Pink Salmon
(Oncorhynchus gorbuscha)

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Pink salmon—also called humpbacks and humpies—are the most abundant Pacific salmon in North America and Asia. They are also the most abundant salmon species in Southeastern Alaska (Southeast). A number of rivers and streams in Southeast have mean annual escapements of more than 100,000 pink salmon, and many more pinks than other salmon are caught commercially. Because of their great numbers and widespread distribution, pink salmon are also a critical source of food for wildlife such as bears and eagles.

Pink salmon also have the simplest and shortest life cycle of all salmon. Upon emerging from the gravel, a young pink migrates quickly to sea, grows rapidly for 18 months, then returns to its river of origin to spawn and die (Armstrong 1996). Pink salmon are unusual in that they have even-year and odd-year populations that may differ considerably in numbers. These even- and odd-year runs are genetically separated with observable though minor morphological differences (Mecklenberg et al. 2002).

An adult pink salmon can be identified by the large, black, oval spots on the tail (Mecklenberg et al. 2002). At sea, it is bright steely blue on top and silvery on the sides. At spawning, the male is brown to black above with a white belly and large hump; the female is olive green with dusky patches above and a light-colored belly (Fig 1). Juvenile pink salmon lack parr marks. Adults average about 4 lb (1.8 kg).

FIG 1. Adult male pink salmon in spawning condition in southeastern Alaska. (John Schoen)

STATUS IN SOUTHEASTERN ALASKA

Distribution

Pink salmon occur throughout the North Pacific Ocean and the Bering Sea. They spawn in streams along all coastal areas of Alaska, but are only occasionally found west of the Bering Strait (Armstrong 1996).

Halupka et al. (2000) stated that Southeast is near the center of the North American distribution of pink salmon; consequently, populations are numerous, well distributed, and often large. Pink salmon inhabit more than 3,000 streams in Southeast (Alaska Department of Fish and Game [ADF&G] 1994) (Fig 2). They tend to spawn in smaller streams, although some Southeast rivers may contain large numbers of pinks (Heard 1991).

The only large transboundary population of pink salmon with a mean annual escapement of 100,000 fish is in the Taku River drainage, where spawning occurs primarily in the Nakina River (McGregor and Clark 1990).

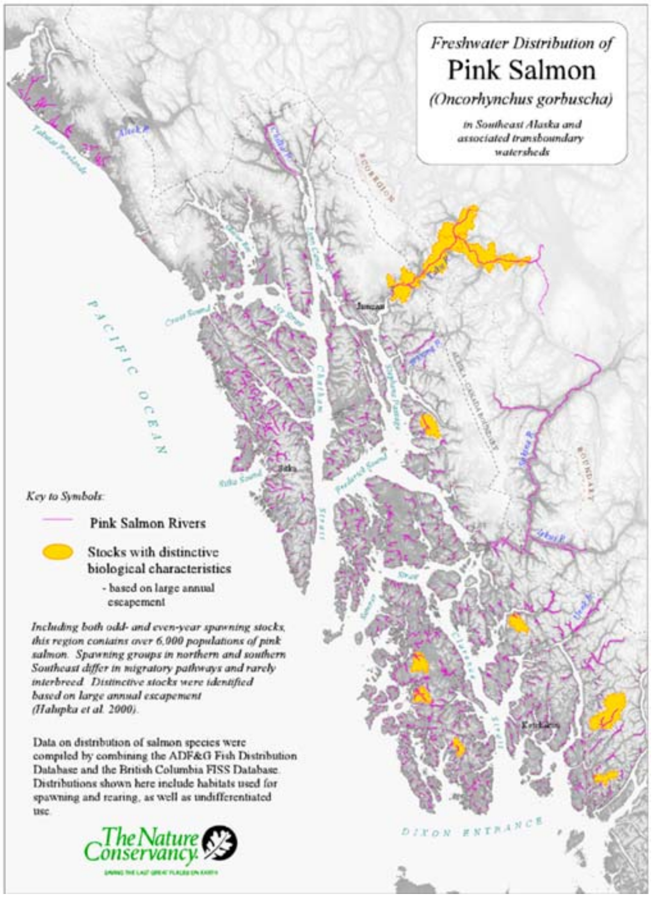

FIG 2. Distribution map of pink salmon spawning streams in southeastern Alaska.

