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Trends in Abundance of Hatchery and
Wild Stocks of Pink Salmon in Cook Inlet,
Prince William Sound, and Kodiak, Alaska¹

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D.M. Eggers, L.R. Peltz¹, B.G. Bue², and T.M. Willette³. 1991. Trends in Abundance of Hatchery and Wild Stocks of Pink Salmon in Cook Inlet, and Prince William Sound, and Kodiak, Alaska. Can. Spec. Publ. Fish. Aquat. Sci.

Abstract

Trends in pink salmon (Oncorhynchus gorbuscha) abundance, production, and average weight of hatchery and wild stock catches, were examined for Kodiak Island, Lower Cook Inlet, and Prince William Sound areas, 1960 to 1990. Wild pink salmon abundance was the sum of wild stock catches and escapements, which were aerial survey index counts expanded by estimates of stream life. Hatchery stock abundance was the sum of the estimated contribution of hatchery stocks to catches and the returns to the hatchery. Production estimates were based on hatchery stock returns from fry released at the hatchery and wild stock returns from parent escapement. Hatchery runs have increased greatly since the late 1970's and currently exceed wild stock runs. The total central Gulf of Alaska runs of pink salmon have increased and average weights have decreased since the early 1970's. Since the construction of hatcheries, wild pink salmon runs in Kodiak and Cook Inlet have not declined; however, in Prince William Sound a marked decrease in wild stock runs has coincided with the increase in hatchery

runs. Return per spawner for wild stocks and survival of releases for hatchery stocks were similarly affected by ocean temperatures. The recent decline in Prince William Sound wild pink salmon runs is believed to be the result of lower wild stock escapement levels due to the heavy exploitation of weak to moderate wild stock runs.

Introduction

Pink salmon (Oncorhynchus gorbuscha) have been produced in Alaskan hatcheries, since 1972. Hatchery production of pink salmon was initiated in 1972, with the Kitoi Bay hatchery in the Kodiak Area, (Figure 1). The facility was operated by the Fisheries Rehabilitation, Enhancement, and Development (FRED) Division, Alaska Department of Fish and Game (ADF&G) which was created by state legislation in 1971 following a period of very poor wild stock salmon runs throughout Alaska. Seven hatcheries are now producing pink salmon in the central Gulf of Alaska area (Table 1). These hatcheries are now operated by private nonprofit corporations.

These hatcheries are ocean ranching operations producing significant numbers

The status of wild and hatchery propagated Swedish salmon stocks after 40 years of hatchery releases in the Baltic

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Abstract:

The Baltic stocks of Atlantic salmon have been subjected to impact of human exploitation for many centuries. Especially during the last century, salmon populations have been subjected to dramatic changes in spawning stream access, fishing patterns, and fishing pressure.

At the end of the 19th century salmon spawned in 60-70 rivers in the Baltic proper. From 1940 onwards many of the large salmon rivers were dammed, most of them below the lowest spawning rapids for salmon. Methods for rearing salmon up to the smolt stage were developed and the first smolt releases started around 1950. The number of smolts released in Swedish rivers has gradually increased to between 2-2.5 milj released in the middle of the 1980s. During the last ten years other countries have started salmon release programs resulting in an annual release of about 3 milj. smolts. The smolt releases have been successful showing high survival rates of stocked fish. Today, only about 20 rivers, most of them in Sweden, are attainable for natural spawning runs. The runs are very weak.

Before the second world war the Baltic salmon fishery mainly consisted of coastal and river catches of spawning migrators ascending the rivers. After the war the an off-shore drift gillnet fishery has been developed, nowadays making up the major part of the total catch. As a consequence, the spawning runs of wild salmon have decreased dramatically. One hundred years ago the natural production of salmon smolts from the Baltic salmon rivers was around 7-8 milj. smolts annually. In the beginning of 1970s the wild smolt run to the Baltic was about 2 milj. At present, only about 0.5 milj. wild smolts are produced to the whole Baltic proper, which is only about 20% of still remaining smolt production capacity of the rivers.

The off-shore fishery on mixed populations in the central areas of Baltic proper leads to an extremely high fishing pressure on the Baltic salmon stocks. Wild stocks are unable to cope with the present exploitation rate. As a result, the number of wild spawners in natural streams gradually diminishes. In absence of a compensatory programme, a reduction in stock-size of the magnitude showed by wild salmon in the Baltic would decrease catch per unit effort to such a degree that a salmon fishery would be meaningless. At present, however, about 90% of the salmon smolts leaving Baltic rivers are of hatchery origin. Depending on extremely high egg-to-smolt survival rates the reared stocks can withstand this high exploitation. It is concluded that the success of hatchery enhancement programs in combination with lack of effective regulations allowing a high catch per unit effort in the off-shore fishery, explains a major part of the sad fate of remaining wild salmon stocks in the Baltic.

A biologically sound management programme for the Baltic salmon is bound to include a stop (or strict regulation) of the off-shore fishery on mixed stocks. Salmon stocks should be exploited in relation to the carrying capacity of individual populations, by a more terminal fishery at the coast, or in rivers.

However, an established off-shore fishery in the main Baltic, including (at least) 7 nations, has so far made any kind of regulations difficult. A recent, and hopefully more accessible management program is a compromise, suggesting a ban on salmon fishing outside 24 nautical miles from the coast. The fishery closer to the coast will be supported by net-pen delayed releases of salmon at selected areas along the coast of the Baltic main basin. The proposed off-shore fishery regulation would increase escapement considerably, while total catch (in tons) would remain unchanged. If the proposal is accepted, we estimate that most wild salmon stocks would have a possibility to recover within 3-4 generations. If not, we believe that the fate of all the wild salmon stocks in the Baltic are at stake within a few additional salmon generations.

Genetic Variation in Timing of Anadromous Migration Within a Spawning
Season in a Population of Pink Salmon.

IN PRESS / REVIEW

W.W. Smoker, A.J. Gharrett, and M.S. Stekoll.

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Autumn
9/15/9

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Smoker, W.W., A.J. Gharrett, and M.S. Stekoll. 1991. Genetic variation in timing of anadromous migration within a spawning season in a population of pink salmon. Can. J. Fish. Aquat. Sci. Spec. Publ. 00:000-000.

Abstract

Variation of the timing of anadromous migration and spawning during the spawning season, and consequently of seaward migration of offspring fry, affects variation of survival and fitness in pink salmon (Oncorhynchus gorbuscha). We analysed variation of anadromous timing in 120 families made by hierarchical mating of 60 males and 120 females representing both early-run and late-run subpopulations in Auke Creek, Alaska. The families were incubated separately, released as fry with identifying coded microwire tags, and recovered in the stream as adults. There were significant sire effects indicated by significant differences of return date between families spawned on the same day by different fathers ($P < 0.045$ male offspring, $P < 0.040$ female offspring). This is evidence of additive genetic variation underlying the variation of timing. Significant differences between returning dates of offspring of early-run parents and of offspring of late-run parents, spawned 34 days apart, ($P < 0.0001$ males or females) are also consistent with such genetic variation. Heritability of timing of anadromous migration in odd-year pink salmon spawned in Auke Creek, Alaska, is about 0.2 (SE 0.16) in males and in females about 0.4 (SE 0.20); both estimates are based on effects of sires mated on the same day. Genetic variation of return timing is probably adaptively important to the fitness of pink salmon in Auke Creek.

GENETIC STOCK IDENTIFICATION STUDY
OF YUKON RIVER CHUM AND CHINOOK SALMON

by

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ABSTRACT

The United States and Canada opened negotiations in 1985 concerning the allocation of Yukon River chum (*Oncorhynchus nerka*) and chinook salmon (*O. tshawytscha*). Approximately 90% of the in-river harvest is by U.S. fishermen. An unknown proportion of this catch would have returned to the Canadian portion of the Yukon Drainage. In order to negotiate an equitable treaty between the two countries, it is necessary to determine what proportion of the U.S. harvest is of Canadian origin. In 1987, the U.S. Fish and Service began a genetic stock identification (GSI) study in the Yukon River to address this problem.

Tissue samples were taken from 34 chum salmon populations and 30 chinook salmon populations and genetically characterized using enzyme electrophoresis. Nineteen variable characters were used to analyze the population structure of Yukon River chum salmon, and 22 variable characters in chinook salmon. Genetic separation between the summer run and fall run of chum salmon was very good as determined using simulations of stock mixtures of given contributions of each stock. Separation between U.S. fall run stocks and Canadian fall run stocks was also good. Estimates down to the stock level are not reliable for management purposes at this time. Resolution of an additional known 14 variable characters, and the use of mtDNA variation, may allow reliable estimates to the stock level. Genetic separation between U.S. and Canadian chinook stocks was very high as determined by simulations. Separation was also very good for sub-groups within both the U.S. and Canadian groups. Accuracy down to the stock level is substantially better for chinook salmon than for chum salmon, but is still not reliable for management purposes. Resolution of an additional 13 variable characters, and use of mtDNA variation, may allow discrimination to the stock level.

Samples have been taken from the mixed-stock fishery at the mouth of the Yukon River and estimates of stock contribution were calculated for the years 1987-90. Due to legal problems concerning management of the Yukon River fishery, these results will not be released until a thorough peer review of the data.

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Missoula, MT 59812. U. S. A. CONSERVATION OF SALMONID FISHES: WHY, WHAT,
AND HOW.

There are three questions that must be addressed before we can develop objectives and methods for conserving salmonid fishes: (1) Why should we preserve salmonid fishes? (2) What should we attempt to preserve? and (3) How should we conserve salmonid fishes? It is important to address the issue of why we want to conserve salmonids in order to unify our efforts and to obtain the resources that are necessary to do it. The question of what we should be preserving is an important and perhaps surprisingly difficult one. Loss of local salmonid populations is occurring throughout the world. We cannot halt this ongoing process; that is, we cannot conserve all local salmonid populations. Therefore, choices and compromises must be made. How do we best use our limited resources to conserve genetic diversity in salmonid fishes? Our first priority should be to protect extant wild populations and their habitat. The loss of genetic diversity is usually irreversible. Therefore, our primary efforts should be to prevent such losses.

A Theoretical Evaluation of the Carrying Capacity
of Prince William Sound, Alaska for Juvenile Pacific Salmon

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Abstract

The present feeding demand on zooplankton resources by wild and ocean ranched juvenile Pacific salmon in Prince William Sound is estimated between 1.0 and 4.0 percent of the total "herbivore" production, and 4.0 to 16.0 percent of the annual macrozooplankton production in the region. When annual fry losses to early ocean mortality are taken into account, the feeding demand associated with growth rates averaging 3 to 4 percent of the body weight per day fall to 0.4 to 1.6 percent of the total herbivore production and 1.5 to 5.0 percent of the macrozooplankton production. Uncertainties associated with the numerous assumptions used in this analysis are discussed in relation to what is understood about the biology and ecology of salmon in Prince William Sound and elsewhere.

Introduction

Successes with ocean ranching of Pacific salmon in Prince William Sound, Alaska are beginning to raise management and enhancement questions about the ability of the region to support even larger releases of juveniles planned for coming years. Hatchery released salmon now comprise 50 percent or more of all adults returning to common property fisheries in the Sound. In view of a growing controversy over apparent adverse interactions between hatchery and wild salmon stocks in Washington, Oregon and British Columbia, it seems appropriate to examine the question of carrying capacity as one means to assist with the continued enhancement and management of these vital commercial and subsistence resources in the Sound. The assessment presented here follows accepted ecological theory but is based on several untested assumptions. As a result, conclusions derived from the formulation are probably valid only as general guidelines and perhaps most useful as assertions to be formally examined under field and experimental conditions.

Parsons (1987) presents generalized carbon budgets for open ocean, shelf, fjord and estuarine ecological zones in the North Pacific. Because of its depth and oceanographic characteristics, Prince William Sound is best described as a complex fjord-type ecosystem (Schmidt, 1977). In the deep fjord environment a large percentage of the organic matter produced by phytoplankton is

INFO TO SAVE FOR USE IN CHAPTER ON BIOLOGICAL ISSUES:

Successful hatchery development may actually cause further depletion of already suffering natural stocks, some to the point of extinction. This ironic effect is due to several factors:

1. The extent of habitat and other environmental damage can be camouflaged by hatchery production so it may go unrecognized and unchecked, impeding survival of natural runs.
2. A large influx of hatchery fish may compete with natural stocks for food and other survival necessities. There has been considerable debate about the question of "ocean carrying capacity." While it is not too difficult to determine how many fish can survive or spawn in a stream or hatchery tank, data is not yet available to show just how many salmon can be adequately sustained in the ocean environment. For example, when the average body weight of pink salmon throughout Alaska was significantly lower in 1991 than normal, there was speculation that massive hatchery production of pink salmon may have pushed populations beyond what the ocean can adequately sustain. If indeed there is such a threshold, overproduction of hatchery fish could potentially harm natural stocks.
3. Fisheries management decisions and allowed harvest levels are based on total amounts of fish available. If only a small percentage of total fish population in an area is natural fish, the percentage mandated to be left for escapement may be high enough to sustain hatchery stocks but insufficient to sustain the declining natural runs.

Ironically, the success of hatcheries, and the associated decline of natural runs, may eventually even spell trouble for the future of hatchery stocks. This is because the genetic diversity found in natural runs, and introduced into hatchery stocks through broodstock from wild fish stocks, is important to the long-term health and adaptability of all stocks including hatchery fish. After a number of generations, hatchery fish can lose their genetic diversity and thus lose their ability to adapt to changes and survive.

The commissioner may place conditions on a PNP permit, ~~this~~ includes a provision that donor stock eggs must be from the department or a source approved by the department. [This action is supported by Board of Fisheries regulations 5 AAC 41.001-41.100 for the fish transport permit process. 5AAC 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 the person holds a fish transport permit issued by the commissioner and the person is in compliance with all conditions of the permit and the provisions of the chapter. 5 AAC 41.030 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 ADF&G Principal Pathologist and the ADF&G Principal Geneticist, as well as the regional supervisors for the fisheries divisions, the Chief of Technology and Development, the FRED division director, and the commissioner. The potential for disease and genetic impacts are primary considerations in this review process.]

put in genetic section.

