Coho Salmon
(Oncorhynchus kisutch)

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Coho, or silver, salmon may be the most successful of all salmon species, even though fewer coho than most other salmon species spawn in Alaska's fresh waters. Although this species is less abundant, spawning coho and their young seem to be in almost every accessible body of fresh water within their range.

Successful habitation of small coastal streams is related to aggressiveness and determination of coho to reach small headwater creeks and tributaries to spawn and rear. The adult coho seems to overcome obstacles that stop other salmon in their upstream journeys. Coho can leap vertically more than 6 ft (1.8 m). They also migrate during fall floods, when water levels are higher and most other species have ceased spawning.

An adult coho salmon can be identified by the small black spots on its body dorsally and laterally, and on the upper lobe of its caudal fin (Fig 1). The gums at the base of its teeth and lower jaw are white (Mecklenberg et al. 2002). At sea, a coho has a dark metallic back, silver sides, and silver belly. At spawning, males have green backs and red on the sides; females are bronze to reddish on the sides. Juvenile coho have white on the leading edge of the dorsal and anal fins, and all fins may be tinted orange. The state angling record for coho salmon is 26 lb (12 kg), but most adults weigh from 7-12 lb (3.2-5.5 kg).

Coho smolts migrate to sea usually after 1 to 4 years in freshwater streams and lakes. In streams, they prefer glides and pool habitats with cover and generally avoid fast riffles. In salt water, they gradually move offshore and travel within major current systems (Mecklenberg et al. 2002). Mature adults return to spawn after about 6 to 18 months at sea. About 85% return to their natal streams. In Southeastern Alaska

FIG 1. Adult coho salmon. (Bob Armstrong)

(Southeast), coho salmon typically spawn in short, coastal streams.

STATUS IN SOUTHEASTERN ALASKA

Distribution

In Alaska, coho salmon occur in coastal salt water from Southeast to Point Hope on the Chukchi Sea, in streams and rivers of all sizes, and in lakes and beaver ponds. Some travel more than 1,200 mi (1,920 km) up the Yukon River (Armstrong 1996). In Southeast, coho salmon spawn in nearly 4,000 watercourses, including the headwaters of transboundary rivers in British Columbia and the Yukon Territory (Alaska Department of Fish and Game [ADF&G] 1994) (Fig 2). Almost all bodies of water that have access from the sea and are capable of supporting fish have coho salmon in them.

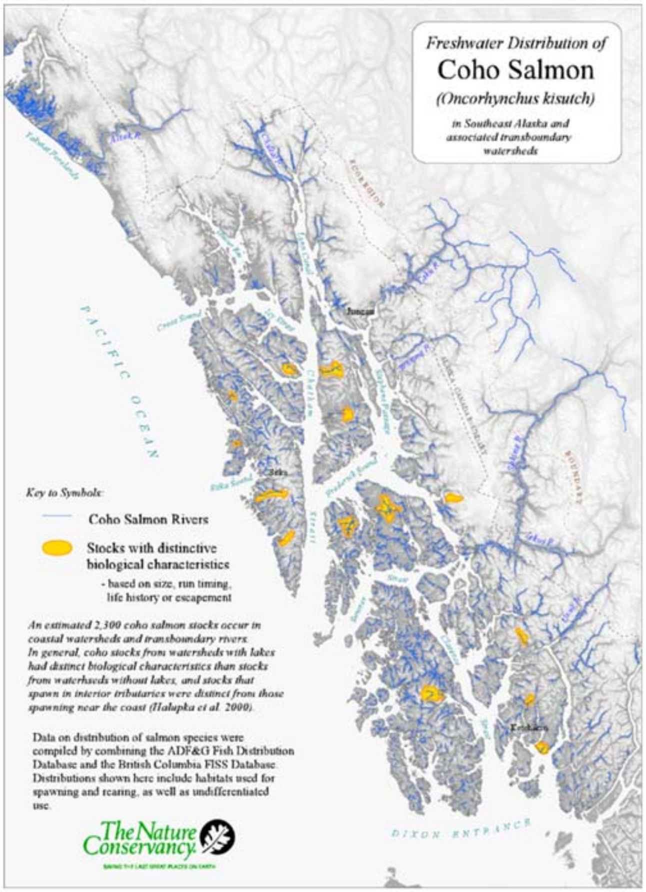

FIG 2. Distribution map of coho salmon spawning streams in southeastern Alaska.

