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Salmon Hatcheries in Alaska—Plans, Permits, and Policies Designed to Provide Protection for Wild Stocks

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Abstract.—The hatchery program in Alaska was initiated in the 1970s to rehabilitate depleted salmon fisheries. It was predicated on protecting wild salmon stocks through development of rigorous permitting processes that include genetics, pathology, and management reviews, policies that require hatcheries to be located away from significant wild stocks, use of local brood sources, laws that give priority to wild stocks in fisheries, requirements for marking hatchery fish, and requirements for special studies on hatchery/wild stock interactions. The program is comprised of state, federal and private nonprofit (PNP) hatcheries. Currently, 16 of 26 operating hatcheries are run by PNP aquaculture associations. In 2002, hatcheries accounted for 23% of the salmon harvested commercially. Hatcheries produce approximately 1.5 billion juvenile fish annually, the majority of which are pink salmon *Oncorhynchus gorbuscha* and chum salmon *O. keta*. Whether hatchery production adversely impacts wild stocks is debated in Alaska. Interactions between hatchery-produced and relatively smaller populations of wild salmon are unavoidable. However, obvious, adverse impacts from hatcheries on wild salmon are not evident. The success of the Alaska hatchery program can be attributed to the development of laws, plans, and policies that require continued protection of wild stocks and to favorable environmental conditions in the North Pacific Ocean.

Introduction

The hatchery program in Alaska was initiated in the early 1970s to contribute to the rehabilitation of the state's depleted and depressed salmon fisheries. It was intended to supplement, not supplant, wild stock production. For this reason, numerous policies and regulations were promulgated to guide hatchery development and operations and to serve as safeguards for the maintenance of wild stocks. As evidenced by the dramatic increases in commercial harvests of wild salmon after the inception of the salmon enhancement program in 1971 (Figure 1), the salmon enhancement program does not appear to have significantly impacted the abundance of Alaska's wild salmon stocks.

Alaska has not repeated mistakes made in the Pacific Northwest, where habitat destruction, hydropower development, and use of hatcheries to replace damaged wild stock production have resulted in serious depletion of most salmon resources (Heard 1996, 1998; Beechie and Bolton 1999). The hatchery program in Alaska was predicated on the protection of wild stocks, and many of the formal policies and regulations that constitute the basis of this program were developed before most hatcheries were built. In Alaska, protection of wild salmon stocks is accomplished through (1) a rigorous hatchery permitting process that includes genetics, pathology, and fishery management reviews; (2) policies that require hatcheries to be located away from significant wild stocks; (3) use of local brood sources; (4) legal mandates that require wild stocks to be given priority in fishery management; (5) requirements for tagging/marking of hatchery fish; and (6) as necessary, requirements for special studies on hatchery/wild stock interactions.

These policies and procedures were crafted specifically to avoid the kinds of direct and indirect genetic effects from interbreeding, disease transfer, fishing mortality, and competition described by Campton (1995). Many of the same requirements put in place for the development of the hatchery program in Alaska are also being used by the Hatchery Scientific Review Group (HSRG 2003) in a hatchery reform project for the state of Washington. This group made the following recommendations: (1) take a regional approach to

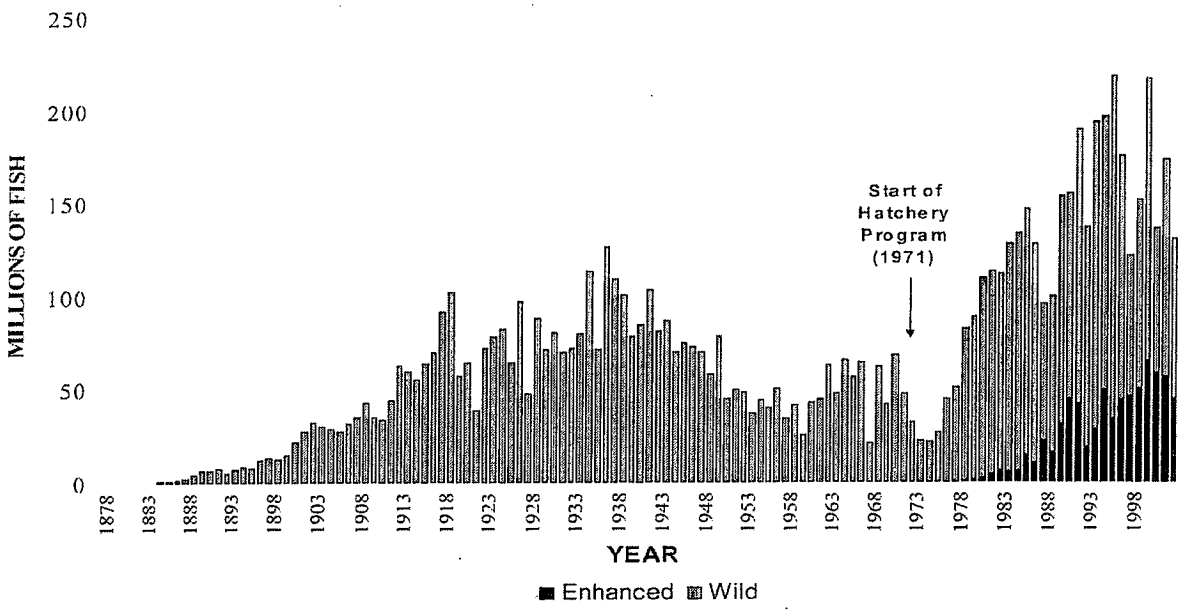

Figure 1. Commercial fishery harvest of wild and enhanced salmon in Alaska, 1878–2002.

hatchery programs; (2) measure success in terms of contributions of adult fish to fisheries rather than production of juveniles; (3) require regular monitoring programs; (4) use locally adapted brood stocks; (5) take eggs throughout the run to maintain return timing; (6) develop specific spawning protocols; and (7) take into account both fresh and marine carrying capacities in determining production goals. These procedures have been in place in Alaska for more than 20 years.

History of the Hatchery Program

Alaska's current hatchery program has evolved in three phases. Initially, the state legislature authorized construction of state-owned and operated hatcheries as well as research projects related to fisheries enhancement. Initial funding for hatchery construction was provided by the legislature in 1968. In 1971, the legislature authorized creation of the Division of Fisheries Rehabilitation, Enhancement and Development within the Alaska Department of Fish and Game (ADF&G) to be responsible for developing the state's salmon hatchery system; at its peak in 1983, 20 state hatcheries were operating (Figure 2). Additionally, the federal government has operated two research hatcheries in southeast Alaska for more than 50 years; since 1980, it has also funded the operation of a tribal hatchery at Metlakatla.

The second phase of contemporary hatchery development in Alaska began in 1974 with passage of the Private Nonprofit Hatchery Act. This legislation, which was developed and refined over several legislative sessions, was intended to allow private-sector, nonprofit aquaculture corporations to construct and operate salmon hatcheries. Privately operated hatcheries were considered by some legislators to be more fiscally efficient than those operated by the government. The intent of the act was . . . "to authorize the private ownership of salmon hatcheries by qualified nonprofit corporations for the purpose of contributing, by artificial means, to the rehabilitation of the state's depleted and depressed salmon fisheries. The program shall be operated without adversely affecting natural stocks of fish in the state and under a policy of management which allows reasonable segregation of returning hatchery-reared salmon from naturally occurring stocks" (Section 1 Chapter 111 Session Laws of Alaska 1974). The nonprofit hatchery corporations had the advantage of being allowed to harvest and sell a portion of the returning fish to pay for the costs of building and operating hatchery facilities. Two categories of private nonprofit (PNP) hatchery corporations were authorized by the state legislature: (1) those representing all user groups, especially all commercial fishermen, in a designated geographic area and recognized by ADF&G as a regional aquaculture association, and (2) those formed by unaffiliated groups of individuals to construct and operate hatcheries for the benefit of all users. This second category is generally referred to as the nonregional hatchery corporations. By 1987, permits had been issued for the operation of 24 PNP salmon hatcheries (Figure 2).

