FRED Reports

FRED 1990 ANNUAL REPORT TO THE ALASKA STATE: LEGISLATURE

Edited by
Marianne McKean

Number 109

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

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Don W. Collinsworth
Commissioner

Brian J. Allee, Ph.D.
Director

P.O. Box 3-2000
Juneau, Alaska 99802-2000

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FRED's major objectives are the rehabilitation, enhancement, development, protection, and maintenance of the salmon, trout, sheefish, and grayling resources of the state for the use of all Alaskans. To accomplish these, FRED utilizes hatcheries, stream rehabilitation, lake stocking, and fishways as its basic tools. Hatcheries are about eight times more efficient in converting eggs to fish than the natural environment, and fishways open new spawning areas to anadromous fishes. FRED's Limnology, Coded-Wire Tag Processing, Genetic, and Pathology Laboratories continue to provide important information about the state's fishery resources. FRED encourages rehabilitation efforts by private nonprofit aquaculture associations and provides technical services to them.

Over 1.5 billion salmon eggs were collected for hatcheries in the State of Alaska during 1990 through the combined efforts of the FRED Division and private nonprofit hatchery operators.

During 1990 FRED released more than 228 million juvenile fish. Approximately 348.5 million eggs were taken for incubation during the year, and over 6.3 million salmon and trout returned in 1990 as a result of FRED projects.

Private nonprofit hatcheries throughout the state released over 925.2 million salmon and collected over 1.2 billion salmon eggs in 1990. An estimated 42.4 million adult salmon returned in 1990 as a result of private nonprofit hatchery operations.

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TABLE OF CONTENTS

Chapter **Page**

Chapter **Page**

Chapter **Page**

LIST OF TABLES

Table		Page

LIST OF FIGURES

PREFACE

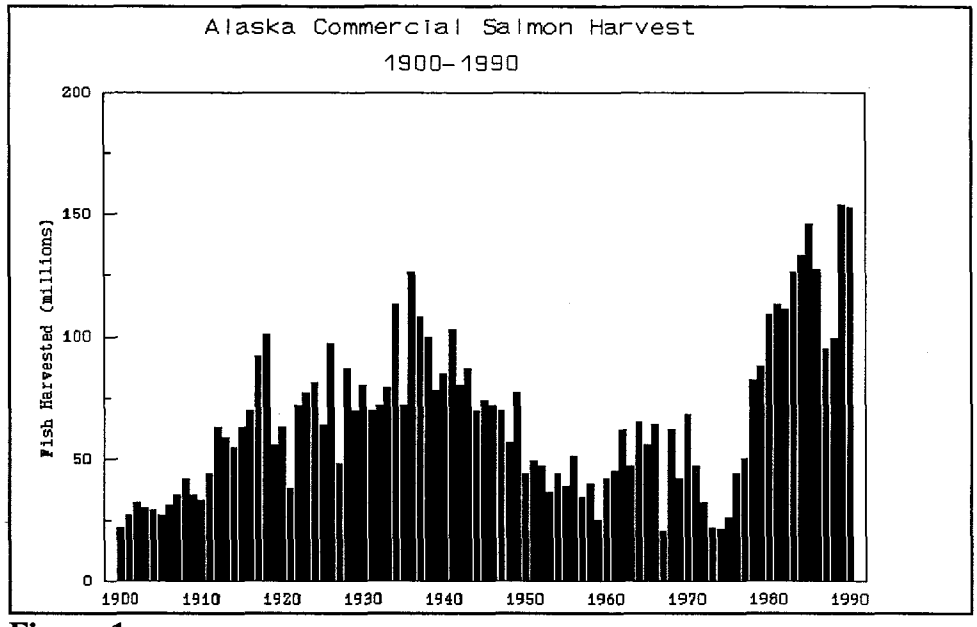

Figure 1

The Fisheries Rehabilitation, Enhancement and Development (FRED) Division of the Alaska Department of Fish and Game (ADF&G) was created in 1971 by the Alaska State Legislature and the Governor when the people of Alaska expressed grass roots support for an enhancement program to revitalize an ailing salmon fishing industry. Catches were at all-time lows (Figure 1), and the development of an enhancement program that would serve the state in both years of lean and bountiful salmon harvests was envisioned by Alaskans. Bond issues to build the public hatchery facilities were passed overwhelmingly during the 1970s. The FRED Division was given broad statutory authority by the Alaska State Legislature that directed the division "through rehabilitation, enhancement and development programs do all things necessary to insure perpetual and increasing production and use of food resources of Alaska waters and continental shelf area (AS 16.05.092)." In less than 20 years, the FRED Division has guided the development of the second largest salmon enhancement program in the world through development of technologies that have revolutionized salmon production. In addition, the division has sought and successfully implemented a unique partnership with the private sector.

The fisheries enhancement program in Alaska is a unique blend of government and private sector cooperation. The FRED Division's role is to provide technical services to the industry, effectively develop many areas of salmon technology, and successfully transfer that technology to the private sector. In the 1970s and early 1980s, the FRED Division developed hatchery production of pink and chum salmon in Alaska and worked with the state's private nonprofit salmon producers, helping them to acquire necessary skills to achieve their production goals. In the mid-1980s, the FRED Division initiated and developed lake and hatchery technology for production of sockeye salmon, eventually becoming the world leader in that area. This technology, along with most of the FRED Division's fully developed pink and chum salmon hatcheries, was transferred to the private sector in the late 1980s.

Through its unique partnership with the private sector, the FRED Division makes the enhancement program work, not by throwing governmental dollars at a problem, but by

facilitating a process through which the users can pay for programs that benefit them. This innovative leveraging of government funds is in keeping with what is to some a fundamental goal of government, complimenting private sector investment patterns, not substituting public for private investment.

Economic Benefits

FRED Division activities are a prime example of the basic economic principle that government should invest its money in activities that stimulate the economy. The overall economic impact of the Alaskan enhancement program has been phenomenal. In 1990 hatchery-produced fish represented 21% of the total statewide common-property salmon catch. The employment impact on the state's economy has been projected, using a model created by the University of Alaska's Institute of Social and Economic Research, to sustain over 3,500 resident jobs and $102 million in personal resident income at current levels of enhanced fish production.

Alaskans across the state are reaping the harvest of monies wisely invested in the state fisheries enhancement program. Enhancement-produced fish are extremely popular with anglers in Alaska, as evidenced by the high percentage of hatchery fish caught by sport fishermen. It is important to note that, although state salmon harvests have reached all-time highs in recent years, catches are not uniformly robust across the state.

Helping Alaskans Help Themselves...

The fisheries enhancement program is a prime example of government helping Alaskans to help themselves. The residents of the state saw a need and became participants in the enhancement program through fishermen's groups and other private organizations. The enhancement program impacts a broad cross-section of Alaskans through direct, indirect, and induced benefits through all sectors of the economy.

The FRED Division has developed a valuable resource of technical expertise and acts as a focal point of the government's interaction with the burgeoning private nonprofit salmon ocean ranching and shellfish mariculture industries. FRED Division personnel provide many services, including pathology, genetics, limnology, economics, biology, fish culture, engineering, and data management expertise to all salmon producers of the state.

Economic Development

The fisheries enhancement program, in general, can and does make a positive impact on the state's economy. A salmon price-forecasting model created for the FRED Division by the University of Alaska demonstrates that Alaskan salmon are undersupplied in the marketplace. Fishermen could be receiving greater revenues, if catches were increased. The FRED Division can direct economic opportunities through implementation of enhancement strategies designed to benefit specific geographic areas, always with the

goal of developing the technology and making it available to the private sector. Directed economic development through effective fisheries enhancement is being initiated in many new areas, such as the Yukon River, Norton Sound, and other northwestern Alaskan communities.

FRED in the 1990s

In the 1990s the FRED Division will expand its programs to regions of the state not yet directly benefiting from enhancement projects. It will continue to lead the salmon enhancement program and its private sector partners through technological development and application of technical services. It will move into new and critical areas, such as king crab, scallop, black cod, and halibut enhancement. It will expand its fisheries habitat rehabilitation efforts and become involved with restoration programs in oil spill-affected areas. In short, the FRED Division will continue to lead the nation in fisheries enhancement.

Based on the overwhelming success of the FRED Division program, there is a growing interest in using fisheries enhancement as a means for economic diversification for both rural and urban Alaska. From northwest to southeast Alaska, the public is seeking fisheries enhancement as an important economic tool because there is a positive return on this public investment. With projected oil production on the decline, the need to diversify the economy in all of Alaska becomes essential, and renewable natural resources become much more critical to Alaska's economy. The biological and economic potential of all of Alaska's fisheries can be more fully realized through fisheries enhancement.

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 Alaskan fisheries through the development and application of technologies in supplemental production and natural stock rehabilitation. The division's roles are: development of new enhancement technology; hatchery production for sport, subsistence, and non-cost-recovery commercial fisheries; technical services; habitat restoration and fisheries rehabilitation; regulation and management of the Private Nonprofit (PNP) Program; and 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 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). 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) and process fish transport permits and applications for PNP hatcheries (AS 16.10.440). 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 FRED Division's duties (AS 16.05.092) also include the annual presentation of a comprehensive annual report to the Legislature. This report, along with a detailed budget request, satisfies the division's reporting requirements.

Functions and Services

The FRED Division operates 16 hatcheries to produce salmonid fishes for subsistence, commercial, and sport fisheries. Fishpasses located throughout the state provide spawning and rearing habitat that would otherwise be unattainable to salmon stocks. The FRED Division maintains many of these fishpasses cooperatively with the U.S. Forest Service (USFS). The strategies of lake fertilization, habitat improvement, and fish stock introduction are used to provide improved freshwater survival and new production opportunities for salmon stocks.

The FRED Division operates five laboratories that serve ADF&G and other agencies. The Fish Pathology Section has two laboratories, one in Anchorage and one in Juneau, and provides diagnostic services and broodstock evaluation for both state and PNP fisheries programs. The Limnology Section has a laboratory in Soldotna and supervises all lake enrichment projects and analyses of water, plankton, and aquatic insect 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 Genetic 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 the regional salmon planning teams that are comprised of ADF&G and regional aquaculture association members. The PNP Program Office coordinates the review of PNP hatchery applications and the permitting process, which includes hatchery, scientific/educational, and fish transport permits.

The FRED Division also 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 1990 with 28 active farms in the state and 41 proposed farms pending final permit action. Species now farmed and/or being proposed for farming include oysters, mussels, scallops, abalone, clams, and aquatic plants.

CHAPTER 2

FRED PRODUCTION SUMMARY

Total production for the FRED Division was slightly over 6.3 million fish in 1990 (Figure 2.1). This represents a decrease of approximately 5.75 million fish from the 1989 production figure. The primary cause for this drop in production was the poor pink salmon return of both wild and hatchery-produced fish to Kodiak and Cook Inlet. The common-property commercial catch of FRED Division-produced fish increased by 1.6 million fish in 1990. This increase is due, in part, to outstanding sockeye salmon returns and the fact that the 1989 commercial catch was reduced by oil spill fisheries closures. Production figures in all areas of the state for species other than sockeye and pink salmon remained consistent with prior-year numbers. Chinook and chum salmon production slightly increased in 1990, while while production of coho salmon production slightly decreased. Sockeye salmon production increased significantly, while pink salmon production decreased significantly. Nonanadromous species production decreased as well.

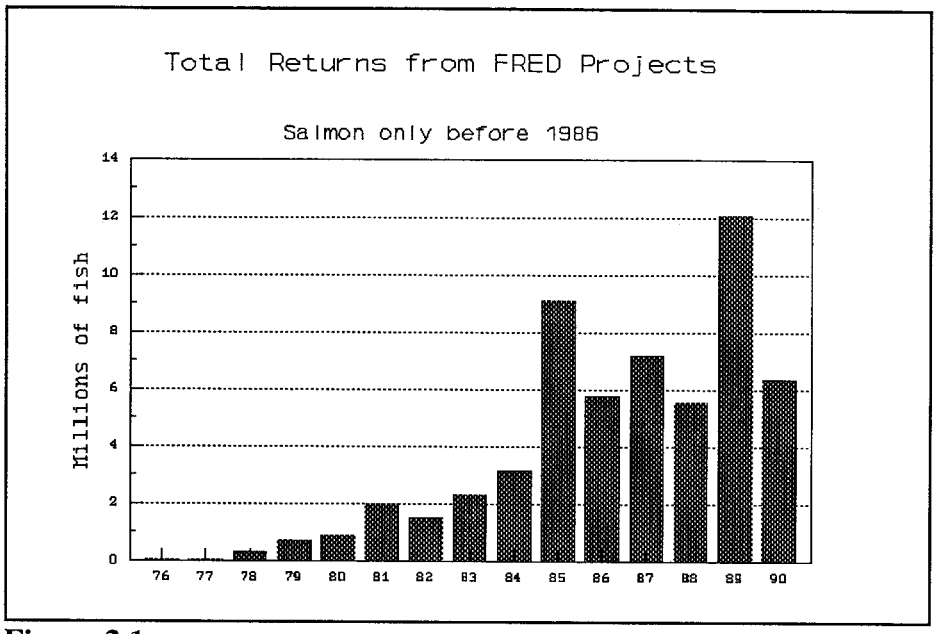

Figure 2.1

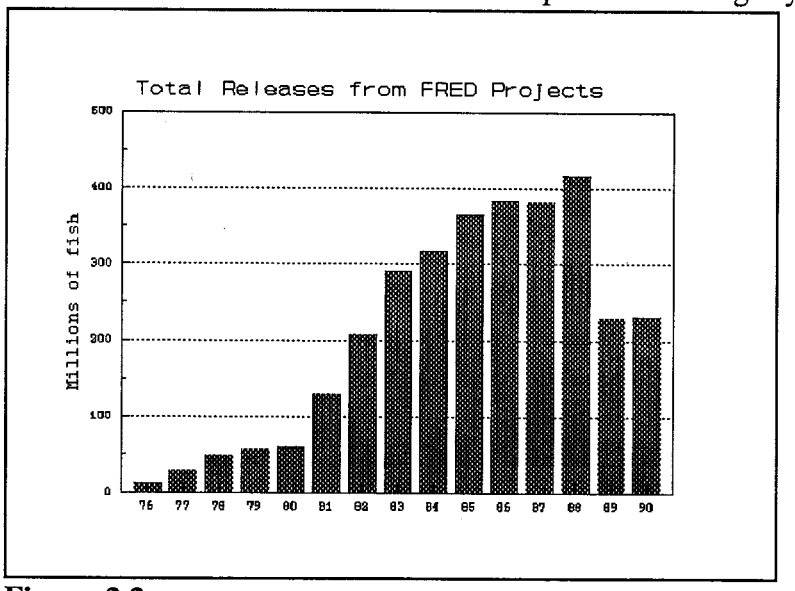

Figure 2.2

Releases of fish from FRED Division facilities totaled 231 million fish in 1990, 2 million more than in 1989 (Figure 2.2).

Over 123 million pink salmon were released, predominately from Kitoi Bay Hatchery. Release numbers were

consistent with last year's numbers.

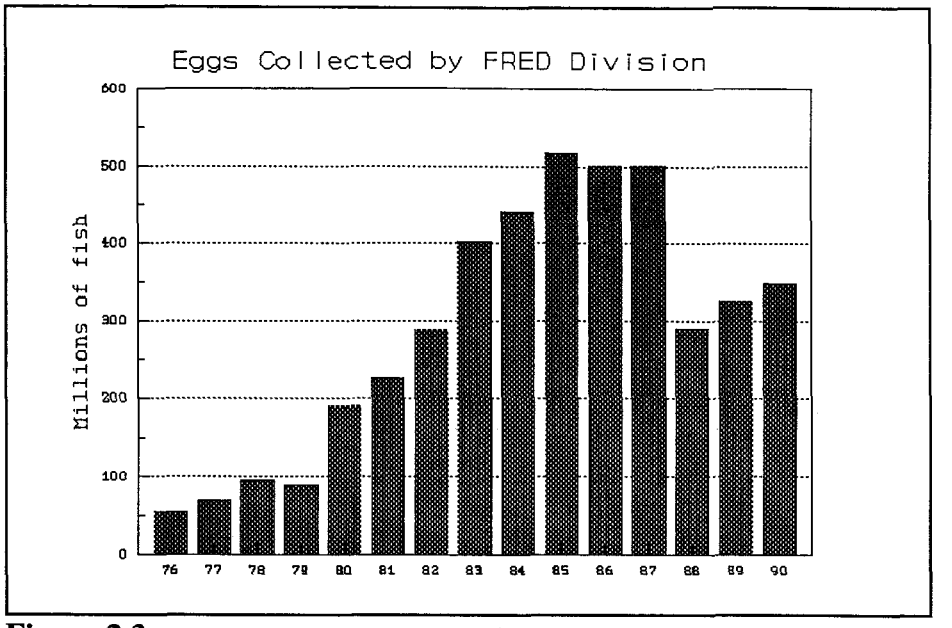

Figure 2.3

Egg-take information provided in Figure 2.3 shows an increase in the number of eggs taken for FRED Division activities in 1990. Over 348.5 million eggs were taken in 1990, compared to 324.7 million eggs taken in 1989. An increase in pink salmon eggs occurred in 1990 due to expansion in the incubation capacity of the Kitoi Bay Hatchery. Coho and sockeye salmon egg-take numbers decreased, while chinook and chum salmon egg-take numbers increased.

CHAPTER 3

SOUTHEAST

Summary of FRED Projects

The FRED Division has 3 area offices and operates 5 hatcheries in southeast Alaska. A 6th state-owned hatchery in this region is operated by a regional aquaculture association via contract. Area offices are located in Juneau, Petersburg, and Ketchikan. State-operated hatcheries in southeast Alaska include: Snettisham, approximately 40 miles south of Juneau; Crystal Lake, on the road system outside of Petersburg; Deer Mountain and Beaver Falls in Ketchikan; and 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). In southeast Alaska, as well as in other regions of the state, the FRED Division uses hatcheries as primary tools of enhancement; still, other strategies are employed as well, such as fishpasses, spawning channels, lake fertilization, lake and stream stocking, and habitat restoration.

Deer Mountain Hatchery, located in Ketchikan's City Park, produces chinook and coho salmon and steelhead trout primarily intended for local sport fisheries. During 1990, 116,000 chinook salmon, 43,000 summer coho salmon, and 4,530 steelhead trout smolts were released into Ketchikan Creek. Although the hatchery is not a high-volume producer, additional releases of coho and chinook salmon at several remote sites help to disperse the benefits of this hatchery. Most of the 220,000 chinook salmon now rearing will be released into Ketchikan Creek. Returns from previous releases into the creek provided 297 chinook salmon to local commercial fisheries and 460 to sport and personal-use fisheries in 1990, as well as ample escapement to meet broodstock needs. Two Prince of Wales Island remote releases, Thorne Bay and Big Salt Lake, are again being planned. The community of Coffmann Cove, on Prince of Wales Island, is also interested in becoming a remote-release site.

In 1990 hatchery staff transported chinook salmon smolts to Thorne Bay, adjacent to Prince of Wales Island, for imprinting and release from saltwater net pens. Local residents volunteered to feed and care for the smolts during the 10-day acclimation and imprinting period. Adult production should exceed 1,200 fish, contributing to sport and commercial fisheries in the Thorne Bay area.

Nearly 103,000 brood year (BY) 89 summer coho salmon are being reared at Deer Mountain Hatchery and are scheduled for release in 1991. An adult return of 10,300 coho salmon to the Ketchikan area in 1993 is possible from these releases.

Ward Lake has been stocked since 1987 with summer coho salmon presmolts that emigrate during the following spring. This has become a popular local project, evidenced by the nearly 2,400 adults that were intercepted by commercial fishermen in 1990. A significant roadside fishery at Ward Cove has developed and, although no

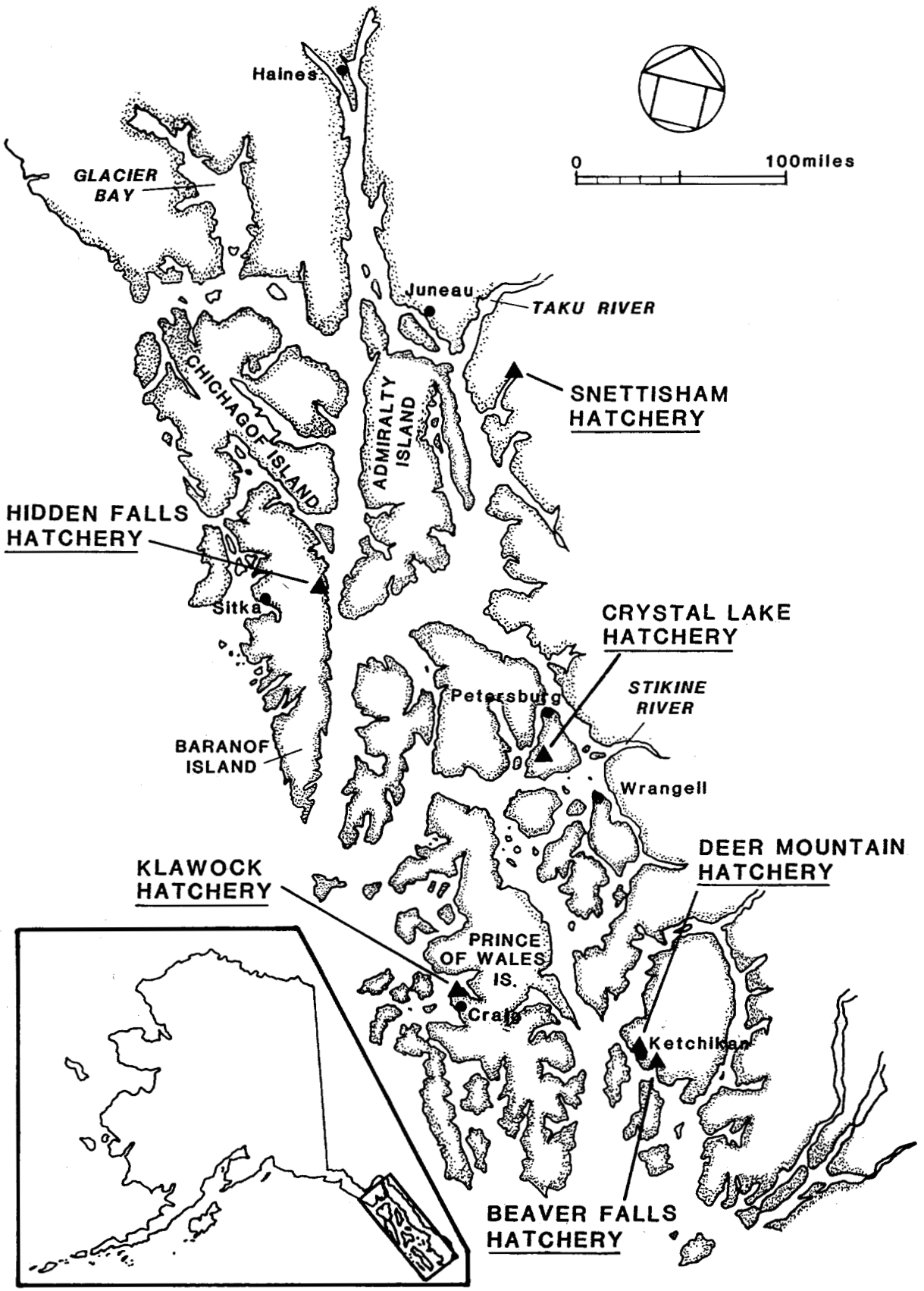

Figure 3.1. Map of Southeast.

formal evaluation has occurred, the angler harvest was around 200-300 fish in 1990. Approximately 37,000 presmolts were planted in December 1990 and should yield a total return of approximately 3,700 adults in 1992. Marine survival of summer coho salmon planted into Ward Lake has been as high as 11% (1990 returns). Tagged summer coho salmon returns to Ward Lake were used for part of the Deer Mountain Hatchery broodstock in 1990. Deer Mountain Hatchery's brood source population of summer coho salmon is being enhanced through fry and presmolt plants into Reflection Lake. The first substantial returns from planted fry will occur in 1991. Approximately 29,000 presmolts were planted in December 1990. The projected total return, over a 2-year period, will be at least 1,450 fish.

Personal-use dipnet fishing was open at Ketchikan Creek for 2 days in 1990. Deer Mountain Hatchery summer coho salmon were included in the catch for the first time. FRED Division personnel monitored the fishery and recovered coded-wire tags; the public responded with a large turnout. Ketchikan Creek was open to sport fishing on 1 September, two weeks earlier than usual, so that anglers could take advantage of the remaining summer coho salmon. Deer Mountain Hatchery staff were able to produce 45-g, osmocompetent, age-one (yearling) steelhead trout smolts in 1990. All smolts were transported to a net pen in the estuary (Thomas Basin) of Ketchikan Creek and acclimated for 10 days before release.

Adult rainbow trout were captured in Carlanna Lake in Ketchikan. Kidney samples were sent to the FRED Division Juneau Pathology Laboratory for bacterial kidney disease (BKD) analysis. Although BKD bacteria were identified in this stock, the stock could still be cultured at the Deer Mountain Hatchery because BKD was already present at the hatchery. The juveniles will be planted back into Carlanna Lake. If problems with public access to the lake can be solved, this project could create an important recreational fishery for Ketchikan.

Beaver Falls Hatchery, a central incubation facility (CIF) near Ketchikan, produced more than 4 million sockeye salmon fry in 1990 from McDonald and Hugh Smith Lakes' stocks. Resultant adult returns are expected to number 98,000. Beaver Falls Hatchery was converted from a chum salmon facility to a CIF for sockeye salmon in 1985 in response to the FRED Division's sockeye salmon initiative in southeast Alaska. The CIF has the capability of culturing 5 different salmon stocks in complete isolation that will provide sockeye salmon fry for the division's continuing cooperative projects with the USFS. Operation of the Beaver Falls Hatchery was not funded for fiscal year (FY) 1991 and was transferred, perhaps temporarily, to the Southern Southeast Regional Aquaculture Association (SSRAA). SSRAA is presently culturing BY 90 sockeye salmon in 1 of the association's 5 isolation modules.

Approximately 1.5 million sockeye salmon fry were planted back into Hugh Smith Lake from eggs collected there in 1989. Lack of escapement continues to be the main obstacle in maintaining a satisfactory level of production. One million emergent sockeye salmon fry were planted into McDonald Lake this year in conjunction with a lake fertilization program, and nearly 700,000 emergent sockeye salmon fry were planted into Badger Lake.

The USFS completed a fishpass on the outlet to Virginia Lake 2 years ago. Sockeye salmon planting above the pass will augment the natural colonization process. In 1990, 889,000 emergent sockeye salmon fry were planted above this fishpass.

Klawock Hatchery, on Prince of Wales Island, reared 1.35 million coho salmon fingerlings from the 1989 brood. Most of these coho salmon were released into Klawock Lake as presmolts in December 1990. The remaining 70,000 will be released as smolts in May 1991 to test the effect of this release strategy on marine survival. An estimated 67,500 adult coho salmon will return in 1992 because of these releases. This hatchery contributes heavily to southeast Alaska commercial fisheries; the 1990 contribution was 27,400 coho salmon. Scale-pattern analysis in previous years has shown that an average of 85% of the coho salmon returning are of hatchery origin.

Steelhead trout eggs from BY 90 were incubated in heated water to accelerate development. Also rearing are 5,400 BY 89 steelhead trout. These were retained at the hatchery because of their small size last spring but, by December 1990, these trout averaged 225 g. An appropriate nonanadromous stocking location is being sought for possible development of a "put-and-take" steelhead trout fishery for Prince of Wales Island. Reinstatement of chum salmon production at Klawock Hatchery is being investigated: 150 ovarian fluid samples were collected from spawning females in 1990 for infectious hematopoietic necrosis virus (IHNV) testing by the Juneau Fish Pathology Laboratory.

Klawock Hatchery staff were able to produce osmocompetent steelhead trout smolts this year by making several changes in fish culture practices to maximize growth and minimize human disturbance. Nearly 16,000 adipose-clipped smolts were released into Klawock Lake in May.

Limited broodstock availability in the Klawock River continues to plague development of a major sockeye salmon program. Two strategies were implemented in 1990 to maximize sockeye salmon production: (1) A portion of the sockeye salmon fry released from Klawock Hatchery in 1990 were reared for 1.5 months, growing from 0.15 g to 2.25 g before release into Klawock Lake. The sockeye salmon were reared in an isolation room, supplied with disease-free "city" water, and provided with a backup ultraviolet depuration system. Hatchery staff designed and modified an Archimedes screw to move emergent fry uphill from a collection box to the rearing troughs. Placing an electronic fry counter in line at the top of the screw allowed movement and enumeration of emergent fry with a reduction in staff time; and (2) collection of sockeye salmon broodstock and eggs was conducted at Three-Mile Creek on Klawock Lake, thus avoiding having to hold adult sockeye salmon in the hatchery raceways for ripening. In the past, holding at the hatchery has resulted in unacceptable levels of prespawning mortality.

Coho salmon in excess of broodstock and escapement goals were distributed to the public by hatchery staff, with particular attention to local residents that are unable to fish. This year 993 coho salmon were given away. The sale of 3,388 coho salmon carcasses to a local processor helped fund hatchery operations.

The Snettisham Hatchery is located at the head of Speel Arm in Port Snettisham and is approximately 30 air miles east of Juneau. The facility is located at the outfall of a large

hydroelectric facility that provides the majority of Juneau's electricity. This facility also provides Snettisham Hatchery with two of its greatest assets: abundant good quality water and inexpensive electricity. Snettisham Hatchery became operational in 1981, although pilot studies were started in 1976. In 1984 capital improvement project (CIP) funds were acquired to complete the initial phases of the hatchery. Full-production capacity is now 40 million chum salmon eggs and 5 million chinook or coho salmon eggs.

Approximately 230,000 chinook salmon eggs were taken at the hatchery in 1990. About half the hatchery eggs (110,000) were of King Salmon River stock origin, and those eggs, along with an additional 72,000 obtained at the King Salmon River, were transferred to Little Port Walter for broodstock development purposes. In addition, Snettisham Hatche ry staff collected 210,000 coho salmon eggs from the final brood return of the coho salmon program.

In 1988 a major addition was built at the site to culture sockeye salmon. Construction of a 25 million-egg CIF for sockeye salmon is being provided as part of U.S./Canada Pacific Salmon Treaty mitigation. At present, a temporary incubation area is being used for sockeye salmon culture at an interim level of 10 million eggs.

