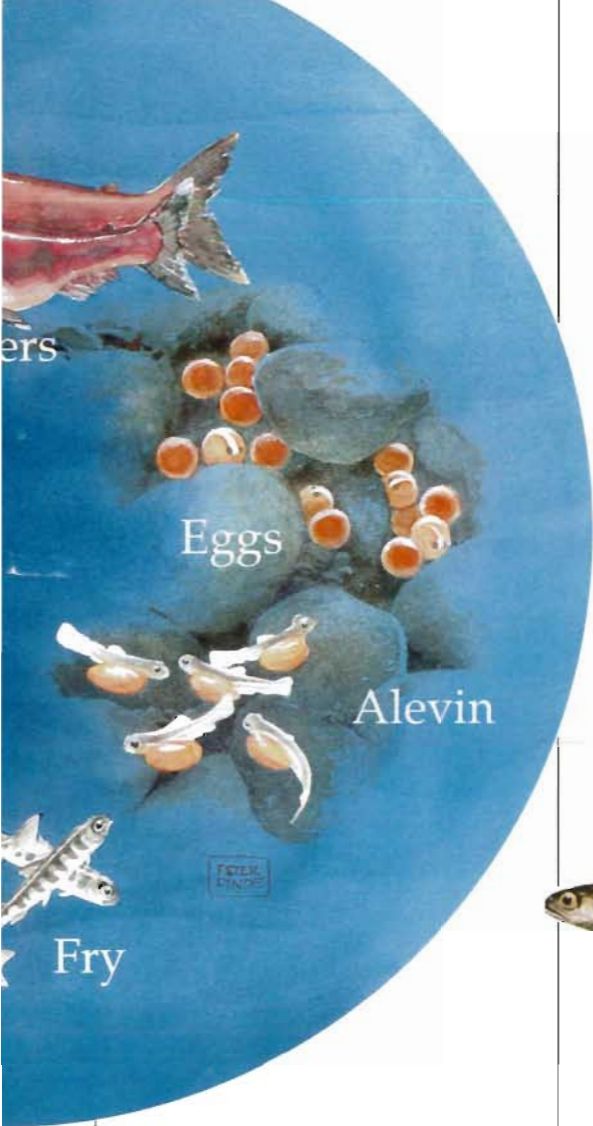
Pink salmon (Oncorhynchus gorbuscha), the most abundant of the five species of Pacific salmon in British Columbia waters, spawn mainly in rivers and streams near the coast. In North America they are found from California to the mouth of the Mackenzie River, although major spawning grounds are between Puget Sound and Bristol Bay.

A peculiarity of the species is its fixed two-year life span. The young migrate to sea soon after emerging from the gravel; all return as two-year-olds after about 18 months at sea. Due to the genetic rigidity, there is no overlapping between the stocks of one year and that of the next. Thus, two different and unique stocks of pink salmon may utilize the same stream for breeding, each in its own year.

In many areas of British Columbia, pink salmon are abundant in both even and odd years. In some areas, however, either the even- or the odd-year stock vastly outnumbers that of the alternate cycle. The Fraser River has an odd-year cycle of pinks; Queen Charlotte Island streams have even-year cycles, and the area between enjoys both cycles.

During the ocean feeding and maturation phase of life, pink salmon are found throughout the North Pacific and Bering Sea north of 38°N in the western part, and 42°N in the eastern part. During fall and winter the pink populations are found distributed in the southern part of their range.

