

FRED Reports

FRED 1992 ANNUAL REPORT
TO THE ALASKA STATE LEGISLATURE

Edited by
Marianne McNair
J. S. Holland, Ph.D.

Number 127



Alaska Department of Fish & Game
Division of Fisheries Rehabilitation,
Enhancement and Development

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Alaska Department of Fish and Game
Fisheries Rehabilitation, Enhancement
and Development Division

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PREFACE

In the early 1970s, Alaska's wild stock harvest of salmon reached an all-time low of about 20 million fish. In response, the Alaska State Legislature created the Fisheries Rehabilitation, Enhancement and Development (FRED) Division in 1971. Its mission was to do all things necessary to ensure perpetual use of the state's aquatic resources, in part, by involving private enterprise in the process. In 1974, legislation passed that allowed the formation of private nonprofit (PNP) aquaculture corporations. These PNP groups were formed by fishers concerned about the lack of harvestable fish.

One of the principal tools held in common between the FRED and PNP groups was the risky technology used to produce and release extremely large numbers of fish from hatcheries. Originally, the roles of the two groups overlapped with both groups building and operating large-scale production hatcheries. FRED then began to develop the culture techniques necessary to take the risk out of culturing fish at high densities. However, the need for increased fish production, combined with the snail's pace of building the department's program, did lead to somewhat parallel programs—instead of cooperation, there was competition.

Included in the foundation of the state's salmon ocean ranching program was protection of wild stocks. Early on, its development was guided by stringent genetic and fish disease policies. Also, a rigorous fish transport permitting system was established which mandated prior review and approval of stock transfers by departmental scientists and managers.

The production hatchery program started with pink salmon, because of its short life cycle—18 months from egg to returning adult—would produce rapid returns of fish. This was very successful. In the 1980s, it became obvious that the development of

technologies for hatchery production was taking the risk out of culturing salmon. Soon, culturing of other salmon as well as trout became routine. Thus, FRED began to concentrate on technical and programmatic oversight; e.g., regional fisheries planning and permitting and privatization of state-owned production hatcheries.

Currently, the PNP program has grown to become a successful statewide industry that employs Alaskans in over 232 full-time-equivalent jobs. Obviously, the PNP groups feel comfortable in their role of operating large-scale hatcheries. Now, the enhancement program produces nearly 20 million fish annually, while wild stock production is at record levels of around 130 million fish.

Over the last 20 years, many changes have occurred in the science behind Alaska's salmon program. We have come far in our understanding of fish genetics and have new tools to decipher stock differences. Newer methods of marking hatchery fish, such as inducing thermal banding patterns on fish earbones (otoliths), will give managers tools to sort out wild and hatchery fish on the fishing grounds. Discrete wild stock restoration technologies and habitat rehabilitation strategies have been added to our list of tools. New industries, like aquatic farming, are emerging, and such developing fisheries are looked upon as tools for rural economic diversification.

Why should contentious issues continue to surface when fish production from both the enhancement and wild stock management programs in Alaska are booming? First, the production of fish from other enhancement programs in the Lower 48 is not booming. Some people point to these Lower 48 programs and categorically claim that Alaska's program will follow suit. This ignores much of the

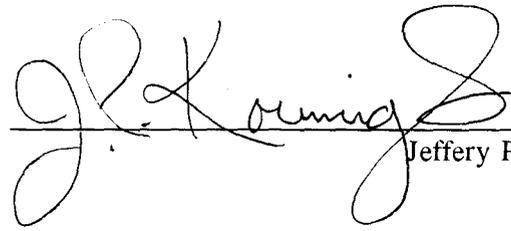
protection for wild stocks and their habitats that the Alaskan program was built around. It also ignores the fact that Lower 48 hatcheries focused on replacing wild stocks already lost to habitat alteration, resulting from removal of water for irrigation, droughts, and phenomenal population growth. Often cited as causes for the decline of Washington, Oregon, and northern California wild stocks of salmon are the four H's—Habitat, Hydroelectric, Harvest, and Hatcheries. Recent analysis of the history of those stocks points a long and bony finger at the former two: habitat losses associated with the long-term operation of hydroelectric power dams. Poor and often misguided hatchery practices and stock transfers then either failed to make up for the loss of wild stocks or, in some cases, further exacerbated the losses.

Second, in the market place Alaska salmon compete internationally with farmed salmon. Within the last decade, the number of metric tons of fish from international farms has moved ahead of Alaska's annual production. This has placed tremendous pressure on the supply side of the markets to which the demand side has yet to keep pace. Unfortunately, the result has been lower prices on the fishing grounds. In response to this threat, the industry is developing new fish product forms to better compete in world salmon markets.

In light of these concerns, there is a real need to carefully plan and control Alaska's successful program so that it continues to supplement and not supplant wild stock production. Also, with declining state revenues, the aquaculture industry and the state have to further refine their roles. For example, the operation and funding of large-scale production hatcheries has to remain with the PNP groups. The programmatic oversight, including fish culture research, will remain within the Department of Fish and Game. Through this type of partnership or joint venture, Alaska's world class salmon enhancement program will continue.

Join us now in a review of FRED's program. The business of making fish in Alaska appears to be at risk again, not because of science but because fish production has become a truly global industry, sensitive to international markets. Even so, I believe you will agree that the future is bright, in part, because of the foresight that founded the

program nearly 20 years ago. These are exciting times for the enhancement community in Alaska—watch us grow.



Jeffery P. Koenigs

EXECUTIVE SUMMARY

FUNCTIONS AND SERVICES

The primary role of the FRED Division is to sustain and enhance Alaska's fisheries through the development, application, and dissemination of technologies in supplemental production and natural stock rehabilitation. The division supports two regional and nine area offices, which support ongoing operational activities, and the division's ten production facilities provide a variety of fish species to support the state's commercial, sport, personal-use, and subsistence fisheries. In addition, five laboratories provide technical services to the Alaska Department of Fish and Game (ADF&G) and other state, federal, and private nonprofit (PNP) agencies. For example, the Coded Wire Tag Processing Laboratory in Juneau decodes metal tags implanted in fish and supplies resultant information for inseason management of specific chinook and pink salmon stocks. The Fisheries Genetics Laboratory in Anchorage has an active program to provide wild stock protection as well as new tools for use in stock identification.

The FRED Division's PNP Program oversees the state's aquaculture industry. This includes coordination of statewide fishery planning within eight planning regions, as well as the newly established, drainage-wide Yukon River planning effort. The division also provides technical assistance to shellfish farmers and has permitting responsibilities for the state's emerging mariculture industry. The latter exemplifies the FRED Division's lead role in developing new opportunities for rural economic diversification. The division also continues to develop fish culture technology, such as sockeye salmon culture at

STATUTORY AUTHORITIES

Plan and implement a program that ensures the perpetual and increasing production and use of Alaska's fishery resources (AS 16.05.092).

Coordinate the rehabilitation and enhancement activities of the department and regional aquaculture associations (AS 16.10.380).

Process fish transport permits and applications for private nonprofit (PNP) hatcheries (AS 16.10.400).

Technically assist the PNP hatcheries to the extent possible (AS 16.10.443) and cooperate in the development of regional salmon plans (AS 16.10.375).

Develop a disease management and control program for aquatic farms and hatcheries (AS 16.10.150), and review suitability of proposed aquatic farms or hatcheries to traditional fisheries, fish, wildlife, or their habitats (AS 16.40.105).

Snettisham Hatchery and chinook salmon culture at Crystal Lake Hatchery. Finally, resource economics has become an integral part of the division's focus as the rapidly changing worldwide supply and demand for fish has impacted all aspects of Alaska's fishery resource.

STAFFING

An organizational chart depicting the division's structure to the regional level and the number of full-time and seasonal staff are shown in Figure 1 and Table 1, respectively.

Table 1. Number of FRED full-time and seasonal staff by location.

Location	PFT	PSEA	Location	PFT	PSEA
Anchorage	20	5	Kotzebue	3	8
Clear	3	3	L Pt Walter	1	2
Cordova	1	1	Nome	1	1
Crystal Lake	5	3	Petersburg	1	6
Homer	1	8	Snettisham	4	10
Juneau	44	27	Soldotna	4	7
Ketchikan	8	8			
Kodiak	1	7	TOTAL	97	96

BUDGET OVERVIEW

In fiscal year (FY) 1993 (1 July 1992 through 30 June 1993), the FRED Division's general operating budget received an increase of \$813,100 in program receipt authority to cover costs necessary to operate the Gulkana, Kitoi Bay, and Pillar Creek Hatcheries. The FRED Division also accepted a \$200,500 reduction in personal services as well as a \$350,000 miscellaneous reduction targeted toward hatchery operations. These losses resulted in closure of the Russell Creek Hatchery in FY93 and a downsizing of staff in the division's headquarters and two regional offices.

The FY93 general fund budget was further reduced through an exchange of \$500,000 in general funds for federal funds. The final FY93 budget did provide funding for the operation of the Big Lake Hatchery, which had not been included in the division's original FY93 budget request.

Overall, the FRED Division's FY94 operating appropriation has been reduced by 31% in general funds and 64% in federal funds from FY93 levels. A reduction in general funds totaling \$3,359,000 results in the closure or transfer of operations of ten production hatcheries throughout Alaska: Deer Mountain, Klawock, Big Lake, Crooked Creek, Gulkana, Kitoi Bay, and Pillar Creek Hatcheries are targeted for transfer or closure, and the Fort Richardson, Elmendorf, and Broodstock Development Center will be transferred to the department's Sport Fish Division. These hatchery transfers or closures will accompany a decrease in

staff at each region who have responsibilities in facility oversight and support.

In FY94, the FRED Division will expand its mariculture program and the Coded Wire Tag Processing Laboratory to include otolith mark evaluation. The division will also expand its efforts to stimulate rural economies through fisheries development and wild stock restoration projects.

CURRENT PROGRAMS

Technology and Development

The genetics program's research into possible oil spill-related chromosome damage to pink salmon in **Prince William Sound** holds promise of being an extraordinary discovery. The chromosome damage could be inheritable.

FRED limnologists continue to investigate fish survivals in the **Kenai River** lakes. Large overescapements of sockeye salmon have led to very poor overwinter survivals of juvenile fish in **Kenai** and **Skilak** Lakes. The dramatic reduction in smolts heading to sea questions the sustainability of both commercial and sport sockeye salmon fisheries.

The in-hatchery thermal marking of sockeye salmon otoliths (ear bones) is proving up. Marked otoliths have been recovered from adults returning to

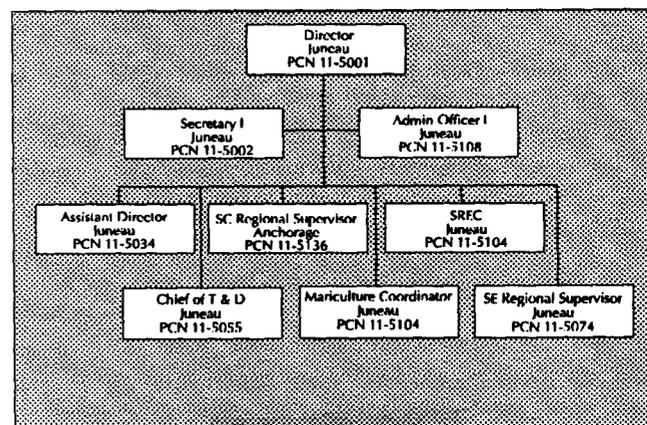


Figure 1. FRED Division organizational structure to the regional level.

Sweetheart Lake located south of **Juneau**. FRED limnologists are also pioneering image analysis of sockeye salmon otoliths for wild stock identification.

The Genetics Laboratory continues its exciting work with cryopreservation to both simplify aspects of hatchery production and to preserve, or bank, sperm of wild salmon, such as the **Chilkat River** chinook salmon stock near **Haines**.

FRED Pathology staff continue to work on the prevalence of Bitter Crab disease in **Southeast, Kodiak, and Bering Sea** Tanner crabs. Fishermen did not crab in **Upper Lynn Canal** due to a very high prevalence of the disease, yet the disease does not appear to be seriously impacting crab fisheries in other areas of the state.

Real-time coded wire tag processing by the division's Coded Wire Tag Processing Laboratory has allowed fishery managers to adjust inseason catches of pink salmon in **Prince William Sound** and chinook salmon in Southeast for hatchery and wild stocks.

Hatchery Contracts

A total of ten state hatcheries are now being operated or funded by regional aquaculture associations under the state's privatization program. At existing levels, over \$5,500,000 in annual operating costs are now user-generated.

The FY94 budget requires that four additional hatcheries either be operated, as well as funded, by the private sector or closed. If all are successfully contracted rather than closed, this would bring the total number of state hatcheries privatized to fourteen.

Comprehensive Salmon Planning

The PNP Program is administered by the FRED Division. PNP Program staff organize and oversee the regional salmon planning teams which are comprised of ADF&G and regional aquaculture association members. Staff also coordinate the review of PNP hatchery applications and coordinate management of statewide enhancement data and reporting, annual facility management plans for 38

facilities, and the permitting process for hatchery, fish transport, and scientific/educational permits. Over 230 fish transport and 85 scientific/educational permits were reviewed during 1992.

In conjunction with the **Kodiak Regional Planning Team**, FRED staff prepared a complete revision of the *Kodiak Regional Comprehensive Salmon Plan, Phase II, 1982-2002*. The document was approved by the commissioner of ADF&G in March 1992.

A public review draft of the *Chignik Regional Comprehensive Salmon Plan* was distributed in August 1992. The document will be completed in February 1993.

A planning core group comprised of ADF&G representatives, the **Northwest Arctic Borough**, and the National Park Service completed a plan entitled, *Sikusuilaq Springs Hatchery Development Alternatives* for the Kotzebue region. The document was approved by the commissioner in October 1992.

A primary goal of the new salmon management and stock restoration planning process will be to assist **Yukon River** salmon users and resource managers to make informed decisions regarding management and stock restoration activities. The result will be a comprehensive salmon plan for the Yukon River.

A draft regional comprehensive salmon plan for Area M (**Aleutian Islands**) was prepared for review by the regional planning team in September 1992. A draft should be available for public review and comment in February 1993.

FRED staff chaired public information sessions and discussions regarding chinook salmon production and harvest in **Ketchikan, Petersburg, Wrangell, Sitka, and Juneau** prior to Alaska Board of Fisheries deliberations.

U.S. Treaties

In the fall of 1992, the Northern Panel and Alaska Commissioners to the Pacific Salmon Treaty developed **Southeast Alaska** positions for treaty annex arrangements for negotiation between the U.S. and Canada during the 1992/1993 Pacific Salmon Commission cycle.

FRED Division staff coordinated and chaired a U.S./Canada transboundary river treaty-negotiating session to develop criteria and guidelines for restoration and development along the **Yukon River**.

Mariculture

The Aquatic Farm Act of 1988 authorizes ADF&G to issue permits for the construction and operation of aquatic farms or hatcheries for shellfish and aquatic plants.

In 1992, 24 aquatic farm permit applications were received and processed and 16 farm operation permits issued. A total of 68 farms and one hatchery is currently permitted from **Ketchikan** to **Kodiak**, including **Yakutat**, **Prince William Sound**, and **Lower Cook Inlet**.

Aquatic farm sales in 1992 approached \$197,000, and current inventory indicates close to \$5 million in future sales.

Hatchery Enhancement

In 1992, the statewide fisheries enhancement program contributed 9% of the 127,000,000 fish caught in the commercial salmon fisheries, and 18% of the total chum salmon catch. Over 400,000 enhancement-produced fish were caught in the 1992 recreational fisheries.

Chinook salmon produced by hatcheries in **Southeast Alaska** contributed nearly 34,000, or 16%, of the total 1992 Southeast chinook salmon catch.

In **Northwest Alaska**, **Sikusuilag Springs Hatchery** contributed a record 35,000 chum salmon to the 1992 **Kotzebue** gillnet fishery.

Approximately 66% of the sport fish harvested in the **Tanana Valley** were hatchery produced, keeping fishing pressure off of natural stocks and allowing them to rebuild.

In 1992, enhancement projects accounted for approximately 79% of the \$2.7 million ex-vessel value of the **Lower Cook Inlet** sockeye salmon harvest.

Education

In 1992, 56 permits were issued for classroom fish incubators in 41 cities, towns, or villages from **Ketchikan** to **Nome** to **Cold Bay**. FRED biologists frequently assisted with these projects and provided teacher in-service workshops and classroom assistance. Tests among rural school students along the **Yukon River** have indicated a significant increase in their knowledge of fisheries biology.

Stream Rehabilitation

FRED staff continue to focus on the development of stream rehabilitation potential. Working with the City of Anchorage, the Anchorage School District, and dozens of volunteers, organizations, and individuals, four stream rehabilitation projects were completed in the Anchorage Bowl. In addition, numerous projects throughout Southeast have successfully combined the efforts of area staff, volunteers, businesses, and students from several communities. The Alaska Science and Technology Foundation has provided funding for the division to develop technologies in this field.

Economic Development

FRED Division staff conducted fisheries development and restoration projects in areas surrounding **St. George**, **Nome**, **Kotzebue**, **Nelson Island**, and **Elim**. These projects have included experimental instream incubation boxes and site evaluations.

The **Toklat River** fall chum salmon have been targeted by the **Yukon River Drainage Fisheries Association** for a rebuilding and restoration pilot study. In 1992, the **Clear Hatchery** began incubating the first **Toklat River** eggs. Funding was received from the 17th Alaska State Legislature to begin a comprehensive regional fisheries restoration planning process for the **Yukon River**.

ISSUES

Reduction in Program Receipt Authority

A reduction in the FRED Division's program receipt authority will require the **Kodiak Regional Aquaculture Association** and the **Prince William Sound Aquaculture Corporation** to consider operating existing state facilities within their own limited infrastructure. For the past several years, these associations have provided the state with operational funding for three public facilities.

Increased Economic Diversification

The need for increased economic diversification in rural **North/Northwest Alaska** will require identification of new project opportunities to meet increasing demands for fisheries development in these areas and funding to implement such programs. Working with the Department of Commerce and Economic Development, the FRED Division has recently developed a **Western Alaska Salmon Restoration Initiative**.

St. George Island is an example of a community which looks toward fisheries development as a tool for economic diversification. Currently, no wild stocks of salmon return to the island. Feasibility studies for salmon development continue.

Increases in Mariculture

The demand for oyster seed stock for the mariculture industry in Alaska currently exceeds the capability of out-of-state suppliers. The FRED Division needs to supply a consistent and sufficient in-state supply of oyster and other shellfish seed stock, as well as meet other requirements of the burgeoning Alaskan mariculture industry.

Development of Mark Analysis

To respond to harvest management of fish, PNP operators are requesting that the division establish a capability to process otoliths. Thermally marked

otoliths will identify hatchery fish contributions to fisheries and facilitate wild stock management.

Regional Comprehensive Planning

FRED is the lead agency within ADF&G responsible for implementation of comprehensive salmon planning. With two international salmon fishing treaties, the increasing involvement with salmon enhancement and restoration activities in the **Yukon and Northwest Alaska**, and the maintenance of current regional salmon plans, the magnitude of the division's planning effort is a major issue.

Fishery Resource Economics

There is a pressing need to establish within state government a group of economists to work on issues related to international demand for salmon, price expectations, and the cost/benefits associated with salmon management and enhancement. As with crude oil, issues surrounding salmon harvest, processing, and sale are becoming so complex that, in order to provide answers to salmon policy questions that repeatedly confront the state, it is necessary to have analyses ongoing at all times.

FUTURE DEVELOPMENTS

In FY94, the FRED and Commercial Fisheries Divisions will be combined. This possibility was discussed during the 1992 legislative session. The department identified a potential \$300,000 in savings that could result from the potential merger. In anticipation of the department's plans, the legislature reduced the FRED Division's FY94 budget by \$90.0 and the Commercial Fisheries Division FY94 budget by \$210,000.

The process of consolidating functions of the FRED and Commercial Fisheries Divisions takes precedent in the combination of the department's fisheries genetics capability. Two years ago, the two divisions began a joint approach to expand the fisheries genetics program out of Anchorage, yet the program has already outgrown existing laboratory space. Consequently, the department's

FY93 capital request includes funding for increased laboratory space for the joint program.

In a similar manner, the two divisions have planned to combine their individual programs in coded wire tag and otolith processing into a single laboratory that will be located in the Juneau/Douglas area.

Again, the department has included funding for a new laboratory in its FY94 capital request, which seeks to establish a Fisheries Mark/Tag Laboratory.

In the future, the consolidated division will look at establishing a resource economics capability. The FRED Division currently has a fisheries economist on staff who concentrates on salmon supply/demand questions which are of critical importance to the state. The Commercial Fisheries Division has two years of funding for an economist to work on groundfish questions. Within the combined division, both economists will serve as a focus on a consistent resource economics thrust within ADF&G.

CHAPTER 1

FRED DIVISION BACKGROUND

The Fisheries Rehabilitation, Enhancement and Development (FRED) Division of the Alaska Department of Fish and Game (ADF&G) plays a major role in the state's salmon management program. Its purpose is to sustain and enhance Alaska's fisheries through the development and application of technologies in supplemental production and natural stock rehabilitation. The division's roles are (1) development of new enhancement technology; (2) hatchery production for sport, subsistence, and non-cost-recovery commercial fisheries; (3) technical services; (4) habitat restoration and fisheries rehabilitation; (5) regulation and management of the Private Non-profit (PNP) Program; (6) administration of the department's mariculture program; and (7)

statewide program coordination, including production, planning, and technology transfer. As such, it contributes knowledge gained from tagged fish studies and technological research; it mitigates fish losses from foreign interceptions and environmental disruptions; it contributes fish to existing but depressed fisheries; it creates new opportunities for commercial, sport, and subsistence fisheries and rural economic diversification; it develops and provides new technology and expertise for the expansion of mariculture, fish marking, and stock identification; and it aids other aspects of the statewide enhancement program through technical services and PNP Program coordination.

Statutory Authorities

The mission of the FRED Division is to plan and implement a program that ensures the perpetual and increasing production and use of Alaska's fisheries resources (AS 16.05.092). Its statutory direction is broad enough to include species other than salmon, such as king crab, halibut, black cod, scallops, mussels, and marine plants. In addition, employees of the FRED Division, with approval of the ADF&G Commissioner's Office, coordinate the rehabilitation and enhancement activities of the department and regional aquaculture associations (AS 16.10.380), process fish transport permits and applications for PNP hatcheries (AS 16.10.440), and coordinate fish resource (e.g., scientific/educational) permits. The division also technically assists the PNP hatcheries to the extent possible (AS 16.10.443) and cooperates in the development of regional salmon plans (AS 16.10.375).

The Aquatic Farm Act of 1988 encourages the establishment and responsible growth of an aquatic farm industry. The FRED Division is also required to develop a disease management and control program for aquatic farms and hatcheries (AS 16.40.150), review suitability of proposed aquatic farms or hatcheries (AS 16.40.105), and ensure the proposed farm does not significantly alter traditional fisheries or adversely affect fisheries, wildlife, or their habitats (AS 16.40.105).

The FRED Division's duties (AS 16.05.092) also include the annual presentation of a comprehensive annual report to the Alaska State Legislature. This report, along with a detailed budget request, satisfies the division's reporting requirements.

Functions and Services

The FRED Division operates 13 hatcheries to produce salmonid fishes for subsistence, commercial, and sport fisheries. Fish passes located throughout the state provide spawning and rearing habitat that would otherwise be unattainable to salmon stocks. The FRED Division maintains many of these fish passes cooperatively with the U.S. Forest Service (USFS). The strategies of lake fertilization, habitat improvement, and fish stock introduction are being more widely used to provide improved freshwater survival and new production opportunities for salmon stocks.

The FRED Division operates five laboratories that serve ADF&G, other government agencies, and PNP operators. The Fish Pathology Section has two laboratories, one in Anchorage and one in Juneau, and provides diagnostic services and brood stock 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 quality, plankton, and in-lake fish populations sampled for lake-productivity studies. The Coded Wire Tag Processing Laboratory 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.

The PNP Program is administered by the FRED Division. One responsibility of administering this program is to organize regional salmon planning teams which are comprised of ADF&G and regional aquaculture association members. The PNP Program coordinates the review of PNP hatchery applications and the permitting process which includes hatchery, fish transport, and fish resource (scientific/educational) permits.

The FRED Division administers the department's mariculture program. Mariculture administration, permitting, technical assistance, and research coordination are major components of the division's mariculture program. The program continued in

1992 with 68 permitted farms in the state and 14 proposed farms pending final permit action. Species farmed and/or being proposed for farming include oysters, mussels, scallops, abalone, clams, and a variety of aquatic plants.

CHAPTER 2

ALASKA ENHANCEMENT PROGRAM

The statewide fisheries enhancement program continued to grow in 1992. More eggs were taken and more fish released than ever before. Alaskan hatchery crews took over 1.7 billion eggs (Table 2.1) and released 1.3 billion fish into Alaska's waters (Table 2.2). Pink salmon accounted for approximately 60% of the eggs taken and fish released, followed by chum salmon.

A 1992 return of 23.5 million enhancement-produced fish (Figure 2.1, Table 2.3) was substantially less than the 1991 return of 48.3 million. This decrease was largely due to a poor return of pink salmon to Prince William Sound. In 1992, pink salmon accounted for 63% of the total enhanced fish return and 79% of the return in 1991. Prince William Sound hatcheries contributed only 42% of the enhancement-produced adult return in 1992, whereas in 1991 they contributed 72%. Southeast Alaska hatcheries contributed 37% of the adult return, and Kodiak hatcheries and enhancement projects contributed 14%. Sockeye salmon accounted for 17% of the enhancement-produced return, and chum salmon 14%.

In summary, the statewide salmon enhancement program contributed 11,000,000 fish to Alaska's commercial fisheries. Approximately 9% of the salmon caught in Alaska with commercial gear were from enhancement projects. Nearly 440,000 enhancement program-produced fish were harvested in sport fisheries. This production helps make

Alaska's fisheries enhancement program the largest in North America and the second largest in the world. These fish provide direct benefits to commercial, sport, subsistence, and personal-use fishermen, as well as indirect benefits to fish processors, tackle shops, etc. The enhancement program also serves an important role in Alaska's economic diversification and helps ease Alaska's dependence on an oil-based economy.

Fish Species Produced by the Enhancement Program		
Coho salmon	Pink salmon	Steelhead trout
Chinook salmon	Chum salmon	Arctic grayling
Sockeye salmon	Rainbow trout	Arctic char

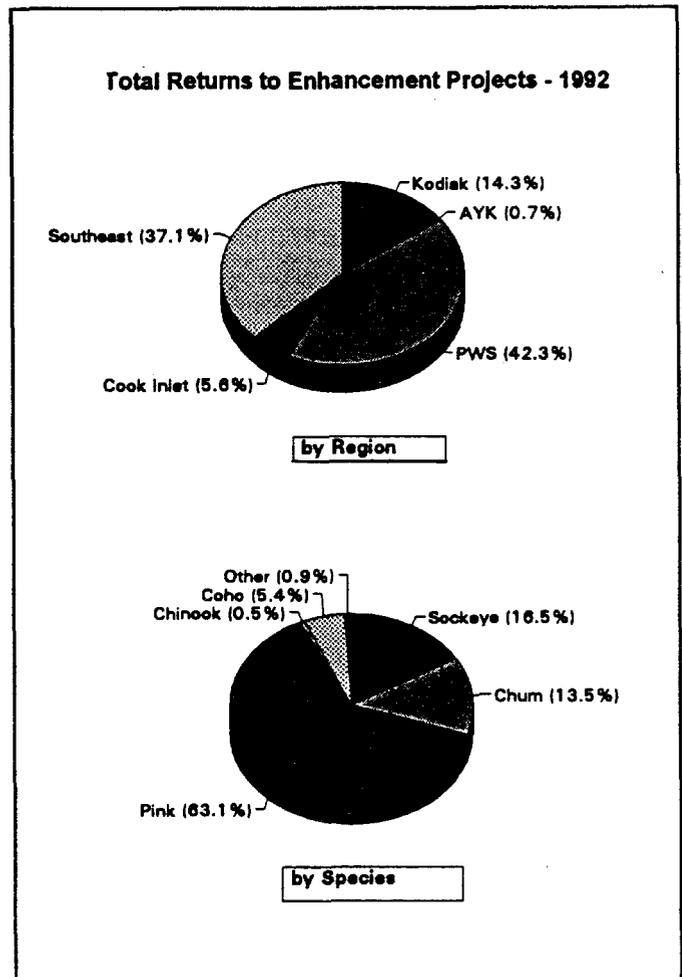


Figure 2.1.

Table 2.1. 1992 eggtakes from Alaskan hatcheries (combined PNP + FRED)

Region	Pink	Chum	Coho	Chinook	Sockeye	Other	TOTAL
ARCTIC/YUKON/KUSKOKWIM							
FRED		11,431,000				3,844,000	15,275,000
	0	11,431,000	0	0	0	3,844,000	15,275,000
COOK INLET							
FRED			2,577,000	2,567,000	24,525,000	4,533,900	34,202,900
PNP	60,000,000		920,000		12,610,000		73,530,000
	60,000,000	0	3,497,000	2,567,000	37,135,000	4,533,900	107,732,900
KODIAK & AK PENINSULA							
FRED	196,843,000	12,634,000	1,003,000		18,260,000		228,740,000
	196,843,000	12,634,000	1,003,000	0	18,260,000	0	228,740,000
PRINCE WILLIAM SOUND							
FRED					21,080,000		21,080,000
PNP	677,460,000	132,240,000	4,710,000	1,270,000	8,000,000		823,680,000
	677,460,000	132,240,000	4,710,000	1,270,000	29,080,000	0	844,760,000
SOUTHEAST							
FRED			1,274,000	3,070,000	15,638,000	55,800	20,037,800
PNP	145,460,000	363,120,000	10,880,000	6,130,000	4,930,000		530,520,000
	145,460,000	363,120,000	12,154,000	9,200,000	20,568,000	55,800	550,557,800
TOTALS	1,079,763,000	519,425,000	21,364,000	13,037,000	105,043,000	8,433,700	1,747,065,700

Table 2.2. 1992 releases from Alaskan hatcheries (combined PNP + FRED)

Region	Pink	Chum	Coho	Chinook	Sockeye	Other	TOTAL
ARCTIC/YUKON/KUSKOKWIM							
FRED		8,448,000				2,621,288	11,069,288
	0	8,448,000	0	0	0	2,621,288	11,069,288
COOK INLET							
FRED			2,084,000	2,121,000	17,756,000	3,448,171	25,409,171
PNP	31,950,000	3,110,000	390,000		8,450,000		43,900,000
	31,950,000	3,110,000	2,474,000	2,121,000	26,206,000	3,448,171	69,309,171
KODIAK & AK PENINSULA							
FRED	153,300,000	31,500,000	631,000		6,398,000		191,829,000
	153,300,000	31,500,000	631,000	0	6,398,000	0	191,829,000
PRINCE WILLIAM SOUND							
FRED				65,200	27,109,000		27,174,200
PNP	495,490,000	100,640,000	3,060,000	570,000	4,370,000		604,130,000
	495,490,000	100,640,000	3,060,000	635,200	31,479,000	0	631,304,200
SOUTHEAST							
FRED			1,619,600	1,422,300	7,912,100	35,230	10,989,230
PNP	121,030,000	290,500,000	6,840,000	5,640,000	3,130,000		427,140,000
	121,030,000	290,500,000	8,459,600	7,062,300	11,042,100	35,230	438,129,230
TOTALS	801,770,000	434,198,000	14,624,600	9,818,500	75,125,100	6,104,689	1,341,640,889

Table 2.3. 1992 estimated returns to Alaskan hatcheries (combined PNP + FRED)

Region	Pink					Chum				
	Commercial	Sport	Cost recovery	Other	Total	Commercial	Sport	Cost recovery	Other	Total
ARCTIC/YUKON/KUSKOKWIM										
FRED					0	40,000	200		15,300	55,500
	0	0	0	0	0	40,000	200	0	15,300	55,500
COOK INLET										
FRED					0					0
PNP	97,588	4,500	276,000	95,000	473,088	2,883	400	600	63	3,946
	97,588	4,500	276,000	95,000	473,088	2,883	400	600	63	3,946
KODIAK & AK PENINSULA										
FRED	823,900	200		384,700	1,208,800	3,500			15,530	19,030
	823,900	200	0	384,700	1,208,800	3,500	0	0	15,530	19,030
PRINCE WILLIAM SOUND										
FRED					0					0
PNP	4,416,464	27,000	3,062,734	1,064,856	8,571,054	213,684	200	50,510	177,162	441,556
	4,416,464	27,000	3,062,734	1,064,856	8,571,054	213,684	200	50,510	177,162	441,556
SOUTHEAST										
FRED	382,264	5,000		83,066	470,330	23,386			16,235	39,621
PNP	926,459	16,588	2,670,609	542,281	4,155,937	1,435,331	5,450	690,166	502,108	2,633,055
	1,308,723	21,588	2,670,609	625,347	4,626,267	1,458,717	5,450	690,166	518,343	2,672,676
TOTAL	6,646,675	53,288	6,009,343	2,169,903	14,879,209	1,718,784	6,250	741,276	726,398	3,192,708

Region	Coho					Chinook				
	Commercial	Sport	Cost recovery	Other	Total	Commercial	Sport	Cost recovery	Other	Total
ARCTIC/YUKON/KUSKOKWIM										
FRED		22,125			22,125					0
	0	22,125	0	0	22,125	0	0	0	0	0
COOK INLET										
FRED	5,600	38,795		6,100	50,495	2,265	37,955		2,388	42,608
PNP	205	1,231	1,234	1,865	4,535					0
	5,805	40,026	1,234	7,965	55,030	2,265	37,955	0	2,388	42,608
KODIAK & AK PENINSULA										
FRED	10,102	3,700		16,067	29,869				80	80
	10,102	3,700	0	16,067	29,869	0	0	0	80	80
PRINCE WILLIAM SOUND										
FRED		10,000			10,000					0
PNP	123,300	11,010	72,897	2,654	209,861	462	80	849	1,091	2,482
	123,300	21,010	72,897	2,654	219,861	462	80	849	1,091	2,482
SOUTHEAST										
FRED	73,506	4,668		19,284	97,458	19,837	10,502		6,110	36,449
PNP	543,298	26,366	264,594	21,432	855,690	13,731	3,011	16,798	6,379	39,919
	616,804	31,034	264,594	40,716	953,148	33,568	13,513	16,798	12,489	76,368
TOTAL	756,011	117,895	338,725	67,402	1,280,033	38,295	51,548	17,647	16,048	121,538

Table 2.3 (continued).