The sockeye salmon production phase of Snettisham Hatchery became operational in 1988 when a small number of eggs were collected at Speel Lake, both to help rehabilitate the stock and to assess techniques to be employed in the CIF. One of these techniques utilizes the chilling of incubation water to delay emergence of the fry until ice is off the lake to be stocked. The other technique is the thermal marking of the otolith of developing embryos. It was shown that an identifying mark can be placed on the otolith by sharply changing the temperature during the incubation period. The successful use of this technique on sockeye salmon was a breakthrough for the FRED Division's sockeye salmon program.

In 1990, 2.4 million sockeye salmon eggs were collected at Speel Lake and 800,000 at Crescent Lake. The Speel Lake eggs will be used to stock Sweetheart Lake for supplementary sockeye salmon production, while the Crescent Lake eggs will be used to rehabilitate that system. Additionally, the following numbers of eggs were received from Canadian systems: 4.7 million eggs from Tahltan Lake on the Stikine River, and 2.4 million and 1.1 million eggs from Tatsamenie and Trapper Lakes, respectively, on the Taku River. The resultant fry will be returned next spring for enhanced production at the respective lakes. Sockeye salmon production is one of Snettisham Hatchery's most promising programs.

Crystal Lake Hatchery, located 17.5 miles south of Petersburg on Mitkof Highway, began operation in 1972 and is designed for long-term rearing of salmon and trout. Long-term annual hatchery production objectives are to rear 1.3 million chinook salmon smolts, 100,000 coho salmon smolts, and 43,000 steelhead trout smolts for a return of 60,000 adult chinook salmon, 6,000 adult coho salmon, and 2,000 adult steelhead trout, respectively. Besides smolt production, 3 isolation modules are capable of incubating 200,000 eggs and rearing 60,000 fry to a size of 2 g, or 12,000 smolts to a size of 10 g. The isolation modules are used to stock underutilized habitat for U.S./Canada projects and for cooperative fishway projects with NSRAA, SSRAA, and the USFS. Annually,

500,000 chinook salmon smolts from Crystal Lake Hatchery are taken to the Earl West Cove remote release site in a cooperative project with SSRAA and the USFS.

Crystal Lake Hatchery is the major chinook salmon brood source for both state and PNP hatcheries in northern Southeast. Adult spawners used for broodstock elsewhere are screened for BKD; gametes from each positive spawner are discarded. Originally, Crystal Lake Hatchery operated by using heated, recirculating water, but now operates utilizing a single-pass water system. Investments are being made to replace or repair operational features at Crystal Lake Hatchery to improve efficiency. The hatchery crew filled the production incubators with approximately 1.7 million chinook salmon eggs and 402,500 coho salmon eggs. Crystal Lake Hatchery staff also obtained 3.77 million green chinook salmon eggs for distribution to 4 other northern Southeast hatcheries in addition to transferring 320,000 of its own eyed eggs to 1 of these 4 facilities.

FRED Division personnel cooperated with other agencies, primarily the USFS and PNP hatchery operators, in many nonhatchery projects in 1990. Fishpass projects were particularly evident in the Southeast Region. Information on these fishpasses can be found under the Fish Habitat Enhancement and Improvement Section in Chapter 9.

One function provided by Southeast Region staff is aid to the private sector. The general charge is to provide technical expertise on enhancement to other agencies and organizations, such as the USFS, Douglas Island Pink and Chum, Inc. (DIPAC), PNP hatchery operators, teachers in Juneau and Skagway, and others. Support includes such activities as participation in projects, such as the Skagway School District's hatchery and Chilkat chinook salmon investigations.

Another of the FRED Division's strategies is to provide appropriate research so that enhancement, rehabilitation, and development activities can be optimized. Some of this research is summarized below.

Klawock Coho Salmon Rearing-Density Trial - A rearing-density study is being conducted on approximately 35,000 summer coho salmon being reared in 2 groups. These fish were planted into Ward Lake in November 1990 as presmolts. Information on marine survival of these groups will help to refine fish-culture practices; other rearing-density research has focused on smolt releases.

Klawock Coho Salmon Diet Trial - Returns to the commercial fisheries of coho salmon fed either Rangen feed (dry) or Oregon Moist Pellet (OMP) (moist, frozen) show no significant difference in marine survival resulting from in-hatchery diet (1.15% vs. 1.32%). If the results are confirmed by coded-wire tags recovered at the hatchery weir in 1990, large-scale use of the dry feed, which is far less expensive to ship and store, can be implemented. The 1989 return of groups fed the same two diets showed a 1.8% return for OMP and a 3.4% return for Rangen.

Klawock Holding Trial - The 1990 returns of the BY 86 coho salmon have provided some interesting information. Most were released into Klawock Lake in December 1987 to overwinter and emigrate in the spring of 1988. However, one group was transferred to net pens in Klawock Lake in September 1987 for the final 3 months of rearing. Coded-wire tag recoveries show that the net-pen group

had a 6.32% return to the 1990 commercial fisheries, while the average contribution of all other groups was 1.4%. Rearing coho salmon in net pens in Klawock Lake means a savings in labor as well as better marine survival. In this second year of research, groups of BY 89 coho salmon are being reared to 2 final densities, 0.82 lb/ft^3 and 2.75 lb./ft^3, and released at 2 life stages, presmolt and smolt. All four experimental groups will be coded-wire-tagged. This project and the coho salmon presmolt project at Deer Mountain Hatchery are "pioneer" projects—the first rearing-density research involving presmolt releases.

Deer Mountain Triploid Study - Four age-1.1 chinook salmon from the BY 87 triploid group returned to Ketchikan Creek in 1990. Staff obtained blood samples from 2 fish and sent the samples to the Northwest and Alaska Fisheries Center in Seattle for analysis to find whether these 2 fish were either truly triploid or from the 15% of the group that were not successfully genetically altered by the thermal shock treatment administered shortly following fertilization.

Deer Mountain BKD Study - A group of coho salmon and a group of chinook salmon are being reared to the smolt stage in ultraviolet-depurated hatchery water in an attempt to determine the effect on BKD incidence. Kidney samples will be analyzed for the presence and intensity of the BKD organism in January and May 1991. Both experimental groups and their corresponding control groups have been coded-wire-tagged for evaluation of marine survival. Tag returns of BY 86 summer coho salmon to Ketchikan Creek show that the group released on 23 May had 10% marine survival and the group released on 12 May had 5% marine survival.

Deer Mountain Holding Trial - A group of 30,600 chinook salmon were transported to Thomas Basin for 10 days' acclimation to saltwater net pens before their release on 21 May. A group of 85,500 chinook salmon were released from Deer Mountain Hatchery on the same day. Relative survival of the 2 groups will show the importance of acclimation in net pens versus natural migration downstream.

Deer Mountain Chinook Salmon Diet Trial - Returns of BY 84 chinook salmon from a diet trial of Alaska Dry Pellet (ADP) and OMP are complete: Total marine survival was 4.5% for ADP and 4.1% for OMP. There were no differences in size of smolts at release or in size of returning adults in the various age classes.

FRED Division personnel participated in many types of projects other than hatcheries in 1990. Below is an example of projects undertaken in southeast Alaska.

Tahini River Chinook Salmon Investigations - The Tahini River is a tributary of the Chilkat River near Haines. The Chilkat River has experienced a decline in chinook salmon production during the last few years, and a project has been initiated by the ADF&G Commercial Fisheries and Sport Fish Divisions to investigate causes of that decline. As part of those studies, a program was begun in 1989 in which chinook salmon eggs are collected from the Tahini River and the fry coded-wire-tagged before being planted back into the river during the following spring. This technique provides marked fish in the system for later evaluation in the fisheries, as well as enhanced production. FRED Division staff

provide operational and technical assistance for the chinook salmon egg takes on the Tahini River and the fry transports to the river system. Approximately 70,000 eggs were collected in 1990 and are being incubated at a scientific/educational facility at the Jerry Myers Hatchery in Skagway. Approximately 35,000 coded-wire-tagged fry will be returned to the river and around 15,000 fry will be retained at Pullen Creek for release as smolts. In 1990 FRED Division staff provided support for the tagging and transport of 30,146 BY 89 fry back to the Tahini River.

Lutak Inlet Smolt Stocking - As part of a concern for the status of chinook salmon in the Chilkat River, the Haines Fish and Game Advisory Committee and local sportsmen association have asked for smolt releases in the Haines area that will produce returns in places where effort can be directed away from the wild stock. Because any fish released in this area would have to be from a stock of local origin, the lack of smolts with the correct "pedigree" has precluded a project. However, when NSRAA decided to discontinue use of the Tahini stock of chinook salmon at Hidden Falls Hatchery, suitable fish became available. FRED Division personnel obtained the permits to release approximately 38,600 Tahini River-origin smolts at Lutak Inlet in 1990. FRED Division staff also developed and completed the cooperative agreement, provided and installed the net pen, and transported the smolts from Hidden Falls Hatchery to the Lutak Inlet site. This successful transport was especially noteworthy in that it took over 19 hours.

Turner Lake Assessment - The department's proposal to stock Turner Lake with sockeye salmon was the subject of environmental review by the USFS. ADF&G played an active role in this process. FRED Division staff had the lead role in 1990 in preparing an environmental impact statement for the project. Although the project's status was made inactive in early 1990, it still required significant input by FRED Division staff.

Southeast Highlights

- Klawock Hatchery contributed more than 27,000 coho salmon to the commercial fisheries.

- Personal-use dip-net fishing on Ketchikan Creek was open for 2 days in 1990. Deer Mountain Hatchery summer coho salmon were included in the catch for the first time. A total of 251 coho salmon and 195 chinook salmon were harvested.

- In 1990 Deer Mountain Hatchery staff were able to produce 45-g, osmocompetent steelhead trout smolts in 1 year. Growth was maximized by changes in fish-cultural practices.

- Area and hatchery staff implemented a pilot project at Deer Mountain Hatchery to collect program receipts from tourists. More than 220 people responded during the 2-month trial period. The net monetary benefit to operations is expected to be nearly $1,000, including cash donations of approximately $575. One of the products of this program is a newsletter that contributes to public education on

the hatchery program and salmon biology. There is good potential for improving the program in 1991.

- Returns of BY 84 chinook salmon to Deer Mountain Hatchery from a diet trial of ADP and OMP are complete. Total marine survival was 4.5% for ADP and 4.1% for OMP. There were no differences in size of smolts at release or in size of returning adults in the various age classes.

- Coho salmon escapement to Klawock River in 1990 was again in excess of 10,000, and the egg-collection goal of 1.7 million is expected to be met. Scale-pattern analysis in previous years has shown that an average of 85% of the returning coho salmon are of hatchery origin.

- For the first year in a continuing program, Snettisham Hatchery released 1 million sockeye salmon fry into Tahltan Lake in Canada as part of U.S./Canada Pacific Salmon Treaty mitigation.

- More than 20% of the chinook salmon harvested in the Juneau sport fishery during the last 3 years have been of hatchery origin; Snettisham Hatchery was the major contributor.

- Alaskan hatchery chinook salmon contributions to the troll fishery in Frederick Sound are growing steadily, approaching 50% of the local catch.

- Crystal Lake Hatchery chinook salmon stocks provided approximately 18,720 fish to the commercial, sport, and personal-use fisheries in 1990.

Southeast Returns and Fishery Contributions

FRED Division projects produced a return of over 570,000 salmon to southeast Alaska in 1990 (Table 3.1). For the first time in this region the dominant state project-produced fish was the sockeye salmon, accounting for 233,000 fish in 1990; Beaver Falls Hatchery, Bakewell Fishpass, and Klawock Hatchery produced the returning fish. In the future, the CIF at Snettisham also will be contributing significantly to the sockeye salmon fishery. The dominance of sockeye salmon reflects the programmatic changes that have been occurring within the FRED Division. Pink and chum salmon hatcheries are being contracted to the private sector while the FRED Division develops new fish-cultural technology for other species, such as sockeye salmon. The sockeye salmon initiative, begun in 1987, uses hatchery, lake stocking, and lake enrichment to produce sockeye salmon in Southeast. Pink salmon had the second-highest number of returns numbering 200,000 fish. This is significantly lower than the 1989 return of 362,000; this is due to odd-/even-year run timing. The FRED Division's Southeast coho salmon projects produced nearly 86,000 fish; nearly 34,000 chinook salmon were produced as well. Production from existing Alaskan chinook salmon enhancement programs is not expected to peak until the mid-1990s.

Harvest estimates of Alaskan hatchery chinook salmon indicate that state projects provided approximately 24,000 of this prized species to southeast Alaska fisheries in

Table 3.1. Estimated contribution of fish by FRED hatcheries and projects in 1990.

Hatchery or Project	Species	Commercial Catch	Sport Catch	Personal Use	Subsis-tence	Brood Stock/ Escapement	Total	Comments
ARCTIC-YUKON-KUSKOKWIM								
Clear	Coho		18,614				18,614	1989 Sportfish harvest data
	Grayling		1,895				1,895	1989 Sportfish harvest data
	A char		359				359	1989 Sportfish harvest data
Fort Richardson								
Interior lakes	Rainbow		74,765				74,765	1989 Sportfish harvest data
Sikusuilaq	Chum	5,000			3,000	6,000	14,000	
AYK TOTALS:		5,000	95,633	0	3,000	6,000	109,633	
COOK INLET								
Big Lake								
Big Lake	Sockeye	61,400		5,500		41,400	108,300	
	Coho	2,000	600	100		2,000	4,700	
Cottonwood Cr Dr.	Coho	400	200			200	800	
Wasilla Creek	Coho	200	100			100	400	
Jim Creek	Coho	300	150			150	600	
Rabbit Slough	Coho	200	100			100	400	
Landlocked Lakes	Coho		11,041				11,041	1989 Sportfish harvest data
Crooked Creek								
Crooked Creek	Coho		880			1,220	2,100	
	Steelhead		160			190	350	
Tustumena Lake	Sockeye	134,000		2,900		57,000	193,900	
Leisure Lake	Sockeye	49,600	3,500			1,000	54,100	24% of LCI sockeye
Chenik Lake	Sockeye	70,150		200		21,800	92,150	34% of LCI sockeye
Port Dick Lake	Sockeye	11,700		100		200	12,000	
Kirschner Lake	Sockeye	16,700				300	17,000	
Elmendorf								
Crooked Creek	Chinook	0	4,750	80		1,710	6,540	In addition to Crooked Creek Hatc

Table 3.1. Continued

Hatchery or Project	Species	Commercial Catch	Sport Catch	Personal Use	Subsis-tence	Brood Stock/ Escapement	Total	Comments
Halibut Cove	Chinook	800	1,500				2,300	
Homer Spit	Chinook		2,200				2,200	
	Coho		3,500	1,600			5,100	Some of 1600 is subsistence
Seldovia	Chinook	340	1,000				1,340	Second year of returns
Ship Creek	Chinook	160	650			1,000	1,810	1989 Sportfish harvest data
	Coho	1,350	1,330			800	3,480	1989 Sportfish harvest data
Resurrection Bay	Chinook		940				940	1989 Sportfish harvest data
	Coho		5,000				5,000	1989 Sportfish harvest data
Fort Richardson								
Willow Creek	Chinook	200	1,400			390	1,990	
Little Susitna	Coho	3,000	2,400			3,600	9,000	
Cook Inlet lakes	Rainbow		89,041				89,041	1989 Sportfish harvest data
	Coho		15,617				15,617	1989 Sportfish harvest data
Tutka Bay Lagoon								
Kachemak Bay	Pink	50,000	2,000			106,700	158,700	43% (with HCL) of LCI pink harv
	Chum	1,000				1,000	2,000	
Halibut Cove	Pink	117,200					117,200	
Ingram Creek	Pink	200	200				400	1989 data
Homer Spit	Pink		600				600	
Clear								
Landlocked lakes	Grayling		66				66	1989 Sportfish harvest data
	A Char		722				722	1989 Sportfish harvest data
COOK INLET TOTALS:		520,900	149,647	10,480	0	240,860	921,887	*
KODIAK/ALASKA PENINSULA								
Kitoi Bay	Pink	539,500				190,650	730,150	
	Chum	4,100				21,200	25,300	
	Coho	2,000				500	2,500	Anadromous returns only.
Kodiak Lakes	Coho	3,000	5,000		2,500	1,000	11,500	See footnote.

Table 3.1. Continued

Hatchery or Project	Species	Commercial Catch	Sport Catch	Personal Use	Subsis-tence	Brood Stock/ Escapement	Total	Comments
Landlocked lakes	Coho		60				60	1989 Sportfish harvest data
	Rainbow		1,046				1,046	1989 Sportfish harvest data
	Grayling		189				189	1989 Sportfish harvest data
Karluk	Sockeye	1,491,000				738,000	2,229,000	
Frazer fishpass	Sockeye	800,000				226,700	1,026,700	Fishpass operated by Comm Fish
Afognak Fishpasses	Coho	2,100				6,400	8,500	See footnote. Operated by Comm
(combined)	Pink	0				7,100	7,100	See footnote. Operated by Comm
	Sockeye	150				18,200	18,350	See footnote. Operated by Comm
Waterfall Fishpass	Pink	52,845					52,845	See footnote.
Russell Creek	Pink					20,200	20,200	See footnote.
KODIAK/AK PEN TOTALS:		2,894,695	6,295	0	2,500	1,229,950	4,133,440	
PRINCE WILLIAM SOUND								
Elmendorf								
Whittier	Coho		1,000				1,000	
Fort Richardson								
Cordova	Coho		10,000				10,000	
PWS Lakes	Rainbow		5,431				5,431	1989 Sportfish harvest data
Gulkana	Sockeye	140,700	few			93,500	234,200	Bstock includes Subs and Pers use
Main Bay	Sockeye	9,000					9,000	1-ocean jacks
	Chum	320,000				1,000	321,000	Mostly cost-recovery
Clear	Grayling		2,181				2,181	1989 Sportfish harvest data
PWS TOTALS:		469,700	18,612	0	0	94,500	582,812	*

Table 3.1. Continued

Hatchery or Project	Species	Commercial Catch	Sport Catch	Personal Use	Subsis-tence	Brood Stock/ Escapement	Total	Comments
SOUTHEAST REGION								
SOUTHERN								
Bakewell	Sockeye	7,392	50			120	7,562	
Big Salt Lake	Chinook	46					46	
Bold Island	Chinook	3					3	
Cable Creek	Coho	84				5	89	See footnote.
Craig	Chinook	23	4				27	
Deer Mountain	Chinook	447	92	194		637	1,370	
	Coho	2,050	290	143		3,110	5,593	
Dog Salmon	Pink	23,500				4,700	28,200	1st year opened, no catch
	Coho	68				114	182	
Hugh Smith Lake	Sockeye	2,615				1,269	3,884	
Fish Creek-Hyder	Chum	194				375	569	
Ketchikan Creek	Pink	64,000	1,100			11,500	76,600	Fishpass. See footnote
Klawock	Coho	27,430	1,300	993		9,095	38,818	
	Steelhead		300			105	405	
	Sockeye				3,500	1,300	4,800	
McDonald Lake	Sockeye	100,000				117,000	217,000	
Marten River	Chinook	40	10			131	181	
Reflection Lake	Coho	31				15	46	
Sunny Creek	Pink	79,800				15,961	95,761	Fishpass. See footnote
Thorne Bay	Chinook	51	2				53	
Tunga Lake	Coho	5,359				300	5,659	See footnote.
Ward Creek	Coho	2,378	303			3,566	6,247	Reared at Deer Mtn Hatchery. See
CENTRAL								
Crystal Lake	Chinook	4,640	2,280			7,920	14,840	
	Coho	3,800	200			2,130	6,130	See footnote
Earl West Cove	Chinook	11,150	70	40			11,260	Joint release with SSRAA
Ohmer Creek	Chinook	410					410	
Farragut	Chinook	85				80	165	
Harding River	Chinook	45					45	
Irish Creek	Coho	6,000					6,000	Fishpass

Table 3.1. Continued

Hatchery or Project	Species	Commercial Catch	Sport Catch	Personal Use	Subsis-tence	Brood Stock/ Escapement	Total	Comments
Slippery Creek	Coho	700					700	
St. John's Creek	Coho	37					37	
NORTHERN								
Chilkat Ponds	Coho	1,000				250	1,250	
Doty Cove	Chum	4,000					4,000	
Eliza Lake	Chinook	38				57	95	
Jerry Myers	Chinook	36	19			5	60	
Indian Lake	Coho	692				172	864	
Indian River	Chinook	9				14	23	
Juneau/DJ	Chinook	753	707			688	2,148	Juneau/DJ = Fish Cr, Sheep Cr,
	Coho	6,983	1,073			4,575	12,631	Montana Cr, Auke Cr,
Snettisham	Chinook	569	464			246	1,279	Dredge L, Twin Lakes
	Coho	1,185	21			300	1,506	
	Chum	8,000				3,000	11,000	
Twin Lakes	Chinook		2,000				2,000	
Tahini River	Chinook	13	12			25	50	
Southeast Totals:		365,656	10,297	1,370	3,500	188,765	569,588	
STATE TOTALS:		4,255,951	280,484	11,850	9,000	1,760,075	6,317,360	

BY SPECIES:				
	Chinook	51,175	Steelhead	755
	Coho	196,164	Rainbow	170,283
	Chum	377,869	Grayling	4,331
	Sockeye	4,227,946	A Char	1,081
	Pink	1,287,756		
		6,140,910		176,450

Footnote: Most estimates are based upon a combination of historical data, standard survival assumptions, and minimal or no sampling.

1990. The commercial fleets harvested 18,636 state-produced chinook salmon in 1990. Approximately 5,640 hatchery-produced chinook salmon contributed to the sport fishery in southeast Alaska. Crystal Lake Hatchery again provided the bulk of Alaskan hatchery contributions to Southeast fisheries from 3 release sites: Crystal Creek at the hatchery, Ohmer Creek south of the hatchery, and Earl West Cove near Wrangell. Early harvest estimates of Alaskan hatchery chinook salmon indicate that Crystal Lake Hatchery stocks provided approximately 16,200 fish to southeast Alaska commercial fisheries in 1990. Sport anglers throughout southeast Alaska received the benefit of an additional 2,500 Crystal Lake Hatchery chinook salmon, of which approximately 1,950 fish were landed in a special fishery downstream from the hatchery.

The 1990 coho salmon return to Southeast was larger than in 1989. The total production of coho salmon by state projects in 1990 is estimated at nearly 86,000, with approximately 58,000 being harvested by the commercial fleets, 3,200 taken by sport fishermen, and 1,130 taken by personal-use fishermen. Klawock Hatchery was a major contributor of coho salmon in 1990 with a total production of almost 39,000 fish. The federal aid Dingell-Johnson (D-J)-/Wallop-Breaux (W-B)-supported sport fish program at Snettisham had a major return of over 12,000 fish, of which 1,000 were taken by sport fishermen in the Juneau area.

Southeast Releases

The FRED Division released over 17.1 million fish in 1990 (Table 3.2). This represents a major decrease from 1989 releases, due primarily to poor broodstock returns of chum salmon to Snettisham Hatchery and discontinuation of the chum salmon release program at Marx Creek. Chum salmon releases from southeast Alaska hatcheries, which have totaled between 80 and 95 million for the past several years, were slightly over 2.6 million in 1990, due, in part, to the contracting of Hidden Falls Hatchery in 1988.

Sockeye salmon releases from Southeast FRED Division projects remained constant. Nearly 8.6 million sockeye salmon fry were released in both 1989 and 1990. This is continuing evidence of the FRED Division's commitment to its sockeye salmon initiative. Increasing sockeye salmon production from Snettisham will continue to bring release numbers up through time.

Chinook salmon releases increased slightly over 1989 releases with a release of over 3.1 million chinook salmon smolts in 1990. For the third year in a row, the Crystal Lake Hatchery released over 1.5 million chinook salmon. Coho salmon releases in the region decreased in 1990 with releases of 2.6 million, compared to 3.9 million in 1989. Crystal Lake Hatchery was the major coho salmon producer in 1990, with the Snettisham, Deer Mountain, and Klawock Hatcheries also producing coho salmon for local fisheries.

Southeast Egg Takes

The numbers of eggs taken at Southeast FRED Division projects were slightly lower in 1990 than in 1989, primarily because of smaller numbers of chum salmon eggs available

Table 3.2. Number of fish released during 1990 by FRED facilities

Facility	Broodyear, Stock	Species	Released
ARCTIC/YUKON/KUSKOKWIM			
Clear H	1988 Aleknagik L	Arctic Char	1,312
	1989 Alek/Domestic	Arctic Char	112,973
	1989 Aleknagik L	Arctic Char	23,543
	1990 Moose L	Grayling	1,100,586
	1989 Paxson L	Lake Trout	83,700
	1980 Koy-Yukon Mix	Sheefish	7
Sikusuilaq H	1989 Noatak R	Chum	6,364,003
	ARCTIC/YUKON/KUSKOKWIM		7,686,124
COOK INLET			
Big Lake H	1987 Big L (Big L)	Coho	426
	1988 Big L (Big L)	Coho	21,671
	1989 Big L (Big L)	Coho	1,398,677
	1989 L Susitna R	Coho	1,163,327
	1989 Meadow Cr	Sockeye	10,815,319
Crooked Cr H	1988 Crooked Cr	Coho	71,790
	1989 Crooked Cr	Coho	404,000
	1989 Glacier Flats	Sockeye	15,513,500
	1988 Crooked Cr	Steelhead	106,959
Elmendorf H	1989 Crooked Cr	Chinook	1,094,522
	1989 Ship Cr	Chinook	211,988
	1988 Bear L	Coho	243,520
	1988 Ship Cr	Coho	64,006
	1989 Bear L	Coho	324,706
Ft Richardson H	1989 Ninilchik R	Chinook	215,804
	1989 Willow Cr	Chinook	731,000
	1988 Caswell Cr	Coho	143,102
	1988 Fleming Spit	Coho	142,786
	1988 L Susitna R	Coho	308,439
	1989 L Susitna R	Coho	102,000
	1984 Swanson R	Rainbow	1,363
	1987 Big L (Big L)	Rainbow	507

Table 3.2. Continued

Facility	Broodyear, Stock		Species	Released
	1987	Swanson R	Rainbow	10
	1989	Swanson R	Rainbow	326,296
	1990	Big L (Big L)	Rainbow	514,817
	1990	Swanson R	Rainbow	1,826,070
Tutka Bay H	1989	Tutka Cr	Chum	1,508,557
	1989	Tutka Cr	Pink	30,300,803
	1989	English Bay	Sockeye	355,347
		Cook Inlet:		67,911,312
KODIAK & AK PENINSULA				
Kitoi H	1989	Big Kitoi Cr	Chum	1,502,501
	1988	L Kitoi L	Coho	99,972
	1989	L Kitoi L	Coho	73,561
	1989	Big Kitoi Cr	Pink	84,907,550
	1989	U Station L	Sockeye	1,286,396
Russell Cr H	1989	Russell Cr	Chum	13,702,036
	1989	Mortenson Cr	Coho	35,000
	1989	Russell Cr	Pink	8,300,000
		KODIAK & AK PENINSULA:		109,907,016
PRINCE WILLIAM SOUND				
Gulkana I H	1989	Gulkana E Fork	Sockeye	25,155,021
Gulkana II H	1989	Gulkana E Fork	Sockeye	828,613
Main Bay H	1988	Coghill L	Sockeye	2,616,498
	1989	Coghill L	Sockeye	125,000
		PRINCE WILLIAM SOUND:		28,725,132
SOUTHEAST				
Beaver Falls H	1989	Hugh Smith L	Sockeye	2,176,447
	1989	Mcdonald Lake	Sockeye	2,178,700
Crystal Lake H	1988	Crystal Cr	Chinook	1,386,003

Table 3.2. Continued

Facility	Broodyear, Stock		Species	Released
	1989	Harding R	Chinook	31,208
	1988	Crystal Cr	Coho	96,277
	1989	Crystal Cr	Coho	365,203
	1989	Slippery Cr	Coho	144,613
	1989	St John's Cr	Coho	36,731
	1988	Crystal Cr	Steelhead	12,581
Deer Mountain	1988	Lpw (Unuk R)	Chinook	151,629
	1988	Reflection L	Coho	136,181
	1990	Ketchikan Cr	Steelhead	13,700
	1989	Ketchikan Cr	Steelhead	4,525
Klawock H	1989	Cable Cr	Coho	69,689
	1989	Rio Roberts Cr.	Coho	25,262
	1989	Klawock L	Coho	1,280,000
	1989	Klawock L	Sockeye	474,089
	1989	Klawock R	Steelhead	15,994
Snettisham CIF	1989	Crescent L	Sockeye	215,576
	1989	Speel L	Sockeye	2,465,844
	1989	Tahltan L	Sockeye	1,041,757
Snettisham H	1987	Snettisham Inlt	Chinook	10,941
	1988	Crystal Cr	Chinook	1,246,796
	1988	King Salmon R	Chinook	19,724
	1988	Snettisham Inlt	Chinook	337,368
	1989	Snettisham Inlt	Chum	2,644,263
	1987	Pavlof Cr	Coho	27,280
	1987	Snettisham Inlt	Coho	46,209
	1989	Snettisham Inlt	Coho	403,849
	1986	Peterson L	Steelhead	5,998
		SOUTHEAST:		17,064,437

Species:				
	Chinook	5,436,983	Steelhead	159,757
	Coho	7,228,277	Grayling	1,100,586
	Chum	25,721,360	Arctic Char	137,828
	Sockeye	65,248,107	Lake Trout	83,700
	Pink	123,508,353	Sheefish	7
	Rainbow	2,669,063		
			TOTAL	231,294,021

at Snettisham than anticipated and smaller numbers of sockeye salmon eggs taken by Klawock. More than 23 million eggs were taken in 1990 (Table 3.3), compared to 24 million eggs in 1989.

The numbers of sockeye salmon eggs decreased in 1990 due to the contracting of Beaver Falls Hatchery to the PNP sector. Discounting the 1989 Beaver Falls component, sockeye salmon eggs actually increased significantly in 1990 because of the expansion of the sockeye salmon program at Snettisham.