Additional permit conditions include: ~~no~~ placement of salmon eggs or resulting fry into the waters of the state; ~~except as designated in the permit~~; ~~restrictions on sale of eggs or resulting fry~~; ~~no~~ release of salmon; ~~before departmental approval~~; destruction of diseased salmon; departmental control over where salmon are harvested by

restrictions on

determine conditions of

The commissioner of ADF&G may issue a ^{nontransferable} permit to a nonprofit corporation for the construction and operation of a salmon hatchery after the permit application has been reviewed by the regional planning team. ~~A hatchery permit is nontransferable.~~ A public hearing, held in a central location in the vicinity of the proposed hatchery facility, is required at least 30 days before ~~the issuance of~~ a permit is ^{issued}.

~~The commissioner may place~~ ^{may be placed} conditions on a PNP permit, including a provision that donor stock eggs must be from the department or a source approved by the department. ~~Additional~~ ^{Other} permit conditions include restrictions on placement of salmon eggs or resulting fry into the waters of the state; restrictions on sale of eggs or resulting fry; the timing and conditions of releasing salmon; destruction of diseased salmon; departmental control over where salmon are harvested by hatchery operators; and ~~the~~ siting requirements ^{so that} reasonable segregation from natural stocks occurs ^{while still allowing} ~~but~~, when feasible, ~~allows~~ returning hatchery fish to pass through traditional salmon fisheries.

The commissioner may alter, suspend, or revoke a PNP permit if the operator fails to comply with the terms and conditions of the permit within a reasonable period after notification of noncompliance. The commissioner may also alter the permit or ~~initiate a termination of~~ the operation, if it is found that the hatchery is not in the best interest of the public.

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 the department for hatchery harvest. The 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~~ ^{locations of} designated by the department for harvest by the operator (i.e. hatchery special harvest areas) (AS 16.10.440B). However, this authority has never been used.

^{biological} ~~The department is required by statute to provide assistance before and after permit issuance, within the limits of time and resources~~ ^{available staff.} AS 16.10.445 reinforces that the department shall approve the ~~source and number of salmon eggs for hatchery operators. Salmon eggs shall first be taken from stocks native to the area in which the~~

biological
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 shall be expended on other fisheries activities of the qualified regional association. 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 current market.

biological
A hatchery operator must file

ADFIC

An annual report ~~must be filed~~ with the department by December 15 of each year, ~~that contains~~ information on hatchery returns, numbers of eggs taken, and numbers of fry or smolt released.

The permit application procedures for a PNP hatchery, the regional comprehensive salmon planning process, and general provisions on the permitting and operation of PNP hatcheries are described in regulations 5 AAC 40.100-40.990. *the permit application process from ADFIC*
The permit application procedures include: pre-application assistance, a management feasibility analysis, the permit application and fees, determination of acceptance by the department for formal review, regional planning team review, a provision for requesting additional information, completeness determination by the department, the public hearing process, review and determination by the commissioner (this includes six major criteria), and a provision for reconsideration. The departmental review of all PNP hatchery permit applications includes review and comment by all fisheries divisions, the Habitat Division, the Principal Geneticist, and the Principal Pathologist. A public hearing and full review by state and Federal agencies through the coastal zone review process is also required.

A Basic Management Plan (BMP) is developed as part of the actual permit. The BMP includes a complete description of the facility *plus* including the special harvest area, brood stock development schedules, and descriptions of brood stock and hatchery stock management. ~~Where deemed necessary~~ *think it's necessary* by the management divisions, marking programs for hatchery-produced fish ~~are required~~ *can be* in the hatchery permit and BMP. Such programs are ~~usually optional~~ *these are* unless the fisheries management divisions ~~specify~~ *specify* the need for special in-season management capability [during the permit or permit alteration process]. Representative numbers of most species are routinely coded ~~and tagged~~ *are* at most facilities and other (e.g. otolith) ~~mass marking techniques are being developed~~. When a permit becomes operational, an Annual Management Plan (AMP) is

is approved

VI. BIOLOGICAL/GENETIC ISSUES

In November, 1991, in Cordova, Alaska, the Prince William Sound Science Center (PWSSC) and the School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, convened a group of world-renowned experts to examine "The Biological Basis for Maintaining Strong Co-existing Stocks of Natural and Enhanced Salmon Populations in Alaska." This workshop followed a series of international symposiums on this topic during the past two years in Norway, Canada, Idaho, Washington, and Japan. Top fisheries biologists, ecologists and geneticists from the United States, Norway, Sweden, the Soviet Union and Japan were present at this workshop. As a follow-up to the workshop, the group intends to produce a summary report and list of recommended policies and procedures to be considered by the state of Alaska in managing its wild and enhanced salmon stocks.

The cumulative effect of hydroelectric dams, habitat destruction, over-fishing and large-scale hatcheries has lead to the decimation of many wild salmon stocks in Pacific Northwest states. Biologists in states with a long history of hatchery programs are generally less enthusiastic about these programs than biologists in areas such as Alaska and British Columbia with comparatively more recent programs. Although poor hatchery practices can clearly endanger wild salmon populations, scientists do not agree on the extent to which hatcheries with sound practices can co-exist with sustained healthy runs of wild salmon.

The lack of consensus among scientists results from insufficient data and research. Even where information exists, however, it is often subject to conflicting interpretations. To complicate matters, results of specific studies may not be transferable to other areas or salmon species, and year-to-year environmental changes may affect the results of studies.

The Genetic Effects of Hatcheries

Most scientists agree that it is essential to have healthy wild stocks in order to maintain the health and genetic diversity of both wild and hatchery stocks; genetic diversity must be preserved. Scientific knowledge about the genetic impact

on wild stocks of hatchery fish, however, is still incomplete. Reduction in the fitness of salmon stocks, to the extent it has been documented, may involve numerous factors. Most scientists agree that hatcheries can complicate mixed-stock fisheries and affect the genetic composition of wild fish stocks. Scientists do not agree on the degree to which genetic changes affect the short- or long-run fitness of wild stocks.

Straying and intermingling of stocks is a major concern to scientists. The extent of straying, the mechanism causing imprinting, and the success of crossbreeding are largely unknown. Large-scale ocean ranching appears to set the stage for straying of wild stocks in the harvest areas of enhanced stocks and also for hatchery fish to stray into the natural streams. What impact this has on the genetic diversity of salmon stocks in a given region is a question that remains to be answered.

It is known that the greater the distance between the donor stream or hatchery and the release site, the greater the amount of straying. **Many scientists are concerned about the extensive releases at remote sites practiced by many hatchery operations today,** with many more planned for the future. They fear that such straying could potentially, in time, destroy genetic diversity -- resulting in a permanent, irreversible loss. Some scientists believe remote releases should be banned altogether. Others believe they should be permitted with stringent controls and careful monitoring.

Ocean Carrying Capacity

Some scientists suspect that the carrying capacity of freshwater rearing areas, nearshore waters, and the high seas for salmon may be exceeded by large-scale releases of hatchery salmon. A reduction in the average size of salmon has been reported throughout the Pacific region in 1991, but various factors may be responsible. Some researchers believe ocean conditions affect the size of salmon more than competition. Much evidence, however, supports the theory of density-dependent growth for some salmon species, although there is considerable debate regarding its occurrence.

Disease

Few studies document the transmittal of diseases between hatchery and wild salmon and there is no documentation of such transmittal in Alaska. Where transmittal of a disease by hatchery salmon has been documented, it occurred after fish were transplanted long distances. Hatchery fish appear to be more vulnerable to disease than wild fish because of the stress of hatchery conditions and large concentrations of eggs and fry.

State Genetics Policy

Describe here the current state policy and the process of reviewing Fish Transport Permits.

CHAPTER VIII. BIOLOGICAL/GENETIC ISSUES

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Disease

Since 95% of the growth of salmon occurs in the sea

looks very promising), the use of coded-wire tags is not going to be replaced in the foreseeable future. The CWT Lab is a vital link in the in-season management of fisheries in Southeast and Prince William Sound. Chinook salmon fisheries from California to Alaska are managed by treaty convention on the basis of coded-wire tag data. The massive returns of hatchery pink salmon to Prince William Sound is critically assessed against season tag data. Coastwide, this laboratory has the reputation of being the best operation of its kind.

Fish Pathology Laboratory

Active laboratories will be maintained in both Juneau and Anchorage to provide continuing fish health services to salmon hatcheries, mariculture operations, other fisheries divisions, and the public-at-large. The basic function of the fish pathology discipline is to implement policies and procedures that guard against the spread of fish and shellfish diseases in Alaska. The two laboratories serve this function. Routine diagnostics and processing of transport permits for finfish and shellfish will continue as in the past. Monitoring for viral hemorrhagic septicemia virus in Pacific cod will continue. Mapping the distribution and infection rates of bitter crab disease in tanner crabs will go forward in association with the ADF&G Commercial Fisheries Division and the crab fleet. Oyster spat certification for import into Alaska will remain a significant task for the pathologists. Transport permits for aquatic farming activities will increase significantly.

Genetics Laboratory:

The primary service of the genetics discipline is to implement policies and procedures that protect and maintain the genetic uniqueness of Alaska's wild salmon stocks in the face of North America's largest salmon enhancement program. In the coming year, the department's fish genetics policy will be reexamined and updated. Routine processing of transport permits for finfish and shellfish will continue as in the past; however, contentiousness now accompanies a growing number of transport requests, and it is our intent to establish a genetic-screening program for salmon stocks so that answers to tough questions regarding the genetic implications of stock movement can be facilitated. The Genetics Laboratory is now equipped and ready to process samples that will reveal the genetic conformation of our wild salmon stocks. This compatibility has application for stock separation in mixed-stock interception fisheries, identification to the country of origin of salmon caught on the high seas, and examination of the

interaction of hatchery stocks and wild stocks. The incumbent principal geneticist is an expert on techniques employed to sterilize fish and shellfish—a concept that has great practical application in Alaska. FRED Division will work toward using sterile animals for outstocking in projects where fertile animals would have a genetic impact on indigenous wild stocks and thus prohibit such projects. The development of sterile Japanese scallop spat is an example; stocking of sterile rainbow trout for sport fishing is another example.

Limnology Laboratory:

The Limnology Laboratory and the lake-enrichment and water-quality capabilities associated with it are in great demand by cooperators across the state. This unit generally has 30-40 cooperative projects ongoing around the state during any given year. Nutrient enrichment of sockeye salmon lakes has proven to be an extremely cost-effective tool for rehabilitating depressed sockeye salmon runs, and such projects will continue into the future. Karluk Lake is an outstanding example of what can be done; in 1990, it had the largest return of sockeye salmon since good record-keeping was established in the early 1900s. This return was made up principally of late-run adults that, as juveniles in 1986, received the benefits of our initial application of fertilizer to Karluk Lake. Similar projects will continue in Southeast, Southcentral, and Prince William Sound, and new ones will be established on the Alaska Peninsula. Work will continue on marrying habitat features of lakes to forecasting adult fish returns in subsequent years. FRED scientists have used this approach to sockeye salmon forecasting, and in subsequent years will extend it to the marine environment. Water-quality studies on lakes will go forward with funding from the Department of Natural Resources, the United States Environmental Protection Agency is interested in the laboratory to conduct water-quality studies on lakes in populated areas of Alaska. The North Slope Borough has asked limnologists to participate in borough enhancement and water-quality planning in the coming months.

Library Services:

Fishery scientists, planners, and managers in two of the department's fishery divisions (Sport Fish & FRED) are served by a centralized library managed by the FRED Division. Funding for the library is shared among them and is prorated on a user basis.

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 shall be expended on other fisheries activities of the qualified regional association. 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 current market.

gentles, { The department may inspect the hatchery facility at any time the facility is operating. Each facility is inspected at least every other year, and each brood stock is examined for disease prior to its use in a hatchery.

An annual report must be filed with the department by December 15 of each year that contains information on hatchery returns, numbers of eggs taken and numbers of fry or smolt released.

The permit application procedures for a PNP hatchery, the regional comprehensive salmon planning process, and general provisions on the permitting and operation of PNP hatcheries are described in regulations 5 AAC 40.100-40.990. Permit application procedures include: pre-application assistance, a management feasibility analysis, the permit application and fees, determination of acceptance by the department for formal review, regional planning team review, a provision for requesting additional information, completeness determination by the department, the public hearing process, review and determination by the commissioner (this

Few studies document the transmittal of diseases between hatchery and wild salmon and there is no documentation of such transmittal in Alaska. Where transmittal of a disease by hatchery salmon has been documented, it occurred after fish were transplanted long distances. Hatchery fish appear to be more vulnerable to disease than wild fish because of the stress of hatchery conditions and large concentrations of eggs and fry. Norway has had considerable problems with disease transmitted by farmed salmon that have escaped and mixed with wild stocks.

State Genetics Policy

Describe here the current state policy ^{& Genetics Lab} and the process of reviewing Fish Transport Permits.

Salmon eggs must first be taken from stocks native to the area in which the hatchery is located.

Active fish pathology labs are maintained in both Juneau & Anch.

Broodstock mgmt.

SCOMM

74:41

→ individual facilities strong for...
Sikensulag hatchery...
personal use v. true substance.

hatchery

last page on report -

new index - substance 
1-2 11-12, 3

~~1~~ extent of tagging program. last spring

Coded wire tag lab -
who pays for what

decoding & analysis - state

people who tag fish - pay for it - ...

1. if expanded

who should pay

om fish - need more money, ...

A night prison

operators - if we have to pay, then we should
be resolution of this issue.

no one will give up their position

new increments of production - put operator
on notice - operator will have to pay for
tagging & analysis.

5

Burnett Inlet -
PWS

new 9 of production

existing production is questionable -

- not figured into their cost of doing business
- or cost recovery needs.

PWS-

oil spill paid for 2 yrs tag study.

if show migration patterns & fish timing
just after few yrs.

but if use tags for in-season mgmt -
weekly basis -
maintained in perpetuity.

even a PWS - should we need for in-season mgmt.

