Anadromous Fish in Southeastern Alaska

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Nine anadromous fish species are abundant and of special importance in Southeastern Alaska (Southeast) (Mecklenburg et al. 2002). Favored by humans for their commercial, sport, and subsistence values, these species are Chinook (*Onchorhynchus*), chum, (*O. keta*) coho (*O. kisutch*), pink (*O. gorbuscha*), and sockeye (*O. nerka*) salmon; Dolly Varden (*Salvelinus malma*); steelhead (*O. mykiss*) and cutthroat trout (*O. clarki*); and eulachon (*Thaleichthys pacificus*). This report discusses all nine species, except steelhead/rainbow trout.

Southeast is fortunate to have healthy runs of salmon and other anadromous fish. Two studies that evaluated the abundance and trends of the salmon runs in Southeast have concluded that most salmon populations are currently stable (Baker et al. 1996, Halupka et al. 2000). Factors associated with the observed high levels of productivity and abundance include (1) relatively pristine and undeveloped habitats because much of the region is inaccessible, (2) successful habitat and salmon management policies within Alaska, (3) enhancement by hatcheries, and (4) favorable environmental conditions (Royce 1989, Meachum and Clark 1994). Marine conditions favorable to high survival of Alaska salmon have been an important reason for record returns (Beamish and Bouillion 1993, Francis and Hare 1994).

Problems also characterize fish stocks in Southeast, however, and the species face an uncertain future as human population and development increase. The numbers of some anadromous fish have decreased in parts of the region because of increasing pressure from anglers. Declines in the numbers of steelhead, cutthroat trout, Dolly Varden, and perhaps eulachon stocks have been noted. For example, the steelhead in the Karta River (Harding and Jones 1993), Situk River (Glynn and Elliott 1993), and Peterson Creek (Harding and Jones 1992) have all experienced declines. The numbers of cutthroat trout harvested by anglers have dropped throughout Southeast, despite a near doubling of angler effort (Mills 1994). And the abundance of Dolly Varden along the Juneau road system has been much less than in previous years (Armstrong 1979).

These declines prompted the Alaska Board of Fisheries to reduce bag limits of steelhead, cutthroat trout, and Dolly Varden; completely close some systems to harvest; and establish catch-and-release-only fisheries on other streams (Larson 1990; Harding and Jones 1992, 1993). More anglers are now releasing the fish they catch; however, excessive mortality from hooking and releasing fish remains a concern.

Murphy (1995) described potential effects of logging on freshwater habitat of anadromous salmon in the region as follows:

> "Logging and associated activities can have multiple effects on salmonid habitat. Salmonid habitat is a product of interactions among the stream, floodplain, riparian area, and uplands—in short, the entire watershed. Effects of timber harvest, road construction, and other activities anywhere in the watershed can be transmitted through changes in hydrologic and erosional processes to modify habitat for salmonids."

Murphy (1995) also noted that "Use of forest chemicals (fertilizers, pesticides, and fire retardants)

can affect salmonids directly and indirectly" (Norris et al. 1991).

Of interest is the size change in salmon that has been observed throughout the North Pacific Ocean during the last two decades. These changes may have been introduced by competition for food from the enormous numbers of salmon released from hatcheries in North America, Japan, and Russia or by climatic and oceanographic changes. Bigler et al. (1996) showed that salmon were decreasing in size from 1980 through 1994. Since the mid-1990s, however, size has been increasing, indicating another possible change in the North Pacific Ocean (Helle and Hoffman 1998).

Damage to fish habitat has occurred throughout Southeast —especially near cities and in areas of logging. Politicians often try to change environmental laws and open up protected lands to make it easier to "develop" Alaska. Changes in land use and increased development could adversely affect salmon in Southeast. Detrimental results of development on salmon have been documented elsewhere and could happen in Southeast.

SIGNIFICANCE TO THE REGION AND THE TONGASS NATIONAL FOREST

Anadromous fish have played a major role in the history and economy of Alaska and its commercial, sport, and subsistence fisheries (refer to Chapter 9 for a discussion of the Southeast fishing industry). Alaska currently produces about 80% of all salmon harvested in the western United States and Canada (Burger and Wertheimer 1995). In Southeast, harvests of all species except chinook salmon have increased dramatically since the 1970s and are at or approaching historically high levels (Baker et al. 1996). In 2003, the estimated ex-vessel value of salmon alone in Southeast commercial harvests was $59 million. Therefore, from a human standpoint, the value of salmon and other anadromous fish in Southeast is unquestionable.

But anadromous fish provide more than food and income. According to a publication from the U.S. Department of Agriculture, Pacific Northwest Research Station (*Fish and Forest: Ecological Links Between Water and Land*), researchers are discovering a great deal about the way anadromous fish knit together the ocean, fresh water, and the land. Fish distribute nutrients; promote the health and reproduction of other species; influence the winter survival of birds, mammals, and fish; and even affect vegetation along stream banks and in the forest (Willson and Halupka 1995).

Anadromous fish not only feed saltwater species such as seabirds, seals, sea lions, porpoises, and orcas, they also provide forage for more than 40 different species of mammals and birds in fresh waters of Southeast (Willson and Halupka 1995). These predators eat anadromous fish eggs, juveniles, live adults, and carcasses.