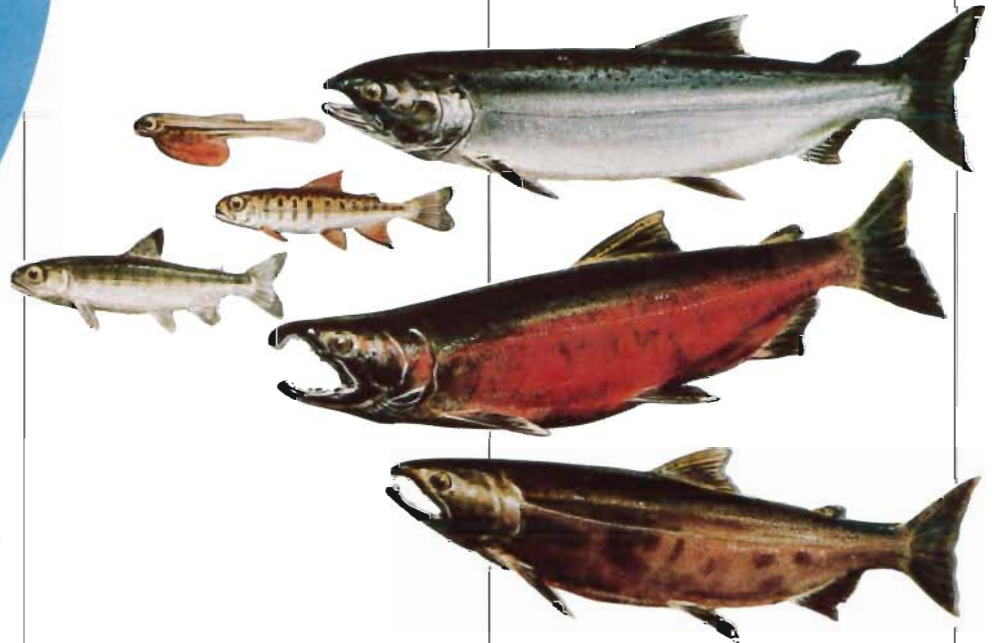




COHO SALMON

Coho salmon (*Oncorhynchus kisutch*) have breeding grounds from California to western Alaska, with major producing areas lying between the Columbia River and Cook Inlet. Coho spawn in over half the 1,500 streams in British Columbia for which records are available. The young migrate to sea after one or two years in fresh water, spending up

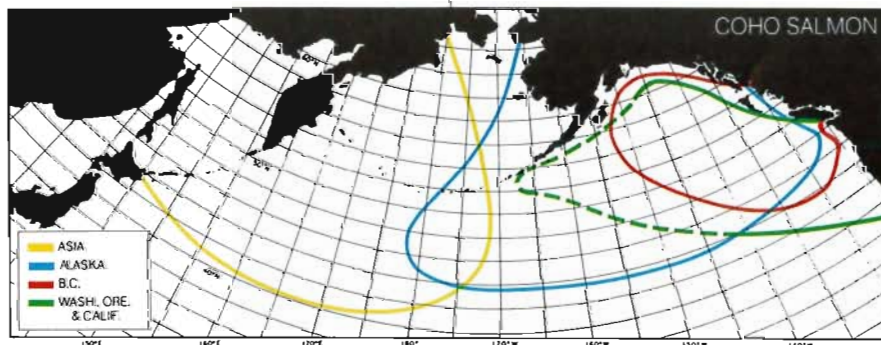
Coho Salmon



SALMONID LIFE CYCLE

to 18 months at sea. Most return as mature adults at three years of age; some as jacks at two years.

Coho smolts enter the sea between April and July. Incomplete information suggests that juvenile coho from British Columbia streams move northwards, remaining within 40 km of the shore. In late fall and winter, they move southward again. In the spring the maturing coho migrate northwards once again, staying within 160 km of the North American coast until dispersing toward home streams to spawn.



CHINOOK SALMON

Chinook salmon (*Oncorhynchus tshawytscha*) spawn in large rivers from California to Alaska. They are found in a relatively small number of streams in British Columbia with the bulk of production coming from the major river systems, the most important of these being the Fraser. Substantial numbers of chinook are found in the Canadian section of the Yukon River.

Unlike most of the other species of Pacific salmon, chinook young remain in fresh water for varying lengths of time after hatching. In southern areas, some migrate oceanward as fry; some remain in fresh water for a few months to a year. In northern areas most spend at least a year in fresh water.

Chinook are known to migrate vast distances and are found sparsely distributed across the Pacific Ocean from 41°N to 60°N, and from the Okhotsk to Bering seas. Limited tag recovery and catch data suggest that most Canadian chinook are within 160 km of the Gulf of Alaska shore.

The age of chinook adults returning to spawn varies from two to seven years. Three-, four-, and five-year-olds are most common in southern streams, while five- and six-year-olds are more abundant farther north. Many river systems have more than one stock of chinook; some rivers have spring, fall, and winter runs.