Do it - but they aren't using it yet for - daily & weekly.
in-season mgmt - they aren't comfortable with it yet.

need to work things out of it.

~~grossantel~~

private sector also spends money.



other species

for private sector - of non-salmonids,
need addtl. legislation.

family - steelhead



some \$\$\$ for propose gen stock i.d. & tagging
in capital budget.

Harvest -

John White

2

looks very promising), the use of coded-wire tags is not going to be replaced in the foreseeable future. The CWT Lab is a vital link in the in-season management of fisheries in Southeast and Prince William Sound. Chinook salmon fisheries from California to Alaska are managed by treaty convention on the basis of coded-wire tag data. The massive returns of hatchery pink salmon to Prince William Sound is critically assessed by in-season tag data. Coastwide, this laboratory has the reputation of being the best-run operation of its kind.

Fish Pathology Laboratory:

Active laboratories will be maintained in both Juneau and Anchorage to provide continuing fish health services to salmon hatcheries, mariculture operations, other fisheries divisions, and the public-at-large. The basic function of the fish pathology discipline is to implement policies and procedures that guard against the spread of fish and shellfish diseases in Alaska. The two laboratories serve this function. Routine diagnostics and processing of transport permits for finfish and shellfish will continue as in the past. Monitoring for viral hemorrhagic septicemia virus in Pacific cod will continue. Mapping the distribution and infection rates of bitter crab disease in tanner crabs will go forward in association with the ADF&G Commercial Fisheries Division and the crab fleet. Oyster spat certification for import into Alaska will remain a significant task for the pathologists. Transport permits for aquatic farming activities will increase significantly.

Genetics Laboratory:

The primary service of the genetics discipline is to implement policies and procedures that protect and maintain the genetic uniqueness of Alaska's wild salmon stocks in the face of North America's largest salmon enhancement program. In the coming year, the department's fish genetics policy will be reexamined and updated. Routine processing of transport permits for finfish and shellfish will continue as in the past; however, contentiousness now accompanies a growing number of transport requests, and it is our intent to establish a genetic-screening program for salmon stocks so that answers to tough questions regarding the genetic implications of stock movement can be facilitated. The Genetics Laboratory is now equipped and ready to process samples that will reveal the genetic conformation of our wild salmon stocks. This compatibility has application for stock separation in mixed-stock interception fisheries, identification to the country of origin of salmon caught on the high seas, and examination of the

DRAFT

Research will also be initiated to aid in the development of the industry. Areas identified as having high potential benefits include the feasibility of producing sterile scallops, developing shellfish and aquatic plant hatchery technology for Alaska species, researching new species for aquatic farming, site-evaluation techniques, broad-based research on determining optimal areas for aquatic farming in the state, oyster-maturation studies, broodstock development, and seedstock-collection research. FRED Division will use its technical expertise and facilities to accomplish the research and then transfer that technology to the private sector. Continual interaction with the industry will identify new areas of concern or benefit that cannot be addressed directly by the industry because of a lack of expertise, facilities, or high costs.

Technology and Development Services

DRAFT

The FRED Division operates five laboratories that serve ADF&G and other agencies. The Fish Pathology Section has two laboratories (one in Anchorage and Juneau) and provides diagnostic services and broodstock evaluation for both state and PNP fisheries programs. The Limnology Section has a laboratory in Soldotna and supervises all lake-enrichment projects and analyses of water, plankton, and juvenile fish populations sampled for lake-productivity studies. The Coded-Wire Tag Processing Laboratory (CWT Lab) decodes metal tags implanted in fish and supplies resultant information for hatchery and natural stock evaluation as well as for evaluation of U.S./Canada salmon interceptions. The Genetics Laboratory monitors the interaction of hatchery salmon stocks with wild hatchery salmon and employs genetic techniques for finfish and shellfish stock identification and stock improvement. In summary, these laboratories and their associated scientists provide a set of technical services in extremely strong demand by the department, regional aquaculture associations, aquatic farming industry, PNP hatchery operators, and other state and federal agencies.

Coded-Wire Tag Processing Laboratory:

DRAFT

The division is seeking a new home for its CWT Lab. Working conditions at the present facility have deteriorated to the point where the state is at risk to liability lawsuits from employees that work there. Further, the workload at the lab has tripled since 1985, outstripping the space available. Monies to acquire a different lab space will be requested in the FY 95 budget. While efforts are underway by this division and others to develop new marking techniques (e.g., otolith marking,

asked for further legal direction on their responsibilities to provide for hatchery broodstock and for cost recovery fisheries, especially when they appear to compete or reduce fishing opportunities in traditional fisheries. Staff is nearly finished with the legal analysis of this issue. The Legislature will definitely want to consider whether or not to put a stronger wild stock priority into law.

** if you need tagging for allocation reasons, can be factored in earlier on. - RPT's should have responsibility not necessarily the authority*

Allocation Conflicts

All rain in conflict

Minimizing or reducing allocation conflicts can and should be done through the planning and permitting process. However, this is not a perfect process, and it is inevitable that conflicts develop over who gets which fish. The Board of Fisheries has twice now (in Prince William Sound and in Southeast) directed the regional aquaculture associations to develop their own allocation plan for hatchery-produced fish. The Prince William Sound plan was approved by the Board of Fisheries in January, 1991, and has now been incorporated into the area's Comprehensive Regional Salmon Plan. Development of a Southeast allocation plan is currently underway, with a final product due in March '93.

Challenges of In-Season Management

Support study on quality.
** Board.*

More information about run timing and quality, as well as how to fund marking and tag recovery programs are the key here. ADF&G Commercial Fisheries Division has suggested a research project be funded for this year to analyze salmon quality at various distances from their terminal streams in an effort to determine how best to manage fishing effort to produce top-quality and marketable product.

** Potential problems of newly contracted issues state agencies - not gone thru PNP permitting process.*

VIII. OTHER ISSUES

This section deals with more minor "side" issues such as the use of hatcheries as a form of environmental mitigation, the role of hatcheries in international treaties, environmental regulations,

State Genetics Policy - Jim Se

* Describe here the current state policy and the process of reviewing Fish Transport Permits.

VII. MAJOR FISHERIES MANAGEMENT ISSUES

Over-Harvest of Wild Stocks

The fundamental issue facing fisheries managers is how to control fishing effort on stocks in mixed-stock fisheries. The predominant management concern is that the weakest stocks will be over-fished. In cases in which hatchery productivity is significantly greater than natural stock productivity, wild stocks face the risk of being depleted. Smaller stocks are always in danger of depletion in mixed-stock fisheries because there is a tendency to optimally harvest the larger stocks before quality declines in terminal fisheries.

The problems posed by mixed-stock fisheries are not new. Almost all Alaska salmon fisheries had some degree of mixed stocks prior to the development of current hatcheries. However, hatchery-produced fish further complicate management. An adequate program of tagging, recovery and analysis is essential for most mixed-stock fisheries comprised of large numbers of hatchery fish.

Tagging Needs and Requirements

* This section will describe current tagging technology, its usefulness, cost, and the question of who should pay.

3 legal questions.

Wild Stocks Priority Policy

Concern has been expressed by ADF&G managers and by the Board of Fisheries that the state does not have a strong enough wild stock priority policy in statute. In addition, Fisheries Board members have

Endangered Species sect in: - WA Task Force

* Definition of stocks & guidelines for allocation of what is a stock

is statutory language being changed?
1) how should quality be factored into managing fishing - does board have enough authority to decide.

clarify roles & uses - for biological mfg & allocation purposes.
+ level of tagging - much conflict - state agreement.

FRED Division - Weekly Report

Broodstock Development Center (BDC) staff discussed the hazards of bypassing the safety switch on the small tractor/snow blower while it is operating.

Division Highlights:

The 1991 Sockeye Culture Workshop was held at the Northern Southeast Regional Aquaculture Association's (NSRAA) headquarters in Sitka on October 24-25. Approximately 65 people from five states and British Columbia attended the workshop. Proceedings of the workshop will be available in approximately 5-6 months.

At the invitation of Chief of Technology and Development Bob Burkett, three Soviet fisheries scientists visited Alaska this week. In the delegation were Dr. Leonid Klyashtorin, Dr. Valentin Artemov, and Mr. Stanislov Karachune. Klyashtorin and Artemov are from VNIRO, Moscow, while Karachune hails from Magadan. These men arrived on Monday, October 28, in Anchorage and departed Juneau on November 1. Tours were made of Big Lake and Fort Richardson Hatcheries. In Juneau, activities centered on sockeye salmon, with the primary discussion on artificial production of fry, and yearling and underyearling smolts. The Soviets are extremely interested in launching a sockeye salmon hatchery program based on release of underyearling smolts; i.e., a program that handles sockeye salmon just like pink and chum salmon. Dr. Klyashtorin believes that the Japanese are positioning to convert their massive hatchery chum salmon program to sockeye salmon. Auke Bay Laboratory (National Marine Fisheries Service) scientists participated in the discussions.

Headquarters Office Highlights:

A memo from Director Jeff Koenings went out to all participants that have been involved in the review and drafting of Scientific or Educational permit regulations/policy. The memo seeks comments from representatives from all fishery divisions on the new, so-called "Fish Resource Permit." Comments on the regulations/policy are due to PNP Program Administrative Assistant Jeri Museth no later than November 6.

Chief of Technology and Development Bob Burkett was the keynote speaker at the Annual Sockeye Salmon Workshop.

PNP Program Fishery Biologist Steve McGee traveled on Wednesday to present to the Board of Fisheries the department's positions on the three hatchery-related proposals (83, 84, and 85), and to answer any questions from board members regarding the PNP hatchery program. In the end, the board took no action on any of the proposals. However, it does want a report on marking, tagging, and evaluation of hatchery fish by the end of March 1992.

Salmon Rehabilitation and Enhancement Coordinator Kevin Duffy spent the week chairing the Northern Panel meeting of the Pacific Salmon Commission in Portland, Oregon.

Assistant Director Johnny Holland, now the contract coordinator for the division, worked on Pillar Creek Contract No. IHP 92-006. He worked out verbage details in order to get the document signed

Distribute
to
Benton
JPPFC Adv
from
C. Meacham
11-10-91

MEMORANDUM

To: Molly McCammon
From: Doug Rickey
Date: January, 1992
Re: Hatchery legal issues

DRAFT

You have asked me to provide a review of the legal questions that appear to be making it difficult for the Board of Fisheries to make decisions regarding the management of hatchery salmon, and to discuss potential statutory changes the legislature might consider during this session.

In preparing this response, I reviewed a letter from the chairmen of the board of fisheries, pertinent constitutional, statutory, and regulatory provisions, and four recent legal opinions concerning a number of issues relating to the requirements for the management of hatchery fish.

I have divided this memorandum into three sections. The first is a brief summary of the powers and duties of the Board of Fisheries ("board"), and regulations governing private nonprofit hatcheries. The second reviews the concerns of the board as expressed in a May 6, 1991, letter from Chairman Michael Martin to Senator Richard Eliason. The third summarizes several recent legal opinions concerning the state's duty, or lack thereof, to manage fisheries for broodstock and cost recovery by hatcheries.

I. Powers and duties of the board/PNP hatchery regulations.

The board was created "for purposes of the conservation and development of the fishery resources of the state . . ." AS 16.05.221 (a). In order to carry out that charge, the board may "adopt regulations it considers advisable in accordance with the Administrative Procedures Act (AS 44.62)." AS 16.05.251(a).¹

¹/AS 16.05.251 (b) lists the purposes for which the board may exercise this power, including

- . . . (2) establishing open and closed seasons and areas for the taking of fish;
- (3) setting quotas, bag limits, harvest levels, and sex and size limitations on the taking of fish;
- (4) establishing the means and methods employed in the pursuit, capture and transport of fish; . . .
- (6) classifying as commercial fish, sport fish, personal use fish, subsistence fish, or predators or other categories essential for regulatory purposes;

The statutes governing the private nonprofit hatchery system are found at AS 16.10.375 - AS 16.10.470. They provide for: regional salmon plans; regional associations; criteria for the issuance of hatchery permits; public hearings prior to permit issuance; permit conditions; criteria for permit alteration, suspension or revocation; board regulation authority; department assistance and cooperation for permit applicants and holders; salmon egg sources; salmon egg sales; hatchery inspection; and an annual report to the department by permittees.

The board has adopted a number of regulations relating to private nonprofit hatcheries. Codified at 05 AAC 40.005 - 05 AAC 40.900, they include: delegating to the commissioner the authority to specify gear type and fishing periods for hatchery cost recovery; requiring hatchery permit holders who harvest salmon to comply with fish purchaser reporting requirements; allowing hatchery permit holders who harvest salmon for broodstock exemptions from the salmon "waste" statute, regulations concerning "closed waters" and vessel area registration; designating special harvest areas; procedures for permit application, application review, public hearings, review and determination, and reconsideration; establishing regional comprehensive planning teams and procedures to be followed by them; prohibiting permit transfers; requiring hatchery management plans, inspections, and performance reviews; establishing criteria for the sale of surplus salmon eggs.

II. Board concerns.

In a May 6, 1991 letter to Senate President Richard Eliason, Fisheries Board Chairman Michael R. Martin stated the following:

In managing fisheries that involve hatchery raised salmon, the Board of Fisheries has encountered problems due to ambiguities in the current Alaska statutes. These problems commonly arise when the management of hatchery stocks conflicts with either the health of wild stocks or with the opportunity of fishermen to harvest wild stocks. Essentially,

(7) watershed and habitat improvement, and management, conservation, protection, use, disposal, propagation and stocking of fish;

(8) investigating and determine the extent and effect of disease, predation, and competition among fish in the state, exercising control measures considered necessary to the resources of the state;

(9) prohibiting and regulating live capture, possession, transport, or release of native or exotic fish or their eggs; . . .

(12) regulating commercial, sport, subsistence, and personal use fishing as needed for the conservation, development, and utilization of fisheries...