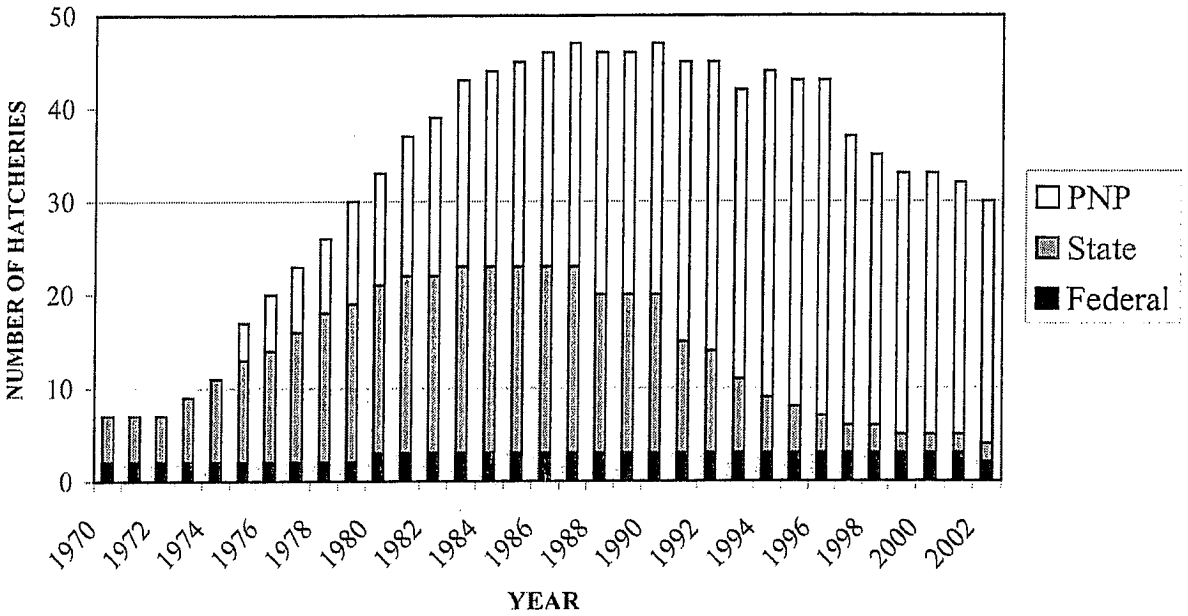

Figure 2. Number of salmon hatcheries in Alaska, 1970–2002.

The third phase in the evolution of Alaskan hatcheries began in 1988 with authorization from the state legislature to contract state hatchery operations to PNP hatchery corporations. The number of state-operated facilities declined substantially over the next 10 years (Figure 2) as they were either contracted or closed. The state now operates only 2 of its remaining 13 hatcheries; the other 11 are operated by PNP corporations. Aquaculture associations manage 16 of the 26 PNP hatcheries operating in Alaska in 2003, including nine state-owned facilities.

Policy Development

Beginning with the inception of Alaska's hatchery program, various policies, statutes, and regulations were instituted by ADF&G, the legislature, and the Alaska Board of Fisheries to control hatchery development and, at the same time, protect wild stocks. Rigorous genetics and fish health policies were developed to guide the program. As evidenced by the fact that since the inception of the hatchery program Alaska's wild salmon harvests have been at all-time high levels (Figure 3), the development of the salmon enhancement program has been generally successful in supplementing, not supplanting, wild stock production.

Following legislative approval of the PNP hatchery program, ADF&G's *Genetic Policy* was initially formalized in 1975 to provide guidance for the state's enhancement program and to minimize adverse impacts on wild stocks; it was revised in 1978. The current revision (Davis et al. 1985) was developed by a team of scientists from ADF&G, PNP corporations, the University of Alaska, and the National Marine Fisheries Service who reviewed and updated the genetic guidelines presented in the earlier policy. The policy prohibited importation of live salmonids into Alaska, prohibited transplantation of stocks between major geographic regions of the state, provided criteria for evaluation of intraregional transplants that minimized the risk of interactions between hatchery and wild stocks, including provisions for establishing wild stock genetic sanctuaries, and required maintenance of genetic diversity by restricting use of a single donor stock to no more than three hatcheries and by requiring minimum effective population sizes for broodstock development at hatcheries. The policy represented a consensus of opinion at the time, and it was intended to be reviewed periodically to ensure that consistency with current scientific knowledge was maintained. Protection of wild stocks remains the principal objective of the policy. The *Background of the Genetic Policy of the Alaska Department of Fish and Game* (Davis and Burkett 1989) was completed in 1989 to discuss the basis for the policy and to demonstrate that the policy's objectives had been achieved.

The publication *Regulation Changes, Policies, and Guidelines for Fish and Shellfish Health and Disease Control* (Meyers et al. 1988) was compiled by the State Pathology Review Committee. This multi-agency group worked from 1985 through 1987 to develop changes in state regulations, new fish disease policies,

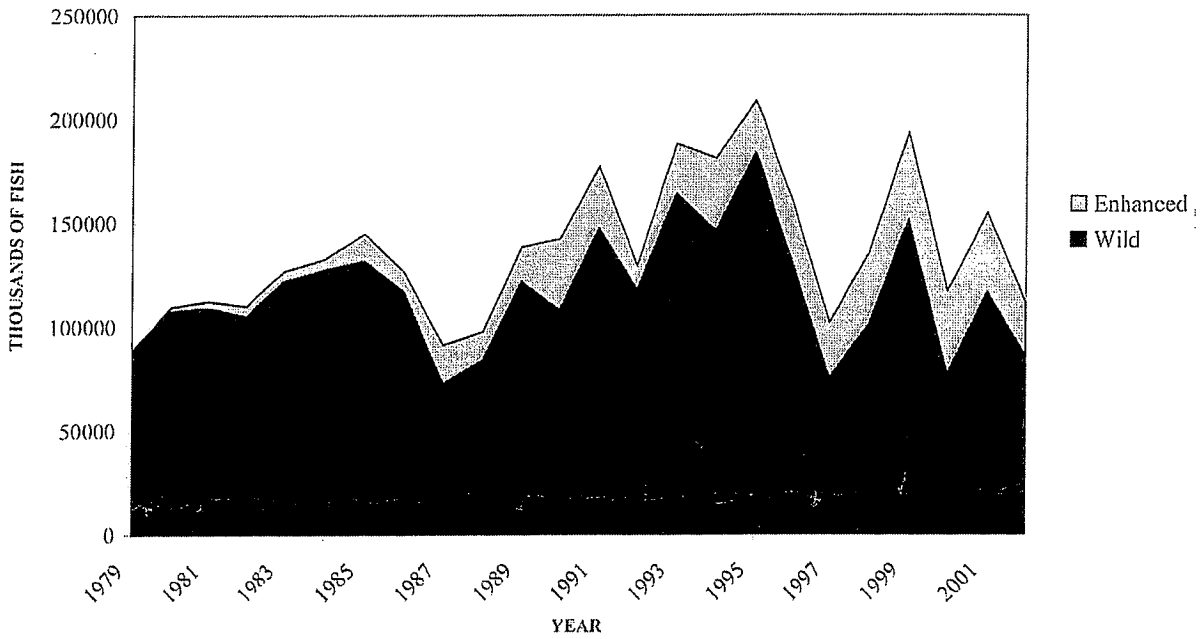

Figure 3. Commercial fishery harvests of wild and enhanced salmon in Alaska, 1979–2002.

and recommendations for maintaining finfish and shellfish health in Alaska. Its goal was to prevent dissemination of infectious diseases in fish and shellfish within and from outside the state without creating impractical constraints for aquaculture and other fisheries enhancement or rehabilitation projects. This document includes the department's sockeye salmon *Oncorhynchus nerka* culture policy, which was updated and published under separate cover (McDaniel et al. 1994). Meyers (2003) revised the 1988 policy to better reflect the current fish health program in Alaska.

The *Salmon Escapement Goal Policy* (Rosier 1992) provides the mechanisms for establishing biological escapement goals for wild salmon stocks to allow management of fisheries on scientifically based spawning stock levels that produce the maximum number of harvestable fish. The policy further supports Alaska's constitutional mandate to manage fishery resources on a maximum sustained yield basis. The department's policy to manage fisheries with a priority for protecting wild stocks was placed in statute (AS 16.05.730) by the legislature in 1992. The Alaska Board of Fisheries also incorporated this statute into its *Policy for the Management of Mixed Stock Salmon Fisheries* (5 AAC 39.220), making the conservation of wild stocks one of its highest priorities (along with sustained yield) for the allocation of salmon resources. The *Policy for the Management of Sustainable Salmon Fisheries* (5 AAC 39.222) was adopted by the Alaska Board of Fisheries in 2000 to provide guidelines for protecting wild salmon populations and the spawning, incubating, rearing, and migratory habitats they require. Guidelines for evaluation of salmon rehabilitation and enhancement projects are also included in this regulation.