Sockeye					
Region	Commercial	Sport	Cost recovery	Other	Total
ARCTIC/YUKON/KUSKOKWIM					
FRED					0
	0	0	0	0	0
COOK INLET					
FRED	323,880	3,900		59,689	387,469
PNP	168,591	600	9,198	64,980	243,369
	492,471	4,500	9,198	124,669	630,838
KODIAK & AK PENINSULA					
FRED	1,078,986	500		1,032,823	2,112,309
	1,078,986	500	0	1,032,823	2,112,309
PRINCE WILLIAM SOUND					
FRED	116,700	500		95,000	212,200
PNP	368,427		158,893	7,055	534,375
	485,127	500	158,893	102,055	746,575
SOUTHEAST					
FRED	192,806	22		210,540	403,368
PNP	3,226		2,538		5,764
	196,032	22	2,538	210,540	409,132
TOTALS	2,252,816	5,522	170,829	1,470,087	3,898,854

Other						GRAND TOTAL
Region	Commercial	Sport	Cost recovery	Other	Total	
ARCTIC/YUKON/KUSKOKWIM						
FRED		77,932			77,932	155,557
	0	77,932	0	0	77,932	155,557
COOK INLET						
FRED		120,345		805	121,150	601,722
PNP					0	724,938
	0	120,345	0	805	121,150	1,326,660
KODIAK & AK PENINSULA						
FRED		3,225			3,225	3,373,313
	0	3,225	0	0	3,225	3,373,313
PRINCE WILLIAM SOUND						
FRED					0	222,200
PNP					0	9,759,328
	0	0	0	0	0	9,981,528
SOUTHEAST						
FRED		1,800		21	1,821	1,049,047
PNP					0	7,690,365
	0	1,800	0	21	1,821	8,739,412
TOTALS	0	203,302	0	826	204,128	23,576,470

FRED	3,093,232	341,369	0	1,948,208	5,401,839
PNP	8,313,649	96,436	7,277,620	2,486,926	18,174,631
TOTAL	11,406,881	437,805	7,277,620	4,435,134	23,576,470

CHAPTER 3

FRED PRODUCTION

SOUTHEAST

Summary of FRED Projects

The FRED Division mans three area offices and operates four hatcheries in Southeast Alaska. Two additional state-owned hatcheries in the Southeast Region are operated by regional aquaculture associations under contract with the state. The area offices are located in Juneau, Petersburg, and Ketchikan. The state-operated hatcheries in Southeast Alaska (Figure 3.1) include (1) Snettisham, approximately 40 miles south of Juneau; (2) Crystal Lake, on the road system outside of Petersburg; (3) Deer Mountain Hatchery in the City of Ketchikan; and (4) Klawock on Prince of Wales Island, near the community of Klawock (Figure 3.1). Hidden Falls Hatchery, on the east side of Baranof Island, is owned by the state and operated under contract by the Northern Southeast Regional Aquaculture Association (NSRAA), and Beaver Falls Hatchery, on the Ketchikan road system, is owned by the state and operated by the Southern Southeast Regional Aquaculture Association (SSRAA) under contract. In Southeast Alaska and other regions of the state, the FRED Division uses hatcheries as primary tools for fisheries enhancement while continually expanding the employment of other technologies, such as fish passes, spawning channels, lake fertilization, lake and stream stocking, and habitat restoration, in ever increasing numbers.

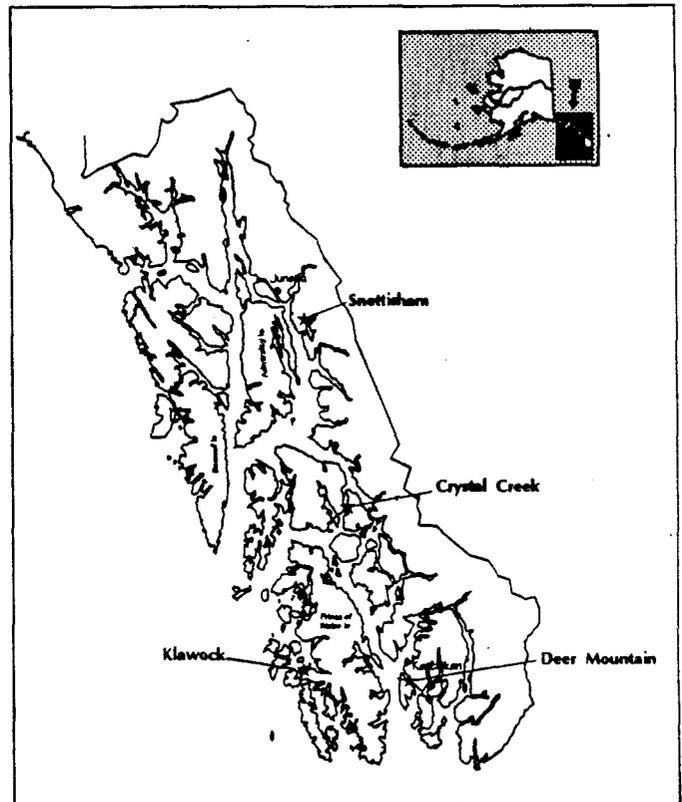


Figure 3.1. FRED Division hatcheries in Southeast.

Southern Southeast:

Deer Mountain Hatchery, in Ketchikan's City Park, produces chinook and coho salmon and steelhead and rainbow trout primarily for local sport fisheries (Figure 3.2). The hatchery is also a site for research that will help optimize fisheries projects statewide. In 1992, Deer Mountain staff released chinook salmon, coho salmon, and steelhead trout smolts in Ketchikan Creek. Additional releases of coho and chinook salmon and rainbow trout at

several sites away from the hatchery helped to disperse the benefits from this small hatchery.

The FRED Division expects to continue the Deer Mountain Hatchery chinook salmon program at a production level of 85,000 smolts per year. In order to optimize usage of the Ketchikan Creek stock, planning is underway to develop a major urban sport fishery in Ketchikan Creek. The in-hatchery program emphasis is on research; recent main thrusts of this work have been in triploid (sterile) fish production and in culture methods to reduce the incidence of bacterial kidney disease (BKD).

Deer Mountain Hatchery staff are performing an experiment to assess the relative growth rates of normal and genetically altered (full-sibling diploid and triploid) chinook salmon reared in either separate tanks or together. Four families are being tracked throughout their freshwater residency to obtain information on their relative growth rates and survival.

The presence of the causative agent for BKD in Deer Mountain Hatchery's water supply allows for research projects aimed at learning to "farm around" this serious fish disease. Results of a test concluded in 1992 provided evidence that using a feed containing feathermeal provides some immunity against the disease. The test is being repeated to confirm these findings.

Enhancement efforts directed at building up the brood stock source for Deer Mountain Hatchery's summer coho salmon program continue. In 1992, adults returned from the first presmolt release in Reflection Lake with an estimated 6% survival rate. While this is lower than rates seen in presmolt releases at other locations, it is far better than the 1% return rate realized from fry plants in Reflection Lake.

In this second year of the triploid rainbow trout planting

program, 34,000 fingerlings were planted in two lakes on the road system in the Ketchikan area. Also during 1992, a mark-recapture exercise at a lake stocked in 1991 provided data on growth and survival rates of triploid rainbow trout. These genetically altered, sterile fish are showing good growth and survival rates, and appear to be coexisting with the wild population. Some recruitment was noted in the wild population this fall, despite the presence of the triploid fish. Another 7,500 triploid rainbow trout from the 1991 brood are still being held for a pilot project to determine the feasibility of producing catchable rainbow trout to stock in area lakes.

The basic mission of the Klawock Hatchery, located on Prince of Wales Island, is under reexamination due to a shift in program emphasis for the FRED Division. Production of coho salmon, most of which are commercially harvested, has been the core of Klawock's program for many years. Development of a five-year plan for the hatchery, a process begun in 1991, continued in 1992. The two basic facility goals consist of (1) working toward full production from the Klawock Lake watershed on a self-sustaining basis, and (2) fully utilizing Klawock Hatchery as a resource to achieve goal #1 and for bioenhancement and rehabilitation projects in other Prince of Wales Island drainages. Progress toward goal #2 has been



Figure 3.2. Sport fishers hoping to catch the big one.

underway for several years, as the hatchery has provided both coho salmon for colonization above three fish passes constructed by the USFS, and steelhead trout smolts to enhance the populations in Klawock River and Ward Creek on Revillagigedo Island. Goal #1 calls for rehabilitating the Klawock sockeye salmon population. Toward this goal, the hatchery is reducing the number of coho salmon presmolts planted in Klawock Lake, thus reducing the likelihood of coho feeding on the sockeye fry.

During 1992, the Klawock Hatchery entered a cooperative agreement with the City of Klawock to work toward development of a new water supply for the hatchery. Increases in the availability and reliability of the city water supply will reduce dependence on a backup system. This should result in reduced operating costs, increased rearing capacity, and a safer system.

Availability of brood stock had been a limiting factor in the development of the Klawock Hatchery sockeye salmon program. The program is now at a stage in which returns from initial enhancement efforts have probably increased escapement levels. Increased escapement has resulted in significant increases in the number of eggs collected. This, coupled with installation of a UV water-depuration unit, has allowed a twenty-fold increase in the hatchery's sockeye salmon rearing capacity. The facility now has enough rearing capacity to attain its sockeye salmon production goals.

Northern Southeast:

The Snettisham Hatchery's sockeye salmon central incubation facility continues to produce fry for enhancement projects such as several lakes in northern Southeast Alaska; this should result in large increases in sockeye salmon catches by the gillnet fleet and, potentially, by personal-use and sport fishermen. The first evidence of the program's success was marked by a return of sockeye salmon jacks to Sweetheart Creek this past fall. In 1992, more than 300 sockeye salmon jacks returned to the outlet stream pool at tide water. For those who tried, the sport fishing was excellent.

Equally promising is the hatchery's potential to raise sockeye salmon smolts for release in gillnet areas. This potential has been developed into a proposal that could produce up to 2,000,000

sockeye salmon smolts annually; that is, a production level projected to produce 200,000 adults each year. The first release of Snettisham-produced sockeye salmon smolts will occur in 1993.

In 1990, the FRED Division initiated a project to develop a chinook salmon run on southern Baranof Island. The original plan was to produce smolts at Snettisham Hatchery and release them at Deep Cove. This project was funded by U.S./Canada enhancement funds. Following a complex period of negotiation and planning, the project was transferred to the Port Armstrong Hatchery. The two primary reasons for the change included: (1) It would facilitate the modification of Snettisham to sockeye salmon production, and (2) the Port Armstrong facility has better chinook salmon production capabilities and is located far closer to the desired release site. Plans are to release more than 1,500,000 chinook salmon smolts annually at Port Armstrong.

In cooperation with the National Marine Fisheries Service (NMFS), FRED Division staff transported and released 2,500 steelhead trout juveniles and 149 adults into Juneau's Twin Lakes in May 1992. These fish were the product of research carried out by NMFS at the Little Port Walter Research Station on south Baranof Island. Because the research was completed, the fish were available for planting. While chinook salmon planted in the lakes as part of the Dingell-Johnson/Wallop-Breaux (DJ/WB) program contributed very well to Juneau's sport fisheries, sport fishermen appreciated the added draw of steelhead trout, especially large adults.

Central Southeast:

Crystal Lake Hatchery is located 17.5 miles south of Petersburg on Mitkof Highway. The hatchery began operation in 1972 and is designed for long-term rearing of salmon and trout. In 1978, the facility received a thorough disinfection because of BKD and susceptibility to infectious hematopoietic necrosis (IHN) virus in the chinook salmon stock. Crews imported new, local stocks of eggs. Andrew Creek, a tributary of the Stikine River, was the chinook salmon stock chosen, and Duncan Salt Chuck on Kupreanof Island for coho salmon. The steelhead trout came from Falls Creek on Mitkof Island, about seven miles north of the hatchery.

The Crystal Lake Hatchery's foundation is its chinook salmon program, which includes releases into Crystal Creek and Earl West Cove. The need for Crystal Lake Hatchery chinook salmon eggs, traditionally a brood stock used by several other Southeast hatcheries, diminished in the past year because some of those hatcheries are either becoming self-sufficient or are selecting another source for brood stock.

This year, Crystal Lake Hatchery's steelhead trout program underwent a change to better learn how to produce optimal smolts for the area. The fish will be divided into eight groups for release at two different sizes and times.

Specific production numbers for Southeast projects can be found in Tables 3.1, 3.2, 3.3, 3.4, and 3.5.

Southeast Highlights

- For the first time, chum salmon returned to Marx Creek in sufficient numbers to make a self-sustaining run.
- A seine fishery opened in 1992 which targeted McDonald Lake sockeye salmon. More than 30,000 sockeye salmon, the product of a FRED Division lake fertilization project, were harvested.
- Results of a test concluded at Deer Mountain Hatchery in 1992 provided evidence that using a feed containing feathermeal gives some immunity against BKD.
- An estimated 200,000 visitors toured Deer Mountain Hatchery in 1992.
- Klawock Hatchery egg-take crews collected nearly 2,000,000 sockeye salmon eggs in 1992. This, coupled with installation of a UV water-depuration unit, has permitted a twenty-fold increase in the facility's sockeye salmon rearing capacity.
- An incredible 20% marine survival of summer coho salmon, originally planted in Margaret Lake, was estimated after 61% of the fish were intercepted by commercial fishermen.
- FRED and USFS personnel completed the first coho salmon egg take for the Mitchell and Portage Creek fish pass projects.
- The first sockeye salmon returned to the Sweetheart Lake outlet and proved that stocking that lake with juveniles is a successful strategy. The fish readily attacked sport fishing gear.
- The experimental use of sockeye salmon presmolts, incubated and reared at Snettisham Hatchery to enhance Crescent Lake, is an apparent success.
- There were an estimated 1,335 Snettisham-produced chinook salmon caught by sport anglers as a result of the DJ/WB-funded Juneau recreational fisheries project.
- A successful transport of 308,000 chinook salmon smolts from Snettisham Hatchery to Port Armstrong Hatchery completed the first step of an agreement which allowed the transfer of a U.S./Canada project from ADF&G to Armstrong-Keta, Inc.
- Crystal Lake Hatchery is the most successful chinook salmon hatchery in Southeast Alaska and a primary source of chinook salmon eggs for numerous projects throughout the area.
- Development of the *Chilkat River Chinook Salmon Plan* has set in place a framework for addressing the decline of this important stock of chinook salmon.
- Milt from nine Chilkat River chinook salmon males was cryopreserved (frozen in liquid nitrogen) to help preserve the stock's genetic integrity.
- Instream structures were installed in Switzer Creek to increase pool volume and scour accumulated fine sediments and detritus. Removal of debris, trash, and silt from a pool will allow fish access to upwelling groundwater for spawning.

Table 3.1. Estimated contribution of fish by FRED hatcheries and projects in 1992.

Hatchery or Project	Species	Commercial Catch	Sport Catch	Pers Use	Subsistence	Brood/ Escpmnt	Total	Comments
ARCTIC-YUKON-KUSKOKWIM								
Clear Hatchery	Grayling		3,540				3,540	b
	A char		2,368				2,368	b
Ft Rich- Interior lake	Rainbow		72,024				72,024	b
Big Lake- LL lakes	Coho		22,125				22,125	b
Sikusuilag Hatchery	Chum	40,000	200		3,300	12,000	55,500	
AYK TOTALS:		40,000	100,257	0	3,300	12,000	155,557	
COOK INLET								
Big Lake Hatchery								
Big Lake	Sockeye	70,700		4,000		23,800	98,500	
	Coho	1,700				1,700	3,400	
Crooked Creek Hatchery								
Crooked Creek	Coho		4,400			1,100	5,500	
	Steelhead		1,800			805	2,605	
Tustumena Lake	Sockeye	108,550		1,775		20,944	131,269	
Leisure/Hazel L	Sockeye	89,790	3,800				93,590	
Chenik Lake	Sockeye	14,380	100			9,170	23,650	
Port Dick Lake	Sockeye	420					420	
Kirschner Lake	Sockeye	40,040					40,040	
Landlocked Lakes	Coho		4,215				4,215	b
Elmendorf Hatchery								
Crooked Creek	Chinook		6,600			2,088	8,688	
Halibut Cove	Chinook	980	2,000				2,980	
Homer Spit	Chinook		3,000				3,000	
	Coho		3,500	800			4,300	
Seldovia	Chinook	310	1,100				1,410	
Ship Creek	Chinook	975	1,610				2,585	b
	Coho	0	1,380				1,380	b
Landlocked lakes	Coho		23,900				23,900	b
Resurrection Bay	Chinook		1,776				1,776	b
Fort Richardson Hatchery								
Willow Creek	Chinook		3,500			300	3,800	
Niniichik R	Chinook		2,789				2,789	
Little Susitna	Coho	3,900	1,400			2,500	7,800	
Cook Inlet lakes	Rainbow		108,280				108,280	b
	Chinook		15,580				15,580	b
Tutka Bay Hatchery listed under PNP								
Clear Hatchery								
Landlocked lakes	Grayling		8,510				8,510	b
	A Char		1,755				1,755	b
COOK INLET TOTALS:		331,745	200,995	6,575	0	62,407	601,722	
KODIAK/ALASKA PENINSULA								
Kitoi Bay Hatchery								
	Pink	815,000				275,000	1,090,000	
	Chum	3,500				15,530	19,030	
	Coho	4,900				1,000	5,900	
Port Lions	Coho		1,000		4,000		5,000	
Landlocked lakes	Coho		1,200				1,200	
Little Kitoi Lake	Sockeye	3986				5,720	9,706	

Table 3.1. Continued.

Hatchery or Project	Species	Commercial Catch	Sport Catch	Pers Use	Subsistence	Brood/ Escprmt	Total	Comments
Kitoi Bay Hatchery								
Little Kitoi Lake	Coho	4962				1,048	6,010	
Crescent Lake	Coho		1,000	4,000			5,000	d
Hidden Lake	Coho	240				1,019	1,259	
Karluk	Sockeye	775,000	500	1,000		831,400	1,607,900	d
Frazer fishpass	Sockeye	300,000				186,000	486,000	a
Afognak Fishpasses	Coho					3,500	3,500	a
(combined)	Pink	0				36,500	36,500	a
	Sockeye	0				8,703	8,703	a
Elmendorf Hatchery								
Island Lake	Chinook			50	30		80	d
Ft Richardson								
Landlocked lakes	Rainbow		2800				2,800	
Clear Hatchery								
Landlocked lakes	Grayling		425				425	
Waterfall Fishpass	Pink	2,000				43,000	45,000	a
Russell Creek Hatch	Coho		500			1,500	2,000	
	Pink	6,900	200			30,200	37,300	
KODIAK/AK PEN TOTALS:		1,916,488	7,625	5,050	4,030	1,440,120	3,373,313	
PRINCE WILLIAM SOUND								
Gulkana Hatchery	Sockeye	116,700	500	11,000		84,000	212,200	
Main Bay Hatchery	listed under PNP							
PWS TOTALS:		116,700	500	11,000	0	84,000	212,200	
SOUTHEAST SOUTHERN								
Bakewell R	Sockeye	8,651				2,163	10,814	a
Dog Salmon R	Coho	60				100	160	a
Dog Salmon R	Pink	21,900				5,475	27,375	a
Ketchikan Cr	Pink	250,000	5,000			50,000	305,000	a
Marx Cr Spwn Ch	Chum	416				16,135	16,551	
Margaret L	Sockeye	410				322	732	a
Margaret L	Pink	41,964				10,491	52,455	a
Sunny Cr	Pink	68,400				17,100	85,500	a
Hugh Smith L	Sockeye	25,000				65,586	90,586	e
McDonald L	Sockeye	124,198			9,000	113,000	246,198	e
Heckman L	Sockeye	14,639				11,520	26,159	e
Deer Mountain Hatchery								
Big Salt L	Chinook	4					4	
Bold Island L	Coho	173	36				209	
Margaret L	Chinook	3,066				1,932	4,998	
Deer Mountain	Chinook	113	164	55		742	1,074	
	Coho	2,435	300	72		1,468	4,275	
Reflection L	Coho	1,119				575	1,694	
Thorne Bay	Chinook	32	11				43	
Ward Cr	Coho	1,506	192			944	2,642	
Klawock Hatchery								
Cable Cr	Coho	694				600	1,294	
Klawock	Coho	44,741	4,000	1,000		11,950	61,691	

Table 3.1. Continued.

Hatchery or Project	Species	Commercial Catch	Sport Catch	Pers Use	Subsistence	Brood/ Escpmnt	Total	Comments
Klawock	Steelhead		1,800				1,800	
	Sockeye	19,908			4,000	4,649	28,557	
Tunga L	Coho	94					94	
Rio Roberts	Coho	1,354				45	1,399	
CENTRAL								
Irish Creek	Coho	13,300					13,300	a
Crystal Lake Hatchery								
	Chinook	5,950	3,140			2,680	11,770	
	Coho	3,190	140	433		1,475	5,238	
	Steelhead					21	21	
Earl West Cove	Chinook	8,225	270				8,495	f
Ohmer Creek	Chinook	485	230				715	
Farragut	Chinook	4				1	5	
Harding River	Chinook	18					18	
Slippery Creek	Coho	3,300					3,300	
St. John's Creek	Coho	95					95	
NORTHERN								
Chilkat Ponds	Coho	1,000				200	1,200	
Eliza Lake	Chinook	8					8	
Jerry Myers	Chinook	9	9			4	22	
	Coho	39				15	54	
Snettisham Hatchery								
Doty Cove	Chum	1,510					1,510	
Indian Lake	Coho	401				400	801	
Indian River	Chinook	1				20	21	
Limestone Inlet	Chum	12,030				100	12,130	
Juneau/DJ	Chinook	941	1,335			575	2,851	
	Coho	5				7	12	
Snettisham	Chinook	840	307			100	1,247	
	Chum	9,430					9,430	
Sweetheart Lake	Sockeye		22			300	322	
Tahini River	Chinook	3					3	
Lutak Inlet	Chinook	138	36			1	175	
Twin Lakes	Chinook		5,000				5,000	
Southeast Totals:		691,799	21,992	1,560	13,000	320,696	1,049,039	
STATE TOTALS:		3,096,732	331,369	24,185	20,330	1,919,223	5,391,831	
BY SPECIES:		Chinook 79,129			Steelhead 4,426			
		Coho 199,947			Rainbow 183,104			
		Chum 114,151			Grayling 12,475			
		Sockeye 3,115,346			A Char 4,123			
		Pink 1,679,130						
		5,187,703			204,128			

Estimates are based upon a varying combination of historical data, standard survival assumptions, fish ticket and coded-wire ta

- a. fishpass
- b. Sportfish estimate taken from 1991 Sport fish harvest surveys
- c. Juneau/DJ = Fish Cr, Auke L, Montana Cr, Dredge L
- d. personal use and subsistence combined
- e. co-op project with SSRAA, lake enrichment
- f. co-op project with SSRAA

Table 3.2. Estimated commercial contribution of fish by FRED hatcheries and projects in 1992.

Hatchery or Project	Species	Seine	Set Gillnet	Drift Gillnet	Troll	Total	Comments
ARCTIC-YUKON-KUSKOKWIM							
Sikusuilag	Chum		40,000			40,000	
AYK TOTALS:		0	40,000	0	0	40,000	
COOK INLET							
Big Lake							
Big Lake	Sockeye		35,350	35,350		70,700	
	Coho		850	850		1,700	
Crooked Creek							
Tustumena Lake	Sockeye					108,550	a
Leisure/Hazel	Sockeye	89,790				89,790	
Chenik Lake	Sockeye	14,380				14,380	
Port Dick Lake	Sockeye	420				420	
Kirschner Lake	Sockeye	40,040				40,040	
Elmendorf							
Halibut Cove	Chinook		980			980	
Seldovia	Chinook		310			310	
Ship Creek	Chinook	325	650			975	
	Coho						
Ft Richardson							
Little Susitna	Coho					3,900	a
COOK INLET TOTALS:		144,955	38,140	36,200	0	331,745	b
KODIAK/ALASKA PENINSULA							
Kitoi Bay	Pink	815,000				815,000	
	Chum	3,500				3,500	
	Coho	4,900				4,900	
Little Kitoi Lake	Sockeye	3,986				3,986	
	Coho	4,962				4,962	
Hidden Lake	Coho	240				240	
Karluk	Sockeye	775,000				775,000	
Frazer fishpass	Sockeye		300,000			300,000	
Afognak Fishpass	Pink					0	
(combined)	Sockeye					0	
Waterfall Fishpass	Pink	2,000				2,000	
Russell Creek	Pink	6,900				6,900	
KODIAK/AK PEN TOTALS:		1,616,488	300,000	0	0	1,916,488	
PRINCE WILLIAM SOUND							
Gulkana	Sockeye			116,700		116,700	
PWS TOTALS:		0	0	116,700	0	116,700	

Table 3.2. Continued.

Hatchery or Project	Species	Seine	Set Gillnet	Drift Gillnet	Troll	Total	Comments
SOUTHEAST REGION							
SOUTHERN							
Bakewell	Sockeye	3,979		4,672		8,651	
Dog Salmon	Pink	21,900				21,900	
	Coho	30			30	60	
Ketchikan Creek	Pink	167,500		62,500	20,000	250,000	
Marx Cr Spwn C	Chum	123		293		416	
Margaret Lake	Sockeye	121		280	9	410	
Margaret Lake	Pink	31,964		10,000		41,964	
Sunny Creek	Pink	68,400				68,400	
Hugh Smith L	Sockeye	11,919		13,081		25,000	
McDonald Lake	Sockeye	62,911		61,287		124,198	
Heckman Lake	Sockeye	4,319		10,008	312	14,639	
Deer Mountain Hatchery							
Big Salt Lake	Chinook				4	4	
Bold Island	Coho	101		46	26	173	
Margaret Lake	Coho	282	1	2,013	770	3,066	
Deer Mountain	Chinook	1		4	108	113	
	Coho	509	7	1,356	563	2,435	
Reflection Lake	Coho	109		811	199	1,119	
Thorne Bay	Chinook				32	32	
Ward Creek	Coho	94		1,030	382	1,506	
Klawock Hatchery							
Cable Creek	Coho	223		13	458	694	
Klawock	Coho	7,767		153	36,821	44,741	
	Sockeye	19,808			100	19,908	
Tunga Lake	Coho				94	94	
Rio Roberts	Coho	312		356	686	1,354	
CENTRAL							
Irish Creek	Coho	2,800			10,500	13,300	
Crystal Lake Hatchery							
Crystal Lake	Chinook	40		70	5,840	5,950	
	Coho	600		1,270	1,320	3,190	
Earl West Cove	Chinook	1,575		5,300	1,350	8,225	
Ohmer Creek	Chinook			110	375	485	
Farragut	Chinook				4	4	
Harding River	Chinook	15			3	18	
Slippery Creek	Coho	1,060		10	2,230	3,300	
St. John's Creek	Coho	13		22	60	95	

Table 3.2. Continued.

Hatchery or Project	Species	Seine	Set Gillnet	Drift Gillnet	Troll	Total	Comments
NORTHERN							
Chilkat Ponds	Coho			500	500	1,000	
Eliza Lake	Chinook	1		5	2	8	
Jerry Myers	Chinook					9	
Jerry Myers	Coho			11	28	39	
Snettisham							
Doty Cove	Chum			1,510		1,510	
Limestone Inlet	Chum			12,030		12,030	
Indian Lake	Coho	36		121	244	401	
Indian River	Chinook			1		1	
Juneau/DJ	Chinook	6		515	420	941	
	Coho			5		5	
Snettisham	Chinook	35		461	344	840	
	Chum			9,430		9,430	
Tahini River	Chinook			1	2	3	
Lutak River	Chinook	2		118	18	138	
SOUTHEAST:		408,555	8	199,393	83,834	691,799	
STATE TOTALS:		2,169,998	378,148	352,293	83,834	3,096,732	b

a = unidentified gear groups

b = sum of gear group totals does not equal total catch because of unidentified gear groups

Table 3.3. Estimated number of eggs taken by FRED Division during 1992

Facility	Broodstock	Species	Eggs Taken
ARCTIC/YUKON/KUSKOKWIM			
CLEAR	ALEK/DOMESTIC	A CHAR	1,168,000
	TOKLAT R	CHUM	131,000
	CHENA R	GRAYLING	206,000
	MOOSE L	GRAYLING	2,470,000
SIKUSUIAQ	NOATAK R	CHUM	11,100,000
NOME INCUBATORS	SNAKE R/BOULDER	CHUM	60,000
	NOME R/HOBSON	CHUM	140,000
	ARCTIC/YUKON/KUSKOKWIM		15,275,000
COOK INLET			
BIG LAKE	BIG LAKE	COHO	396,000
	LITTLE SUSITNA	COHO	296,000
	ENGLISH BAY	SOCKEYE	995,000
	MEADOW CR	SOCKEYE	10,330,000
CROOKED CREEK	KASILOF R	CHINOOK	349,000
	CROOKED CR	COHO	325,000
	TUSTUMENA L	SOCKEYE	13,200,000
	CROOKED CR	STEELHEAD	55,900
ELMENDORF	CROOKED CR	CHINOOK	1,200,000
	SHIP CR	CHINOOK	368,000
	SHIP CR	COHO	88,000
	BEAR CREEK	COHO	745,000
FT RICHARDSON	NINILCHIK R	CHINOOK	258,000
	WILLOW CR	CHINOOK	392,000
	LITTLE SUSITNA	COHO	727,000
	SWANSON/BIG LAKE	RAINBOW	4,478,000
	COOK INLET		34,202,900
KODIAK & AK PENINSULA			
KITOI BAY	KITOI BAY	CHUM	12,634,000
	KITOI BAY	PINK	196,843,000
	UPPER STATION L	SOCKEYE	4,300,000
	LITTLE KITOI L	COHO	993,000
PILLAR CREEK	UPPER STATION L	SOCKEYE	9,900,000
	AFOGNAK L	SOCKEYE	2,650,000
	MALINA L	SOCKEYE	1,410,000
	MONASHKA CR	COHO	10,000
	KODIAK & AK PENINSULA		228,740,000
PRINCE WILLIAM SOUND			
GULKANA I	GULKANA R	SOCKEYE	19,294,000
GULKANA II	GULKANA R	SOCKEYE	1,786,000
	PRINCE WILLIAM SOUND		21,080,000

Table 3.3. Continued.

Facility	Broodstock	Species	Eggs Taken	
SOUTHEAST				
CRYSTAL LAKE	CRYSTAL CR	CHINOOK	1,894,000	
	FARRAGUT R	CHINOOK	153,000	
	HARDING R	CHINOOK	78,000	
	CRYSTAL CR	COHO	422,000	
	MITCHELL CR	COHO	48,000	
	PORTAGE CR	COHO	96,000	
	CRYSTAL CR	STEELHEAD	20,000	
DEER MOUNTAIN	KETCHIKAN CR	CHINOOK	257,000	
	REFLECTION L	COHO	212,000	
	KETCHIKAN CR	STEELHEAD	13,500	
KLAWOCK	KLAWOCK L	COHO	496,000	
	KLAWOCK L	SOCKEYE	1,698,000	
	KLAWOCK L	STEELHEAD	22,300	
SNETTISHAM	CRYSTAL L	CHINOOK	688,000	
	SPEEL L	SOCKEYE	2,851,000	
	CRESCENT L	SOCKEYE	1,498,000	
	TAHLTAN L	SOCKEYE	5,384,000	
	TATSAMENIE L	SOCKEYE	1,628,000	
	TRAPPER L	SOCKEYE	2,579,000	
	SOUTHEAST		<u>20,037,800</u>	
	CHINOOK	5,637,000	RAINBOW	4,478,000
	COHO	4,854,000	STEELHEAD	111,700
	CHUM	24,065,000	A CHAR	1,168,000
	SOCKEYE	79,503,000	GRAYLING	2,676,000
	PINK	196,843,000		<u>319,335,700</u>

Table 3.4. Number of fish released during 1992 by FRED facilities.