AS 16.05.251(b).

establishing open and closed seasons

the statutes are not clear on the status of wild stock management.

State statutes are also not clear about the state's duty to provide fish for hatchery broodstock and cost recovery, and about hatcheries' obligations to contribute to the common property fisheries. We perceive that the development of state policy toward hatcheries may create a conflict of interest. On the one hand, the state manages fisheries as a common property resource for the benefit of all user groups. On the other hand, the state loans money to hatcheries with the expectation that the hatcheries will receive enough fish to be able to repay these loans.

While Chairman Martin went on to note other concerns,² the overall problem for the board appeared to be the perceived statutory ambiguities which lead to conflict between wild stock protection and broodstock/cost recovery.

The only direct statutory reference to the protection of wild stocks from harm due to hatchery operations is found at AS 16.10.400(g):

During the development of a comprehensive plan for a region, no permit may be issued for a hatchery unless the commissioner determines that such an action would result in substantial public benefits and would not jeopardize natural stocks. (emphasis added)

The concern the board has is that the statute requires the department to make a judgment concerning the potential harm to wild stocks prior to the issuance of a hatchery permit; the inference being that once that judgment is made and a hatchery permit is issued, there is no statutory "protection" for wild stocks that are jeopardized by hatchery-related dangers that arise after a permit is issued.³ This raises the possibility that a protective wild stock management regime, unsupported in statute, would conflict with, and might be overridden by, existing statutes that indicate the state must manage hatchery fish for broodstock and cost recovery. These statutes will be more fully discussed in the following section.

III. Recent legal opinions.

A. Hatchery fish and "sustained yield".

Article VIII, section 4 of the Alaska Constitution states:

²/These included

³/See Martin letter, p. 2.

Fish, forests, wildlife, grasslands, and all other replenishable resources belonging to the State shall be utilized, developed, and maintained on the sustained yield principle, subject to preferences among beneficial users.

The general rule is clear that wild salmon, while they are in the natural waters of the State, "belong" to State and must be managed on the sustained yield principle. Metlakatla Indian Community, Annette Island Reserve v. Egan, 362 P.2d 901, 915-915 (Alaska 1961). Whether hatchery-reared salmon enjoy the same status is less clear, and has been the subject of disagreement among attorneys who have recently written on that issue. The issue is important in the context of Chairman Martin's concerns because if hatchery fish must be managed on the sustained yield principle, that implies the Board of Fish must provide hatcheries with broodstock, and possibly cost recover fish, even if that may cause some harm to the wild stocks.

In an August 1990 letter to Fish & Game Commissioner Don Collinsworth, Assistant Attorney General Steve White concluded that the Department of Fish & Game and the Board of Fish had the legal authority, and were in fact directed by law, to manage fisheries so that salmon hatcheries receive broodstock and cost recovery fish for their operations. He based these conclusions in part on the assumption that the above quoted section of the Alaska Constitution mandates that hatchery fish be managed in the same manner as wild stocks. Two other attorneys, George Utermohle of the Legislative Affairs Agency's Legal Services Division, and Juneau attorney Michael Stanley, later called that assumption into question. Sometime after that, Anchorage attorney A. William Saupe analyzed the three prior opinions and concluded that Mr. White's initial assumption was correct.⁴ What follow is a summary, extracted from the four opinions, of the arguments on both sides of the proposition that that the sustained yield management requirement of art. VIII, sec. 4 applies to hatchery raised fish:

First is the issue of "ownership." On its face, sec. 4 of art. VIII applies only to resources "belonging" to the state. Are hatchery raised fish in that category? Stanley and Utermohle argue that they may not be.

Stanley points out that the framers of our constitution did make distinctions between resources "occurring in their natural state" and those that are "subject to intensive culture," at least for the purpose of exempting the latter from the requirements of art. VIII, sec. 3 (the "common use clause").⁵ Because humans play a substantial role in the growth and

⁴/Copies of the four legal opinions are attached to this memorandum.

⁵/art. VIII, sec. 3 provides

development of hatchery fish, Stanley reasons that they may not be the "natural resources" the drafters of article VIII had in mind.

George Utermohle points to the fact that the legislature, when it created the private nonprofit hatchery system, used the following language to provided for the common use of hatchery fish:

Fish released into the natural waters of the state by a hatchery operated under AS 16.10.400 - 16.10.470 are available to the people for common use and are subject to regulation under applicable law in the same way as fish occurring in their natural state until they return to the specific location designated by the department for harvest by the hatchery operator.

AS 16.10.440 (a).

Utermohle finds the above language significant in a number of respects: first, while the statute provides for the common use of hatchery fish, it is silent as to state ownership and makes no mention of sustained yield; second, the fact that hatchery fish are to be treated "in the same way" as fish occurring in their natural state "until they return to the specific location. . ." suggests that the legislature did not consider them a common property resource belonging to state, but merely felt they should be treated as if they were until they returned to the hatchery for harvest; finally, Utermohle suggests that the provision for harvest by the hatchery operator indicates "some lingering private property interest in the hatchery fish by the hatchery," another indicator that these fish may not "belong" to the state for purposes of the sustained yield section of art. VIII.

In his lengthy memorandum to PWSAC President John McMullen, attorney A. William Saupe disagreed with the arguments made by Stanley and Utermohle that the sustained yield clause may not apply to hatchery fish.

Initially, Saupe relies on legislative history to refute the "ownership" argument. He quotes this passage from Linda J. Snow July 31, 1991 memorandum to Senator Eliason:

Consensus is that the legislature had always intended that the fish from PNP hatcheries belong to the common property fishery until such time as they return to the hatchery, and then they belong to the hatchery for broodstock and cost recovery. Testimony by Senator Dick Eliason at a 1975 Senate Resources Committee hearing on SB 180 indicates that the initial concept of a private hatchery system considered profit-making corporate ownership. However, a profit-making corporation might advance a claim to exclusive ownership of everything it produced. Thus, it was felt that private, nonprofit ownership of hatcheries would be more consistent with with

the concept of publicly owned hatchery fish. This opinion is echoed by former Representative Terry Gardiner.

At a March 7, 1977 House Resources Committee hearing, Jack Milnes, Executive Director of Southern Southeast Regional Aquaculture Association testified: "I wish to recognize the fact that these are common property fish, that they belong to the state of Alaska and to the people of Alaska and therefore they should be protected by the representatives of the people of the state of Alaska." At a 1979 Senate Resources Committee hearing on HB 48, Don Clocksin, and attorney with Alaska Legal Services discussed the question of ownership of hatchery fish. In his testimony, he asked "When are fish no longer common property fish?" He felt that constitutionally, they were to be considered common property fish at all times. Consequently, it appears there was never any question that hatchery fish were common property of the people of the state while in Alaska waters, and they may or not be the property of the PNP hatchery operator at the hatchery, but that he allowed to harvest a sufficient number for broodstock and cost recovery.

(Emphasis his).

Saupe also relies on certain portions of the commentary of the Committee on Resources of the Alaska Constitutional Convention. The first concerns the common use clause:

Game fish, wildlife, fisheries, and water are recognized as belonging to the state so long as in a natural state. These resources are subject to a private right only when they have been acquired or utilized as provided by law. (emphasis his).

Saupe asserts that this passage indicates the framers' belief that fish reserved for common use "belonged" to the state. Because hatchery fish are reserved for common use by AS 16.10.440 (a), Saupe reasons that they must be owned by the state and be subject to the sustained yield principle.

The second commentary the sustained yield clause itself:

Sustained yield is recognized as a principle applicable to the administration of plant and animal life subject to the immediate authority of the state. (emphasis his).

Because hatchery fish are subject to the authority of the state by AS 16.10.440(a), Saupe reasons, they are subject to the sustained yield clause. This conclusion, he asserts, "also comports with common sense" because

[i]f they did not belong to the State, it could not reserve hatchery fish for use by others without paying for them. Moreover, if the

mere expectation that a hatchery will later be allowed to harvest some unidentified fraction of the returning fish constitutes an ownership interest in all of its fish, then every other limited entry permit holder could be said to have the same "lingering property interest," leading to the false conclusion that none of the fish in Alaska's waters ever belong to the State or are subject to the sustained yield principle of management.

A more reasonable interpretation of these related statutory and constitutional provisions is that, once released, hatchery fish become like wild stocks in every legal respect. They belong to the state, are reserved to the people for common use and must be managed for sustained yield. . .

Saupe, pp. 10-11.

Initially, I agree with Saupe on the "ownership" issue. When it created the hatchery system the legislature made a number of policy choices: first, the hatcheries would be operated by private nonprofit, rather than profit making, entities, apparently because it was feared that profit making entities would make ownership claims to their fish; second, the statutes governing hatchery operations place a tremendous amount of control in the hands of the Department of Fish & Game and the Board of Fish, including the power to revoke a hatchery permit, and to designate where and when hatchery operators may harvest; third, hatchery fish, until they reach a designated operator harvest area, are a "common property resource," a designation associated with state dominion and control. In my view, these are all persuasive indicators of state ownership.

However, even if the state "owns" the hatchery fish, it does not automatically follow that the state must manage those fish on a sustained yield basis. As George Utermohle notes, the sustained yield requirement is always subject to "beneficial uses". the Commentary on Article on State Lands and Natural Resources , at page 98, states:

This principle [sustained yield] is qualified in terms of "the highest beneficial public use" in recognition of its not being in the public interest to preserve certain parasitic or predatory organisms destructive of more beneficial plant and animal life

And, during the debate on the sustained yield clause, Delegate Riley explained

... we have in mind no narrow definition of "sustained yield," as is used for example, in forestry, but the broad premise that insofar as possible a principle of sustained yield shall be used with respect to administration of those resources which are susceptible of sustained yield, and where it is desirable. For

example, predators would not be maintained on a sustained yield basis.

Alaska Constitutional Convention Proceedings, p. 2451.

Utermohle argues that

the delegates understood that the concept of preferences among beneficial uses would allow the state to make reasoned decisions to prefer certain renewable resources over other renewable resources to achieve a more beneficial public purpose. The authority to establish preference among beneficial uses may permit the state to harvest hatchery fish without providing for a sustained yield from the hatchery, provided that those who have vested rights in hatchery fish are compensated for those rights that are taken by the state.

The ability of the state to establish preferences among beneficial user is reflected in AS 16.10.430(b) which allows the commissioner of fish and Game to terminate the operation of a hatchery in the best interests of the public, if the adverse effects of the operation of the hatchery are irreversible and cannot be mitigated.

Utermohle memo, pp. 3-4.

Saupe, on the other hand, argues that AS 16.10.430(b) is not merely a reflection of the state's ability to establish preferences among beneficial uses but is in fact the only basis upon which a hatchery permit may be terminated. He also argues that the contribution made by PWSAC to the growth of the commercial fishing industry in Alaska demonstrate its beneficial use to the state, and that "short of the extreme situation envisioned by AS 14.10.430(b) it is hard to conceive how denial of a reasonable hatchery harvest in favor of other beneficial uses could achieve a greater public purpose." Saupe memo, p. 14.

In my view, the arguments made and conclusions reached by Micheal Stanley, George Utermohle and A. William Saupe on this issue all have merit. It is unfortunate that our supreme court has never defined "sustained yield," much less taken up the question whether hatchery raised fish must be managed on that principle. Suffice to say that knowledgeable people disagree on this issue and it would probably take a constitutional amendment to guarantee an unassailable legal conclusion one way or the other.

My own view is that art. VIII, sec. 4 probably does require that hatchery reared fish, after they are released and until they are allowed to be harvested by the hatchery operator, be managed on a sustained yield basis unless the state finds that such management would cause significant

harm to the wild stocks. No one would seriously argue that the preservation of wild stocks is not a "beneficial use" of the fishery resource, and there apparently is a concern that managing hatchery fish for broodstock and cost recovery may, in some instances, be harmful to that beneficial use. The difficulty with such a conclusion is that it probably raises more questions than it answers. How significant must the harm be? Can it be clearly substantiated? Isn't the continued health and development of hatchery raised fish also a "beneficial use" of the resource?

I have included the above arguments, conclusions and question for the purpose of demonstrating that there is no clear answer to the question whether there is a constitutional mandate that hatchery fish be managed on a sustained yield basis. That is not to say, however, that the legislature should not exercise its constitutional law making authority in this area. As Chairman Martin's letter makes clear, the Board of Fisheries is struggling with statutory ambiguities, and the board is obviously looking for legislative action.

B. Statutory basis for broodstock and cost recovery.

As noted earlier, assistant attorney general Steve White concluded that the board and the department are authorized and directed by law to allocate fishery resources for broodstock. He also concluded that the board has the authority, but is not required, to manage for cost recovery. White memo., p. 7. Going a step further, Mr. Saupe reached the conclusion that the board and the department must manage for both broodstock and cost recovery. Saupe memo., p. 16. In reaching their conclusions, White and Saupe both rely on the notion that hatchery fish must be managed on the principle of sustained yield, discussed above, and on the a number of statutes and court decisions which point to legislative approval for such activity.

(1) Broodstock.

As noted above, the board is to provide for "the conservation and development of of the fishery resources of the state." AS 16.05.221(a). The supreme court, in Kenai Peneinsula Fishermens Coop Ass'n v. State, 628 P. 2d 897, 903 (Alaska 1981), defined "conservation" as "controlled utilization of a resource to prevent its exploitation, destruction or neglect." Steven White argues that, since managing for broodstock helps to perpetuate the fishery resource (i.e., prevents its "exploitation, destruction or neglect"), managing for broodstock is analogous to managing for escapement of wild fish. Therefore, the board has the power to adopt regulations that will provide for hatchery broodstock. White memo., p. 2. I believe White is correct. The board does have the statutory authority⁶ to so provide, and has promulgated regulations to that end.⁷

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(2) Cost recovery.