Abundance

In the early 1990s, the annual commercial catches of pink salmon exceeded 30 million fish (Hofmeister 1994). In 2003, commercial fisheries in Southeast harvested more than 52 million pink salmon, 4 times as many fish as any other species of salmon (ADF&G 2004a).

Because pink salmon occur in more than 3,000 streams in Southeast and the species has genetically distinct even-year and odd-year runs, the region has 6,000 populations of pink salmon (Halupka et al. 2000). At least 200 of these populations have mean escapements that exceed 10,000 fish (ADF&G 1994).

The following rivers and streams in Southeast have mean annual escapements of more than 100,000 pink salmon: Humpback Creek, Wilson River, Klawock River, Anan Creek, Nutkwa Creek, and Staney Creek, all in southern Southeast. Rivers and streams with fewer but significant annual mean escapements of between 60,000 and 100,000 fish annually include the Chuck River, Sanborn Creek, Situk River, Red Bluff Bay, Rusty River, Nakina River, Deep Bay, and Lisianski River, all in northern Southeast (Halupka et al. 2000). Many of these systems in southern and northern Southeast have sometimes had much larger escapements than the means indicate. A single system may have between 200,000 and 700,000 fish in a single year.

When Halupka et al. (2000) evaluated the escapement trends of 1,334 pink salmon stocks in Southeast, they found that more than 18% were significantly increasing while only 2% were declining. Eighty percent of the stocks were considered stable.

Baker et al. (1996) also evaluated the abundance trends of pink salmon in Southeast. Looking at 752 spawning aggregations, the authors found that 163 (42%) odd-year spawning aggregates were increasing, 218 (56%) were stable, and 8 (2%) were declining. None was in precipitous decline. They found that 137 (38%) even-year spawning aggregates were increasing, 211 (58%) were stable, 14 (4%) were declining, and 1 (<1%) was in precipitous decline.

Halupka et al. (2000) concluded that the predominantly positive trend in pink salmon escapements could be attributed to several factors, including the following:

- ADF&G efforts to rebuild pink salmon stocks;
- Favorable ocean conditions and winter temperatures from 1980 through 1990; and
- The generally pristine quality of spawning habitat in Southeast.

Taxonomic Considerations

Many streams populated by pink salmon in Southeast are short coastal streams (Noll et al. 2001). Consequently, in maximizing productivity opportunities, pink salmon may exhibit more gene flow, or straying, than occurs in other Pacific salmon. The estimated straying for pink salmon that spawn in intertidal areas is higher than for pinks that spawn farther upstream (Thedinga et al. 2000).

Because the species has a 2-year life cycle, pink salmon runs in odd- and even-numbered years are genetically separated, demonstrating observable though minor morphological differences (Mecklenberg et al. 2002). Extreme northern and southern pink salmon stocks also can be distinguished by genetic differences (Gharrett et al. 1990).

Significance to the Region and Tongass National Forest

Spawning pink salmon provide food for many creatures in Southeast. Because they are so numerous and widespread, pink salmon are especially important to bears. Consumption of pink salmon helps bears build important fat stores needed to carry them through hibernation (Willson et al. 1998). Studies have shown that the carrying capacity of bears increases where salmon are available. Observed bear populations have been as much as 80 times denser in coastal areas, where salmon are abundant, than in interior areas (Miller et al. 1997, Hilderbrand et al. 1999).

Pink salmon are important to bald eagles (*Haliaeetus leucocephalus*) because the fish are small enough to be carried to the nest at a time when the eaglets are the largest and hungriest. Also, pink salmon are usually available when most young eagles leave the nest, about mid-August. Dead and dying pink salmon provide ready sources of nourishment for young eagles, which are inept at obtaining live fish and are learning to feed on their own (Armstrong and Hermans 2004).

A host of other fish feed on young pink salmon. Examples are coho salmon (*Oncorhynchus kisutch*) smolts, Dolly Varden (*Salvelinus malma*), at least three species of sculpin (Mortensen et al. 2000), and cutthroat trout (*Oncorhynchus clarki*).