Facility	Broodyear, Stock	Species	Released	Avg wt (gm)
ARCTIC/YUKON/KUSKOKWIM				
CLEAR	91 ALEK/DOMESTIC	A CHAR	432,000	47.0
	90 ALEK/DOMESTIC	A CHAR	3,670	722.0
	92 CHENA R	GRAYLING	34,000	0.5
	92 CLEAR	GRAYLING	46,000	0.0
	92 CLEAR/MOOSE	GRAYLING	254,000	0.0
	86 MOOSE L	GRAYLING	216	300.0
	87 MOOSE L	GRAYLING	216	281.5
	91 MOOSE L	GRAYLING	1,186	115.0
	92 MOOSE L	GRAYLING	1,850,000	2.0
SIKUSUIAQ	91 NOATAK R	CHUM	<u>8,448,000</u>	0.4
	ARCTIC/YUKON/KUSKOKWIM:		11,069,288	
COOK INLET				
BIG LAKE	90 BIG LAKE	COHO	215,000	11.3
	91 BIG LAKE	COHO	215,000	2.5
	91 ENGLISH BAY	SOCKEYE	290,000	0.2
	91 MEADOW CR	SOCKEYE	4,154,000	0.3
CROOKED CREEK	90 KASILOF R	CHINOOK	273,000	20.5
	90 CROOKED CREEK	COHO	74,000	20.0
	91 CROOKED CREEK	COHO	246,000	2.2
	91 TUSTUMENA L	SOCKEYE	13,312,000	0.2
	90 CROOKED CR	STEELHEAD	39,700	71.2
ELMENDORF	91 CROOKED CR	CHINOOK	1,005,000	17.2
	91 SHIP CREEK	CHINOOK	284,000	15.6
	90 BEAR L	COHO	216,000	23.7
	91 BEAR L	COHO	349,000	5.9
	90 SHIP CREEK	COHO	67,000	18.3
FT RICHARDSON	91 NINILCHIK R	CHINOOK	173,000	12.5
	91 WILLOW CR	CHINOOK	386,000	87.6
	90 LITTLE SUSITNA	COHO	515,000	25.4
	91 LITTLE SUSITNA	COHO	187,000	7.3
	91 LITTLE SU/WILLOW	COHO/CHIN	1,500	15.0
	87 BIG L/SWANSON	RAINBOW	31	1,500.0
	89 BIG L/SWANSON	RAINBOW	4,360	890.0
	90 BIG L/SWANSON	RAINBOW	1,580	472.0
	91 BIG L/SWANSON	RAINBOW	321,000	101.5
TUTKA BAY	Listed under PNP			
	COOK INLET:		<u>25,409,171</u>	
KODIAK & AK PENINSULA				
KITOI BAY	90 BIG KITOI CR	COHO	61,000	32.0
	91 BIG KITOI CR	COHO	383,000	4.5
	91 KITOI BAY	CHUM	22,200,000	1.8
	91 KITOI BAY	PINK	147,000,000	0.5
	91 UPPER STATION L	SOCKEYE	1,463,000	1.6

Table 3.4. Continued.

Facility	Broodyear, Stock	Species	Released	Avg wt (gm)
PILLAR CREEK	91 MONASHKA R	COHO	112,000	2.7
	91 AFOGNAK L	SOCKEYE	1,894,000	2.2
	91 MALINA L	SOCKEYE	85,000	0.4
	91 UPPER STATION L	SOCKEYE	2,200,000	0.2
RUSSELL CREEK	91 RUSSELL CR	CHUM	9,300,000	0.6
	90 MORTENSON CR	COHO	75,000	18.0
	91 RUSSELL CR	PINK	6,300,000	0.3
	91 MORTENSON CR	SOCKEYE	756,000	0.5
KODIAK & AK PENINSULA:			191,829,000	
PRINCE WILLIAM SOUND				
GULKANA I	91 GULKANA R	SOCKEYE	26,062,000	0.2
GULKANA II	91 E FK GULKANA R	CHINOOK	65,200	0.7
	91 GULKANA R	SOCKEYE	1,047,000	0.2
MAIN BAY	Listed under PNP			
PRINCE WILLIAM SOUND:			27,174,200	
SOUTHEAST				
CRYSTAL LAKE	90 CRYSTAL CR	CHINOOK	895,000	11.8
	91 FARRAGUT R	CHINOOK	66,500	1.3
	91 HARDING R	CHINOOK	41,800	1.5
	90 CRYSTAL CR	COHO	83,200	10.9
	91 CRYSTAL CR	COHO	313,000	0.8
DEER MOUNTAIN	90 KETCHIKAN CR	CHINOOK	133,000	23.7
	90 REFLECTION L	COHO	162,000	17.6
	91 REFLECTION L	COHO	103,000	11.5
	92 FT RICHARDSON	RAINBOW	34,200	6.1
	90 KETCHIKAN CR	STEELHEAD	1,030	17.9
KLAWOCK	91 CABLE CREEK	COHO	67,400	5.3
	91 KLAWOCK L	COHO	891,000	19.4
	91 RIO ROBERTS CR	SOCKEYE	39,100	6.4
	91 KLAWOCK R	SOCKEYE	1,148,000	3.9
SNETTISHAM	90 CRYSTAL CR	CHINOOK	286,000	6.9
	90 CRESCENT L	SOCKEYE	634,000	0.7
	90 TAHLTAN L	SOCKEYE	3,048,000	0.1
	90 LITTLE TATSAMENIE L	SOCKEYE	1,232,000	0.2
	90 LITTLE TRAPPER L	SOCKEYE	1,811,000	0.2
SOUTHEAST:			10,989,230	
SPECIES TOTAL:				
	CHINOOK	3,608,500	RAINBOW	3,441,171
	COHO	4,334,600	STEELHEAD	40,730
	CHUM	39,948,000	A CHAR	435,670
	SOCKEYE	59,175,100	GRAYLING	2,185,618
	PINK	153,300,000		266,469,389

Table 3.5. A projection of the number of salmon expected to return in 1993 as a result of FRED hatcheries and projects (excluding fishways and PNP transfers).

Return site	Numbers by species					
	Chinook	Coho	Sockeye	Chum	Pink	Steelhead
ARCTIC-YUKON-KUSKOKWIM						
Sikusuilag				65,000		
AREA TOTALS:				65,000		
COOK INLET						
Big Lake		2,000	82,500			
Cottonwood Drainage		2,000				
Wasilla Creek		2,000				
Willow Creek	5,200					
Little Susitna		15,000				
Crooked Creek	6,500	2,500				1,000
Ninilchik River	2,500					
Chenik Lake			20,000			
Tustumena			30,000			
Halibut Cove	27,000					
Homer Spit	5,200	6,500				
Seldovia Bay	2,000					
Leisure Lake			60,000			
Kirschner Lake			30,000			
Bruin Lake			20,000			
Hazel Lake			30,000			
Caribou Lake		7,200				
Seldvia	2,370					
Resurrection Bay	4,000	9,000				
Ship Creek	1,000	1,000				
Eagle River	500					
AREA TOTALS:	56,270	47,200	272,500	0	0	1,000
KODIAK-AK. PENINSULA						
Karluk			1,600,500			
Kitoi		13,150	15,000	17,000	7,079,000	
Kodiak other	3,000	12,000	740,000		134,000	
Russell Creek		2,000		15,000		
AREA TOTALS:	3,000	27,150	2,355,500	32,000	7,213,000	0
PRINCE WILLIAM SOUND						
Gulkana			215,000			
AREA TOTALS:	0	0	215,000	0	0	0
SOUTHEAST - SOUTHERN						
Bakewell/Badger			5,318			
Bold Island		3,335				
Big Salt	63					
Cable Creek		402				
Deer Mountain	3,447	5,424				287
Hugh Smith Lake			17,922			
Klawock		41,564	45,785			500

Table 3.5. Continued.

Return site	Numbers by species					
	Chinook	Coho	sockeye	Chum	Pink	Steelhead
Margaret Lake		102	921			
Marx Creek				54,818		
McDonald Lake			229,249			
Reflection Lake		2,676				
Rio Roberts		1,014				
Salmon Lake			5,424			
Thorne Bay	263					
Virginia Lake			2,293			
Ward Creek		4,074				
SOUTHEAST - CENTRAL						
Crystal Lake	14,700	4,500				100
Earl West Cove	13,800					
Farragut River	0					
Harding River	70					
Ohmer Creek	2,300					50
SOUTHEAST - NORTHERN						
Chilkat Ponds		1,200				
Indian Lake		2,000				
Indian River	20					
Crescent Lake			5,000			
Jerry Myers	100					
Sweetheart Lake			20,000			
Juneau/DJ	2,670					
Lutak Inlet	400					
Limestone Inlet				37,000		
Snettisham	1,870			1,000		
Twin Lakes	5,000					
AREA TOTALS:	44,703	66,291	331,912	92,818	0	937
STATE TOTALS:	103,973	140,641	3,174,912	189,818	7,213,000	1,937
GRAND TOTAL: 10,824,281						

PRINCE WILLIAM SOUND

Summary of FRED Projects

The Prince William Sound area encompasses ADF&G Commercial Fisheries Management Area E and includes the marine waters and freshwater drainages between Cape Suckling and Cape Fairfield (Figure 3.3).

In 1992, FRED Division activities in Prince William Sound were heavily influenced by continuing repercussions from the *Exxon Valdez* oil spill. Prince William Sound area staff continued their involvement in several oil spill damage assessment and restoration projects. Natural

Resource

Damage

Assessment Study

Number 4

involved recovery of over

1,000,000

juvenile salmon,

including 1,200

coded-wire-

tagged fish each year from 1989

through 1991.

Laboratory

studies of fry

feeding habits

and growth rates

were conducted

in 1992. The

results from this

study will be

used to estimate

the effects of the

Exxon Valdez oil

spill on the

growth and

survival of

juvenile salmon

during the early

marine period.

This project

should also

provide useful information needed to improve pink salmon forecasting techniques and evaluate rearing and release strategies at Prince William Sound hatcheries. Restoration Implementation Study Number 105 has focused on determining the best methods for restoring damaged salmon spawning habitats. Staff investigated nine potential spawning channel sites in 1992. The results from these investigations will be used to develop detailed project proposals for specific sites.

FRED Division staff continued limnological studies on lakes in the Prince William Sound area.

Limnological sampling at Coghill, Eshamy, and Davis Lakes continued, along with fry feeding studies at Coghill Lake in 1992. A cooperative project is being developed with the USFS to rehabilitate the depressed sockeye salmon runs to Coghill Lake.

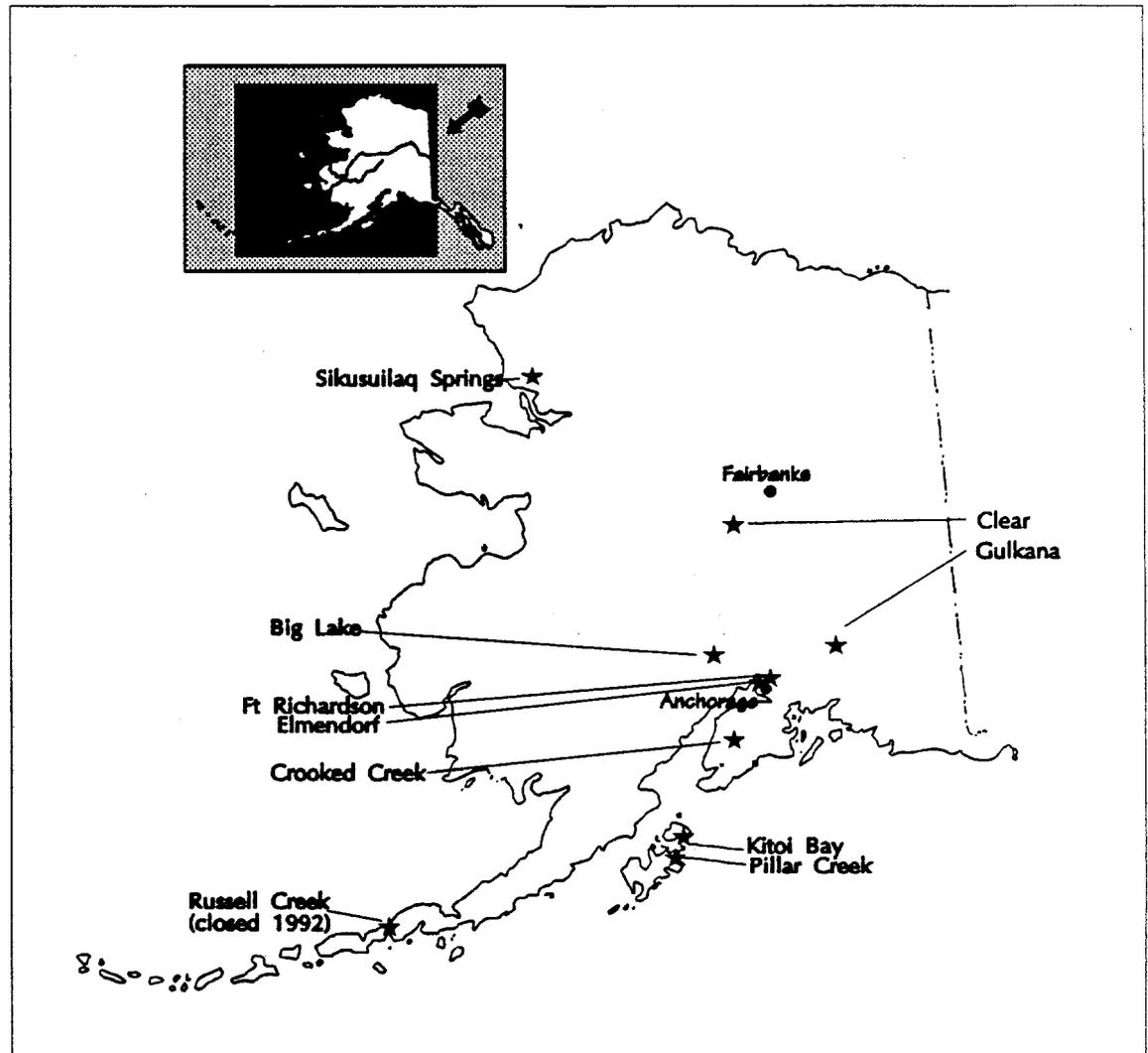


Figure 3.3. Map of Southcentral, Interior, Kodiak, and Prince William Sound Hatcheries.

FRED Division staff also continued to provide training and quality control services for the application of coded wire tags to over 1,000,000 juvenile salmon at five Prince William Sound hatcheries. This service is essential to ensure the quality of tag application is uniform among all hatcheries and treatment groups. The information obtained from these coded-wire-tagged fish will be used for inseason commercial fisheries management, development of improved commercial harvest strategies, wild stock forecasting, and evaluation of hatchery rearing and release strategies.

The Main Bay Hatchery (Figure 3.4) continues to produce sockeye salmon smolts. The Prince William Sound Aquaculture Corporation (PWSAC) took over operation of the Main Bay Hatchery on 1 July 1991. PWSAC also provides funds to the FRED Division to operate the Gulkana incubation facility. ADF&G expects this relationship to continue until 1 July 1993. FRED Division area, regional, and headquarters personnel have spent a great deal of time and energy to assure a successful transition at both hatcheries.

The Gulkana I streamside sockeye salmon incubation facility, located on the East Fork of the Gulkana River, retained its status as the largest hatchery producer of sockeye salmon fry in Alaska. Sockeye salmon fry were released at three sites to produce fish for commercial, subsistence, personal-use, and sport fisheries. In addition to releasing fry, staff performed limnological and biological sampling at Paxson, Summit, and Crosswind Lakes to assess the biological effects of the FRED Division's enhancement efforts. The Gulkana II facility continues to incubate sockeye salmon fry to build brood stock levels for future use.

Enhancement of the sport fishery in Prince William Sound and the Copper River Basin remains a high priority for the FRED Division (Figure 3.5). The Fort Richardson Hatchery rainbow trout sport fisheries enhancement program continued in 1992. This program involves stocking fry and fingerling rainbow trout in accessible lakes along the Richardson and Glenn Highways. A similar program using Arctic grayling is conducted from the FRED Division's Clear Hatchery. In addition to stocking emergent fry in lakes along the Richardson and Glenn Highways, several lakes accessible from

the Copper River Highway have been stocked as well.

The Prince William Sound area has the largest concentration of commercial fishery-oriented hatcheries in Alaska (See Figure 3.3). As chairman of the Prince William Sound/Copper River Regional Planning Team, the FRED Division's area biologist is heavily involved in the development of the Regional Comprehensive Phase III Salmon Enhancement Plan for Prince William Sound. In addition, as a member of the PWSAC Board of Directors and Executive Committee, the FRED Division area biologist remains actively involved with the financial and operational activities of the corporation.

Specific production numbers for Prince William Sound can be found in Tables 3.1, 3.2, 3.3, 3.4, and 3.5.



Figure 3.4. Commercial fishery opening at Main Bay.

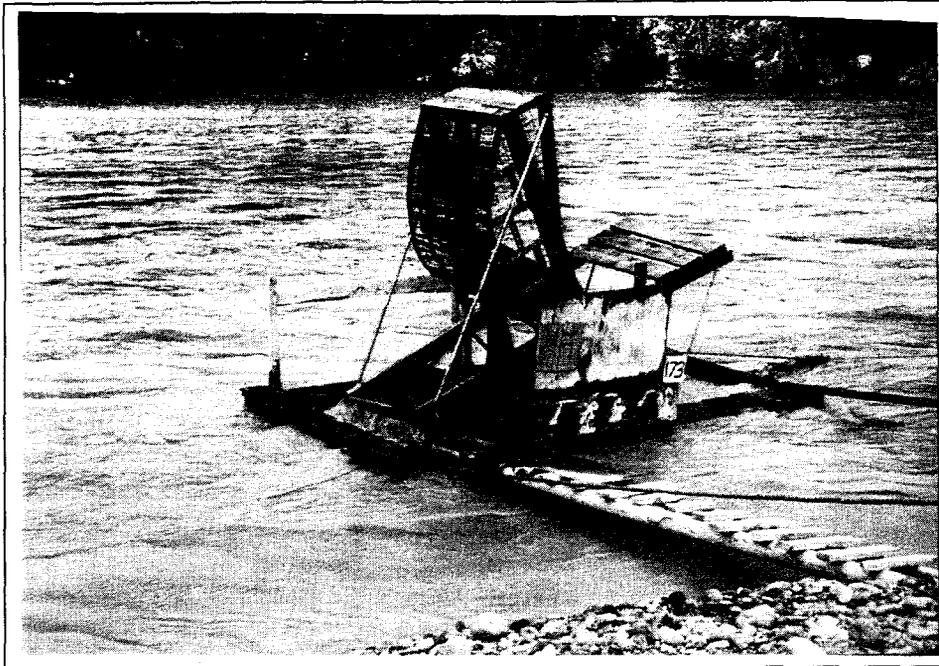


Figure 3.5. Fish wheel on the Copper River.

salmon. On the average, approximately 260,000 salmon are sport-caught in Central Cook Inlet.

Consequently, numerous FRED Division projects focus on this part of the state. There are five FRED Division facilities located in Cook Inlet (See Figure 3.3): Big Lake Hatchery, in the Susitna Valley, produces coho and sockeye salmon; Elmendorf and Fort Richardson Hatcheries produce fish for sport fishery enhancement projects throughout Southcentral, Interior, and other parts of the state; the Broodstock Development Center (BDC) provides rainbow trout eggs for the

Prince William Sound Highlights

- A comprehensive survey of potential wild stock salmon restoration techniques focused on an evaluation of nine sites for development of spawning channels.
- The 1992 Gulkana I sockeye salmon fry release of 26,030,000 fry is the largest sockeye salmon fry release in Alaskan history that used modern culture methods.
- The 1992 Gulkana II sockeye salmon fall egg take of 1,780,000 and spring fry release of 1,050,000 were both records for the facility.

statewide rainbow trout stocking program; and Crooked Creek Hatchery primarily produces sockeye salmon for commercial fisheries, and chinook and coho salmon and steelhead trout for sport fishermen. FRED Division fishery biologists located at Big Lake, Soldotna, and Homer provide technical support for these projects and maintain coordination with other biologists from the department's fishery management divisions.

Big Lake Hatchery was built in 1976 as a 16,000,000-egg sockeye salmon incubation facility to supplement poor adult returns to Upper Cook Inlet. The facility has been releasing salmon fry throughout Northern Cook Inlet since 1977. Initially, the facility stocked unfed sockeye and coho salmon fry in area lakes. As rearing facilities were added, the hatchery began to short-term rear all fish prior to release. In recent years, all coho salmon production has shifted from the release of fed fry to the release of fingerlings and smolts. In 1992, the Big Lake Hatchery released 3,100,000 sockeye salmon fry in the Big Lake drainage, as well as transported sockeye salmon fry to Eklutna Hatchery to rear to smolt, stocked coho salmon smolts in Knik Arm tributaries, and stocked coho salmon fingerlings in Interior Alaskan lakes.

COOK INLET

Summary of FRED Projects

The drainages of Cook Inlet comprise only a small portion of the entire state, but this area includes approximately one-half of the state's population. The recreational fishing effort in Central Cook Inlet has averaged 40% of that for the entire state, with most of that effort concentrating on Kenai River

The primary mission of the Elmendorf Hatchery is to produce chinook and coho salmon smolts to

enhance sport fishing opportunities at sites throughout Southcentral Alaska and near the City of Kodiak. The hatchery is located two miles north of downtown Anchorage near the Elmendorf Air Force Base power plant. The hatchery uses the power plant's excess heated-water effluent to accelerate growth and development of several fish stocks. The hatchery produces accelerated-growth, age-zero chinook salmon smolts, age-one coho salmon smolts, and coho salmon fingerlings. Elmendorf Hatchery is a centralized incubation and rearing facility whose programs serve Kachemak Bay, Resurrection Bay, Central Cook Inlet, the Matanuska Valley, Anchorage, and Kodiak.

The objective of the BDC is to develop and maintain brood stock for rainbow trout enhancement projects throughout Alaska. In addition, the BDC was designed as a small research facility to solve problems encountered in the production of rainbow trout and other species. To accomplish these goals, FRED Division engineers designed and built the BDC as a part of the Fort Richardson Hatchery. The three primary projects—brood stock maintenance, random-lot spawning, and development of an "all-female" brood stock—are the BDC's core program elements. These elements satisfy the facility's primary objective of rainbow trout production.

The goal of the BDC's random-lot spawning project is to perform an annual rainbow trout egg take and collect enough eggs for Alaska's rainbow trout sport fishery enhancement projects and ensure replacement brood stock. Fish spawned randomly within each of three strains produced 4,500,000 green eggs following eight days of egg takes in 1992. Another project at the BDC is designed to manipulate the sex of rainbow trout brood stock to improve both production efficiency and angling opportunities. Fish from these groups were fed testosterone-treated food to create males for future production. It appears that this project will lead to reduced costs for brood stock maintenance. Staff released an experimental group of rainbow trout in order to evaluate their growth and survival and their contribution to the sport fish enhancement program.

Research projects carried out by BDC staff during the past year included: (1) Production of "all-female" rainbow trout, (2) production of "all-

female-triploid" and "mixed-sex-triploid" rainbow trout, and (3) production of diploid and triploid coho salmon, as well as diploid and triploid coho salmon x chinook salmon hybrid crosses.

The FRED Division operates the Fort Richardson Hatchery located on the U.S. Army's Fort Richardson Military Reservation near Anchorage. This complex "central incubation facility" is designed and operated to produce rainbow trout, chinook salmon, and coho salmon for stocking in numerous streams, lakes, and marine waters to either create or enhance a wide variety of sport fisheries. The facility's most important program is its production of rainbow trout. FRED staff designed the hatchery to use only well water for fish production. Heat is extracted from the U.S. Army's Central Heat and Power Plant effluent through a heat exchanger system to warm the well water and accelerate fish growth. Current maximum production at Fort Richardson Hatchery, limited by the availability of well water, is approximately 5,000,000 fish, or 55,000 kg, annually. Typically, this will include 2,000,000-2,500,000 rainbow trout fingerlings, 200,000-250,000 catchable-sized rainbow trout, 800,000 chinook salmon smolts, and 600,000 coho salmon smolts.

All fish produced at Fort Richardson Hatchery are targeted for sport fisheries enhancement. The fish are released throughout Interior and Southcentral Alaska. Approximately 200 lakes, streams, and estuaries receive fish from the hatchery, requiring nearly 20,000 miles of transport-related travel. Rainbow trout fingerlings are released in the Fairbanks area, and large subcatchable rainbow trout are released in Anchorage, Palmer, Glennallen, and Fairbanks area lakes. While coho salmon smolts are released in Upper Cook Inlet streams, chinook salmon smolts are released in the Willow Creek and Ninilchik River. In addition, Fort Richardson Hatchery increased its production of large, post-smolt chinook salmon for the popular Anchorage urban lakes winter fishery.

The Crooked Creek Hatchery is located in Central Cook Inlet near Kasilof. The hatchery has an egg capacity of approximately 20,000,000 sockeye salmon eggs, and produces fingerlings for stocking programs at Tustumena Lake and eight lakes in Lower Cook Inlet. In 1989, the Crooked Creek

Hatchery expanded its production by taking over a portion of the coho salmon sport fish enhancement program that was previously provided by the Trail Lakes Hatchery. The moist-air incubation procedure, initially used for coho salmon eggs in 1989, is also being used for Kasilof River chinook salmon eggs to accelerate their development. Crooked Creek Hatchery produces coho salmon fingerlings, age-one chinook and coho salmon, and steelhead trout smolts each year.

The English Bay Lakes system has the only significant natural run of sockeye salmon in the Southern District of Lower Cook Inlet. The FRED Division initiated an enhancement project in 1989 to reverse declining trends in the English Bay sockeye salmon escapements and harvests in the English Bay Lakes system. The major goal of this rehabilitation and enhancement project is to restore the depleted English Bay sockeye salmon fishery to allow harvest by subsistence, commercial, and sport fishing user groups in the English Bay-Port Graham area. This is a cooperative project between the Village of English Bay, the North Pacific Rim Corporation, the Bureau of Indian Affairs, and the FRED Division. Local villagers receive on-the-job training in fisheries enhancement techniques. The egg-take crew collected almost 1,000,000 sockeye salmon eggs from the 1992 brood stock for incubation at the Big Lake Hatchery. The fry from these eggs will be transported back to the English Bay Lakes system next spring.

The FRED Division also maintains an area office in Homer on the lower Kenai Peninsula. The Lower Cook Inlet management area includes the waters west of Cape Fairfield, north of Cape Douglas, and south of Anchor Point. Fisheries enhancement continues to play a major role in salmon production for the various user groups in the Lower Cook Inlet area. Homer's location at the end of the road system attracts a popular and intense sport fishing effort (Figure 3.6); the demand for sport fishing

opportunities increases yearly. Additionally, a unique situation has developed in the Lower Cook Inlet area where both sport and commercial fishermen operate cooperatively, side-by-side in pursuit of their portion of the fishery resources produced by enhancement projects. This is particularly evident at multiple-user group projects, such as Leisure Lake and Tutka Lagoon Hatchery.

Oil Spill Restoration Surveys

An *Exxon Valdez* Oil Spill Restoration Site Survey is in progress on the Outer Gulf Coast area on the southern tip of the Kenai Peninsula. The division selected Port Dick Creek, an important pink and chum salmon system, because of its moderate to heavy oil exposure during the 1989 *Exxon Valdez* oil spill. The Port Dick system has demonstrated decreasing salmon production trends which were evident prior to the oil spill. Further sublethal effects from this previous oil accumulation or other events could jeopardize long-term pink salmon production in this area.

The goal of this restoration site survey involves continuing identification of impacted areas and making a determination on the optimal method of restoration. Preliminary work has resulted in the selection of a proposed spawning channel site at



Figure 3.6. The popular Homer Spit sport fishery.

Port Dick Creek as a potential method of restoring both pink and chum salmon stocks. Groundwater levels and other engineering baseline information is currently being collected to develop final recommendations relating to the feasibility of constructing and operating a salmon spawning channel at Port Dick Creek.

Specific numbers for Cook Inlet production can be found in Tables 3.1, 3.2, 3.3, 3.4, and 3.5.

Cook Inlet Highlights

- A Big Lake Hatchery egg-take crew took almost 1,000,000 English Bay sockeye salmon eggs and successfully transported them to Big Lake. This was the most successful egg take to date for the English Bay project.
- Elmendorf Hatchery staff worked with the Alaska Air National Guard to transport 95,000 chinook salmon smolts via a C-130 transport aircraft for release near Kodiak. Last year, high losses occurred during a 25-hour-long barge transport; this year, all went smoothly under the revised transport method.
- Based on return data from age-zero and age-one coho salmon smolts released in 1990 and 1991, the age-zero coho salmon smolt production program at Elmendorf Hatchery will be discontinued.
- The Elmendorf Hatchery's salmon viewing area on Ship Creek received 54,000 visitors in 1992, versus only 47,000 in 1991. More visitors were attracted by an increased escapement of adult chinook salmon.
- Fort Richardson Hatchery staff stocked 310,000 coho salmon smolts in the Little Susitna River in 1992. In addition, 115,900 were stocked in Bird Creek and 110,800 in the Campbell Creek drainages to initiate new programs intended to augment sport fisheries closer to Anchorage.
- The Fort Richardson Hatchery contributed approximately 16% of the 1992 coho salmon sport fish harvest in the Little Susitna River, while at Willow Creek, approximately 50% of the 1992 chinook salmon sport fish harvest was of hatchery origin. In addition, approximately 57% of the 1992 Ninilchik River chinook salmon sport fish harvest was of hatchery origin.
- In 1991, up to 89,000 angler days were generated by Fort Richardson Hatchery rainbow trout projects in Anchorage area lakes, maintaining its popularity as second only to the Russian River (1992 data not yet available).
- The total number of hatchery-produced sockeye salmon returning in 1992 from the outplants of fingerlings from Crooked Creek Hatchery into Tustumena Lake has been estimated at 131,300. The number of hatchery-produced sockeye salmon caught in the commercial fishery was an estimated 108,550. At an average price of \$1.60 per pound for sockeye salmon in Cook Inlet during the 1992 commercial fishery, the ex-vessel value of these fish amounts to nearly \$781,600.
- The stocking of steelhead trout in Crooked Creek has firmly established a new bank and drift fishery. This fishery occurs in early spring and late fall on the Kasilof River, before the fish begin to migrate up Crooked Creek to spawn. Thus, it provides one of the earliest and latest fishing opportunities of the season for Kenai Peninsula sport fishermen.
- Since 1983, FRED Division projects in Lower Cook Inlet have annually contributed 28-74% of the total commercial salmon ex-vessel value. In 1992, enhancement projects accounted for nearly 74% of the \$1.5 million ex-vessel value of the Lower Cook Inlet salmon harvest. Approximately 15% of the ex-vessel value was utilized for cost recovery for the enhancement projects.
- The Chenik, Kirschner, Leisure, Hazel, and Port Dick Lakes stocking projects provided 82% of the total Lower Cook Inlet sockeye salmon harvest in 1992. Ex-vessel value from these projects is estimated at \$0.9 million.
- The salmon stocking program on the Homer Spit has created an extremely popular, family-

oriented fishery. There were 3,000 chinook, 2,000 pink, and 3,500 coho salmon harvested by anglers at this sport fishery enhancement site in 1992. This provided an estimated 19,000 angler days of effort.

KODIAK AND ALASKA PENINSULA

Summary of FRED Projects

The FRED Division Kodiak Area Office is located in the City of Kodiak. The area includes the Kodiak Island Archipelago and the southern and eastern slopes of the Alaska Peninsula from Cape Douglas to the southern entrance of Imuya Bay. The FRED Division fish production facilities in the Kodiak area and Alaska Peninsula (*See Figure 3.3*) include Pillar Creek and Kitoi Bay Hatcheries near Kodiak that are operated with funds provided by the Kodiak Regional Aquaculture Association (KRAA) and, until August 1992, Russell Creek Hatchery, located near Cold Bay.

The FRED Division operates numerous projects and facilities that contribute salmon to Kodiak's annual production. The Frazer, Malina, and Afognak Lakes fertilization projects rehabilitate areas that have been historically productive; others, such as Kitoi Bay and Pillar Creek Hatcheries, enhance natural production. The salmon produced by FRED Division projects benefit commercial, sport, personal-use, and subsistence fisheries.