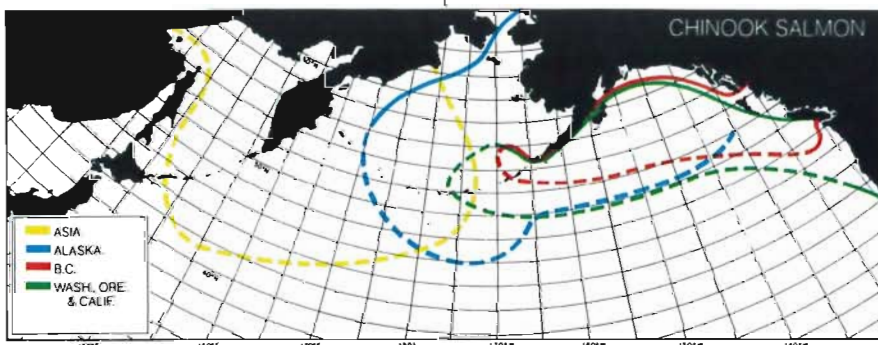


MASU SALMON

Masu salmon (*Oncorhynchus masou*) are restricted to the Asian side of the North Pacific. This species occurs in streams farther south than those inhabited by other members of the Pacific salmon. Two types of masu salmon are recognized: the sakura (*Oncorhynchus masu* var. *masu*), which is sea-going; and yamame (*Oncorhynchus masu* var. *ishikawae*), which lives in fresh water.

The centre of distribution of masu in Japan is on Hokkaido. On the Russian coast this species is most abundant in the northern Primorskaia area. The spawning distribution of yamame, the freshwater type, extends farther south and more or less covers all of Japan. A freshwater type of masu salmon is also found in the Taiko River in Taiwan.

Although masu are found throughout the northern part of the Sea of Japan in spring, little is known about their distribution in the Pacific Ocean.



STEELHEAD TROUT

Steelhead trout (*Salmo gairdneri*) can be found from southern California to the Alaska Peninsula with the major spawning grounds centred from northern Oregon to northern British Columbia in coastal rivers and streams as well as tributaries to major river systems.

On the Asian side of the Pacific there is one related anadromous species (*Salmo mykiss*) found in streams around the Okhotsk Sea and along the east coast of Kamchatka north to the Kamchatka River.

The steelhead very closely resembles the Atlantic salmon in structure and appearance but it is usually more heavily spotted. It differs from the Pacific salmon in having a shorter anal fin containing less than 12 supporting rays. When in the sea the body is mainly silvery with a blue back. At spawning time a band of red

colour develops along each side of the body.

Steelhead spawn in winter or spring in both large and small streams. They may enter fresh water shortly before the eggs are deposited or they may arrive weeks or months ahead of the spawning act. In a given watercourse the runs usually follow an established pattern year after year. Winter, spring and summer runs can sometimes be distinguished.

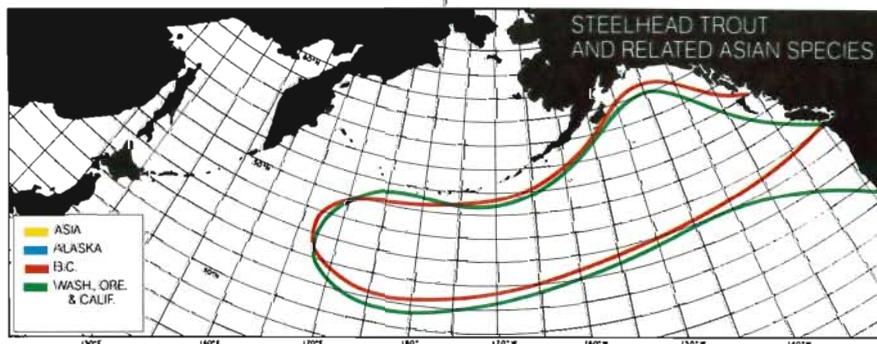
After spawning many adult steelhead go back to the sea and some (between six and 30 percent) return to fresh water after recuperation to spawn a second time, unlike salmon which die after their first and only spawning.

Just like salmon, the steelhead female digs a nest (redd) with her tail and the male fertilizes her eggs at the same instant that she lays them. The young steelhead live for one or two (occasionally three) full years in fresh water before travelling to the sea as smolts ranging in length from 10 to 25 cm. This migration takes place in the

spring. Usually two or more summers are spent in the North Pacific before the fish seek the spawning streams at the general age of four or five years.

Steelhead are prized as game fish by the freshwater sport fishermen because of their fighting qualities. They can be caught by spinner, bait or fly either as young fish (of legal size) before going to the sea or when they come back to fresh water prior to spawning. Most of the commercially-caught steelhead are taken by gill nets in or near the mouths of larger rivers.

Mature steelhead commonly average 3.5 or 4.0 kg (eight or nine pounds) but occasionally reach 9 kg (20 pounds) with individuals up to 16 kg (37 pounds) being recorded.



CUTTHROAT TROUT

Most migration information about salmonids comes from recovered tags, but tagging cutthroat is extremely difficult. As a result, little is known about their ocean migration.

What information has been obtained indicates that cutthroat remain near shore, favouring brackish or estuarine waters. It is thought that they usually remain in the estuaries of the rivers from which they entered the sea.