Gende et al. (2004) quantified the energy and mineral composition (nitrogen and phosophorous) of live pinks as well as their eggs and carcasses. They found that bears removed nearly 50% of the salmon-derived nutrients and energy from the stream by capturing salmon and dragging the carcasses from the stream. Much of the pink salmon biomass was made available to riparian scavengers because bears only partially consumed the fish (Fig 3).

In 2003, the value of the commercial pink salmon harvest in Southeast exceeded $18 million (based on an ex vessel price of 10 cents per pound) (ADF&G 2004a). That same year, sportfishers harvested an estimated 74,000 pink salmon (ADF&G 2004b). In 2002, more than 2,800 pink salmon were taken for subsistence and personal use (K. Monagle, ADF&G, personal communication 2004).

A study by Pella et al. (1993) demonstrates the importance of pink salmon produced from systems in Southeast to the commercial salmon fishery. The study found that throughout the fishing season most pink salmon in nearly all Alaskan fisheries were of Alaskan origin. Only in two of nine Alaskan fishing areas examined did the percentage from Alaskan stocks sometimes drop below 75%. The percentage of Alaskan pink salmon taken in Canadian fisheries was also substantial, but it varied more among areas and years of tagging than in Alaska. The percentage of Alaskan pink salmon taken in Canada was generally greatest in areas adjoining Alaska.

FIG 3. Pink salmon, which spawn in many small streams, are an important food resource for bears and other wildlife in southeastern Alaska. In this photo from Admiralty Island, brown bears are fishing for pink salmon in intertidal areas at low tide. (John Schoen)

Special Management/Conservation Designations

The U.S. Forest Service and other agencies have designated a number of sites in Southeast as viewing areas for spawning pink salmon. These sites include Indian River footbridge in Sitka National Historic Park, Starrigavin Creek near Sitka, and Wrangell-Anan Creek wildlife viewing area, where black bears (*Ursus americanus*) (and a few brown bears [*Ursus arctos*]) concentrate because of pink salmon spawning runs.

HABITAT RELATIONSHIPS

Because pink salmon young go to sea almost immediately after emerging from the gravel, the type and condition of their spawning beds are their most important freshwater habitat requirements. Heard (1991) noted the following observations about spawning beds. Pink salmon choose areas with fairly uniform gravel in both small and large streams for spawning. Usually these spawning beds are located in riffles with clean gravel or along stream borders between pools and riffles in shallow water with moderate to fast currents (Fig 4). In large rivers, pinks may spawn in discrete sections of main channels or in tributary channels. They avoid spawning in quiet deep water, in pools, in areas with a slow current, and over heavily silted or mud-covered streambeds.

FIG 4. A mixed school of pink and chum salmon are moving upstream to spawn in this small stream system in southeastern Alaska.

In contrast to Prince William Sound, spawning in the intertidal zone in Southeast is estimated to represent less than 20% of pink salmon spawning (Heard 1991).

Heard (1991) summarized the habitat requirements of pink salmon eggs and alevins as follows:

> Fertilized eggs begin their 5- to 8-month period of embryonic development and growth in intragravel interstices. To survive successfully, the eggs, alevins, and pre-emergent fry must first be protected from freezing, desiccation, streambed scouring or shifting, mechanical injury, and predators. Water surrounding them must be non-toxic and of sufficient quality and quantity to provide basic requirements of suitable temperatures, adequate supply of oxygen, and removal of waste materials. Collectively, these requirements are, on average, only partially met even under the most favorable natural conditions. Overall freshwater survival of pink salmon from egg to alevin, even in highly productive streams, commonly reaches only 10%-20%, and at times is as low as about 1%.

Certain types of nearshore areas in Southeast are also extremely important to the well-being and early growth of juvenile pink salmon. Heard (1991) noted that young pink salmon used specific nursery areas for feeding during their first weeks in salt water. These nursery areas were located along irregular shorelines with complex eddies, which in some areas continuously replenished the nursery with zooplankton and provided shelter from wind-generated waves and currents and from strong tidal currents.

