Sockeye Salmon
(Oncorhynchus nerka)

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Sockeye, or red, salmon exhibit more variety in their life history than other Pacific salmon. Most populations are closely tied to lakes where they may spawn along lake shores or in lake outlets or inlets (Armstrong 1996). The young sockeye typically spend 1 or more growing seasons in these nursery lakes before migrating to sea. They usually stay near shore during the day. At night, they move offshore, near the surface, where they feed on insects and zooplankton that migrate from the lake depths to the surface at night.

There are a few exceptions among lake-type sockeye. Some populations or a portion of some populations do not use lakes as nursery areas and migrate to sea as young of the year (the same year as hatching) (Heifetz et al. 1989, Thedinga et al. 1993, Rice 1994). Also, some populations rear in rivers, rather than lakes, for one year (Rice 1994, Murphy et al. 1997). At least two systems in Southeastern Alaska (Southeast), the Taku and Stikine rivers, produce all three types of sockeye salmon—lake type, 0-age stream type, and stream-rearing type (Rice 1994).

Sockeye salmon are typically anadromous, but some, over geologic time, have become land-locked and live their entire life cycle in fresh water (Armstrong 1996). These land-locked sockeye salmon are called "kokanee." The presence of kokanee in some Southeast lakes accounts for production of trophy-sized cutthroat trout (*Oncorhynchus clarki*) and Dolly Varden (*Salvelinus malma*), which prey on the young kokanee.

Sockeye salmon adults are distinguished by having no distinct black spots on their back or fins. If black spots are present, they are smaller than the pupil of the eye and limited to lobes of the caudal fin or irregular marks on the dorsal fin. Sockeyes have gill rakers that are long, slender, serrated, closely set, and usually numbering 30 or more (Mecklenberg et al 2002). At sea, sockeye salmon are blue-black on the top of the head and back and have silvery sides. At spawning they have green heads and bright red bodies (Fig 1). Juveniles have 8 to 14 elliptical to oval parr marks.

FIG 1. Adult sockeye salmon, also called red salmon, in summer-fall spawning coloration. (John Schoen)

The state angling record is 16 lb (7.3 kg), but most sockeye weigh from 4-8 lb (1.8-3.6 kg).

Sockeye salmon are important in Southeast commercial and sport fisheries and are the salmon most harvested for subsistence and personal use. They also serve as food for wildlife. When large numbers die after spawning, they help distribute nutrients between marine and terrestrial ecosystems.

STATUS IN SOUTHEASTERN ALASKA

Distribution

In Alaska, sockeye salmon occur from Southeast north to Kotzebue Sound. Found primarily in the North Pacific Ocean and the Bering Sea, they also occur in limited numbers in the Chukchi and Beaufort seas (Armstrong 1996). About 200 populations, or stocks, of sockeye salmon have been found in Southeast (Fig 2). They are distributed fairly evenly throughout the region (Halupka et al. 2000).

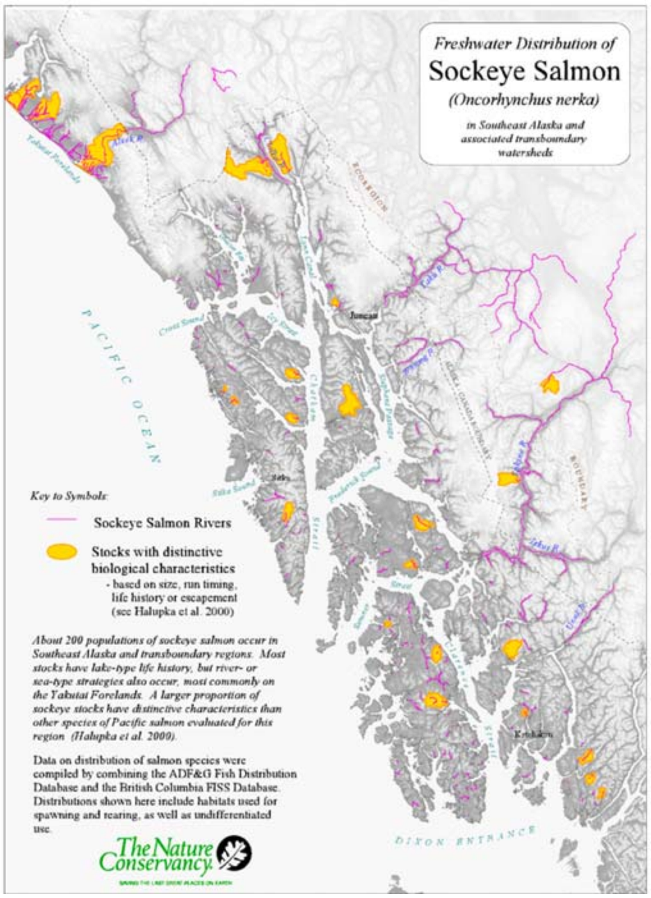

FIG 2. Distribution map of known sockeye salmon spawning streams and lakes in southeastern Alaska.

