Wild Trout in Alaska—Now and Future

Norval Netsch and Robert E. Putz

ABSTRACT

Alaska has an abundance of pristine water and indigenous trout. Developmental activities have and will continue to impact fish habitat. Recent legislation has significantly impacted land ownership and has led to increased conflicts between users. Public opinion can influence decisions that determine the protection given to Alaska's wild trout for future generations.

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Alaska is sometimes referred to as the Last Frontier with good justification. Nowhere in the United States are there more waters containing more wild trout than are found in Alaska. Four million ha of inland waters and 53,000 km of shoreline are a water base of staggering proportions.

These waters support a statewide total of 21 species of trout (Salmonidae). Of these, 20 species are wild trout indigenous to Alaska. The brook trout (*Salvelinus fontinalis*) is a non-native which was initially introduced to southeastern Alaska in 1920 and is now naturalized (MacCrimmon and Campbell 1969). Fishermen pay up to $3000 per week for world-class trophy fishing in a relatively uncrowded setting available in Alaska. All of the indigenous species have healthy, self-supporting populations in many separate waters that have never received introductions or transplants by man.

The most popular and widely distributed species are rainbow trout (*Salmo gairdneri*), Arctic grayling (*Thymallus arcticus*), Arctic char (*Salvelinus alpinus*)/Dolly Varden (*Salvelinus malma*), and five species of Pacific salmon. Also, cutthroat trout (*Salmo clarki*) are abundant in southeast Alaska, lake trout (*Salvelinus namaycush*) occur in most regions of the state, and inconnu (*Stenodus leucichthys*) are found in western and interior Alaska and are called the tarpon of the north by some fisherman.

However, factors that result in impacts to fish populations and habitat may cause Alaska's wild trout resource to follow the same dismal history of many areas in the Lower 48. The foremost of these is the development of Alaska's energy, mineral, and renewable resources as well as the indirect impacts associated with population growth and the inevitable spinoffs.

Another factor which has a bearing on the future of wild trout in Alaska are the many-faceted public attitudes in a last frontier atmosphere. Vast, pristine areas of untapped resources offer many choices of what is done, how things are done, and what is not done. Federal legislation and reactive state decisions over the past 15 years have significantly changed Alaska. Public opinion can and must influence future changes which may be even more significant than past activities. There are many parallels between development in Alaska now and what happened in the Lower 48 a century ago. The difference is that Alaska still has the time and opportunity to avoid some of the mistakes of the past.

***Norval Netsch** was a fishery biologist and Robert Putz was regional director with the U.S. Fish and Wildlife Service in Anchorage, Alaska when they authored this paper. Dr. Putz recently retired from the Service to his farm in West Virginia. Mr. Netsch also recently retired and is going into private business in Missouri.*

Pressures on Wild Trout in Alaska

Habitat

The perception of habitat degradation problems in Alaska usually differs with the observer's experience and point of view. To some, the fact that Alaska still enjoys extensive pristine areas is reason enough not to be concerned with habitat modification when it does occur. Others have the view that since Alaska is the last place where large areas are still pristine, it should be kept that way and little or no habitat destruction should be tolerated. These opposing positions have served as a balancing mechanism and reality, in terms of actions taken, is somewhere in between.

Virtually all developmental activities impact aquatic habitat regardless of the site of immediate direct disturbances. The water cannot be separated from the watershed. Specific data on the amount of aquatic habitat that has been or will be impacted is currently unavailable. However, it is anticipated that over 2.5 million surface ha will be impacted by seven categories of developmental activities for the period 1983–2003 (Table 1).

The amount of water within this area which may be impacted is unknown. The only way it can be described at present is that a lot of fishery habitat will be involved. How these activities can impact fishery habitat has been described elsewhere, but some of special concern in Alaska are listed below.

Gravel Removal. Few developments in Alaska can be made without gravel. Most roads, drilling pads, and construction sites require 1 m or more of gravel to insulate against thawing of the underlying permafrost. Offshore islands commonly used in the Beaufort Sea are entirely built from gravel. Simple cut and fill cannot be used in most of the state and hundreds of millions of cubic meters of gravel is required. Some upland sites are available, but the common practice of mining in river flood plains is likely to continue indefinitely. The impacts of this have been studied in Alaska (Woodward-Clyde Consultants 1980).