Lake fertilization was expanded in 1992 at Frazer, Malina, and Afognak Lakes as an important step in rehabilitating significant runs of sockeye salmon. As with other programs in the Kodiak area, this is a cooperative venture between ADF&G and KRAA; KRAA handles the contract and the FRED Division evaluates the results.

Sockeye salmon culture and technology expanded at the Kitoi Bay and Pillar Creek Hatcheries. The Pillar Creek Hatchery successfully stocked 4,100,000 fry and fingerlings into Spiridon, Waterfall, Malina, Afognak, Crescent, and Hidden Lakes. At Kitoi Bay Hatchery, sockeye salmon

technology expanded with the release of age-zero smolts.

Pillar Creek Hatchery was constructed in the summer of 1990 under a cooperative agreement between the FRED Division and KRAA. The facility was designed as a 20,000,000-egg sockeye salmon incubation facility located on the road system approximately seven miles from the City of Kodiak. The facility will create new fisheries for Kodiak Island seiners and gill net fishermen by planting several barren lake systems with sockeye salmon fry from donor stocks. Depleted natural runs in need of rehabilitation will also be stocked with fry from their native stock.

The Pillar Creek Hatchery's largest project is the stocking of late-run sockeye salmon into Spiridon Lake. Other enhancement projects include stocking Hidden Lake (Afognak Island), the Waterfall Lake system (Afognak Island), Crescent Lake (near Port Lions), and Little Kitoi Bay (Afognak Island). Afognak Lake eggs will provide an early-run stock for the above systems. In addition, a rehabilitation project for Pillar Creek Hatchery will take place on the Malina Lakes, with eggs collected on-site and returned to the system.

Kitoi Bay Hatchery is located on Afognak Island at the head of Kitoi Bay at the north end of Marmot Bay. The metal-frame hatchery building was constructed in 1965 after the original building was destroyed during the 1964 earthquake. The primary group served by the hatchery is the Kodiak commercial purse seiners. Operational and capital costs are provided by KRAA under a cooperative agreement with the FRED Division.

The Kitoi Bay Hatchery's primary goal is to increase the number of returning adult pink, chum, sockeye, and coho salmon passing through the fishery, and to increase the commercial harvest in areas that historically have not produced good or sustainable catches; i.e., cape fisheries in the Duck Bay/Izhut Bay areas. In conjunction with the Sport Fish Division, Kitoi Bay Hatchery also provides coho salmon fingerlings for programs designed to create recreational salmon fisheries along the Kodiak road system.

The sockeye salmon enhancement program at Kitoi Bay Hatchery was expanded in 1992 with the

addition of early-run fish into the saltwater pen-rearing program. This program addition should round out the hatcheries returns so that fish are available to fishermen from June until September.

In 1992, a new project began with the stocking of sockeye salmon presmolts into Hidden Lake on Afognak Island. This project is located on the Kodiak National Wildlife Refuge and required extensive negotiations with the U.S. Fish and Wildlife Service (FWS) Federal Refuge personnel before the Environmental Assessment was agreed upon. The system should sustain a fishery of 70,000-90,000 adult sockeye salmon per year.

Russell Creek Hatchery is located at the tip of the Alaska Peninsula, approximately three miles southwest of the town of Cold Bay and about 1.5 miles upstream from salt water on Russell Creek. The hatchery, originally constructed in 1977-1978, had a potential of being one of the largest hatcheries in the system, with a capacity for 250,000,000 pink and chum salmon eggs. However, due to budget constraints, the FRED Division closed the Russell Creek Hatchery in August 1992. The Aleutians East Borough will maintain the facility in operable condition until it is superseded by the state. The department anticipates that the Aleutians East Borough will acquire the hatchery.

Specific production numbers for Kodiak projects can be found in Tables 3.1, 3.2, 3.3, 3.4, and 3.5.

Kodiak and Alaska Peninsula Highlights

- A total of 117 tons of fertilizer was applied in Frazer, Malina, and Afognak Lakes to increase survival of sockeye salmon. Projects were completed in cooperation with the FWS and KRAA.
- Sockeye salmon fry stocking was expanded when fry, fingerlings, and presmolts were introduced into Waterfall, Crescent, and Hidden Lakes. These systems are barren to anadromous fish and will create new fishing opportunities.
- Post-fertilization studies continued at Karluk Lake. Survey results indicate abundant levels

of zooplankton, a migration of 3,700,000 high-quality smolts, and adequate escapement levels. The Karluk Lake sockeye salmon run is now restored and has again become a major contributor to the Kodiak salmon fishery.

- The Waterfall fish pass project continued and expanded to the Paul's and Portage Lake sockeye salmon systems. Fish pass maintenance and improvement was conducted at three fish passes at Waterfall Creek, two at Laura/Paul's Creek, one at Gretchen Creek, and one at Portage Creek. Pink salmon escapement at Waterfall Creek was 43,000; 6,000 salmon reached the upper reaches of the system.
- Preliminary egg-take goals for 1992 were nearly fulfilled for Pillar Creek Hatchery with approximately 14,000,000 eggs currently incubating, the most eggs ever taken for this facility.

NORTHWEST ALASKA - YUKON

Summary of FRED Projects

Two FRED Division hatcheries are located in the Northwest Alaska-Yukon (formerly Arctic-Yukon-Kuskokwim) area (*See Figure 3.3*). The Clear Hatchery at the Clear Air Force Station produces Arctic grayling and Arctic char for Interior Alaska sport fisheries. In addition, a pilot program for chum salmon on the Toklat River was begun in 1992 to rehabilitate the depressed stock. Sikusuilaq Springs Hatchery, on the Noatak River near Kotzebue Sound, produces fall chum salmon for the Kotzebue area commercial and subsistence fisheries. A FRED Division biologist in Nome investigates opportunities to either restore depressed stocks or develop new runs to benefit local communities.

The northwest portion of the Northwest Alaska-Yukon area encompasses a vast portion of Western Alaska, extending from north of Kotzebue Sound above the Arctic Circle and south to the

Kuskokwim Bay area. The Norton Sound area supports a commercial, subsistence and sport fishery, and extends from Cape Douglas near the Bering Strait south, approximately 500 miles to Canal Point Light. All five species of Pacific salmon occur in the area, with chum salmon being the most abundant species, followed by coho, pink, and chinook salmon. Sockeye salmon are rare and in low abundance throughout the area. The Norton Sound area is divided into six subdistricts, each containing at least one major spawning stream. Nome subdistrict salmon stocks are less abundant than stocks from other portions of Norton Sound, with fisheries demands exceeding production in most Nome area streams. Management actions in 1991 resulted in the closure of subsistence as well as commercial and sport fisheries in an effort to reach minimum escapement goals. In 1992, the chum salmon escapement in the Nome subdistrict was very difficult to quantify due to large numbers of pink salmon. However, the stocks have declined throughout Norton Sound over the past several years, with escapements in the northern subdistricts continuing to be of major concern. The problem is exacerbated in the Nome area by habitat degradation resulting from mining and road construction.

In response to needs expressed by communities in Western and Northwestern Alaska, the FRED Division further developed its program in 1992. Work is underway in the vicinity of Nelson Island, Chevak, and Nunivak Island, with monitoring sites to evaluate several opportunities to develop new commercial and personal-use fisheries. Several studies were completed under contract for this area, with funding provided by the Bering Sea Fishermen's Association. ADF&G and the Bering Sea Fishermen's Association are continuing to investigate the potential for salmon enhancement facilities in the Yukon-Kuskokwim Delta area. Water temperatures are monitored on several streams in the region.

The most promising sites observed in the area to date are on Nunivak Island where large groundwater springs occur. Additional monitoring is being done at a number of springs identified thus far. Staff will continue to look for ice-free streams and warm springs that might support an enhancement project. The long-term goal will be to build salmon runs or create new runs in the area at

large enough levels to start a commercial salmon fishery in the area.

In the Elim area, the FRED Division is assisting the village in an effort to restore and enhance existing fisheries to create new opportunities and economic developments. In the Nome area, most studies have concentrated on site surveys to evaluate potential development procedures. Water temperature and water quality are being monitored. Brood stock investigations have begun and several small egg takes have occurred. Experimental egg-incubation boxes have been installed in a number of locations, and various restoration and enhancement options are being discussed. Based on the success of pilot studies in Nome area streams in the winter of 1991-1992, streamside incubator projects continued on the Nome and Snake Rivers this year, and 100,000 chum salmon eggs are incubating at each of the systems this winter. Coho and chum salmon eggs are currently being incubated at several sites near Nome and at the high school to begin a restoration effort of severely depressed wild stocks in the area.

The FRED Division is assisting the Community of St. George for the second year in a pilot project to evaluate the feasibility of developing a salmon run to the island. At present, there are no salmon returning to St. George Island. Last year, 100,000 pink salmon eggs were incubated. The resultant fry were short-term-reared in the harbor and approximately 90,000 fed fry were released in June 1992.

Yukon River Restoration Studies

The FRED Division, in cooperation with the Commercial Fisheries Division, began the field sampling and egg-take phases of the Toklat River chum salmon restoration research project. Despite the best efforts of fishery managers, the 33,000-minimum adult spawning escapement objective for fall chum salmon on the Toklat River has been achieved only once since 1979. The presence of this severely depressed stock in the mixed-stock fishery has impacted the Yukon's ability to provide adequate harvests of other healthy salmon stocks as they move through the fishery. Toklat River fall chum salmon have been targeted by the Yukon River Drainage Fisheries Association for a

WILD STOCK RESTORATION ON THE TANANA

In Interior Alaska, sport fishing effort has been increasing during recent years, but the fishing effort on wild stock fisheries of the Tanana drainage sport fishery has been reasonably stable since 1977, averaging somewhat less than 100,000 angler days per year. However, harvest of wild fish has decreased by a factor of around 50% since the mid-1980s. Fishing effort targeted upon stocked fish has increased dramatically since 1977, going from between 15,000 and 20,000 person-days during the late 1970s to almost 100,000 person-days. The recreational harvest of stocked fish in the Tanana drainage has dramatically increased from about 13,000 fish in 1977 to over 100,000 fish in 1991. The net effect of the stocking program in Interior Alaska since the late 1970s has been to allow the recreational fishery to increase substantially in both effort and harvest, while at the same time deflecting increasing pressure from wild stocks that are quite susceptible to overharvest.

The stocking of game fish from FRED Division hatcheries has been used as a powerful tool by fishery managers responsible for the Tanana Valley sport fishery over the past 15 years. The Sport Fish Division formally adopted a policy concerning stocking in the Arctic-Yukon-Kuskokwim Region during the late 1980s. The essence of this policy is to only stock fish when a determination has been made that (1) the stocking will not seriously affect wild fish populations in a negative manner, but will divert increasing fishing effort from such stocks; and (2) the stocking will be cost effective. The management goal is to protect wild fish endemic to the region while providing for sustained use of both wild and stocked fishery resources by sport and other users. Many of the fishery resources utilized by sport fishermen in the Tanana Valley are fragile and can sustain only a low level of consumptive utilization, and accessible wild stocks of fish are limited and unable to withstand the level of fishing pressure applied in the past by anglers. These factors resulted in consumptive utilization levels during the mid-1980s that were not sustainable. Stocking hatchery fish has taken pressure off the wild stocks. The harvest of stocked fish has steadily increased, and during recent years has reached an average level of about 100,000 fish per year—equivalent to the entire annual harvest by the Tanana Valley sport fishery 10-15 years ago.

rebuilding and restoration pilot study. The department received funding from the legislature to begin a comprehensive regional fisheries restoration planning process on the Yukon River. This planning process is in its initial phases.

Clear Hatchery, near Nenana, was completed in January 1980. The facility has produced coho salmon, sheefish, Arctic grayling, Arctic char, lake trout, and rainbow trout predominantly for Interior sport fisheries, and has historically produced fall chum, chinook, and coho salmon for the Tanana/Yukon River commercial and subsistence fisheries. The facility currently produces Arctic char and Arctic grayling. In 1992, the department initiated a pilot study on Toklat River fall chum salmon. Since the Clear Hatchery is Interior Alaska's only hatchery, it is a center for developing rearing programs for Interior fishes. The site was selected partly because of the availability of heated waste water which allows a flexible rearing program.

The Arctic char project at Clear Hatchery is designed to develop, maintain, and expand domestic brood stock to replace wild stock egg takes and to continue to provide fingerlings, subcatchables, and catchables for Interior and Southcentral Alaska sport fish programs. The Arctic grayling project is designed to maintain and expand a domestic brood stock to replace a wild

egg take and to continue to provide fry and fingerlings for statewide sport fisheries projects. Additional emphasis is placed on developing techniques to increase survival levels at all stages of fish culture.

Clear Hatchery has one of the best aquifers in the state, with an apparently unlimited amount of clean water at two temperatures, 3.5°C and 6.5°C, as well as from 4,000 to 6,000 liters per minute of 13.0°C water. Close at hand are steam and warm water sources to heat incubation and rearing water to any desired temperature. There is an inexpensive option of doubling the facility's rearing capacity through the installation of a double-pass system. Performance can be judged by the hatchery's progressive history of fish cultural success of up to seven species, including its success in culturing Alaska's "exotic" species.

The Clear Hatchery provides multiple fishing opportunities to Alaskan anglers. Over 100 lakes are stocked with Arctic char and Arctic grayling fingerlings, subcatchables, catchables and adults, totaling over 2,800,000 fish.

The Sikusuilaq Springs Hatchery is located on the Noatak River about halfway between Kotzebue and Noatak Village. Funding came from a 1978 Bond Issue, and construction costs were nearly \$3 million. The original legislative intent was for a

demonstration hatchery to be built and operated at a suitable site in the Kotzebue area so that the practicality of hatchery operations in the Arctic could be assessed and information gathered for the design of a full production salmon hatchery if the original operation was successful. During 1987, the capacity of the hatchery was expanded from 2,000,000 to 10,000,000 eggs. So far, indications show that annual returns from a 60,000,000-egg production hatchery at Sikusuilaq could produce at least 500,000 adult chum salmon for harvest by the Kotzebue Sound commercial fishery. Schematic design of the production hatchery is complete and a planning process to assess various production alternatives is nearly finished. Complete design to the construction-document stage still needs to be done. Overall costs for design and construction are currently estimated at \$12.75 million. If all goes well, the production hatchery could be on line by 1996.

During the summer of 1992, the steep pass at Sikusuilaq was lengthened and resting tanks added. Before this change, the steep pass had never worked. This year, all returning fish climbed to the hatchery raceways.

Specific production numbers for Northwest Alaska-Yukon projects can be found in Tables 3.1, 3.2, 3.3, 3.4, and 3.5.

Northwest Alaska-Yukon Highlights

- A pilot project to study the potential of instream incubation technology in western Alaska has been a success in several Nome area streams. Approximately 3,000 chum salmon fry were released in the Nome River and 10,000 pink salmon fry were released in the Snake River after using experimental instream incubation boxes.
- The first ever production-level egg take was conducted in 1992 on the Nome and Snake Rivers. Approximately 200,000 chum salmon eggs were collected and are now incubating in instream incubation boxes.
- The June 1992 fry release of 8,500,000 chum salmon fry from Sikusuilaq Springs Hatchery was a new facility record.

- Returns of adult chum salmon to Sikusuilaq Springs Hatchery were greater than previously recorded and even provided a first ever excess of brood stock.
- Modifications to the Sikusuilaq Springs Hatchery steep pass have allowed returning salmon to climb into the hatchery raceways for the first time. About 12,000 salmon climbed to the raceways this fall. In previous years, the hatchery crew had to carry all returning salmon up the hill for egg takes.
- Installation of water-filtration and operational equipment within Sikusuilaq Springs Hatchery have allowed a 1,000,000-egg increase. The 1992 egg take of 11,100,000 eggs is a new facility record.
- A total of 95 separate lakes were stocked with two different species from Clear Hatchery.
- Fishing effort targeted upon stocked fish in Interior Alaska has increased dramatically since 1977, going from a level of between 15,000 and 20,000 person-days during the late 1970s to recent levels of almost 100,000 person-days.
- The recreational harvest of stocked fish in the Tanana drainage has dramatically increased from a level of around 13,000 fish in 1977 to over 100,000 fish in 1991.
- The net effect of the stocking program in Interior Alaska since the late 1970s has been to allow the recreational fishery in terms of both effort and harvest to increase substantially, while at the same time deflecting increasing pressure from wild stocks that are quite susceptible to overharvest.

FRED PRODUCTION SUMMARY

Total returns for FRED Division salmon enhancement projects in 1992 amounted to over 5,300,000 fish (Table 3.1). This is substantially less than the record 1991 return of 9,200,000 fish.

This is partially due to an accounting artifice, as two hatcheries previously reported under the FRED Division are now reported by PNP operators. Additionally, while 1991 was a record sockeye salmon return year to Kodiak fish passes, 1992 was only an average return year.

Releases of fish from FRED Division facilities totaled over 266,000,000, an increase of over 18,000,000 from 1991 (Figure 3.7). Major increases in releases occurred at Kitoi Bay, Sikusuilaq Springs, and Gulkana Hatcheries. A release of 147,000,000 pink salmon from Kitoi Bay was almost 23,000,000 fish over the 1991 release. Releases at Sikusuilaq Springs and Gulkana River were 1,000,000 and 4,000,000 fish greater than 1991 releases, respectively. Otherwise, release numbers generally decreased in 1992. Some of this is a reporting artifice, as explained above, but this

also reflects the enhancement program's shifting emphases.

Egg-take information provided in Figure 3.7 shows a decrease in numbers of eggs taken by the FRED Division in 1992. More than 319,000,000 eggs were taken in 1992 compared to 338,000,000 in 1991. Much of this decrease was due to a poor brood stock return to Gulkana Hatchery. In 1991, Gulkana Hatchery staff were able to take 36,000,000 eggs; in 1992, they were able to take only 19,000,000.

PROGRAM PROJECTIONS

The FRED Division uses many strategies other than hatcheries to rehabilitate, enhance, and develop Alaska's fisheries. Several of these strategies, including the operation of fish ladders that allow salmon to reach unutilized spawning areas, lake fertilization, habitat improvement, and fish planting programs, are far more difficult to evaluate than standard hatchery production. For lake fertilization and fish-planting projects, tagging and use of sonar counters allow for evaluation, often on a par with hatchery evaluation, but at greater cost. Fish ladders and habitat improvement projects are difficult to evaluate. Often, if evaluation is biologically feasible, it is cost-prohibitive. Since hatchery production is the most quantifiable strategy, it is often used as a standard by which the effectiveness of fisheries enhancement is measured. Table 3.5 presents projected numbers of fish expected to return to a diverse group of FRED Division projects, excluding fish pass projects or projects involving transfers of eggs or fish to PNP operators.

The projected number of fish returning in 1993 that can be attributed to fisheries enhancement projects is nearly 11,000,000. This number does not reflect fish passes and several lake enrichment projects, and therefore underestimates the return.

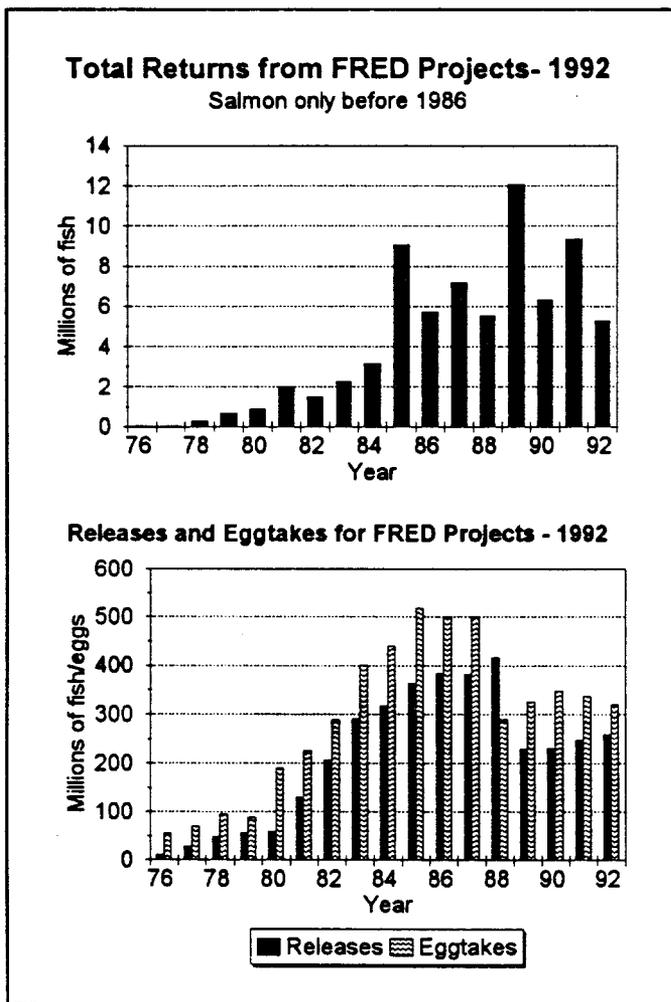


Figure 3.7. Total returns, egg takes, and releases for FRED Division projects.

CHAPTER 4

FISH HABITAT RESTORATION AND IMPROVEMENT

The FRED Division continues to develop and pursue fish habitat restoration and improvement projects in several areas of the state, with major emphasis in the Anchorage area, Prince of Wales Island, and northern Southeast Alaska. The goal of these projects is to restore, create, or improve fish habitat so that long-term natural productivity of the state's waters is improved. These projects are oriented to include public and community participation and involvement and to enhance public education and awareness. Public participants have included sportsmens' groups, Boy Scouts, Girl Scouts, students and teachers, construction firms, and other individual volunteers, organizations, and businesses.

ANCHORAGE

Campbell Creek and other drainages in the Anchorage area are the focus of stream restoration and improvement work. The Anchorage area stream rehabilitation project has coordinated aquatic resource education, volunteer activities, and community involvement. In addition, a grant was obtained from the Alaska Science and Technology Foundation (ASTF) to develop and evaluate technology for fish habitat improvement. In addition to creating new fish habitat, projects are designed to incorporate public involvement and public education, as well as project evaluation that will result in improved methods and techniques. All work sites and other survey locations are being monitored in cooperation with the department's Sport Fish Division, Department of Environmental Conservation (DEC), Trout Unlimited, and

Anchorage School District students to evaluate and assure that these projects benefit the salmon and trout living in area streams.

Campbell Creek - An excavation was made in early March with donated machinery to improve juvenile coho salmon rearing habitat in Campbell Park Slough (Campbell Creek) and to construct experimental habitat structures which would create an artificial undercut bank and woody debris cover to create protective areas for juvenile fish. Several groups of volunteers, e.g., members of the Alaska Flyfishers, McLaughlin Youth Center and the Boy Scouts, completed habitat structure installation, cleanup, and revegetation work in late spring (Figure 4.1). The public donated all required materials and equipment.

A fish ladder was installed in Dimond Slough on lower Campbell Creek. The ladder replaces a blockage created by beavers, and enables juvenile fish to enter or leave the pond-type slough during high-water events. Volunteers from the Alaska Flyfishers and Boy Scouts assisted with the installation.

Chester Creek - Staff conducted general stream surveys in the entire Chester Creek drainage and sections of Ship, Fish, Campbell, and Little Campbell Creeks in Anchorage to document reaches that may need rehabilitation.

Workshops - During 1992, the FRED Division assumed a lead role with personnel from the USFS and FWS to implement the fourth annual "Fish Habitat Improvement Workshop"

Stream Rehabilitation Projects

Prince of Wales Island	SSE
Fish Creek	SSE
Marx Creek Spawning Channel	SSE
Bennett Creek	SSE
Bryce Creek	SSE
Big Boulder Creek	NSE
Haines Airport	NSE
Haines Highway	NSE
One Mile Creek	NSE
Duck Creek	NSE
Jordan Creek	NSE
Campbell Creek	NCI

sponsored by the Alaska Chapter of the American Fisheries Society. State, federal, and private sector organizations attended the workshop in Haines to discuss groundwater applications to improve or create spawning and rearing habitat. Also during 1992, the FRED Division, along with the department's Habitat Division, the federal Bureau of Land Management, and FWS arranged and implemented a class in "Applied Fluvial Geomorphology" to help Alaska's fishery scientists to understand stream hydrology and processes.

SKIF - FRED Division staff has also participated in the Anchorage SKIF (Streams, Kids and Fish) Committee that proposed the development of an integrated, multidisciplinary approach to habitat restoration, fisheries enhancement, and educating school children on fish and their environment. The Municipality of Anchorage Assembly has recognized the importance of aquatic resources and the need for both enhancement and better community understanding of this resource by creating the special "Anchorage Aquatic Resource Commission" as a direct outgrowth of the SKIF Committee. One member of this commission was appointed from the FRED Division, along with ten additional members who represent a wide background of interests throughout the municipality.

SOUTHERN SOUTHEAST

Harding River - A barrier four miles from the mouth of the Harding River prevents chinook salmon from using about six miles of stream habitat. A five-year effort to bioenhance chinook salmon above the barrier on the Harding River (funded by U.S./Canada Pacific Salmon Treaty monies) began in 1991. FRED personnel released 41,800 fry in 1992. Concurrent to the bioenhancement, the USFS will improve access through the barrier as the adults from the 1989 brood return.

Dog Salmon Creek - Dog Salmon Creek flows through a clearcut area on native-owned land on the west side of Prince of Wales Island. Restoration work by FRED Division personnel at two sites corrected fish habitat degradation related to logging. The project goal was to stabilize eroding streambanks, decreasing the amount of downstream sediment that threatened spawning habitat. The main stream flow was directed back into the active channel, restoring spawning and rearing capability in this section of stream. Staff stabilized an eroding slide area by securing coniferous tree revetments along the stream and biodegradable erosion-control matting on the slide face. All instream work was accomplished with hand and small power tools; log structures were transported to the site by helicopter.

North Threemile Creek - North Threemile Creek is one of the non-cataloged, unmapped tributaries to Klawock Lake. Stream rehabilitation staff saw juvenile salmonids below an obstructed and perched culvert. The culvert was repaired to allow access to spawning habitat above the stream. The stream now supports production of sockeye, coho, and pink salmon, cutthroat trout, and Dolly Varden char. The project was a cooperative educational project with the Klawock School fisheries class. The Alaska Department of Transportation and Public Facilities (DOT/PF) assisted with installation of log weirs on either side of the culvert and excavation of an inlet pool upstream from the culvert.

Noname Creek - At the request of DOT/PF in Klawock, stream rehabilitation personnel and students from the Klawock School fisheries class removed a beaver dam on Noname Creek. Students examined the species composition of the pool habitat through trapping before removal of the beaver dam. They will trap the same stream reach at the corresponding time next year to assess changes in species composition.

Bennett Creek - The lower 1.2 miles of Bennett Creek, in a clearcut area near Klawock, were stabilized in 1991 using 25 instream structures and tree revetments. A followup evaluation in 1992 showed an increase in rearing juvenile coho salmon and chum salmon escapement further upstream than in any prior year since logging. More recent activities have impacted the creek, and additional instream work is in the planning stage to compensate for these impacts.

NORTHERN SOUTHEAST

Big Boulder Creek - Long-term rehabilitation work continued on Big Boulder Creek, a tributary to the Klehini River along the Haines Highway. The stream provides important spawning habitat to a subpopulation of Chilkat River-system chinook salmon. Habitat quality has degraded, partially due to highway construction and bridge maintenance activities. Staff installed boulder clusters to improve the spawning habitat available to chinook salmon. The clusters are part of the compensation required to mitigate the impacts caused by construction of a new bridge. The area was monitored during 1992 for use by spawning chinook salmon.

During the 1991 bridge reconstruction, a water intake was installed in the bridge-approach dike to supply streamside incubation boxes at Big Boulder Creek. Staff constructed a shed in 1992 to protect the water-supply system and incubators, and a water-supply distribution system and incubator have been installed in the shed for chinook salmon eggs. This project is

being pursued in cooperation with Haines NSRAA staff.

Haines Highway Reconstruction - As an important transportation corridor to the Interior, the Haines Highway will undergo a major reconstruction from the Chilkat River crossing to the Canadian border. Several sections will be realigned, possibly requiring construction of a road portion on the floodplain-margin of the Klehini River. A number of valuable spring-fed stream channels flow through the floodplain. These small channels support spawning and rearing populations of chum, chinook, and coho salmon and Dolly Varden char. The preliminary review of highway realignment alternatives began in the fall of 1991. Potential areas for enhancement are being monitored this winter for groundwater and surface hydrology. FRED Division, DOT/PF, and NSRAA are working cooperatively to develop plans for potential habitat enhancement applications along the highway route.

Duck Creek - Fisheries habitat in this small stream, which drains the central Mendenhall Valley in Juneau, has been degraded by nearly 50 years of development activity. The mosaic of habitat degradation includes gravel extraction, filling of riparian wetlands, diversion of runoff, ditching for utility corridors, and improper installation of many of the numerous culverts installed in the stream's course. The creek is polluted by stormwater runoff.

Student volunteers monitored Duck Creek from the fall of 1991 through 1992. The program, part of Alaska Water Watch, is an effort to track water-quality patterns and trends in the stream. The FRED and Habitat Divisions, along with DEC staff initiated the project with the Juneau Youth Services' Miller House. Bimonthly samples are collected and analyzed. The data are used to track non-point-source pollution entering the stream from surrounding roads, residences, parking lots, and service stations.

Switzer Creek - Past logging on the drainage, gravel extraction, and residential development have impacted this small stream on the west

The Chilkat River: A Potential for Long-Term Chinook Salmon Restoration

Chinook salmon populations in the Chilkat River have drastically declined in recent years. The combined efforts of a number of different agencies has helped restore this stock. In 1992, the *Chilkat River Chinook Salmon Plan* was amended and implemented by the department's three fishery divisions to solidify this effort. The plan sets forth the department's intent to research, manage, rehabilitate, enhance, and restore habitat. The FRED Division has played a major role in this process and has worked diligently to formulate the portion designed to provide rehabilitation on the Chilkat River and to develop enhanced fisheries for local sport fishermen.

Information on migration and harvest patterns in the common-property fisheries was lacking in the analysis of Chilkat River chinook salmon biology. In 1989, a project was initiated by the Commercial Fisheries and Sport Fish Divisions to determine those patterns. As part of that study, chinook salmon eggs are collected from the Tahini River (a tributary of the Chilkat River), and the resultant fry tagged with coded wire before returned to the river the following spring. This effort expanded in 1991 to include another tributary, Big Boulder Creek. This approach provides marked fish in the river at a much lower cost than traditional wild smolt tagging. Later, the fish are recovered in the commercial fishery and the information is used to analyze migration and harvest rate information.

A program to determine the genetic variance in the population and the differences, if any, between spawning populations in different tributaries was initiated in 1991 and continued in 1992. This is a cooperative project with the Sport Fish Division. Tissue samples were collected from spawning adults in five different locations on the Chilkat River. Those tissues were preserved in liquid nitrogen in the field and transferred to an extremely cold (-80°C) freezer in Juneau. The samples will be analyzed by starch-gel electrophoresis. Population stock structure can then be determined based on genetic relationships of the subpopulations. This information is critical to management and enhancement efforts for the Chilkat stock.

side of the Lemon Creek Valley in Juneau. The stream produces coho, pink, chum, and sockeye salmon, along with Dolly Varden char and cutthroat trout. With the assistance of three high school volunteers, nine logs have been installed in the west fork of Switzer Creek. The structures are intended to act as deflectors. Deflectors constrict flow and encourage streambed scouring. The deflector logs will scour pools and allow transport of some accumulated sediments downstream. In addition, silt, refuse, and wood-cutting slash were removed from a large pool at the confluence of the west and east forks. The pool is the site of upwelling groundwater and is used by spawning and rearing fish.

Verstovia School Creek - A small stream near the Verstovia Elementary School in Sitka is the site of a planned environmental education trail funded by a Sport Fish Partnership Grant. Construction impacts have left the stream in a severely degraded condition. A project plan is being developed to restore the stream's potential to support greater populations of Dolly Varden char and cutthroat trout. FRED Division staff spent a day with fourth graders from the school clearing debris from part of the stream.

Bradfield River - FRED and USFS personnel started investigating the Bradfield River for

possible stream rehabilitation. Much of the riparian vegetation was removed when the Bradfield River was extensively logged in the 1960s and 1970s. Chinook salmon are known to prefer large, woody debris in the main stream of rivers for rearing. The combination of an unstable stream channel on the Bradfield River and a lack of large timber in the floodplain appears to be producing less and less of the habitat type preferred by juvenile chinook salmon. Efforts are being planned to put more large trees into the river and to establish tree stands that will be a source of chinook salmon habitat.