Whether the board has the authority to manage for cost recovery is less clear than it is for broodstock. The board does have the authority to allocate fish to various user groups.⁸ However, private nonprofit hatcheries are not specifically designated in law as a user group. Nevertheless, Steve White has concluded that private nonprofit hatcheries could be considered a "subgroup" of commercial users. Because our supreme court has upheld the board's power to allocate among subgroups (e.g., drift gillnetters and se. gillnetters),⁹

IV. Conclusions.

1. There is no statutory "priority" for wild stocks.

2. Article VIII, sec. 4 of the Alaska Constitution, and existing statutes, strongly indicate that hatchery fish are required to be managed on the sustained yield principle, unless the state finds that such management causes significant harm to the wild stocks (i.e., that the protection of the wild stocks is a more "beneficial use" of the fishery resource than managing for broodstock).

3. The board has the power to adopt regulations for hatchery broodstock management, and probably has the same for cost recovery.

V. Recommendations.

1. That the legislature make a policy choice as to the priority of wild stock fish and express that choice by statutory amendment.

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2.

non-PNP, Mom+Pop hatcheries.

confusing statute - sale of surplus eggs - not used for broodstock,
suspension - that broodstock priority could be used as profit. Burnett Inlet.

- 1) used stock priority first
- 2)

PNP's - not being required to integrate their production plans - for allocation -

- 1) consider legislative passing statutes
- 2) legislation that

Endangered Species Act section

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STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

DIVISION OF COMMERCIAL FISHERIES

WALTER J. HICKEL, GOVERNOR

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January 15, 1992

Molly

Ms. Molly McCammon
Room 510, Capitol
P.O. Box V
Juneau, AK 99811

Dear Ms. McCammon:

This letter is in response to your request that the Division of Commercial Fisheries provide a brief letter outlining management issues associated with large scale salmon hatchery enhancement activities such as those in Prince William Sound.

The Department has the constitutional responsibility to conserve and manage wild stocks of salmon for sustained yield. In a wild stock fishery, this conservation responsibility entails maintaining minimum spawning escapement levels for wild stocks. However, when hatcheries are established in wild stock salmon producing areas the department has two additional conservation responsibilities: 1/ maintaining the genetic diversity of wild stocks as stated in the department's genetics policy, 2/ maintaining fish health and prohibiting the spread of fish disease, and 3/ providing sufficient returns of fish to the hatchery to provide for brood stock and cost recovery. There are strict regulations regarding selection of brood stock, transporting, and remote releases of hatchery produced fry and smolt, which require a comprehensive genetic monitoring and permitting process.

Because salmon runs occur in a short period of time, early indicators of run strength based on fishery performance or test fisheries are required for effective management. Commercial fishing effort must be reduced whenever runs of hatchery or wild stocks are weak. Early in-season assessments of populations that are mixtures of hatchery and wild stocks require some capability to distinguish wild fish from hatchery fish. The effective management of mixed hatchery and wild stock fisheries is more difficult and more expensive than the management of fisheries on wild salmon stocks alone.

The division's principal concern with large scale hatchery enhancement is that the additional costs of managing mixed hatchery wild stock commercial fisheries, as well as the permitting requirements, are not always considered in the operation of these

facilities. When decisions are made to construct and operate these facilities, the general public and the hatchery operators, with no concomitant increase in funding, expect the division to be able to manage the commercial fisheries that subsequently, as a consequence of the hatchery, will be prosecuted on mixtures of hatchery and wild stocks. Further, the managers are expected to meet multiple (i.e. conserve wild stocks, maintain high product quality, assure an acceptable level of hatchery harvest in the commercial fishery, and provide for hatchery cost recovery/brood stock requirements) and inconsistent management objectives.

The basic management plans that addressed harvest of hatchery fish were developed cooperatively by the department and the operators of the Prince William Sound hatcheries. Returning adults were to be primarily managed using more terminal harvest areas, thereby minimizing harvest conflicts with wild stocks. Additional harvest management costs were not considered under this strategy. Initially, fish quality was not an issue as terminally caught fish were of high quality. However, as the program grew, processing capacities were filled, forcing delays in harvesting terminal fish. Such delays resulted in poorer quality fish and thus the demand to harvest fish farther away from terminal areas. To manage both hatchery and wild stocks away from the terminal areas requires additional management tools and costs.

The scale of the hatchery operations is the key factor in evaluating the additional management costs. In Prince William Sound the hatchery stocks now make up over 80 percent of the total pink salmon runs. Consequently, Prince William Sound is the focus of the division's concern. The division's pre-hatchery assessment and management program was adequate to protect the Prince William Sound wild pink salmon resource. With the emerging hatchery runs, the department initiated, during the mid 1980s, a hatchery/wild stock identification program. At the time of the oil spill, hatchery runs were greater than wild stock runs; however, the hatchery/wild stock assessment program necessary to protect wild stocks was not fully developed nor was the funding for such a program in the division's base budget. The department's program was not adequate to address the emerging hatchery/wild stock fishery issues, much less address the oil spill. The program could not begin to provide the level of accuracy and precision required for assessment of the oil spill damage, or for the stock specific management measures required to protect and restore damaged pink salmon stocks that might occur due to oil spill.

In the wake of the oil spill, Natural Resource Damage Assessment funds were available, and provided the department with sufficient resources to assess the population level response of the Prince William Sound pink salmon resources to the oil spill. The completion of these studies, together with funding of the pink salmon restoration studies, will ultimately provide the department

January 15, 1992

with the information base and tools to develop a harvest management system with the objectives of protecting wild pink salmon stocks both with respect to maintaining genetic diversity and escapement levels, providing for hatchery cost recovery and brood stock requirements, and responding to industry demand for high quality.

The oil spill has greatly exacerbated the problems in meeting these management objectives in two ways. First, certain pink salmon stocks were greatly impacted by the oil spill and require very stock-specific management measures in order to protect and rebuild these populations. Second, the delayed harvest of the large 1989 pink salmon run in PWS due to the presence of oil resulted in an extremely poor quality pack and a public perception of oil contamination of those fish harvested. These factors greatly impacted the marketability of PWS pink salmon. In 1991, the reputation of poor quality was further exacerbated by large pink salmon runs statewide and low prices. To maximize the intrinsic quality of the harvest, processors and fishermen demand to harvest returning adult pink salmon at the entrance areas to Prince William Sound. At these locations the wild stocks damaged by the Exxon Valdez spill are mixed with undamaged wild stocks as well as the large returns of hatchery fish. Harvesting in these areas, while maximizing quality, also puts these wild stocks at great risk of overexploitation.

It is anticipated that no additional general funds will be required to protect and restore the damaged Prince William Sound wild pink salmon stocks, provided that oil spill settlement funds continue to be available for completion of the department's damage assessment and restoration programs. However, when these funds expire additional general funds will be required for implementation of a stock-specific harvest management system. Since the harvest management system is underdevelopment, we do not have an estimate of the additional funds required. However, we anticipate the costs to be much less than the current combined general fund, damage assessment, and restoration programs.

Sincerely,

Paul R. Eggers

Douglas M. Eggers
Chief Fisheries Scientist

cc: Denby Lloyd
Jeff Koenings
Bob Clasby
Hal Geiger

TAGGING AND MARKING SALMON

INTRODUCTION

The Magnuson (Fisheries Conservation and Management) Act of 1976 provided for United States jurisdiction over fisheries with 200 miles of the U.S. shore line as an effort to end foreign exploitation of our fisheries and aid in rebuilding stocks. A cooperative management effort was called for involving regional fishery management councils and the federal government. One of the most important factors of the act toward providing more data is the observer program. This requires foreign vessels, if requested to do so, to carry a U.S. observer on board when operating within the 200 mile limit. While the catch levels and biological data provided by the observers is very valuable it is only a piece of what is necessary to responsibly manage our fisheries. For example, where do the fish come from which are caught in the north Pacific no mans land "doughnut hole"? Are these of U.S. (lower 48) Alaskan, Russian, or Japanese origin and if we don't know where they come how can we ever expect to protect and or allocate "our own" fish (Gordon 1990).

High Seas Tagging

The International Convention for the High Seas Fisheries of the North Pacific Ocean signed by the United States, Canada, and Japan in 1952 requires research to determine the continental origins of Pacific salmon. This agreement known as the North Pacific Treaty established the International North Pacific Fisheries Commission to act as a guide to recommend and review research on salmon in the area of the Japanese high-seas fisheries. The Commission has supported the high-seas salmon research efforts of the Fisheries Research Institute at the University of Washington since 1955. The Institute has based its research on the use of a Peterson disk tag and a scale sample and other data gathered at the time of tagging. This process is initiated using two types of capture floating

longlines and purse seines. The Japanese use the longline technique exclusively and tag salmon caught in the western and central north Pacific, Bering Sea, and the Gulf of Alaska. The Canadians also use the longline technique and concentrate their efforts in the Gulf of Alaska and the eastern north Pacific. The United States through the Fisheries Research Institute and in cooperation with the U.S.S.R.'s Pacific Scientific Research Institute of Fisheries and Oceanography have used a combination of longline and purse seine over the years have tagged salmon in the central north Pacific and the Bering Sea.

This research has provided valuable information since high-seas salmon research started with the Fisheries Research Institute in 1955; however, the information is neither easy nor inexpensive to gather. As with any tag and recovery program several factors influence the quality of the research.

Weather is often a controlling factor in high-seas salmon research when tagging is as part of the program. While the longline technique can be used successfully in moderately rough seas and in areas of low concentration of fish it the salmon are more likely to be injured than when captured with a purse seine. In light seas and with the use of an outrigger to hold the net away from the research vessel a purse seine may be used to capture large numbers of fish for tagging which are less size specific and less likely to be injured than those captured with the longline technique.

Major factors limiting the success of high seas tagging operations are magnitude of the area where the fish may be captured and the distribution of fish in such a large area. Beyond the difficulties encountered in capturing and tagging fish there is the possibility that these tagged fish will be caught while in the high-seas of the north Pacific before beginning their migration to spawning areas. A tagged fish may survive the predators of the open sea, be caught by fishermen not participating in the tagging program, or just avoid interception by the inshore fisheries causing a loss of data. Some fish find their way into remote spawning areas where tag recovery is very unlikely and thus

limiting the amount of data available from the tagging operation (Davis et al. 1990).

The Mark and the Salmon

When it comes to creating a way to give fish a unique identification there is little left to the imagination as a form of mark or tag that has not been tried, tested, revised, retried, retested and in some cases continues to be used. In addition to the variety of external tags or marks applied to fish for identification there are a number of internal tags or marking techniques that have been used with varying degrees of success. Some of techniques used for internal tags or marking are the use of implants, parasites, physiological, or genetic changes to create an identifiable tag or mark in the fish.

Implants

The least intrusive implant is the utilization of a tattoo using red, blue, green or yellow tattoo artist's ink injected with a Syrijet Mark II dental inoculator. The mark should be readily visible to the naked eye (Laufle et al. 1990). The next least intrusive may be fluorescent grit pigments in blue, red, yellow, light green, or a combination of red and blue implanted into the fish using a sand blaster operating with the nozzle at a distance of 40 cm and nozzle pressures ranging from 300 to 400 g/cm². These marks are detected by using an ultraviolet light to look at the blasted area of the fish in a darkened room or area (Nielson 1990).

Coded-wire-tag (CWT) is another popular tagging or marking system. The CWT is typically a 1.0 mm long by 0.25 mm diameter type 302 stainless steel wire which has been etched to provide notches representing binary code which are readily discernable using a microscope set at 400 power magnification. The CWT can be injected, using a 24 guage hypodermic system, directly into the nasal cartilage in salmon (Buckley and Blankenship 1990).

Another implant technique involving additional technology is the use of a Passive Integrated Transponder (PIT). The PIT is a glass tube 12.0

mm long by 2.1 mm in diameter which contains an integrated circuit with antenna. This is a small radio transmitter which can be activated from an external energy source usually at a return site. This induced signal is then decoded to provide a unique factory set identification for the fish. Implantation is accomplished by using a 12 gauge hypodermic syringe system (Prentice et al. 1990).

The most invasive implant system is the application of fully powered radio transmitters measuring 6.5 cm long by 2.0 cm in diameter and weighing about 20 grams with an antenna about 30.0 cm long. This system is typically placed in the stomach of an adult salmon and basically used to track salmon movements in turbid glacial systems (Eiler 1990).

Parasites

The use of parasites as a tag or method to mark fish is an area where there may be a need for further research. Since parasites are common and present throughout most of the developmental stages of a fish they may provide a very acceptable tagging or marking technique. Some parasites naturally occurring in fish offer some very desirable qualities for tagging or marking fish.

At least seven types of endoparasitic tags or marks have been used in fisheries research. They can be identified as acanthocephala, cestoda, digenea, nematoda, plerocercoids, protoza, and sporozoan but these are only seven of possibly 180 species of parasites known to infect Pacific salmon. Parasites can be very specialized surviving in a single species of fish or a close relative or very unspecialized and occur in a variety of different fish. Much of this is dependent not only on the host fish but the environmental factors affecting the contact between the parasite and host as well as the evolutionary factors related to the stage of growth or development of both. Mark or tag recovery requires that the suspect fish be dissected to find some presents of the parasite or an indication that it had been infected by the parasite used as a mark. Recovery is simplified if the parasite used is of the variety that infects or can be found in a specific tissue or organ of the host (Buckley and Blankenship 1990).

Analysis of plerocercoids and nematode parasites have been used to identify sockeye Salmon from Alaska and Asia respectfully. Parasites which can be identified in the brain of sockeye salmon have been used to identify stocks originating from southeast Alaskan or northern British Columbia. Precision has been added to this analysis of the sporozoan brain parasite myxobolus neurobius by comparing scale characteristics also commonly used to distinguish fish from different continents (Moles et al. 1990).

Physiological

There are two basic physiological structure changes used as a mark or tag, these are scale circuli and otolith bone structure. These are both basic physical structures of fish and both have identifiable characteristics which are changed either by naturally occurrence or have changes in structure which are induced. These and other calcified structures offer a powerful technique for identifying stocks by looking at their chemical composition. Certain elements and other environmental factors such as temperature affect their crystalline density or chemical composition of these structures and can be considered a chemical mark or tag (Brothers 1990).