Because salmon die when they spawn, they also provide a tremendous influx of nutrients to spawning streams and their watersheds. These nutrients benefit the aquatic insects in streams that then serve as food for juvenile salmon and other fish. Bears and other creatures move the salmon away from the streams, and fish carcasses serve as fertilizer to the near-stream vegetation and trees (Gende et al. 2002, 2004).

In addition to the direct benefits of salmon, indirect benefits are possibly realized. For example, salmon fertilization of streamside vegetation could benefit the herbivorous insects that feed on that vegetation; the insects, in turn, would benefit insectivorous breeding birds along salmon streams in spring (Gende and Willson 2001).

The importance of salmon as food for other wildlife species in Southeast is so great that salmon have been termed "keystone species" (Willson and Halupka 1995). They have also been termed a "cornerstone species" because they provide a resource base that supports much of the coastal ecosystem in Southeast (Willson et al. 1998).

In summary, considering the benefits of anadromous fish to our economy and to the preferred lifestyles of Southeast Alaskans, the importance of anadromous fish as food for humans and scores of other creatures, and the potential indirect benefits of anadromous fish to Southeast ecosystems as a whole, safeguarding anadromous fish habitat is an investment worth making.

IMPLICATIONS FOR CONSERVATION

Anadromous fish depend on healthy freshwater habitat for spawning, rearing, and wintering. Because the landscape of Southeast is predominantly forest, the ability to maintain healthy freshwater habitats for anadromous fish is inextricably tied to the health of the forests and watersheds around them. Many of the areas most important to anadromous fish are also those most valued as sources of timber, however, and those forests and watersheds have been or could be exposed to

impacts from timber harvest on a large scale. Maintaining a balance between the value and contribution of timber to the regional economy and the value and contribution of anadromous fish, especially salmon, is a major challenge to resource management and political decision making.

Murphy (1995) presented "a science overview of the major forest management issues involved in the recovery of anadromous salmonids affected by timber harvest in the Pacific Northwest and Alaska." He stated:

"The issues involve the components of ecosystem-based watershed management and how best to implement them, including how to:

- Design buffer zones to protect fish habitat while enabling economic timber production;
- Implement effective Best Management Practices (BMP's) to prevent nonpoint-source pollution;
- Develop watershed-level procedures across property boundaries to prevent cumulative impacts;
- Develop restoration procedures to contribute to recovery of ecosystem processes; and
- Enlist support of private landowners in watershed planning, protection, and restoration."

Another threat to freshwater habitat for anadromous fish is pollution. According to the Alaska Department of Environmental Conservation (2001), the greatest sources of pollution in Alaska's waters are community runoff (38%); timber harvest activities, including upland timber harvesting, log storage, and log transfer facilities (24%); and mining and other industrial activities (20%).

A panel of fisheries experts assessed the levels of risk to fish habitat from timber harvest and related activities associated with management alternatives in the Tongass Land Management Plan revision. The panel expressed five primary issues of concern (Dunlap 1997):

1. Roads may have negative effects on fish habitat. These effects could come from sedimentation when roads were constructed on slopes that are too steep. Stream crossing structures, especially culverts, may block movement of juvenile fish and result in a long-term reduction of available fish habitat. In addition, the panel expressed concern about an increased risk of overharvests of fish, especially steelhead and cutthroat trout and sockeye salmon, because fishermen would have improved access from roads.

Panel evaluators identified Prince of Wales Island, Kupreanof Island, Kuiu Island, and Chichagof Island as currently having road densities sufficient to be of concern for maintaining adequate fish habitat. The panel stated in conclusion, "A reduction of road development in any alternative reduces risks to fish habitat."

2. The amount of timber harvested under any alternative was the second highest risk to fish habitat. This risk increased as the number of acres harvested increased.

3. Allocation of reserves free of timber harvest reduce the risk to fish stocks. The panel recommended that the most effective protection of fish habitat would be reserves that included entire watersheds rather than only parts of watersheds.

4. Results of watershed analysis may affect management decisions. The panel recommended that a watershed analysis be conducted before decisions are made on how management activities would be applied on the ground.

5. Timber harvest activities in the upper reaches of watersheds where fish do not occur may affect habitat. The panel pointed out that protection of these areas would help maintain and protect fish habitat farther downstream. Timber harvest in these areas is especially important in affecting the rate and amount of wood and sediment delivery.

Rapid declines of salmon populations in Washington, Oregon, and California were brought about in part by loss of freshwater habitat from dams and watershed abuse.

Restoration of those populations, if that is even possible, will involve, in the words of Moyle and Cech (2004), "thousands of streams and rivers, millions of people, huge sums of money, and immense political and cultural will." If the lessons of this tragic loss in a neighboring region can guide future actions, Southeast may be able to maintain the anadromous fish populations so vital to its economy, communities, wildlife, and natural systems. The outcome is not limited only to economics and community survival, though these concerns are important enough. Willson and Halupka (1995) commented on the far-reaching issues associated with the health of anadromous fish in Southeast:

> "A change of perspective—to actively include the wildlife participants in the interaction—is long overdue. Variation in anadromous fish populations can have major effects on the productivity, phenology, and

metapopulation dynamics of wildlife and hence on regional biodiversity… Recognition of the keystone nature of anadromous fish populations should be incorporated into ecosystem-based plans for land management, fishery harvest, and conservation."

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