Table 1. Anticipated surface areas impacted by selected developmental activities in the period 1983 to 2003 in Alaska. From data assembled by the Habitat Resources Program, U.S. Fish and Wildlife Service, Region 7, and based on various published and unpublished reports and professional judgement.

Activity	Surface Hectares	
	Direct Impacts	Direct plus Indirect Impacts
Oil and Gas	264,700	661,700
Minerals	205,800	596,900
Urbanization	160,500	523,500
Agriculture	242,800	291,400
Forestry	152,000	273,600
Transportation	39,900	131,700
Hydropower	37,100	59,300
Total Acres	1,102,800	2,538,100

Siltation. Many activities cause siltation, but none in Alaska has such immediate and obvious impacts as placer mining. During early 1984, the U.S. Environmental Protection Agency received about 450 applications for draft National Pollutant Discharge Elimination System (NPDES) permits for mines which have a sluce loading capacity in excess of 15.3 m^3 per day. These permits were expected to be issued in final form by June 1984, and will be good for a 3-year period. Since there is an unknown number of miners operating without a permit, and smaller mines do not need permits, the total number of mines actually in operation and the total sluce capacity of all placer mines is unknown. An indication of the significance, however, is that in 1981, over 27,400 new mining claims were filed and exploration expenditures were $65–76 million annually during the 1979–1981 period (Tuck 1984).

It is well known that some mines cause considerable amounts of silt to enter streams. Studies recently completed by the Alaska Cooperative Fishery Research Unit at Fairbanks concluded that mining caused as much as 1700 MT per day of additional sediment in Birch Creek during periods of high flows (Van Niewenhuyse 1980). In addition, these studies confirm findings reported in other areas that, compared to unmined streams, mined streams have higher settleable solids, lower specific conductance, lower alkalinity, lower hardness, more cementing of the bottom materials which interfered with intra-gravel flows (in Birch Creek the groundwater was nearly devoid of dissolved oxygen), and lower microinvertebrate densities. In was found that fish moved out of stream areas receiving mine effluents, thus eliminating from use much stream habitat.

Water Withdrawals and Flow Changes. While Alaska appears to have an abundance of water in the summertime, some areas could be classified as desert. Most of southeast Alaska receives more than 500 cm of precipitation annually, Anchorage receives about 50 cm, and the North Slope receives less than 25. In some areas, surface runoff ceases entirely during the winter and, in many watersheds, there are few or no subsurface sources to provide a base flow. This becomes most acute in the Arctic where ice typically becomes 1.8 m or more thick. By late winter, many rivers have liquid water only in deep isolated pools and some streams are frozen solid. Isolated springs frequently become critical overwintering areas for fish. Energy exploration and other activities require liquid water and also depend on the scarce supplies available. Domestic water supplies in several areas of Alaska are not sufficient to meet current or projected demands. Several villages have experienced water shortages during winter for many years, and the rapid population growth of Anchorage is causing a demand that will soon exceed the present supply. A detailed discussion of water problems in the Arctic is found in Wilson et al. (1977).

The hydroelectric potential of Alaska staggers the imagination of even the most zealous engineer. Several huge projects have been proposed (and defeated) including the Rampart Dam on the Yukon River, which would have created an impoundment about the size of Lake Erie.

Under active consideration is a two-dam complex on the upper Susitna River to supply power to south central Alaska and Fairbanks. This proposal would significantly modify the flow regime of the Susitna River and studies are underway to predict what the impacts on the fishery and other resources may be. Through careful site selection, several completed dams have not impacted any significant fisheries. Some dams are upstream of salmon migrations thus avoiding creation of a barrier. In one case, Terror Lake on Kodiak Island, detailed instream flow assessments were made and flow recommendations to protect fish were incorporated into the final designs—an example of good management which involved the cooperation of developers, environmentalists, and government.

Wetland and Streamside Encroachments. Alaska is blessed with an abundance of wetlands and streams. As developments occur, it is impossible to avoid encroachment, and as the human population grows, the problem becomes magnified. Drain and fill of wetlands is occurring at a rapid pace in the populous south central area. Alaskans love the outdoors and recreational cabins are very popular. In those areas where waterfront property is accessible by road, streamside "urbanization" is rapidly spreading. The most popular river in Alaska, the Kenai, is literally lined with cabins and some permanently occupied houses. Many of these structures are on the streambank and have developed dikes, docks, levies, and canals to protect or enhance their property. If this continues, man will gradually destroy the very thing he wants to enjoy—the river and its tremendous fishery.