CENTRAL SOUTHEAST

Mitchell Creek - Mitchell Creek is located on Kupreanof Island and drains into Duncan Canal about ten miles west-southwest of Petersburg. There is a series of falls located 3.1 miles above tidewater. Two of the falls will be modified for coho salmon passage. USFS crews completed construction of a series of fish passes on these barriers in 1992. Coho salmon fry from eggs taken below the barriers in 1992 will be planted upstream in 1993. Staff collected eggs that are now incubating at Crystal Lake Hatchery. The habitat above the

barriers will likely produce an additional 3,200 adult coho salmon annually as well as an undetermined number of steelhead trout who will enter the upper watershed on their own.

Portage Creek - Portage Creek drains into Portage Bay, Kupreanof Island, approximately 15 miles northwest of Petersburg. The USFS plans to provide fish passage over two barriers located 1.5 and 2.0 miles above tide water in 1993. The fish passes are designed to accommodate coho salmon, steelhead trout, anadromous cutthroat trout, and Dolly Varden char, all of which are indigenous to Portage Creek. Coho salmon will be planted above the fish pass. Coho salmon bioenhancement began in 1992 when eggs were taken from females trapped below the first barrier. Eggs are being incubated at Crystal Lake Hatchery.

Fish Pass Projects

In addition to the projects described below, FRED Division staff has also been involved with fish passes in the Kodiak area on both Kodiak and Afognak Islands. A partial listing of Alaskan fish passes appears below. Additional information on bioenhancement can be found in Chapter 6 under Limnology and Lake Fertilization.

USFS Suntaheen Fish Ladder Bioenhancement - Suntaheen River is located on the east side of Chichagof Island. The river originates in a broad valley with many ponds and channels characteristic of prime coho salmon habitat. However, two barriers prevent fish from gaining access to this habitat. In 1989, the USFS began construction of two fish ladders to provide passage over the barriers. To ensure colonization above the ladder, the USFS, NSRAA, and FRED Division have cooperated to place coho salmon fry in the new habitat. This effort continued in 1992 when the fry were distributed throughout the prime habitat. In 1992, FRED Division staff again assisted with adult salmon and egg collections at nearby Game Creek. Fry produced from these eggs will be planted above the Suntaheen River fish ladders in 1993.

Tunga Lake - Juvenile coho salmon from the Klawock Hatchery were planted above this USFS fish pass as part of a four-year colonization program. Prior releases of tagged coho salmon have shown a large contribution to traditional commercial fisheries; however, the lake is spawning-limited, and colonization efforts have not been as successful as hoped. Tunga Lake is located on the west coast of Prince of Wales Island.

Cable Creek - Coho salmon were planted above the Cable Creek fish pass in 1992. This is the sixth and final year of releases in this colonization project carried out in cooperation with the USFS. Initially, fewer-than-expected adults returned from this project, but the 1991 and 1992 returns looked more promising. In 1993, the USFS plans to modify a smaller barrier falls above the jump pools to provide better adult passage to spawning habitat.

Rio Roberts Creek - This project represents another colonization project done in cooperation with the USFS. The final coho salmon fingerling release occurred in 1992. Returns from these releases have been promising with 1,344 adults harvested in the commercial fisheries.

Anan Creek	Southeast
Cable Creek	Southeast
Dean Creek	Southeast
Harding River	Southeast
Irish Creek/Upper Keku Creek	Southeast
Margaret Creek	Southeast
Meter Bight Creek	Southeast
Mitchell Creek	Southeast
Old Franks Lake	Southeast
Rio Roberts Creek	Southeast
Slippery Creek	Southeast
St. John's Creek	Southeast
Suntaheen River	Southeast
Sunny Creek	Southeast
Tunga Lake	Southeast
Afognak Island	Kodiak
Frazer River	Kodiak
Waterfall Creek	Kodiak
Gretchen Creek	Kodiak
Portage Creek	Kodiak
Laura/Paul's Creek	Kodiak

Old Franks Lakes - Fish pass construction in lower Old Franks Creek has been long endorsed as a high priority project for southern Southeast Alaska. Two fish passes were constructed in 1992 by the USFS, Craig Ranger District. The FRED Division is leading the bioenhancement effort, with sockeye salmon fry planted in 1992. U.S./Canada Pacific Salmon Treaty mitigation funding was granted late in 1992 for a three-year coho salmon bioenhancement program. The fish passes have opened up 730 acres of lake habitat and 3.8 miles of stream habitat to anadromous fish production.

Margaret Creek - The Margaret Creek fish pass was built by USFS, Ketchikan Ranger District personnel in 1990. It proved successful in 1992 when adult coho salmon returned from a plant of Deer Mountain Hatchery summer coho salmon. A 20% marine survival was estimated after 61% were intercepted by commercial fisheries. No further coho salmon bioenhancement will occur at this site because natural colonization is occurring and the USFS would like to study this phenomenon. Sockeye salmon fry were planted in the lake in 1988, 1990, 1991, and 1992. Since 1989, the USFS has been doing an extensive study of the resident cutthroat trout population and will be able to document the effect of introducing anadromous fish.

Instream Incubation System - Two incubators, modified for installation in a stream, are being tested in Marx Creek for a second season. A small number of chum salmon eggs are being incubated to test this system design for use in other locations where spawning habitat is limited. Last year's test ended when groundwater levels in Marx Creek rapidly and unexpectedly dropped three feet, dewatering the upper reaches of the spawning channel where the incubators were located. The incubators are now located further downstream in the channel where water supply is reliable.

CHAPTER 5

PROGRAM ELEMENTS

Sport Fisheries Enhancement Program

The sport fisheries enhancement program in Alaska involves rainbow trout, coho, chinook and pink salmon, Arctic grayling, and Arctic char. Life stages stocked include unfed fry, fed fry, fingerlings, smolts, post-smolts, and precatchable- and catchable-sized fish. These fish are released into over 60 stocking locations for anadromous fisheries and approximately 300 stocking locations for landlocked fisheries. Stocking is conducted based upon an approved five-year plan developed with the department's Sport Fish Division. Specific examples of sport fish stocking can be found throughout this document.

Review meetings and planning sessions are held with the Sport Fish Division, regional planning teams, and other interested parties to improve the program whenever possible. The intent is to keep this program as comprehensive and responsive as possible. A solid and increasing public demand for additional sport fish production continues. An area receiving growing interest is local fishing derbies. Derbies can provide many economic and social benefits.

In Ketchikan, Deer Mountain Hatchery provided chinook salmon smolts and triploid rainbow trout for the first Kids' Fishing Derby. The event was cooperatively organized by the FRED and Sport Fish Divisions, the USFS, Big Brothers/Big Sisters, Ketchikan Borough Parks and Recreation Department, and Ketchikan Sports and Wildlife Club. Organizations and local merchants donated numerous prizes for the event. Approximately 200 children participated; they fished by age group and

prizes were awarded in each group. The event was an overwhelming success; in fact, planning is already underway for next year's derby.

Another derby was organized in Klawock. Two-year-old catchable steelhead trout from Klawock Hatchery were planted in One Duck Lake, just prior to a Kids' Fishing Derby during National Fishing Week. The derby drew 300 local children for a day of fishing. USFS and Sport Fish Division staff cooperated with FRED Division staff to make this a highly successful event. Local merchants donated merchandise and gift certificates for prizes.

Personal-Use and Subsistence

Although no FRED Division projects have been designed specifically to improve or create subsistence or personal-use fisheries, these resource users from several areas of the state benefit indirectly from other "common-property" fishery enhancement projects. Personal-use fisheries have developed for sockeye salmon in Cook Inlet as they return to Big Lake, Kasilof River, and Leisure Lake. A few subsistence users harvest small numbers of fish returning to Lower Cook Inlet projects. A cooperative project at English Bay will strongly benefit subsistence users. In the Kotzebue area, subsistence users harvest chum salmon returning to Sikusuiqa Springs Hatchery and, in the Copper River drainage, sockeye salmon from Gulkana Hatchery are caught by subsistence fishermen.

Perhaps the most significant contribution to subsistence fisheries occurs at McDonald Lake in Southeast Alaska. This is a lake enrichment project

for sockeye salmon that provides approximately 30% of the subsistence-caught sockeye in Southeast Alaska.

Klawock Hatchery on Prince of Wales Island also contributes to subsistence fisheries, and Snettisham Hatchery, near Juneau, is developing what could become a very popular personal-use fishery for sockeye salmon at the outfall of Sweetheart Lake.

Commercial Fisheries Enhancement Program

Commercial fishermen benefited throughout Alaska from returns of hatchery-produced fish. During recent years, these benefits have mostly been provided by operations or operational funding from the PNP associations or corporations, primarily in Prince William Sound, Kodiak, and Cook Inlet. The FRED Division, however, continues to provide technical support, overview, and planning for these programs. The division operates commercial fish production programs at Big Lake, Crooked Creek, Snettisham, Crystal Lake, and Klawock Hatcheries. Funds to operate the Kitoi Bay, Pillar Creek, Main Bay, and Gulkana I and II Hatcheries are provided to the state by several PNP associations. The FRED Division also operates and funds a developmental program at Sikusuilag Springs Hatchery which primarily benefits local commercial fisheries near Kotzebue.

Economics Program

The FRED Division economics program provides economic information to fishery interest groups, PNP hatchery operators, regional aquaculture associations, regional planning teams, and managers and policymakers in ADF&G, the Department of Commerce and Economic Development (DCED), and the Alaska State Legislature on the consequences of ocean ranching, fresh and saltwater recreation, and other proposed shellfish enhancement activities.

Salmonid fisheries enhancement for commercial fishery markets as well as subsistence and recreational users has had a variety of effects on Alaska's economy. Because state, federal, and private funds are invested into hundreds of individual salmon enhancement projects, and 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.

FRED Division Economics Program

Highlights:

- 1992 marked the second year the FRED Division participated in the legislature's analysis of the statewide enhancement program. The study is funded and managed by the Senate Special Committee on Domestic and International Fisheries. The FRED Division participated in the final stages of the review. The study included (1) an international market demand model for salmon, (2) a fishing cost model, and (3) a population/exploitation model. This is the most extensive cost-benefit analysis of the statewide fishery enhancement program to date. Preliminary results show that salmon markets have been more negatively impacted by farmed salmon than expected, and that the harvesting of salmon in the commercial fishery is a significant cost of the statewide enhancement and management programs.
- The FRED Division's economist became an advisor to the Equity Task Force for U.S./Canada Pacific Salmon Treaty negotiations. There is increasing interest in how proposed solutions to equity might impact the value of Alaska and West Coast salmon fisheries.
- Staff prepared a manuscript on the role of enhancement in the Alaska recreational fishery for the Senate Special Committee on International and Domestic Fisheries.
- FRED Division staff provided technical support and review to the Commissioner's Office and the Extended Jurisdiction staff of the Commercial Fisheries Division regarding NMFS' cost-benefit analysis of inshore/offshore groundfish allocation.

Strategic Planning

During 1992, the FRED Division completed a strategic plan that was submitted to the commissioner for consideration. This planning process was initiated because of external influences on the program that necessitated change. After assessing social, political, economic, and traditional considerations, the division, having analyzed its strengths and weaknesses, realized it must maintain some of its current programs, transfer to the PNP sector others previously supported with general funds, and diversify by growing selectively into new areas. This strategic plan presents the division's direction for the 1990s and identifies the division's (1) statutory authorizations, (2) mission, (3) core program elements, (4) issues relative to program elements and roles supporting these efforts, (5) descriptions of primary disciplines within the division, (6) descriptions of regional programs, and (7) history.

As a result of this planning process, the FRED Division will focus its efforts and direct fiscal resources toward accomplishing specific program elements. The cornerstones of the division's program have been identified in the document as core program elements designed to guide current and future program directions. These include:

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

Public Involvement and Education

The FRED Division recognizes the importance of keeping the Alaskan aquaculture community and

general public aware of its programs. The division has strengthened a program that commits to improving the methods by which the public becomes involved in project and program planning.

Tours of hatcheries and presentations by FRED Division personnel continue to play an integral role in educating the public on fisheries enhancement. Hundreds of thousands of school children, other state residents, and tourists walked through fish hatcheries in 1992. Division personnel gave many presentations to public groups, ranging from civic clubs to kindergarten classes. Many hatchery activities have been thoroughly covered by the media—newspaper, radio, and television. Incubators were placed in schools around the state. FRED Division staff provided out-of-state consulting/assistance, on-the-job training opportunities, Job Partnership Training, vocational rehabilitation, and training for community service workers.

A byproduct of hatchery operations is leftover adult salmon carcasses. These, as well as excess fish, are given away at many state hatcheries. Sometimes the fish are given on a first come, first served basis, and sometimes to needy people or charitable organizations. These fish might be smoked and used for human consumption, or simply used for dog food.

The following are highlights of FRED Division public involvement in 1992:

- An estimated 200,000 tourists saw Deer Mountain Hatchery during 1992. Informative signs at the hatchery and a brochure help to answer questions commonly asked by the public.
- In 1992, over 30 businesses, several organizations and individuals, as well as cooperating government agencies contributed either materials, equipment, or manpower to Anchorage area stream rehabilitation projects.
- Classrooms and libraries in schools throughout Alaska have begun classroom incubation projects to learn about fish life history and habitat needs. The FRED Division provided assistance to over 30 schools in such places as Ketchikan, Anchorage, Palmer, Wasilla,

Nome, Lower Yukon, Unalakleet, Shaktoolik, and the Kuskokwim drainage.

- Special focus was given to a coho salmon smolt release at Campbell Creek Park in an effort to educate the public about the new stocking program in the creek. Students from two elementary schools and visitors from the general public were given smolts to release with the intent that they would become better stewards of the aquatic resources because "their" fish were now in the stream.
- Several teacher and student training sessions were held in preparation for a spring macroinvertebrate/stream studies pilot project in Chester Creek. FRED Division staff helped with a teacher training course sponsored by the SKIF (Sstreams, Kids and Fish) Committee and the Anchorage School District with presentations on classroom incubation and field work. The teachers received hands-on experience with water chemistry test kits, macroinvertebrate samplers, fish traps, and flow meters. Other presentations and site visits were made with students from East High School and Steller Alternative School on sampling procedure. This project is part of the cooperative ADF&G and DEC Water Watch Program.
- The FRED Division co-hosted the 1992 Northwest Fish Culture Conference in Wenatchee, Washington. This is the premier fish culture conference for the Pacific Northwest and involves 400-500 attendees each year.

Program Receipts

Deer Mountain Hatchery continues to be the leader in innovative ideas for generating hatchery funding. Most programs have targeted the large number of tourists that view the hatchery each summer. None of the existing program receipt mechanisms have shown enough profit or stability potential to reliably fund the entire hatchery operation. However, all programs have served to either educate the public on salmon biology and hatcheries, or to build name recognition for Deer

Mountain. These programs include T-shirt sales and the Adopt-a-Salmon Program.

Engineering Services

Engineering services provided by FRED Division personnel consisted of coordinating various activities, including environmental studies, materials computations, contract administration, consultant coordination, financial management, outside agency coordination, public involvement, and coordination with PNP operators on various projects. Other engineering services included drafting final design plans and specifications, cost estimates, and obtaining environmental permits for other divisions within the department.

Engineering services ensure compliance of construction projects with applicable regulations and standards; manage civil engineering and survey projects; provide guidelines for contractors and staff; coordinate design and construction functions; manage assigned programs; independently assign work; and technical responsibility for design and construction projects. Contacts by engineering staff are made with the heads of contracting firms and consulting firms, attorneys, representatives of federal, state and local agencies, PNP operator representatives, and the general public.

CHAPTER 6

TECHNOLOGY AND DEVELOPMENT

The past year has been an exciting one on several fronts. The legislature approved \$500,000 in order to establish a home for the combined FRED-Commercial Fisheries genetics laboratory. The lab will be located in Anchorage. The genetics programs in both divisions have grown quite rapidly during the past year and we look forward to helping solve fishery management problems where genetic stock identification can play a part. Further, the research into possible oil spill-related chromosome damage to pink salmon in Prince William Sound holds promise of being an extraordinary discovery.

Unraveling the reasons behind the very poor overwinter survival of juvenile sockeye salmon in the Kenai River drainage continues to challenge our limnology staff. Efforts continue on improving the data base central to understanding this phenomenon. The dramatic reduction in smolts heading to sea from this drainage does not bode well for the commercial and sport fishermen that target on these fish as they return as adults.

Thermal marking of the otoliths (Figure 6.1) of sockeye salmon is proving up. Marked otoliths were obtained from jack salmon returns to the outlet of Sweetheart Lake in Port Snettisham. These fish were marked while still in incubators at Snettisham Hatchery and later planted in Sweetheart Lake. All marking patterns were clearly distinguishable on the otoliths. We continue to pursue monies for acquisition of laboratory space for processing both coded wire tags and otoliths.

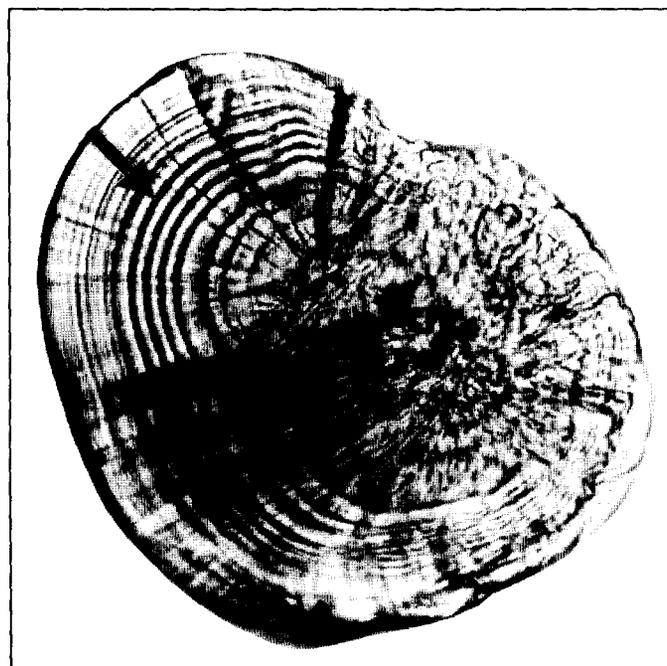


Figure 6.1. Thermal banding patterns on fish otolith (ear bone).

Highlights

- The lake enhancement project at McDonald Lake provided 7% of the total sockeye salmon harvest in southern Southeast Alaska with an ex-vessel value of \$1.2 million. This provided a benefit-cost ratio of 30:1 for that lake fertilization project.
- In 1992, the Soldotna Limnology Laboratory completed nearly 32,000 individual analyses on nearly 1,000 water and zooplankton samples collected from 76 lake and riverine systems.

- The Coded Wire Tag Processing Laboratory processed fish heads in 1992 at a record pace. The goal was a one-week turnaround from receiving the head to deciphering the imbedded codes (Figure 6.2). This goal was consistently met or exceeded.
- The Genetics Laboratory continues its exciting work with cryopreservation to both simplify some aspects of hatchery production and to preserve, or bank, sperm of endangered salmon stocks.

CODED WIRE TAG PROCESSING LABORATORY

The 66,000 heads processed in 1992 did not break the lab's 1991 record of 78,000 heads; yet, all heads received were processed faster than ever before. The lab's goal is to process samples from fish sold one week by Friday of the following week. Staff consistently met or exceeded this goal. Rush samples from Southeast's special June troll fisheries, some Southeast gillnet fisheries, and selected Prince William Sound pink salmon fisheries were processed and the data reported on

the same day received. Tags recovered from sampled sport fisheries were also processed within one week. Laboratory staff worked very closely with commercial and sport fishery managers to assure their processing priorities were met. The lab staff of sixteen seasonal and six full-time employees processed an average of 3,800 samples each week during July and August in an overcrowded, inadequate work place.

For many years, coded wire tag data have been used by Southeast commercial fisheries managers to determine what areas should be opened and to set the duration of fishing periods for the chinook salmon troll catch. The U.S./Canada Pacific Salmon Treaty caps the allowable harvest of chinook salmon, but Alaskan hatchery chinook salmon contribution, as evidenced by coded wire tags, can be added to that all-gear catch ceiling. Alaska takes inseason advantage of this provision because the lab is capable of real-time processing of tags and catch/sample data. Chinook salmon from special June troll fisheries were processed within days of catch. Catch is updated on a database at least twice each week. Samples and contribution data are updated and reported to fishery managers daily. This year, coho salmon from selected gillnet fisheries in Southeast were processed and data made available within hours of sale to Juneau's processors.

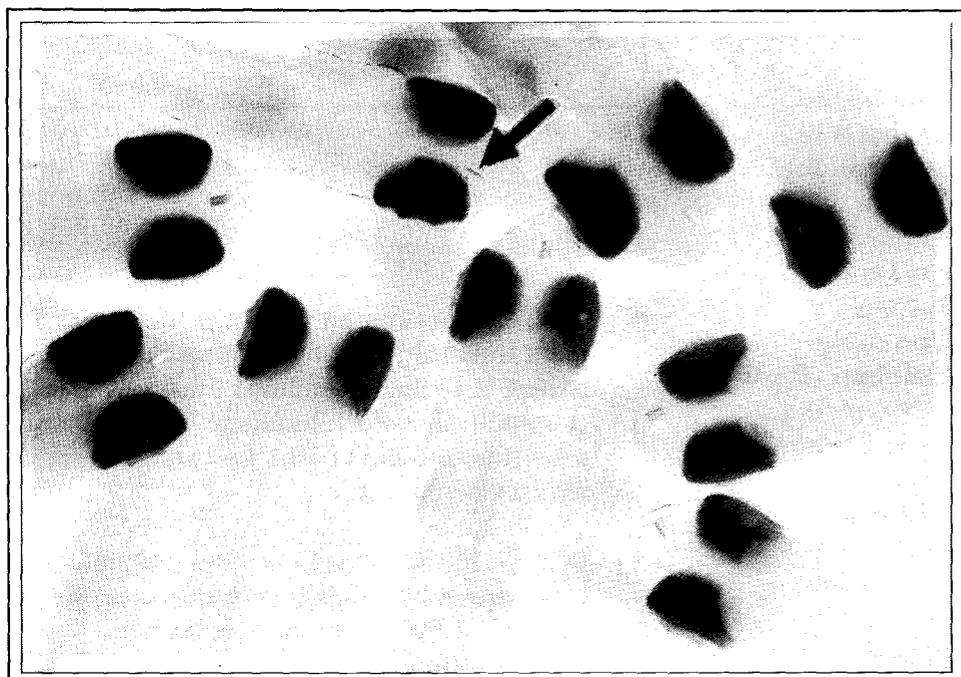


Figure 6.2. Coded wire tags visible in specially treated pink salmon fry.

Analysis of historic tag data allows fishery managers in Prince William Sound to model and predict temporal and spatial distribution of wild and hatchery fish in the sound's mixed-stock fisheries. This year, fishery managers used real-time, inseason analysis of coded wire tag data to modify preseason predictions of abundance by time and area and to manage mixed-stock fisheries for stock-specific exploitation rates. Coded wire tag-recovery data, merged with catch/sample data, were made available to managers within 2.5 days of catch. Samples from selected areas in the

sound were processed and data made available within hours of receipt at the lab, often within a day of catch. Without coded wire tag stock identification information, it is not possible to conduct fisheries which provide protection to early-run wild stocks and still allow nonterminal fishing during late July and early August. Using coded wire tag data, the success of a variety of fishery management strategies can be assessed inseason and modified as required to help reduce congestion, improve quality of fish sold, help prevent overloading of processors, and still assure that wild stock and corporate escapement goals are met.

The majority of the lab's work continues to be generated by sampling programs in Southeast Alaska. Even though the pink salmon return to Prince William Sound was far below expectations, tagged salmon from the sound still produced 31% of the lab's total work. Sampling programs from other areas of the state, including samples from as far away as Kotzebue, contributed 5% of the lab's workload. The species and sample-source composition of the workload is presented in Table 6.1.

The lab continues to look for new ways to increase the speed and accuracy of its work and to better meet the increasingly complex and sophisticated data requirements of project leaders, researchers, hatchery managers, and fishery managers in the public and private sectors. Staff has made effective use of the department's wide-area network to expedite data transfer and resolution of data collection and reporting problems. They also have encouraged modem access of the database by

private and public entities. This year, the staff conducted a user-needs assessment to better understand how researchers and managers use tag data, what they like about the existing system, and what they would like to see in the future. This information is being used to plan the lab's new data processing system. This new system will improve the utility of the data maintained and facilitate access of the database by individual managers and researchers while maintaining the accustomed reliability of the existing system. The power of the new system will increase the speed the computer processes a larger, more complex database, and will increase the speed in which up-to-date information required by the lab's clients can be generated.

LIMNOLOGY AND LAKE FERTILIZATION

The Limnology Laboratory Section supports the FRED Division's lake enrichment and lake stocking programs, and participates in cooperative projects with state and federal agencies, universities, PNP aquaculture associations, and commercial fishing organizations (Table 6.2). Since 1979, the Limnology Section has operated a centralized laboratory in Soldotna, where water quality and biological samples are analyzed from statewide projects.

During 1992, the Soldotna Limnology Laboratory completed nearly 32,000 individual analyses

Table 6.1. Species and sample-source composition of samples processed by the Coded Wire Tag Processing Laboratory in 1992.

	Commercial	Cost recovery	Sport	Rack and escapement	Other	Juvenile	Total
Chinook	6,358	1,433	1,156	1,907	8	0	10,862
Chum	1,437	173	0	714	1	23	2,348
Coho	23,862	2,694	1,088	3,904	11	941	32,500
Pink	3,084	2,016	0	2,591	4	517	8,212
Sockeye	7,300	2,482	0	1,671	52	340	11,845
Steelhead	141	0	6	0	0	1	148
TOTAL	42,182	8,798	2,250	10,787	76	1,812	65,915

Table 6.2. Government and private agencies either contracting or requesting analytical services of the Limnology Laboratory during 1992.

<p>Alaska Department of Fish and Game Commercial Fisheries Division Elmendorf Hatchery Snettisham Hatchery</p> <p>PNP Groups Aleutians East Borough Chignik Regional Aquaculture Association Cook Inlet Aquaculture Association Kodiak Regional Aquaculture Association Lower Cook Inlet Seiners' Association Northern Southeast Regional Aquaculture Association Southern Southeast Regional Aquaculture Association</p> <p>Federal Government Agencies National Marine Fisheries Association National Park Service - Wrangell St. Elias National Park U.S. Environmental Protection Agency U.S. Fish and Wildlife Service U.S. Forest Service U.S./Canada Pacific Salmon Treaty</p> <p>Other Department of Environmental Conservation Department of Natural Resources University of Alaska</p>

(Table 6.3) on nearly 1,000 water and zooplankton samples collected from 76 lake and riverine systems throughout Alaska (Table 6.4). A large number of the 1992 samples were either from the Cook Inlet and Kodiak regions as part of the continuing *Exxon Valdez* oil spill sockeye salmon overescapement studies, or existing or potential salmon enhancement projects. Limnological samples were also processed from ongoing and potential enhancement projects in Prince William Sound and Southeast Alaska, and from potential instream incubation sites in the Nome area. In addition to the 1,000 zooplankton samples received in 1992, over 400 additional samples were collected from three glacial lakes on the Kenai Peninsula to evaluate the effects of juvenile sockeye salmon predation on the diel vertical migration of egg-bearing zooplankters. In addition, juvenile fish samples were collected from these lakes for lipid analysis to determine whether a depletion of body fat (lipid) reserves is contributing to overwinter mortality of sockeye salmon.

In a cooperative project involving the Fishery Industrial Technology Center (University of Alaska) and KRAA, the Limnology Laboratory is determining the feasibility of producing a liquid fish fertilizer for lake enhancement. In addition, the laboratory is participating in the proposed Environmental Protection Agency Clean Lakes Program in cooperation with DEC to determine the impact of eutrophication, sediment runoff, and pollutants on various anadromous salmon systems. The Limnology Section and the University of Alaska-Southeast Center for Fisheries and Ocean Sciences submitted a proposal to ASTF to study the contribution of marine nitrogen from salmon carcasses to the productivity of Chignik Lake.

Limnological samples collected during 1992 are currently being processed on a priority basis. Quality assurance of analytical results is being maintained through participation in the U.S. Geological Survey Standard Reference Water Sample Program. Data processing has been streamlined through computer networking and development of Windows®-driven databases.

Finally, in 1992, the Limnology Laboratory completed its first phase of a study designed to evaluate juvenile pink salmon growth rates utilizing image analysis of otoliths. Also, otoliths from sockeye salmon fry were collected from lakes on Kodiak Island and the Kenai Peninsula for differential growth analysis as part of the assessment of impacts from overescapement resulting from the *Exxon Valdez* oil spill, and to evaluate image analysis of otoliths as a means for stock identification.

Field Projects

Southcentral - Applied limnological and fisheries field research in the Southcentral region was conducted on seven lakes in Prince William Sound, eight lakes in Lower Cook Inlet, eight lakes in Upper Cook Inlet, seven lakes on the Alaska Peninsula, and sixteen lakes on Kodiak

and Afognak Islands. This work includes assessment of potential in-lake production of sockeye salmon, evaluation of nutrient enrichment and stocking projects, and water-quality monitoring. Assessment of active stocking and lake fertilization projects included monthly sampling of each lake during the ice-free period, and conducting one fall hydroacoustic/townet survey on five lakes in Cook Inlet and eight lakes in Kodiak.

In 1992, the Kenai River water-quality project was completed. Two years of study on this system indicated that although differences in water-quality parameters were observed between the more rural upper river and the more urbanized lower river, this watershed as a whole is not suffering any major impacts from present usage. However, as this system is a highly valued ecosystem for fish production and recreation, the potential for major impacts on the water quality of the Kenai River is evident. The Limnology staff recommended annual monitoring of the system.

In the Southcentral region, a total of 156 tons of liquid nitrogen and phosphorus fertilizer was applied to six different lakes to promote zooplankton production for rearing juvenile salmon. Lakes treated with fertilizer in 1992 are listed in Table 6.5.

From nutrient enrichment and stocking projects in Lower Cook Inlet, a harvest of over 145,000 (82% of the total harvest) sockeye salmon were produced in 1991. In 1992, a high escapement count of 30,143 sockeye salmon was recorded at Packers Lake. This lake has been treated with nutrients since 1983 and stocked with fingerlings since 1988. The high escapement in Packers Lake in 1992 allowed for CIAA (project cooperator) to cost recover a record 9,200 sockeye salmon. Evaluation of

the Tustumena Lake sockeye salmon fry stocking project in 1992 indicated an estimated total harvest of 108,550 hatchery-produced sockeye salmon. These fish represented an ex-vessel value of \$782,000. Finally, for the third consecutive year, sockeye salmon fingerlings released into Bear Lake under fertilized conditions have emigrated at large sizes as smolts, and a portion of the released fingerlings emigrated from the lake following 8-10 weeks of rearing.

In 1992, new projects include a lake fertilization project at Coghill Lake, which is being conducted in cooperation with the USFS and PWSAC. The lake was not fertilized in 1992 due to a delay in getting approval of the Environmental Assessment report from the USFS; however, the fertilizer was ordered and the project is set to go in the spring of 1993. Also, a cooperative project on Becharof Lake was initiated with the University of Alaska to study the effects of large escapements on this

Table 6.3. Number of samples and the total number of analyses conducted per test by the Limnology Laboratory during 1992.

Parameter	Number of samples	Number of replicates	Total number of analyses
Conductivity	978		978
Ph	978		978
Alkalinity	978		978
Turbidity	978		978
Color	1,116		1,116
Calcium	1,014		1,014
Magnesium	1,014		1,014
Iron	978	x2	1,956
TP/TFP	2,118	x2	4,236
FRP	1,135	x2	2,270
TKN	1,072	x2	2,144
Ammonia	1,110	x2	2,220
Nitrate, nitrite	1,112	x2	2,224
Reactive silicon	978	x2	1,956
Carbon	1,128		1,128
Chlorophyll	1,044		1,044
Zooplankton	1,014	x3	3,042
Otoliths	2,200		2,200
Fry gut	169		169
Marine Zooplankton	44	x2	88
TOTAL	21,158		31,733

Table 6.4. List of study lakes and riverine systems by geographic region from which water-quality samples were received by the Limnology Laboratory in 1992.

Cook Inlet	Kodiak	Prince William Sound	Northern Southeast	Southern Southeast
Bruin	Afognak	Coghill	Auke	McDonald
Chelatna	Akalura	Copper	Crescent	Neck
Chenik	Big Kitoi	Crosswind	Deer	Salmon
Coal Creek	Crescent	Paxson	Farragut	Virginia
Grant	Frazer	Summit	Kook	
Hazel	Hidden	Tanada	Redoubt	
Hidden	Karluk	Bear	Sitkoh	
Kenai River	Laura		Speel	
Kenai	Little Afognak		Sweetheart	
Kirschner	Malina			
Leisure	Portage			
Lower Paint	Red			
Packers	Spiridon			
Ptarmigan	Upper Station			
Ship Creek	Waterfall			
Skilak				
Tustumena				
Ursus				
Alaska Peninsula	Nome	Miscellaneous		
Archeredin	Daprakmiut	Berg		
Becherof	Kwiniuk River	Crystal		
Charlie Hanson	Kwiniuk Hot Springs	Delight		
Mortensen	Unalakleet River	Delusion		
Orzenoi	Takikchak River	Desire		
Red Cove	Nash Harbor River	Gull		
Thin Point		Lawrence		
		Vivid		

lake system. In addition, funding was received from the Aleutians East Borough for evaluating the potential of eight lakes for sockeye salmon enhancement.