The *Policy and Requirements for Fish Resource Permits* (Rosier 1994) was approved to replace an outmoded 1983 policy for issuing ADF&G scientific collecting and educational permits. This policy was developed by a departmental committee to provide a more detailed explanation to the public of the requirements for obtaining permits for the collection and/or transportation of live fish in any life stage to be used for scientific, educational, propagative, or exhibition purposes.

In Alaska specific statues and regulations were developed to govern the permitting and operating of the state's enhancement program. For example, regulations governing the transportation, possession, and release of live fish (5 AAC 41.001–41.100) established a permit system and requirements for inspections of fish, implemented reporting and control requirements for specific fish diseases, and prohibited importation of live fish for purposes of stocking or rearing in the waters of the state.

The Alaska salmon enhancement program has always concentrated on providing additional fish for harvest, rather than on wild stock restoration. Restoration has generally been unnecessary because wild salmon have not been endangered; however, if necessary, hatchery production could be used in the follow-

ing ways to assist in the restoration of naturally spawning salmon stocks: (1) to supplement the production of naturally spawning stocks of fish, (2) as a management tool to divert fishing pressure from wild stocks, (3) as a subject of research designed to understand both the effects of environmental parameters and the activities of humans on the survival of fish, and (4) in extreme cases, to prevent the immediate extinction of unique wild stocks.

Planning and Permitting

The following sections describe (1) the approach taken by Alaska to plan its salmon enhancement program, particularly the involvement of the private sector in the program; (2) the current magnitude of hatchery programs in the state; and (3) regulatory mechanisms now in place to guide and control development of Alaska's salmon enhancement program.

Regional Planning

The PNP hatchery program was initiated with requirements for the development of long-term regional comprehensive salmon plans to guide fisheries enhancement in Alaska (see Figure 4). The responsibility for these plans rests with the commissioner of ADF&G through regional planning teams (RPTs) composed of personnel from the department's fisheries divisions and representatives from fishermen's organizations (i.e., regional aquaculture associations). In regions where no aquaculture association has been formed, planning core groups representing ADF&G, fishermen, and other local governmental agencies were established to develop the plans.

Regional comprehensive planning in Alaska progresses in stages. Phase I sets the long-term goals, objectives, and strategies for the region. Phase II identifies potential projects and establishes criteria for evaluating the enhancement and rehabilitation potentials for the salmon resources in that region. In some regions, a Phase III in planning has been instituted to incorporate Alaska Board of Fisheries approved allocation and fisheries management plans with hatchery production plans. Salmon planning regions have been established for most of Alaska's coastline, as well as for the Yukon River drainage (Figure 5).

In addition to the development of comprehensive salmon plans, the RPTs also review all PNP hatchery applications, proposed alterations of existing permits, annual management plans for each hatchery operating in the region, and statutorily mandated annual reports from each permitted hatchery in the region. Each RPT develops criteria for project review and hatchery performance evaluation through its comprehensive salmon plan.

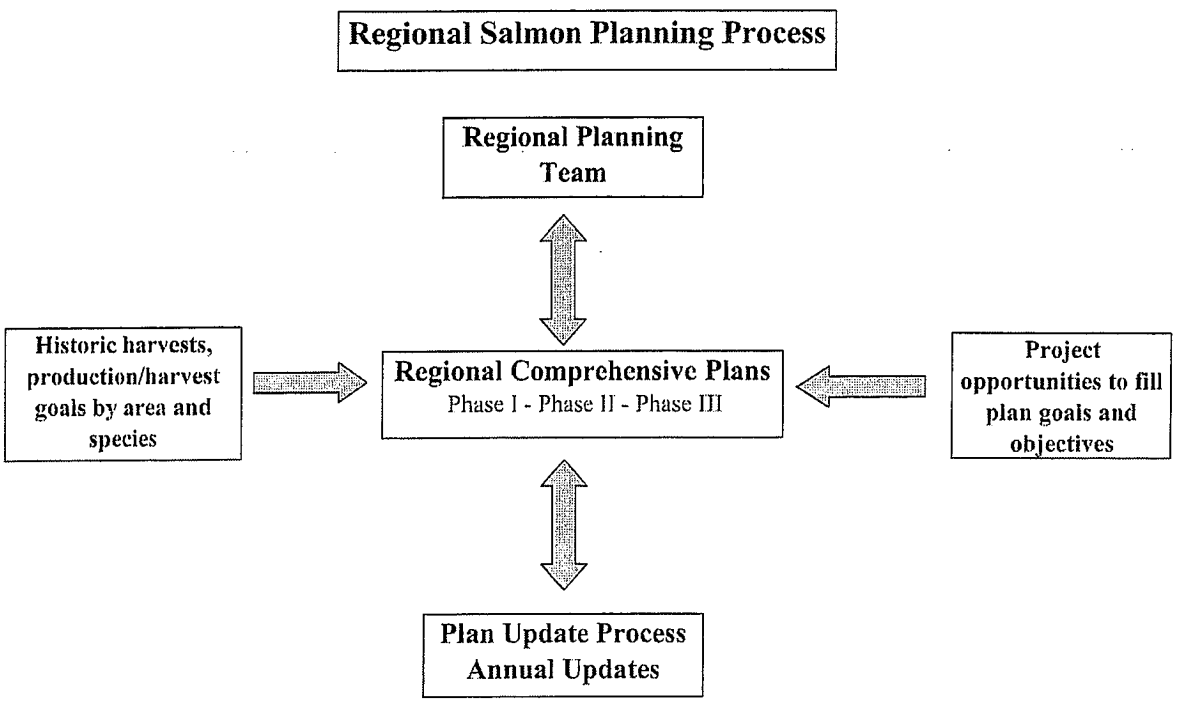

Figure 4. Regional comprehensive salmon planning process.

Hatchery Production

Hatcheries have played a major role in the enhancement and development of fisheries in Alaska. Hatchery contributions of adult salmon to commercial fisheries in Alaska grew from a few thousand fish in the mid-1970s to a high of more than 42 million in 1999. Hatchery production in 2002 accounted for 23.1% of the total salmon harvested in common property commercial fisheries (Farrington 2003). Hatcheries work well as a salmon enhancement tool; however, there are inherent concerns with, as well as documented benefits from, the hatchery program. Alaska's salmon enhancement program, particularly the use of hatcheries, has been closely monitored through its initial 30 years of success in producing fish. Hatchery production in terms of the numbers of salmonid eggs taken and juvenile fish released since 1975 is shown in Figure 6. Hatchery production peaked in 1995–1996 and has leveled out with annual production of approximately 1.5 billion juvenile fish. The percentage of eggs of each species incubated in Alaskan hatcheries in 2002 is shown in Figure 7.

The majority of Alaska's hatchery production is pink salmon *O. gorbuscha* and chum salmon *O. keta*. Species that generally require rearing in freshwater for a full year to the smolt stage (i.e., coho salmon, Chinook salmon *O. tshawytscha*, and sockeye salmon) make up 8% of total number of eggs taken. The numbers of fish that returned to hatcheries from 1975 to 2002 are shown in Figure 8. The total number of returning adults, including all types of harvests and escapements, peaked in 1999 at 71.2 million fish. With releases now relatively stable, the smaller return numbers for the last 3 years are most likely attributable to the inherent variability in marine survival of Pacific salmon *Oncorhynchus* spp. Marine survival of hatchery-produced salmon ranges from less than 1% to greater than 20%, depending on the species and year. The ADF&G uses the following planning assumptions for survival: 2% for pink and chum salmon, 3% for Chinook salmon, and 10% for coho and sockeye salmon.