Table 3.3. Estimated number of eggs taken by FRED division during 1990

Facility	Broodstock	Species	Eggs Taken
ARCTIC/YUKON/KUSKOKWIM			
Clear	Aleknagik L	Arctic Char	302,000
	Alek/Domestic	Arctic Char	2,134,000
	Moose L	Grayling	2,184,000
	Paxson L	Lake Trout	87,000
Sikusuilaq	Noatak R	Chum	9,193,000
			13,900,000
COOK INLET			
Big Lake	Big Lake	Coho	576,000
	English Bay	Coho	420,000
	Meadow Cr	Sockeye	15,200,000
Broodstock Dev Center	Swanson/Big L	Rainbow	4,400,000
Crooked Creek	Crooked Cr	Chinook	1,600,000
	Tustumena L	Sockeye	14,810,000
	Crooked Cr	Steelhead	111,000
Elmendorf	Crooked Cr	Chinook	1,187,000
	Ship Cr	Chinook	374,000
	Bear L	Coho	748,000
	Ship Cr	Coho	97,000
Ft Richardson	Deception Cr	Chinook	495,000
	Ninilchik R	Chinook	101,000
Tutka Bay	Pt Graham	Pink	600,000
	Tutka Bay	Pink	44,300,000
	COOK INLET		85,019,000

Table 3.3. Continued.

Facility	Broodstock	Species	Eggs Taken
KODIAK & AK PENINSULA			
Kitoi	Kitoi Bay	Chum	18,713,000
	L Kitoi L	Coho	1,083,000
	Big Kitoi Cr	Pink	151,000,000
	U Station L	Sockeye	2,140,000
Pillar Cr	Upper Station L	Sockeye	5,100,000
Russell Creek	Russell Cr	Chum	6,000,000
	Russell Cr	Pink	5,000,000
	Mortenson Cr	Coho	260,000
	KODIAK & AK PENINSULA		189,296,000
PRINCE WILLIAM SOUND			
Gulkana I	Gulkana R	Sockeye	30,101,000
Gulkana II	E Fk Gulkana	Chinook	47,000
	Gulkana R	Sockeye	1,312,000
Main Bay	Coghill L	Sockeye	2,709,000
	Eshamy L	Sockeye	3,012,000
	Eyak L	Sockeye	70,000
	PRINCE WILLIAM SOUND		37,251,000
SOUTHEAST			
Beaver Falls	McDonald L	Sockeye	1,473,000
Crystal Lake	Crystal Cr	Chinook	1,714,000
	Crystal Cr	Coho	403,000
Deer Mountain	Ketchikan Cr	Chinook	453,000
	Ketchikan Cr	Steelhead	25,000

Table 3.3. Continued.

Facility	Broodstock	Species	Eggs Taken
	Reflection L	Coho	136,000
	Ward L	Coho	108,000
Klawock	Klawock L	Sockeye	652,000
	Crooked Cr	Steelhead	111,000
	Klawock L	Coho	1,366,000
Snettisham CIF	Crescent L	Sockeye	841,000
	Speel L	Sockeye	2,450,000
	Tahltan L	Sockeye	4,738,000
	Tatsamenie	Sockeye	1,062,000
	Trapper L	Sockeye	2,362,000
Snettisham	Crystal L	Chinook	1,903,000
	King Salmon R	Chinook	72,000
	Snettisham	Chinook	142,000
	Snettisham/KSR	Chinook	110,000
	Snettisham	Chum	2,712,000
	Snettisham	Coho	210,000
	Southeast total:		23,043,000
	Species totals:	Chinook	8,198,000
		Coho	5,407,000
		Chum	36,618,000
		Sockeye	88,032,000
		Pink	200,900,000
		Rainbow	4,400,000
		Steelhead	247,000
		Grayling	2,184,000
		Arctic Char	2,436,000
		Lake Trout	87,000
STATE TOTAL:			348,509,000

CHAPTER 4

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 4.1). The three distinct geographic subareas present are: (1) Prince William Sound drainages and estuary; (2) the Copper River drainage and estuary; and (3) the Bering River drainage and estuary.

The commercial fishery includes three gear groups: purse seine, drift gill net, and set gill net. The catch is composed primarily of sockeye, pink, and chum salmon.

Substantial subsistence and personal-use fisheries occur in the upper Copper River where sockeye salmon are harvested along with lesser numbers of chinook and coho salmon. Some subsistence fishing does occur on the Copper River Delta and in Prince William Sound, but catches are not considered significant.

Extensive sport fisheries exist on the upper Copper River, Valdez Bay (Valdez), Passage Canal (Whittier), and Orca Inlet/Copper River Delta (Cordova). The upper Copper River fishery is aimed primarily at native chinook and sockeye salmon. The Valdez Bay fishery harvests pink and coho salmon. The Passage Canal fishery is aimed primarily at hatchery-produced coho and chinook salmon. The Orca Inlet/Copper River Delta fishery is directed toward coho and sockeye salmon.

FRED Division activities in Prince William Sound in 1990 were heavily influenced by continuing repercussions from the Exxon Valdez oil spill. Prince William Sound area staff played a key role in Natural Resource Damage Assessment Study Number 3, normally called the Prince William Sound Coded-Wire Tagging Program. FRED Division personnel directed the application of coded-wire tags in over 2 million fish in 1990. Some of the tags were placed in wild pink salmon from 6 different Prince William Sound stream systems. This is a significant technological advancement because tagging of wild pink salmon has never before been documented. This program is scheduled to continue in 1991.

Funding for the state-owned hatcheries at Main Bay and Gulkana was dramatically reduced in 1990. Operating funds for the hatcheries were vetoed by Governor Steve Cowper in July. Rather than see the hatcheries close, the Prince William Sound Aquaculture Corporation (PWSAC) agreed to assume operational responsibility for the hatcheries. Staff turnover was large at Main Bay during the state-to-private-management transition period. This forced PWSAC to assume actual day-to-day operation of the Main Bay Hatchery sooner than planned. At the Gulkana Incubation Facility, the FRED Division continues to operate the hatchery with funds provided by PWSAC. This relationship is expected to continue for several years until PWSAC personnel become more familiar with operation of the hatchery. FRED Division area, regional, and

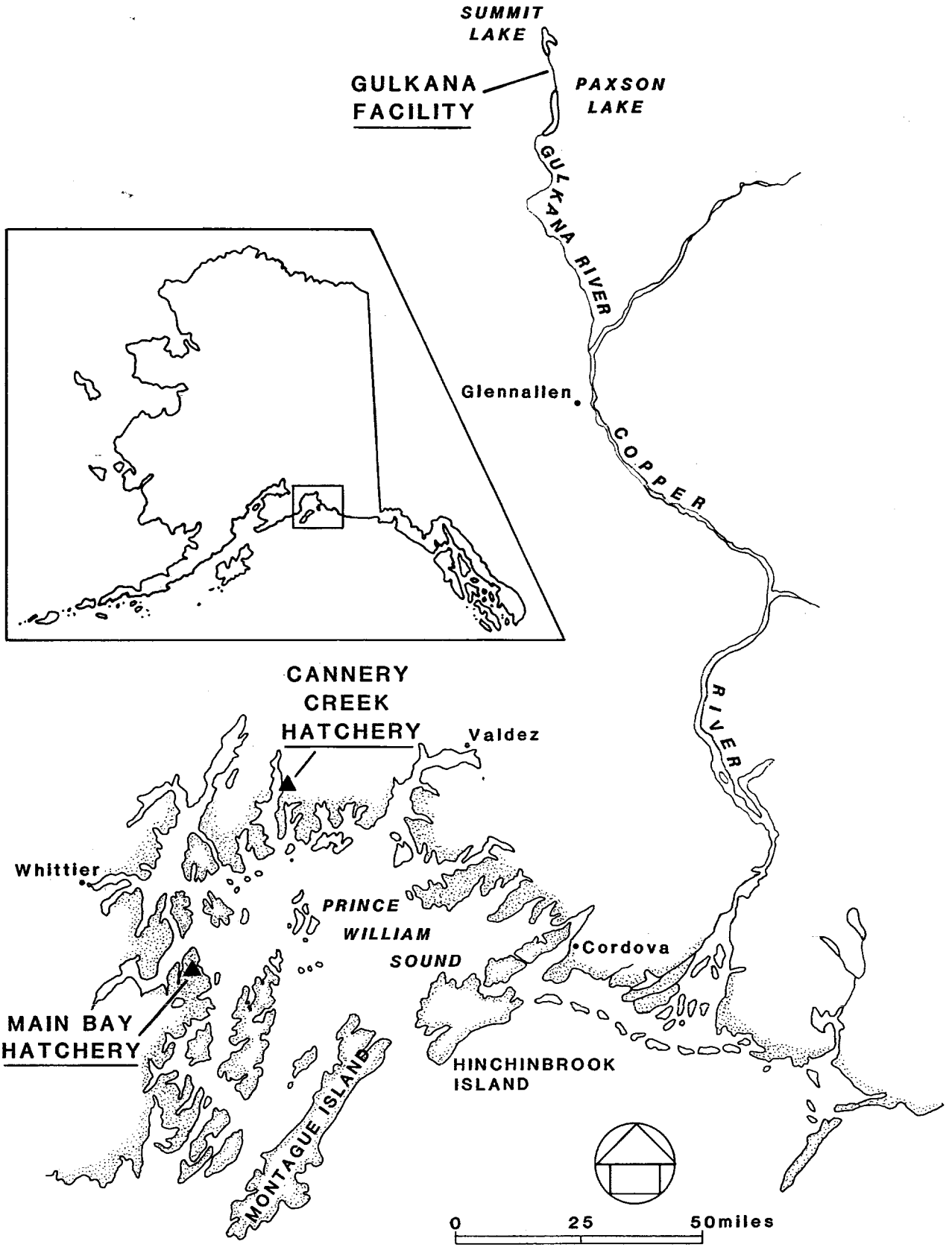

Figure 4.1. Map of Prince William Sound.

headquarters personnel have spent a great deal of time and energy to assure a successful transition at both hatcheries.

The Main Bay Hatchery is the only hatchery in Alaska raising yearling (reared in hatchery raceways for 12 months) sockeye salmon smolts. A milestone was reached in 1990 with the first adult returns from a Main Bay Hatchery sockeye salmon smolt release. Another milestone was achieved when several adults were held and ripened at the hatchery and used to take eggs. Besides smolt production, the Main Bay Hatchery is involved in an experimental lake stocking/lake fertilization project. In 1990 this cooperative project with the USFS was continued at 2 barren lakes in Prince William Sound.

The Gulkana I streamside sockeye salmon incubation facility, located on the East Fork of the Gulkana River, continued to be the largest artificial producer of sockeye salmon fry in Alaska in 1990. Sockeye salmon fry were released at four sites in 1990 to produce fish for commercial, subsistence, personal-use, and sport fisheries. In addition to releasing fry, limnological and/or hydroacoustical sampling of Paxson, Summit, and Crosswind Lakes has been continued to assess the biological effects of the FRED Division's enhancement efforts. Disease-history samples were collected for the FRED Division Fish Pathology Section to monitor prevalence of IHN virus and other pathogens in broodstock populations. The Gulkana II facility continues to incubate sockeye and chinook salmon fry to build broodstock levels for future use.

Enhancement of the sport fishery in Prince William Sound and the Copper River Basin continues to be a high FRED Division priority. A coho salmon smolt-stocking program from the division's Fort Richardson Hatchery was continued in 1990 at Whittier and Cordova. Adult returns to both locations are popular with residents and seasonal visitors. A large rainbow trout program, also from Fort Richardson Hatchery, was continued in 1990. This program involves stocking both catchable and fingerling rainbow trout in accessible lakes along the Richardson and Glenn Highways. A similar program with 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 were also stocked. Finally, an attempt is being made at Harding Lake, near Fairbanks, to establish a kokanee (landlocked sockeye salmon) fishery. Fry from the Gulkana I Hatchery are being used for this experimental program.

The Prince William Sound area has the largest concentration of commercial fishery-oriented hatcheries in Alaska. This large amount of hatchery production has resulted in a user-group conflict centered on allocation of fish. In 1989 PWSAC was directed by the Alaska Board of Fisheries to develop an allocation plan for all enhanced fish in Area E. The FRED Division area biologist spent a great deal of time assisting an Allocation Task Force with development of an allocation policy for PWSAC. As chairman of the Prince William Sound/Copper River Regional Planning Team (PWS/CR RPT), the FRED Division area biologist has continued to be involved in resolution of the allocation issue. The PWS/CR RPT is currently developing a management/allocation plan to be presented to the Alaska Board of Fisheries in 1991.

Prince William Sound Highlights

- An estimated 10,000 sockeye salmon adults from the initial 1988 smolt release returned to Main Bay Hatchery; of these, approximately 9,000 were caught in the commercial fishery.

- Main Bay Hatchery personnel collected 1.6 million eggs from the first sockeye salmon adults that returned to the hatchery.

- The 1990 Gulkana I sockeye salmon fry release of 25 million fry is the second largest sockeye salmon fry release from Gulkana.

- Sockeye salmon returns from Gulkana Hatchery contributed an estimated $2 million to the Prince William Sound commercial fishery.

- Prince William Sound sport fishermen harvested an estimated 10,000 coho salmon that returned from FRED Division coho salmon smolt releases.

- Over 454,000 Arctic grayling fry from the Clear Hatchery were stocked in 24 Prince William Sound lakes to increase area sport fishing opportunities.

- Over 252,000 rainbow trout catchables and fingerlings from the Fort Richardson Hatchery were stocked into 29 Prince William Sound lakes to benefit area sport fishermen.

- The 1990 Gulkana II chinook salmon egg take of 46,500 provided for continued chinook salmon feasibility studies at the facility.

- An estimated 350,000 chum salmon from previous FRED Division releases worth $2.4 million were harvested by the commercial fishing fleet at Main Bay Hatchery.

- The FRED Division directed the tagging of over 2 million salmon fry or smolts as part of an oil spill impact assessment study.

- An experimental lake stocking/lake fertilization project was continued at two Prince William Sound lakes by stocking 125,000 presmolts from the Main Bay Hatchery. This is a cooperative project with the USFS.

Prince William Sound Returns and Fishery Contributions

In 1990 an estimated 350,000 chum salmon returned to Prince William Sound from releases at Main Bay Hatchery. All of these chum salmon were harvested in the commercial fishery. In addition to chum salmon, the Main Bay Hatchery experienced its first adult return of sockeye salmon when an estimated 10,000 adults returned to the hatchery. This marks the first adult sockeye salmon return from a yearling smolt release in modern fish-culture history. While attempts were made to maximize the sockeye salmon egg take, over 90% of the return was intercepted in the commercial fishery.

An estimated 140,700 sockeye salmon from the Gulkana Hatchery, worth approximately $2 million, were harvested in the commercial fishery. These fish resulted from fry releases in 1985 and 1986. Significant contributions to the subsistence and personal-use fisheries also occurred, and carcasses from the Gulkana egg take were donated to area dog mushers for dog food.

Adult coho salmon returns to Cordova and Whittier were popular with area sport fishermen. An estimated 10,000 fish were harvested. Large numbers of stocked Arctic grayling and rainbow trout were also caught by area anglers.

Prince William Sound Releases

The Main Bay Hatchery released over 2.6 million sockeye salmon smolts in 1990. Four groups of fish were released at different times to find the effect of release timing on marine survival. In another experiment, raceway rearing densities were tested. An additional 125,000 presmolts were stocked into 2 barren Prince William Sound lake systems; this is an experimental program with ongoing evaluation.

Gulkana I Hatchery released over 25 million sockeye salmon fry in 1990. This is the second largest release of sockeye salmon fry from a hatchery in Alaskan history. Over 6.3 million fry were transported by truck to Summit Lake for release with 13.3 million released at the Gulkana I Hatchery site. Transport of over 4.9 million sockeye salmon fry from Gulkana I to Crosswind Lake was accomplished using an aerial transport. The Gulkana II Hatchery sockeye salmon fry were released on site.

Over 1.3 million fish were released to enhance area sport fisheries. These releases consisted of (1) releasing an estimated 143,000 coho salmon smolts from the Fort Richardson Hatchery in Whittier and Cordova; (2) stocking a total of 454,000 Arctic grayling fry and fingerlings from Clear Hatchery into 24 road-accessible lakes in the area; (3) releasing 252,000 rainbow trout fingerlings and fry from Fort Richardson Hatchery into 29 road-accessible area lakes; and (4) transporting an estimated 505,000 sockeye salmon fry from Gulkana I Hatchery to Harding Lake, near Fairbanks.

Prince William Sound Egg Takes

Prince William Sound egg takes met with good success in 1990. At Main Bay Hatchery, eggs were taken from 3 different stocks of sockeye salmon. Approximately 2.7 million eggs were taken from the Coghill Lake stock. An extremely poor escapement into Coghill Lake greatly limited egg availability at that site; yet, a better-than-expected return of sockeye salmon from the Coghill Lake broodstock to the hatchery allowed staff to conduct their first sockeye salmon hatchery egg take at that facility. Approximately 3 million eggs were also obtained from the Eshamy Lake sockeye salmon stock. This is a cooperative project with PWSAC. In addition, approximately 70,000 eggs were taken from Eyak Lake sockeye salmon for a broodstock development project.

At Gulkana I, the egg-take crew set a single-day record for sockeye salmon eggs (2.8 million) and a season total of 30.1 million. Not only were many eggs taken, but by following special sockeye salmon egg-take procedures and special handling, IHN virus outbreaks were controlled and minimized with no loss of fry during the 1990 season.

Gulkana II egg takes for sockeye and chinook salmon were conducted for the third season with 1,373,000 and 46,500 eggs taken, respectively.

CHAPTER 5

COOK INLET

Summary of FRED Projects

The drainages of Cook Inlet comprise only a small portion of the entire state, but the population of this area includes half of Alaska's total population. Consequently, many FRED Division projects and 6 FRED Division facilities are located in this area of the state (Figure 5.1). Big Lake Hatchery, located in the Susitna Valley, produces coho and sockeye salmon. Elmendorf and Fort Richardson Hatcheries produce fish for sport fishery enhancement projects. The Broodstock Development Center (BDC) at the Fort Richardson Hatchery provides rainbow trout eggs for the statewide stocking program. The Crooked Creek Hatchery primarily produces sockeye salmon for commercial fisheries and chinook and coho salmon and steelhead trout for sport fisheries. The Tutka Bay Hatchery, on the south end of the Kenai Peninsula, produces pink salmon that are harvested by commercial and sport fishermen. Fishery biologists at Big Lake, Soldotna, and Homer provide technical support for these projects and maintain coordination with biologists from the fishery management divisions.

Big Lake Hatchery was built in 1976 as a 16 million-egg sockeye salmon incubation facility to supplement poor adult returns in upper Cook Inlet. Big Lake Hatchery production is now set at 13 million sockeye salmon fry for the Big Lake drainage, 200,000 coho salmon smolts for Knik Arm, and 300,000 coho salmon fingerlings for stocking into interior Alaska lakes.

In 1990 Big Lake Hatchery smolt production was increased from 50,000 to 200,000. This was done by using baffles in the small, outdoor raceways. With this approach, these outdoor raceways remained ice-free at -45°C.

The Elmendorf State Hatchery produces chinook and coho salmon to enhance sport fishing opportunities at sites throughout southcentral Alaska and Kodiak. The hatchery is two miles north of downtown Anchorage, next to the power plant on Elmendorf Air Force Base. Through an agreement with the U.S. Air Force, the hatchery uses the heated-water effluent from the power plant to accelerate growth and development of fish. The hatchery accelerates growth of age-zero (subyearling) chinook salmon smolts, age-one (yearling) coho salmon smolts, and coho salmon fingerlings. Also, in 1990 the hatchery produced an experimental lot of age-zero coho salmon smolts. Elmendorf Hatchery is a centralized incubation and rearing facility; its programs serve Kachemak Bay, Resurrection Bay, central Cook Inlet, the Matanuska Valley, Anchorage, and Kodiak. A total of 1.3 million age-zero chinook salmon smolts, 308,000 age-one coho salmon smolts, and 89,000 age-zero coho salmon smolts were produced at Elmendorf Hatchery and released into anadromous waters in southcentral Alaska. In addition, 236,000 coho salmon fingerlings were released into landlocked lakes in the Matanuska Valley.

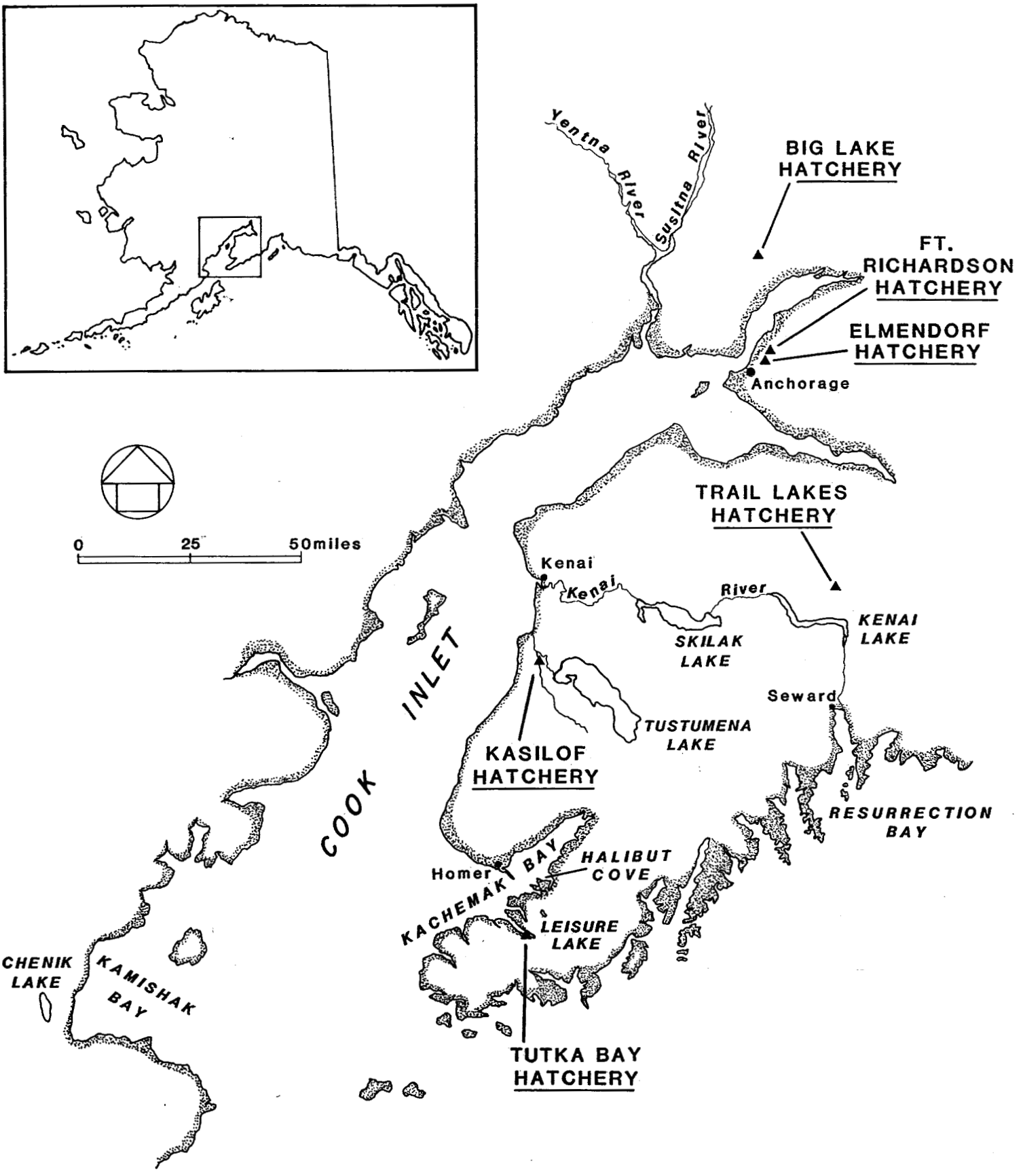

Figure 5.1. Map of Cook Inlet.

The 1990 chinook salmon adult return was low throughout southcentral Alaska. Returns for both wild and enhanced fisheries were around two-thirds of the expected run size. Still, the Crooked Creek chinook salmon fishery had a strong harvest with 7,788 chinook salmon adults taken by shore fishermen and 2,580 more enumerated through the weir. Crooked Creek also had more guided drift boats because of new catch-and-release regulations on the Kenai River. Over 60% of the chinook salmon harvest from Crooked Creek is expected to be from Elmendorf Hatchery releases.

The objective of the BDC is to maintain and develop broodstock for rainbow trout enhancement programs in southcentral and interior Alaska. In addition, the BDC was designed as a small research facility to solve problems in the production of rainbow trout and other species. To accomplish these goals, the BDC was established as a part of the Fort Richardson Hatchery.

The three primary projects of broodstock maintenance, random-lot spawning, and broodstock selection are the core of the BDC program. These projects satisfy the primary objective of the facility. The production of all-female rainbow trout and the production of triploid rainbow trout were the two research projects supported in 1990.

Presently, three rainbow trout broodstocks are maintained at the BDC: Swanson River, Big Lake, and Swanson River Select. The goal of this project is to maintain enough broodstock from these strains to meet the requirements of rainbow trout sport fishery enhancement programs for southcentral and interior Alaska. No major problems were encountered this year in maintaining the three strains of broodstock. Random matings within these stocks produced all the eggs needed during 1990 for southcentral and interior Alaska rainbow trout sport fishery enhancement projects.

The goal of the random-lot spawning project at the BDC is to operate the annual rainbow trout egg take to collect enough eggs for southcentral and interior Alaska rainbow trout sport fishery enhancement projects and to replace broodstock. Fish spawned randomly within the three strains produced 4.4 million green eggs in the spring of 1990.

The goal of the broodstock-selection project at the BDC is to develop a strain of rainbow trout that has high survival and fast growth in both hatchery and wild environments. Through individual and family selection and based on a long-term genetic-selection program, 16 families were ultimately selected for 1990 Swanson River Select broodstock.

Another project at the BDC is designed to manipulate the sex of broodstock to improve the efficiency of rainbow trout production and improve angling opportunities. Three groups of testosterone-treated rainbow trout from BY 88 were spawned to produce groups of all-female fish. Progeny from all test groups were sampled to determine sex ratios that would identify the genetics of the male parent, and progeny from 4 groups were fed testosterone-treated food from emergence to create males for future production. In another phase of this project, a heat-shock box was manufactured for the creation of triploid rainbow trout on a production scale. Approximately 70,000 green eggs were shocked for 20 minutes at 26°C, 20 minutes after fertilization. Analysis showed that 99.25% of the fish sampled were triploid rainbow trout.

The Fort Richardson Hatchery is a state facility operated by the FRED Division. The facility is located on the Fort Richardson Military Reservation near Anchorage. This complex facility is designed and operated for the production of rainbow trout, chinook salmon, and coho salmon for stocking into many streams, lakes, and marine waters to create or enhance sport fisheries. The hatchery's most important program is the production of rainbow trout. Renovation of the hatchery was completed in January 1984. It is designed to use only well water for fish production, and heat is extracted from the U.S. Army's Central Heat and Power Plant effluent 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 million fish or 55,000 kg, annually. Typically, this will include 2.0-2.5 million 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 the Fort Richardson Hatchery, including rainbow trout and coho and chinook salmon, are targeted for sport fisheries. Fish are released throughout interior and southcentral Alaska. Over 300 lakes, streams, and estuaries receive fish from Fort Richardson Hatchery with approximately 20,000 miles of transport-related travel annually. Rainbow trout production has three components: (1) fingerlings are released into numerous lakes in southcentral and interior Alaska; (2) small subcatchables are released into the Fairbanks area; and (3) large subcatchables are released into Anchorage, Palmer, and Fairbanks area lakes.

Coho salmon smolts are released into upper Cook Inlet streams and into Prince William Sound. Fingerlings that are surplus to smolt project needs are released into Matanuska-Susitna Valley lakes. Chinook salmon smolts are released at Willow Creek and the Ninilchik River on the Kenai Peninsula.

By the end of April 1990, slightly over 4.0 million eggs had been received from the BDC. From these eggs, 2.9 million fry were produced. The 1.0-g target-release size was reached by 15 June, the earliest date that significant fingerling releases have been made by the Fort Richardson Hatchery.

The total number of fingerlings released in the summer of 1990 was 2.2 million. Nearly 520,000 of these were released into interior Alaska lakes to replace production that had been discontinued at Clear Hatchery. In addition, 365,000 fingerlings were held to produce 1991 subcatchables and replacement broodstock.

Nearly 600,000 coho salmon were released as smolts in May and June 1990 at Nancy Lake, Caswell Creek, and Fleming Spit.

A total of 972,000 coho salmon eggs were received from Little Susitna River, Caswell Creek, and Fleming Spit. As a precautionary measure, all eggs from the Fleming Spit were destroyed after a potential disease-carrying bacteria was found in the broodstock. Fry in the remaining two stocks emerged in January 1990, and 102,000 surplus Little Susitna River fry were released. Unfortunately, the tailscreens of one raceway became blocked causing the raceway to overflow; approximately 125,000 fish were lost into Ship Creek.

Fort Richardson Hatchery continued production of large, post-smolt chinook salmon for the Anchorage urban lakes winter fishery. Smolts were held from late May, the normal release time, until late October. During that time they gained over 80 g each. A total of 47,300 was released at an average weight of nearly 100 g. During July 1989, 1.5 million chinook salmon eggs were received from Willow Creek and 283,000 were received from Ninilchik River. By January 1990, these fish weighed an average of 4 g each. Totals of 655,600 and 215,800 smolts were released at Willow Creek and Ninilchik River, respectively. A total of 164,000 smolts was coded-wire-tagged. In addition, 50,000 smolts were held for post-smolt production in 1991.

Two hatcheries are located in the central Cook Inlet area. The Crooked Creek Hatchery is located near Kasilof and is operated by the FRED Division. The Trail Lakes Hatchery is located near Moose Pass and has been operated by the Cook Inlet Aquaculture Association (CIAA) under a 20-year state contract since 1988.