Young cutthroat remain in fresh water for periods of from one to as much as five years. Most cutthroat spawn at three or four years of age, although there are exceptions.

WEST COAST RESOURCE

Fishing activity in British Columbia is classified by user groups. Three distinct groups partake in the harvest of salmonid species: the commercial fishing industry, the sport or recreational fishery and the Native food fishery.

The commercial fishery is further broken down by gear type, that is, by what type of equipment the fishing boat uses. Hooks on lines are used by the trollers. They catch mostly chinook and coho, but can take other species. Gill nets of various sized mesh can capture selected sizes of fish as they poke their heads through a net across their path and cannot back out. Smaller fish simply pass through the mesh; larger ones bump the net, but are not caught. The purse seine net, on the other hand, surrounds a mass of fish. Once the net is closed, all those fish are captured.

Sport or recreational fishing is done both on the ocean and along streams and rivers. Various kinds of bait and lures are used, depending on the species being sought and the local feeding conditions. The fish are always taken with a hook and line.

The Native food fishery has access to fish in areas where other people do not, such as at the spawning ground. Enough fish for a successful spawn must, of course, be left. Fishing by methods that others are not allowed to use is also permitted; spearing, dip netting and trapping fish are traditional Native methods still used today.

Salmonids from B.C. waters are caught by fisheries for other nations, too. Japan fishes far out in the Pacific as well as along the Japanese coast. Drift gill nets or floating long lines are often used.

The USSR also fishes for salmon, principally along its shoreline and in the rivers of the USSR.

Although neither the United States nor Canada fish on the high seas, they do intercept fish from one another's streams along the coast. The Canada-U.S. treaty, ratified in 1985, addressed the issue of these interception fisheries. It is administered by both nations and sets regulations and limits to ensure that each country gets an equitable share of the resource.

Fishing for Pacific salmon has been an essential element of West Coast life since the earliest days of occupation. The Native people caught salmonid species each fall and preserved much of their catch by drying or smoking it. This provided winter food and a trade good to barter with other tribes from the interior of North America. When Europeans first settled on the West Coast, fishing as an industry began. The Hudson's Bay Company shipped salted salmon from Fort Langley to the Hawaiian Islands starting in 1835 and the first salmon cannery opened in 1876.

Today, the five species of salmon that are fished commercially are sold fresh, frozen or canned. Steelhead and cutthroat trout, and coho and chinook salmon are sought by recreational fishing enthusiasts and all species continue to form an important part of Native life and culture. A growing aquaculture, or salmon farming industry also makes commercial use of Pacific salmon species, notably coho and chinook. The fish are raised to market size in net pens that float in the ocean.

The salmonid resource remains a source of sustenance and a prized part of West Coast life.



SALMONID ENHANCEMENT PROGRAM

The Salmonid Enhancement Program (SEP) is a joint federal-provincial program that was launched in 1977. Its objectives were to restore the populations of salmonids in B.C. waters to their historic levels, to provide employment, especially in remote and Native communities, to preserve and protect the environment and to provide long-term economic benefits to the people of Canada.

Seven species of salmonids benefit from SEP projects. Five species of salmon are the specific responsibility of the federal government and two species of sea-run trout are the focus of provincial efforts.

Enhancement activities cover a broad range. Hatcheries, fishways, spawning channels, incubation boxes, research, habitat improvements and a number of educational and public awareness activities are among the tools that SEP uses to increase fish production and foster preservation of natural runs and fish habitat.

Along with the professional efforts of biologists and technicians, SEP also draws upon the concern of citizens through volunteer projects. These range from stream cleanups carried out by schoolchildren to sophisticated hatcheries entirely operated with volunteer labour. The efforts of these Public Involvement Program volunteers


are often the only enhancement activities suitable for streams with a small production capacity. It is thanks to these projects that many small, but genetically-significant stocks are preserved. The Community Economic Development Program of SEP also serves the purposes of geographic diversity. Through this program, local communities or Native band councils operate enhancement projects under contract with the federal government. Their efforts enhance salmonid populations in local streams and offer the added benefits of training and employment in isolated communities.

Working with a living resource presents challenges. It also takes time, since nothing can speed up the life cycle of the fish themselves. By the end of the first decade of SEP, however, results were highly satisfactory and the program had substantially increased production of juvenile salmonids. In 1988, SEP produced fish accounted for 12 percent of the commercial catch.

For more information on SEP, write to:

**Community Programs
Salmonid Enhancement
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