Northern Southeast - Limnology and fisheries research projects were conducted on nine lakes in northern Southeast Alaska. These projects were designed to evaluate in-lake productivity using the enhancement techniques of fry stocking and lake enrichment, and to continue the sockeye salmon rearing-capacity research studies to identify rehabilitation, enhancement, or management options to increase stock size.

Redoubt and Deer Lakes continued to receive fertilizer additions during 1992. Both represent

interagency cooperative projects involving the FRED Division Limnology Section, the USFS-Sitka Ranger District, and NSRAA. In addition, through a cooperative project with the USFS-Sitka Ranger District, a lake enrichment feasibility study was initiated at Sitkoh and Kook Lakes. Both of these lakes have depressed indigenous sockeye salmon populations and currently support subsistence fisheries. These lakes are located on the east side of Chichagof Island in areas where trees are currently being harvested by the USFS. This work was initiated as a feasibility study to identify one lake for inclusion in the statewide lake enrichment program. During 1992, ADF&G was responsible for providing technical direction and assistance

with the limnology sampling at two sites per lake on a monthly basis during the ice-free period, perform water-nutrient analysis to document the current in-lake trophic conditions, conduct a fall acoustic/townet survey to determine in-lake rearing juvenile population estimates and, finally, generate bathymetric maps of each lake. Funding for the ADF&G-portion of this project was provided by the USFS through a Sykes Act contract. The USFS provided sampling personnel to conduct the routine limnological sampling and logistical support. The limnology and rearing fry data collected during this past field season will be analyzed to determine whether to proceed into the next study phase with either of these projects.

Deer Lake is a project designed to increase zooplankton populations in a barriered system stocked with coho salmon fry. The department's contribution to this project is to determine the fertilizer application rates, purchase the fertilizer, and perform water-nutrient analyses to monitor the effects of the ongoing fertilizer applications to the lake. This project is funded through a cooperative agreement with NSRAA.

Redoubt Lake is a project designed to rehabilitate the indigenous sockeye salmon population through fertilizer applications, and has been ongoing since 1982. The Limnology Section is responsible for directing all operational aspects of this project and for the evaluation of in-lake responses to the fertilizer applications. During 1992, ADF&G operated a remote camp at this lake to enumerate the smolt emigration and adult escapement, conduct limnological surveys at three sites on a monthly basis during the ice-free period, conduct spring and fall acoustic/townet surveys to determine in-lake rearing juvenile population estimates, and apply 95 tons of liquid fertilizer to the lake surface. Through a Sykes Act contract, the USFS provided funds to purchase the fertilizer for this lake and directly provided sampling personnel and logistical support.

Sweetheart and Crescent Lakes are projects currently receiving sockeye salmon fry from the Speel and Crescent Lake brood stocks with incubation occurring at the Snettisham CIF. Farragut Lake is receiving chinook salmon fry from the Farragut River brood stock with incubation occurring at Crystal Lake Hatchery. The ADF&G Limnology Section was responsible for evaluating the in-lake productivity and survival of the planted fry. Limnological surveys were conducted at two established sites on a monthly basis during the ice-free period. A fall acoustic/townet survey was conducted to determine the in-lake rearing juvenile fish population density.

The Limnology Section was responsible for evaluating the in-lake productivity and survival of planted fry at Farragut Lake. The lake was surveyed for limnological data at two

established sites on a monthly basis during the ice-free period. Also, an acoustic and townet survey was conducted at this lake prior to stocking to determine the existing in-lake-rearing juvenile fish population density. Finally, during the month of October, rearing juvenile chinook salmon were sampled for size and found to be in excellent shape.

Sweetheart Lake did not receive any stocked fry during 1992. This was due to a low escapement in 1991 at the brood stock source of Speel Lake. The Limnology Section continued its evaluation of the in-lake trophic conditions of the lake resulting from two years of fry stocking. In addition, a smolt-enumeration project was conducted at the lake to monitor the resultant smolts from both the 1990 and 1991 plants.

Southern Southeast - Applied limnological and fisheries field research was conducted on Badger, Bakewell, Hugh Smith, Margaret, McDonald, Neck, and Virginia Lakes during 1992. These projects are designed to evaluate juvenile sockeye salmon plants, lake enrichment, adult sockeye salmon production, and to assess sockeye salmon production potential. In support of these projects, a total of 22 limnological and 17 hydroacoustic/townet surveys were completed.

Other activities involved preemergent fry sampling, transport, and application of 62.5 tons of liquid fertilizer over seventeen weekly trips, along with eight escapement surveys at McDonald Lake. In addition, four surveys were conducted to recover coded-wire-tagged

Table 6.5. Lakes fertilized in 1992.

Lake	Area
Frazer	Kodiak
Afognak	Kodiak
Malina	Kodiak
Packers	Cook Inlet
Leisure	Cook Inlet
Bear	Seward
Redoubt	Northern Southeast
Deer	Northern Southeast
McDonald	Southern Southeast

adult sockeye salmon at Heckman Lake to assess the commercial fisheries contribution from stocking of fry in 1988 (U.S./Canada Pacific Salmon Treaty project).

Production from Badger/Bakewell, Hugh Smith, and McDonald Lakes can be seen in Tables 3.1 and 3.2. The ex-vessel value of the McDonald Lake sockeye salmon catch is valued at \$1.2 million, and the catch from the Badger/Bakewell Lakes lake fertilization project had a 1992 ex-vessel value of \$211,000. The catch from Hugh Smith Lake had an ex-vessel value of \$240,000.

PATHOLOGY

The Pathology Section continues its policy of performing rigorous hatchery inspections. Every hatchery facility is inspected a minimum of once every other year, and more often if specific disease problems warrant it. The number of tests performed by the laboratory is shown in Table 6.6.

Statewide IHNV and VHSV Monitoring

The statewide monitoring of IHNV in sockeye salmon brood stock was less than required in FY91 since stock updates are now being done every three years rather than yearly. The remaining virus assays were done primarily to examine non-sockeye salmon species for viral hemorrhagic septicemia virus (VHSV). As yet, no VHSV has been detected in Alaskan salmonids.

Typically, IHN accounted for very minor sockeye salmon fry losses this past year, with only 1,400,000 fry (less than 1% total production) lost at three facilities: one incubator of Gulkana River sockeye salmon at Gulkana Hatchery, one Kitoi Box of Upper Station Lake sockeye salmon at Kitoi Bay Hatchery, and three Kitoi Boxes of Little Trapper Lake sockeye salmon at Snettisham Hatchery.

Continued IHNV detection efforts on returning adult sockeye at Main Bay Hatchery (PWSAC) showed some interesting results. IHNV was

Table 6.6. Pathology Laboratory activities.

Hatchery inspections	24
Cases processed	224
Fish/shellfish processed	19,221
Tests run	24,020
Fish Transport permits reviewed	261
Fish Transport permits approved	237
Fish Transport permits disapproved	2

detected in almost 100% of all mature fish during the fall of 1991, whereas in 1992 no virus-positive fish had been detected at this writing, though all samples have not been completed. The hatchery is on virus-free water and no virus has ever been detected in the Main Bay fry or smolts. The presence of the virus in adult sockeye salmon which matured in a virus-free water supply and are known to have been released from the hatchery continues to suggest that the carrier state for IHNV in sockeye does exist. That nearly all tagged returns were positive for IHNV in 1991 was probably due to horizontal transmission from a few carrier sockeye salmon in the adult holding pond. By limiting the number of fish in the pond in 1992 and eliminating the carcasses of dead fish, it appears that the carrier rate was below detectable levels of the sample size which controlled any horizontal virus transmission.

ELISA Testing for the BKD Agent Antigen

The enzyme-linked immunoabsorbent assay (ELISA) for detecting the antigen of the BKD agent (*Renibacterium salmoninarum*) has been used in the FRED Juneau Fish Pathology Lab for five years. The assay has proven to be a very sensitive and effective tool for brood stock screening and for determination of the carrier state of the BKD pathogen in resident salmonids within various hatchery water supplies. ELISA has largely taken the place of the fluorescent antibody test (FAT), which is now mostly used for diagnostic confirmation and occasional checks on the ELISA assay using higher-level positive fish. This past year, 76 cases for ELISA were processed, amounting to 9,946 individual fish tested. Considerable data accumulated from this assay have been statistically analyzed and summarized in two

manuscripts now in review for publication in a professional journal.

Bitter Crab Disease Syndrome Studies

The importance of Bitter Crab Dinoflagellate Syndrome in Southeast and Bering Sea Tanner crabs has not diminished. Extensive distribution surveys involving participation by FRED Pathology, Commercial Fisheries Division, and NMFS staffs have been completed after four years for Southeast, Kodiak Island, the Aleutians, and the eastern and western Bering Sea, including Norton Sound and the Chukchi Sea. The disease still remains serious in Southeast Alaska, so serious that fishermen did not crab in Upper Lynn Canal due to a very high prevalence of the disease that made such crabs unmarketable.

The occurrence of the disease in the Kodiak, Aleutian Islands, and Bering Sea areas is of concern, but presently does not appear to be seriously impacting the fisheries.

Oyster Certification for Import of *C. gigas* Spat into Alaska

Two Northwest vendors, Westcott Bay in Washington and Kuiper Mariculture of California, were recertified last year for importation of Japanese oyster spat into Alaska. Should they fulfill recertification requirements for 1993, there should be no shortage of spat for Alaskan growers.

ADF&G Continues as a Member of the PNFHPC

In 1990, ADF&G became a member of the Pacific Northwest Fish Health Protection Committee (PNFHPC), which is comprised of state, federal, tribal, and private agencies within the Pacific Northwest and Intermountain states and Canadian provinces. The body functions as an informational and problem solving forum for fish disease concerns within the various states and Canada with meetings every six months. Participants include technical representatives that are primarily fish pathologists and upper-level fishery managers, including the FRED Division's Principal Fish Pathologist and Chief of Technology and

Development. This committee was very instrumental in determining courses of action regarding the VHSV isolations in Washington State and now is concerned with negotiations between the FWS and Food and Drug Administration regarding current restrictions on chemicals and drugs used in aquaculture.

VHSV Monitoring

Susceptibility studies using various salmonids and the Pacific cod VHSV have been conducted this past year by FRED pathology staff to determine the virulence of this virus. As found with the Washington isolates, the virus is mostly avirulent when salmonids are exposed via ambient fresh water. Coho, chinook, and sockeye salmon fry sustained no mortality due to the virus, nor were they able to replicate the virus to any detectable level. Rainbow trout did sustain a cumulative mortality of up to 20% due to virus exposure. Typically, the European strains of VHSV also target on rainbow trout but are much more virulent, capable of killing 90% to 100% of the fish. These results do indicate that extreme caution needs to be exercised should this virus be isolated naturally from any Alaskan salmonids in the future.

The Pacific cod VHSV discovery was a very significant piece of supporting evidence suggesting the source of VHSV in Washington chinook and coho salmon, isolated during 1988, 1989, and 1990, was from a marine fish reservoir. Salmonids may interact directly with cod or with prey species common to cod. It also is possible that some marine fish species other than cod may have allowed for infection of the salmonids prior to their return to Washington State hatcheries.

Although many salmonid stocks in Alaska have been examined for VHSV, none have been positive. Further efforts in Alaska will continue toward reisolating the virus from Pacific cod from various geographic locations to determine the distribution of the virus.

FISHERIES LIBRARY

During 1992, the Fisheries Library continued to operate with primary funding from the FRED Division and limited funding from the Commercial Fisheries and Sport Fish Divisions. Additionally, Commercial Fisheries provided the library with upgraded, used—but serviceable—computers/monitors and technical assistance for all of the equipment.

Total year-to-date use statistics are about average, with 2,910 requests for information received through November. Typically, the biggest users are the three fisheries divisions, and this past year was no exception. Percentage of use are: Commercial Fisheries Division - 39%; FRED Division - 21%; and Sport Fish Division - 22%. Unlike last year, if a request came from someone working on an oil spill project, but was not an Oil Spill Impact and Restoration (OSIAR) Division employee, the statistic was logged under their respective division. Consequently, there was a marked drop in OSIAR requests—from 6% in 1991 to under 1% for 1992. The most significant change this past year was usage by the Habitat Division from under 1% last year to 7% this year. The remaining requests came from "outside" agencies (9%). Other divisions within the department (1%) finished out the total.

The library applied for and received another "library cooperation grant" from the Alaska State Library. The grant money will allow staff to complete phase two of a planned three-year project in cooperation with other natural resource libraries in Juneau. This year's goal is to catalog some of the more unique, mostly historical holdings and add them to the Western Library Network. The three CD-ROM drives and software purchased with last year's grant money will enable staff to perform the cataloging far more quickly. As anticipated, this same equipment and software has enabled the library to cut its receipt of interlibrary loan materials by almost half, since it is no longer necessary to go through the State Library to locate and request items from most libraries out of state.

The in-house, computerized catalog continues to be refined and enlarged with the addition of 500

holdings this past year. This is a tedious process, but the goal is to have the entire collection indexed so that staff statewide will be able to access library holdings through a computer network. Staff is currently able to network with biologists throughout the state using the Commercial Fisheries Division electronic-mail system, and this may be expanded to allow the aforementioned application.

The "current awareness" service for journal articles is still being used extensively by staff. Additionally, there has been a growing demand for computer-based (Dialog Information Services) bibliographic searches as the need to find the most current research intensifies. Through this application, the staff is often able to find the "needle in the haystack"-type of article that helps build the foundation for "cutting edge" research by ADF&G staff.

Library personnel are still working with a formulation committee of fish and wildlife librarians nationwide to set up a comprehensive networking system. A directory of agency libraries has been compiled and staff is currently putting together an extensive list of serial holdings for the same. In conjunction with this, staff has been providing bibliographic information to the Fish and Wildlife Reference Service (FWRS) for expansion of their "federal-aid reports" database. In return, FWRS provides the library with no-cost bibliographic searches of its database.

GENETICS

This year, as each year, a large amount of effort has gone into the evaluation of the genetics concerns presented by fish transport permit requests and hatchery facility permit alteration requests. But also, the Genetics Program has grown considerably due to many factors, including the department's concern for stock identification, wild stock protection, and clarification of hatchery/wild stock issues. The section has been awarded funding by the legislature to acquire new laboratory and office space for a joint FRED/Commercial Fisheries Division facility, and much time has been spent in space negotiations and proposal preparation.

FRED genetics staff has also cooperated with Commercial Fisheries Division staff in other areas, including (1) securing funding for a genetic stock identification project to protect depleted Kenai River stocks of sockeye salmon, (2) producing genetic data for risk assessments on hatchery-related projects in the Yukon and Noatak River drainages, and (3) collecting genetic data to aid in the evaluation of chinook salmon brood stocks in Southeast Alaska.

Oil Spill-Related Research

The department continues to observe reduced survival of pink salmon embryos in Prince William Sound streams affected by the *Exxon Valdez* oil spill. The genetics staff is cooperating in the investigation of heritable genetic effects of oil on pink salmon exposed during their early life history in two ways.

First, adult pink salmon from two oiled and two unoiled streams from Prince William Sound were spawned to produce 900 matings per stream. These eggs were incubated in controlled conditions at the Armin F. Koernig Hatchery, donated by PWSAC. Offspring from these matings will be analyzed for differences in survival between stocks from the oiled and unoiled streams and for potential DNA damage.

Second, pink salmon eggs and alevins are being incubated in an array of concentrations of crude oil at the Little Port Walter Research Station. These will be analyzed at several points during incubation, growth, and maturation for genetic damage. The goal is to obtain information that will provide insight into sublethal genetic damage sustained by wild pink salmon exposed to crude oil during the 1989 *Exxon Valdez* oil spill.

Genetic damage will be assessed using flow cytometry. Flow cytometry is a powerful technique used in biology and medicine for the study of cellular physiology, cancer research, and genetic analysis of cells and organisms. The Genetics Section will use this to assess damage to chromosomes in organisms exposed to oil, and during 1992, the *Exxon Valdez* Oil Spill Trustee Council made funds available for the Genetics Laboratory to purchase a PAS II® flow cytometer.

The PAS II is a mercury arc lamp flow cytometer with a 486-based computer system for data acquisition.

Salmonid eggs and alevins present unique problems for flow cytometry analysis and require special tissue preparation techniques. The staff is now evaluating techniques for preparing and storing tissues that will provide optimal results. Data collection will begin this winter.

Cryopreservation

The Genetics Lab developed successful sperm extension and cryopreservation methods for the BDC's Swanson River-strain rainbow trout and is in the process of modifying methods for use with sex-reversed females. The goal is to aid Fort Richardson Hatchery's efforts to produce all-female lines of rainbow trout for lake sport fisheries. Cryopreservation is a useful technique to simplify production of all-female rainbow trout stocks without having to maintain sex-reversed female brood stock on site. Cryopreserved sperm may also serve as a backup in the event of loss of sex-reversed brood stock.

The sperm banking program to save genetic variation in severely depleted stocks for possible future reintroduction was continued by Southeast FRED area staff. The lab is now holding sperm from Chilkat River chinook salmon taken in both 1991 and 1992.

Cryopreservation of both chinook and coho salmon continues at the BDC in order to produce hybrids between the two species for performance trials and genetic studies.

Triploid Coho and Chinook Salmon Studies

In response to genetic concerns of hatchery releases on wild stocks, the genetics staff, in cooperation with the BDC, is evaluating survival and growth performance of diploid and triploid coho salmon/chinook salmon conspecifics and hybrids. Another set of growth experiments is being carried out at Deer Mountain Hatchery where diploid and triploid chinook salmon are being evaluated. Both hybrids and triploids have been found sterile in other

salmonids, reducing the risk of genetic contamination of wild stocks. Preliminary data indicate that conspecific triploid coho salmon may be the most viable alternative of those studied because they performed equally to the conspecific diploids and better than either ploidy of hybrid.

Genetics staff is also working with Southeast FRED Division staff to test the homing ability of triploid chinook salmon to Deer Mountain Hatchery. Triploid chinook salmon were released from the hatchery in 1989, making this the peak year for returning adults of that year class. Blood samples were taken from potential triploids to be analyzed for ploidy using flow cytometry.

In a related U.S. Department of Agriculture-funded project, the genetics staff is identifying marker genes that can be used to study relationships between heterozygosity and growth in chinook and coho salmon. This research, along with work being done with sockeye salmon matings, will also have applications for hatchery-wild stock risk assessment by confirming the genetic basis of many electrophoretically resolved gene products. Once these variants have been confirmed as inherited, they can provide more power to studies that investigate hatchery-wild stock interactions and to genetically mark hatchery fish.

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CHAPTER 7

THE MARICULTURE PROGRAM

Background

The Aquatic Farm Act (Section 19, Chapter 145, SLA 1988) was signed into law on 8 June 1988, authorizing the commissioner of ADF&G to issue permits for the construction or operation of aquatic farms and hatcheries to supply aquatic plants or shellfish to aquatic farms. The intent of the program is to create an industry in the state that will contribute to the state's economy and strengthen the competitiveness of Alaska seafood in the world marketplace, broadening the diversity of products and providing year-round supplies of premium-quality seafood. The law allowed aquatic farming of shellfish and aquatic plants and placed a moratorium on finfish farming. In 1990, CSHB 432 became law, prohibiting farming of finfish in the state.

Regulations to administer the aquatic farm program were developed by the resource agencies during 1988 and 1989. DNR divided coastal Alaska into eleven districts. The law required that each district be opened annually for 60 days for farmsite application. Permits for farm or hatchery sites not located on state land may be applied for at any time.

The ADF&G, FRED Division Mariculture Program, in cooperation with the department's fisheries management and habitat divisions, carries out the statutory and regulatory responsibilities of the department pertaining to aquatic farming in Alaska.

The Mariculture Program responsibilities include:

- In cooperation with the Habitat and Restoration Division (HARD), coordination of the permitting process for aquatic farms and hatcheries;
- review of aquatic farm and hatchery permit applications for site suitability and technical and operational feasibility;
- issuing and administering the department's aquatic farm and hatchery permits;
- interdivisional coordination of the aquatic farm program;
- administration and coordination of aquatic stock acquisition permits for the purpose of supplying brood stock and seed stock to aquatic farms and hatcheries;
- administration and coordination of the shellfish and aquatic plant transport permit system;
- administration and coordination of research permits for aquatic farming and hatchery activities;
- provide technical assistance to other divisions, agencies, and the public sector; and
- coordination of aquatic farming and hatchery research activities statewide.

Program Implementation

The FRED Division Mariculture Program continued to evolve in 1992. Budget constraints reduced technical assistance provided to the industry. The administrative workload associated with the large number of permittees continued to grow. The latter, coupled with a reduction in clerical staff from one full-time position to one half-time position, resulted in a considerable backlog in program activities, including permitting actions.

Considerable interaction with the other resource agencies, including DEC, DNR, and the governor's Division of Governmental Coordination was again necessary to review and revise the permitting process and ensure coordination of effort. The Interagency Mariculture Workgroup was not reestablished in 1992. The Alaskan Shellfish Grower's Association (ASGA) requested the governor formalize a new working group that would include industry representation. As of December 1992, no action was taken on the request. An informal group of agency representatives met several times to review and revise the aquatic farm permit application form and to discuss applications. FRED coordinated department interaction with DNR on their proposed changes to aquatic farm statutes and regulations. The FRED and HARD Divisions coordinated the farm permitting process. FRED facilitated the overall department program, reviewed permit applications, and issued aquatic farm permits, while HARD coordinated the department's Alaska Coastal Management Program reviews.

Permitting and administrative responsibilities for aquatic stock acquisition, shellfish, and aquatic plant transport and scientific/educational permits were accomplished.

Twenty-four aquatic farm applications and one shellfish hatchery permit application were received and processed this year. Sixteen new farm operation permits were issued and four permits were closed at the request of the respective permittees. By year end, 68 operation permit files were still open. Forty-six of these farms reported activity in 1992. The shellfish hatchery received its permit late in the year and is expected to begin

operations in 1993. Three permit denials from the 1991 opening were reviewed by the commissioner. All three applicants were granted their permits after review and consideration. These sites were located in Kachemak Bay. The large number of users of Kachemak Bay will almost certainly result in more interaction between aquatic farming and other coastal users. The challenge is to make the interactions positive for all. No scientific/educational (research) permits were processed in 1992 primarily due to the ability of researchers to accomplish their projects at permitted farmsites, allowing commercial use of the end product. One site suitability transport permit was issued. The number of stock acquisition and transport permit applications continued to increase (Table 7.1) and are expected to rise again in 1993, reflecting the increase in active farms.

In cooperation with DNR and other department staff, aquatic farmsite inspections were conducted at 55 permitted farms statewide. Permit compliance was determined for each farm. As possible, staff discussed concerns and limitations affecting the farmers' efforts and attempted to extend cooperation between farmers and the department. Inspection of farms not accomplished in 1992 will occur in 1993.

The division again proposed a Mariculture Technical Center (MTC) for inclusion in the Governor's capital projects budget for fiscal year 1994. The project was not funded in 1993. The MTC is proposed as a central facility providing assistance to the industry through practical research and development, providing indigenous seed stocks not available from commercial sources, and space for private mariculture development projects. It is possible that the MTC would also be useful for certain oil spill restoration projects in areas affected by the *Exxon Valdez* oil spill. Various funding packages were submitted because of this possibility; none were approved. Further work on the project was deferred awaiting a determination on facility funding.

Aquatic Farm Operations

1992 was a year of expansion for the aquatic farm industry in Alaska. More farms reached their development plan goals in 1992, though no

applications for farmsite leases were received. This was likely due to the farmers' concerns about lease rate structures and surveying requirements. The first permits issued under the current program expire in August 1993. Decisions regarding the criteria for renewal of permits and leasing versus permitting for another three-year period will have to be made by both the farmers and the agencies prior to August.

Aquatic farmers continued their trend of investment and growth. At market size, the value of the year-end inventory was over \$4.8 million, an increase of almost 50% over the 1992 inventory value. Aquatic farm sales in 1992 increased by 100% to almost \$200,000 (Table 7.2). Production was dominated by oysters, with some mussels produced in Southcentral Alaska. The increase in sales was actually higher than expected, primarily due to the extraordinary oyster growth rates experienced by the Tatitlek Village farms in Prince William Sound.

Southeast farmers received an average of \$0.32/oyster, up slightly from the \$0.29 received in 1991. The Southcentral value was, as last year, higher at \$0.48/oyster, up from \$0.42 in 1991. The average price received for mussels was \$2.25/lb. The amount of product sold was small, though the per-pound value probably does not reflect the price farmers are likely to receive for mussels as production increases. For purposes of blue mussel value projections, \$1.50/lb seemed attainable (Table 7.2). All prices were based upon reported value at the farms.

A growing facet of the aquatic farm industry was employment opportunities provided by farm operations. Excluding owner-operators and nonresident managers or consultants, 71 individuals were employed by the farm industry this year, working over 5,600 person-days (Table 7.2). No figures for jobs in the processing sector were available at this writing.

Industry Projections

The 100% increase in sales and the large inventory value show that 1992 was a critical year for the industry. Over 7,000,000 oyster spat were purchased by Alaskan farmers. Southeast was again the largest producer of oysters. The picture will continue to change in 1993, primarily due to very active Native corporation farms in Southcentral. Southeast Alaska will cease to be the state's largest producer of farmed shellfish. Oysters available from farms will increase significantly statewide. Mussel production is not expected to increase. No other species of shellfish or aquatic plants will contribute significantly to farm sales in 1993.

Aquatic farm development was again constrained in 1992 by the lack of government assistance (loan

Table 7.1. 1992 aquatic farm permit data.

	Southeast Districts	Southcentral Districts	TOTAL
OPERATIONS			
Permit applications	5	19	24 ¹
Permits issued	2	14	16 ²
Permits pending or still in process	1	13	14
Total aquatic farm permits active	25	43	68
Farms reporting activity in 1992	19	27	46
Farms in certified growing areas	16	25	41 ³
Acreage permitted for aquatic farming	93.4	183.7	297.1 ⁴
RESEARCH			
No. permit applications	0	0	0
SHELLFISH AND AQUATIC PLANT ACQUISITION/TRANSPORT			
Permit applications	36	42	78
Permits issued	24	32	56
Permits pending	3	6	9
¹ Includes three amendments to existing farm permits ² Includes one shellfish hatchery permit ³ More than one farm may be located in a growing area defined by the Department of Environmental Conservation ⁴ Includes 20 acres in Kachemak Bay State Park			

Table 7.2. 1992 aquatic farm operations data.

	Southeast Districts	Southcentral Districts	TOTAL
SALES			
Oysters (ind.)	355,762	109,092	464,854
Value	\$112,980	\$52,801	\$165,781
Mussels (lbs)	0	13,860	13,860
Value	\$0	\$31,185	\$31,185
Total Aquatic Farm Sales			\$196,966
END-OF-YEAR INVENTORY			
Oysters (ind.)	5,498,870	6,625,940	12,124,810
Value (\$0.35/ind)	\$2,144,559	\$2,584,117	\$4,728,676
Mussels (lbs)	40,844	7,739	48,583
Value (\$1.50/lb)	\$61,266	\$11,609	\$72,875
Total Aquatic Farm Inventory Value			\$4,801,550
EMPLOYMENT SUMMARY			
No. employees	31	40	71
Days worked	2,258	3,393	5,651
No. volunteers	9	0	9
Days worked	60	0	60

funds, grants, etc.) and the general lack of loans or other sources of investment capital from the private sector. A positive note this year was granting of a commercial loan by an Alaska bank, based upon farm equity to a farmer in Prince William Sound. The industry hopes that this is the start of a positive relationship with banks and other lenders. Out-of-state businesses demonstrated increased interest in Alaska's industry in 1992. The president of the largest and most progressive shellfish farming company in Washington State visited several sites and made a presentation at the ASGA annual meeting.

Nationwide, shellfish production is constrained by pollution and competition for limited coastal resources. The major eastern U.S. production areas, such as Chesapeake Bay, have ceased to be a major factor in shellfish production. Washington State continued to be the largest oyster producer in the United States. Even there, increasing effects of

pollution, upland development, and user conflicts are occurring and will limit growth of the industry. Washington has approximately half the number of permitted aquatic farms that Alaska has, though they are considerably larger in both physical (*as of 31 December 1992, the area permitted for all aquatic farming in Alaska was 297 acres—Table 7.1*) and economic size. British Columbia's industry is growing, receiving considerable support from the public and private sectors. Alaska, with its clean waters and large amount of protected coastline, has immense potential for becoming a major aquatic farming area. Investment capital, the logistics of producing and selling product, and lack of a vertically integrated industry are major constraints that will have to be addressed before this can occur. Solutions to the many problems facing the industry began to emerge this year.

Hatcheries

A major component lacking in Alaska is a hatchery industry to provide a dependable supply of seed to aquatic farms. As of December 1992, the first shellfish hatchery in Alaska was permitted for operation. Located in Seward, it has conservative goals but is expected to demonstrate that such facilities are viable. Currently, all oyster seed must be imported from the Lower 48. Dependence on out-of-state vendors is not without peril, as demonstrated by the 1992 decertification of the primary supplier of Pacific oyster seed to the Alaska industry for noncompliance with their approved operational plan. Though a revised operational plan was subsequently approved and it appears that they will be supplying oyster seed to Alaska's farmers in 1993, the incident was indicative of the uncertainties of the current seed supply situation. Collection of seed from indigenous stocks, such as blue mussels, is also uncertain, being susceptible to the vagaries of nature. If funded, the MTC will also help provide a consistent supply of shellfish and, possibly, aquatic

plant seed until commercial hatcheries come on-line with the capacity to supply the industry's needs.

Issues

Issues facing the industry are changing as it evolves. User group conflicts are increasing in some parts of the state, highlighting the need for public education and positive interaction with other users. Decreasing revenues have resulted in a number of proposals for programmatic changes and changes in the laws governing the industry. With the advent of an instate shellfish hatchery, concerns regarding transport of stocks between brood sources, hatcheries, and farmsites will have to be addressed. ASGA requested the governor reestablish the mariculture working group at the policy level with industry representation. That request was still under consideration at year end.

Rural Development

The benefits of aquatic farming as a source of income and economic stability interested a number of rural Alaskan communities. In 1992, new, Native-owned farms were established near the villages of Angoon in Southeast and Chenega Bay in Southcentral. Farms operated by the Klawock Heenya Corporation and Yakutat Mariculture, Inc., in Southeast, and the Tatitlek Native Corporation in Southcentral continued to grow. Interest in aquatic farming was shown by villages on Kodiak Island, Prince William Sound, and the Kenai Peninsula. The educational community continued its involvement, with the Petersburg High School operating a for-profit farm.

CHAPTER 8

THE PRIVATE NONPROFIT HATCHERY PROGRAM

Background

The 1974 Alaska State Legislature authorized the commissioner of ADF&G to issue permits to PNP corporations for the operation of salmon hatcheries for ocean ranching. The intent of the program is to allow private ownership of salmon hatcheries that will contribute to the state's salmon fisheries. The cost of constructing and operating these hatcheries was to be derived from the sale of a portion of the returning fish.

The PNP Program, administered by the ADF&G, FRED Division, in cooperation with the department's fisheries management divisions, carries out the statutory and regulatory responsibilities pertaining to public and private aquaculture in Alaska.

The PNP Program is responsible for:

- Comprehensive salmon production planning;

- administration of the permitting process for PNP salmon hatcheries and scientific/ educational aquaculture programs;
- development of annual operational management plans for all public and private salmon hatcheries;
- administration and coordination of the statewide fish and shellfish transport permit systems;
- coordination of technical assistance to PNP hatcheries; and
- coordinating the development of and ADF&G relations with qualified regional aquaculture associations.

Regional Associations

Regional associations are comprised of representatives of commercial fishermen and other user groups in the region, including sport fishermen, subsistence fishermen, and members of local communities. These associations cooperate with the department in developing and maintaining regional salmon production plans and in the implementation of various salmon rehabilitation and enhancement activities.

Comprehensive Salmon Planning

The 1976 law authorized the commissioner to designate regions of the state for the purpose of enhancing salmon production (Figure 8.1). This same law also established the formation

Regional Associations

Southern Southeast Regional Aquaculture Association (SSRAA)
Northern Southeast Regional Aquaculture Association (NSRAA)
Prince William Sound Aquaculture Corporation (PWSAC)
Cook Inlet Aquaculture Association (CIAA)
Lower Yukon/Kuskokwim Regional Aquaculture Association (LY/KRAA*)
Bristol Bay Regional Aquaculture Association (BBRAA*)
Kodiak Regional Aquaculture Association (KRAA)
Chignik Regional Aquaculture Association (CRAA)

*Indicates inactive regional association.

of regional planning teams (RPT) to develop regional salmon plans. Each RPT consists of six voting members, with three department personnel appointed by the commissioner and three appointed by the board of directors of the appropriate regional aquaculture association. The duties and responsibilities of the RPTs have been mandated in a formal charter from the commissioner. The responsibilities of the RPTs in developing regional comprehensive salmon plans, including provisions for public involvement in the planning process, are described in regulations. The commissioner may also request the involvement of representatives of other federal and state agencies. The teams develop twenty-year comprehensive plans, five-year action (strategic plans), and perform annual plan update and maintenance.