IMPLICATIONS FOR CONSERVATION

High mortality of pre-spawning pink salmon in Southeast occurs occasionally during periods of low precipitation and low stream flow with accompanying high stream temperatures and low dissolved oxygen. This mortality tends to occur in small drainages at low elevations with little buffering by lakes or ponds, and sometimes in confined intertidal systems with restricted tidal exchange (Murphy 1985, Pentec Environmental, Inc. 1991). Because these types of drainages are often favored for logging, maintaining forested buffer zones along them is important in reducing pink salmon mortality (Halupka et al. 2000).

The effects of large-scale hatchery production on pink salmon is also a concern in Southeast. Large-scale straying by hatchery stocks could have a detrimental effect on wild pink salmon populations by reducing genetic diversity (Gharrett and Smoker 1993). Also, as Halupka et al. (2000) pointed out, “Large, early returns of hatchery fish could provide an erroneous impression of a strong run, if the hatchery fish are not distinguishable from wild populations.”

Halupka et al. (2000) added that currently pink salmon are produced on a large scale by three hatcheries in Southeast. “Production from these hatcheries make [*sic*] important contributions to local fisheries but a relatively minor contribution (<10 percent) to the total commercial catch of pink salmon throughout the region,” observed the authors. Their study did not attempt to document the operations of several small-scale pink salmon hatcheries in the region.

Size variation in adults also appears to be important among pink salmon populations because it increases the ability of the species to deal with environmental factors (Smoker et al. 1994). The selectivity of commercial fisheries and ocean ranching programs can reduce size variation. Effects of decreases in size variation may not be rapid or even immediately discernible before potential harm is done (Smoker et al. 1994).

The low percentage (~2%) of declining pink salmon stocks in Southeast suggests that pink salmon populations are not currently at risk in the region.

Halupka et al. (2000) stated that factors such as the following could contribute to future declines:

- Sex-biased catches that lead to a predominance of males in escapements;
- Pre-spawning mortality;
- Egg and alevin mortality associated with changed hydrologic and thermal regimes of streams in logged watersheds; and
- An ongoing decline in pink salmon body size that could reduce productivity.

Five considerations seem most important for maintaining healthy populations of pink salmon in Southeast:

- Protect spawning areas from disruption or pollution;
- Maintain adequate buffer strips along streams during logging activity;
- Identify and protect nearshore salt water nursery areas, where the young fish feed during their first weeks at sea;
- Determine and monitor the effects of large-scale releases of hatchery fish on wild pink salmon populations; and
- Recognize the importance of size variation to population fitness, especially in wild stocks.

REFERENCES CITED

ADF&G. 1994. Catalog of waters important for spawning, rearing or migration of anadromous fishes. Southeast Region, Resource Management Region I, Juneau, AK. 195 pp.

_____. 2004a. Preliminary review of the 2003 Alaska commercial salmon fisheries: Southeast and Yakutat. <www.cf.adfg.state.ak.us/geninfo/pubs/rir/>. Accessed on April 2005.

_____. 2004b. Southeast sportfish harvest by species, 1994-2003. <http://www.sf.adfg.state.ak.us/Statewide/ParticipationAndHarvest/main.cfm>. Accessed on April 2005.

Armstrong, Robert H. 1996. Alaska's fish: A guide to selected species. Alaska Northwest Books, Anchorage, AK.

_____ and Marge Hermans. 2004. Southeast Alaska's natural world. 224 pp.

Baker, Timothy T., and 8 coauthors. 1996. Status of Pacific salmon and steelhead escapements in Southeastern Alaska. Fisheries: Special Issue on Southeastern Alaska and British Columbia Salmonid Stocks at Risk 21:6-18.

Gende, Scott M., Thomas P. Quinn, Mary F. Willson, Ron Heintz, and Thomas M. Scott. 2004. Magnitude and fate of salmon-derived nutrients and energy in a coastal stream ecosystem. Journal of Freshwater Ecology 19(1):149-160.

Gharrett, A.J., and W.W. Smoker. 1993. Genetic components in life history traits contribute to population structure. NATO ASI Series. Series A Life Sciences 248:197-202.