Scale analysis has been used for years to reliably identify the country of origin for salmon in the north Pacific. However, the use of scale analysis may not be capable of providing the information necessary to identify salmon beyond specific hatchery stocks or wild stocks, geographic region, or spawning time.

Otolith bone development provides a daily record of the internal and external forces affecting fish growth beginning at the eyed stage. This growth occurs in rings somewhat similar to the circuli of a fish scale or the rings of a tree. Growth of the otolith is in alternating rings of high and low concentrations of protein calcium carbonate. The ability to easily manipulate the optical density of these rings to make an obvious visible change in structure is what makes the manipulation of the otolith structure attractive as a marking or tagging technique.

Other changes affecting the chemical composition in the otolith have been to expose the fish to a specific trace element or isotope from a wide variety of chemicals with a specific atomic structure which can be chemically identified in the bone structure. The problem with the technique is that it can require some very sophisticated and sensitive equipment such as tube excited X ray fluorescence or atomic absorption spectroscopy, neutron activation analysis, inductively coupled argon plasma atomic emission spectrometry, or other mass spectrometry methods to detect what can be minute concentrations of the marking or tagging element (Brothers 1990).

The most common otolith mark technique may be to simply make a change in water temperature or to change the feeding pattern. Thermal marking is achieved by causing a rapid drop in water temperature. This technique has been successfully used in the hatchery environment to mark approximately 33 million pink salmon eyed eggs. This was achieved with no mortality or stress loss when water temperature was increased by 3.5°C to 3.7°C from an ambient temperature of 1.3°C to 1.5°C. Temperature control was maintained to $\pm 0.1^\circ\text{C}$ with 48 hour periods of heated water followed by 24 hours of water at ambient temperature to create one distinct ring in the otolith. This cycle was repeated to create a unique series of distinct rings in the otolith (Munk et al. unpublished).

Another technique used to lay down distinct rings is a simple matter of alternating periods of feeding and starvation of juvenile fish. Each day of starvation creates a ring of low optical density material. Subjecting fish an alternating series of days of starvation followed by and days of feeding creates areas of high and low density in the otolith which correspond directly to the periods of starvation and feeding.

Recovery and reading of the otolith mark or tag is very similar to the process used for coded wire tag recovery and reading. However there are some specific and note worthy differences. The coding process for the coded wire tag is a manufacturing process occurring some time before tagging and generally not considered a part of the tagging, recovery or reading operation. While the coding process for the otolith is the tagging operating. It is the preparation of the otolith for reading that may be

considered a production process not unlike manufacturing coded wire tags but occurring between the recovery and reading steps in the process.

The current standard procedure for preparation of otoliths for reading involved removing the bone from the fish, properly arranged in a mold and set in a polyester resin. The resin block with the enclosed otolith bone is then ground and polished on a Buehler Ecomet 3 lapping machine with a Texmet cloth and 1.0 μm alumina abrasive to a point that provides a clear view of the primordia of the otolith. The polished end of these block of plastic is then mounted with epoxy on glass slides and cut on a Buehler Isomet diamond saw to remove all but 0.5 mm of the otolith resin block. This is then polished on a Logitech LP-30 precision lapping and polishing machine to a thickness of between 50 and 150 μm depending on the specimens being prepared (Volk et al. 1990). The rings can then easily be read with a common microscope at 400 power.

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STRATEGIC PLAN

**FISHERIES REHABILITATION
ENHANCEMENT & DEVELOPMENT
DIVISION IN THE 90s**

**Preliminary Draft
Subject To Change**

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**J. P. KOENINGS
DIRECTOR**

DRAFT

ALASKA DEPARTMENT OF FISH AND GAME

**CARL L. ROSIER
COMMISSIONER**

DRAFT

DECEMBER, 1991

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*Preliminary Draft
Subject To Change*

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EXECUTIVE SUMMARY

In 1988 a strategic planning process was initiated to review the division's past responsibilities and programs. This process was initiated because of external influences on our program that necessitated change. After assessing the social, political, economic, and traditional considerations, the division, after analyzing its strengths and weaknesses, realized it must maintain some of its current programs, transfer to the private nonprofit (PNP) sector others previously supported with general funds, and diversify by growing selectively into new areas. The FRED Division found that it must serve as a catalyst to identify and facilitate new opportunities from those fishery development resources available within government and the private sector. The planning process has resulted in an identification of core program elements to guide current and future programs.

This strategic plan document presents the division's direction for the 1990s and identifies the division's (1) statutory authorizations; (2) mission, (3) core program elements, (4) issues related to program elements and roles supporting these efforts, (5) descriptions of primary disciplines within the division, (6) descriptions of the regional programs, and (7) history.

Statutory Authorizations

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Develop and continually maintain a comprehensive, coordinated state plan for the orderly present and long-range rehabilitation, enhancement, and development of all aspects of the state's fisheries for the perpetual use, benefit, and enjoyment of all citizens, and revise and update this plan annually (AS 16.05.092(1)).

Encourage the investment by private enterprise in the technological development and economic utilization of the fisheries resources (AS 16.05.092 (2)).

Through rehabilitation, enhancement, and development programs, do all things necessary to insure perpetual use and increasing production and use of the food resources of Alaska waters and continental shelf areas (AS 16.05.092 (3)).

Mission Statement

To sustain and enhance Alaska fisheries through the development and application of technologies in supplemental production, natural stock rehabilitation, and aquatic farming.

Core Program Elements

1. Support and facilitate private sector aquaculture programs.
2. Provide essential technical services for departmental commercial, sport, subsistence fisheries programs.
3. Restore and enhance fish habitats.
4. Provide technological support for economic development in aquaculture.
5. Restore depleted wild fish stocks.
6. Produce fish for departmental sport and subsistence fisheries programs.

INTRODUCTION

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The strategic planning process was initiated by FRED Division in 1988 in response to a changing social and political environment. Funding constraints and philosophical changes by the legislature and administration concerning the department's role in the fisheries rehabilitation and enhancement program necessitated its reevaluation. Because these factors were directly influencing the division's ability to carry out established programs, it was becoming impossible for the division to meet statutory obligations and program responsibilities. As a result of this planning process the division will focus efforts and direct fiscal resources toward accomplishing specific program elements. As part of this planning process, the division examined current and future economic and organizational trends, and it will make every effort to evaluate the effectiveness and return on investment of all program activities.

The cornerstones of the division's program have been identified here as core program elements. In order to gain an understanding of each element, the issues and support services related to each one have been provided.

Support and Facilitate Private Sector Aquaculture Programs

Issues:

The private nonprofit hatchery program is expanding; i.e., the operation of some enhancement facilities previously operated by the state have been assumed by them. This program requires ongoing permit review procedures, technical assistance, and hatchery management planning to effectively operate.

There is a developing aquatic farming industry for shellfish and aquatic plants. The public is looking to the department for a leadership role in providing technical assistance and management of this program, and that requires ongoing permit review and coordination with the divisions within the department as well as other state and federal agencies. Focus on the department's statutory requirement for assistance in the development of comprehensive salmon plans has been directed toward north, northwest, and western Alaska in addition to the ongoing program in established regions of the state.

Services:

Conduct regional comprehensive fisheries production planning for salmon on a statewide basis. Facilitate, regulate, and manage Alaska's private nonprofit (PNP) salmon enhancement and mariculture programs.

Develop and transfer new information on aquaculture and provide applied fisheries technology and technical services, including tagging/mass marking, pathology, limnology, and genetics.

Apply existing and new techniques to evaluate biological and harvest implications of fishery enhancement programs relative to wild stocks.

Identify and implement efficient methods for cooperative operation (public/private) of hatcheries in order to make the best use of hatchery resources within the state.

Educate, inform, and involve the public in Alaska's fisheries rehabilitation, enhancement, and development programs.

Develop and maintain computerized databases of information on the program.

Provide Essential Technical Services for Departmental Commercial, Sport, and Subsistence Fisheries Programs

Issues:

The impacts of enhancement and aquatic farming programs relative to natural stocks must be evaluated and clearly understood in order to facilitate the concept of protection of natural stocks.

In order to protect wild stocks, fish health services, genetic evaluations, tag/recovery programs, and fishery management concerns associated with the enhancement and aquatic farming programs need to be continually evaluated.

Services:

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Apply existing and new techniques to evaluate biological and harvest implications of fishery enhancement and aquatic farming programs relative to wild stocks.

Assess critical areas of need and provide technical assistance necessary to implement projects for fisheries rehabilitation, enhancement, and development across the state.

Develop, implement, and evaluate technology for natural stock and habitat rehabilitation in lake, stream, nearshore, and marine environments.

Develop applied fisheries technology and provide technical services.

Provide economic evaluation of the statewide aquaculture program.

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Restore and Enhance Fish Habitats

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Issue:

There is an increasing demand on the division for habitat restoration and enhancement activities. The division will emphasize natural stock and habitat rehabilitation activities as part of the ongoing program. An evaluation of needs and requirements for these activities on a statewide basis will be part of the program.

Services:

Restore losses to fisheries caused by natural disasters and adverse impacts caused by human activities.

Develop, implement, and evaluate technology for natural stock and habitat rehabilitation in stream, lake, nearshore, and marine environments.

Develop applied fisheries technology and provide technical services.

Provide Technological Support for Economic Development in Aquaculture

Issue:

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The development and transfer of aquaculture technology and provision of technical assistance to the private sector is a legitimate government role to be emphasized by the division.

Services:

Develop and provide new information on aquaculture.

Provide economic evaluation of the existing and developing statewide aquaculture program.

Assess critical areas of need and provide technical assistance necessary to implement projects for fisheries rehabilitation, enhancement, and development across the state.

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Develop applied fisheries technology and provide technical services.

Develop, implement, and evaluate technology for natural stock and habitat rehabilitation in lake, stream, nearshore, and marine environments.

Apply existing and new techniques to evaluate biological and harvest implications of fishery enhancement (i.e., relative to wild stocks) and aquatic farming programs.

Conduct regional comprehensive fisheries production and management planning for state and PNP hatcheries and in new areas of the state.

Restore Depleted Wild Fish Stocks

Issue:

A greater emphasis needs to be placed on wild stock fisheries rehabilitation efforts. The division must direct resources to accomplish this program element.

Services:

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Provide the technical assistance, emphasizing wild stock genetic integrity necessary to implement projects for fisheries rehabilitation across the state.

Produce fish for natural stock and habitat rehabilitation in lake, stream, nearshore, and marine environments.

Apply existing and new techniques to evaluate biological and harvest implications of fishery enhancement programs relative to wild stocks.

Develop applied fisheries technology and provide technical services.

Develop and conduct sport fish rehabilitation programs.

Develop, implement, and evaluate technology for natural stock and habitat rehabilitation in lake, stream, nearshore, and marine environments.

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Restore losses to fisheries caused by natural and human-caused disasters.

Produce Fish for Departmental Sport and Subsistence Fisheries Programs

Issues:

The division has been required to transfer to the private sector the operation of state hatcheries that primarily focus on the production of fish for commercial benefit. The division will continue this effort.

Additionally, there is an increasing demand for a program to provide fish for sport and subsistence users. The division will continue to expand these efforts based on new opportunities.

Services:

Develop and conduct sport fish programs and provide fish for subsistence and personal use with departmental field projects and hatchery facilities.

Assess critical areas of need and provide the technical assistance necessary to implement projects to rehabilitate, enhance, and develop fisheries across the state.

Apply existing and new techniques to evaluate biological and harvest implications of fishery rehabilitation and enhancement programs relative to natural stocks.

Educate, inform, and involve the public in Alaska's fisheries rehabilitation, enhancement, and development program.

Implementation

It is a challenging time to deliver an effective program that satisfies the demands for change in direction while at the same time addresses the needs of aquaculture in the state; however, at a time when the state's fiscal resources for fisheries rehabilitation, enhancement and development program were declining, there continued to be an increase for technical assistance and delivery of services. The

division must make the best use of available resources in the current social and political environment.

This plan presents core program elements that will be used in setting division priorities and conducting annual program planning and budgeting. The next step in the implementation process of this plan is to identify, in greater detail, the means to guide budget preparation by fiscal year. This will constitute a major part of the division's budget planning and deliberation process, beginning in FY 93 and continuing into the future.

The plan also establishes direction for staff to assess their current and future activities in relation to core program elements. FRED division is committed to proceeding in a manner that will provide the necessary programs and services required by the elements.

This document will be distributed to the public for their evaluation and comment regarding the direction of the division's program. Legislators and constituents will also be involved in this process to evaluate the rationale for diversification and changes in program operations.

STATEWIDE PROGRAMS AND ACTIVITIES

FRED Division began to address the roles envisioned under each core program element depicted in this document while planning for fiscal year (FY) 1993 and beyond. Specific descriptions of the programs, roles, and activities to be undertaken in the early '90s are provided in the following sections.

Mariculture Program

FRED Division will continue to coordinate and administer the aquatic farming program and take the lead in this discipline for the department. The division will participate with the other agencies and the industry in developing a strategic plan for the growth and evolution of the industry. Technical services will be expanded to include operations, siting, design, species selection, and business planning assistance.

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Research will also be initiated to aid in the development of the industry. Areas identified as having high potential benefits include the feasibility of producing sterile scallops, developing shellfish and aquatic plant hatchery technology for Alaska species, researching new species for aquatic farming, site-evaluation techniques, broad-based research on determining optimal areas for aquatic farming in the state, oyster-maturation studies, broodstock development, and seedstock-collection research. FRED Division will use its technical expertise and facilities to accomplish the research and then transfer that technology to the private sector. Continual interaction with the industry will identify new areas of concern or benefit that cannot be addressed directly by the industry because of a lack of expertise, facilities, or high costs.