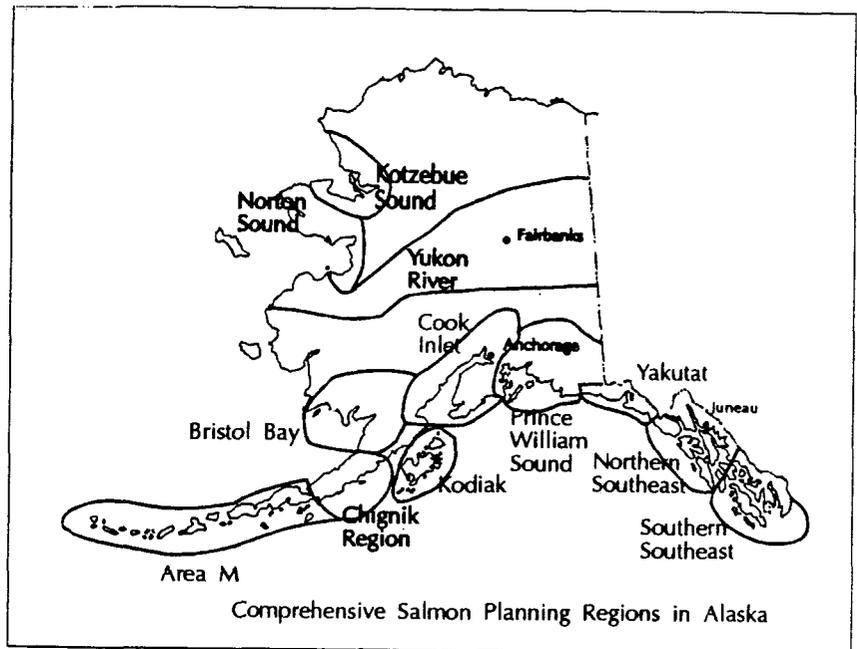


Figure 8.1. Comprehensive salmon planning regions in Alaska.

The status of planning by region (Figure 8.1) follows:

1. *Southern and Northern Southeast*

The southern Southeast regional plans have been approved, and the RPT is in the plan-maintenance and update process. The southern and northern Southeast RPTs decided in 1992 to completely reassess chinook and coho salmon production goals and objectives for Southeast Alaska in 1993. The RPTs will be working with facility operators, user groups, and the department in this endeavor. The result of this planning process will be revised comprehensive salmon plans for southern and northern Southeast Alaska.

2. *Yakutat*

No formal salmon planning activities have occurred in Yakutat since approval of the twenty-year regional plan. The plan has been accepted by the USFS as a basis for the development of land management plans applicable to the region.

3. *Prince William Sound*

The Prince William Sound Phase I and Phase II plans have been approved. The RPT has proceeded into development of a Phase III plan that will incorporate fisheries management, allocation of enhanced fish among user groups, and production of enhanced fish into one overall plan for Prince William Sound. The team anticipates completion of this plan in the spring of 1993.

4. *Cook Inlet*

The planning team efforts in Cook Inlet are presently directed toward watershed system planning, with a goal of assessing the capacity of specific systems to sustain and maintain significant, naturally occurring salmon stocks. Watershed system planning also includes an identification of opportunities for salmon enhancement techniques designed to strengthen existing runs and create new runs. Provisions for user-group access and harvest preferences are given primary consideration in this planning process.

5. ***Kodiak***

The Kodiak regional plans were approved prior to 1988. During 1991 and 1992, the RPT revised the Phase II plan to more accurately reflect production goals, project opportunities, and user-group needs. The revised plan was approved by the commissioner in March 1992.

6. ***Bristol Bay***

The Bristol Bay RPT completed the comprehensive salmon plan for Bristol Bay in 1989. The plan is unique in that, unlike plans for other salmon production regions in Alaska, it does not concentrate on fisheries enhancement through such strategies as hatcheries; rather, it emphasizes maintenance and restoration of fish habitat and effective management practices. The regional association in Bristol Bay became less active when its enhancement tax vote failed to pass. No further planning efforts are currently envisioned.

7. ***Yukon***

In response to a consensus of Yukon River fishery interests, the FRED Division has developed a Yukon Fisheries Enhancement Initiative. With funding from the legislature in fiscal year 1993 for this initiative, the Yukon River comprehensive regional fisheries restoration planning process was initiated. The process will provide local private and public sector consensus building for opportunities up and down the river. The Yukon River Drainage Fisheries Association will play a key role in the facilitation of this planning process. From this planning effort, priorities will be set for future projects.

8. ***Alaska Peninsula Planning***

In 1990, an RPT was appointed to begin development of a comprehensive salmon plan for the Alaska Peninsula/Aleutian Islands/ Area M region. A public-review draft of the Area M plan is nearly complete.

9. ***Chignik***

The commissioner appointed an RPT in 1990 to initiate development of a comprehensive salmon plan for the Chignik region. A public review draft of the plan was prepared in 1992, and the plan should be finalized in the spring of 1993.

10. ***Sikusuilaq Springs Hatchery Management Plan***

Residents of Kotzebue Sound have expressed interest in salmon enhancement planning, and the FRED Division established a core planning group which included ADF&G, the National Park Service, and the local borough to develop alternative production scenarios as part of Basic Management Plan development for the Sikusuilaq Springs Hatchery. This planning was completed in September 1992. These efforts could lead to formation of a regional aquaculture association and development of a regional plan for Kotzebue Sound.

PNP Hatchery Funding

Since 1977, funding necessary for the implementation of salmon rehabilitation and enhancement activities by PNP corporations has been obtained primarily through the Fisheries Enhancement Revolving Loan Fund administered by DCED. The loan program has gone through several modifications by the legislature, the most recent occurring in 1987. The maximal loan amount available for an individual project is \$10 million, with a payback period of up to 30 years at approximately a 9.5% interest rate. Payments and accrual of interest on these loans can be deferred for 6 to 10 years. Loans for projects not endorsed by the regional aquaculture association may also have these terms, except these loans are limited to a maximum of \$1 million. Loans are available for the purpose of planning, construction, and operation of salmon rehabilitation and enhancement projects, primarily salmon hatcheries. These loans are secured through collateral that may include returning hatchery fish and enhancement tax assessments of commercial fishermen.

Cumulative state loans secured by corporations for capital construction and operations, cumulative enhancement tax revenues returned to the regional aquaculture associations, and revenue generated during 1992 by corporate sales of returning hatchery fish are presented in Table 8.1. Through 31 December 1992, \$81.3 million has been borrowed by PNP corporations. Another \$52.7 million has been generated through assessments. In 1992, PNP operators sold \$10.4 million worth of fish to help pay for the operation of their hatcheries. This figure was approximately \$4 million more than the \$6.4 million generated from sales of fish in 1991, even though 41% fewer fish were sold in 1992 than in 1991.

Program Implementation

The application procedures and standards for issuance of PNP salmon hatchery permits are defined by regulations adopted in 1985. These regulations require the completion of a management feasibility analysis by ADF&G prior to the submission of a PNP hatchery application. This analysis must be completed within 30 days after the applicant provides the information requested in 5 AAC 40.130 of the regulations. The application process takes as few as 135 days and is designed to comply with the coastal zone consistency review process established by the governor's Office of Management and Budget.

The appropriate RPT reviews each application and makes a recommendation to the commissioner on the application's compatibility with the regional comprehensive plan. The RPT uses review criteria that are defined in the PNP regulations.

PNP permit holders may request alterations of their permits and basic management plans based on accumulated experience and changing conditions. The RPT may review and make a recommendation to the commissioner on a permit alteration request. The team's review is conducted in accordance with performance standards identified in the PNP regulations.

Since the inception of the PNP Program, 32 salmon hatchery permits have been issued and four permits have been given up. Thirty-nine applications have been either denied or withdrawn from the process.

Four permits were issued to regional aquaculture associations for the operation of state-owned hatcheries at Trail Lakes, Cannery Creek, Kitoi Bay, and Hidden Falls. Additional permits will be issued for operation of the state-owned Tutka Bay, Main Bay, and Beaver Falls facilities in 1993.

Twenty-three of the permitted PNP hatcheries are in operation and all but one (Port Graham) had returns of adult salmon during 1992. Currently, there are three applications for PNP hatchery permits under consideration.

Locations of operational PNP programs and remote release sites are illustrated in Figures 8.2 and 8.3.

Hatchery Production

In 1992, PNP corporations estimated that 18,200,000 adult salmon originally released as juveniles from corporate facilities were either harvested in common-property fisheries or returned

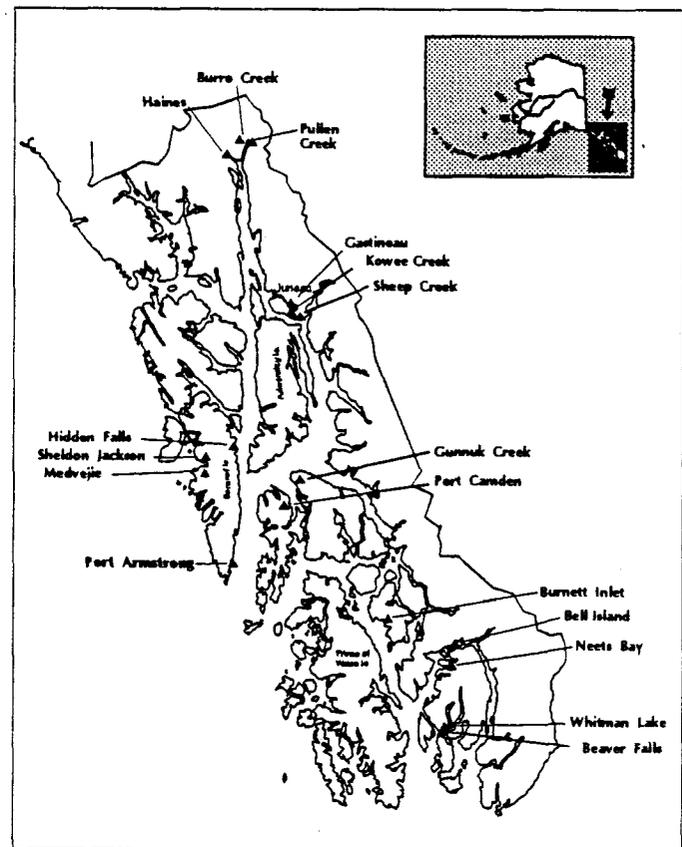


Figure 8.2. Private nonprofit hatcheries in Southeast Alaska.

Table 8.1. Cumulative state loans and enhancement funds returned to associations (through December 31, 1992), and annual fish sales for 20 private nonprofit (PNP) hatcheries (through Dec. 15, 1992).

Region / Corporation (number of permits)	State Loans		Cumulative Enhancement Funds Generated through Assessments. Returned to Associations via Contract	Estimated Revenue From 1992 Sales of Fish Returning to Special Harvest Areas
	For Capital Construction	For Operations		
SOUTHERN SOUTHEAST				
Southern Southeast Regional Aquaculture Association-SSRAA (3)	\$9,093,000.00	\$2,848,942.00	\$16,992,310.21 (note 1)	\$1,663,020.28
Alaska Aquaculture, Inc.-AAI (1)	\$1,262,020.00	\$3,412,784.00	N/A	\$127,485.00
Meyers Chuck Aquaculture Association-MCAA (0)	\$10,000.00	\$0.00	N/A	N/A
NORTHERN SOUTHEAST				
Northern Southeast Regional Aquaculture Association-NSRAA (4)	\$2,724,265.00	\$1,638,496.00	\$10,184,271.89 (note 1)	\$1,847,776.13
Armstrong-Keta, Inc. - AKI (1)	\$3,131,645.00	\$2,229,500.00	N/A	\$1,132,526.84
Burro Creek Farms, Inc.-BCF (1)	\$51,500.00	\$332,875.00	N/A	\$1,384.37
Douglas Island Pink and Chum Inc.-DIPAC (3)	\$9,336,000.00	\$7,927,000.00	N/A	\$1,039,202.00
Kake Nonprofit Fisheries Corp.-KNFC (1)	\$1,500,724.00	\$1,845,060.00	N/A	\$111,111.32
Sheldon Jackson College-SJC (1)	\$362,254.00	\$61,370.00	N/A	\$0.00
Tlingit and Haida Fisheries Development Corp.-THFDC (0)	\$1,464,000.00	\$89,860.00	N/A	N/A
PRINCE WILLIAM SOUND				
Prince William Sound Aquaculture Corp.-PWSAC (3)	\$21,475,419.00	\$1,085,500.00	\$9,953,569.53 (note 2)	\$3,100,677.00
Valdez Fisheries Development Assoc.-VFDA (1)	\$3,193,830.00	\$3,250,543.00	N/A	\$1,209,648.07
COOK INLET				
Cook Inlet Regional Aquaculture Assoc.-CIAA (2)	\$2,338,881.00	\$683,369.00	\$10,273,010.64 (note 2)	\$191,747.95
KODIAK				
Kodiak Regional Aquaculture Assoc.-KRAA (1)	\$0.00	\$0.00	\$5,142,430.56 (note 2)	\$0.00
CHIGNIK				
Chignik Regional Aquaculture Assoc. - CRAA (0)			\$170,763.00 (note 2)	N/A
STATEWIDE TOTALS	\$35,943,538.00	\$25,405,299.00	\$52,716,355.83	\$10,424,578.96

note 1: 3% mandatory assessment tax collected from commercial fishermen.

note 2: 2% mandatory assessment tax collected from commercial fishermen.

N/A: Not Applicable

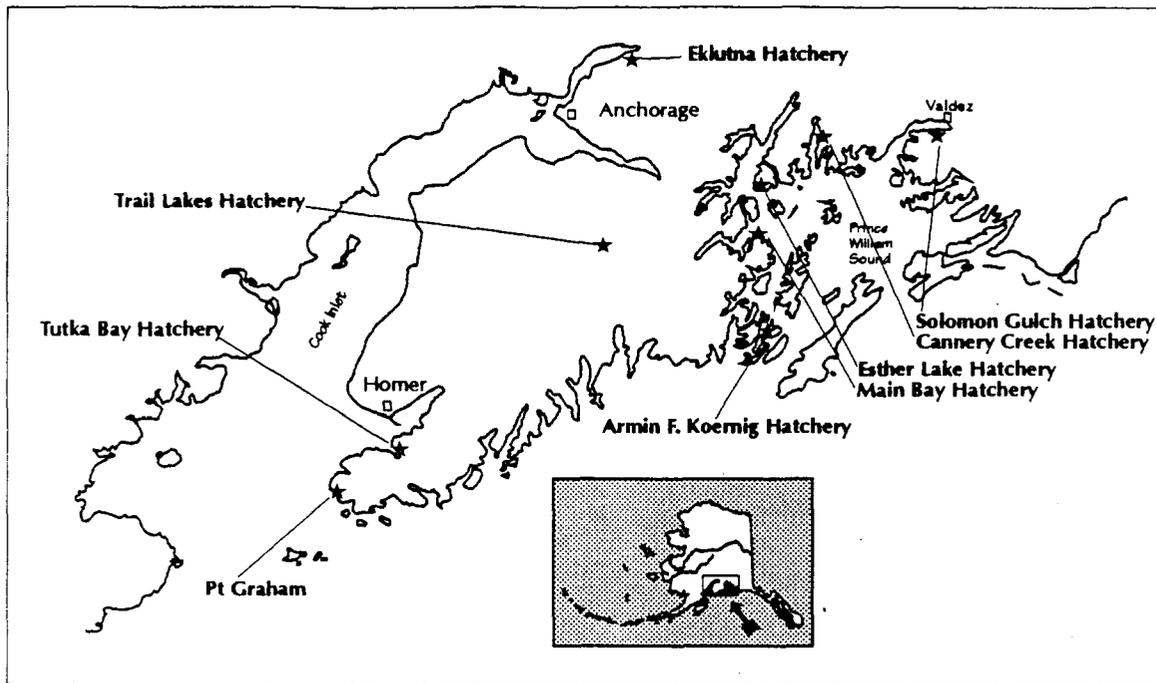


Figure 8.3. Private nonprofit hatcheries in Cook Inlet and Prince William Sound.

to hatchery special harvest areas (Table 8.2). Not included in this figure are 1,100,000 hatchery returns to the Kitoi Bay Hatchery that were already considered under FRED hatchery production elsewhere in this report. Total returns increased for all species except pink salmon in 1992. The pink salmon return in Southeast increased by nearly 50%; however, the pink salmon return was reduced in Prince William Sound by over 26,000,000 fish. In Prince William Sound, returns to PNP hatcheries were estimated by the operators to have contributed just over 4,400,000 pink salmon to the commercial fishery. Even though that contribution is considerably lower than in prior years, it still represents 79% of the total harvest of pink salmon in Prince William Sound. SSRAA estimates its hatcheries at Neets Bay and Whitman Lake contributed over 734,000 chum, coho, and chinook salmon to the common-property fisheries in Southeast. Over 1,000,000 coho salmon were again produced by PNP hatcheries in 1992, and common-property fisheries harvested over 712,000 of the returning adults. Estimated hatchery returns for 1992, including commercial, sport, and cost-recovery harvests, are presented by region and species in Table 2.3 in Chapter 2.

Statewide production data since 1975 for combined species, including adult returns and harvests, are presented in Table 8.3. Preliminary estimates by

the PNP corporations indicate that common-property harvests of the 1992 return were over 9,200,000 fish. Cumulative data for chum salmon produced by PNP corporations since 1975 are presented in Table 8.4. Similar data for sockeye, pink, coho, and chinook salmon are presented in Tables 8.5, 8.6, 8.7, and 8.8, respectively.

Egg takes and fry or smolt stocking are regulated by ADF&G through fish transport permits (FTP), which are administered by the PNP Program. In 1992, 234 FTPs were processed by the program. During 1992, fry and smolt releases decreased slightly from 1991 levels to 1,075,000,000 juvenile fish, a decrease of 11,900,000 fish (Table 8.9). The decrease was largely due to fewer pink salmon fry released into Prince William Sound. 1991 egg takes for PNP hatcheries totaled over 1,427,000,000 green eggs, up 101,000,000 (or 7%) from 1991 levels. The largest egg take of 1992 was at Esther Lake Hatchery where over 300,000,000 pink, chum, coho, and chinook salmon eggs were taken for incubation (Table 8.10). This was followed by the Valdez Fisheries Development Association's Solomon Gulch Hatchery with over 230,000,000 pink, chum, and coho salmon eggs, PWSAC's Cannery Creek Hatchery with over 156,000,000 pink salmon eggs, and PWSAC's Armin F. Koernig Hatchery with over 127,000,000 pink salmon eggs. In total, over 823,000,000

Table 8.2. 1992 estimated adult returns, by species, to PNP hatcheries (including common property harvests) as reported by operators.

REGION / LOCATION	Pink	Chum	Coho	Chinook	Sockeye	TOTAL
SOUTHEAST						
SSRAA - Whitman Lake			28,155	719		28,874 (note 1)
Carroll Inlet				9,367		9,367 (note 1)
Earl West Cove		54,874	35,533			90,407 (note 1)
Naket Inlet		134,317	17,437			151,754 (note 1)
- Neets Bay		690,491	386,450	8,958		1,085,899 (note 1)
- Beaver Falls					5,186	5,186 (note 1)
Shrimp Bay					578	578 (note 1)
NSRAA - Hidden Falls		1,013,199	18,672	2,566		1,034,437 (note 1&4)
- Medvejie Creek		308,079	6,924	14,986		329,989 (note 1&4)
Patterson Bay			134,760			134,760 (note 1)
AAI - Burnett Inlet	273,300	48,167	1,300	1,004		323,771 (note 1&2)
AKI - Port Armstrong	2,722,127		40,140	1,721		2,763,988 (note 1&2)
BCF - Burro Creek	8,000	180	242			8,422 (note 1&2)
DIPAC - Sheep Creek	10,340	283,918				294,258 (note 1)
- Kowee Creek						0 (note 1)
- Gastineau	961,474	39,528	182,181	161		1,183,344 (note 1)
KNFC - Gunnuk Creek	73,701	31,488				105,189 (note 2)
Southeast Cove	88,155	28,682				116,837 (note 2)
AACI - Bell Island			855			855 (note 1)
SJC - Indian River	18,840	132	3,041	437		22,450 (note 1&3)
SOUTHEAST TOTALS	4,155,937	2,633,055	855,690	39,919	5,764	7,690,365
PRINCE WILLIAM SOUND						
PWSAC - Armin F. Koernig	2,655,200					2,655,200 (note 1&4)
- Esther Lake	2,079,068	416,250	164,421	2,482		2,662,221 (note 1&4)
- Cannery Creek	1,706,467					1,706,467 (note 1&4)
- Main Bay					534,375	534,375 (note 1&4)
VFDA - Solomon Gulch	1,866,333	25,306	44,270			1,935,909 (note 1&4)
Boulder Bay	263,986		1,170			265,156 (note 1&4)
PWS TOTALS	8,571,054	441,556	209,861	2,482	534,375	9,759,328
COOK INLET						
CIAA - Eklutna		3,333	293			3,626 (note 2)
- Trail Lakes			4,242		243,369	247,611 (note 2)
- Tutka	412,893	613				413,506 (note 2)
Homer Spit	2,000					2,000 (note 2)
Halibut Cove	58,195					58,195 (note 2)
COOK INLET TOTALS	473,088	3,946	4,535	0	243,369	724,938
KODIAK						
KRAA - Kitoi Bay	Listed under FRED hatchery production					0
KODIAK TOTALS	0	0	0	0	0	0
STATEWIDE TOTALS	13,200,079	3,078,557	1,070,086	42,401	793,508	18,174,631

note 1: estimation based on expansion of coded wire tag recoveries.

note 2: estimation based on assumed common property interception rates.

note 3: estimation based on assumed marine survival rates.

note 4: estimation based on information provided by Division of Commercial Fisheries.

Table 8.3. Summary of statewide salmon production (all species) from PNP hatcheries as reported by operators.

Year	Egg Take	Fry or smolt release	Total return	Special harvest	Hatchery revenue
1975	8,091,395				
1976	16,622,881	3,719,741			
1977	37,008,186	12,360,354	160,147	108,718	\$130,726.00
1978	37,346,167	26,796,238	160,967	114,188	\$141,799.00
1979	54,295,879	29,131,774	356,501	244,555	\$309,612.00
1980	125,740,500	35,587,200	1,506,466	346,168	\$436,171.00
1981	223,600,000	101,600,000	2,563,913	850,293	\$1,274,640.00
1982	234,390,000	126,990,000	5,340,720	1,370,110	\$1,165,608.00
1983	261,310,000	170,375,000	4,285,989	744,767	\$669,838.00
1984	372,880,000	217,730,000	4,764,144	1,048,701	\$1,668,788.00
1985	469,960,000	302,320,000	8,106,485	1,853,483	\$1,878,348.00
1986	522,200,000	380,890,000	7,903,526	1,211,620	\$1,867,054.45
1987	868,250,000	461,170,000	19,096,871	4,172,700	\$6,557,877.16
1988	1,045,620,000	819,800,000	14,343,654	2,499,557	\$9,266,780.00
1989	1,108,700,000	860,190,000	24,044,699	14,849,608	\$28,985,391.36
1990	1,249,160,000	925,210,000	42,405,072	10,387,754	\$13,644,040.77
1991	1,325,990,000	1,087,070,000	40,264,749	12,377,204	\$6,396,187.29
1992	1,427,710,000	1,075,180,000	18,174,631	7,277,620	\$10,424,578.96

Cumulative hatchery revenue from special harvest: \$84,817,439.99

Table 8.4. Summary of chum salmon production from PNP hatcheries.

Year	Egg Take	Fry release	Total return	Special harvest	Hatchery revenue
1975	77,000				
1976	347,275	66,075			
1977	1,614,574	264,068			
1978	1,684,930	1,064,000	543		
1979	6,782,864	924,400	3		
1980	26,850,000	3,340,000	1,588		
1981	32,400,000	21,900,000	20,518	6,115	\$24,640.00
1982	46,130,000	23,590,000	22,133	378	\$302.00
1983	68,790,000	41,770,000	126,783	35,099	\$37,120.00
1984	122,170,000	54,780,000	1,001,449	436,617	\$690,393.00
1985	119,450,000	97,880,000	525,088	123,215	\$209,208.00
1986	181,450,000	100,490,000	779,637	188,754	\$303,080.00
1987	234,500,000	149,790,000	955,294	487,605	\$1,162,578.50
1988	369,610,000	186,050,000	1,835,164	469,754	\$2,180,685.40
1989	267,030,000	286,770,000	1,102,191	183,340	\$754,806.00
1990	425,410,000	216,860,000	1,632,539	369,985	\$1,411,640.43
1991	441,530,000	359,270,000	1,958,538	403,603	\$1,269,086.65
1992	495,360,000	394,260,000	3,078,557	741,276	\$2,449,107.29

Table 8.5. Summary of sockeye salmon production from PNP hatcheries

Year	Egg Take	Fry or smolt release	Total return	Special harvest	Hatchery revenue
1985	310,000	0	0	0	\$0.00
1986	1,295,700	102,000	0	0	\$0.00
1987	1,570,000	750,000	0	0	\$0.00
1988	10,590,000	1,000,000	66,499	0	\$0.00
1989	14,740,000	8,030,000	39,832	39,831	\$254,214.80
1990	11,780,000	8,140,000	101,216	8,513	\$35,506.20
1991	27,480,000	8,070,000	153,606	5,023	\$21,167.36
1992	25,530,000	15,960,000	783,508	170,629	\$1,653,004.27

Table 8.6. Summary of pink salmon production from PNP hatcheries.

Year	Egg Take	Fry release	Total return	Special harvest	Hatchery revenue
1975	8,002,395				
1976	16,251,456	3,653,666			
1977	35,383,112	12,093,184	160,147	108,718	\$130,726.00
1978	34,851,807	25,732,238	160,397	114,188	\$141,799.00
1979	46,582,015	28,204,674	356,498	244,555	\$309,612.00
1980	98,030,000	31,690,000	1,504,878	346,168	\$436,171.00
1981	188,000,000	78,800,000	2,491,345	838,037	\$1,200,000.00
1982	185,170,000	102,550,000	5,253,378	1,354,732	\$1,084,806.00
1983	185,520,000	126,890,000	4,086,552	701,399	\$613,618.00
1984	241,760,000	159,340,000	3,637,927	583,185	\$741,673.00
1985	339,910,000	199,490,000	7,404,789	1,698,732	\$1,320,320.00
1986	324,570,000	271,960,000	6,767,984	948,624	\$1,012,420.00
1987	618,350,000	299,260,000	17,963,785	3,624,586	\$4,711,068.00
1988	645,100,000	625,820,000	12,257,959	2,007,720	\$6,715,887.09
1989	805,870,000	553,090,000	22,561,056	14,519,987	\$27,380,702.66
1990	788,710,000	684,790,000	39,919,911	9,846,364	\$10,846,114.44
1991	830,860,000	704,330,000	37,081,341	11,574,828	\$2,890,652.41
1992	882,920,000	648,470,000	13,200,079	6,009,343	\$3,917,462.76

Table 8.7. Summary of coho salmon production from PNP hatcheries.

Year	Egg Take	Fry or smolt release	Total return	Special harvest	Hatchery revenue
1975	12,000				
1976	24,150				
1977	10,500	3,102			
1978	809,430	0	27		
1979	931,000	2,700	0		
1980	666,500	557,200	0		
1981	2,800,000	900,000	52,050	6,141	\$50,000.00
1982	2,870,000	700,000	61,709	11,500	\$80,500.00
1983	6,200,000	1,570,000	71,781	7,396	\$19,100.00
1984	6,300,000	3,230,000	121,112	27,310	\$233,466.00
1985	4,100,000	4,220,000	168,427	29,530	\$293,820.00
1986	8,300,000	4,280,000	344,749	72,960	\$535,203.00
1987	9,280,000	5,440,000	169,149	58,333	\$625,546.65
1988	13,310,000	4,720,000	122,186	13,383	\$178,771.15
1989	13,740,000	9,040,000	305,048	88,702	\$271,181.23
1990	14,470,000	10,730,000	691,680	140,728	\$939,670.50
1991	16,120,000	11,500,000	1,001,338	372,612	\$1,873,708.61
1992	16,510,000	10,280,000	1,070,086	338,725	\$2,051,465.68

Table 8.8. Summary of chinook salmon production from PNP hatcheries.

Year	Egg Take	Fry or smolt release	Total return	Special harvest	Hatchery revenue
1980	194,000				
1981	400,000				
1982	220,000	150,000	3,500	3,500	N/A
1983	800,000	140,000	872	872	N/A
1984	2,730,000	380,000	3,656	1,589	\$3,256.00
1985	6,180,000	720,000	8,181	2,006	\$55,000.00
1986	6,580,000	4,050,000	11,156	1,282	\$16,351.00
1987	4,550,000	5,940,000	8,643	2,176	\$58,684.00
1988	7,010,000	2,210,000	23,246	8,700	\$191,436.36
1989	7,330,000	3,270,000	36,572	17,748	\$324,486.67
1990	8,790,000	4,700,000	59,726	22,164	\$411,109.20
1991	10,000,000	3,900,000	69,926	21,138	\$333,572.26
1992	7,400,000	6,210,000	42,401	17,647	\$353,538.96

N/A = information not available

Table 8.9. 1992 releases from PNP hatcheries in millions.

REGION/LOCATION	Pink	Chum	Coho	Chinook	Sockeye	TOTAL
SOUTHEAST						
SSRAA - Whitman Lake			0.30	0.11	*	0.41
Carroll Inlet				1.22		1.22
Kendrick Bay		8.02				8.02
Naket Inlet		13.78	0.11			13.90
Earl West Cove		6.03	0.23			6.26
- Neets Bay		48.49	2.31	0.73		51.52
- Beaver Falls						0.00
Shrimp Bay					0.93	0.93
Margaret Lake					0.20	0.20
Virginia Lake					0.67	0.67
Salmon Lake					0.63	0.63
Old Franks Lake					0.23	0.23
Hugh Smith Lake					0.48	0.48
NSRAA - Hidden Falls		36.48	0.17	1.58		38.23
Takatz		19.65				19.65
- Medvejie Creek		4.04				4.04
Deep Inlet	0.13	19.32	2.48	1.14		23.08
- Port Camden		4.21				4.21
AAC - Bell Island				0.01		0.01
AAI - Burnett Inlet	19.34	19.58	0.02	0.05		38.99
AKI - Port Armstrong	39.62	0.42	0.16	0.40		40.60
BCF - Burro Creek	0.24	0.37	0.00	0.01		0.63
DIPAC - Kowee Creek	*	*				0.00
- Sheep Creek	*	27.01	*			27.01
- Gastineau	15.42	12.01	0.40	0.19		28.02
Sheep Creek	31.64		0.58			32.22
Amalga Harbor		35.92				35.92
Boat Harbor		6.71				6.71
Limestone Inlet		8.50				8.50
Chilkat River				0.11		0.11
KNFC - Gunnuk Creek	5.60	13.12				18.72
Southeast Cove						0.00
SJC - Indian River	9.04	0.00	0.07	0.09		9.21
SOUTHEAST TOTALS	121.03	290.50	6.84	5.64	3.13	427.14
PRINCE WILLIAM SOUND						
PWSAC - Armin F. Koernig	112.83	*				112.83
- Esther Lake	163.59	97.95	1.56	0.28	*	263.38
Whittier			0.14	0.10		0.25
Cordova			0.12	0.10		0.23
Valdez				0.09		0.09
- Cannery Creek	132.17	*				132.17
- Main Bay					1.92	1.92
Marsha Lake					0.69	0.69
Coghill					0.72	0.72
Eshamy					1.04	1.04
VFDA - Solomon Gulch	86.90	2.69	1.21			90.80
Boulder Bay			0.02			0.02
PWS TOTALS	495.49	100.64	3.06	0.57	4.37	604.13
COOK INLET						
CIAA - Eklutna		3.11	0.13			3.25
- Trail lakes						0.00
Chelatna Lake					1.14	1.14
Packers Lake					3.17	3.17
Bear Lake/Creek			0.26		2.36	2.62
Hidden Lake					1.72	1.72
Coal Creek					0.07	0.07
- Tutka Bay	25.70					25.70
Halibut Cove	5.95					5.95
Homer Spit	0.30					0.30
COOK INLET TOTALS	31.95	3.11	0.39	0.00	8.45	43.91
STATEWIDE TOTALS	648.47	394.26	10.28	6.21	15.96	1075.18

Note 1: * indicates permitted species but no releases this season.