Abundance

Halupka et al. (2000) observed the following during an analysis of the population status of coho salmon in Southeast:

- About 2,000 coho salmon stocks in Southeast are found in small to medium streams. Coho populations in these systems tend to consist of fewer than 1,000 spawners and often fewer than 200 spawners.
- Coho populations found in drainages containing lakes are characterized by spawning escapements of between 1,000 and 8,000 individuals. Coho salmon inhabit about 200 lake-containing drainages.
- Coho populations in large rivers may support the greatest number of spawners, although good data for these systems are lacking. The Tsiu-Tsivat river system west of Yakutat may support the largest population in the region, with total in-river returns of more than 100,000 individuals reported historically.

Since 1960, annual commercial fishery harvests of coho salmon have ranged from 400,000 in 1960 to 5.7 million in 1994, and harvests have been increasing since the 1970s (Clark 1995).

Baker et al. (1996) identified 2,371 coho salmon spawning locations in Southeast, and 72 locations (3%) had enough escapement data for evaluation. Escapement trends were increasing for 12 locations (16.5%), stable for 56 (78%), and declining for 4 (5.5%). None was in precipitous decline. According to Halupka et al. (2000), most coho stocks have stable escapement trends, with nine (7%) showing significant increases and seven (5.4%) showing significant declines from 1960-1992.

Special Taxonomic Considerations

Halupka et al. (2000) found that Redoubt Lake and the Tsiu-Tsivat river system support clearly distinctive coho stocks, and 16 additional stocks may have distinctive characteristics. They wrote:

> Studies of coho salmon stocks in British Columbia have established several heritable morphologic, physiological, and behavioral differences between interior and coastal stocks. Similar patterns for these biological characteristics may occur in Southeast stocks. Interior spawning stocks that pass through Southeast represent important components of regional coho salmon diversity.

Significance to the Region and Tongass National Forest

In 2004, commercial fisheries in Southeast harvested more than 3 million coho salmon. The ex-vessel value of the coho harvest at an average 75 cents per pound was more than $16 million. This commercial fishing income is higher than the income produced by any other commercial salmon fishery in Southeast (ADF&G 2004a).

In 2003, sportfishers harvested nearly 323,000 coho salmon in Southeast—4 times more fish than any other species of salmon (ADF&G 2004b). In 2002, more than 3,000 cohos were taken for subsistence and personal use in Southeast, ranking the species second only to sockeye in popularity of salmon species in these fisheries (K. Monagle, ADF&G, personal communication 2004).

Coho salmon typically spawn later than other species of salmon. They enter fresh water in September and October, and most spawning takes place in late October and November (Halupka et al. 2000). Therefore, these late-running stocks are available to feed other animals after fish from earlier stocks have disappeared. In addition, coho carcasses may become frozen as streams ice over, often making them available to wildlife during mid-winter thaws and even into spring (Armstrong 1996).

Special Management or Conservation Designations

Several fish viewing sites have been developed by the U.S. Forest Service in cooperation with other agencies and private companies. Sites that include viewing of coho salmon are Lunch Creek in Settlers Cove State Park north of Ketchikan and the fish viewing platform at Rio Roberts Creek Bridge near Thorne Bay.

HABITAT RELATIONSHIPS

Probably the most limiting factor on the number of coho salmon produced from streams in Southeast is good winter habitat—both amount and type—for young cohos, which live in fresh water for one to four years before heading to sea. In winter, the numbers of juvenile coho salmon in streams are reduced substantially from their numbers in summer. Most of this reduction occurs early in autumn with the onset of the first heavy rains increasing stream flow.

Stream sections containing adequate winter habitat in the form of deep pools, log jams, and undercut banks with tree roots and debris lose fewer fish during freshets and maintain higher numbers of coho in winter than sections without these habitat characteristics (Tschaplinkski and Hartman 1983). In a study of winter habitat of young coho in Southeast, Heifetz et al. (1986) found that most wintering coho salmon occupied deep pools with cover such as upturned tree roots, accumulations of logs, and cobble substrate. In winter, the fish did not use riffles, glides, and pools without cover. Most of these pools (73%) were formed by large organic debris (Fig 3).

FIG 3. The Kadashan River on Chichagof Island is an important coho spawning and rearing stream. (John Schoen)

IMPLICATIONS FOR CONSERVATION

Halupka et al. (2000) noted that although small to medium streams without lakes produce roughly 60% of the annual return of coho salmon to Southeast, production of juveniles in those streams is highly variable over time. They wrote:

> These small stream stocks are considered most susceptible to population declines (Elliott and Kuntz 1988). Small escapements caused by poor ocean survival or overharvest, or both, combined with the relative instability of stream habitats, which can cause high rates of egg or juvenile mortality, all contribute to the heightened potential for declines in small stream stocks.

Any increase of hatchery coho salmon production could also threaten wild stocks and should be closely monitored.