Historic contributions of enhanced salmon to common property fisheries are shown in Figures 1 and 3. On a statewide basis, the overall percentage of enhanced salmon rarely has exceeded 25% of the total harvest (McNair 2001); however, for some species in some areas (e.g., pink salmon in Prince William Sound and chum salmon in southeast Alaska), enhanced fish now make up a majority of the harvest (see Figures 9 and 10). In such situations, ADF&G has required extensive marking of hatchery releases to enable in-season evaluation of the mix of wild and hatchery-produced fish in the commercial fisheries. Ocean carrying capacity studies initiated in 1995 to examine oceanic and biological factors responsible for marine

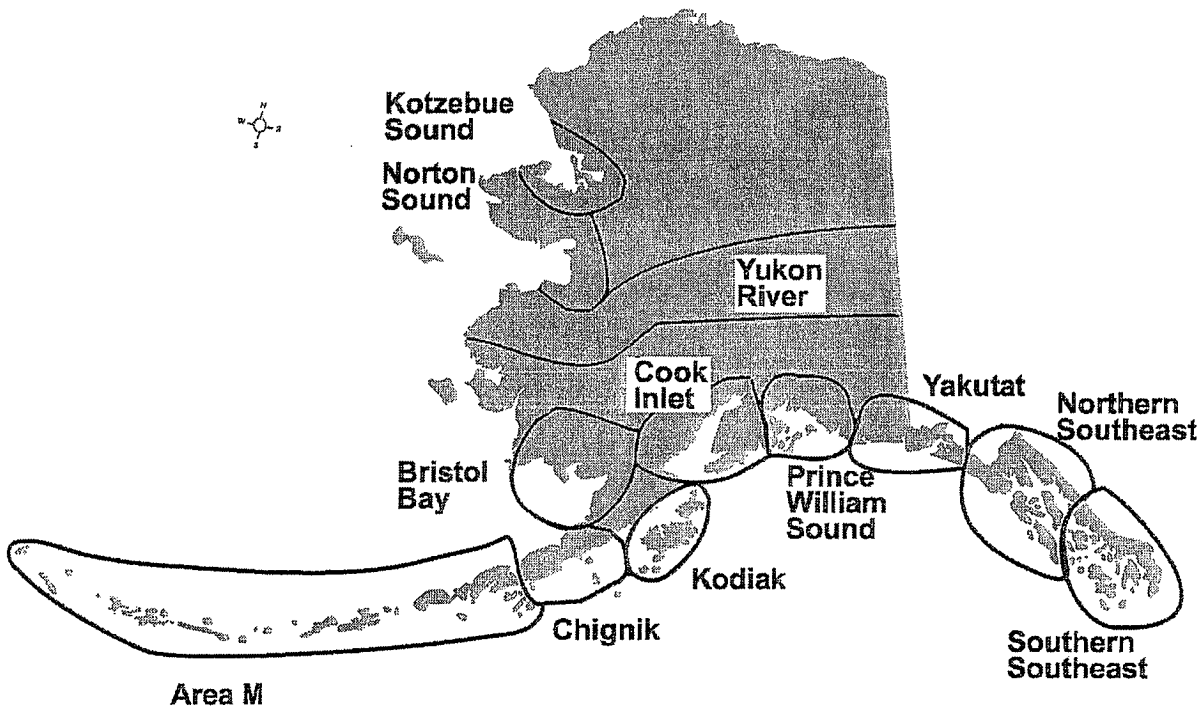

Figure 5. Map of Alaska with designated comprehensive salmon planning regions.

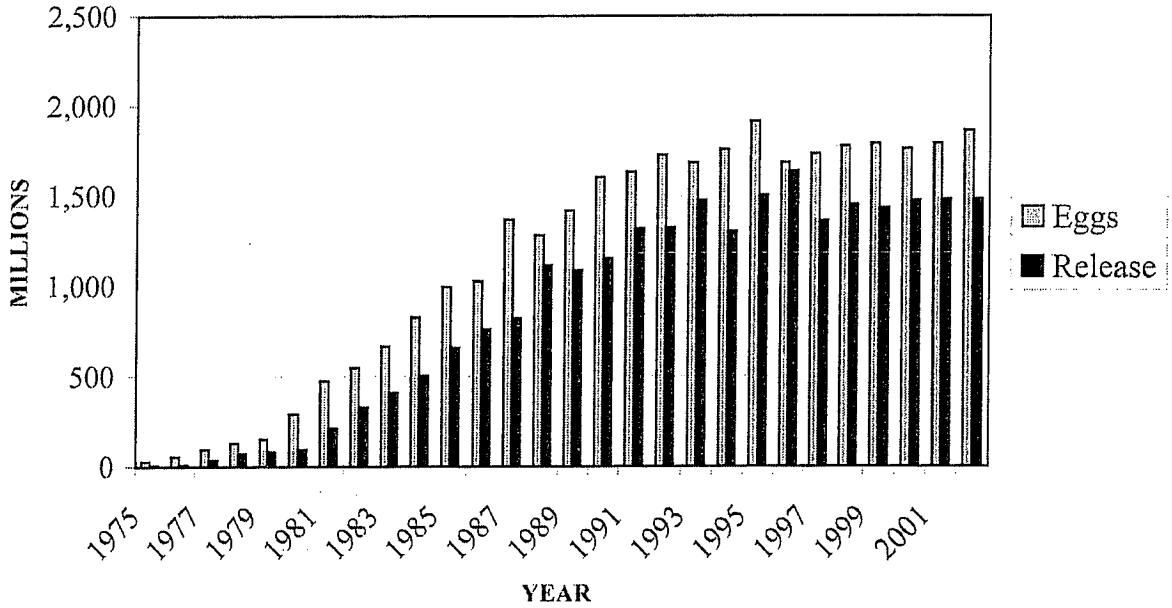

Figure 6. Numbers of eggs taken and juvenile fish releases from Alaskan salmon hatcheries, 1975–2002.

growth and survival of salmon were facilitated by thermal marks placed on the otoliths of hatchery-produced salmon (Orsi et al. 2000). Thermally marked salmon from hatcheries now provide information on the distribution and migration of salmon in both coastal and offshore areas of the North Pacific Ocean (Carlson et al. 2000; Farley and Carlson 2000). Studies on interactions between wild and hatchery-produced salmon through recovery of thermally marked otoliths are ongoing in Alaska.

Whether the current magnitude of hatchery production in Alaska is impacting wild stock production in the regions where it originates has been debated in Alaska, especially in relation to pink salmon production in Prince William Sound (Hilborn and Eggers 2000; Wertheimer et al. 2001, 2004). The most recent analysis by Wertheimer et al. (2004) suggests that variable conditions in the marine environment over time, rather than the number of hatchery fry, best explain the changes in wild stock production of pink salmon in Prince William Sound. Similar conclusions for the causes of salmon run failures in other

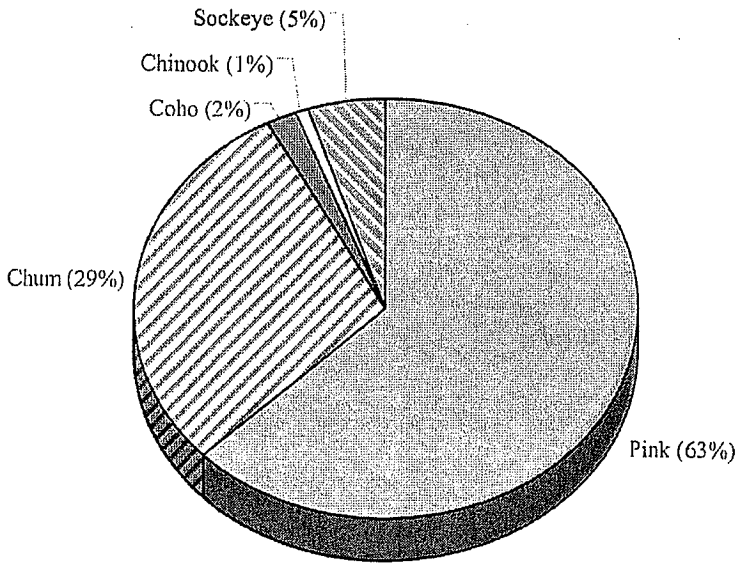

Figure 7. Percentage of eggs of each species of salmon taken for incubation in Alaskan hatcheries in 2002.