The Crooked Creek Hatchery has an egg capacity of approximately 20 million sockeye salmon eggs and produces fingerlings for stocking programs at Tustumena Lake as well as 8 other lakes in lower Cook Inlet. In 1989 the Crooked Creek Hatchery expanded production by taking over a portion of the coho salmon sport fish enhancement program that was previously accomplished at the Trail Lakes Hatchery. The moist-air incubation procedure, first used for coho salmon eggs in 1989, is also being used to accelerate development of Kasilof River chinook salmon eggs. Approximately 420,000 coho salmon fingerlings, 70,000 age-one coho salmon smolts, and 270,000 age-one chinook salmon smolts are produced annually. Also, Crooked Creek Hatchery produces age-one steelhead trout smolts for release into Crooked Creek.

The Tutka Bay Hatchery is a remote hatchery located near the southwest tip of the Kenai Peninsula in southcentral Alaska, approximately 15 air miles across Kachemak Bay from Homer. The hatchery has a one-story structure that includes a pink and chum salmon incubation area, a sockeye salmon module, an office, a laboratory, a shop, and an emergency generator room. There are also two single-family dwellings and a bunkhouse. In addition, an egg-take and short-term-rearing complex is located in Tutka Lagoon, approximately three-quarters of a mile from the hatchery.

The Tutka Bay Hatchery was constructed in 1976 with a design capacity of 10 million eggs, but it can now incubate up to 50 million eggs and rear up to 25 million pink and chum salmon, the primary species produced at Tutka Bay Hatchery. Sockeye salmon production was introduced in 1989.

The Tutka Bay Hatchery serves three user groups: commercial, sport, and subsistence fishermen. The primary user group is the commercial fishermen, which includes approximately 77 seine and 34 set-net permits manned by over 200 individuals. Sport fishing in Tutka Lagoon continues to draw many boats; over 2,000 angler-days were logged in 1990.

The Tutka Bay Hatchery provides the bulk of the pink salmon in lower Cook Inlet. All eggs are incubated at Tutka Bay Hatchery; most of the resultant fry are reared and released into Tutka Bay. The 1990 egg take produced 50 million eggs.

A project was initiated in 1986 to diversify pink salmon returns to lower Cook Inlet other than in the Tutka Bay area. In 1990 a total of 6.1 million pink salmon were released into Halibut Cove Lagoon to relieve some of the fishing pressure in Tutka Bay. Other pink salmon fry were transported outside Tutka Bay to create sport fisheries. Approximately 300,000 fry were taken to the Homer Spit in 1990 to provide a shore-based sport fishery off the Homer Spit, and approximately 300,000 fry were released at Ingram Creek near Portage.

The Tutka Bay chum salmon project was established in 1986 to further enhance the fishery in lower Cook Inlet by introducing late-run chum salmon to Tutka Bay. Approximately 2.1 million chum salmon eggs were taken in 1989 from the Kamishak Bay area of Cook Inlet. However, the 1990 Kamishak Bay chum salmon egg take was dropped and, unfortunately, the return of chum salmon in the fall of 1990 did not occur.

The English Bay Lakes system has the only significant natural run of sockeye salmon in the Southern District of lower Cook Inlet. An enhancement project was initiated there in 1989 to reverse declining trends in English Bay sockeye salmon escapements and harvests in the English Bay Lakes system. Approximately 355,000 fry from the 1989 egg take were released into English Bay Lakes in 1990.

Fisheries enhancement has played a major role in salmon production for the various user groups in the lower Cook Inlet area in recent years. In 1989, for example, enhancement projects contributed over 67% of the entire lower Cook Inlet commercial salmon harvest and ex-vessel value. In 1990 pink salmon made up the largest portion of the commercial salmon harvest in lower Cook Inlet with 43% of the catch from enhancement projects. Sockeye salmon (73% enhancement production) made up the next highest harvest, followed by chum, coho, and chinook salmon. Ex-vessel value of the 1990 salmon harvest of all species was $1.7 million.

The FRED Division also maintains an area office in Homer on the lower Kenai Peninsula. Projects and facilities in lower Cook Inlet include: Tutka Bay Hatchery and enhancement; Halibut Cove Lagoon chinook and pink salmon releases; Leisure Lake sockeye salmon stocking and fertilization; Homer area sport fish stocking; Chenik Lake sockeye salmon stocking and fertilization; English Bay sockeye salmon rehabilitation; Port Graham Bay pink salmon enhancement; sockeye salmon lake stocking and lake studies; project site selection; and the Paint River fishway project.

Cook Inlet Highlights

- The 4th annual statewide hatchery managers' meeting was hosted at Big Lake Hatchery in 1990.
- A record number of visitors toured the Big Lake Hatchery in 1990.
- Personnel at the BDC spawned the first sex-reversed rainbow trout that matured and produced experimental groups of all-female fish to improve the efficiency of the rainbow trout sport fisheries enhancement program.

- The BDC created nearly 40,000 rainbow trout that were essentially all triploid for release as catchables into Pile Driver Slough near Fairbanks. This program was carried out at the request of the ADF&G Sport Fish Division.

- A new project that released small subcatchables into Fairbanks area lakes from Fort Richardson Hatchery was undertaken this season; 92,000 fish were released.

- Hatchery-produced adult coho salmon returns from Fort Richardson Hatchery smolt releases to Prince William Sound were estimated at 10,000 fish.

- An estimated 46% of the chinook salmon harvested at Willow Creek in 1990 originated from the Fort Richardson Hatchery.

- A total of 63,000 visitors came to Elmendorf Hatchery in 1990 to view the returning Ship Creek chinook salmon.

- Chinook salmon smolts from Elmendorf Hatchery were released into Eagle River for the first time.

- Preliminary return data from age-zero coho salmon smolts released from Elmendorf Hatchery show they did as well as the age-one coho salmon smolts.

- In 1990 Crooked Creek Hatchery staff successfully refined and operated a moist-air incubator to accelerate development of coho and chinook salmon eggs. The accelerated egg development will enable production of coho salmon smolts and fingerlings and late-run Kasilof River chinook salmon smolts for sport fisheries enhancement.

- The number of sockeye salmon produced by Crooked Creek Hatchery in Tustumena Lake (Kasilof drainage) and caught in the commercial fishery was an estimated 134,000. At an average price of $1.40 per pound for sockeye salmon in Cook Inlet during the 1990 commercial fishery, the ex-vessel value of these fish was approximately $845,000.

- Anglers that fished from the shore spent 21,415 angler-days to harvest 7,788 Crooked Creek chinook salmon in the Kasilof River sport fishery during 1990. Of these, an estimated 61% (4,750) were the result of Elmendorf Hatchery smolt releases into Crooked Creek. In addition, an unknown but substantial number of chinook salmon were harvested by clients of sport fishing guides operating on the Kasilof River. The annual sport harvest of chinook salmon in the Kasilof River exceeded that for the combined early and late runs of chinook salmon in the Kenai River during 1990. The poor return of chinook salmon in the Kenai River during 1990 resulted in a substantial increase in the number of drift-boat guides operating on the Kasilof River.

- A total of 2,098 Crooked Creek Hatchery-produced coho salmon returned to Crooked Creek in 1990. Of these, an estimated 878 were caught in the sport fishery.

- A record number of sockeye salmon returned to the Hidden Lake weir in 1990: 77,959. This escapement exceeds the previous high return to the weir by 27,000 fish. The adults returning in 1990 were not marked, so no hatchery contribution is available; however, in past years the hatchery contribution has been as high as 80% of the fish returning to Hidden Lake.

- Crooked Creek Hatchery chinook and coho salmon carcasses were sold under a state contract for $4,863. This money supports hatchery operations and evaluation activities at the Crooked Creek Hatchery. In addition, the hatchery received a total of $900 in donations from tourists in 1990.

- A cooperative work program is in its third year between the Tutka Bay Hatchery and the Pacific Rim Corporation, a firm representing Alaska natives. Six Port Graham youths participated in this program during the 1990 season.

- This year the Tutka Bay Hatchery has been involved with several educational intern programs involving both the local high school and the University of Alaska.

- Tutka Bay Hatchery had one of its lowest returns in the facility's 14-year history of 202,000 pink salmon; still, the hatchery's production accounted for 24% of the entire 1990 lower Cook Inlet commercial pink salmon harvest.

- The Halibut Cove Lagoon project had a return of 42,800 pink salmon in 1990 from last year's cooperative rearing project with the Cook Inlet Seiners Association (CISA). This represents a 0.7% ocean-survival rate.

- The Homer Spit pink salmon rearing project had a return of approximately 600 fish from last year's release. This provided a significant extension of the sport fishery on the Homer Spit after the chinook salmon run ended in early July.

- The English Bay sockeye salmon egg take is the first to take place in that drainage system. This Tutka Bay Hatchery project has many great benefits and future potential for commercial and subsistence users.

- One-half million pink salmon eggs were taken from the Port Graham River this summer and placed at the Tutka Bay Hatchery. This project will benefit commercial and subsistence fisheries.

- The harvest goal for the Tutka Bay Hatchery project, as set forth in the Cook Inlet Regional Salmon Enhancement Plan, was an annual harvest of 560,000 pink salmon by the year 1990. The hatchery has exceeded this goal in 1981, 1983, 1988, and 1989.

- In 1990 FRED Division projects accounted for 64% of the $1.7 million ex-vessel value of the lower Cook Inlet salmon harvest.

- The Chenik, Kirschner, Leisure, and Port Dick Lakes stocking projects from the Crooked Creek Hatchery provided nearly 73% of the total lower Cook Inlet

sockeye salmon harvest in 1990. The ex-vessel value from these projects was estimated at $889,000.

- Nearly 42 million salmon fry, fingerlings, and smolts were released in the lower Cook Inlet area in 1990 to provide future contribution to area fisheries. Potential returns from these FRED Division releases could exceed 1 million salmon.

- The Homer Spit sport fish enhancement project received an award from the American League of Anglers and Boaters for the best sport fish management program in the nation in 1990.

- The FRED Division has been expanding local sport fish stocking programs to meet increasing public demand in the Homer and Kachemak Bay areas. Over 19,700 salmon were harvested by sport fishermen in 1990 from various enhancement projects in the Kachemak Bay area.

- Around 90% or more of the salmon harvested by Kachemak Bay anglers originate from FRED Division enhancement projects annually.

- The salmon stocking program on the Homer Spit has created an extremely popular, family-oriented fishery. There were 2,200 chinook salmon, 600 pink salmon, and 3,500 coho salmon harvested by anglers at this sport fishery enhancement site in 1990.

Cook Inlet Returns and Fishery Contributions

The 1990 chinook salmon adult returns were low throughout southcentral Alaska. Returns of both wild and enhanced fisheries were around two-thirds of the expected run sizes. Still, the Crooked Creek chinook salmon fishery had a strong harvest with 7,788 chinook salmon adults taken by shore fishermen and 2,580 more enumerated through the weir. Over 60% of the chinook salmon harvest from Crooked Creek is expected to be from Elmendorf Hatchery releases.

In 1990 coho salmon returns for Homer Spit were 5,100 fish; 3,500 were sport-harvested and 1,600 were taken by subsistence and commercial nets. In Resurrection Bay, no in-season creel estimates were made, but fish heads were collected to evaluate tagged returns. Preliminary adult return data from the 1989 release of age-zero coho salmon smolts show that they returned as well as the age-one coho salmon smolts.

An estimated total return (escapement and harvest) of 193,900 hatchery-produced sockeye salmon returned in 1990 from the Tustumena Lake enhancement project and represented a hatchery-contribution rate (from Crooked Creek Hatchery) of 39% for the total return. Of the 193,900 return of hatchery-produced fish, an estimated 134,000 were caught in the commercial fishery.

The total return (escapement and harvest) of chinook salmon to Crooked Creek in 1990 was an estimated 10,718, of which 6,537 (61%) had been produced from Elmendorf

Hatchery. An estimated 7,788 chinook salmon were caught in the Kasilof River sport fishery during 1990. Of these, an estimated 4,750 were hatchery-produced.

The estimated total return (escapement and harvest) of coho salmon to Crooked Creek in 1990 was 4,778, of which 44% (2,098) were produced by the Crooked Creek Hatchery. Included in the total return was an estimated sport harvest of 2,000 coho salmon, of which 878 were hatchery-produced.

A total of 236 steelhead trout returned to the Crooked Creek weir in 1990. The estimated Crooked Creek Hatchery contribution rate of steelhead trout returning to the Crooked Creek weir was 82.2%. Besides the weir return, an estimated 200 Crooked Creek steelhead trout were sport-caught in 1990.

All of lower Cook Inlet exhibited very low returns of pink salmon in 1990. The pink salmon commercial harvest was one of the lowest on record. Tutka Bay Hatchery was no exception, with one of the lowest survivals ever; reasons for the poor survival are unknown at this time. The total return from hatchery production was 202,000 fish, but Tutka Bay Hatchery production accounted for 24% of the entire 1990 lower Cook Inlet commercial pink salmon harvest. Of the commercial catch of 383,670 fish, 42,800 were from a pink salmon rearing project at Halibut Cove Lagoon that utilized Tutka Bay Hatchery fry. This was a cooperative project between the FRED Division and CISA. Approximately 600 pink salmon returned to the Homer Spit from a 1989 release. Tutka Bay Hatchery contribution to the lower Cook Inlet salmon fleet has been significant over the life of the facility with annual production accounting for as much as 91% of the entire commercial harvest for pink salmon in lower Cook Inlet.

FRED Division projects provided 52% (317,118 salmon) of the total 1990 lower Cook Inlet commercial harvest of 605,170 fish. The Leisure, Chenik, Port Dick, and Kirschner Lakes sockeye salmon enhancement projects produced approximately 73% (148,083) of the total lower Cook Inlet harvest of 203,895 sockeye salmon in 1990. Tutka Bay Hatchery production, along with the FRED Division/CISA cooperative rearing project at Halibut Cove Lagoon, accounted for 43% (166,853 pink salmon) of the 1990 lower Cook Inlet commercial pink salmon harvest of 383,670 fish. The contribution of FRED Division-produced salmon accounted for at least 64% ($1.1 million) of the $1.7 million value of the 1990 lower Cook Inlet commercial salmon harvest.

Over 19,700 salmon were harvested by sport fishermen from various enhancement projects in the Kachemak Bay area in 1990. The Homer Spit sport fish enhancement project provided over 6,300 salmon for shore-based anglers, including 2,200 chinook, 3,500 coho, and 600 pink salmon. Another 1,500 and 1,000 chinook salmon were caught by anglers at Halibut Cove Lagoon and Seldovia, respectively.

The 1990 total return to the Leisure Lake sockeye salmon stocking and fertilization project was estimated at 54,100 sockeye salmon. The commercial harvest of 49,600 fish comprised 24% of the lower Cook Inlet sockeye salmon harvest. Personal-use dip net fishermen and sport fishermen harvested another 3,500 sockeye salmon.

The Tutka Bay Hatchery had its fourth lowest return in the facility's 13-year history. Over 276,000 pink salmon were accounted for in the 1990 return to the hatchery and its

various release sites. The commercial harvest of 49,679 pink salmon from Tutka Bay and Tutka Lagoon, combined with the 117,175 harvested from the Halibut Cove Lagoon remote rearing and release site, accounted for 94% of the Southern District and 43% of the entire lower Cook Inlet commercial pink salmon harvest. Due to the weak return to the hatchery, the sport harvest in Tutka Lagoon was estimated at only 2,000 pink salmon. The reasons for the poor pink salmon return are not yet clear; yet, very weak pink salmon returns were evident in most areas of lower Cook Inlet, except for the Outer District. Pink salmon returns to the Kodiak area were extremely weak as well.

Chinook salmon smolts have been released on the Homer Spit since 1984. Pink salmon fry have been released since 1987 in a cooperative project between the Tutka Bay Hatchery, the City of Homer, the South Peninsula Sportsman's Association (SPSA), and CISA. Coho salmon smolt releases were initiated in 1988. The sequential returns of the three species create fishing opportunities from late May through September, where none had previously existed. Over 6,300 salmon returned to the Homer Spit sport fish enhancement project in 1990. Sport fishermen harvested 2,200 chinook salmon from late May to early July, 600 pink salmon during July through early August, and 3,500 coho salmon in August and September. An additional 1,650 coho salmon (31%) were intercepted in the personal-use gillnet fishery.

The Homer Spit sport fish enhancement project is funded by the D-J/W-B federal funding system and received national recognition and an award from the American League of Anglers and Boaters. ADF&G, the City of Homer, and SPSA were co-recipients of the Sportfish Management Award for 1990 in honor of the best project in the nation. The Commissioner of ADF&G, Don W. Collinsworth, and the Mayor of the City of Homer, John Calhoun, traveled to Washington, D.C., in June 1990 to receive the award. Because of this project's national recognition and economic benefits to the local community, the City of Homer is considering major improvements to the small lagoon through expansion, dredging, and bank stabilization. In addition, the City of Homer constructed an elderly/handicap access and fishing platform overlooking the lagoon in July 1990.

The third year of chinook salmon returns to Seldovia Bay occurred in 1990 and totaled around 1,340 fish. An estimated 1,000 of these fish were caught by sport fishermen and the remaining 340 chinook salmon (25%) were intercepted in the commercial sockeye salmon set net fishery in Seldovia Bay. City officials and residents remain very enthusiastic about this project; this developing fishery is attracting more interest to Seldovia. City officials feel that this project was responsible for doubling to tripling the harbor-related economy during May and June of this year by attracting many nonresident fishermen.

The commercial harvest of Chenik Lake sockeye salmon totaled 70,150 fish, 34% of the entire lower Cook Inlet sockeye salmon harvest. Escapement into the lake was estimated at 22,000 fish.

The first returns of sockeye salmon to Kirschner and Port Dick Lakes took place in 1990. Over 12,000 sockeye salmon were harvested from Port Dick Lake and nearly 18,000 returned to Kirschner Lake. Although these returns were under the forecasted levels, both systems performed similarly to Chenik and Leisure Lakes. It is encouraging to note

that smolt-mortality rates through the extensive waterfall outlets of several of the lakes may not be as high as initially expected.

Cook Inlet Releases

Releases of fish from the Fort Richardson Hatchery in 1990 for sport fishery enhancement projects included: Rainbow trout fingerlings—2.1 million, small subcatchables—92,000, and large subcatchables—233,000; coho salmon fingerlings—102,000 and smolts—594,700; and chinook salmon fingerlings—30,600, smolts—871,000, and post-smolts—47,300.

A total of 15.5 million sockeye salmon fingerlings was released from the Crooked Creek Hatchery into 9 lakes in the Cook Inlet area. Eight lakes in lower Cook Inlet were stocked in addition to Tustumena Lake. A total of 480,800 juvenile coho salmon were released from the Crooked Creek Hatchery, including 71,800 age-one smolts and 409,000 fingerlings, into a variety of lakes. Almost 107,000 age-one steelhead trout smolts were released into Crooked Creek.

Over 30 million pink salmon fry were produced at Tutka Bay Hatchery in 1990; of these, approximately 23 million were reared and released into Tutka Lagoon with the highest weight gains ever achieved (140%). In addition over 1.5 million Kamishak Bay chum salmon were released into Tutka Bay. Six million pink salmon were transported from Tutka Bay Hatchery to Halibut Cove Lagoon for rearing and release, 300,000 pink salmon fry were transported from Tutka Bay Hatchery to the Homer Spit for rearing and release for sport fish enhancement, and approximately 300,000 pink salmon fry were transported to the upper Turnagain Arm to develop a sport fishery. Tutka Bay Hatchery also released 355,000 sockeye salmon fry back into English Bay Lakes.

A total of 41.8 million juvenile salmon of all five species of Pacific salmon were released into lower Cook Inlet in 1990.

Six million pink salmon fry were transported by seine vessel from Tutka Bay Hatchery to Halibut Cove Lagoon. This was a cooperative program with CISA, CIAA, and ADF&G to release pink salmon fry into new, unexploited nursery areas and to disperse the commercial fishery. During the 30-day period, personnel were able to achieve a new record for fry growth at 166% weight gain.

In 1990, 3.25 million sockeye salmon fry were released into Chenik Lake from the Crooked Creek Hatchery. The lake was enriched with the application of over 5,000 liters (1,344 gallons) of liquid fertilizer over a three-month period. Fertilizer application was accomplished by airplane. This is a cooperative project with CISA and the FRED Division.

Several lower Cook Inlet lakes were again selected for stocking sockeye salmon fry produced by the Crooked Creek Hatchery. A total of 4.0 million sockeye salmon fry were stocked into 6 different lakes in 1990, after prestocking studies were conducted in 1986-1989. The 6 lakes were Kirschner Lake, Bruin Lake, Upper and Lower Paint Lakes, and Elusivak Lake in the Kamishak District, as well as Hazel Lake in the

Southern District. Sockeye salmon fry releases into Port Dick Lake were discontinued due to low plankton population levels observed in 1989.

Efforts to rehabilitate the depressed sockeye salmon return to the English Bay Lakes system were initiated with an egg take in 1989. The first stocking of sockeye salmon fry took place in 1990 with the release of 350,000 fry. These eggs were incubated at Tutka Bay Hatchery in an isolation module constructed by hatchery staff, but over 420,000 eggs collected from the 1990 broodstock were transported to Big Lake Hatchery for incubation.

Cook Inlet Egg Takes

Approximately 4.4 million rainbow trout eggs were taken from Swanson River, Big Lake, and Swanson River Select strain broodstocks during 20 days of egg takes at the BDC.

Egg takes for fish production at Fort Richardson Hatchery were all accomplished "off-site," but these included 4 million rainbow trout from the BDC, 483,700 coho salmon from the Little Susitna River, and 612,500 chinook salmon from Willow Creek.

A total of 16 million eggs was taken from the sockeye salmon stock at Tustumena Lake to continue Crooked Creek Hatchery releases of sockeye salmon fingerlings into Tustumena Lake and lakes in lower Cook Inlet. Chinook salmon eggs taken by Crooked Creek Hatchery staff included 1.18 million eggs from the Crooked Creek broodstock that were transferred to the Elmendorf Hatchery for age-zero smolt production, 101,000 eggs from the Ninilchik River broodstock that were transferred to the Fort Richardson Hatchery for age-zero smolt production, and 330,000 eggs from the Kasilof River broodstock for age-one smolt production at the Crooked Creek Hatchery. Approximately 600,000 coho salmon eggs and 100,000 steelhead trout eggs were taken from Crooked Creek for incubation and rearing at the Crooked Creek Hatchery.

The 1990 egg take was the largest at Tutka Bay Hatchery to date, with over 50 million eggs collected. The local FRED Division biology staff collected 600,000 pink salmon eggs from the Port Graham River stock for a new cooperative enhancement project with the Village of Port Graham. Additionally, over 420,000 sockeye salmon eggs were taken at the English Bay Lakes system for incubation at Big Lake Hatchery.

Based on requests from the Village of Port Graham and The North Pacific Rim Corporation, rehabilitation of the pink salmon run in Port Graham River was initiated in 1990. This project was reactivated on very short notice after it was canceled due to lack of funding during the contracting of Tutka Bay Hatchery. Three egg takes were conducted during August to attempt to collect pink salmon eggs for incubation to the eyed stage at Tutka Bay Hatchery. Some of these eyed eggs will later be transported to a new hatchery facility being constructed in part of the Port Graham cannery. Over 550,000 pink salmon eggs were collected. All of the resultant emergent fry will be held and fed in net pens anchored near the Village of Port Graham.

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CHAPTER 6

KODIAK AND ALASKA PENINSULA

Summary of FRED Projects

The FRED Division Kodiak area office, located in the City of Kodiak, is responsible for the area covering the Kodiak Island Archipelago (Figure 6.1) and the southern and eastern slopes of the Alaska Peninsula from Cape Douglas to the southern entrance of Imuya Bay (Figure 6.2). The office also supports the Russell Creek Hatchery in Cold Bay.

The FRED Division operates projects and facilities that contribute salmon to the Kodiak area. Projects, such as the Karluk and Frazer Lakes fertilization were designed to rehabilitate areas that were historically productive; others, such as the Kitoi Bay Hatchery, enhance natural production. The salmon produced by these projects benefit commercial, sport, personal-use, and subsistence fisheries. Four active scallop- and mussel-culture activities are coordinated through the FRED Division's Kodiak area office. The Japan-Alaska feasibility study of scallop spat collection and "grow-out" had a considerable impact on space and time in the Kodiak office.

The 1990 fishing season was marked by a poor return of pink salmon to most river systems and to the Kitoi Bay Hatchery. The catch of 5.9 million pink salmon was only 46% of the forecast. The return of 700,000 pink salmon to Kitoi was only 24% of the forecast. The season was also noteworthy in the record catch of 5.2 million sockeye salmon, which more than made up for the value lost in pink salmon.

Lake fertilization was expanded in 1990 at Karluk, Frazer, 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 with the Kodiak Regional Aquaculture Association (KRAA) handling the contract and the FRED Division evaluating the results of the effort.

Sockeye salmon culture and technology were expanded at the Kitoi Bay Hatchery and at Pillar Creek. In July, the new Pillar Creek Hatchery construction was completed. This facility, whose construction was fully funded by KRAA, is presently incubating 5.1 million sockeye salmon eggs. At Kitoi Bay, sockeye salmon technology was expanded with the release of 853,000 age-zero smolts at the hatchery. The sockeye salmon egg-take goal for Pillar Creek and Kitoi Bay Hatcheries will be expanded in 1991. A total of 14 million eggs may be taken for Pillar Creek and 5 million for Kitoi Bay.

Kitoi Bay Hatchery is located on Afognak Island at the head of Kitoi Bay on the north end of Marmot Bay. The metal-frame hatchery building was constructed in 1965 after the 1964 earthquake destroyed the facility. The primary user group served by the hatchery is the Kodiak commercial purse seine salmon fishermen. Sport and subsistence fishermen comprise the secondary groups, harvesting fish stocked along the Kodiak road system.

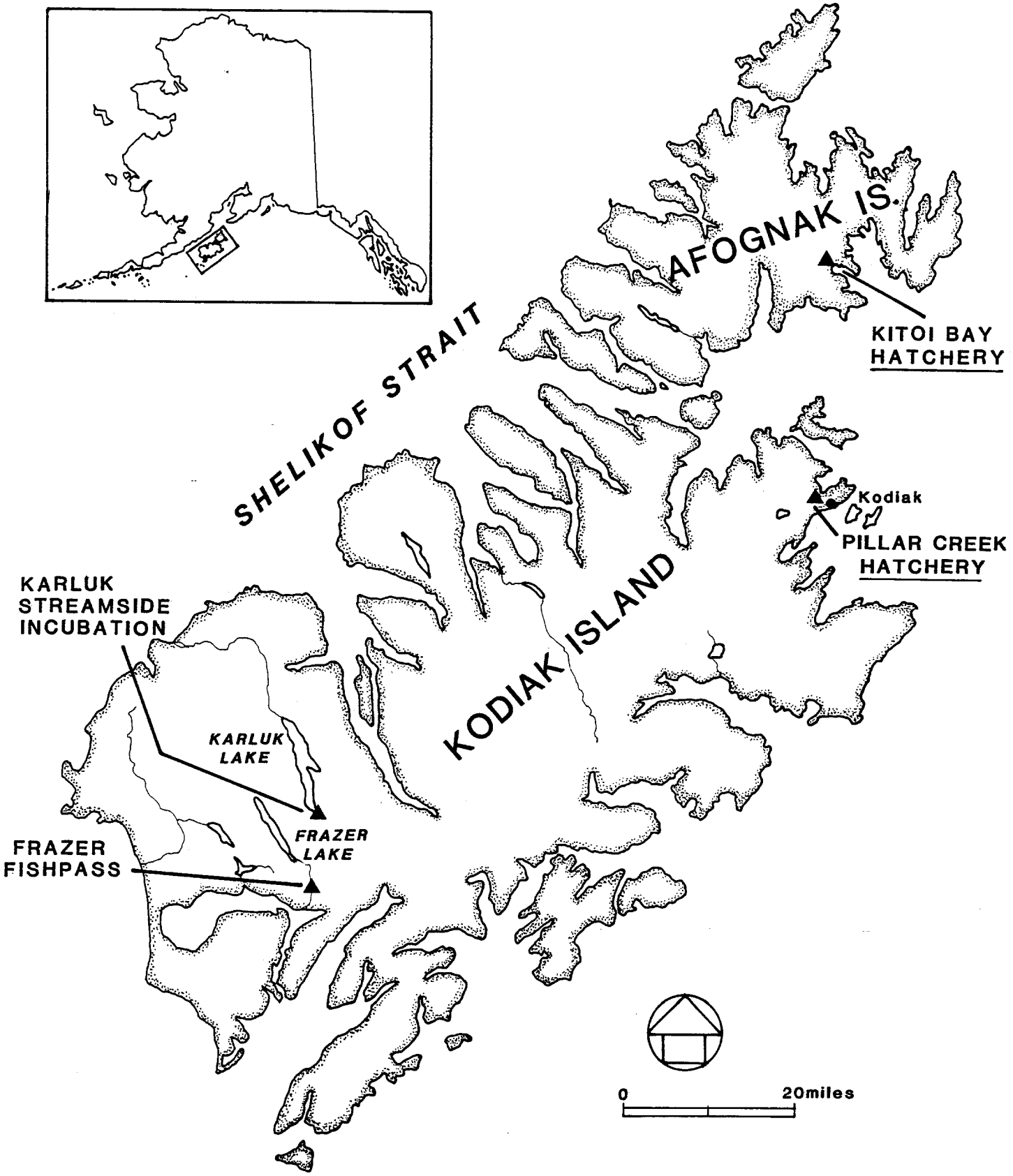

Figure 6.1. Map of Kodiak Island Archipelago.