Abundance

Sockeye salmon are the third most abundant salmon after pinks and chums (Burgner 1991), but fewer sockeye than other salmon, except chinooks (*Oncorhynchus tshawytscha*), are taken in commercial fisheries (Alaska Department of Fish and Game [ADF&G] 2004a).

Halupka et al. (2000) evaluated the escapement trends of sockeye salmon in Southeast for the period 1960 through 1992. Of the 107 stocks with sufficient information, four (4%) were significantly increasing, 10 (9%) were declining significantly, and the rest (93, or 87%) were considered to be stable.

Baker et al. (1996) evaluated the escapement trends for 26 spawning aggregations in Southeast and concluded that one (4%) was increasing, 24 (92%) were stable, and one (4%) was declining. None was in precipitous decline. The long-term mean annual escapement of these 26 spawning aggregates was 7,212 fish and ranged from 100 to 79,590 fish per year.

Taxonomic Considerations

Guthrie et al. (1994) observed substantial divergence among sockeye salmon collected from 52 Southeast stocks, which is consistent with what is known about the accurate homing of sockeye salmon. They identified 3 geographic groupings that differed genetically. These groups corresponded to the southern inside waters; the far southeastern islands, including Prince of Wales Island; and inside waters of northern and central Southeast.

Halupka et al. (2000) determined that a number of sockeye salmon stocks in Southeast had distinctive biological characteristics:

- Leask Lake—high proportions of age 2.2 individuals of both sexes in escapements.
- McDonald Lake (Hatchery Creek)—large population size (possibly artificially maintained by lake fertilization), high proportion of stream spawners, and possibly two stocks present.
- Karta River—distinctively large age 1.2 males. This stock is near or at the top of the size distribution for all other sex and age classes. Sex ratio skewed in favor of males.
- Luck Lake—reverse sexual size difference and high level of sexual difference in mean saltwater age (MSWA) (high jack proportion).
- Kah Sheets Lake—high level of sexual difference in mean freshwater age (MFWA) (females remain in fresh water longer).
- Petersburg Lake—high level of sexual difference in MSWA (high proportion of jacks).
- Hackett River—river-type stock with a sex ratio skewed toward males.
- Auke Lake—high proportions of age 2.3 females in escapements and a declining population.
- Ford Arm Lake—lake-type stock with a sex ratio skewed toward females.
- Chilkat Lake—large population size, 2 separate stocks probably present, and prolonged run duration.
- East Alsek River—high proportion of age 0.2 individuals in escapements of this distinctively large

sea-type stock (mean escapements greater than 30,000 fish).

- Situk River—large population size and lake-, river-, and sea-type life histories all in the same system.
- Lost River—high level of sexual difference in MFWA (males remain in fresh water longer) and high proportion of age 0.2 females in escapements.

The following stocks also had unusual genetic characteristics:

- Tahltan Lake (interior lake in the Stikine River drainage)—may produce smaller eggs than other Stikine stocks (Craig 1985).
- Sitkoh Lake—only Chichagof Island stock included in the analysis.
- Klukshu Lake (interior lake in the Alsek River drainage)—clusters with southern British Columbia stocks.

Significance to the Region and Tongass National Forest

In 2004, commercial fisheries in Southeast harvested nearly 2 million sockeye salmon. The ex-vessel value of the sockeye harvest at 69 cents per pound was more than $8 million (ADF&G 2004a). In 2003, sportfishers harvested some 27,000 sockeye salmon in Southeast (ADF&G 2004b). In 2002, more than 48,000 sockeye salmon were harvested for subsistence and personal use. That figure is 15 times as many as any other species of salmon (K. Monagle, ADF&G, personal communication 2004).

Returning sockeye salmon can also be a significant nutrient source to their nursery lakes (Kline 1993). The salmon release nutrients through excretion and decomposition of spawned-out fish. As with other salmon species, the spawned-out carcasses of sockeye salmon provide food for a wide variety of birds and mammals.