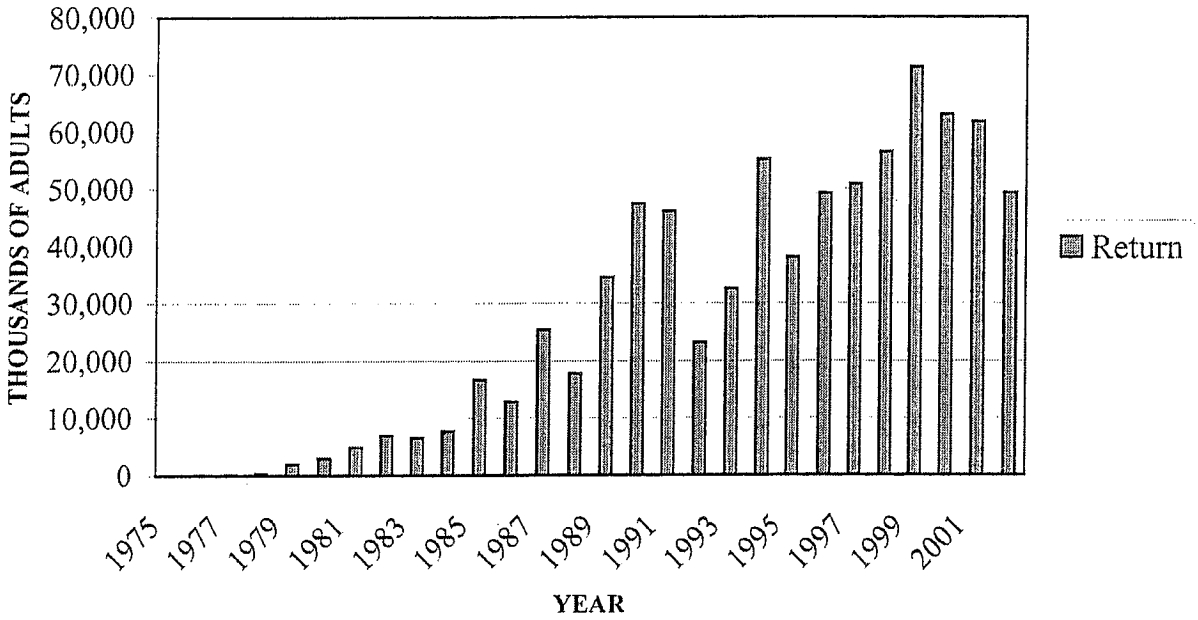

Figure 8. Numbers of adult salmon that returned to Alaskan hatcheries, 1975–2002.

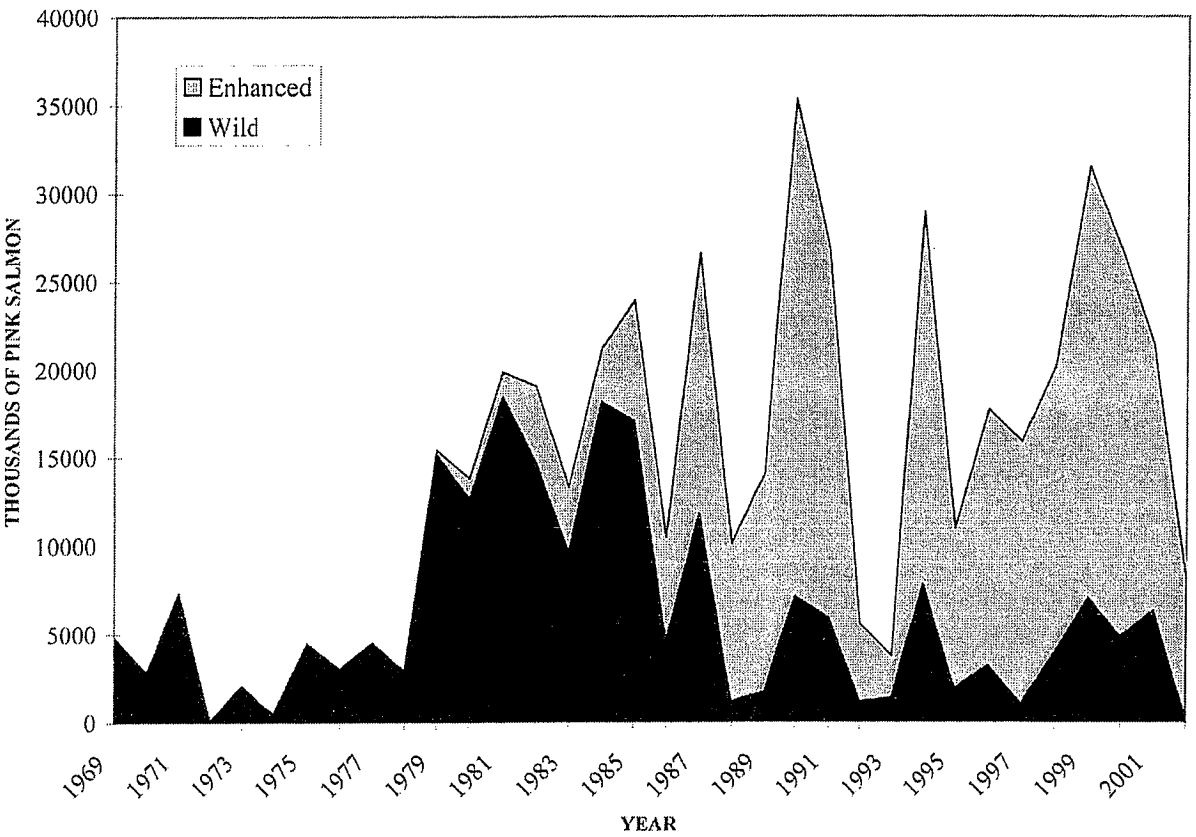

Figure 9. Commercial fishery harvests of wild and enhanced pink salmon in Prince William Sound, Alaska, 1969–2002.

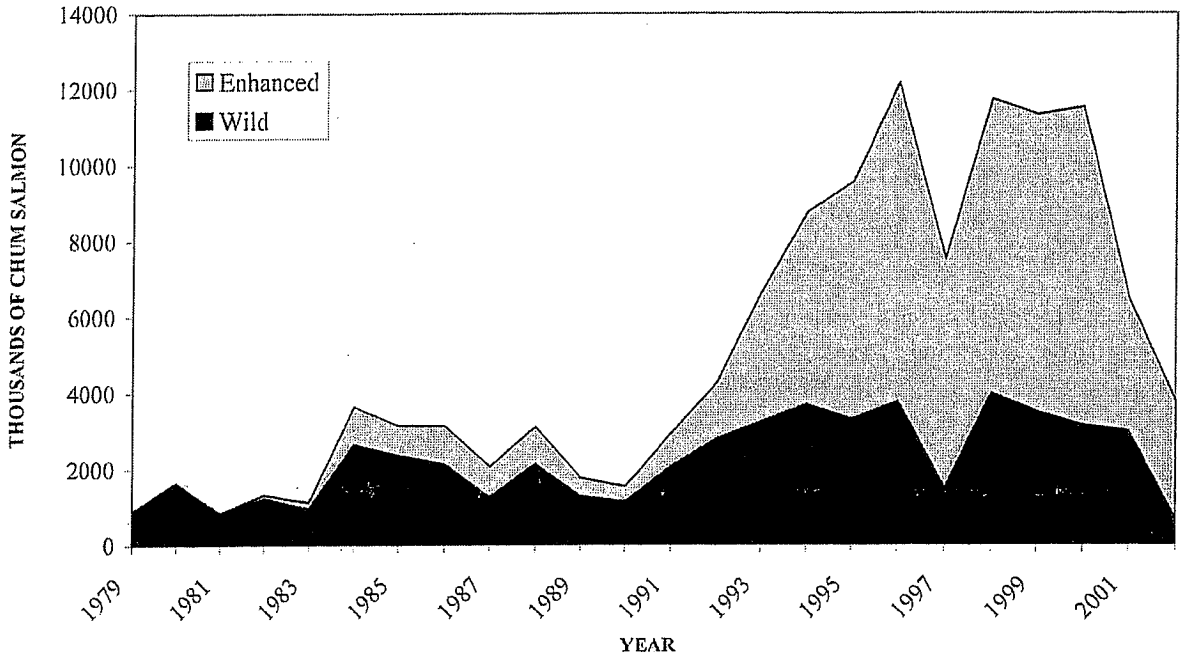

Figure 10. Commercial fishery harvests of wild and enhanced chum salmon in southeast Alaska, 1979–2002.

parts of Alaska were reached by Kruse (1998).