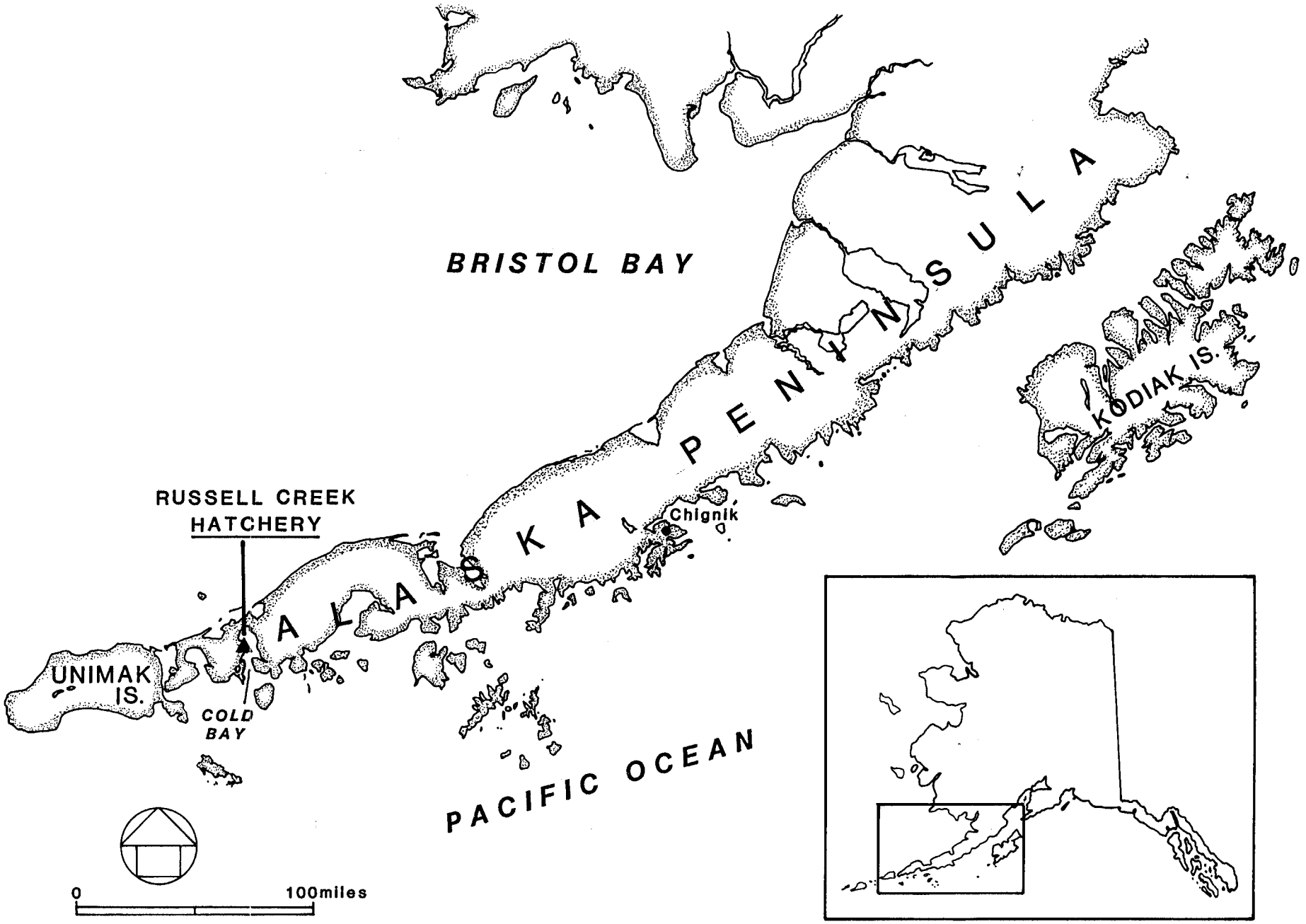

Figure 6.2. Map of Alaska Peninsula.

The main goal of the Kitoi Bay Hatchery is to increase the number of returning adult pink, chum, sockeye, and coho salmon returning to the fishery, and to increase the commercial harvest in areas that historically did not produce good or sustained catches; i.e., cape fisheries in the Duck Bay/Izhut Bay areas. In conjunction with the ADF&G Sport Fish Division, the Kitoi Bay Hatchery provides coho salmon fingerlings for programs designed to create recreational salmon and trout fisheries along the Kodiak road system.

A pilot project using age-zero sockeye salmon was continued at Kitoi Bay Hatchery in 1990. Smolts averaged 2.0 g-3.0 g in size at release and were slightly larger than naturally occurring age-zero sockeye salmon smolts in the wild. This project is expected to produce several hundred thousand sockeye salmon for future harvests.

A new incubation building was completed in 1990 that allowed for expansion of the Kitoi Bay Hatchery's production. The facility went from the normal 100 million-egg capacity to a 170 million-egg capacity in 1990 and will expand to 200 million in 1991.

Russell Creek Hatchery is located at the tip of the Alaska Peninsula approximately 3 miles southwest of the City of Cold Bay and about 1.5 miles upstream from salt water on Russell Creek.

Originally constructed in 1977-1978, it has the potential to be one of the largest hatcheries in the state, with a capacity for 250 million pink and chum salmon eggs. Recent construction by hatchery personnel corrected several design problems and added a large complex of aluminum raceways. At full operation, this hatchery will tremendously enhance the local commercial, subsistence, and sport fisheries.

The original plan for the hatchery was to produce chum salmon, and the hatchery staff spent several years successfully producing a returning broodstock. However, problems created by the False Pass fisheries controversies resulted in several program changes. After discussions and public hearings, the current pink and chum salmon program was reestablished in 1989.

Fish produced by the Russell Creek Hatchery will be taken by commercial fishermen in the Sand Point-King Cove-False Pass area. Sport fishermen also will harvest the returning salmon from Russell Creek and Cold Bay.

Because of a low level of wild stock pink salmon returning to Russell Creek, an effort to increase returns has been underway. Stocks were introduced from Kitoi Bay Hatchery in the fall of 1987.

Because there was no return to the hatchery this year, wild fish had to be used as broodstock. Despite weak natural runs throughout most of the local area, the hatchery staff collected 6 million chum salmon eggs that will be released into Russell Creek after being held and fed in the hatchery's freshwater raceway complex.

During 1990 the Alaska Peninsula organized a salmon planning region. Several meetings of the regional planning team were held to initiate a detailed salmon enhancement plan. As this process is completed, candidate enhancement projects will be identified. Specific

opportunities, stocks, and goals will be identified. In addition, field surveys were initiated to evaluate several lakes near Sand Point to assess their potential for enhancement. Also, Ilnik Lagoon, near Port Heiden, was surveyed to evaluate whether this system could provide more rearing for juvenile sockeye salmon and if it could be produced in an egg-incubation system.

The City of Cold Bay expressed a need for a coho salmon program to enhance the local sport fishery and is underwriting the cost of the program again this year. There will be 100,000 coho salmon smolts produced under this program for release into Russell Creek.

Kodiak And Alaska Peninsula Highlights

- Two hundred tons of fertilizer were applied to Karluk, Frazer, and Afognak Lakes to increase survival of sockeye salmon. Projects were completed in cooperation with the U.S. Fish and Wildlife Service and KRAA.

- Lake surveys were completed to calculate the optimal stocking densities of sockeye salmon fry into Jennifer, Hidden, Summit, Red Fox, Crescent, Uyak, and Waterfall Lakes. This was a cooperative project with KRAA.

- Lake rehabilitation projects were initiated at Portage, Pauls, Barabara, Little Kitoi, Uganik, Buskin, and Little River Lakes. Field data were gathered to calculate total euphotic volume to ascertain rearing escapement levels. This was a cooperative project with KRAA.

- More than 30,000 pink salmon and 5,100,000 sockeye salmon eggs were incubated successfully to the eyed stage at Pillar Creek Hatchery. Egg survival was over 90%. Resultant fry will be stocked into barren lake systems.

- Over 853,000 age-zero sockeye salmon smolts were released into Kitoi Bay. A total of 2.1 million sockeye salmon eggs are currently incubating at Kitoi Bay Hatchery to continue this project. These fish are the foundation for creating a brood source for the Pillar and Kitoi Bay Hatcheries' sockeye salmon programs.

- Instream fry-survival studies at the Terror and Kizhuyak Rivers were continued under agreement with the Alaska Power Authority. Approximately 30,000 eyed pink salmon eggs were planted into Terror River to evaluate instream survivals effected by hydroelectric water demands.

- A chinook salmon sport fisheries enhancement project was continued by stocking 100,000 smolts into Island Lake after a long transport by a SeaLand Barge from Elmendorf Hatchery in Anchorage.

- Oil assessment studies were continued in the Kodiak area for evaluation of overescapement of sockeye salmon into Red, Akalura, and Upper Station Lakes.

- An additional incubation building was constructed at Kitoi Bay Hatchery and plumbed with new incubators to double the incubation of pink and chum salmon.

- More than 11,500 adult coho salmon returned for sport, commercial, and subsistence fisheries enhancement.

- Asbestos insulation in the Kitoi Bay Hatchery was removed under state contract, eliminating a health hazard from this carcinogenic material. This marathon project was completed without disrupting hatchery egg-take goals.

- A significant return of over 21,000 chum salmon to Kitoi Bay Hatchery allowed for a record 18.7 million eggs to be taken. This is a fourfold increase over any previous chum salmon egg takes.

- Pillar Creek Hatchery building construction was completed in cooperation with KRAA.

- Karluk Lake had its first sockeye salmon returns from the lake fertilization program. These returns produced the best commercial fishery on Karluk sockeye salmon since 1926.

- Local support for the Russell Creek Hatchery was developed with a contribution of $51,000 from the Aleutians East Borough and $15,000 from the City of Cold Bay.

- A Russell Creek Hatchery basic management plan (BMP) was completed and accepted by the newly formed regional planning team. This gives the local residents a voice in FRED Division projects that affect them.

- The Ilnik Lagoon drainage system was studied to determine whether more young sockeye salmon could be reared and if the headwater springs would be capable of operating an egg incubation box system.

- The coho salmon return to the Village of Port Lions was excellent with over 5,000 fish returning. The villagers caught enough salmon for all of their subsistence needs. The village is now trying to persuade ADF&G to install a fishpass to expand spawning for the escapement. This program has resulted in good public relations between the village and ADF&G.

Kodiak and Alaska Peninsula Returns and Fishery Contributions

The total return of 730,100 pink salmon to Kitoi Bay Hatchery included a commercial catch of 539,500 and broodstock and escapement of 190,600. An additional 4,100 chum salmon were caught in the commercial fishery; 21,200 were used for broodstock.

The Karluk Lake sockeye salmon population and commercial fishery continues to rebuild following 50 years of depression. The total return of 2,229,000 sockeye salmon included 1,491,000 in the commercial catch and 738,000 in the escapement. This year saw the first returns that showed the influence of lake fertilization. The catch was one of the best on record as far back as the 1930s.

The Frazer Lake sockeye salmon return continues to improve. This was the second consecutive year that the Frazer Lake sockeye salmon commercial catch was 800,000. Frazer Lake, which was a barren system for salmon until it was stocked in the 1950s, is the most successful sockeye salmon introduction project in North America. While the ADF&G Commercial Fisheries Division operates the ladder facility, the FRED Division, in cooperation with KRAA, is fertilizing the lake system.

Contributions of fish from Russell Creek Hatchery to the area's commercial fishery were negligible this year, as there were no returning hatchery chum salmon this year. This facility is in its broodstock-building phase of program development and will not see a hatchery return until the BY 89 fish return as adults.

Kodiak and Alaska Peninsula Releases

Kitoi Bay Hatchery was again a leading producer of fish. A total of 84.9 million pink salmon fry (83.9 million fed and 1.0 million direct release) were released. A total of 1.5 million chum salmon were reared up to 2.0 g and released from net pens. Over 36,000 coho salmon fingerlings were stocked into Kodiak area lakes and 140,000 coho salmon smolts and 853,000 sockeye salmon smolts were released into Little Kitoi estuary. An additional 1.3 million sockeye salmon fry and fingerlings were stocked out of the facility. The total number of fish released from Kitoi Bay, all species combined, was over 90 million.

During 1990 the Russell Creek Hatchery released 8 million pink salmon fry, 13 million chum salmon fry, and 35,000 coho salmon smolts.

Kodiak and Alaska Peninsula Egg Takes

A total of 151 million pink salmon, 18.7 million chum salmon, and 1.0 million coho salmon eggs were taken at Kitoi Bay to expand salmon enhancement.

Five million pink salmon and 6 million chum salmon eggs were taken from Russell Creek in the summer of 1990. An egg take of at least 100,000 coho salmon eggs will continue the smolt-stocking program, supported, in part, by the City of Cold Bay.

The sockeye salmon enhancement program in Kodiak expanded egg takes for 2 projects: 5.1 million eggs for the new Pillar Creek Hatchery and 2.1 million eggs from Upper Station Lake for Little Kitoi Bay.

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CHAPTER 7

ARCTIC-YUKON-KUSKOKWIM

Summary of FRED Projects

Two FRED Division hatcheries are located in the Arctic-Yukon-Kuskokwim (AYK) Region (Figure 7.1). Clear Hatchery, at the Clear Air Force Station, produces Arctic grayling, Arctic char, and lake trout for Interior sport fisheries. Sikusuilaq Springs Hatchery on the Noatak River near Kotzebue produces fall chum salmon for the Kotzebue area commercial and subsistence fisheries.

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

The Arctic char project is designed to develop, maintain, and expand domestic broodstock to supplement and eventually replace wild stock egg takes, and to continue to provide fingerlings, subcatchables, and catchables for Interior and Southcentral sport fish programs. The Arctic grayling project is designed to maintain and expand a domestic broodstock 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. The domestic sheefish program was a very successful fish-cultural program, but the sheefish have not survived well after release and have not contributed significantly to the sport fish harvest; therefore, the program has been discontinued. The lake trout program currently depends on a remote egg take from a wild broodstock to provide enhancement and a mixed fishery in several lakes.

The Arctic grayling, Arctic char, and lake trout programs continue to expand as an integral part of the Interior and statewide sport fisheries enhancement programs. The rainbow trout fingerling project, an important sport fish species in the Interior, was transferred from Clear Hatchery to the Fort Richardson Hatchery in 1991 to allow for further expansion of lake trout and Arctic char programs. The sheefish program is being stopped because of unsatisfactory lake survivals, high program costs, and the need to expand the lake trout and Arctic char programs. In addition, expanded rearing and broodstock-holding facilities are being pursued to attain increased goals and to use available resources and funds in the most efficient and productive manner.

Clear Hatchery has one of the best aquifers in the state, with abundant clean water available at several temperatures. Steam and warm-water sources are available to heat incubation and rearing water to any desired temperature. Performance can be judged by Clear Hatchery's progressive history of fish-cultural success with up to 7 species.

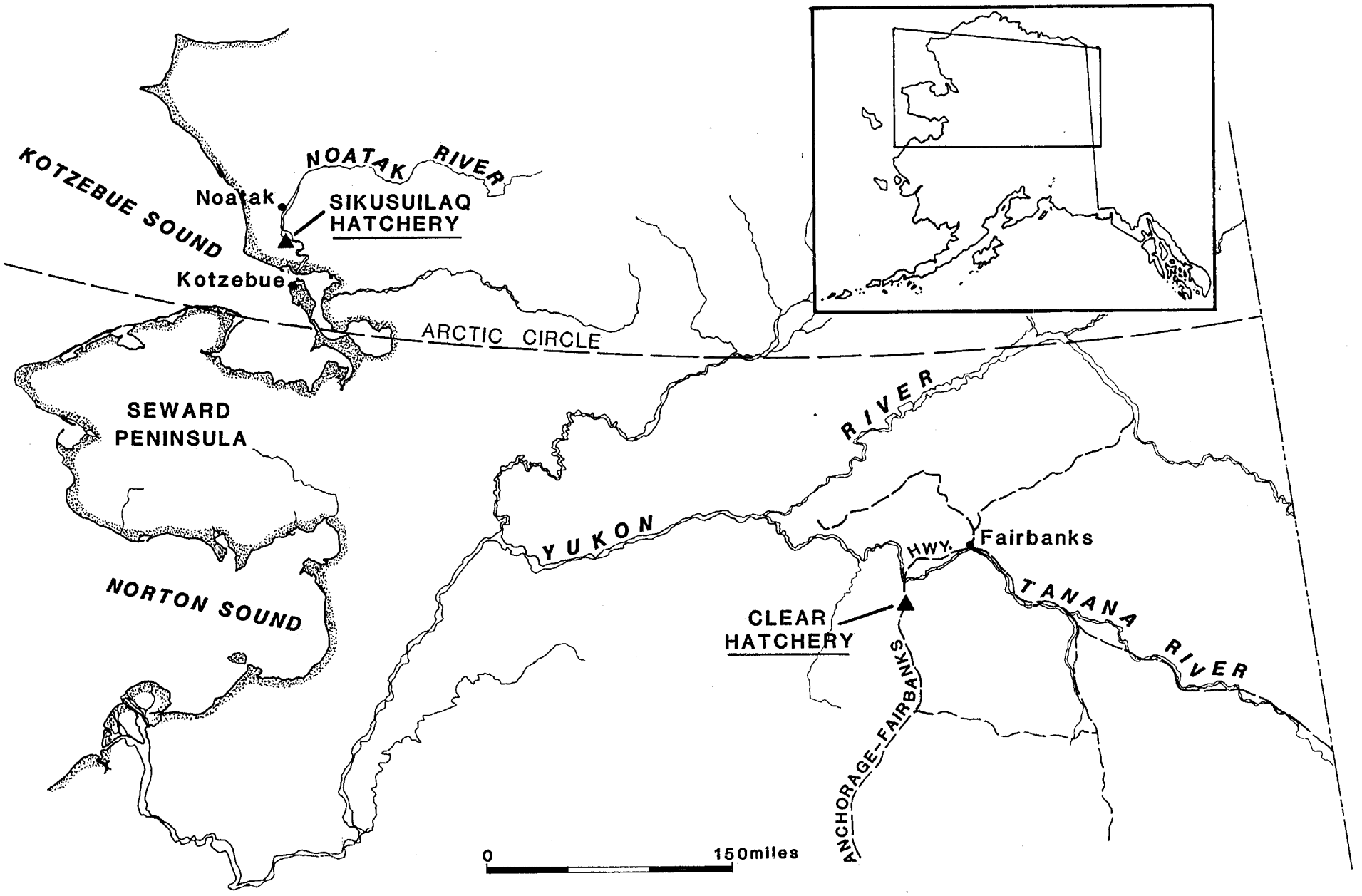

Figure 7.1. Map of Arctic-Yukon-Kuskokwim.

Success in culturing Alaska's "exotic" species, Arctic grayling, Arctic char, lake trout, and sheefish, continues with considerable success.

The Sikusuilaq Springs Hatchery is located on the Noatak River about halfway between Kotzebue and Noatak Village. Funding came from the 1978 Bond Issue and construction costs were around $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 were successful. During 1987 the capacity of the hatchery was expanded from 2 million to 10 million eggs. So far, all indications are that annual returns from a 60 million-egg production hatchery at Sikusuilaq Springs Hatchery 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 has been initiated to produce a plan. Complete design to the construction-document stage still needs to be done. Total costs for design and construction are currently estimated at $12.75 million. If all goes well, the production hatchery could be completed by 1995.

The "Jobs Bill" warehouse construction project for Sikusuilaq Springs Hatchery finally got underway in 1990 after staff had trouble getting all the material on site. A crew of nonpermanent carpenters, a trades helper, and a cook were hired from Noatak Village. After 6 long weeks of work and lots of cooperation from the weather, the building was essentially completed—some finish work remains.

Sikusuilaq Springs Hatchery operates with a complete open-door policy. People are welcome to come in at any time of the day or night, year round. Cold travelers are served coffee and provided a place to stay when travel is difficult. At least four parties have been rescued out of overflow at the Agashashok River and one party upriver from Sikusuilaq Springs. The hatchery also serves as a communications point during searches in the area.

Several rehabilitation projects were begun in western Alaska in 1990. FRED Division, in cooperation with the ADF&G Commercial Fisheries Division and the Bureau of Land Management, helped the Nome-Beltz High School to develop and install a small (50,000-egg) "Scientific and Educational" fish hatchery and to collect a small number of coho salmon eggs (the goal of 50,000 eggs was frustrated because of scheduling problems). The students and staff are highly involved with this hands-on learning opportunity. The FRED Division is proceeding to expand this experience to improve the scheduling and technical detail of this facility. This small project will also help to improve fishing in the Nome area. In addition, planning has begun for the enhancement of pink and chum salmon in the Nome River. Preliminary discussions with the school personnel at Unalakleet also suggest strong interest in this type of project.

The FRED Division has begun to monitor studies in western Alaska for potential development of enhancement projects in Elim, Nelson Island, and Chevak. Following initial field surveys, several monitoring stations were established in each area to evaluate water temperatures, quality, and volume. Two sites in the Nelson Island/Chevak area show promise for developing egg-incubation projects. The FRED Division is helping the Bering Sea Fishermen's Association to prepare a grant-request proposal to obtain

funding for these projects that will establish new salmon runs. The site near Elim also appears to have good potential for development of a hatchery to enhance and develop additional salmon production.

Arctic-Yukon-Kuskokwim Highlights

- Arctic grayling diet experiments at Clear Hatchery resulted in a record 87% fry survival during a 12-day period.
- A total of 152 lakes was stocked with 5 different species from Clear Hatchery in 1990.
- Clear Hatchery personnel are providing educational opportunities for the Tok and North Pole schools by supplying technical expertise and materials for self-contained incubation units. Personnel, fish, and displays are provided for the annual "Fishing is Fun" day in Fairbanks.
- The June 1990 fry release of 6.36 million chum salmon was a new record for Sikusuilaq Springs Hatchery.
- The 1990 egg take of 9.2 million chum salmon eggs is a new facility record for Sikusuilaq Springs Hatchery.
- The second record spring flood in a row for the Noatak River caused the premature release of 500,000 fry from the Sikusuilaq Springs Hatchery.
- The "Jobs Bill" warehouse construction project at Sikusuilaq Springs Hatchery was completed this summer, thanks to excellent work by a nonpermanent work crew from Noatak Village.

Arctic-Yukon-Kuskokwim Returns and Fishery Contributions

Nearly 22,000 adult chum salmon from Sikusuilaq Springs Hatchery releases had been expected to return to the Kotzebue area during the summer and fall of 1990. Still, the commercial fishery harvested about 5,000 of these fish in Kotzebue Sound. Subsistence users harvested at least 3,000 of these returning fish and nearly 6,000 returned to Sikusuilaq Springs. These fish provided 8.2 million eggs for incubation this year and an additional 1 million eggs were collected from spawning areas on the Noatak River.

Arctic-Yukon-Kuskokwim Releases

Releases from Clear Hatchery in 1990 included Arctic char, Arctic grayling, sheefish, and lake and rainbow trout. Approximately 152,000 Arctic char were released from Clear Hatchery into 28 Interior and Southcentral lakes with this rapidly expanding program. In addition, over 2,000 Arctic char were transported to the Red Dog Mine near Nome for

water-pollution experiments. Nearly 807,000 Arctic grayling fry were stocked from Clear Hatchery into 36 lakes statewide, and 86,900 Arctic grayling fingerlings were stocked into 34 lakes statewide. All sheefish adult broodstock were stocked into an Interior lake. The 114,300 lake trout were stocked into 8 Interior and Southcentral lakes. Approximately 424,700 rainbow trout fingerlings were stocked into 45 Interior lakes.

This was the third year of production at Sikusuilaq Springs Hatchery using the equipment installed during the 1987 expansion to a 10 million-egg capacity. During September 1989 8.7 million eggs were collected for incubation; of these eggs, 6.4 million survived until they were released as fed fry in June 1990. Suffocation problems occurred during hatch that resulted in lower-than-expected survivals; lower survivals continued through fry rearing because of damage caused during hatch. The emergent fry were held in the outside fish-holding tanks for 6 weeks of rearing.

For the second year in a row, Sikusuilaq Springs Hatchery had a record spring flood. This year's flood topped the rearing raceways and at least half a million fry escaped prematurely. Fry growth was good this year, in large part due to switching from a dry diet to a more palatable semimoist diet.

A test group of 140,000 fry was held for continued rearing after the rest of the fry were released. These fry were reared for 3 additional weeks in a net pen in the Noatak River. The warm river water temperatures were excellent for fry growth: the fry tripled in size. This technique probably will not work for production-size groups of fish; however, a warm-water pipeline from the river to the raceways would allow warm-water rearing of all fry.

In summary, 6.3 million fry were released from Sikusuilaq Springs Hatchery during June 1990 at an average weight of 0.5 g each. Approximately 138,000 fry were warm-water-reared for an additional 3 weeks and released at an average weight of 1.4 g each. The 1991 fry release is expected to be around 8.2 million fed fry. These fry should return as approximately 82,000 adult salmon during the years 1993 and 1996.

Arctic-Yukon-Kuskokwim Egg Takes

Egg takes for Clear Hatchery included both domestic and wild Arctic char as well as Arctic grayling and wild lake trout.

Staff at Sikusuilaq Springs Hatchery took approximately 8.2 million eggs from fish returning to Sikusuilaq Creek. An additional 1 million eggs were taken from fish on the spawning grounds near Noatak Village.

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CHAPTER 8

PROGRAM PROJECTIONS FOR 1991

The FRED Division uses many strategies for rehabilitation, enhancement, and development of fisheries other than hatcheries. Several of these strategies, including operation of fish ladders to allow salmon to reach unutilized spawning areas, lake fertilization, habitat improvement, and fish-planting programs are much more difficult to evaluate than standard hatchery production. With lake fertilization and fish-planting projects, tagging and use of sonar counters allow for evaluation, often on a par with hatchery evaluation, but at a much greater cost. Fish ladders and habitat improvement projects are difficult to evaluate; i.e., estimating the increased number of fish attributable to a project. Often, if evaluation is biologically feasible, it is cost-prohibitive. Since hatchery production is the most quantifiable strategy, it often is used as the standard by which the effectiveness of fisheries enhancement is measured. Table 8.1 presents projected numbers of fish expected to return to a diverse group of FRED Division projects, not including fishpass projects or projects involving transfers of eggs or fish to PNP cooperators.

The numbers of salmon that returned in 1990 as a result of FRED Division hatchery operations met or exceeded many of the projections. The obverse was equally true; some returns were lower than projected values. Overall, the 1990 projection presented in last year's annual report exceeded the estimated actual production in 1990. This was due primarily to the depressed pink salmon return to Kitoi Bay Hatchery where only 730,000 salmon returned; just over 3 million pink salmon had been projected. Our prediction for pink salmon in 1990 was high for both the Kodiak and lower Cook Inlet areas because of an unexpected run failure that affected both wild and enhanced fish. The pink salmon commercial harvest in lower Cook Inlet was one of the lowest on record. Our prediction for sockeye salmon returns for 1990 was less than half the actual estimated production. The record return of sockeye salmon to Kodiak area projects was a pleasant surprise.

Projected Returns for 1991

A statewide total of over 9.5 million salmon is expected to return to FRED Division projects in 1991 (Table 8.1). Pink salmon comprise the largest segment of the projected returns, primarily to Kitoi Bay, Main Bay, and Tutka Bay Hatcheries and to the Halibut Cove project. The projection for 1991 is for sockeye salmon to be the second-largest segment of the 1991 returns. This trend is following the FRED Division's sockeye salmon initiative. Major sockeye salmon producers for 1991 will include Tustumena, Big, Gulkana, Chenik, Karluk, Hidden, McDonald, Hugh Smith, and Leisure Lakes. Projections for chinook, sockeye, and pink salmon 1991 returns are greater than 1990 return projections, while coho and chum salmon and steelhead trout projections are lower.

Table 8.1. A projection of the number of salmon expected to return in 1991 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						
Sikusuilaq				13,000		
AREA TOTALS:				13,000		
COOK INLET						
Big Lake		4,000	100,000			
Cottonwod Drainage		800				
Wasilla Creek		500				
Jim Creek		500				
Willow Creek	1,950					
Little Susitna		9,000				
Crooked Creek	6,500	2,500				650
Ninilchik River	2,000					
Chenik Lake			125,000			
Paint River			22,000			
Tustumena			120,000			
Tutka				41,800	870,000	
Halibut Cove	2,600				300,000	
Homer Spit	5,500	6,100			7,500	
Seldovia Bay	3,400	800				
Leisure Lake			100,000			
Port Dick Lake			9,200			
Kirschner Lake			13,800			
Hazel Lake			39,000			
Caribou Lake		4,900				
Resurrection Bay	4,000	9,000				
Ship Creek	4,000	2,000				
AREA TOTALS:	29,950	40,100	529,000	41,800	1,177,500	650
KODIAK-AK. PENINSULA						
Karluk			1,400,000			
Kitoi		16,200	5,000	100,000	3,500,000	
Kodiak other	300	18,000	700,000		500,000	
Russell Creek		2,000			80,000	
AREA TOTALS:	300	36,200	2,105,000	100,000	4,080,000	0
PRINCE WILLIAM SOUND						
Cordova		5,000				
Gulkana			222,700			
Main Bay			173,000	225,000	200,000	
Whittier		5,000				
AREA TOTALS:	0	10,000	395,700	225,000	200,000	0

Table 8.1. Continued.

Return site	Numbers by species Chinook	Coho	Sockeye	Chum	Pink	Steelhead
SOUTHEAST - SOUTHERN						
Bakewell/Badger			14,200			
Big Salt	890					
Bold Island Lakes		3,150				
Deer Mountain	2,900	3,400				
Hugh Smith Lake			8,800			
Klawock		40,200	13,400			500
Marx Creek				56,900		
McDonald Lake			155,000			
Rio Roberts		180				
Thorne Bay	280					
Tunga Inlet		5,250				
Ward Creek		4,300				
SOUTHEAST - CENTRAL						
Crystal Lake	23,900	6,000				10
Earl West Cove	19,400					
Farragut River	50					
Harding River	230					
Ohmer Creek	850					
SOUTHEAST - NORTHERN						
Boat Harbor				46,000		
Chilkat Ponds		1,200				
Eliza Lake	50					
Indian River	90					
Jerry Myers	50					
Juneau/DJ	4,700	3,600				
Limestone Inlet				73,000		
Snettisham	2,000			48,000		
Tahini River	40					
Twin Lakes	2,000					
AREA TOTALS:	57,430	67,280	191,400	223,900	0	510
STATE TOTALS:	87,680	153,580	3,221,100	603,700	5,457,500	1,160
	GRAND TOTAL:		9,524,720			

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CHAPTER 9

PROGRAM ELEMENTS

Sport Fisheries Enhancement Program

The sport fisheries enhancement program is large and complex. It involves coho, chinook, pink, and sockeye salmon, rainbow, lake, and steelhead trout, Arctic grayling, and Arctic char. Lifestages stocked include: unfed fry, fed fry, fingerlings, presmolts, smolts, postsmolts, and precatchable- and catchable-sized fish. These fish were released from 13 facilities into over 60 stocking locations for anadromous fisheries and approximately 300 stocking locations for landlocked fisheries.