Technology and Development Services

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The FRED Division operates five laboratories that serve ADF&G and other agencies. The Fish Pathology Section has two laboratories (one in Anchorage and Juneau) and provides diagnostic services and broodstock evaluation for both state and PNP fisheries programs. The Limnology Section has a laboratory in Soldotna and supervises all lake-enrichment projects and analyses of water, plankton, and juvenile fish populations sampled for lake-productivity studies. The Coded-Wire Tag Processing Laboratory (CWT Lab decodes metal tags implanted in fish and supplies resultant information for hatchery and natural stock evaluation as well as for evaluation of U.S./Canada salmon interceptions. The Genetics Laboratory monitors the interaction of hatchery salmon stocks with wild hatchery salmon and employs genetic techniques for finfish and shellfish stock identification and stock improvement. In summary, these laboratories and their associated scientists provide a set of technical services in extremely strong demand by the department, regional aquaculture associations, aquatic farming industry, PNP hatchery operators, and other state and federal agencies.

Coded-Wire Tag Processing Laboratory:

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The division is seeking a new home for its CWT Lab. Working conditions at the present facility have deteriorated to the point where the state is at risk to liability lawsuits from employees that work there. Further, the workload at the lab has tripled since 1985, outstripping the space available. Monies to acquire a different lab space will be requested in the FY 95 budget. While efforts are underway by this division and others to develop new marking techniques (e.g., otolith marking,

looks very promising), the use of coded-wire tags is not going to be replaced in the foreseeable future. The CWT Lab is a vital link in the in-season management of fisheries in Southeast and Prince William Sound. Chinook salmon fisheries from California to Alaska are managed by treaty convention on the basis of coded-wire tag data. The massive returns of hatchery pink salmon to Prince William Sound is critically assessed by in-season tag data. Coastwide, this laboratory has the reputation of being the best-run operation of its kind.

Fish Pathology Laboratory:

Active laboratories will be maintained in both Juneau and Anchorage to provide continuing fish health services to salmon hatcheries, mariculture operations, other fisheries divisions, and the public-at-large. The basic function of the fish pathology discipline is to implement policies and procedures that guard against the spread of fish and shellfish diseases in Alaska. The two laboratories serve this function. Routine diagnostics and processing of transport permits for finfish and shellfish will continue as in the past. Monitoring for viral hemorrhagic septicemia virus in Pacific cod will continue. Mapping the distribution and infection rates of bitter crab disease in tanner crabs will go forward in association with the ADF&G Commercial Fisheries Division and the crab fleet. Oyster spat certification for import into Alaska will remain a significant task for the pathologists. Transport permits for aquatic farming activities will increase significantly.

Genetics Laboratory:

The primary service of the genetics discipline is to implement policies and procedures that protect and maintain the genetic uniqueness of Alaska's wild salmon stocks in the face of North America's largest salmon enhancement program. In the coming year, the department's fish genetics policy will be reexamined and updated. Routine processing of transport permits for finfish and shellfish will continue as in the past; however, contentiousness now accompanies a growing number of transport requests, and it is our intent to establish a genetic-screening program for salmon stocks so that answers to tough questions regarding the genetic implications of stock movement can be facilitated. The Genetics Laboratory is now equipped and ready to process samples that will reveal the genetic conformation of our wild salmon stocks. This compatibility has application for stock separation in mixed-stock interception fisheries, identification to the country of origin of salmon caught on the high seas, and examination of the

interaction of hatchery stocks and wild stocks. The incumbent principal geneticist is an expert on techniques employed to sterilize fish and shellfish—a concept that has great practical application in Alaska. FRED Division will work toward using sterile animals for outstocking in projects where fertile animals would have a genetic impact on indigenous wild stocks and thus prohibit such projects. The development of sterile Japanese scallop spat is an example; stocking of sterile rainbow trout for sport fishing is another example.

Limnology Laboratory:

The Limnology Laboratory and the lake-enrichment and water-quality capabilities associated with it are in great demand by cooperators across the state. This unit generally has 30-40 cooperative projects ongoing around the state during any given year. Nutrient enrichment of sockeye salmon lakes has proven to be an extremely cost-effective tool for rehabilitating depressed sockeye salmon runs, and such projects will continue into the future. Karluk Lake is an outstanding example of what can be done; in 1990, it had the largest return of sockeye salmon since good record-keeping was established in the early 1900s. This return was made up principally of late-run adults that, as juveniles in 1986, received the benefits of our initial application of fertilizer to Karluk Lake. Similar projects will continue in Southeast, Southcentral, and Prince William Sound, and new ones will be established on the Alaska Peninsula. Work will continue on marrying habitat features of lakes to forecasting adult fish returns in subsequent years. FRED scientists have pioneered this approach to sockeye salmon forecasting, and in subsequent years they will extend it to the marine environment. Water-quality studies on the Kenai River will go forward with funding from the Department of Natural Resources. The United States Environmental Protection Agency is interested in funding the laboratory to conduct water-quality studies on lakes in populated areas of Alaska. The North Slope Borough has invited limnologists to participate in borough enhancement and water-quality planning in the coming months.

Library Services:

Fishery scientists, planners, and managers in two of the department's fishery divisions (Sport Fish & FRED) are served by a centralized library managed by the FRED Division. Funding for the library is shared among them and is prorated on a user basis.

Little Port Walter Field Station:

The research station at Little Port Walter (LPW) on the south end of Baranof Island is operated by the National Marine Fisheries Service's Auke Bay Laboratory (ABL). This station plays an important role in developing new technologies for the ocean ranching of salmon, particularly chinook and coho salmon. FRED Division has, for the past 15 years, helped to financially support the operation of LPW. While the division's monetary contribution is small compared to that made by ABL, it is nevertheless very critical because it funds field travel to and from the station-- something ABL cannot do because monies for field travel were cut from its budget. The division intends to continue with this cooperative arrangement.

Private Nonprofit Hatchery Program Administration

Beginning in 1974, the Alaska State Legislature authorized the Commissioner of ADF&G to issue permits to qualified PNP corporations for the construction and operation of salmon hatcheries. The intent of the program is to allow private ownership of hatcheries that will contribute to the state's common-property salmon fisheries. The cost of constructing and operating these hatcheries is to be derived from (1) sale of a portion of the returning fish, (2) fish enhancement tax, and (3) operating loans from Alaska Department of Commerce and Economic Development and other sources.

The PNP hatchery program carries out the department's statutory and regulatory responsibilities pertaining to public and private ocean ranching in Alaska, including (1) administration of the permitting process for PNP hatcheries and scientific/educational aquaculture projects, (2) development of annual operations/management plans for all public and PNP salmon hatcheries, (3) compilation and dissemination of production data for PNP hatcheries, (4) administration and coordination of the statewide finfish transport permit system, and (5) provision and coordination of technical assistance to PNP hatchery operators.

The PNP hatchery program is continually expanding as permits for new hatcheries are issued and permit alterations for existing facilities are approved. New PNP permits for the operation of state-owned facilities by regional aquaculture associations will be needed to allow for cost-recovery harvests at these facilities.

Regional Comprehensive Salmon Planning

The Commissioner of ADF&G, in accordance with Alaska Statutes 16.10.375-470, has designated salmon production regions throughout the state. In each region, the Commissioner is responsible for the development and amendment of a comprehensive salmon production plan. Although the Commissioner has placed this responsibility with regional planning teams (RPT) that statutorily consist of representatives from ADF&G and the regional aquaculture associations, he still approves those plans developed and amended by the RPTs. The mission of the RPTs is to plan for the long-term future of the salmon resource within its region by initiating and continuing an orderly process that examines the full potential of the region's salmon-production capacity.

Emphasis on this comprehensive salmon planning process has recently been and will continue to be placed in western, northwestern, and northern Alaska in order to develop comprehensive salmon plans for approval by the Commissioner. These planning efforts are currently active in ten regions of the state. In 1990 the Commissioner appointed an RPT to initiate the development of a plan for the newly established Chignik region in conjunction with the regional aquaculture association. A draft Phase I (20 year) plan is scheduled to be completed by December 1991. In 1990 the Commissioner also appointed an RPT to begin development of a plan for the Alaska Peninsula/Aleutian Islands/Area M Region. A draft Phase I comprehensive plan is also scheduled to be completed by December 1991. Residents of Kotzebue Sound have been interested in salmon enhancement planning, and the FRED Division has established a planning core group that includes ADF&G, the National Park Service, and the Borough to develop alternative production scenarios as part of a basic management plan for the Sikusuilaq Springs Hatchery. A regional aquaculture association will probably be established in 1992, and a comprehensive salmon plan for the region should be completed in 1992.

No specific planning activity has occurred in the Lower Yukon/Kuskokwim Region since 1982; however, in response to a consensus of Yukon River fishery interests, the FRED Division has developed a Yukon Fisheries Enhancement Initiative. Residents of the region are organizing an aquaculture association and, with funding from the Legislature for the initiative, regional enhancement planning will be reactivated and expanded to include the Yukon River. A draft comprehensive salmon plan could be completed by the fall of 1992.

For the Bristol Bay Region, a plan has been completed. This plan does not concentrate on fisheries enhancement through such strategies as hatcheries; rather, it emphasizes maintenance and restoration of fish habitat and effective management practices. Commercial fishermen in the region recently turned down the idea of an enhancement tax to fund the aquaculture association and, therefore, project funding is minimal at this point.

In Kodiak, the Phase II (five-year project plan) comprehensive salmon plan was recently revised to incorporate new production objectives and new project ideas. In 1991 the RPT will establish a process for annually updating the comprehensive plan. In Cook Inlet and Prince William Sound, both regional aquaculture associations have full-time professional planners that conduct RPT activities. Therefore, the FRED Division's responsibility in these regions is one of coordination between the department and the association, and monitoring RPT activities.

In Northern and southern southeast Alaska, both RPTs are staffed by the FRED Division and are in the plan-maintenance and plan-update process. In 1991 and 1992 the regional aquaculture associations, the RPTs, and the FRED Division will be working to develop a Southeast-wide allocation plan for enhanced fish that will be presented to the Alaska Board of Fisheries as a proposal. Once approved, the board will use the plan for decisions relative to the enhancement program in southeast Alaska. Given the multiple gear groups, two regional associations, U.S./Canada Pacific Salmon Treaty implications, and the nature of the mixed-stock fishery, this will be a major undertaking.

Planning staff will also be responsible for working with the FRED Director to articulate and promote special projects planning efforts based on the identification of new opportunities and requirements that may be recommended by the current administration or the Legislature.

Economic Evaluation

Salmonid fisheries enhancement for commercial fishery markets and subsistence and recreational users has had a variety of effects on Alaska's economy. Since state, federal, and private funds are invested into hundreds of individual salmon enhancement projects, and since the state's salmon resource is common property in nature, it is important for planners and policymakers to understand the resulting economic viability and employment potential of these programs.

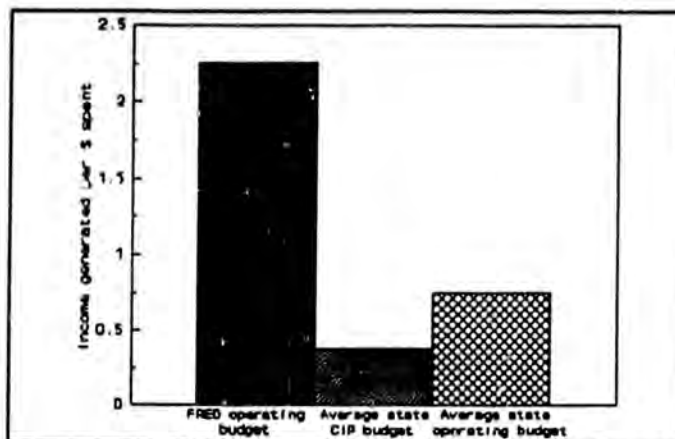


Figure 1. Income to Alaskans from an average dollar spent out of the state operating, capital budgets and fisheries enhancement program. Data from Institute of Social and Economic Research.

The economics program provides economic information to fishery interest groups; PNP hatchery operators; regional aquaculture associations; RPTs; and managers and policymakers in ADF&G, The Department of Commerce and Economic Development, and the Alaska State Legislature on the consequences of ocean ranching and aquatic farming (i.e., shellfish and aquatic plants). The economics program assists in the evaluation of investments to ensure maximum social and economic benefits are derived from Alaska's extensive application of fisheries enhancement and aquatic farming technologies. The enhancement program has achieved a proven economic return on investment. This is one of the higher, if not the highest, return ever realized from state investments (Figure 2).

Data Management

The primary function of data management in FRED Division is to gather and disseminate information about the statewide enhancement program; there are several databases already in use that maintain historical production records. These data are used in scientific reports and economic analyses. Data are provided to the legislature, governmental and nongovernmental agencies, and the media; data are also used to prove compliance with Federal Aid standards. As enhancement projects are more carefully scrutinized and the program held more accountable for

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its actions, data management will play an increasingly important role in verifying the value of the enhancement program in an auditable manner.

Tools to make the gathering and use of reliable information easier are being developed. Technological advances in networking (i.e., wide area, local area) have allowed easy data sharing. As these networking technologies grow, so will their applications; for example, personnel and expenditure tracing and budget preparing systems. As such, these databases will be used to streamline many of our basic administrative duties.

SOUTHEAST REGIONAL PROGRAMS AND ACTIVITIES

Northern Southeast Alaska

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Snettisham Hatchery:

There are three primary elements involved in the program at Snettisham: (1) the production of fish for sport fisheries, (2) the development and application of new fisheries technology, and (3) the production of fish to fulfill the U.S./Canada Pacific Salmon Treaty obligations.

The production of chum salmon was one of the initial programs at the hatchery. This program was transferred to the private sector in 1991. In a cooperative program with both Douglas Island Pink and Chum, Inc. (DIPAC) and the Northern Southeast Regional Aquaculture Association (NSRAA), FRED Division reared and released 12.5 million juvenile chum salmon at Limestone Inlet in 1991. The release site at Limestone Inlet will be transferred to DIPAC in 1992. In the summer of 1991, the resources used to produce chum salmon at Snettisham were redirected toward sockeye smolt production.