Interactions between hatchery-produced salmon and relatively smaller populations of wild salmon are unavoidable, especially in areas such as Prince William Sound where hatcheries produce most of the pink salmon harvested in commercial fisheries. In the immediate vicinity of these hatcheries, hatchery-produced pink salmon do stray into and spawn in wild stock streams. However, the hatcheries are not located near significant wild stocks; therefore, the observed straying of hatchery-produced fish into nearby small streams will not have a significant impact on the total pink salmon population. Such straying occurs more often in years when abundance of hatchery fish is high. In some years, returning hatchery salmon were so abundant that local fish-processing facilities were slow to handle the volume and flesh quality began to degrade. On at least two occasions when the supply was greater than the demand, carcasses of pink salmon that were surplus to the processing capacity in Prince William Sound were killed and disposed of in deep water. Although undesirable, this practice does remove surplus salmon from the spawning population before they stray into streams in the area of the hatcheries.

In southeast Alaska, fisheries for chum salmon are concentrated in terminal areas on hatchery production. Release sites for hatchery chum salmon are isolated from significant wild populations. Wild chum salmon production has generally increased during the growth of hatchery production and is generally stable (Baker et al. 1996). Heard et al. (1995) reported a similar lack of impacts from hatchery stocks on wild stocks of Chinook salmon in southeast Alaska.

This is not to say hatchery production in Alaska does not have some effect on wild stocks. Waples (1999) suggested some level of genetic change in hatchery populations relative to wild populations is unavoidable. A similar conclusion was reached by Withler et al. (2000) regarding the effect of straying of nonnative hatchery fish into natural populations; however, by design the hatchery program in Alaska has attempted to minimize genetic interactions between wild and hatchery stocks by intentionally locating hatcheries away from rivers and streams with significant wild populations of salmon and by requiring the use of local broodstocks

Nonhatchery Project Production

In addition to hatcheries, the Alaska salmon enhancement program utilizes many other techniques to produce fish for a variety of user groups. Alaska employs fishpass construction, lake enrichment, stream and lake habitat rehabilitation projects, instream incubation, and spawning channels to enhance production of fish in several areas of the state.

Lake enrichment involves the addition of nutrients to lakes to increase their ability to produce food

organisms for fish. Such fertilization projects have been successfully carried out for more than 23 years by ADF&G, often in conjunction with other agencies as well as PNP salmon producers.

Stream and lake rehabilitation, instream incubation, and spawning channels are also used in Alaska. Major emphasis on stream and lake rehabilitation projects is centered in southeast Alaska and the Anchorage area, where the majority of the human population resides. Spawning channel development is ongoing near Haines and Hyder. Instream incubation boxes have been used at several locations in southeast Alaska, near Nome in Norton Sound, and for a major project for sockeye salmon on the Gulkana River near Paxon.

The ADF&G also participates in the development of fish passes throughout the state. All of this work is done in conjunction with other governmental agencies (e.g., the U.S. Forest Service) or the private sector. All of these projects are subjected to rigorous review and permitting requirements through ADF&G.

Regulation of Hatcheries

Alaska Statutes 16.10.400–16.10.480 address the application process for a PNP hatchery permit. This process is also explained in detail in 5 AAC 40.100–40.990. The application process is shown in Figure 11.

Alaska Statute 16.10.400 states that the commissioner of ADF&G may issue a permit, subject to restrictions imposed by statute or regulation, to a nonprofit hatchery corporation for the construction and operation of a salmon hatchery after the permit application has been reviewed by the appropriate regional planning team. A hatchery permit is nontransferable. A public hearing is required at least 30 d before the issuance of a permit. The hearing must be held in a central location in the vicinity of the proposed facility.

The commissioner always places conditions on a PNP permit. These include a provision that donor-stock eggs must be from the department or a source approved by the department. This action is supported by Alaska Board of Fisheries regulations 5 AAC

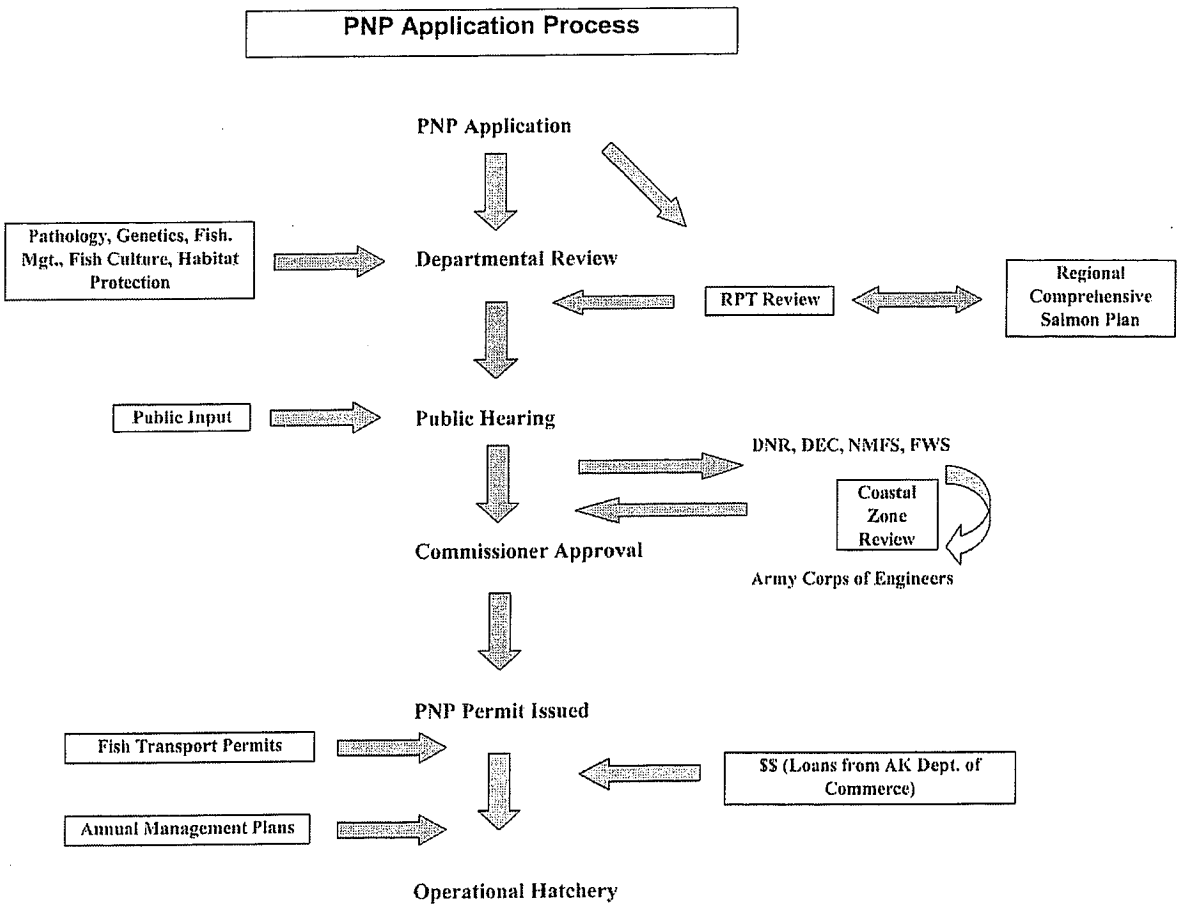

Figure 11. PNP hatchery permit application process.

41.001–41.100 for the fish transport permit process (Figure 12); 5 AAC 41.005 states that no person may transport, possess, export from the state, or release into the waters of the state any live fish unless that person holds a fish transport permit issued by the commissioner and is in compliance with all conditions of the permit and the provisions of the rest of the regulations in that chapter. Chapter 41.030 of Title 5 of the Alaska Administrative Code states that the commissioner will only issue a fish transport permit if it is the department's determination that the proposed transport, possession, or release of fish will not adversely affect the continued health and perpetuation of native, wild, or hatchery stocks of fish. All fish transport permit applications are reviewed and signed (recommending either approval or denial) by the department's principal pathologist and principal geneticist, regional supervisors for the fisheries divisions, and the commissioner. The potential for disease and genetic impacts to wild and hatchery stocks are the primary considerations in this review process.