Harvest

As human population increases, more people in more user groups are placing more demands on a finite fishery resource. Managers and the public must realize that the quantity harvested or qualities associated with the fishery, or both, will change. An essential factor in the management equation is the capability of Alaska waters to produce resident fish. The fact that some waters may, at times, produce a fish every cast, and that there are areas where 4.5 kg rainbow trout are common creates a dangerous illusion of universal abundance and productivity. Many of these are relatively small areas where fish are concentrated for feeding, spawning, or overwintering.

Much of the illusion of abundance is due to salmon spawning runs that can involve tremendous, concentrated numbers of fish. Many of the freshwater hotspots for rain-

bow trout and some other resident species are areas that are supported by salmon as a food (including nutrient) base.

Many game fish species feed on salmon eggs, flesh from salmon carcasses, and/or juvenile salmon. Decomposed salmon carcasses then add nutrients to the entire system. Waters fed by this salmon food base are generally very productive for resident species compared to waters that do not have salmon. Also, overall production of inland waters of Alaska that do not have salmon is relatively low when compared to waters elsewhere that have higher temperatures and longer growing seasons.

In nearly all cases, growth rates of fish in Alaska are slow and most species are long lived. For example, grayling may be 16 years old (Craig and Poulin 1975), lake trout as old as 35 (Bendock 1982), and rainbows might reach 13 years old (Russell 1974).

Commercial Fishing

Commercial fishing has been an important part of Alaska's economy for over 50 years. The 1981 catch was over 113 million salmon and collectively weighed 277,813,200 kg for which fishermen were paid over $398 million (ADFG 1984). The value and tradition of the commercial fishing industry has led to a powerful lobby to protect their interests.

The State of Alaska has established escapement goals for salmon on most major streams and carefully monitors the catch and escapement to adjust regulations to meet these goals. The North Pacific Fishery Management Council manages the fishery outside state waters to the 322-km limit. Although most fishery managers consider Alaska salmon stocks in good shape, there are unresolved problems between the United States and Canada, particularly regarding chinooks.

The documented commercial take of trout and char in Alaska was 9,980 kg in 1981. The incidental catch of steelhead is of particular concern to anglers, but no reliable figures are available on the magnitude of the problem. Unconfirmed reports indicate that incidental harvest of steelhead could become a problem in a few cases where there is active commercial fishing near stream mouths when steelhead begin their runs.

Sport Fishing

In 1982, 293,011 anglers fished 1,623,090 days and harvested 2,828,706 fish in Alaska (Mills 1982). Since 1977, the first year of statewide sport fish surveys, the number of anglers has increased at an average annual rate of 8 percent. However, between 1981 and 1982, the number of resident anglers increased 18 percent and non-resident anglers increased 17 percent. Overall, 72 percent of the anglers are residents.

Compared to fishing pressure in many other areas, this is relatively light on a statewide basis. In fact, there are many areas that are seldom if ever fished, and some that are subjected to very heavy pressure. The latter situation usually occurs in areas accessible by road from Anchorage where about half of Alaska's population resides. Of the statewide totals, 70 percent of the angler days were expended in the south-central region and one river alone, the Kenai River, supported 14 percent of the state total. Streams in this populated area frequently have elbow to elbow fishermen—not quite the picture of Alaska fishing sometimes seen in magazines.

The monetary value of sport fishing in Alaska is unknown, but actual expenditures by sport fishermen on the Copper River (a tributary to Lake Iliamna) converted to an average cost of $40.04 per trout caught and $243.01 per trout retained in 1972 (Siedelman, Cunningham, and Russell 1973).

Subsistence Fishing

Subsistence fishing has long been an important part of the lifestyle of many native Alaskans as well as non-natives living in remote areas. Since early statehood, Alaska has demonstrated its concern for continuation of subsistence opportunities (Kelso 1981). In anticipation of the Alaska National Interest Lands Conservation Act (ANILCA), a statuatory priority for subsistence uses of Alaska's fish and game resources was enacted in 1978.