Review meetings and planning sessions are frequently held with the ADF&G Sport Fish Division, Regional Planning Teams, and other interested parties to improve the program wherever possible. The intent is to keep this complex program as comprehensive and responsive as possible. There continues to be a solid and increasing public demand for additional sport fish production via the hatchery system.

Highlights of the 1990 sport fisheries enhancement program include:

- Personal-use dip-net fishing on Ketchikan Creek was open for 2 days in 1990. Deer Mountain Hatchery summer coho salmon were included in the catch for the first time. A total of 251 coho and 195 chinook salmon were harvested.

- More than 20% of the chinook salmon harvested in the Juneau sport fishery during the last 3 years have been hatchery fish, the major contributor being Snettisham Hatchery.

- Prince William Sound sport fishermen harvested an estimated 10,000 coho salmon that returned from FRED Division coho salmon smolt releases.

- Over 454,000 Arctic grayling fry from Clear Hatchery were stocked into 24 Prince William Sound lakes to increase area sport fishing opportunities.

- Over 252,000 catchable and fingerling rainbow trout from Fort Richardson Hatchery were stocked into 29 Prince William Sound lakes to benefit area sport fishermen.

- Approximately 4.4 million rainbow trout eggs were taken at the BDC in March and April 1990 for the rainbow trout sport fisheries enhancement program.

- BDC personnel spawned the first sex-reversed rainbow trout that matured and produced experimental groups of all-female fish to improve the efficiency of the rainbow trout sport fisheries enhancement program.

- The BDC created nearly 40,000 rainbow trout that were essentially 100% triploid for ultimate release as catchables into Pile Driver Slough near Fairbanks. This program was implemented specifically at the request of the ADF&G Sport Fish Division.

- A new project, the release of small subcatchables into Fairbanks area lakes from Fort Richardson Hatchery, was undertaken this season, and 92,000 fish were released.

- Over 233,000 large, subcatchable rainbow trout were released from Fort Richardson Hatchery.

- Hatchery-produced adult coho salmon returns from Fort Richardson Hatchery smolt releases in Prince William Sound were estimated at 10,000 fish.

- An estimated 46% of the chinook salmon harvested at Willow Creek in 1990 originated from Fort Richardson Hatchery.

- In 1990 staff of the Crooked Creek Hatchery successfully refined and operated a moist-air incubator to accelerate development of coho and chinook salmon eggs. The accelerated egg development will enable production of coho salmon smolts and fingerlings and late-run Kasilof River chinook salmon smolts for sport fisheries enhancement.

- Anglers that fished from shore spent 21,415 angler-days to harvest 7,788 Crooked Creek chinook salmon in the Kasilof River sport fishery during 1990. Of these, an estimated 61% (4,750) were the result of Elmendorf Hatchery smolt releases into Crooked Creek. In addition, an unknown but substantial number of chinook salmon were harvested by clients of sport fishing guides operating on the Kasilof River. The annual sport harvest of chinook salmon in the Kasilof River exceeded that for the combined early and late runs of chinook salmon in the Kenai River during 1990. The poor return of chinook salmon in the Kenai River during 1990 resulted in a substantial increase in the number of drift-boat guides operating on the Kasilof River.

- A total of 2,098 Crooked Creek Hatchery-produced coho salmon returned to Crooked Creek in 1990. Of these, an estimated 878 were caught in the sport fishery.

- The Homer Spit pink salmon rearing project had a return of approximately 600 fish from last year's release. This provides a significant extension of the sport fishery on the Homer Spit after the chinook salmon run ended in early July.

- Since 1978 over 66,000 pink salmon have been harvested by sport fishermen in and around Tutka Lagoon. Tutka Lagoon has become a very popular pink salmon sport fishery with the number of campers and charter-boat operators increasing annually.

- The Homer Spit sport fish enhancement project received an award from the American League of Anglers and Boaters for the best sport fish management program in the nation in 1990.

- The FRED Division has been expanding local sport fish stocking programs to meet increasing public demand in the Homer and Kachemak Bay areas. Over 19,700 salmon were harvested by sport fishermen in 1990 from various enhancement projects in the Kachemak Bay area.

- Nearly 90% or more of the salmon harvested by Kachemak Bay anglers originate from FRED Division enhancement projects, annually.

- The chinook salmon project at Halibut Cove Lagoon, which has involved the release of over 1.5 million smolts since 1974, has resulted in an annual harvest of 400-2,600 chinook salmon since 1981 and provided recreational opportunities for up to 3,000 anglers in a single season.

- The salmon-stocking program on the Homer Spit has created an extremely popular, family-oriented fishery. There were 2,200 chinook, 600 pink, and 3,500 coho salmon harvested by anglers at this sport fishery enhancement site in 1990.

- A chinook salmon sport fishery enhancement project was continued by stocking 100,000 smolts into Island Lake on Kodiak Island after a long transport by a SeaLand Barge from Elmendorf Hatchery in Anchorage.

- With production of 3 year-classes of domestic broodstock, the Arctic char project at Clear Hatchery is rapidly expanding. Over 375,000 Arctic char eggs were taken from 2 of the year-classes, resulting in 77% of the fingerlings released.

- A total of 152 lakes was stocked with 5 different species from Clear Hatchery in 1990.

Commercial Fisheries Enhancement Program

Commercial fishermen benefited throughout the state from returns of hatchery-produced fish. Sockeye, chum, and pink salmon are primarily released for the commercial fisheries enhancement program. Main Bay Hatchery is the only Alaskan hatchery that releases yearling sockeye salmon as smolts. During 1990 a substantial egg take was completed at Main Bay Hatchery from adults that returned from the first release of sockeye salmon smolts. These adults were held and ripened before the egg take in the hatchery. Pink salmon returns to Tutka Bay and Kitoi Bay Hatcheries were lower than expected in 1990; yet, although the numbers were low, the contribution was important. In the Kodiak area, the contribution to the sockeye salmon fisheries was large. The Kotzebue Sound commercial fishery was also below expectations, so contributions from the Sikusuilaq Springs Hatchery were very important.

Highlights from 1990 commercial fisheries enhancement projects include:

- Klawock Hatchery contributed 27,000 coho salmon to the commercial fisheries.

- Alaskan hatchery chinook salmon contributions to the troll fishery in Frederick Sound are growing steadily, approaching 50% of the local catch.

- An estimated 10,000 sockeye salmon adults from the initial 1988 smolt release returned to Main Bay Hatchery; of these, approximately 9,000 were caught in the commercial fishery.

- Sockeye salmon returns from Gulkana Hatchery contributed an estimated $2 million to the Prince William Sound commercial fishery.

- An estimated 350,000 chum salmon worth $2.4 million from previous FRED Division releases were harvested by the commercial fishing fleet at Main Bay Hatchery.

- The number of sockeye salmon produced by Crooked Creek Hatchery in Tustumena Lake (Kasilof drainage) and caught in the commercial fishery was estimated at 134,000. At an average price of $1.40 per pound for sockeye salmon in Cook Inlet during the 1990 commercial fishery, the ex-vessel value of these fish amounts to $845,000.

- Tutka Bay Hatchery had one of its lowest returns in the facility's 14-year history at 202,000 pink salmon. Still, hatchery production accounted for 24% of the entire 1990 lower Cook Inlet commercial pink salmon harvest.

- The Halibut Cove Lagoon project had a return of 42,800 pink salmon in 1990 from last year's cooperative rearing project with CISA. This represents a 0.7% ocean-survival rate.

- The harvest goal for the Tutka Bay Hatchery project, as set forth in the Cook Inlet Regional Salmon Enhancement Plan, is an annual harvest of 560,000 pink salmon by 1990. The hatchery has exceeded this goal in 1981, 1983, 1988, and 1989.

- Since 1983 FRED Division projects in lower Cook Inlet have annually contributed 28%-67% of the total commercial salmon ex-vessel value.

- In 1990 FRED Division projects accounted for 64% of the $1.7 million ex-vessel value of the lower Cook Inlet salmon harvest.

- The Chenik, Kirschner, Leisure, and Port Dick Lakes stocking projects from Crooked Creek Hatchery provided nearly 73% of the total lower Cook Inlet sockeye salmon harvest in 1990. Ex-vessel values from these projects were estimated at $889,000.

- Nearly 42 million salmon fry, fingerlings, and smolts were released in the lower Cook Inlet area in 1990 to provide future contribution to area fisheries. Potential returns from these FRED Division releases could exceed 1 million salmon.

- Karluk Lake had its first sockeye salmon returns from its lake fertilization program. This produced the best commercial fishery on Karluk sockeye salmon since 1926.

Oil Spill Operations

On 24 March 1989 the Exxon Valdez went aground on Bligh Reef in eastern Prince William Sound. Approximately 11 million gallons of north slope crude oil poured out of the ruptured vessel to create the largest oil spill ever in North America. The downcurrent drift of this oil spill covered the highly productive nearshore waters and shorelines of Prince William Sound, the Gulf of Alaska, western Cook Inlet, the Kodiak Archipelago, the Shelikof Straits, and the Alaska Peninsula. FRED Division facilities were directly effected by this floating oil at Main Bay Hatchery in Prince William Sound and at Kitoi Bay Hatchery on Afognak Island. Although floating crude oil did not reach the Tutka Bay Hatchery on the lower Kenai Peninsula, adjacent shorelines were oiled and a direct impact appeared imminent for several weeks. Area biologists and hatchery managers in Prince William Sound, Kodiak, and lower Cook Inlet and their staffs were immediately involved with the effects of the oil spill as they tried to anticipate where the oil might drift and how it might affect the natural habitat, commercial, and PNP facilities and activities.

In the time since the oil spill, FRED Division biologists became partners in a multifaceted, multiagency scientific oil spill impact assessment team. Talents and resources were immediately pooled to plan and implement field studies to assess and document detrimental effects of the oil spill. FRED Division involvement with oil spill impact assessment programs are continuing as part of the joint state-federal cooperative assessment effort. The FRED Division has had lead responsibility for projects within the package of approved projects.

Now, the FRED Division is working within ADF&G and with PWSAC, CIAA, and KRAA to provide the fish and the expertise to rehabilitate stream and fish populations that have been effected by the floating oil and to mitigate for impacts. This need and potential contribution makes it even more imperative that the hatcheries, their broodstocks, and their production systems remain intact and uncontaminated.

Fish Habitat Enhancement and Improvement

The FRED Division has continued to develop and pursue fish habitat improvement and enhancement projects in several areas of the state. The goal of these projects is to improve, create, or rehabilitate fish habitat so that long-term, natural productivity of the waters in the state are improved. FRED Division personnel cooperated with other agencies, primarily the USFS and PNP enhancement groups, in many nonhatchery projects during 1990. Fishpass projects were particularly evident in the Southeast Region.

Besides the following projects, FRED Division staff also acted in an advisory capacity for fishpasses constructed by the USFS at Kwatahein Creek, Kuiu Island, and Meter Bight Creek on Zarembo Island.

Sunny Creek - This successful fishpass allowed access to spawning habitat for at least 16,000 pink salmon in 1990 (one escapement survey). Constructed in 1984, the Alaska steeppass design has functioned well.

Dog Salmon Creek Fishpass - In its second year of operation, this fishpass provided access to upstream spawning habitat for at least 4,700 pink salmon and 114 coho salmon (numbers from one survey only). FRED Division limnology staff assessed rearing salmonid populations in the lake above the ladder in 1989 and recommended that no fish be planted; increased habitat utilization would be by natural immigration only. The pass opens up 2 miles of spawning habitat for pink and chum salmon.

Big Lake Fishpass - A partial barrier exists on 108 Creek, the outlet stream of Big Lake on Prince of Wales Island. A fishpass is under construction by the USFS, Thorne Bay District that will provide upstream access for pink and chum salmon. Sockeye and coho salmon now utilize the upstream habitat. FRED Division limnology staff are continuing fry and smolt survey work to determine if sockeye or coho salmon should be planted above the ladder.

Tunga Lake - Klawock Hatchery carried out a colonization project above a USFS fishpass, planting coho salmon fingerlings over a 4-year period. Returns to the commercial fishery have been excellent: in 1990, 5,359 coho salmon were intercepted, amounting to 2.3% of the fingerlings stocked. Although escapement has not been thoroughly evaluated, natural production from the system should be significant in future years.

Margaret Creek Fishpass - Deer Mountain Hatchery provided 21,000 summer coho salmon presmolts in 1990 for colonization above a fishpass on Margaret Creek (Revillagigedo Island) completed in 1989 by the USFS. Fishpass opening and the start of the colonization phase were delayed until 1990 while the USFS completed a prestocking assessment of the resident cutthroat trout population. The pass provides anadromous access to a 145-acre lake and its tributaries. In addition to coho salmon, sockeye salmon fry have been planted into Margaret Lake: 500,000 Naha River stock in 1988 and 300,000 McDonald Lake stock in 1990. Continued assessment of in-lake fish populations by the USFS and the FRED Division's Limnology Section will provide useful information on the effect of introduced species. For example, the FRED Division Limnology Section determined that 56,000 (11.5%) sockeye salmon from the 1988 plant survived to smolts. Data are not yet available on survivals of 1990-planted fish. Extensive predation by resident fish is assumed to be the cause of lower-than-expected survivals.

Rio Roberts Creek Fishpass - Colonization by coho salmon above the Rio Roberts fishpass is the FRED Division's portion of a cooperative agreement with the USFS, Thorne Bay Ranger District. The fishpass opens approximately 2 miles of upstream habitat in the Thorne River drainage. The Klawock Hatchery crew

planted 25,300 coho salmon fingerlings above the pass in 1990 and are collecting eggs at remote locations in the Thorne River for another release group in 1991.

Cable Creek Fishpass - Some 69,700 coho salmon fingerlings averaging 6.7 g were planted above the Cable Creek fishpass in 1990. Approximately 2,100 adults should result from this release. Another 40,000 eggs were collected in 1990 for Cable Creek. This enhancement project has been a cooperative effort with the USFS, Craig Ranger District, that constructed the fishpass. However, Cable Creek, including the fishpass, is part of a state land selection and was to be transferred to state ownership in December 1990. Construction design is a pool-and-weir type, fabricated of concrete. Pools probably will have a maintenance problem because of downstream wash of gravel.

Slippery Creek Fishway - The USFS constructed a fishway on this system in 1988. A joint effort by the FRED Division, NSRAA, and the USFS distributed 45,900 fed and 98,700 unfed coho salmon fry throughout the upper watershed of Slippery Creek in 1990. A total of 225,000 fed fry and 678,000 unfed fry have been released into Slippery Creek during the past 4 years. This completes the bioenhancement in this system. Tag recoveries suggest that 700 adult coho salmon entered the fisheries in 1990 from BY 86 releases. This brings the total contribution to the fisheries from the initial release to 1,150 adults.

St. John's Creek Fishway - The USFS built the St. John's Creek fishway in 1986. Efforts to enhance coho salmon production on St. John's Creek were initiated in 1985. Through 1987 less than 24,000 fry were planted above the barrier. A committee of local ADF&G, NSRAA, SSRAA, and USFS personnel recommended use of hatchery stocks in 1988. Permission was granted to use Crystal Lake Hatchery coho salmon eggs fertilized with milt obtained from St. John's Creek coho salmon stocks. This resulted in 36,700 fed fry released in 1990. USFS personnel from Wrangell attempted to capture male coho salmon in 1990 to fertilize eggs from Crystal Lake Hatchery, but repetitive storms thwarted all efforts to obtain males. Tagged coho salmon from this project first appeared in the fisheries in 1989. The estimated contribution in 1990 is 37 fish, and the total harvest to date is 60 adult coho salmon. Though estimated contributions to the fisheries appear low, surveys on the watershed indicate that juvenile coho salmon are using the habitat above the fishpass.

Old Franks Lakes Fishpass - A fishpass project in lower Old Franks Creek has long been endorsed as a high-priority project in southern southeast Alaska. Resolution of several issues surrounding the project occurred in 1990, and construction of the two passes is scheduled for 1991 by the USFS, Craig Ranger District. The FRED Division will stock the area above the passes in 1992 with as many as 1 million coho salmon fingerlings, resulting in an anticipated adult production of 50,000. The two passes will open 730 acres of lakes and 3.8 miles of stream habitat to anadromous fish production. Several private corporations will be brought into this project as partners, as well as the Ketchikan Sports and Wildlife Club who is interested in contributing labor, equipment, and expertise to the project.

USFS Suntaheen Fish Ladder Bioenhancement - The USFS constructed a fish ladder over a barrier on the Suntaheen River on Chichagof Island. Because bioenhancement above the ladder is critical for production of coho salmon, FRED Division staff have been helping the USFS in this phase of the project. FRED Division staff have helped with tagging of wild fry placed above the barrier and the capture of adults and subsequent egg takes on an adjacent stream.

Davidson Creek Ladder Bioenhancement - This project is similar to the Suntaheen project but is conducted by the USFS, Juneau Ranger District. Davidson Creek is on the Taku River. The FRED Division office has had a pivotal role in mediation with other ADF&G divisions to obtain permission for the USFS to conduct this project.

Mill Creek/Virginia Lake - The USFS constructed a fishway on Mill Creek in 1988 to provide access to Virginia Lake on the mainland across Eastern Passage from the town of Wrangell. Virginia Lake is approximately 600 acres in size with a potential to produce up to 60,000 adult sockeye salmon. Although a small indigenous stock of sockeye salmon already exists in the system, enhancement of production using McDonald Lake stocks was recommended and approved. The FRED Division provides both bioenhancement and limnology support for this project.

FRED Division staff participated in many other types of projects in 1990 that included the following:

Marx Creek Spawning Channel - This has been a very successful cooperative project with the USFS, Misty Fjords Ranger District. Evaluation of chum salmon fry production from the channel is continuing. Using preemergent sampling and electronic counting of emigrant fry, production from the channel was estimated at 2.8 million in 1990. Incubation survival in the old (1985) part of the channel was estimated at 57%. Survival from the new (1989) section was considerably lower; weir design and siltation problems need to be addressed. Adult chum salmon returns to the channel in 1990 were very low (375), as were chum salmon returns to most streams in southern Southeast. The FRED Division helped to design and implement an adult sampling plan.

Bryce Creek Coho Salmon Channel - Located near Marx Creek Channel, this proposed project will compensate for the present lack of winter rearing habitat for coho salmon in the area and should substantially increase smolt production. The USFS is continuing with the project design; USFS and FRED Division biologists are cooperating in planning enhancement of the endemic stock. Evaluation of this stock is continuing. Increased sport fishing pressure in this area (head of Portland Canal) increases the urgency of this project.

Beaver Dam Removal - Beaver dams blocking anadromous fish passage in two streams on Prince of Wales Island (Snipe Creek and Natzuhini Creek) were removed in September 1990. The FRED Division contracted with a local Prince of Wales Island company to perform the work using chainsaws and hand tools.

Sweetheart Falls Investigation - Sweetheart Lake has the potential to produce several hundred thousand adult sockeye salmon, if the smolts can survive the falls at the outlet. As part of the increased emphasis on the valuable sockeye salmon, FRED Division staff undertook assessment work of the Sweetheart Lake outlet. In 1988 approximately 22,000 coho salmon smolts were tagged and released into the lake above the falls so that they could volitionally emigrate. Based on contributions to the fishery, the return rate of these fish in 1989 was 1.4 times greater than that of a similar group released at the hatchery. Estimated survival was 3%. Based upon initial evaluation of the falls, it was recommended that a sockeye salmon plant take place in the lake to evaluate the effect of the falls on that species. In 1990 approximately 2.2 million sockeye salmon fry were stocked into the lake. An assessment of the effect of the falls on those fish will be undertaken by the FRED Division Limnology Section in the spring of 1991.

Big Boulder Creek - Big Boulder Creek is a chinook salmon spawning stream on the Chilkat River. It has suffered from habitat degradation because of a highway bridge crossing in the center of the spawning area. The department has struggled for years with ways to mitigate the decline in escapement to this system. In 1990 the FRED Division funded a hydrological study of the system with an emphasis on providing a set of alternatives to modify habitat that would benefit chinook salmon. Results of this study will be available in early 1991 and will be shared with the public. Recommendations will be taken to the Alaska Department of Transportation and Public Facilities as mitigation for their proposed highway projects in the area.

Ophir Creek - The Ophir Creek system in Yakutat has a history of summertime drying in its upper reaches. This phenomenon is somewhat new, having begun in the late 1960s. In response to concerns over this loss, the FRED Division secured permits to construct several fry-refuge ponds in the impacted area. Four ponds were excavated in 1989 and are expected to provide sanctuary for the salmon fry during droughts. In 1990 FRED Division staff reexamined the system and are now developing a cooperative agreement with the USFS to share in hydrological assessment and habitat restoration.

Aquatic Education - Aquatic education has an important role in habitat restoration. Because "prevention is the best cure," education is critical to habitat protection. In 1990 FRED Division staff participated in a streamside education curriculum where students could participate in identifying aquatic insects and measuring flows and other habitat parameters.

Duck Creek Coho Salmon Habitat and Education - FRED Division staff have been working with a private landholder to restore a section of Duck Creek in Juneau. Recently, staff have designed floating islands and obtained permits to install these habitat structures. A class from the Floyd Dryden Middle School will help construct, install, and monitor the structures.

Eagle River Rearing Channel - FRED Division staff have been assisting the USFS in design, construction, and evaluation of a coho salmon rearing channel on Eagle River near Juneau.

Farragut River - FRED Division personnel collected chinook salmon eggs on the Farragut River in 1983-1985. A total of 78 chinook salmon were obtained for broodstock use. The eggs were incubated and the fry reared at Crystal Lake Hatchery for a short term. Fry were tagged and returned to rearing areas above the barrier on the Farragut River. In 1990 an estimated 85 chinook salmon from this project were harvested in commercial fisheries. This project contributed an estimated 465 chinook salmon to Southeast fisheries during the past 4 years and will continue to contribute for 2 more years. A project proposal to mitigate for the U.S./Canada Pacific Salmon Treaty has been approved to expand this project so that it produces 2,000-4,000 adult chinook salmon annually for the fisheries. State monies to expand this project in 1990 were vetoed by Governor Steve Cowper, but are requested in the FY 92 budget. Federal monies will be available for a portion of the project.

Harding River - A canyon 4 miles up the Harding River (south of Wrangell) is preventing chinook salmon from using nearly 4 additional miles of stream habitat. The FRED Division and the USFS entered a joint agreement to evaluate chinook salmon habitat above a partial barrier on the Harding River. FRED Division staff incubated the eggs at Crystal Lake Hatchery and tagged and released 30,500 fed fry upstream from the barrier in May 1987. The fisheries harvested an estimated 45 fish from this project in 1990 for a cumulative return of 51 fish to date. In 1989 FRED Division staff, funded by the USFS, conducted a joint chinook salmon egg take on the Harding River with the Burnett Inlet (PNP) Hatchery. Staff collected eggs for both future habitat assessment and for Burnett Inlet. In May 1990 FRED Division personnel released another 31,200 fry above the barrier. The USFS tagged 30,000 of these fry for future evaluation of this release. A 5-year effort to enhance chinook salmon production on the Harding River will be funded by U.S./Canada Pacific Salmon Treaty monies beginning in 1991. The USFS will be improving access through the canyon before the first adult returns to determine whether additional work will be necessary.

USFS and FRED Division staffs are also considering a project to provide chum salmon access to waters upstream from the Harding River canyon. In 1988 and 1989, 18,000 chum salmon fry were tagged to figure out what fisheries these fish were contributing to. In 1989, 123,000 green eggs were placed into instream incubation boxes in the upper Harding River to imprint fry above the canyon. An estimated 105,000 chum salmon fry emerged from these incubators in the spring of 1990. In 1993 and 1994, fishery personnel will monitor the resulting adult chum salmon movement in the canyon to locate access problem areas. The upper Harding River has significant potential to produce chum as well as chinook salmon, but the canyon is formidable. It appears that instream incubation will be an important strategy for future enhancement in the Harding River.

Campbell Creek - During 1990 several tasks were completed on Campbell Creek in Anchorage. The Alaska Fly Fishers volunteered to provide most of the labor. In one section of Campbell Creek, rock riprap was installed to stabilize an approximately 200-ft-long streambank that was eroding because of heavy foot traffic, causing downstream siltation. In another section, 8 spruce trees were anchored onto the streambank in a shingle-like fashion to provide a "soft armor"

to reduce bank erosion and to provide habitat for rearing fish. The trees provide hiding places, protection from high-velocity currents, places for food organisms, and a filter to trap sediment. The cover is used primarily by chinook salmon presmolts, but is also used by yearling coho salmon fingerlings and Dolly Varden. After these tasks were completed, a Boy Scout troop helped to plant vegetation that will further stabilize the bank as roots develop.

Nome Site Surveys - The FRED Division, together with the ADF&G Commercial Fisheries and Habitat Divisions and the Bureau of Land Management, has begun to develop several potential habitat improvement projects in the Nome area. Field data collection has been initiated and strategy meetings have begun. Several fish populations in the area have been depressed, apparently due to intensive fishing and habitat loss.

Fish Habitat Improvement Workshop - During 1990 FRED Division personnel participated with personnel from the ADF&G Habitat Division, the USFS, the Bureau of Land Management, and the U.S. Fish and Wildlife Service in a cooperative effort to stage the second annual "Fish Habitat Improvement Workshop." A total of 31 attendees participated in discussions and information exchanges with 8 presenters in classrooms and field trips. Sessions included: Fish habitat requirements, culvert design and fish passage problems, gravel extraction and stream channel morphology, icing and glaciation problems, revegetation and bank stabilization, invertebrate populations, recreational use effects, and mitigation practices.

SKIF - The FRED Division is also a major participant on the ad hoc SKIF (Streams, KIds and Fish) Committee that has proposed to develop an integrated, multidisciplinary approach to educating school children about fish and the environment. Members include ADF&G, the Anchorage Assembly, the Anchorage School District, and the Anchorage Department of Health and Human Services.

Economics Program

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

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 and other new shellfish activities related to the FRED Division enhancement program.

The Alaska fishery enhancement program has been the subject of a variety of studies designed to determine the economic effects of the program. These studies have been undertaken or contracted by the FRED Division economist. The FRED Division economics program assists in the evaluation of program investments to ensure maximum social and economic benefits are derived from Alaska's extensive application of salmon enhancement technology.

The following is a list of the FRED Division economist's various functions:

- Determine the value of enhancement projects to fishery user groups by conducting and updating cost/benefit analysis for specific salmon projects and facilities;

- maintain econometric demand models of five salmon species for estimating present and future revenues from enhanced commercial salmon production and cost/benefit analysis;

- make annual projections of regional personal income and employment resulting from the enhancement program;

- provide economic advice and assistance to the FRED Division Director's Office, PNP operators, regional aquaculture associations, and regional planning teams, as well as to other divisions within ADF&G; and

- collaborate with other state government agencies involved in fisheries economic planning.

The FRED Division economist accomplished the following in 1990:

- Conducted a financial and salmon production survey of PNP hatchery operators. Combined PNP survey data with the public enhancement program to project the regional employment impacts of the statewide enhancement program. The statewide program impacts are projected to be 3,500 full-time jobs.

- Completed a special simulation of this model on the economic consequences of the Governor's veto of over $2.0 million from the FRED Division's FY 91 budget, identifying more than 500 jobs at risk because of this action.

- Administered a contract with the Institute of Social and Economic Research to develop full documentation of the statewide economic impact model.

- Administered a contract to develop demand models for 5 species of salmon with the University of Alaska-Fairbanks. The resulting study entitled, "A Comparison of Demand Models for Alaska Salmon," by Dr. John Boyce, applied improved techniques for estimating prices and price responsiveness of enhanced fish.

- Participated in advisory group meetings on economic modeling in the Tongass Land Management Plan.

- Submitted economic proposals for the Exxon Valdez oil spill restoration plan.

- Participated as economic advisor for the FRED Division's King crab rehabilitation program.

Strategic Planning and Public Participation

During 1990 the FRED Division continued work on a strategic plan under the direction of the division's Senior Management Team (SMT). The SMT set out to address the division's goals in a strategic planning document designed to articulate the direction of the FRED Division for the 1990s in an orderly and ongoing process. The SMT sought the assistance of staff in the development of objectives, strategies, and action plans. The result of these activities was an initial draft of the plan that was distributed in October to all FRED Division employees for review and comment. This draft was edited substantially after incorporating employee comments, and a draft summary of the strategic plan was redistributed to divisional staff and regional aquaculture associations for review and comment. The intent is to make the summary available for review during the 1991 legislative session.

The FRED Division recognizes the importance of keeping the Alaskan aquaculture community and the general public aware of programs being conducted. The SMT has adopted a "Citizen Participation Program" that commits the division to improve the methods by which the public becomes involved in project and program planning. As part of this planning effort, the FRED Division anticipates that public meetings will be held in 1991 in each geographic region of the state. These meetings will include discussions of the division's strategic plan, statewide summaries of division activities, and region-specific overviews of FRED Division activities.

Public Participation and Education

Tours and presentations continue to play an integral role in educating the public in fisheries enhancement. Tens of thousands of school children, tourists, and residents walked through FRED Division hatcheries in 1990. Student work programs were initiated in hatcheries. Presentations were given to many groups, including Rotary clubs, city councils, schools, and fishing-interest groups. Many hatchery activities were covered by the media: FRED Division employees were interviewed by newspaper reporters, radio stations, and television shows. The following are highlights of FRED Division public involvement.

- Deer Mountain Hatchery staff were aided by a variety of non-paid workers. Projected total hours through 1990 is 2,050 and includes community service workers (1,000 hours), Job Partnership Training Act employees (760 hours), high school marine biology students (120 hours), and other volunteer help (170 hours). An equivalent hourly cost of one Fish and Game Technician I would be $20,131.

- Deer Mountain Hatchery staff set up a pilot project for program receipts from tourists. More than 220 people responded during the 2-month trial period. The net monetary benefit to operations is expected to be nearly $1,000, including cash

donations totaling approximately $575. One of the products of this program is a newsletter that contributes to public education on the hatchery program and salmon biology. There is good potential for improving the program in 1991.

- Clear Hatchery personnel are providing educational opportunities for the Tok and North Pole schools by supplying technical expertise and materials for a self-contained incubation unit. Also, personnel, fish, and displays are provided for the annual Fairbanks "Fishing is Fun Day."