Standard PNP permit conditions also include (1) no placement of salmon eggs or resulting fry into waters of the state except as designated in the permit; (2) restrictions on the sale of eggs or resulting fry either to the state or another approved PNP hatchery corporation; (3) no release of salmon before departmental inspection and approval; (4) destruction of diseased salmon; (5) departmental control over where salmon are harvested by hatchery operators; and (6) the hatchery must be located in an area where reasonable segregation from natural stocks occurs but, when feasible, in an area where returning hatchery fish pass through traditional salmon fisheries. In many cases, isolated terminal fisheries are established at hatchery release sites to allow harvest of returning fish without impact to wild stocks.

The commissioner may alter, suspend, or revoke a PNP hatchery permit if the operator fails to comply with the terms and conditions of the permit within a reasonable period of time after notification. The commissioner may also alter the permit or initiate a termi-

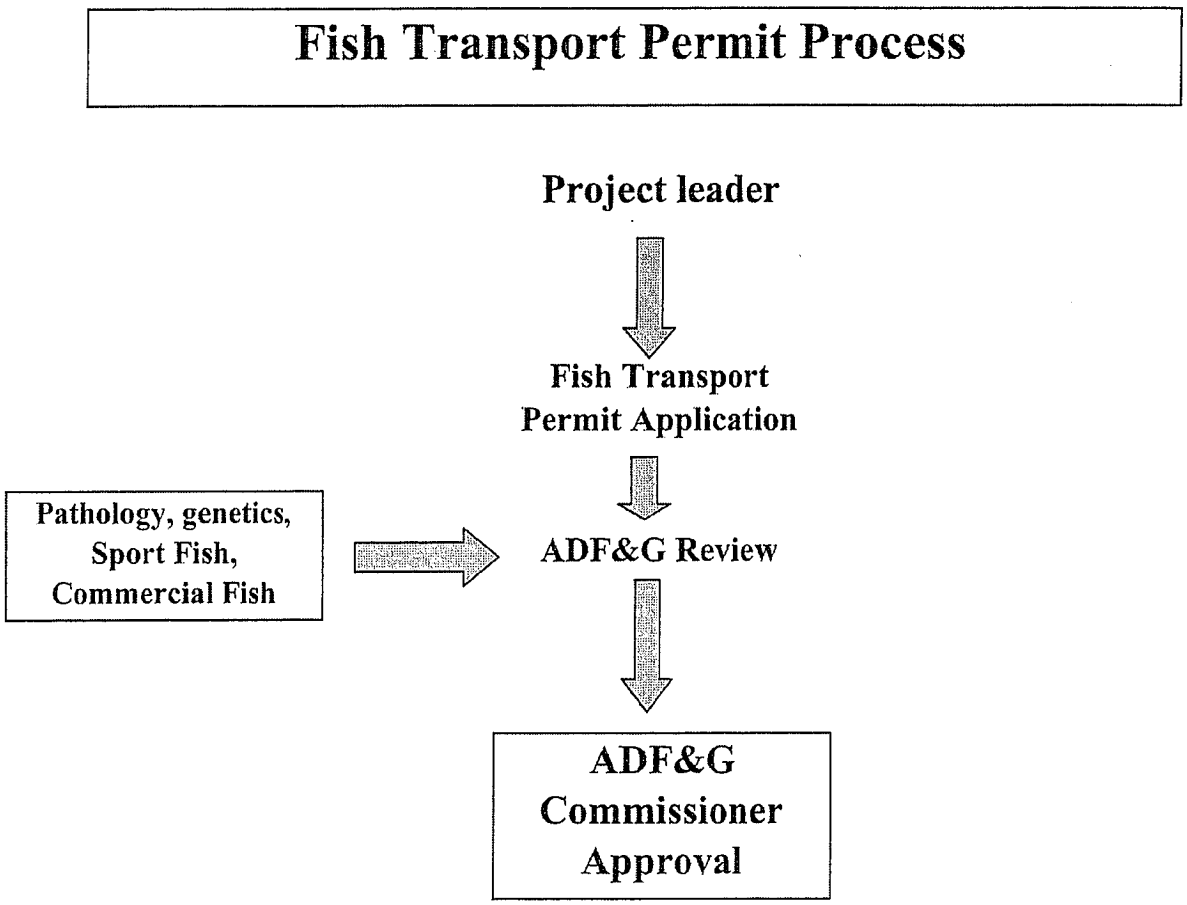

Figure 12. Fish transport permit process.

nation of the operation if it is found not to be in the best interest of the public. Since the inception of the program, 13 PNP hatchery permits have been revoked, most when they ceased operations voluntarily or because the facilities were not constructed within a reasonable period of time after issuance of the permit.

Regulation of Harvest

Fish released by hatchery operators are available to the people for common use in the same way as natural stocks until they return to the location established by ADF&G for harvest by hatchery operators (see Figure 13). According to AS 16.10.440 (b), the Alaska Board of Fisheries may, after a permit has been issued, amend by regulation the terms of the permit relating to the source and number of eggs, the harvest by hatchery operators, and the locations designated by the department for such harvests (i.e., special harvest area). In addition, AS 16.05.730 requires fisheries to be managed consistent with sustained yield of wild fish stocks. With approval by the Alaska Board of Fisheries, salmon fisheries may also be managed for sustained yield of enhanced fish. Conservation of wild salmon stocks consistent with sustained yield is accorded the highest priority among competing uses in the Alaska Board of Fisheries' policies for the management of mixed-stock salmon fisheries (5 AAC 39.220) and sustainable salmon fisheries (5 AAC 39.222).

Regulation of Brood Stock

The ADF&G is required by statute to provide assistance before and after permit issuance, within the limits of staff time and resources. Alaska Statute 16.10.445 requires department approval of the source and number of salmon eggs used by hatchery operators. Salmon eggs must first be taken from stocks native to the area in which the hatchery is located. The sale of salmon and salmon eggs by operators is addressed in AS 16.10.450. After the operator uses funds from such sales for debt service and reasonable operating costs, any remaining funds must be expended on other fisheries activities of the qualified regional aquaculture association for the area. Also, fish returning to hatcheries and sold for human consumption must be of comparable quality to fish harvested by commercial fisheries in the area and must be sold at prices commensurate with the local market.

The department may inspect a hatchery facility at any time it is operating. Each facility is inspected at