_____, R.B. Wilson, B.M. Baker, C.M. Guthrie III, C.M. Kondzela, and H.R. Carlson. 1990. Preliminary report on genetic diversity of southern Southeastern pink salmon populations. NWAFC Processed Report 90-03. National Marine Fisheries Service.

Halupka, Karl C., Mason D. Bryant, Mary F. Willson, and Fred H. Everest. 2000. Biological characteristics and population status of anadromous salmon in Southeast. General Technical Report PNW-GTR-468. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, OR. 255 pp.

Heard, W.R. 1991. Life history of pink salmon (*Oncorhynchus gorbuscha*). Pages 119-230 in C. Groot and L. Margolis, editors. Pacific salmon life histories. University of British Columbia Press, Vancouver, Canada..

Hilderbrand, G.F., et al. 1999. The importance of meat, particularly salmon, to body size, population productivity, and conservation of North American brown bears. Canadian Journal of Zoology 77:132-138.

Hofmeister, K. 1994. Southeast winter air temperature cycle and its relationship to pink salmon harvest. In Proceedings of the 16th Northeast Pacific pink and chum salmon workshop, Juneau, AK. 24-26 Feb. 1993. University of Alaska, Alaska Sea Grant College Program, Fairbanks, AK.

McGregor, A.J., and J.E. Clark. 1990. Adult mark/recapture studies of Taku River salmon stocks in 1989. Regional Information Report 1J90-28. ADF&G, Division of Commercial Fisheries, Juneau, AK. 71 pp.

Mecklenburg, C.W., T.A. Mecklenburg, and L.K. Thorsteinson. 2002. Fishes of Alaska. American Fisheries Society.

Miller, S.D, et al. 1997. Brown and black bear density estimation in Alaska using radiotelemetry and replicated mark-resight techniques. Wildlife Monographs 133:1-55.

Milner, A., and R. Bailey. 1989. Salmonid colonization of new streams in Glacier Bay National Park. Aquaculture and Fisheries Management 20:179-192.

Mortensen, Donald, Alex Wertheimer, Sidney Taylor, and Joyce Landingham. 2000. The relation between early marine growth of pink salmon, *Oncorhynchus gorbuscha*, and marine water temperature, secondary production, and survival to adulthood. Fishery Bulletin 98:319-335.

Murphy, M. 1985. Die-offs of pre-spawn adult pink and chum salmon in Southeastern Alaska. North American Journal of Fisheries Management 5:302-308.

Noll, Claire, and 12 coauthors. 2001. Analysis of contemporary genetic structure of even-broodyear populations of Asian and western Alaskan pink salmon, *Oncorhynchus gorbuscha*. Fishery Bulletin 99:123-138.

Pella, Jerome, Margaret Hoffman, Stephen Hoffman, Michele Masuda, Sam Nelson, and Larry Talley. 1993. Adult sockeye and pink salmon tagging experiments for separating stocks in northern

British Columbia and southern Southeast. NOAA Technical Memorandum NMFS-AFSC-18. National Marine Fisheries Service, Alaska Fisheries Science Center.

Pentec Environmental, Inc. 1991. Factors affecting pink salmon pre-spawning mortality in Southeast. Technical Report 91-01. Edmonds, WA.

Smoker, William W., Anthony J. Gharrett, Michael S. Stekoll, and John E. Joyce. 1994. Genetic analysis of size in an anadromous population of pink salmon. Canadian Journal of Fisheries and Aquatic Sciences 51(Suppl. 1):9-15.

Thedinga, J.F., A.C. Wertheimer, R.A. Heintz, J.M. Maselko, and S.D. Rice. 2000. Effects of stock, coded-wire tagging, and transplant on straying of pink salmon (*Oncorhynchus gorbuscha*) in Southeastern Alaska. Canadian Journal of Fisheries and Aquatic Sciences 57(10):2076-2085.

Willson, Mary F., Scott M. Gende, and Brian H. Marston. 1998. Fishes and the forest: expanding perspectives on fish-wildlife interactions. Bioscience 48(6):455-462.