- A cooperative work program is in its third year between the Tutka Bay Hatchery and The North Pacific Rim Corporation, a firm representing Alaska Natives. This cooperation has led to one of the first projects involving the FRED Division in the rehabilitation of a subsistence fishery with the Native communities of English Bay and Port Graham. These projects opened new funding avenues for the FRED Division through the Federal Bureau of Indian Affairs and The North Pacific Rim Corporation.

- Tutka Bay Hatchery is actively involved with the public in various programs at the local community level. Involvement with educational programs in the private sector, Native communities, state and federal government, and foreign interests has become a vital component of the Tutka Bay Hatchery. Two educational programs, funded through the Job Training Partnership Act, involving The North Pacific Rim Corporation, the Bureau of Indian Affairs, and the Tutka Bay Hatchery, are continuing. During the last 3 years, over 10 Native residents have participated; this experience has allowed them to qualify for placement on the state's hiring register.

- The FRED Division worked with volunteers from SPSA and the Homer Charter Boat Association feeding pink salmon fry and coho and chinook salmon smolts on the Homer Spit.

- FRED Division staff cosponsored the first Homer Youth Sport Fish Fair with the University of Alaska Marine Extension Office and SPSA. This pilot program went exceptionally well and FRED Division staff received many positive comments.

- FRED Division staff hosted Skyview High School students at the Limnology Laboratory in Soldotna for a demonstration of the science behind fish stock management as a part of a career opportunities tour. FRED Division staff also provided training in the use of the laboratory's video-microscope equipment for teachers at North Star Elementary School for use in their science classes.

- A total of 63,000 tourists visited the Elmendorf Hatchery in 1990 to view the returning Ship Creek chinook salmon.

- Central Cook Inlet area staff provided training to students on how to operate scientific instruments used to monitor water quality as part of the statewide "Adopt-A-Stream" program.

- A Russell Creek Hatchery BMP was completed and accepted by the newly formed Area M Regional Planning Team (AMRPT). This gives local residents a voice in FRED Division projects that effect them. The AMRPT is also working with other FRED Division personnel to develop a plan for fisheries enhancement in the area.

- The Campbell Creek habitat enhancement project was initiated with the assistance of nearly 100 hours of volunteer labor provided by the Alaska Fly Fishers, 40 hours by a Boy Scout troop, and donation of a front-end loader for the equivalence of one work day.

International Technical Exchange

Sharing technical expertise and information with other countries is an important and steadily increasing role for the FRED Division. During 1990 key exchanges occurred with the following:

USSR - The City of Homer is involved with a sister city relationship with Khabarovsk, a city in the Soviet Union. A mayor and ADF&G official from Khabarovsk visited the Tutka Bay Hatchery and are interested in establishing a trade relationship in fisheries between the two cities.

Reports and technical information were exchanged with the two lead scientists of the Salmon Enhancement Laboratory in Moscow and a research biologist in Kamchatka.

Chile - FRED Division staff traveled to the southernmost region of Chile on a United Nations Development Program cooperative project with the University of Magellan. The purpose of the trip was to attend a seminar on cold-water mariculture and investigate the Chilean progress in southern king crab mariculture.

A formal cooperative agreement was developed between the University of Magellan and ADF&G for a fishery information exchange. The Chilean mariculture programs in the southern region of Chile face similar environmental and logistical problems as Alaska, but are progressing at a rapid rate due to lack of political constraints and low overhead costs. Although king crab culture is in its infancy, saltwater farming and ocean-ranching programs with chinook and coho salmon are expanding rapidly.

Japan - FRED Division staff assisted the Commissioners of ADF&G and DCED with the Alaska/Japan Executive Committee meeting on fisheries. FRED Division personnel chaired a technical committee overseeing a macrocystis mariculture feasibility study in Sitka sponsored by the Alaska/Japan Executive Committee on Fisheries.

Canada - FRED Division staff got an intense look at small-scale special projects in fisheries stream and habitat rehabilitation as well as the Canadian community

development program during a trip through British Columbia with personnel from the Government of Canada, Department of Fisheries and Oceans.

Staff from the FRED Division toured an Arctic char hatchery in Whitehorse, Yukon Territory, exchanging information on Arctic char culture.

FRED Division personnel attended Aquaculture International, an international aquaculture exposition in Vancouver, British Columbia, and toured various British Columbia aquaculture facilities.

FRED Division staff once more played an active role in U.S./Canada Pacific Salmon Treaty negotiations and mitigation.

Engineering Services

Engineering services provided by FRED Division staff consisted of consulting, design, contracting, drafting, and project management both within and outside the FRED Division.

Within the FRED Division, the following work was completed during 1990:

- Pillar Creek Hatchery incubation building and water well.
- Gulkana Hatchery concrete slab for its incubation facility.
- ADF&G Sand Point facility restoration and remodeling.
- Big Lake Hatchery wastewater disposal.
- Big Lake Hatchery Well #7 rehabilitation.
- Crystal Lake Hatchery electrical upgrade.
- Crystal Lake Hatchery reroofing design.
- Snettisham Hatchery sockeye salmon CIF design.
- Snettisham Hatchery food storage building wall repair.
- Fort Richardson Hatchery fuel tank foundation.
- Fort Richardson Hatchery paving.
- Tutka Bay Hatchery proposed future expansion plan.
- Kitoi Box Model KL2 revised design.
- Elmendorf Hatchery standby generator.

- Elmendorf Hatchery well rehabilitation.
- Main Bay Hatchery adult maturation system.
- Main Bay Hatchery expansion.

FRED Division engineering staff also provided interfacing actions with state and federal agencies and with regional aquaculture associations in contracting state hatcheries.

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CHAPTER 10

TECHNOLOGY AND DEVELOPMENT

The fish genetics program within the division is alive again! Following a nationwide search, Dr. James E. Seeb was selected to fill the position of principal geneticist for the FRED Division. Dr. Seeb is an accomplished scientist with extensive experience and numerous publications in the areas of genetic stock identification and induced polyploidy of fishes. Dr. Seeb anticipates building an active laboratory program that serves all three fisheries divisions, the private salmon ocean ranchers, and the shellfish growers.

FRED Division fish pathologists won international distinction upon their important discovery of viral hemorrhagic septicemia (VHS) virus in Pacific cod. Details of this development appear in the narrative that follows.

The mark/tag processing laboratory set yet another record for volume of work completed in a single year. The human health and safety problems attendant to this laboratory are still with us and will not be solved until this lab is relocated into a different building. Once again, the division has requested capital improvement funds to acquire a new home for the mark/tag processing laboratory.

The division continues its research for a "mass mark" to apply to hatchery-released salmon. Placement of thermal marks on otoliths appears to be promising technology for application at some hatcheries. However, very large, remote hatcheries, like those in Prince William Sound, may not have the capability to heat the quantities of water necessary to impart the mark during the egg-incubation process. The search continues. Meanwhile, should we acquire the monies to relocate the mark/tag processing laboratory, it is our intent to incorporate otolith processing into the laboratory operation. At present, management of pink and chum salmon fisheries in Prince William Sound is dependent upon the coded-wire tag. Coastwide chinook salmon management is now dependent and will probably always remain dependent upon the coded-wire tag.

Our fisheries library continues to function as a cornerstone of information retrieval and exchange for the fisheries divisions. In these recent times, the ADF&G Division of Oil Spill Impact, Assessment and Restoration (OSIAR) and the Office of the Attorney General have discovered this resource.

The decade of the '80s has been an extremely exciting one with regard to the state-of-the-knowledge of sockeye salmon. Procedures were established to successfully culture sockeye salmon despite the presence of IHN virus. Lake enrichment was proven as an effective tool for rehabilitating depressed sockeye salmon runs. Carrying capacity models were developed for sockeye salmon lakes. Whole-lake manipulations of juvenile sockeye salmon density were done in order to witness the causal effects that density has on the plasticity of age and size at smoltification. The effects of sockeye salmon over-escapements on the carrying capacity of rearing lakes has been demonstrated. The marine survival of sockeye salmon was measured several times and found to be

astoundingly high compared to that of other salmon species. And the ability of sockeye salmon to go to sea as underyearlings (age zero) was rediscovered.

The decade of the '90s will see significant advancements with sockeye salmon on four fronts: (1) hatchery production of underyearling smolts for direct marine growout and release; (2) hatchery production of yearling smolts in fresh water; (3) holding and maturation of adult sockeye salmon in manmade structures; and (4) an intellectual linking-up of the factors underlying freshwater survival with those underlying nearshore, early marine survival for sockeye salmon and other species of salmon. FRED Division limnologists are pursuing item 4.

Coded-Wire Tag Processing Laboratory

The previous processing record set by the Coded-Wire Tag Processing Laboratory in 1989 was shattered in 1990. Laboratory staff processed 60,000 heads recovered by sampling programs throughout the state. This surpassed the previous record by 19,000 heads. For 9 weeks, beginning the last week of June, the 18 laboratory staff members extracted and read tags from an average of 3,330 heads each week. More than 4,000 samples were completed in two different weeks. In order to maintain its commitment to one-week processing, staff were forced to delay the second reading of most tags until post-season. They were only able to process these record numbers and continue to provide access to inseason, catch, sample, recovery, and contribution estimates because of the exceptional crew employed in 1990. The use of coded-wire tagging continues to expand; accordingly, the numbers of samples the lab must process will also increase. This project is at a point in its development where the required quality of service provided to statewide projects will begin to deteriorate because the number of technicians the lab can employ during the short salmon season is limited by the size of the laboratory. Efforts to secure a larger and safer working environment for this laboratory operation continue.

Although the majority of work continues to be generated from sampling programs in southeast Alaska, all other regions of the state contributed 32% to the laboratory's total workload, a small increase over last year. The species and sample-source composition of the workload are presented in Table 10.1.

Table 10.1. Coded-Wire Tag Processing Laboratory sample-source composition by species.

	Commercial	Cost recovery	Sport	Rack and escapement	Other	Juvenile	Total
Chinook	12,642	719	1,007	3,063	118	10	17,559
Chum	1,120	99	0	409	6	11	1,645
Coho	18,264	1,035	1,290	4,347	517	145	25,598
Pink	8,154	2,306	11	1,344	0	1,329	13,144
Sockeye	1,535	2	3	447	4	24	2,015
Steelhead	86	0	8	1	0	0	95
TOTAL	41,801	4,161	2,319	9,611	645	1,519	60,056

Over 16,000 heads from all 5 Pacific salmon species were received from Prince William Sound sampling programs conducted as part of the state's effort to assess the impact of the Exxon Valdez oil spill on salmon fisheries in the Sound. Data were express-mailed weekly to Cordova in formats required for inseason fishery management and oil spill impact assessment evaluation. Work continues to automate data transfer to area offices using the state's wide-area computer network. The laboratory processed coded-wire tag samples from all state and federal projects assessing early marine salmon injury in Prince William Sound. Special procedures designed to ensure the fish were not contaminated during tag extraction were carefully followed on these 1,300 samples. Heads of juvenile salmon and of adult pink salmon recovered in the cost-recovery fisheries and at hatchery racks of 3 Prince William Sound hatcheries were identified and saved for later removal and examination of otoliths.

Fishery managers responsible for salmon fisheries in southeast Alaska were able to use coded-wire tag data, including hatchery contribution, to assist them in making inseason management decisions. Using coded-wire tag data, fishery managers took inseason advantage of the hatchery add-on clause of the U.S./Canada Pacific Salmon Treaty. During the 1990 fishery accounting year (1 October 1989-30 September 1990), Alaskan hatcheries contributed 55,000 chinook salmon (15.6% of the catch) to commercial and sport harvests in southeast Alaska. This estimate is reduced by 5,000 fish (base hatchery harvest) and by 2,800 fish (estimated error, risk adjustment), resulting in a catch ceiling of 353,500 chinook salmon.

Laboratory programmers wrote and distributed a personal computer (PC) database program to assist project leaders by automating collection, detailed record maintenance, and reporting of coded-wire tag release data. After project leaders enter raw data into the program, the computer performs all calculations and generates the required tagging and release information forms. Data can be accessed through other database and spreadsheet programs commonly used by state programs. The release database on the laboratory's computer was also reprogrammed to accept, store, and report additional data required by the Pacific Salmon Commission and reported on the PC database. These new programs will facilitate retrieval of important tagging study details only previously available through file cabinet searches.

The laboratory continued to send letters to all commercial and sport fishermen that caught marked fish. These letters to 1,200 commercial fishermen and 1,500 sport fishermen list the hatchery and various release data about each tagged fish caught. This year laboratory staff also instituted a new program intended to thank fishermen for their cooperation with the department and to advertise the success of Alaska's fishery programs. "Support Your Local Fisheries Program" stickers were sent to each fisherman that caught a tagged Alaskan salmon.

Limnology/Lake Fertilization

Water Quality:

The Limnology Laboratory supports FRED Division's lake enrichment and lake stocking programs as well as those of cooperating state, federal, and private agencies (Table 10.2).

Table 10.2. List of government and private agencies contracting analytical services of the Limnology Laboratory during 1990.

Alaska Department of Fish and Game

Commercial Fisheries Division. Kodiak/Juneau.
Big Lake Hatchery. Big Lake.
Crooked Creek Hatchery. Kasilof.
Elmendorf Hatchery. Anchorage.
Pillar Creek Hatchery. Kodiak.
Snettisham Hatchery. Juneau.

PNP Groups

Cook Inlet Regional Aquaculture Association. Soldotna.
Kodiak Regional Aquaculture Association. Kodiak.
Lower Cook Inlet Seiners' Association. Homer.
Northern Southeast Regional Aquaculture Association. Sitka.
Prince William Sound Aquaculture Corporation. Cordova.
Southern Southeast Regional Aquaculture Association. Ketchikan.

Federal Government Agencies

National Marine Fisheries Service.
U.S. Fish and Wildlife Service. Soldotna.
U.S. Forest Service. Anchorage/Sitka/Ketchikan.
U.S./Canada Pacific Salmon Treaty.

Other

City of Anchorage (Chester Creek).
City of Nome (instream incubation feasibility).
Department of Environmental Conservation (Kasilof River water quality). Juneau.
Department of Natural Resources (Kenai River water quality cooperative study).
University of New York-Stoneybrook (stickleback habitat study).

The Limnology Section has laboratory facilities in Soldotna, where both water-quality and zooplankton samples are sent from projects located throughout the state.

During 1990 the Limnology Laboratory conducted nearly 30,000 individual water-quality and zooplankton analyses (Table 10.3) on samples collected from over 60 lakes statewide as well as from Speel Arm estuary (Table 10.4). Many of the samples were collected from the Kodiak area as part of the "oil spill" sockeye salmon overescapement studies. In addition, the laboratory provided analytical services to the Crooked Creek, Elmendorf, and Pillar Creek Hatcheries and analyzed samples collected from potential instream incubation sites in the Nome area. Because of low dissolved oxygen and high turbidity levels within the Snettisham Hatchery intake, limnological investigations were initiated at Crater Lake (hatchery source water) to determine possible causes for the poor water quality. Also, the laboratory conducted nutrient, metal, hydrocarbon, and bacterial analyses as part of the Kenai River Water-Quality Cooperative Study as well as for the Department of Environmental Conservation's (DEC) Kasilof River Water-Quality Study. Finally, a contract was initiated with the City of Anchorage for the analysis of organic carbon in Chester Creek.

This year the Limnology Laboratory developed a completely new automated data-entry system (DBase) to facilitate management of its water-quality database. Analytical results are now automatically directed to the appropriate individual lake files, and water-quality summary reports are printed in minutes. As a result, laboratory personnel have nearly 25% more time available to process samples and analyze data. In addition, the laboratory has acquired various state-of-the-art statistics and graphics software for more comprehensive data analysis. Staff are also developing a procedure for determining in-lake heat budgets and generating bathymetric maps using a recently acquired computerized image analysis system (*See* Zooplankton Section). Finally, the laboratory installed a new water-purification system and dishwasher; these have greatly reduced the amount of time spent manually cleaning sample bottles and glassware.

To date laboratory staff have completed the 1989 nutrient, carbon, and chlorophyll a samples and are analyzing 1990's nutrient samples on a priority basis. Analytical results will be disseminated to appropriate project personnel upon completion of each project. Quality assurance of analytical results was maintained as evidenced by the results of the 1989 U.S. Geological Survey Standard Reference Water-Sample Program.

Health and Safety:

In 1990 limnology staff continued to upgrade the laboratory's health and safety program. Use of autoanalyzers and new labware-cleaning procedures have reduced the amount of hazardous-waste discharge; waste formalin is being stored for disposal by a private waste-management company. Staff anticipate conducting an internal waste audit by year's end. In addition, a new, more efficient exhaust hood was installed to properly vent noxious fumes, all laboratory employees were provided with upgraded respirators, and new safety and regulatory signs were posted throughout the laboratory and adjacent warehouse and storage areas. Finally, limnology personnel attended an Occupational Safety and Health Administration-certified first-aid course and a cold-water survival training session.

Table 10.3. Number of samples and the total number of analyses conducted per test by the Limnology Laboratory during 1990.

Methodology	Number of samples	Number of replicates	Total number of analyses
Conductivity	1,270	--	1,270
pH	1,270	--	1,270
Alkalinity	1,268	--	1,268
Turbidity	1,256	--	1,256
Color	383	--	383
Calcium	1,227	--	1,227
Magnesium	1,173	--	1,173
Iron	1,245	x2	2,490
TP/TFP	1,987	x2	3,947
FRP	1,339	x2	2,678
TKN	823	x2	1,646
Ammonia	995	x2	1,990
Nitrate/nitrite	1,070	x2	2,140
Reactive silicon	1,200	x2	2,400
Carbon	822	--	822
Chlorophyll	681	--	681
FW Zooplankton	775	x3	2,325
Marine Zooplankton	96	x3	288
Total	18,880		29,254

Table 10.4. List of study lakes by geographic region from which water-quality samples were received by the Limnology Laboratory during 1990.

Cook Inlet	Kodiak	Prince William Sound	Northern Southeast	Southern Southeast
Bear	Afognak	Coghill	Auke	Badger
Beluga	Akalura	Crosswind	Chilkat	Bakewell
Big Lake Hatchery	Barabara	Eshamy	Chilkoot	Hugh Smith
Bruin	Buskin	Esther Pass	Crater	McDonald
Chelatna	Crescent	Pass	Crescent	Virginia
Chenik	Frazer	Paxson	Deer	Woodpecker
Crooked Creek H.	Hidden	Summit	Speel	
Elmendorf Hatchery	Jennifer		Speel Arm	
English Bay	Karluk		Sweetheart	
Hazel	Laura			
Hidden	L. Kitoi			
Kenai	Little R.			
Kirschner	Malina			
Leisure	Pike			
Packers	Pillar Creek			
Paint River	Portage			
Port Dick	Red			
Skilak	Red Cove			
Tustumena	Red Fox			
Ursus	Spiridon			
	Summit			
	Uganik			
	Upper Station			
	Uyak			
	Waterfall			

Freshwater and Marine Zooplankton:

Limnology Laboratory staff continue to process freshwater zooplankton samples. Analyses include species identification, body size, density, and biomass estimates.

During 1990 the laboratory received 1,081 freshwater zooplankton samples from approximately 60 lakes statewide (Table 10.5). Staff have also received 397 freshwater zooplankton samples under contract for a National Science Foundation-funded stickleback study. Additionally, the laboratory received 180 nearshore marine zooplankton samples from Speel Arm in southeast Alaska, and from Kitoi and Olga Bays on Kodiak Island.

In August of 1990 laboratory staff completed an oil spill-related contract for the National Marine Fisheries Service. Analyses included species identification, life-history staging, density estimates, percent abundance, and Shannon-Weiner Diversity Index for 96 nearshore marine zooplankton samples from Prince William Sound.

In order to expand the data acquisition and analysis capabilities of the zooplankton section, an Image Analysis System was purchased from BioSonics, Inc. This hardware system, coupled with Optical Pattern Recognition System and Optimas software, will provide an efficient method to enhance, measure, and process data in a variety of ways through video images. To facilitate the transfer of the laboratory's routine freshwater zooplankton data to the computer, staff have purchased from BioSonics, Inc., a counting program and software that will allow data to be stored on the computer directly as the samples are processed, thus eliminating time-consuming manual data entry. In addition, video-image manipulation may allow for measurement of the lipid content of individual zooplankters. A second application is to determine growth patterns on sectioned salmonid otoliths which may facilitate identification of juvenile salmon stocks.

Technology Transfer:

International. Reports and technical information were exchanged with Leonid Klyashtorin and Victor Bugaev, leading scientist with the Salmon Enhancement Laboratory in Moscow and research biologist in Kamchatka, respectively. In addition, Victor Pintchuk, Mayor of a borough with 35 cities, and Boris Kalinin, Commissioner of fish stock in the Amur River Basin were accompanied by a limnologist on a tour of Tutka Bay Hatchery, as they were interested in learning as much as possible about sockeye salmon enhancement.

Limnology staff received a request for a diskette of the Frazer Lake paper (published in the *Canadian Journal of Fisheries and Aquatic Sciences* [CJFAS]) from the Canadian Department of Fisheries and Oceans' Cultus Lake sockeye salmon research group. The paper will be used as an example of how to write a scientific paper for their scientific writing tutorial program. Limnology staff received a manuscript on the marine survival of sockeye salmon in Chilko Lake (Canada) to review for possible publication in the CJFAS.

Table 10.5. Freshwater zooplankton samples received at ADF&G's Limnology Laboratory in 1990.

Cook Inlet	No.	Prince William Sound	No.	Northern Southeast	No.	Southern Southeast	No.	Kodiak	No.	Nome	No.
Bear	32	Coghill	20	Auke	12	Badger	6	Afognak	28	J. Nelson	2
Bruin	8	Crosswind	12	Chilkat	24	Bakewell	6	Akalura	22		
Chelatna	6	Eshamy	20	Chilkoot	22	Eagle	4	Barabara	8		
Chenik	62	Esther Pass	10	Crescent	12	Hugh Smith	2	Big Waterfall	6		
English Bay	16	Pass	10	Deer	30	McDonald	16	Buskin	6		
Hazel	8	Paxon	12	Redoubt	32	Virginia	6	Crescent	8		
Hidden	24	Summit	12	Speel	12	Woodpecker	4	Frazer	36		
Kenai	58			Sweetheart	28			Hidden	8		
Kirschner	8							Ilnik	3		
Leisure	20							Jennifer	6		
Packers	32							Karluk	54		
Paint River	16							Laura	6		
Port Dick	8							Little Kitoi	8		
Skilak	56							Little River	8		
Tustumena	68							L. Waterfall	8		
Ursus	8							Malina	20		
								Portage	8		
								Red	20		
								Red Cove	2		
								Red Fox	8		
								Salmon	6		
								Sitkalidak	2		
								Summit	8		
								Spiridon	20		
								Uganik	8		
								Upper Station	20		
Totals	430		96		172		44		337		2

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Total number of fresh water zooplankton samples = 1081

Total number of samples from stickleback study = 397

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TOTAL = 1378

Statewide. Limnology staff attended a regional aquaculture association meeting at Chignik Bay where they gave a presentation on enhancement and rehabilitation projects (lake fertilization/stocking) that are being conducted in cooperation with other PNP groups. In addition, an overview of the function and capabilities of the Limnology Laboratory and Section was presented. The Chignik fishermen were quite interested in initiating limnology sampling in Black and Chignik Lakes to determine the current productivity status of these lakes.

Dr. Mike Bell of the State University of New York at Stoney Brook is sending the laboratory lake-water samples for his National Science Foundation-funded project on evolutionary rates in sticklebacks. Contracts are being developed for samples from the water-quality study on the Kasilof River (DEC and ADF&G Habitat Division), and for the water quality of the Anchorage Bowl streams through the University of Alaska-Anchorage.

FRED Division Limnology personnel participated in drafting the department's new escapement goal policy for salmonids in committee meetings held in both Juneau and Anchorage. Personnel drafted the detailed OSIAR study plan dealing with overescapement of sockeye salmon. Staff also participated in U.S./Canada Pacific Salmon Treaty negotiations in Vancouver, British Columbia.

Field Projects:

Southcentral. The Kenai River water-quality project, conceptualized and funded in 1989, was initiated in 1990. Water samples were collected on a monthly basis from 19 sites within the Kenai River drainage for establishing baseline data as well as identifying potential problem sites in regard to such parameters as hydrocarbons, metals, oxygen, bacteria, and numerous physical features. The Kenai River project is conducted in cooperation with the U.S. Fish and Wildlife Service and DNR. Funding is provided, in part, by a CIP appropriation through DNR.

Applied limnological and fisheries field research was conducted on 7 lakes in Prince William Sound, 9 lakes in lower Cook Inlet, 8 lakes in upper Cook Inlet, and 26 lakes on Kodiak and Afognak Islands. This work included assessment of potential in-lake production of sockeye salmon, evaluation of nutrient enrichment and stocking projects, and research feasibility of using limnocorrals to potentially evaluate manipulations of fish density, zooplankton, and productivity levels. Assessment of active stocking and lake fertilization projects included monthly sampling of each lake at two stations and conducting one hydroacoustic/townet survey on selected (10) lakes during the fall.

From nutrient enrichment and stocking projects in lower Cook Inlet, over 100,000 sockeye salmon were produced in 1990. Since many of the treated lakes are systems with outlet barriers, most of the fish produced were available for commercial harvest. In 1990 a record escapement count of 40,400 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 allowed the CIAA (project cooperator) to cost-recover over 8,500 sockeye salmon. The estimated commercial harvest of sockeye salmon returning to Packers Lake in 1990 was 60,000.

Southern Southeast. Applied limnology and fisheries field research was conducted on Badger, Bakewell, Big (Ratz Harbor), Dog Salmon, Eagle, Hofstad, Hugh Smith, Margaret, McDonald, Old Franks, Orchard, Virginia, and Ward Lakes during 1989 to evaluate juvenile sockeye salmon outplants, lake enrichment, and to assess sockeye salmon production potential. In support of these projects, a total of 28 limnological and 15 hydroacoustical surveys were completed.

The 1990 production from the McDonald Lake fertilization project was 222,890 adult sockeye salmon of which the commercial seine and drift gillnet fleets in Fishing Districts 101-108 caught 98,753, based on coded-wire tag recoveries. This represents 8% of the total sockeye salmon harvest in southern Southeast with an ex-vessel value of $950,000 (benefit/cost ratio of 27:1 for the lake fertilization portion). Personal-use fishermen at McDonald Lake harvested an additional 5,000 sockeye salmon. Badger/Bakewell Lakes (sockeye salmon outplants) produced 7,392 sockeye salmon for the commercial fleets in Districts 101-108 (including Metlakatla) and had an ex-vessel value of $67,000. Hugh Smith Lake (sockeye salmon outplants) produced 17,234 sockeye salmon for the commercial catch in Districts 101-108 (including Metlakatla) and had an ex-vessel value of $157,000. Additional evaluation of sockeye salmon juvenile outplants continues at Badger/Bakewell, Hugh Smith, Margaret, Salmon (Karta River), and Virginia Lakes.

Additional activities involve sockeye salmon preemergent fry sampling, application of 50 tons of liquid fertilizer over 15 weekly trips, assisting SSRAA with a 1.6 million-egg sockeye salmon egg take, and escapement surveys at McDonald Lake. Limnologists also helped to differentiate age-zero adult sockeye salmon from wild fish using scale-pattern analysis at SSRAA's Beaver Falls facility, and constructed bathymetric maps of Big, Dog Salmon, Eagle, Margaret, Mary, Old Franks, upper Old Franks, and Ward Lakes. Also completed were USFS Sikes Act progress reports for the Ketchikan, Misty Fjords, and Wrangell Ranger Districts, as well as final enhancement evaluation reports for the Old Franks Lake system, Dog Salmon Lake, and Big Lake. A report on McDonald Lake adult sockeye salmon run timing was completed at the request of the ADF&G Commercial Fisheries Division (Ketchikan and Petersburg) and the U.S./Canada Northern Panel for U.S./Canada Pacific Salmon Treaty negotiations. Stickleback samples from lakes throughout southeast Alaska were sent to the University of New York at Stoney Brook for future evaluation by Dr. Mike Bell.

Funding for these projects continues as highly cooperative ventures. Funding sources include primarily the USFS (Craig, Ketchikan, Misty Fjords, Thorne Bay, and Wrangell Ranger Districts), as well as SSRAA and the U.S./Canada Pacific Salmon Treaty.

Northern Southeast. Limnology and fisheries field research was conducted on 8 lakes in northern Southeast as a continuation of the FRED Division's sockeye salmon enhancement and research program. These projects were designed to (1) rehabilitate indigenous sockeye salmon populations using lake-enrichment techniques, (2) identify lakes suitable for enhancement by fry stocking (and) lake enrichment, and (3) continue rearing-capacity studies to identify rehabilitation, enhancement, or management options for increasing indigenous sockeye salmon populations.

Limnology staff conducted 47 limnological surveys at Auke, Chilkoot, Chilkat, Crater, Crescent, Redoubt, Speel, and Sweetheart Lakes. Along with the water-quality surveys, a

total of 14 hydroacoustic surveys were completed in order to evaluate sockeye salmon fry densities and growth during the late fall period.

U.S./Canada. During 1990 the U.S./Canada Pacific Salmon Treaty provided funds for the Redoubt, Speel, and Sweetheart Lakes projects in the northern Southeast area. Snettisham Hatchery stocked 2.5 million sockeye salmon fry into Sweetheart Lake in 1990. Acoustical and townet surveys conducted in October indicate that these fish will smolt during the spring of 1991.

Cooperative projects. A cooperative project involving the FRED Division, the Commercial Fisheries Division, and NSRAA was continued in 1990 at Chilkat and Chilkoot Lakes in the Haines area.

The Redoubt Lake enrichment project was reinitiated this field season and was a cooperative project involving the FRED Division, the USFS, and NSRAA. This project in 1990 involved the application of nearly 60 tons of fertilizer to the lake and evaluation of in-lake trophic-level responses.

An all-time record of 72,000 adult sockeye salmon escaped to this lake in 1990. These adult fish are the direct result of fertilizer applications to this lake from 1984-1988.

Under NSRAA direction and USFS funding, the in-lake incubation of sockeye salmon fry was expanded to a maximum capacity of 1.0 million eggs. A total of 350,000 green eggs were collected for this project during the 1990 field season.