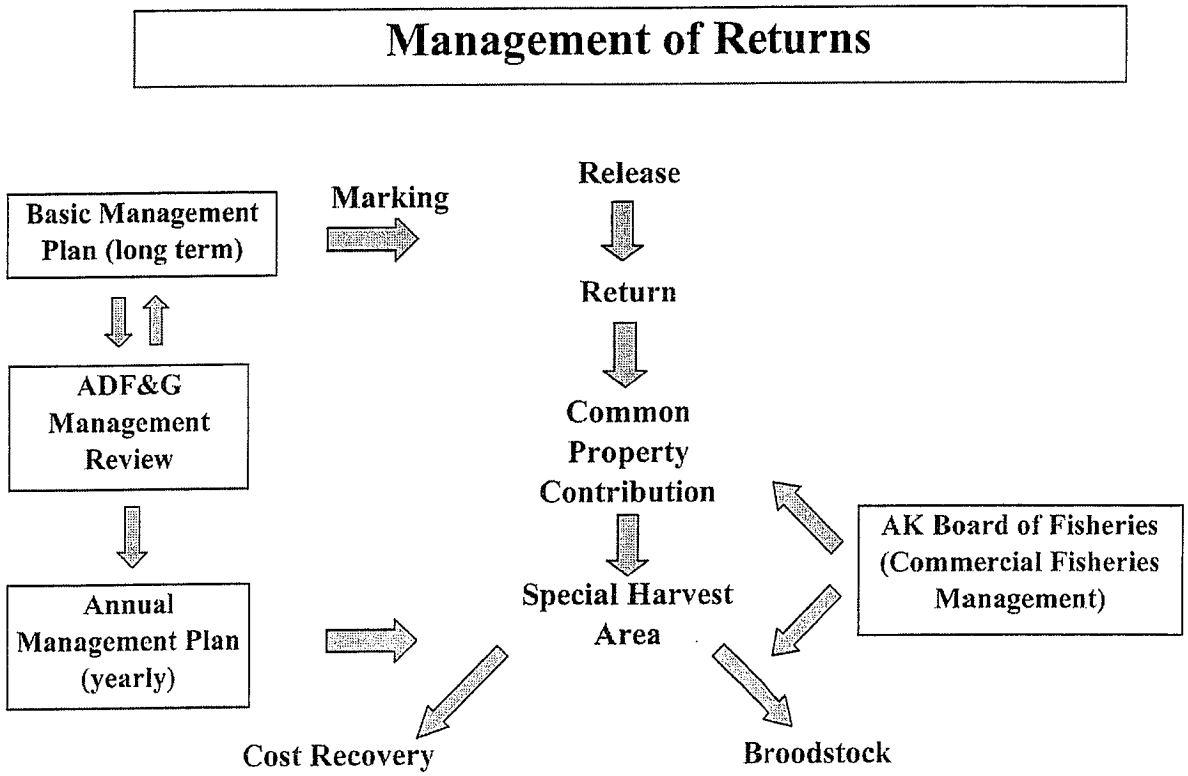

Figure 13. Management of hatchery returns.

least every other year, and each broodstock is examined for disease prior to its use in a hatchery. The disease history of each stock must be kept current, and samples of fish must be sent to the department's pathology section for analysis any time there is an incidence of disease. An annual report containing information on hatchery returns, numbers of eggs taken, and numbers of fry or smolt released by species and stock must be filed with ADF&G by December 15 of each year.

PNP Permit Process

The permit application procedures for a PNP hatchery, the regional comprehensive salmon planning process, and general provisions for the permitting and operation of PNP hatcheries are described in regulations 5 AAC 40.100–40.990. Permit application procedures include (1) preapplication assistance, (2) a management feasibility analysis, (3) the permit application form and fees, (4) determination of acceptance by the department for formal review, (5) regional planning team review, (6) a provision for requesting additional information, (7) completeness determination by the commissioner that includes six major criteria, and (8) a provision for reconsideration. The departmental review of all PNP hatchery permit applications includes review by the fisheries divisions (including habitat considerations), the principal pathologist, and the principal geneticist. A public hearing and full review by other state and federal agencies through a coastal zone review process is also required.

Regulations 5 AAC 40.800–40.990 address (1) nontransferability of permits, (2) preference rights to potential hatchery locations for the regional aquaculture associations, (3) basic management plans for each hatchery, (4) hatchery inspection requirements, (5) annual management plan requirements, (6) notice and review of permit alteration requests, (7) provisions for performance review by the department and the regional planning team, (8) requirements for reporting of mortalities, (9) details on what may be done with surplus salmon eggs, (10) requirements for report coordination with the Department of Community and Economic Development, and (11) definitions of terms.

Hatchery Management Plans

A basic management plan (BMP) for each hatchery is developed as a part of the PNP hatchery permit. The BMP includes a complete description of the facility, including the special harvest area, broodstock development schedules, and descriptions of broodstock and hatchery stock management. Where necessary for fishery management, marking and evaluation programs for hatchery-produced fish are required in the hatchery permit and BMP. Such programs have been optional, unless department fisheries managers specified the need for special in-season management capability during the permit or permit alteration process; however, more recently, marking of all hatchery releases is being required to facilitate studies on wild and hatchery stock interactions such as Orsi et al. (2000). Representative numbers of some species are routinely coded-wire-tagged and other mass marking techniques (e.g., otolith) have also been implemented at most facilities.

When a permitted hatchery becomes operational, an annual management plan (AMP) is developed for each year of operation (Figure 14). Specific plans for egg takes, cost- recovery harvests, fry and smolt releases, marking and recovery, and other operations are included and approved in the plan by the commissioner. Annual management plans are developed by the department in conjunction with the operator and are reviewed by the fisheries divisions and the regional planning team before approval by the commissioner. The PNP permitting process is rigorous and thorough and usually takes 1–2 years to complete.

Conclusion

Alaska's current hatchery program has been in place for more than 30 years, arguably without widespread, adverse impacts on wild salmon, which are at all-time-high levels of production. Both Alaska's wild stock production and its hatchery production have benefited from favorable environmental conditions over the past 30 years, particularly conditions in the North Pacific Ocean that result in high marine survival. Wild salmon in Alaska also benefit from generally intact spawning and rearing habitats, and both wild and hatchery-produced salmon benefit from an outstanding, escapement-based state fishery management program. The success of the hatchery program in having minimal impact on wild stocks can be attributed to the development of state statutes, regulations, policies, procedures, and plans that require hatcheries to be located away from significant wild stocks, the use of local broodstocks, priorities in fisheries management that provide protection for wild stocks, and constant vigilance on the part of ADF&G and hatchery opera-

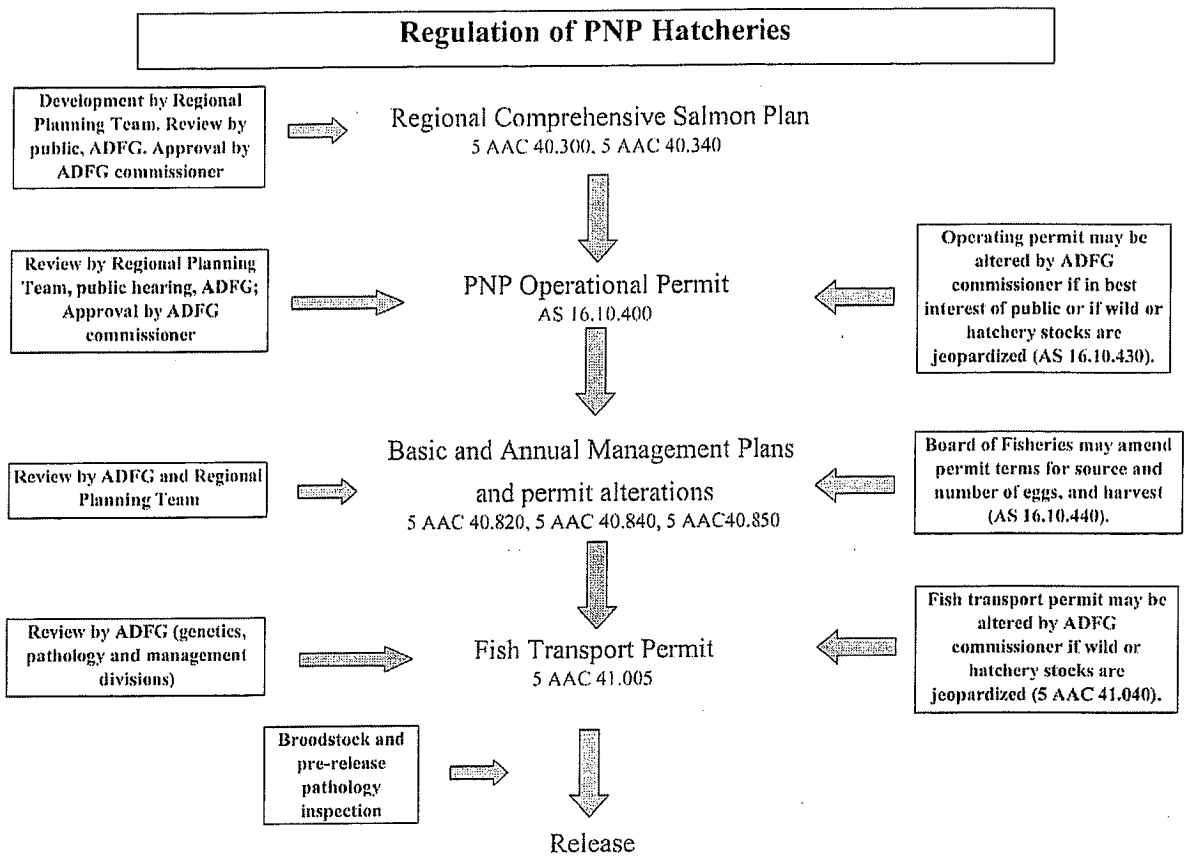

Figure 14. Regulation process for PNP hatcheries.

tors to improve the program through ongoing analysis of hatchery performance.

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