Kokanee, or land-locked sockeye, are the primary reason why some lakes in Southeast produce trophy-size cutthroat trout and Dolly Varden. Apparently, feeding on kokanee allows these fish to grow larger than fish in lakes without kokanee.

Special Management or Conservation Designations

The U.S. Forest Service has established salmon viewing areas and life history displays along Steep Creek near Mendenhall Glacier in Juneau primarily because of the sockeye salmon run. Sockeye can also be viewed at Nine Mile Bridge and Tawah Creek near Yakutat (Armstrong 1996).

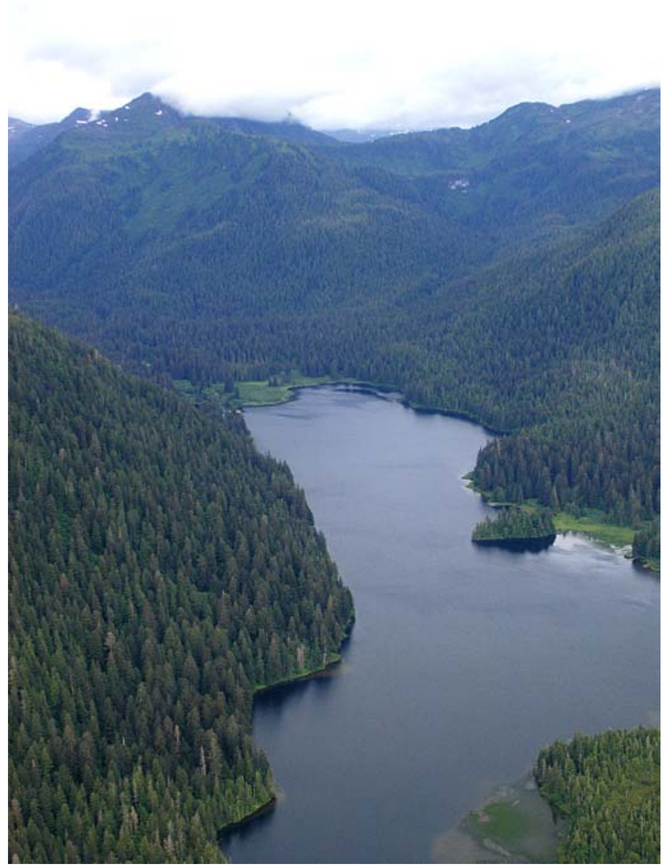

FIG 3. Lake Eva on northeastern Baranof Island is an important spawning area for sockeye salmon. (John Schoen)

HABITAT RELATIONSHIPS

Lakes in Southeast that are accessible from the sea are undoubtedly of special importance to the region's sockeye salmon, especially for the rearing of young sockeye before their migration to sea (Fig 3). In lakes, the young feed extensively on zooplankton, and in most lakes, sockeye are the predominant fish species utilizing this food resource (Burgner 1991).

Characteristically, sockeye spawning areas are adjacent to lake-rearing areas. In this aspect, the sockeye salmon differs from the other Pacific salmon species in Southeast, which normally do not depend on lake rearing during the juvenile stage (Burgner 1991). Also, sockeye salmon are the only salmon species to spawn extensively in shoal beach areas along lake shores, typically in areas of upwelling groundwater that provide circulation through the nest (Burgner 1991).

IMPLICATIONS FOR CONSERVATION

The overall status of sockeye populations in Southeast is good, but Halupka et al. (2000) pointed out at least four potential risks:

• Increased demand for this commercially valuable species;

• Over-exploitation of small, artificially enhanced, or weak stocks in mixed-stock fisheries;

• Heavy and poorly monitored subsistence harvests; and

• Lack of adequate information about small populations.

Halpuka et al. (2000) also wrote, "The potential for the Hubbard Glacier to block Russell Fjord and divert its water through the channel of the Situk River is a unique risk factor. Most sea-type sockeye that spawn in the Situk system use the Old Situk River, the channel that would be most heavily affected by flooding (Thedinga and others 1993)."

Three considerations seem most important for conserving healthy populations of sockeye salmon in Southeast:

• Identify and protect lakes that support populations of sockeye salmon and kokanee;

• Identify and protect the few sockeye salmon populations that do not use lakes as nursery areas; and

• Recognize the importance of genetic diversity in sockeye populations identified as having distinctive biological characteristics.

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