Removal of the forest canopy by logging can increase coho fry abundance in summer by increasing primary production (Holtby 1988); however, this positive effect can be nullified by reduced winter habitat that can lead to substantial mortality, as shown by Murphy et al. (1986). Thedinga et al. (1989) found that even though summer density of coho salmon fry was greater in both clear-cut streams and those with buffer zones than it was in old-growth streams, pre-smolts in later winter were less abundant in clear cuts than in old growth and were most dense in buffered streams. Short-term increases in fry production after clear cutting may also be nullified by the long-term decreases in production caused by increased shading by a dense second-growth canopy in later successional stages. Winter habitat is frequently a bottleneck in freshwater production of coho salmon smolts, and clear cutting without buffer zones can be detrimental to fish survival (Heifetz et al. 1986).

Two other logging-related factors also affect salmon survival: sedimentation and stream debris. Increased sedimentation from logging may decrease the survival rate for salmon eggs and yolk-sac fry before emergence. At Carnation Creek in British Columbia, for example, Scrivener and Brownlee (1989) found that following logging, survival to emergence of coho salmon declined from 29.1% to 16.4%.

In the long run, clear-cut logging typically reduces the amount of large woody debris in streams, which reduces the crucial winter habitat available for juvenile coho. Murphy and Koski (1989) reviewed the input and depletion of large woody debris in streams and concluded:

- Large woody debris (LWD) is an integral part of streams in forested watersheds and provides structure to the stream ecosystem and important habitat for salmonids (Bisson et al. 1987). Timber harvest in streamside zones can adversely affect salmonids by disturbing or removing LWD (Murphy et al. 1986, Bisson et al. 1987). Even when LWD is left undisturbed during logging, it declines over time after logging because second-growth forest provides insufficient new debris to replace the LWD that decays or washes downstream (Grette 1985, Andrus et al. 1988, Heimann 1988).
- Depletion of large woody debris has important consequences for fish populations. Abundance of juvenile salmonids in a stream often is directly related to the amount of LWD (Murphy et al. 1986, Bisson et al. 1987); debris removal reduces populations of juvenile salmonids (Dolloff 1986, Elliott 1986). Adult salmonids use the large pools formed by LWD for resting cover and the gravel retained by LWD for spawning (Bisson et al. 1987). Some likely long-term consequences of reduced LWD are (1) decreased production of salmonids, (2) reduced biological productivity in general, and (3) increased transfer of sediment from headwaters to downstream areas (Swanson et al. 1976).

Water quality is a key factor in maintaining high-quality spawning and rearing habitat for coho. The harmful long-term effects of clear-cut logging on coho salmon probably negate any positive short-term effects.

Halupka et al. (2000) suggest three considerations that seem most important for conserving healthy stocks of coho salmon in Southeast: lack of sufficient information, disruption of habitat, and potentially negative effects from hatchery production. They wrote:

> Existing data suggested the wild coho salmon resource in the region is in stable condition. Lack of sufficient information is the most pervasive risk factor threatening sustainable management of coho salmon stocks in the region. Additional risk factors include habitat disruption of watersheds associated with natural resource extraction and urbanization, and the potentially negative effects of increasing artificial enhancement on wild stocks.

Maintaining adequate buffer strips along streams is probably the single most important thing that can be done to protect coho salmon habitat during clear-cut logging and other forms of development. Unfortunately, because coho salmon utilize most of the small tributaries in watersheds, buffer strip maintenance can be difficult. The Alaska Region of the National Marine Fisheries Service, recognizing the importance of large woody debris to salmonid habitat, issued a policy statement in 1988 advocating the protection of riparian habitat through the retention of buffer strips not less than 100 ft (30 m) wide along all anadromous fish streams and their tributaries (Murphy and Koski 1989).

Thedinga et al. (1989) further stressed the importance of buffer strips in the following statement:

> The ultimate measure of the effects of timber harvest on coho salmon is the density and size of smolts produced and their emigration timing. Increased fry density and size in summer are negated in winter if rearing habitat is inadequate and smolt size is insufficient for marine survival. Protection of stream habitat by buffer strips allows a high proportion of large fry in summer ample overwinter habitat. If high densities of presmolts can be maintained through winter and migration timing can be preserved, then smolt production will be enhanced. Thus, in summer and winter, buffer strips protect stream habitat and can enhance freshwater coho salmon production.

Secondly, Halupka et al. (2000) point out:

> Artificial enhancement of salmon stocks through hatcheries has the potential to adversely affect natural runs via overexploitation (artificially raising the number of harvestable fish, followed by increased harvests that take both hatchery and natural runs) and genetic introgression [introduction of genes] from hatchery stock to wild runs…

The effects of habitat degradation, artificial enhancement, and overexploitation are synergistic and can lead to rapid decline of productivity of wild stocks, as they did in the Pacific Northwest.

For a further summary of the effects of logging on salmon in Southeast, see Hall et al. 2004.

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