Federal concerns about continuation of the opportunity for subsistence uses were reflected in Title VIII of ANILCA which was passed in 1980. Section 804 of ANILCA provides that ". . .the taking on public lands of fish and wildlife for non-wasteful subsistence uses shall be accorded priority over the taking on such lands of fish and wildlife for other purposes." The act does recognize the need to manage fish and wildlife under "sound management principles," but it is clear in this law as well as in the Alaska subsistence law that subsistence needs will be the highest priority of consumptive uses. Fish make up about 80 percent of the subsistence harvest.

Although there are numerous reports of subsistence use by individual villages or regions, precise information on a consolidated statewide basis is unavailable. In upper Cook Inlet, where the most serious controversies have developed, there were 1,331 subsistence salmon permits issued in 1980 with a reported catch of 14,775 salmon (Braund 1982). Implementation of these laws is an extremely complex political, social, cultural, and biological problem and is discussed by Kelso (1982) and in an undated compilation of papers by Langdon.

Growing Conflicts Between User Groups

For many years, Alaska enjoyed the luxury of enough fish to keep most people happy with the exception of low cycle years of salmon. As population and demands for more fish increased, scattered incidents of discontent began to develop, particularly in the upper Cook Inlet area. Sport fishermen began a battle for a larger share in the allocation of salmon with commercial and subsistence fishing interests. The 1983–84 Fishery Board meetings provided a forum for the most heated exchanges between user groups ever held for allocation of fish in Alaska. The Fishery Board (consisting of seven people appointed by the Governor) proceeded to set annual regulations, some of which are being challenged in court. Sport fishing groups challenged the Governor's appointments to the Board, arguing that sport fishermen were under-represented (initially only one of the seven members represented sport fishermen; this was subsequently increased to two).

Major federal legislation has greatly impacted the future of Alaskan waters. The first was the Alaska Native Claims Settlement Act (ANCSA) of 1971. This act provides for the transfer of 17.8 million ha of federal land to private ownership by the various native village and regional corporations.

The land selected by the natives included lands around

their villages, and these were often located at premium fishing sites. Once conveyed to the natives, these lands are now under their control which means they may regulate access and use. Many lodges now pay fees for the privilege of fishing in waters once in public ownership. One prime example is the world-renowned Karluk River on Kodiak Island. This famous steelhead, chinook, sockeye, and coho stream is totally owned, including the streambed, by the Koniag Regional Corporation.

Of major importance, ANCSA was responsible for ANILCA, which set aside approximately 50.6 million ha of land in Alaska as National Parks, Wildlife Refuges, and Wild and Scenic Rivers. It also provided wilderness areas and other protective designations. However, as with all complex legislation, there were many compromises in ANILCA. One of the most controversial is Title VIII, which gives subsistence uses priority over other consumptive uses of fish and wildlife in Alaska. The controversy will continue for years as many Alaskans feel they have the "right" to obtain at least some of their food from the naturally occurring fish and wildlife resources. The definition of subsistence users has undergone much debate and is still not clear. Conflicts have occurred in several areas involving steelhead, chinook, and sockeye salmon. Specific subsistence and personal-use fisheries have been established but much remains to be done, and the problem grows.

Titles X and XI of ANILCA also cause concern among fishermen. Title X provides for oil and gas leasing and development on federal lands in Alaska including National Wildlife Refuges. On refuges these activities must be compatible with the purposes for which the refuge was established. Title XI deals with hydroelectric projects, transportation corridors, and access on conservation system units. The actual impact on fishery resources depends on many factors, but the fact that these provisions are in the legislation has caused continued outcries from some environmentalists.

Hatcheries

Commercial fishing for salmon in Alaska began in the late 1800s and by 1900 several salmon processing companies had built hatcheries to enhance production. The real momentum for development of hatcheries, however, came in the early 1970s during several years of low salmon runs and a pending "boom" in wealth brought about by the discovery of oil at Prudhoe Bay. In 1971, the Alaska legislature created, within the Department of Fish and Game, a Division of Fisheries Rehabilitation, Enhancement and Development (FRED) to plan and implement a program that ensures the perpetual and increasing production and use of Alaska's fishery resources.

Appropriated funds and bond issues approved by the voters provided for rapid development of an ambitious program. In 1983, FRED had 20 salmon and trout hatcheries in operation, released nearly 260 million fish, and had a return of nearly 2.3 million fish (McMullen and Hansen 1984). In addition, FRED administers permits associated with a private nonprofit hatchery program representing seven regional aquaculture associations which, in 1983, had 17 hatcheries in operation that released over 170 million fish.