Sockeye Salmon Smolts. In 1991 the division will initiate a pilot program for the production of sockeye salmon smolts and presmolts at Snettisham. Development and application of sockeye smolt and presmolt enhancement strategies by FRED Division was discontinued with the transfer of Main Bay Hatchery to the private sector. The physical facility at Snettisham resembles Main Bay. Reapplying the resources used to produce chum salmon at Snettisham provides an opportunity to continue developmental work with sockeye smolts and presmolts. Developmental work will focus on answering questions about size of smolts at release, time of release, and the relative merit of freshwater and saltwater rearing prior to release. The first smolt release may take place as early as 1993. As many as 400,000 adult sockeye could be produced annually by these programs at Snettisham.

Sockeye Salmon Fry, Snettisham Central Incubation Facility (CIF). This proposed facility should be completed in 1992 or 1993. The facility will be constructed with federal U.S./Canada enhancement funds and produce fish associated with U.S./Canada treaty mitigation on transboundary rivers. The isolation modules may also be used for local rehabilitation projects in areas such

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as upper Lynn Canal. The capacity of the permanent CIF will be from 15 to 30 million eggs. The CIF projects could produce as many as 250,000 adult sockeye per year.

Chinook Salmon at Deep Cove. The Deep Cove project is funded with U.S./Canada funds. The project will begin with the release of 500,000 smolts in the summer of 1992. In 1993 the program will move to full production with a release of 2.5 million smolts. This release should produce as many as 75,000 adult chinook salmon. The fish returning to Deep Cove in 1996 may be used to fund the program from that time forward.

Northern Southeast Alaska Area Biology:

The primary role of the Northern Southeast Alaska area biologist is to enhance area sport fisheries, support local public and private hatcheries, and to rehabilitate fisheries habitat. The Juneau recreational fisheries program; Snettisham Hatchery; habitat restoration (in Haines, Yakutat, and Juneau); and support for local private hatcheries (DIPAC facilities, Burro Creek Hatchery, Skagway City Hatchery), NSRAA, the U.S. Forest Service (USFS), and Upper Lynn Canal chinook planning all come under this program. The most important accomplishment of the area biologist is the successful translation of the diverse needs and desires of the user groups into meaningful rehabilitation and enhancement programs.

Central Southeast Alaska

Crystal Lake Hatchery:

The primary roles of the programs at the Crystal Lake Hatchery are to aid in fulfilling U.S./Canada treaty obligations, produce sport fish, and assist in fisheries rehabilitation projects. Crystal Lake Hatchery is the cornerstone of the southeast Alaska chinook salmon program. The facility is presently being upgraded with U.S./Canada enhancement funds. In 1991, 850,000 chinook smolts were released at Crystal Lake; beginning in 1992 and continuing indefinitely, 1.3 million chinook smolts will be produced annually. The adult chinook salmon from these releases will make significant contributions to both sport and commercial fisheries. In addition, Crystal Lake Hatchery is the single most important source of chinook salmon eggs in southeast Alaska; each year 5 to 8 million chinook eggs are moved from Crystal Lake to private and public hatcheries across southeast Alaska.

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Steelhead Trout. The division has not done the research necessary to develop the parameters for steelhead trout production in southeast Alaska. This work, which began at Crystal Lake in 1991, is designed to examine different strategies for the rearing and releasing of these fish. The work will be evaluated by both Sport Fish and FRED Division biologists.

Coho Salmon. Smolts and fry are also released from Crystal Lake Hatchery. This small but important local program produces 100,000 smolts and 250,000 fry. There is a small isolation facility at Crystal Lake that is used to provide fry for enhancement and colonization projects, such as those planned for the Harding and Farragut Rivers. It may be possible to expand these facilities at Crystal Lake as the demand for these modules increases.

Central Southeast Alaska Area Biology:

The primary role of the area biologist is to enhance and rehabilitate fisheries and support the programs at Crystal Lake Hatchery. The Farragut River project involves moving chinook fry above a barrier in the river system to utilize rearing habitat that would otherwise be unavailable to these fish. Each release of 200,000 fry above the barrier is expected to generate from 2,000 to 4,000 adult chinook salmon. After five years (in 1997) the field of operations may be transferred to NSRAA.

The Harding River project is a joint effort between FRED Division and the U.S. Forest Service to improve upstream access for adult salmon and recolonize the unutilized section of the river. The FRED Division has obtained 5 years of U.S./Canada enhancement funding to take 100,000 chinook salmon eggs in the lower river and return 80,000 fry above the barrier. The project is expected to generate up to 3,000 adult chinook salmon annually, once the upper watershed is fully utilized by chinook salmon.

The area biologist continues to work with the U.S. Forest Service in Petersburg and Wrangell to develop fishpass projects. The U.S. Forest Service works primarily on fishpass design and construction, while the FRED Division performs the bioenhancement. The isolation facility at Crystal Lake is a vital component of this work. Proposed bioenhancement involves work on Mitchell and Portage Creeks on Kupreanof Island and Eagle River in Bradfield Canal.

Southern Southeast Alaska

Deer Mountain Hatchery:

This small urban salmon and trout hatchery role in fish-culture research and development has been increasing. The hatchery is being used to test special treatments for salmon, such as the production of triploid fish. The hatchery programs are also being developed to assess and refine current fish culture methods. The work accomplished at Deer Mountain will continue to be used in establishing fish culture standards and practices throughout the state.

Deer Mountain Hatchery produces chinook and coho salmon and steelhead trout primarily for the local sport fisheries. The hatchery produces at least 3,000 adult chinook salmon, 10,000 adult coho salmon, and 200 steelhead trout each year.

Deer Mountain Hatchery is located in the Ketchikan City Park; it is a primary tourist destination in Ketchikan. More than 200,000 people tour the facility each year. In addition, the staff at the hatchery have developed educational programs in cooperation with the local school, and numerous students can be found working (learning) at the hatchery daily.

Beaver Falls Hatchery:

Beaver Falls Hatchery is used primarily in cooperative sockeye salmon projects with the local regional aquaculture association. Most of these projects have been designed to enhance natural populations of sockeye salmon in rehabilitation and mitigation projects. The hatchery will eventually be used at its full capacity (20 million eggs). The potential annual production of the hatchery at this capacity is at least 170,000 adult sockeye salmon. In order to reduce the costs of providing sockeye salmon to the fishermen of southeast Alaska, the Beaver Falls facility will be operated by the Southern Southeast Regional Aquaculture Association, although FRED Division will be cooperatively involved in directing these enhancement efforts throughout the region.

Klawock Hatchery:

The intent of the work at Klawock Hatchery is primarily to develop subsistence and personal-use fisheries, fisheries restoration and habitat rehabilitation projects,

and sport fish production. The FRED Division, Commercial Fisheries Division, local fishermen, local native organizations, and the BIA have cooperatively initiated an effort to restore the Klawock River sockeye and chum salmon runs from their present depressed state. This work involves the combined efforts of the FRED Division Limnology Section, the FRED area biologist, and the hatchery staff. In addition to Klawock River fisheries restoration, the hatchery staff is involved with the U.S. Forest Service in several rehabilitation projects on Prince of Wales Island.

There are also successful coho salmon and steelhead trout programs at Klawock. Between 700,000 and 1,100,000 coho salmon are released each year. At this production level, the program annually produces about 68,000 adult coho salmon. Although some of these fish are harvested in sport and personal-use fisheries, the majority are harvested in the commercial fisheries. Up to 70,000 steelhead trout smolts are released in the Klawock River each spring.

The staff at Klawock Hatchery has recently submitted several project proposals suggested by Native groups and the BIA that would involve local people in the hatchery program. The objectives of the work would be to (1) improve traditional Native fisheries and (2) train selected individuals in fisheries enhancement work. In addition the staff at the hatchery has initiated a program with the local school system to develop fisheries and resource-related curriculum; the program brings professionals into the classroom and students into the hatchery.

Southern Southeast Alaska Area Biology:

The area biologist is responsible for three major areas of work: (1) rebuilding natural stocks, (2) hatchery-related research, and (3) fish colonization projects.

Natural stocks are being rebuilt in areas (primarily on Prince of Wales Island) impacted by subsistence, land-based sport fisheries, or habitat disturbances (e.g., logging, mining, construction, etc.) by stabilizing disturbed habitat (e.g., stream rehabilitation) and restoring natural salmonid production. In some instances, fish produced in hatcheries are used to enhance threatened stocks.

The program at Deer Mountain continues to evolve toward research. One current project involves the production of 40,000 triploid chinook salmon from the 1991 brood at Deer Mountain. Because they have been neutered, these triploid fish will

grow faster and live longer; however, there is a question as to their homing abilities.

The FRED Division area biologist will continue enhancement projects in cooperation with the U.S. Forest Service fishpass construction program. Sockeye and coho salmon fry from hatcheries will be used to colonize barren habitat. The effectiveness of these projects will be monitored with the evaluation of coded-wire-tag recoveries. Although the number of fish produced by any one of these projects will probably not be impressive, their cumulative effects will be significant. The value of preserving, restoring, and enhancing natural stocks of fish and their habitat as well as producing information through hatchery research is immeasurable.

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SOUTHCENTRAL, WESTWARD, AND AYK REGIONAL PROGRAMS AND ACTIVITIES

Overview

Region II includes Prince William Sound, Cook Inlet, Kodiak, Alaska Peninsula, Bristol Bay, North and Northwest Alaska, and the Interior. The regional program currently includes area offices at Cordova, Homer, Wasilla, Nome, and Kodiak and hatcheries at Gulkana, Main Bay, Tutka, Crooked Crook, Big Lake, Fort Richardson, Elmendorf, Clear, Pillar Creek, Kitoi, Russell Creek, and Sikusuiak. The program also includes dozens of projects across the region, including the following: (1) evaluation of enhancement programs, (2) stream rehabilitation work in Anchorage and Nome, (3) sport fish enhancement projects in Cook Inlet, (4) the Alaskan Rainbow Trout Broodstock Development Center, (5) Lake survey, stocking and fertilization projects in Prince William Sound, Cook Inlet, Kodiak, and the Alaska Peninsula, (6) Sockeye salmon restoration work at English Bay, and (7) technical support for development work for Nelson Island, Chevak, Elim, and the Yukon River.

The FRED Division program for Southcentral, Westward and Arctic-Yukon-Kuskokwim Region is supported by an office located in Anchorage. Within the region, there are a number of initiatives that have been undertaken by the FRED Division.

Regional Initiatives

Northwest Alaska Initiative:

In FY 92 FRED Division established a full-time biologist position in Nome to facilitate initiation of fisheries restoration and development activities in northwest Alaska. This position provides technical support for the development of projects from the Kuskokwim River north to Kotzebue Sound.

Northwest Alaska has been previously supported by the Anchorage or Fairbanks offices. With the recent surge of interest in fisheries enhancement programs and development of new projects there, it became clear that it would be more

economically viable for staff to support these operations from ADF&G's Nome office.

Work funded by the FRED Division includes support for feasibility studies for potential fisheries enhancement projects in the Nelson Island/Chevak area. In cooperation with local villages and the Bering Sea Fishermen's Association, additional funding has been requested from the Bureau of Indian Affairs (BIA) and National Coastal Resources Research and Development Institute.

FRED Division provides technical support to the Norton Sound Economic Development Corporation to assist in the development of a new fisheries enhancement program at Elim. Supplemental support for fisheries enhancement work in Norton Sound is being sought by the North and Northwest Mayors' Conference through their Norton Sound Economic Development Initiative. This initiative was developed in February 1991 and presented to the Economic Development Forum of the Alaska Department of Commerce and Economic Development, where it is currently being considered.

FY 92 funds have been allocated to support the Northwest Alaska Initiative. These funds, which were derived from reduced middle-management staff in the Anchorage regional office, support a full-time position and projects at Nelson Island, Chevak, and Elim.

Anchorage Stream Rehabilitation Initiative:

FRED Division is solidifying the Anchorage area stream rehabilitation program by establishing a full-time position to develop and initiate stream rehabilitation projects there. The program will serve to restore fish habitat that has been damaged by development and enhance existing fish stocks; it provides funding for staff time and limited operational support. FRED Division will look to private and corporate donations of labor, materials, and equipment to implement specific stream rehabilitation projects throughout the year. Work will be conducted in cooperation with the City of Anchorage, sport fishermen's associations, Boy Scouts, and Anchorage School District. Additional funding is being received from the Alaska Science and Technology Foundation (ASTF). This ASTF project has been initiated with the cooperation of the City of Anchorage and the Anchorage School District. ASTF funding will allow FRED Division to solidify stream rehabilitation technology and practices to the benefit of similar projects throughout

the state. The City of Anchorage and the Anchorage School District are also working with FRED Division staff to solidify a cooperative approach to fisheries development and education. The City of Anchorage has requested funds for this program through Streams, Kids, and Fish (SKIF). For FY 92, monies have been reallocated from the Anchorage Regional Office staffing to the Anchorage Stream Rehabilitation Initiative.

Yukon River Enhancement Initiative:

In cooperation with Yukon River fishermen and communities, a Yukon Fisheries Enhancement Initiative was developed in January 1991. The initiative was considered by the Governor's Office and the Legislature. With the prospects of a U.S./Canada Treaty for the Yukon River, fisheries enhancement represents a very viable mitigation tool.

King Crab Initiative:

In cooperation with fishermen and the Kodiak Island Borough, a King Crab Initiative was developed in February 1991. Additional funding for this program is being requested from the Alaska Science and Technology Foundation (ASTF) who has proposed to help fund the examination of shellfish rehabilitation projects in other countries and states to help us solidify this initiative. King Crab rehabilitation research was begun in March 1991 with program development and solidification based on various funding packages.

Railbelt Sport Fisheries Initiative:

FRED Division will be working to solidify an Anchorage and Railbelt Sport Fisheries Enhancement Program. In cooperation with the City of Anchorage and Sport Fish Division, staff are currently developing an initiative to provide additional water to the Fort Richardson Hatchery to allow FRED Division to reduce electrical costs and thereby provide the opportunity to double production. Funding for this has been requested as a high priority on the city's CIP request. An engineering feasibility analysis for this project has been funded by Anchorage Electric Light and Power. The Anchorage Economic Development Corporation has evaluated the economic development potential associated with this proposal at the request of the Mayor's Office. In addition to these efforts concerning the Fort