Note 2: individual hatchery releases may not add up to the regional or statewide totals because of rounding.

Table 8.10. 1992 egg takes for PNP hatcheries in millions.

REGION / LOCATION	Pink	Chum	Coho	Chinook	Sockeye	TOTAL	Comments:	
SOUTHEAST								
SSRAA - Whitman Lake		31.90	4.39	1.70	*	37.99	(note 1)	
- Neets Bay		66.41		0.79		67.20		
- Beaver Falls					4.93	4.93		
NSRAA - Hidden Falls		91.19	1.73	1.99		94.92		
- Medveje Creek	0.15	31.62	2.66	1.21		35.63		
- Port Camden		6.00				6.00		
AAI - Burnett Inlet	20.60	20.45	*	*		41.05	(note 1)	
AKI - Port Armstrong	58.32		0.80			59.12		
BCF - Burro Creek	1.93	0.07	0.01	0.02		2.03		
DIPAC - Kowee Creek	*	*				0.00	(note 1)	
- Sheep Creek	*	27.87	0.05			27.92	(note 1)	
- Gastineau	51.01	71.02	1.08	0.29		123.40		
KNFC - Gunnuk Creek	6.21	16.50				22.70		
SJC - Indian River	7.24	0.10	0.16	0.13		7.63		
SOUTHEAST TOTALS	145.46	363.12	10.88	6.13	4.93	530.51	(note 2)	
PRINCE WILLIAM SOUND								
PWSAC - Armin F. Koernig	127.47	*				127.47	(note 1)	
- Esther Lake	184.75	112.43	2.49	1.27	*	300.94	(note 1)	
- Cannery Creek	156.46	*				156.46	(note 1)	
- Main Bay					8.00	8.00		
VFDA - Solomon Gulch	208.78	19.81	2.22	*		230.81	(note 1)	
PWS TOTALS	677.46	132.24	4.71	1.27	8.00	823.67	(note 2)	
COOK INLET								
CIAA - Ekiutna			0.07		*	0.07	(note 1)	
- Trail Lakes			0.84	*	12.61	13.45	(note 1)	
- Tutka Bay	60.00					60.00		
COOK INLET TOTALS	60.00	0.00	0.92	0.00	12.61	73.53	(note 2)	
KODIAK								
KRAA - Kitoi Bay	Listed under FRED hatchery production							
KODIAK TOTALS	0.00	0.00	0.00	0.00	0.00	0.00	(note 2)	
STATEWIDE TOTALS	882.92	496.36	16.61	7.40	25.53	1427.71		

ALL SPECIES TOTAL: 1,427,709,826

Note 1: * indicates permitted species but no egg take this season.

Note 2: individual hatchery egg takes may not add up to the regional or statewide totals because of rounding.

salmon eggs were taken by PNP operators in Prince William Sound in 1992. In Southeast Alaska, Douglas Island Pink and Chum, Inc., took over 151,000,000 pink, chum, chinook, and coho salmon eggs for its facilities, NSRAA took over 136,000,000 pink, chum, coho, and chinook salmon eggs for its three hatcheries, and SSRAA took over 110,000,000 chum, coho, chinook, and sockeye salmon eggs for its three hatcheries.

Significant progress was made in 1992 in initiating sockeye salmon production from PNP hatcheries. Releases of juvenile sockeye salmon totaled almost 16,000,000 in 1992. Sockeye salmon egg takes totaled 25,500,000 eggs at permitted PNP hatcheries and those operated by PNP aquaculture associations under contract to the state. Significant increases in chum and pink salmon production were made in 1992. Coho salmon production increased slightly; chinook and sockeye salmon production were reduced from prior year egg-take levels.

Many PNP hatcheries are still in the process of brood stock development and, consequently, have not reached their permitted capacities. Permitted capacities for PNP hatcheries now total over 1,980,000,000 eggs, an increase of 227,000,000 from 1991 levels (Table 8.11). Potential returns from statewide PNP hatchery-originated production at the 2,000,000,000-egg level should exceed 30,000,000 adults annually, assuming conservative FRED standard assumptions of hatchery and marine survival. Exceptional marine survival, similar to that experienced during recent years, could boost adult production considerably over these estimates. Under the existing permits, approximately 54% of hatchery capacity is scheduled for pink salmon, 40% for chum salmon, and 6% for steelhead trout, sockeye, coho, and chinook salmon.

Projected returns to PNP facilities for the 1993 season are presented in Table 8.12. Approximately 65,000

chinook salmon, 635,000 coho salmon, 4,301,000 chum salmon, and 2,685,000 pink salmon are expected to return to PNP hatcheries in Southeast Alaska. Returns to PNP facilities in Prince William Sound are projected at 23,351,000 pink salmon, 877,000 chum salmon, 252,000 coho salmon, 9,500 chinook salmon, and 771,000 sockeye salmon for 1993. Projected returns, especially of pink salmon, are expected to be considerably higher than the actual return for 1992. Approximately 18,000,000 fish returned in 1992; 34,000,000 are expected in 1993. However, the actual return in 1992 was less than half of the projected amount.

Significant hatchery special harvests are expected at the Armin F. Koernig, Esther Lake, Cannery Creek, Solomon Gulch, Main Bay, Tutka Bay, Neets Bay, Whitman Lake, Port Armstrong, Burnett Inlet, Hidden Falls (Figure 8.4), Sheep Creek/ Gastineau, Gunnuk Creek, and Medvejie Creek Hatcheries. Significant common-property terminal harvests by commercial gear groups are expected at the Kitoi Bay, Esther Lake, Cannery Creek, Medvejie Creek, Hidden Falls, and Whitman Lake (Nakat Inlet, Carroll Inlet, and Earl West Cove) Hatcheries.



Figure 8.4. Hidden Falls Hatchery.

Table 8.11. Permitted egg capacities, in millions, of PNP hatcheries within the planning regions, 1992.

REGION	Pink	Chum	Coho	Chinook	Sockeye	Steelhead	Total
SOUTHERN SOUTHEAST							
Association Facilities	0.00	105.80	8.40	5.54	4.00		123.74
Non-Association Facilities	46.00	82.00	0.27	0.82		0.01	129.09
Total	46.00	187.80	8.67	6.35	4.00	0.01	252.83
NORTHERN SOUTHEAST							
Association Facilities	0.30	189.80	5.00	3.65	2.00		200.75
Non-Association Facilities	138.00	250.50	4.35	0.85		0.09	393.79
Total	138.30	440.30	9.35	4.50	2.00	0.09	594.54
YAKUTAT (no PNP facilities)							
Total	0.00	0.00	0.00	0.00	0.00		0.00
PRINCE WILLIAM SOUND							
Association Facilities	548.00	129.00	4.00	4.00	31.00		716.00
Non-Association Facilities	240.00	28.00	2.00	0.30			270.30
Total	788.00	157.00	6.00	4.30	31.00		986.30
COOK INLET							
Association Facilities			6.16	4.00	32.00		42.16
Non-Association Facilities	110.00				1.35		111.35
Total	110.00	0.00	6.16	4.00	33.35		153.51
STATEWIDE TOTALS							
	1082.30	785.10	30.18	19.15	70.35	0.10	1987.18

Table 8.12. Projected adult returns, by species, to PNP hatcheries for 1993 (including common property harvests) as reported by operators.

REGION/LOCATION		Pink	Chum	Coho	Chinook	Sockeye	TOTAL
SOUTHEAST							
SSRAA	- Whitman Lake			22,200	1,600		23,800
	Earl West Cove		20,400	25,000			45,400
	Nakat Inlet		121,100	11,400			132,500
	Carroll Inlet				19,500		19,500
	Kendrick Bay		27,300				27,300
	- Neets Bay		728,000	299,400	14,200		1,041,600
	- Beaver Falls					16,800	16,800
	Shrimp Bay					200	200
NSRAA	- Hidden Falls		1,028,000	25,000	1,800		1,054,800
	Takatz Bay		343,000				343,000
	- Medvejie Creek		225,000		15,000		240,000
	Deep Inlet		1,300,000	14,000			1,314,000
	Mist Cove			71,000			71,000
	- Port Camden		9,659				9,659
AAI	- Burnett Inlet	780,000	27,000	1,250	2,500		810,750
AKI	- Port Armstrong	793,936		16,477	5,794		816,207
BCF	- Burro Creek	5,000	230	50			5,280
DIPAC	- Sheep Creek		134,000				134,000
	- Gastineau	308,400	172,000	59,754	1,083		541,237
	Sheep Creek	632,700		87,411	2,367		722,478
	Amalga Harbor		3,900				3,900
	Boat Harbor		126,000				126,000
	Limestone Inlet		1,300				1,300
KNFC	- Gunnuk Creek	50,730	20,195				70,925
	Southeast Cove	89,185	13,650				102,835
AAC	- Bell Island				61		61
SJC	- Indian River	25,254	580	2,520	1,620		29,974
SOUTHEAST TOTALS		2,685,205	4,301,314	635,462	65,525	17,000	7,704,506
PRINCE WILLIAM SOUND							
PWSAC	- Armin F. Koernig	5,648,620					5,648,620
	- Esther Lake	8,438,988	820,705	131,305	6,664		9,397,662
	Cordova			10,363	852		11,215
	Valdez				1,110		1,110
	Whittier			12,082	884		12,966
	- Cannery Creek	5,788,186	26,923				5,815,109
	- Main Bay					573,674	573,674
	Coghill					41,018	41,018
	Eshamy					157,028	157,028
VFDA	- Solomon Gulch	3,476,000	29,500	96,518			3,602,018
	Boulder Bay			1,565			1,565
PWS TOTALS		23,351,794	877,128	251,833	9,510	771,720	25,261,985
COOK INLET							
CIAA	- Eklutna		96,000	2,700			98,700
	- Trail Lakes						
	Packers Lake					109,450	109,450
	Hidden Lake					53,825	53,825
	Bear Lake					34,298	34,298
	Chelatna Lake					74,100	74,100
	- Tutka Bay	500,000	13,300				513,300
	Halibut Cove	120,000					120,000
	Homer Spit	12,000					12,000
	- Port Graham	60,000					60,000
COOK INLET TOTALS		692,000	109,300	2,700	0	271,673	1,075,673
STATEWIDE TOTALS		26,728,999	5,287,742	889,995	75,035	1,060,393	34,042,164

Annual Management Plans

The PNP regulations require that ADF&G prepare, in conjunction with PNP permit holders, an annual management plan (AMP) to guide hatchery operations for the succeeding calendar year. AMPs will be developed for 13 state- and 25 PNP- operated hatchery facilities prior to the 1993 operating season. The AMPs will be reviewed by both the department and the RPTs before final approval by the commissioner. The AMPs outline expected operational activities at each facility, including wild and hatchery egg takes, proposed fish and egg transports and releases, anticipated adult returns, anticipated impacts on the management of mixed-stock fisheries, and terminal-harvest management strategies. Also included are anticipated facility brood stock requirements and, in the case of PNP facilities, hatchery cost-recovery plans that identify legal gear types for hatchery harvest and the number of fish required in order to meet capital and operating expenses.

Scientific/Educational Permitting

Scientific/educational permits for 85 aquaculture research projects or school district aquaculture programs were issued in 1992 by the commissioner. These permits are administered under the PNP Program. Fifty-seven of the permits issued in 1992 allowed the release of juvenile fish. These projects are listed in Table 8.13 by regions of the state. If all these projects operated at permitted capacities, 954,000 pink, coho, chum, and Arctic char would have been released under scientific/educational permits.

In 1993, a new policy and regulations for scientific/educational collecting and propagation permits will be developed. These permits will now be called Fish Resource Permits, and will be issued for scientific collecting, holding, exhibition, and propagation of fish.

PNP Program Highlights

- Approximately \$4 million more in cost-recovery revenue was generated in 1992 than in 1991, even though 41% fewer fish were sold.
- Over 26,000,000 fewer pink salmon returned to Prince William Sound in 1992 than returned the prior year. However, hatchery production still accounted for 79% of the commercial harvest.
- Approximately 66% of the coho salmon return to PNP hatcheries was caught in the common-property fisheries.
- Over 1,400,000,000 salmon eggs were taken at PNP hatcheries in 1992. This is the 18th year in a row that more eggs have been taken by PNP operators than in the previous year. Permitted capacities for PNP hatcheries now total almost 2,000,000,000 eggs.
- PNP corporations have now borrowed a total of \$81.3 million for hatchery construction and operation. They have harvested and sold \$84.8 million worth of salmon for cost recovery.

Table 8.13. Summary of Sci/Ed. permitted salmon production in Alaska for 1992.

REGION / PERMITTEE	PROJECT TYPE	SPECIES	RELEASE NUMBER
SOUTHEAST			
NSRAA (Aqua. Assoc.)	Instream incubation	Chum	200,000
Sitka High School	Classroom incubation	Coho	500
Haines Borough School District	Classroom incubation	Chum	2,500
Valley Park Elementary (Ketchikan)	Classroom incubation	Coho	250
White Cliff Elementary (Ketchikan)	Classroom incubation	Coho	250
Petersburg High School	School Hatchery	Pink	4,000
Skagway City Schools	School Hatchery	Pink, Coho & Chinook	100,000
USDA Forest Service (Sitka)	Stream Stocking	Chinook	50
USDA Forest Service (Sitka)	Stream Stocking	Coho	15,000
USDA Forest Service (Ketchikan)	Stream Stocking	Coho	1,000
USDA Forest Service (Hoonah)	Stream Stocking	Coho	5,500
USDA Forest Service (Hoonah)	Stream Stocking	Coho	100
USDA Forest Service (Craig)	Stream Stocking	Coho	100
USDA Forest Service (Juneau)	Stream Stocking	Coho	110
USDA Forest Service (Juneau)	Stream Stocking	Coho	2,000
SOUTHCENTRAL			
Bear Valley Elementary (Anchorage)	Classroom incubation	Coho	250
Inlet View Elementary (Anchorage)	Classroom incubation	Coho	250
Chugiak High School (Eagle River)	Classroom incubation	Coho	250
Colony High School (Palmer)	Classroom incubation	Coho	250
Colony Middle School (Palmer)	Classroom incubation	Coho	250
Central Jr. High (Anchorage)	Classroom incubation	Coho	250
Susitna Elementary (Anchorage)	Classroom incubation	Coho	250
Girdwood Jr. High	Classroom incubation	Coho	1,000
Gruening Middle School (Eagle River)	Classroom incubation	Coho	250
Homer Intermediate School	Classroom incubation	Pink	250
Palmer Middle School	Classroom incubation	Coho	250
Rogers Park Elementary (Anchorage)	Classroom incubation	Coho	250
Steller Alt. Secondary School (Anchorage)	Classroom incubation	Coho	250
Palmer High School	Classroom incubation	Coho	250
Nanwalek Traditional Council (English Bay)	Experimental Rearing	Sockeye	20,000
INTERIOR			
North Pole Middle School	Classroom incubation	Chum	7,000
Tri Valley School (Healy)	Classroom incubation	Arctic Char	500
Delta/Greely Schools	Classroom incubation	Coho	11,200
WESTERN			
Main Elementary (Kodiak)	Classroom incubation	Coho	250
East Elementary (Kodiak)	Classroom incubation	Coho	200
Peterson Elementary (Kodiak)	Classroom incubation	Coho	200
St. George Island	Hatchery Feasibility Study	Pink	300,000
AYK			
Galena School District	Classroom incubation	Coho	250
Kaitag City Schools	Classroom incubation	Coho	250
Koyukuk City Schools	Classroom incubation	Coho	250
Beaver School	Classroom incubation	Coho	250
Circle City School	Classroom incubation	Coho	250
David Louis Mem. School (Grayling)	Classroom incubation	Coho	250
A.K. Demoski School (Nulato)	Classroom incubation	Coho	250
Ft. Yukon School	Classroom incubation	Coho	250
Holy Cross School	Classroom incubation	Coho	250
M.A. Kangas School (Ruby)	Classroom incubation	Coho	250
McGrath School	Classroom incubation	Coho	250
Tanana City School	Classroom incubation	Coho	250
Nome-Beltz School	School Hatchery	Coho & Pink	70,000
AK PENINSULA			
Akutan School	School Hatchery	Pink & Chum	45,600
Cold Bay School	Classroom incubation	Pink or Chum	6,600
False Pass School	Classroom incubation	Pink or Chum	6,600
King Cove School	Classroom incubation	Pink or Chum	6,600
Nelson Lagoon School	Classroom incubation	Pink or Chum	6,600
Sand Point School	School Hatchery	Coho & Pink	82,400
Unalaska City School District	School Hatchery	Coho & Pink	52,000
STATEWIDE TOTAL			954,360

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GLOSSARY OF ACRONYMS

ADF&G	Alaska Department of Fish and Game
AMP	Annual Management Plan
ASGA	Alaskan Shellfish Growers' Association
ASTF	Alaska Science and Technology Foundation
BDC	Broodstock Development Center, Fort Richardson Hatchery
BKD	Bacterial Kidney Disease (fish disease)
CIAA	Cook Inlet Aquaculture Association
CIF	Central Incubation Facility
DCED	Alaska Department of Commerce and Economic Development
DEC	Alaska Department of Environmental Conservation
DGC	Division of Governmental Coordination, Governor's Office
DJ/WB	Dingell-Johnson/Wallop-Breaux federal aid grant
DNR	Alaska Department of Natural Resources
DOT/PF	Alaska Department of Transportation and Public Facilities
ELISA	Enzyme-Linked Immunoabsorbent Assay (pathology)
FAT	Fluorescent Antibody Test (pathology)
FRED	Fisheries Rehabilitation, Enhancement and Development Division, ADF&G
FWRS	Fish and Wildlife Reference Service
FY	State Fiscal Year (1 July-30 June)
FTP	Fish Transport Permit
HARD	Habitat and Restoration Division, Alaska Department of Fish and Game
IHNV	Infectious Hematopoietic Necrosis Virus (fish disease)
KRAA	Kodiak Regional Aquaculture Association
MTC	Mariculture Technical Center
NMFS	National Marine Fisheries Service
NSRAA	Northern Southeast Regional Aquaculture Association
PNFHPC	Pacific Northwest Fish Health Protection Committee
PNP	Private Nonprofit
PWSAC	Prince William Sound Aquaculture Corporation
RPT	Regional Planning Team
SKIF	Streams, Kids and Fish Program (Municipality of Anchorage)
SSRAA	Southern Southeast Regional Aquaculture Association
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
FWS	U.S. Fish and Wildlife Service
VHSV	Viral Hemorrhagic Septicemia Virus (fish disease)

APPENDIX 1

Updated Contribution of Fish by FRED Hatcheries in 1991

Appendix 1. Updated contribution of fish by FRED hatcheries in 1991.

Hatchery or Project	Species	Commercial Catch	Sport Catch	Pers Use	Subsistence	Brood/ Escpmnt	Total	Comments
ARCTIC-YUKON-KUSKOKWIM								
Clear Hatchery	Grayling		10,300				10,300	b
	A char		5,400				5,400	b
	L trout		800				800	
Ft Rich- Interior lakes	Rainbow		136,300				136,300	b
Big Lake- LL lakes	Coho		33,300				33,300	b
Sikusuiq Hatchery	Chum	20,000	100		5,000	6,700	31,800	
AYK TOTALS:		20,000	186,200	0	5,000	6,700	217,900	
COOK INLET								
Big Lake Hatchery								
Big Lake	Sockeye	20,300	230	4,900		19,770	45,200	b
	Coho	1,300				1,300	2,600	
Crooked Creek Hatchery								
Crooked Creek	Coho		4,400			3,085	7,485	b
	Steelhead		180			90	270	b
Tustumena Lake	Sockeye	125,000	6,660	2,800		73,000	207,460	
Leisure/Hazel L	Sockeye	117,000	5,000				122,000	
Chenik Lake	Sockeye	60,400	100			9,900	70,400	
Port Dick Lake	Sockeye	4,560					4,560	
Kirschner Lake	Sockeye	42,700					42,700	
Landlocked Lakes	Coho		4,220				4,220	b
Elmendorf Hatchery								
Crooked Creek	Chinook		6,560			1,340	7,900	b
Halibut Cove	Chinook	420	1,060				1,480	b
Homer Spit	Chinook		2,395				2,395	b
	Coho		5,870	800			6,670	b
Seldovia	Chinook	270	40				310	b
Ship Creek	Chinook	130	1,610			800	2,540	b
	Coho	410	1,380			200	1,990	b
Landlocked lakes	Coho		23,900				23,900	b
Resurrection Bay	Chinook		1,550				1,550	b
	Coho		6,570				6,570	b
Fort Richardson Hatchery								
Willow Creek	Chinook		800			300	1,100	b
Ninilchik R	Chinook		7,480				7,480	b
Little Susitna	Coho		9,890			8,400	18,290	b
Cook Inlet lakes	Rainbow		108,300				108,300	b
	Chinook		15,600				15,600	b
Tutka Bay Hatchery								
Kachemak Bay	Pink	114,000	3,180			120,000	237,180	b
	Chum	816				112	928	
Halibut Cove	Pink	90,800	338				91,138	b
Homer Spit	Pink		143				143	b
Clear Hatchery								
Landlocked lakes	Grayling		8,500				8,500	b
	A Char		1,760				1,760	b
COOK INLET TOTALS:		578,106	227,716	8,500	0	238,297	1,052,619	
KODIAK/ALASKA PENINSULA								
Kitoi Bay Hatchery	Pink	1,390,700				231,300	1,622,000	
	Chum	31,700				39,300	71,000	
	Coho	9,800	1,650		200	7,050	18,700	
Port Lions	Coho				5,000		5,000	
Landlocked lakes	Coho		120				120	b
	Rainbow		2,800				2,800	b
Clear	Grayling		425				425	b
Karluk	Sockeye	1,376,000			500	1,134,000	2,510,500	
Frazer fishpass	Sockeye	1,111,200				190,400	1,301,600	a
Afgnag Fishpasses (combined)	Coho					3,500	3,500	a
	Pink	2,200				36,500	38,700	a

Appendix 1. Continued.

Hatchery or Project	Species	Commercial Catch	Sport Catch	Pers Use	Subsistence	Brood/ Escpmnt	Total	Comments
Afognak Fishpasses	Sockeye	32				8,703	8,735	a
Waterfall Fishpass	Pink	6,900				115,000	121,900	a
	Coho					60	60	
	Sockeye					151	151	
Russell Creek Hatchery	Coho		500			1,500	2,000	
	Chum					15,000	15,000	
	Pink	0				15,000	15,000	
KODIAK/AK PEN TOTALS:		3,928,532	5,495	0	5,700	1,797,464	5,737,191	
PRINCE WILLIAM SOUND								
Ft Rich- Cordova	Coho		3,260				3,260	b
Landlocked Lakes	Rainbow		8980				8,980	b
Clear LL lakes	Grayling		4790				4,790	b
Gulkana Hatchery	Sockeye	102,000	420	6,790	3,530	63,400	176,140	b
Main Bay Hatchery	Chum	137,300					137,300	
	Sockeye	480,200				4,700	484,900	
PWS TOTALS:		719,500	17,450	6,790	3,530	68,100	815,370	
SOUTHEAST SOUTHERN								
Bakewell R	Sockeye	7,766				10,725	18,491	a
Dog Salmon R	Coho	60				100	160	a
Dog Salmon R	Pink	25,000				5,000	30,000	a
Ketchikan Cr	Pink	240,000	4,000			40,000	284,000	a
Marx Cr Spwn Ch	Chum	166				325	491	
Margaret L	Sockeye					78	78	a
Sunny Cr	Pink	220,000				44,000	264,000	a
Beaver Falls Hatchery								
Hugh Smith L	Sockeye	2,271				1,471	3,742	
McDonald L	Sockeye	35,377			4,105	44,748	84,230	
Deer Mountain Hatchery								
Big Salt L	Chinook	26	3				29	
Bold Island L	Coho	2,400	47				2,447	
Craig	Chinook	24					24	
Deer Mountain	Chinook	196	231			820	1,247	
	Coho	3,934	1,030			2,377	7,341	
Reflection L	Coho	186				110	296	
Thorne Bay	Chinook	16					16	
Ward Cr	Coho	1,765	823			740	3,328	
Klawock Hatchery								
Cable Cr	Coho	757				20	777	
Klawock	Coho	53,537	1,080			18,000	72,617	
Klawock	Sockeye			1,140		2,600	3,740	
Tunga L	Coho	6,486					6,486	
Rio Roberts	Coho	17					17	
CENTRAL								
Irish Creek	Coho	32,095				500	32,595	a
Crystal Lake H								
	Chinook	9,762	3,930			3,550	17,242	
	Coho	2,930	320	210		3,160	6,620	
Earl West Cove	Chinook	13,403	733	50			14,186	
Ohmer Creek	Chinook	138	50				188	
Farragut	Chinook	17	1			8	26	
Harding River	Chinook	49	6			5	60	
Slippery Creek	Coho	494					494	
St. John's Creek	Coho	27					27	

Appendix 1. Continued.

Hatchery or Project	Species	Commercial Catch	Sport Catch	Pers Use	Subsistence	Brood/ Escpmnt	Total	Comments
NORTHERN								
Chilkat Ponds	Coho	1,000				200	1,200	
Eliza Lake	Chinook	13					13	
Jerry Myers	Chinook	29	24			16	69	
	Coho	428				107	535	
Snettisham Hatchery								
Doty Cove	Chum	6,733					6,733	
Indian Lake	Coho	22				22	44	
Indian River	Chinook	8	15			35	58	
Limestone Inlet	Chum	13,613					13,613	
Juneau/DJ	Chinook	862	1,105			667	2,634	
	Coho	2,160	1,445			2,930	6,535	
Snettisham	Chinook	799	221			296	1,316	
	Coho	5					5	
	Chum	33,016				2,371	35,387	
Tahini River	Chinook	2	1			5	8	
Lutak Inlet	Chinook	59	13		1	6	79	
Twin Lakes	Chinook		5,000				5,000	
Southeast Totals:		717,648	20,078	1,400	4,106	184,992	928,224	
STATE TOTALS:		5,963,786	456,939	16,690	18,336	2,295,553	8,751,304	
BY SPECIES:								
	Chinook	82,550				Steelhead	270	
	Coho	279,189				Rainbow	256,380	
	Chum	312,252				Grayling	24,015	
	Sockeye	5,084,627				A Char	7,160	
	Pink	2,704,061						
		8,462,679					287,825	

a. fishpass

b. Sportfish estimate taken from 1991 Sport fish harvest surveys

c. Juneau/DJ = Fish Cr, Auke L, Montana Cr, Dredge L

APPENDIX 2

Updated Commercial Contribution of Fish by FRED Hatcheries and Projects in 1991

Appendix 2. Updated commercial contribution of fish by FRED hatcheries and projects in 1991.

Hatchery or Project	Species	Seine	Set Gillnet	Drift Gillnet	Troll	Total	Comments
ARCTIC-YUKON-KUSKOKWIM							
Sikusuilag	Chum		20,000			20,000	
AYK TOTALS:		0	20,000	0	0	20,000	
COOK INLET							
Big Lake							
Big Lake	Sockeye		10,150	10,150		20,300	
	Coho		325	975		1,300	
Crooked Creek							
Tustumena Lake	Sockeye					125,000	a
Leisure Lake	Sockeye	117,000				117,000	
Chenik Lake	Sockeye	60,400				60,400	
Port Dick Lake	Sockeye	4,560				4,560	
Kirschner Lake	Sockeye	42,700				42,700	
Elmendorf							
Halibut Cove	Chinook	140	280			420	
Seldovia	Chinook		270			350	b
Ship Creek	Chinook			130		130	a
	Coho			410		410	a
Tutka Bay Lagoon							
Kachemak Bay	Pink	114,000				114,000	
	Chum	816				816	
Halibut Cove	Pink	90,800				90,800	
COOK INLET TOTALS:		430,416	11,025	11,665	0	578,186	b
KODIAK/ALASKA PENINSULA							
Kitoi Bay	Pink	1,390,700				1,390,700	
	Chum	31,700				31,700	
	Coho	9,800				9,800	
Karluk	Sockeye	1,376,000				1,376,000	
Frazer fishpass	Sockeye		1,111,200			1,111,200	
Afognak Fishpass	Pink	2,200				2,200	
(combined)	Sockeye	32				32	
Waterfall Fishpass	Pink	6,900				6,900	
Russell Creek	Pink	6,900				6,900	
KODIAK/AK PEN TOTALS:		2,824,232	1,111,200	0	0	3,935,432	
PRINCE WILLIAM SOUND							
Gulkana	Sockeye			102,000		102,000	
Main Bay	Sockeye		184,000	296,200		480,200	
	Chum		23,300	114,000		137,300	
PWS TOTALS:		0	207,300	512,200	0	719,500	

Appendix 2. Continued.

Hatchery or Project	Species	Seine	Set Gillnet	Drift Gillnet	Troll	Total	Comments
SOUTHEAST REGION							
SOUTHERN							
Bakewell	Sockeye	3,572		4,194		7,766	
Dog Salmon	Pink	17,500		5,000	2,500	25,000	
	Coho	10			50	60	
Ketchikan Creek	Pink	160,000		60,000	20,000	240,000	
Marx Cr Spwn Ch	Chum	84		82		166	
Margaret L	Sockeye					0	
Sunny Creek	Pink	154,000		44,000	22,000	220,000	
Beaver Falls Hatchery							
Hugh Smith Lake	Sockeye	1,045		1,226		2,271	
McDonald Lake	Sockeye	16,273		19,104		35,377	
Deer Mountain Hatchery							
Big Salt Lake	Chinook				26	26	
Bold Island	Coho	810	17	1,310	263	2,400	
Craig	Chinook				24	24	
Deer Mountain	Chinook	3		15	178	196	
	Coho	662	36	2,260	976	3,934	
Reflection Lake	Coho	44		97	45	186	
Thorne Bay	Chinook	3		2	11	16	
Ward Creek	Coho	145	13	1,075	532	1,765	
Klawock Hatchery							
Cable Creek	Coho	183			574	757	
Klawock	Coho	14,901		143	38,493	53,537	
Tunga Lake	Coho	1,885		33	4,568	6,486	
Rio Roberts	Coho			11	6	17	
CENTRAL							
Irish Creek	Coho	8,595			23,500	32,095	
Crystal Lake Hatchery							
Crystal Lake	Chinook	16		1,216	8,530	9,762	
	Coho	430		1,000	1,500	2,930	
Earl West Cove	Chinook	1,256		8,788	3,359	13,403	
Ohmer Creek	Chinook	44		37	57	138	
Farragut	Chinook				17	17	
Harding River	Chinook			3	46	49	
Slippery Creek	Coho	192			302	494	
St. John's Creek	Coho	1		14	12	27	
NORTHERN							
Chilkat Ponds	Coho			500	500	1,000	
Eliza Lake	Chinook				13	13	
Jerry Myers	Chinook	4		9	16	29	
Jerry Myers	Coho	8		277	143	428	

Appendix 2. Continued.

Hatchery or Project	Species	Seine	Set Gillnet	Drift Gillnet	Troll	Total	Comments
Snettisham							
Doty Cove	Chum			6,733		6,733	
Limestone Inlet	Chum			13,613		13,613	
Indian Lake	Coho	22				22	
Indian River	Chinook				8	8	
Juneau/DJ	Chinook	76		331	455	862	
	Coho	128		897	1,135	2,160	
Snettisham	Chinook	163		199	437	799	
	Coho	5				5	
	Chum			33,016		33,016	
Tahini River	Chinook				2	2	
Lutak River	Chinook	10		49		59	
Southeast Totals:		382,070	66	205,234	130,278	717,648	
STATE TOTALS:		3,636,718	1,349,591	729,099	130,278	5,970,766	b

a = unidentified gear groups

b = sum of gear group totals does not equal total catch because of unidentified gear groups

APPENDIX 3

1992 Average Commercial Salmon Fishery Harvest Weights

Appendix 3. 1992 Average commercial salmon fishery harvest weights

Area	Species	Avg Harvest Weight(lb)	Area	Species	Avg Harvest Weight (lb)
Arctic/Yukon/Kuskwokwim			AK Peninsula		
	Chum(Kotzebue)	8.6		Chinook	15.7
Cook Inlet				Sockeye	5.7
	Chinook	25.0		Coho	6.6
	Sockeye	7.0		Pink	3.3
	Coho	6.2		Chum	6.9
	Pink	3.5	Prince William Sound		
	Chum	9.5		Chinook	24.5
Kodiak				Sockeye	6.0
	Chinook	14.3		Coho	9.1
	Sockeye	5.7		Pink	3.4
	Coho	8.2		Chum	7.8
	Pink	3.8	Southeast		
	Chum	7.3		Chinook	16.8
				Sockeye	6.1
				Coho	7.2
				Pink	3.3
				Chum	8.0

data from Division of Commercial Fisheries; ADF&G; based on total commercial fishery. Data as of 11/18/92.

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Campbell Creek	35, 36
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Irish Creek	39
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Frazer River	29, 30, 39
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