Although the bulk of the above production is made up of five species of Pacific salmon, there were 1,250,600 rainbow trout, 57,400 steelhead, and 1,355,500 Arctic grayling planted in 1983. During that same year, sport fishermen caught an estimated 18,800 fish which resulted from FRED activities.

The Outlook

There is little question that pressures on Alaska's fishery resources will increase. The national need for energy and minerals will necessitate further development of non-renewable resources, remote areas will be made accessible by new roads, expansion of agriculture will occur in spite of early questionable economics, more logging will take place, commercial salmon fishing will continue to be an important part of the economy and will expand to other species. All of this will cause population growth which will result in accelerated urbanization and increases in the number of sport fishermen. Reduced dependence on foreign energy sources, concerns about national and state economies, and the relative health of local economies in the Lower 48 compared to Alaska will all play a role in the determination of how quickly these and other developments will take place.

Several significant recent pieces of legislation will continue to have a profound influence on Alaska's wild trout and the fishermen who enjoy them. Land ownership patterns and access to prime areas will change as more lands are conveyed to private ownership. Battles over subsistence priority provisions are likely to continue for many years. The question of native sovereignty is still being debated. Public use policy and regulations on the 50.5 million ha of national parks, preserves, and wildlife refuges in Alaska will vary with different interpretations made by different administrations. Differing opinions by special interest groups will result in lawsuits leaving many management decisions to be decided by the courts, not professional land and resource managers. This is one of the reasons why Alaska reports the highest number of lawyers per capita in the nation outside of Washington, D.C.

Other signs for wild trout and their habitat are promising. Authorities already exist for the appropriate state and federal agencies to mitigate habitat degradation—provided they are capable, willing, and have the resources to do so. The many agencies that have responsibilities for habitat protection have a good track record of working together in an attempt to reach acceptable solutions to problems. A special task force made up of many special interest groups and governmental agencies made recommendations to the Governor which resulted in legislation intended to resolve the complex problems facing the Kenai River—and to preserve its priceless fishery. Another example of successful cooperative effort was the formulation of a joint fish and wildlife advisory team which monitored construction of the Trans-Alaska Oil Pipeline and was used as a case study by Morehouse, Childers, and Leask (1978).

Recognition of the high value of the sport fishery and interests in maintenance of "quality" fishing is increasing. Andrews (1980) described some important concepts for wild trout management and discussed the 1966 establishment of special regulations for quality fishing in selected waters in the famed Bristol Bay area. Those basic ideas have since progressed and have been expanded by several organized sport fishing groups which are finally gaining sufficient strength and momentum to influence policy and regulations. The Alaska Department of Fish and Game has formed a sport fish planning group made up of individuals and representatives of several sportsmen's groups to develop a

rainbow trout management policy for submittal to the Fishery Board for approval.

Ideas relatively new to Alaska, such as drastic reductions in bag limits, artificial lure only regulations, and catch-and-release, which didn't have a chance of widespread acceptance even 3 years ago, were adopted for several accessible waters at the 1983–84 Fishery Board meetings. Many of the high quality fishing guides and lodges have a catch-and-release policy for most resident species and steelhead. Most now realize that providing quality fishing on a continuing basis is more important than allowing their clients to take home large quantities of fish meat.

Although Alaska has and will continue to have a significant hatchery program, concerns about genetic integrity and protection of wild stocks are increasing. The FRED Division has on-going programs to study proposed new hatchery sites, to determine best egg sources, to evaluate results, to protect genetic diversity, and to protect against spread of parasites and diseases. Early use of out-of-state egg sources has changed to strictly Alaska sources, and in many cases, eggs come from the same system where stocking will occur. Management problems associated with mixed wild and hatchery stocks are potentially serious in some cases and will be difficult to resolve. Several agencies are conducting research, but answers may be years in coming. The misconception that hatcheries are the solution to fish shortages is changing to the reality that hatcheries are but one tool which must be properly applied to fisheries management.

Alaska is a challenging and exciting place. In spite of some areas of serious habitat degradation, which started in the gold rush days, and continued degradation resulting from mining, logging, energy development, and other activities since, the biggest challenge is yet to come—protecting the remaining huge amounts of pristine waters and the wild trout they can support for future generations. The excitement is knowing it is very possible. The future of wild trout in Alaska rests with public opinion and the responsiveness of the appropriate governmental agencies and landowners.

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