Pathology

A total of 46 hatcheries were inspected this past year out of a total of 50. Four facilities were not inspected for lack of significant fish-culture activities at those sites. Fish health cases processed totaled 183 and required a total of 17,008 tests performed; 5,663 at the Anchorage laboratory, 11,345 at the Juneau laboratory, and 938 worked on by both labs. A total of 232 fish transport permits (FTP) were reviewed (Southeast-127; Southcentral-105) with a total of 217 approved, 2 disapproved, and 13 withdrawn.

Statewide IHNV Monitoring Program:

The statewide monitoring of IHNV in sockeye salmon broodstock was reduced this past year from 3,254 virus assays in FY 89 to 1,888 in FY 90. The FRED Division has been able to accumulate a massive IHNV database that encompasses 16 years and over 96 stocks of anadromous sockeye salmon, all of which have been shown to be positive for IHNV. Hatchery production experience has shown some predictability of IHN outbreaks in progeny fish through vertical transmission of the virus when parent stocks have high proportions of high virus-titered fish ($>10^4$), and large numbers of eggs are taken (20-30 million). In this situation, the rare and random occurrence of vertical transmission of the virus is enhanced. Using the keystones of the FRED Division sockeye salmon policy that includes strict disinfection, a virus-free water supply, and compartmentalization of eggs and fry, IHN accounts for very minor sockeye salmon fry losses on an annual basis. This past year only 923,000 fry (about 1.5% of total production) were lost at 2 facilities (one

lot of Chelatna Lake and two incubators of Packers Lake sockeye salmon at Trail Lakes Hatchery; and one incubator of Upper Station Lake sockeye salmon at Kitoi Bay Hatchery). At this point within the database, future information to be gained by annual monitoring of IHNV in sockeye salmon broodstock is minimal. Such monitoring has been reduced even more in FY 91, while efforts have been refocused on specific sockeye salmon smolt projects at Main Bay, Kitoi Bay, and SSRAA facilities.

ELISA Assay for BKD Agent Antigen:

The enzyme-linked immunoabsorbent assay (ELISA) for detecting the antigen of the bacterial kidney disease (BKD) agent (*Renibacterium salmoninarum*) has been used in the FRED Division Juneau Fish Pathology Laboratory for 3 years and has proven to be a very sensitive and effective tool for broodstock screening and determination of the carrier state for this pathogen in resident salmonids within various hatchery water supplies. The ELISA assay has largely taken the place of the fluorescent antibody test (FAT), which is now used mostly for diagnostic confirmation and occasional spot checks for the ELISA assay using the higher level positive fish. This past year 47 cases for ELISA were processed and amounted to 7,573 individual fish tested. Considerable data have been accumulated from this assay and are in the process of being statistically analyzed for publication in the near future. Future challenges with ELISA include adapting ovarian fluids for use in the assay since this is the material in direct contact with fish eggs and, therefore, plays an important role in vertical transmission of the BKD bacterium. Ovarian fluids also offer a method of nondestructive sampling of adult fish. Duplication of the necessary ELISA equipment in the Anchorage laboratory is also another potential need for the future.

Bitter Crab Disease Syndrome Studies:

The importance of bitter crab disease in Southeast and Bering Sea Tanner crabs has not diminished. Extensive distribution surveys involving participation of FRED Division pathology, the ADF&G Commercial Fisheries Division, and the National Marine Fisheries Service are in the process of being completed for Southeast as well as for the eastern and western Bering Sea, including Norton Sound and the Chukchi Sea. All work currently being done has not been specifically funded, despite a modest proposal submitted by ADF&G that was unsuccessful in remaining within the legislative budget last session. Consequently, adequate attempts at management of the problem within the Southeast fisheries has not been possible due to this lack of funding. The disease has become serious in southeast Alaska to the extent that crab fishermen did not fish in upper Lynn Canal due to the very high prevalence of the disease that makes such crabs there unmarketable.

Oyster Certification for Import of *Crassostrea gigas* Spat:

Several Pacific Northwest vendors continue to be recertified annually for importation of Japanese oyster spat into Alaska. There presently is no shortage of spat for Alaskan growers.

ADF&G Becomes a Member of the PNFHPC:

ADF&G became a member of the Pacific Northwest Fish Health Protection Committee (PNFHPC) that is represented by state, federal, tribal, and private agencies within Pacific Northwest and Intermountain states and provinces. This body functions as an informational forum for fish-disease problems within these various states and Canada with meetings held once every 6 months. Most members are fish pathologists and the FRED Division's Principal Fish Pathologist attends these meetings. This forum has been very instrumental in determining courses of action regarding the recent viral hemorrhagic septicemia virus (VHSV) isolations in the State of Washington.

IHNV Susceptibility Studies in Subarctic Species - IHNV Vaccine:

The FRED Division Pathology Section initiated a series of experiments to determine the susceptibility of lake trout, Arctic char, and Arctic grayling to IHN virus because of numerous transports of these species to various watersheds containing sockeye salmon and IHNV. The information generated is new in that no information exists in the scientific literature regarding the ability of IHNV to infect these fish species. The experiments have been concluded, but results are still being analyzed. In order to conduct these experiments, the Anchorage Pathology Wet Lab had to be refitted with a new water pump, a hot-water heater for temperature mixing, automatic temperature-flow-control valves, and gas-stabilization columns. A backup oxygenation system was installed and a dechlorinator is awaiting installation as a backup source for city water.

In the course of these studies, Oregon State University scientists asked FRED pathology staff to conduct a vaccine trial in sockeye salmon using an Alaskan isolate of IHNV and a native stock of sockeye salmon against their genetically engineered IHNV vaccine. The trial was conducted in the Anchorage Wet Lab and indicated nearly complete protection in the vaccinated group when exposed to the lowest dilution of IHNV. These are very promising results, but further studies will be done to repeat and refine the test data.

VHSV Discovered in Pacific Cod from Prince William Sound:

Last August, skin lesion material from a sport-caught Pacific cod in Prince William Sound was submitted to the FRED Division Anchorage Pathology Laboratory by Ms. Ruth Fairall. Ms. Fairall first contacted the Anchorage laboratory in 1988 with observations and concern that many cod that she had caught had various ulcerations and other unsightly skin lesions. Consequently, she was given instructions and materials by Anchorage Pathology staff to properly take samples for diagnostic examination of the next fish she caught exhibiting such skin lesions. Tissue-culture assay of the submitted lesion material detected a possible viral agent, a sample of which was sent to the Juneau FRED Pathology Laboratory for examination using the FRED Division's recently acquired transmission electron microscope. This examination confirmed that the isolate was indeed a bullet-shaped rhabdovirus similar in appearance to IHNV. The isolate was then sent to the U.S. Fish and Wildlife Service Laboratory at Sand Point in Seattle for further testing. The cod virus was identified by serum neutralization as VHSV, which is a serious pathogen in the European rainbow trout industry and has been recently isolated from returning coho and chinook salmon in the State of Washington. The

isolation of this virus from Washington fish in the last two years has been cause for great concern; many fish have been destroyed in order to eradicate the virus.

The cod finding was very significant since the source of VHSV in the Washington fish was a mystery; however, it was beginning to look more and more like a saltwater reservoir because the virus is more stable in salt water than in fresh water, and only salmonids returning from the ocean have been positive for the virus. Also, the Washington isolates have not shown significant pathogenicity for many salmonid species tested in the laboratory. Although further work must be completed to determine the true nature of the Pacific cod VHSV, it is possible that the virus has been in Pacific cod all along and, possibly, in other saltwater fishes. The salmonids may interact directly or with a prey species common to the cod that may allow for infection of the salmonids prior to return to Washington hatcheries. In 1979, a similar and possibly identical VHSV was isolated in Denmark from Atlantic cod having skin lesions, a condition later named the Ulcus Syndrome.

Although many salmonid stocks in Alaska have been examined for VHSV, no stock has been found to be positive. Further efforts in Alaska are being directed towards reisolating the virus from Pacific cod from various geographical locations to determine the distribution of the virus. Additional studies conducted by the U.S. Fish and Wildlife Service in cooperation with the FRED Division will include: (1) ribonucleic acid (RNA) fingerprinting studies of the cod virus to make genetic comparisons with other VHSV isolates; and (2) pathogenicity testing in Pacific cod and other species to determine whether the skin lesions are caused by the virus.

Genetics

Dr. Bob Davis, Principal Geneticist, retired in 1990 following 15 years of work, including production of possibly the most insightful genetics policy used by a management agency in North America. Dr. James Seeb, formerly from the Fisheries Research Laboratory at Southern Illinois University, was hired to replace Dr. Davis.

Genetic Stock Identification:

Staff are currently refitting the FRED Genetic Research Laboratory in Anchorage, in cooperation with the ADF&G Commercial Fisheries Division, into a state-of-the-art facility capable of performing genetic stock identification studies using both protein electrophoresis and deoxyribonucleic acid (DNA) analysis. FRED Division interests in genetic stock identification research are to (1) examine genetic interactions of hatchery fish and wild fish; (2) assemble a more complete genetic baseline of wild populations in order to aid staff to make knowledgeable recommendations on FTP applications; and (3) develop techniques to measure the contributions of unmarked but genetically identifiable hatchery fish, e.g., chum and pink salmon, to commercial fisheries.

Sterility and Sex Control:

Experiments underway at the BDC appear to be very successful. The first attempt at creating a production lot of triploids (genetically sterilized fish) was more than 99%

successful. Also, the BDC can now successfully and routinely produce all-female rainbow trout for stocking. Staff are now considering the production of up to 600,000 all-female triploids for put-and-take sport fisheries in 1991.

The Genetic Laboratory additionally received a $74,000 grant from the U.S. Department of Agriculture to study improved performance of coho and chinook salmon through induced triploidy. Staff plan to perform controlled studies of survival and feed-conversion ratios. Such sterile fish likely will offer reduced rearing costs and may provide trophy opportunities in freshwater lake fisheries. Sterile fish may sometimes be useful for supplementation of commercial fisheries when natural reproduction of the hatchery fish is unwanted.

Fisheries Library

During 1990 the Fisheries Library continued to operate with funding from the FRED, Commercial Fisheries, and Sport Fish Divisions. The FY 91 funding level of $70,100 has been sustained equitably by the three fisheries divisions based upon respective 1989 calendar-year usage statistics. This is a bare-bones budget that covers salaries and benefits for a full-time librarian and a part-time library assistant position and also includes funds to cover most journal subscriptions. Additionally, the ADF&G OSIAR Division contributed a small amount of money toward unanticipated travel/training costs early in the year.

In an effort to conserve space and consolidate library holdings, several "stand alone" collections from the FRED and Sport Fish Divisions were culled and integrated into the main collection this year. While both collections contained valuable information and had their own catalog schemes, there was extensive duplication and some irrelevant documents. Excess documents of value were offered to other natural resource libraries, locally and statewide, before being discarded.

Although usage of the library has been average, the subject matter of requests has shifted from standard fisheries/hatchery management/biology to include shellfish mariculture. For example, there has been a growing demand for management/biological data on miscellaneous seaweeds, sea urchins, and sea cucumbers, as well as more information on the culture of crustaceans and mollusks. Consequently, the Fisheries Library has strengthened its collection in these areas and will continue to compile both historical and contemporary documents of relevance. Additionally, the collection of "oil spill"-related reports continues to grow, but at a slower pace than in 1989.

Due to the March 1989 Exxon Valdez oil spill, there has been an increasing demand by both state and oil company legal teams to locate and collect pertinent documents to be used in litigation. The library staff has worked with staff from the Attorney General's Office to facilitate compilation of relevant reports by both parties. Although it has gone smoothly, there has been some difficulty because some documents are cited but not "published," and others are of a "confidential" nature.

Over the past year, all three fisheries divisions have increased the kinds and quantity of formal reports. While the addition of these documents is worthwhile, it has, nonetheless,

resulted in tighter shelf space. This, in turn, will mean expansion or culling the existing collection each year to create additional room. Fortunately, a number of "high volume" serials are now being distributed on space-saving microfiche, and fisheries staff are becoming more willing to use this format. With the volume of monographs/journals/ serials published today, it is becoming more and more necessary to select wisely and share resources with other libraries more routinely. Having easy access to one other natural resources library is truly a tremendous asset.

The Fisheries Library's "current awareness" program continues to get heavy use by fisheries staff. This service allows them to get tables of contents from approximately 50 journals/serials on a regular basis. Then, upon request, library staff provide copies of individual articles to fisheries staff. This program saves the divisions a tremendous amount of money by providing comprehensive and timely journalistic literature without each individual having to purchase a subscription. Staff are asked annually to update their selections to ensure they are receiving the information they need.

Formal Technical Presentations

Boyle, L. and N. Dudiak. 1990. History of sockeye salmon enhancement at Leisure and Chenik Lakes. 1990 Annual Sockeye Salmon Workshop, 10-11 July, Anchorage, Alaska.

Boyle, L. and N. Dudiak. 1990. Significance of salmon enhancement to lower Cook Inlet area sport and commercial fisheries. Alaska Chapter American Fisheries Society Annual Meeting, 12-16 November, Homer, Alaska.

Edmundson, J. A. and J. P. Koenings. 1990. Quality assurance within the Alaskan limnology program through statewide standardization of field and laboratory methodologies. 32nd Rocky Mountain Conference on Analytical Chemistry, 28 July-2 August, Denver, Colorado.

Haddix, M. H. 1990. Evaluation of sockeye salmon rehabilitation and enhancement projects in southeast Alaska. Annual International Kokanee Workshop, 20-21 March, Kalispell, Montana. (Abstract published in *Proceedings*.)

Haddix, M. H. 1990. Kokanee salmon in Alaska. Annual International Kokanee Workshop, 20-21 March, Kalispell, Montana. (Abstract published in *Proceedings*.)

Hauser, W. 1990. Fish habitat enhancement in Campbell Creek. Alaska Chapter American Fisheries Society Annual Meeting, 12-16 November, Homer, Alaska.

Koenings, J. P. and J. A. Edmundson. 1990. Relationships between changes in turbidity and yellow color (gilvin), and measures of underwater light: a unifying field theory. American Society of Limnology and Oceanography 1990 Annual Meeting, 10-15 June, College of William and Mary, Virginia.

Koenings, J. P. and H. J. Geiger. 1990. Historic and current survival patterns of sockeye salmon smolts at sea: is bigger always better? Minisymposium: Current

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CHAPTER 11

THE MARICULTURE PROGRAM

Background

The Aquatic Farm Act of 1988 (HCS CSSB 514) 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 would contribute to the state's economy and strengthen the competitiveness of Alaska seafood in the world marketplace by broadening the diversity of products and providing year-round supplies of premium quality seafood. The law limits aquatic farming to shellfish and aquatic plants; in 1990 CSHB 432 became law, prohibiting the 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 11 districts. The law requires that each district be open each year for 60 days for farmsite applications. 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 ADF&G Habitat Division, coordinate the permitting process for aquatic farms and hatcheries;
- review of aquatic farm and hatchery permit applications for site suitability and technical and operational feasibility;
- issue and administer department aquatic farm and hatchery permits;
- provide interdivisional coordination of the aquatic farm program;
- participate on and act as chair of the Governor's Interagency Mariculture Workgroup (IAMWG);
- administer and coordinate aquatic stock acquisition permits for the purpose of supplying broodstock and seedstock to aquatic farms and hatcheries;
- administer and coordinate the shellfish and aquatic plant transport permit system;

- administer and coordinate research permits for aquatic farming and hatchery activities;
- provide technical assistance to other divisions, agencies, and the public sector; and
- coordinate aquatic farming and hatchery research activities statewide.

Program Implementation

The direction of the FRED Division Mariculture Program changed significantly in 1990. In prior years permitting responsibilities were assumed by the PNP Program. The FRED Division mariculture coordinator's primary activities were research and technology development. In 1990 all permitting and administrative responsibilities were shifted to the mariculture coordinator. Budget constraints eliminated the research program and reduced technical assistance provided to the industry. The number of applications received and processed in 1990 (Table 11.1) necessitated these changes to allow implementation of a cohesive program.

Considerable interaction with the other resource agencies, which include DEC, DNR, the Governor's Division of Governmental Coordination (DGC), and federal agencies, were required to review and revise the permitting process and ensure coordination of effort. The IAMWG met on numerous occasions to discuss issues and formulate interdepartmental policy. The FRED and Habitat Divisions developed a coordinated permitting process. The FRED Division now coordinates the overall department program, reviews permit applications, and issues aquatic farm permits. The Habitat Division coordinates the department's Alaska Coastal Management Program and statutory review, providing that information to DGC.

Permitting and administration responsibilities for aquatic stock acquisition, shellfish, and aquatic plant transport and scientific/educational permits were also transferred to the Mariculture Program in 1990. One clerical position was assigned to the program to assist with administrative functions.

Ninety aquatic farm permit applications were processed this year. Twenty-four permits for Southeast farms were issued. Scientific/educational (research) and transport permit applications were at levels consistent with the number of permitted farms (Table 11.1) and are expected to increase significantly in 1991, reflecting the increase in active farms.

A statewide opening of all aquatic farm districts is scheduled for March/April 1991.

Aquatic Farm Production

1990 was a transitional year for the aquatic farm industry in Alaska. With the implementation of the Aquatic Farm Act, farmers can acquire a farmsite permit from DNR that is a property right that can be revoked only for breach of permit conditions.

Table 11.1. 1990 Aquatic Farm Permit data.

	Southeast Districts	Southcentral Districts	TOTAL
OPERATIONS			
No. permit applications processed in 1990	54	36	90
No. permits issued in 1990	24	0	24
No. permits pending or still in process	5	36	41
No. of farms operating in 1990 1) 2)	16	12	28
No. of certified growing areas 3)	14	4	18
RESEARCH			
No. permit applications processed in 1990	6	3	9
No. permits issued in 1990	6	2	8
No. permits pending or still in process	0	1	1
SHELLFISH AND AQUATIC PLANT TRANSPORT			
No. permit applications processed in 1990	64	6	70
No. permits issued in 1990	54	2	56
No. permits pending or still in process	5	1	6

1) Due to the re-permitting process, operating status for 6 farms was not reported
2) Eight new farms permitted in Southeast elected to defer permit effective dates to January 1, 1991
3) More than one farm may be located in a growing area as defined by the Department of Environmental Conservation

The initial permit is for a 3-year period, during which the permittee must attain goals agreed upon in the farm's development plan. Once the goals are attained, the permittee may apply for a 10-year lease, which is assignable. This adds stability to the industry and should provide some renumeration for the effort and investment of developing a farm-site. Many operating farmers took a conservative approach in 1990, waiting for the outcome of the permitting process. A number of farms did not purchase or acquire seedstock. Overall, considering the lack of economic incentive and difficulties acquiring capital, the overall picture was bright. Aquatic farm sales for 1990 were less than $100,000 (Table 11.2). Production was dominated by oysters, with a small amount of mussels produced in southcentral Alaska. Southeast farmers received an average of $0.27/oyster. The Southcentral value was significantly higher at $0.48. The average price for mussels was $2.16/lb. The amount of product sold was quite small, though, and probably does not reflect the price farmers are likely to receive for mussels as production increases. For purposes of value projections, $1.50/lb seemed attainable (Table 11.2). All prices are based on landed value at the farms and do not take into account production or transportation costs.

Though 1990 production was low, the end-of-year inventory of farm product exceeded $1.3 million in value at marketable size. Over 2 million oyster spat were purchased by Alaskan farmers. The production was regional in nature, primarily due to successes of farms within the regions. Southeast Alaska will be the primary producer of oysters for the next few years, while Southcentral will produce the majority of farmed mussels (Table 11.2).

Industry Projections

A more indicative picture of the industry was revealed by looking at production projections for aquatic farms permitted in 1990 and those farms now in the permit process. If all the farms now in the application process are permitted and reach their development goals, over 5 million oysters valued in excess of $1.8 million will be produced by 1994. Southcentral Alaska will continue to dominate mussel production, producing over 500,000 pounds of mussels. Scallop production will be low for the next few years as the industry develops the technology for farming these shellfish (Table 11.3). Four species of scallops were proposed for farming. Hatchery culture research on weathervane and purple-hinge rock scallop is being conducted by private enterprise under a grant by the Alaska Science and Technology Foundation. These two species seem to hold the most promise among the scallop species. Farms proposing production of smaller quantities of clams (little neck/butter), pinto abalone, and aquatic plants were also under development.

Large-scale aquatic farm industry development was constrained in 1990 by the lack of state or federal assistance (such as loan funds, grants, etc.) and the unavailability of loans or other sources of investment capital from the private sector. Out-of-state businesses did not elicit interest in investing in the industry this year. This is almost certain to change. Nationwide, shellfish production is constrained by pollution and competition for limited coastal resources. The major eastern U.S. production areas, such as the Chesapeake Bay, have ceased to be a major factor in shellfish production. Everything

Table 11.2. 1990 Aquatic Farm Sales and Production Data.

SALES	Southeast Districts	Southcentral Districts	TOTAL
Oysters (ind.)	166,503 1)	57,780	224,283
Value	$45,638	$27,899	$73,537
Mussels (lbs)	0	1,720 1)	1,720
Value	$0	$3,718	$3,718
Total Aquatic Farm Sales			$77,255
END OF YEAR INVENTORY			
Oysters (ind.)	2,227,000 2)	1,627,800 1)	3,854,800
Value	$691,950	$569,730	$1,261,680
Mussels (lbs)	0	45,800	45,800
	$0	$68,700	$68,700
Total Aquatic Farm Inventory Value			$1,330,380
SEEDSTOCK PURCHASED/COLLECTED			
Oyster spat	1,865,000	300,000	2,165,000
Mussel seed	no estimate	no estimate	

1) One farm did not report production data
2) 5 of 17 active farms did not report end of year inventory

Table 11.3. Aquatic farm production estimates -- at the end of the first three years of operation (1993/1994). 1)

Species	Southeast Districts	Southcentral Districts	TOTAL
Oysters (ind.)	2,633,500	2,745,000	5,378,500
Value	$921,725	$960,750	$1,882,475
Mussels (lbs)	90,700	586,000	676,700
Value	$136,050	$879,000	$1,015,050
Scallops (ind.) 3)	48,000	55,000	103,000
Value	2)	2)	
Clams (lbs) 4)	0	<10,000	<10,000
Value	2)	2)	
Abalone (ind.) 5)	305,000	0	305,000
Value	2)		
Aquatic plants (lbs)	16,000	<10,000	<26,000
Value	2)	2)	

1) Based upon development plans for 29 farms in Southeast and 36 farmsite applications in Southcentral
2) Value dependent upon species and/or product type
3) Includes weathervane, rock, spiny and pink scallop production
4) Little neck and butter clam production
5) Juvenilles

points to Alaska, with its clean waters and large coastline, as having the potential of becoming a major aquatic farming area. Investment capital and the logistics of producing and selling the product are viewed as major constraints.

Another major component lacking in Alaska is a hatchery industry to supply seed to aquatic farms. No shellfish or aquatic plant hatcheries exist in the state. All oyster seed must be imported from Washington. Development of scallop and clam farming will ultimately depend upon the availability of hatcheries in the state. Technology is generally available elsewhere, but regulatory and logistical barriers prevent any significant research on indigenous Alaskan stocks at out-of-state facilities.

The benefits of aquatic farming as a source of income and economic stability is of interest to a number of rural Alaskan communities. In 1990 development and site-suitability research were conducted near Klawock, Angoon, and Yakutat in Southeast. The Village of Akhiok on Kodiak Island had a small research-level farm. Villages in Southcentral, including Tatitlek, English Bay, Port Graham, and the Village Corporation in Cordova elicited interest in the possibilities of aquatic farming. The funding for these projects generally comes from state rural development agencies and the federal government (Bureau of Indian Affairs). The FRED Division provides permitting and technical assistance to these programs.

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CHAPTER 12

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 is 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 operations 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;
- coordination in the development of and ADF&G relations with qualified regional aquaculture associations; and
- administration and coordination of the U.S./Canada fisheries enhancement program.

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. Eight regional associations have been formed:

1. Southern Southeast Regional Aquaculture Association (SSRAA)
2. Northern Southeast Regional Aquaculture Association (NSRAA)

3. Prince William Sound Aquaculture Corporation (PWSAC)

4. Cook Inlet Aquaculture Association (CIAA)

5. Lower Yukon/Kuskokwim Regional Aquaculture Association (LY/KRAA)*

6. Bristol Bay Regional Aquaculture Association (BBRAA)

7. Kodiak Regional Aquaculture Association (KRAA)

8. Chignik Regional Aquaculture Association (CRAA)

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 authorizes the Commissioner to designate regions of the state for the purpose of enhancing salmon production. This same law also established the formation of RPTs to develop regional salmon plans. Each RPT consists of 6 voting members, with 3 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 20-year comprehensive plans, 5-year action (strategic) plans, and perform annual plan update and maintenance.

The status of planning by region follows:

1. **Southern Southeast**

   The southern Southeast regional plans have been approved, and the team is in the plan-maintenance and update process.

2. **Northern Southeast**

   The northern Southeast regional plans have been approved, and the team is in the plan-maintenance and update process.

* Indicates inactive regional association

3. **Yakutat**

No formal salmon planning activities have occurred in Yakutat since the approval of the 20-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.

4. **Prince William Sound**

The Prince William Sound Phase I and Phase II plans have been approved. The team 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.

5. **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.

6. **Kodiak**

The Kodiak regional plans were approved prior to 1988. During 1990 the RPT has been revising the Phase II plan to more accurately reflect production goals, project opportunities, and user-group needs.

7. **Bristol Bay**

The Bristol Bay RPT has completed the comprehensive salmon plan for Bristol Bay. 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 team has resumed active planning and is preparing a 5-year action plan, including projects for implementation.

8. **Lower Yukon/Kuskokwim**

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 for the initiative, regional enhancement planning will be reactivated and expanded to include both the upper and lower Yukon River.

9. **Alaska Peninsula Planning**

In 1990 an RPT was appointed to begin development of a comprehensive salmon plan for the Alaska Peninsula/Aleutian Island/Area M region.

10. **Chignik**

The Commissioner appointed an RPT in 1990 to initiate development of a comprehensive salmon plan for the Chignik Region.

11. **Sikusuilaq Springs Hatchery Management Plan**

Residents of Kotzebue Sound are interested in salmon enhancement planning, and the FRED Division is developing alternative production scenarios as part of the basic management plan for the Sikusuilaq Springs Hatchery. These efforts may lead to 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 assessments of commercial fishermen.

Cumulative state loans secured by corporations for capital construction and operations, cumulative enhancement funds returned to the regional aquaculture associations, and revenue generated during 1990 by corporate sales of returning hatchery fish are presented in Table 12.1. Through 31 December 1990, $71.0 million has been borrowed by PNP corporations. Another $42.2 million has been generated through assessments. In 1990 PNP operators sold more than $13.6 million worth of fish to help pay for the operation of their hatcheries.

Program Implementation

The application procedures and standards for issuance of PNP salmon hatchery permits are defined by regulations issued in 1985.

Table 12.1. Cumulative state loans and enhancement funds returned to associations (through December 31, 1990), and annual fish sales for 20 private nonprofit (PNP) hatcheries (through Dec. 31, 1990).

Region/Corporation (number of permits)	State Loans		Cumulative Enhancement Funds Generated through Assessments, Returned to Associations via Contract	Estimated Revenue From 1990 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	$13,820,467.21 (note 1)	$1,180,692.00
Alaska Aquaculture,Inc.-AAI (1)	$1,091,985.00	$2,303,208.00	N/A	$21,499.30
Meyers Chuck Aquaculture Association-MCAA (1)	$10,000.00	$0.00	N/A	N/A
NORTHERN SOUTHEAST				
Northern Southeast Regional Aquaculture Association-NSRAA (3)	$2,724,265.00	$1,638,496.00	$7,895,083.89 (note 1)	$1,253,052.38
Armstrong-Keta, Inc.- AKI (1)	$1,733,645.00	$2,015,500.00	N/A	$350,934.30
Burro Creek Farms, Inc.-BCF (1)	$51,500.00	$332,875.00	N/A	$606.00
Douglas Island Pink and Chum Inc.-DIPAC (3)	$9,171,000.00	$3,821,000.00	N/A	$68,366.00
Kake Nonprofit Fisheries Corp.-KNFC (1)	$1,500,724.00	$1,632,060.00	N/A	$101,328.93
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)	$19,475,419.00	$1,085,500.00	$8,019,732.53 (note 2)	$8,005,445.08
Valdez Fisheries Development Assoc.-VFDA (1)	$3,193,830.00	$3,250,543.00	N/A	$2,614,413.59
COOK INLET				
Cook Inlet Regional Aquaculture Assoc.-CIAA (2)	$1,438,881.00	$683,369.00	$9,301,544.64 (note 2)	$47,703.19
KODIAK				
Kodiak Regional Aquaculture Assoc.-KRAA (1)	$0.00	$0.00	$3,182,883.56 (note 2)	$0.00
STATEWIDE TOTALS	$51,310,503.00	$19,762,723.00	$42,219,711.83	$13,644,040.77

note 1: 3% mandatory assessment tax collected collected from commercial fishermen.
note 2: 2% mandatory assessment tax collected from commercial fishermen.

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, 30 salmon hatchery permits have been issued and 3 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.

Twenty-one of the permitted PNP hatcheries are in operation and all had returns of adult salmon during 1990. Currently, there is one application for a PNP hatchery permit under consideration. In addition, 58 scientific/educational permits for aquaculture research projects or school district aquaculture programs were issued in 1990 by the Commissioner. These permits are administered by the PNP Program.

Locations of operational PNP programs and remote release sites are illustrated in Figures 12.1, 12.2, and 12.3.

Hatchery Production

In 1990 PNP corporations estimated that 42.3 million adult salmon originally released as juveniles from corporate facilities were either harvested in common-property fisheries or returned to hatchery special harvest areas (Table 12.2). Not included in this figure are 730,000 hatchery returns to the Kitoi Bay Hatchery that were already considered under FRED Division hatchery production elsewhere in this report. In Prince William Sound, returns to PNP hatcheries were estimated by the operators to have contributed over 28.2 million pink salmon to the commercial fishery. That contribution represents 80% of the total harvest of pink salmon in Prince William Sound. SSRAA estimates its hatcheries at Neets Bay and Whitman Lake contributed over 390,000 chum, coho, and chinook salmon to the common-property fisheries in Southeast. Estimated hatchery returns for 1990, including commercial, sport, and cost-recovery harvests, are presented by region and species in Table 13.1 in the next chapter.

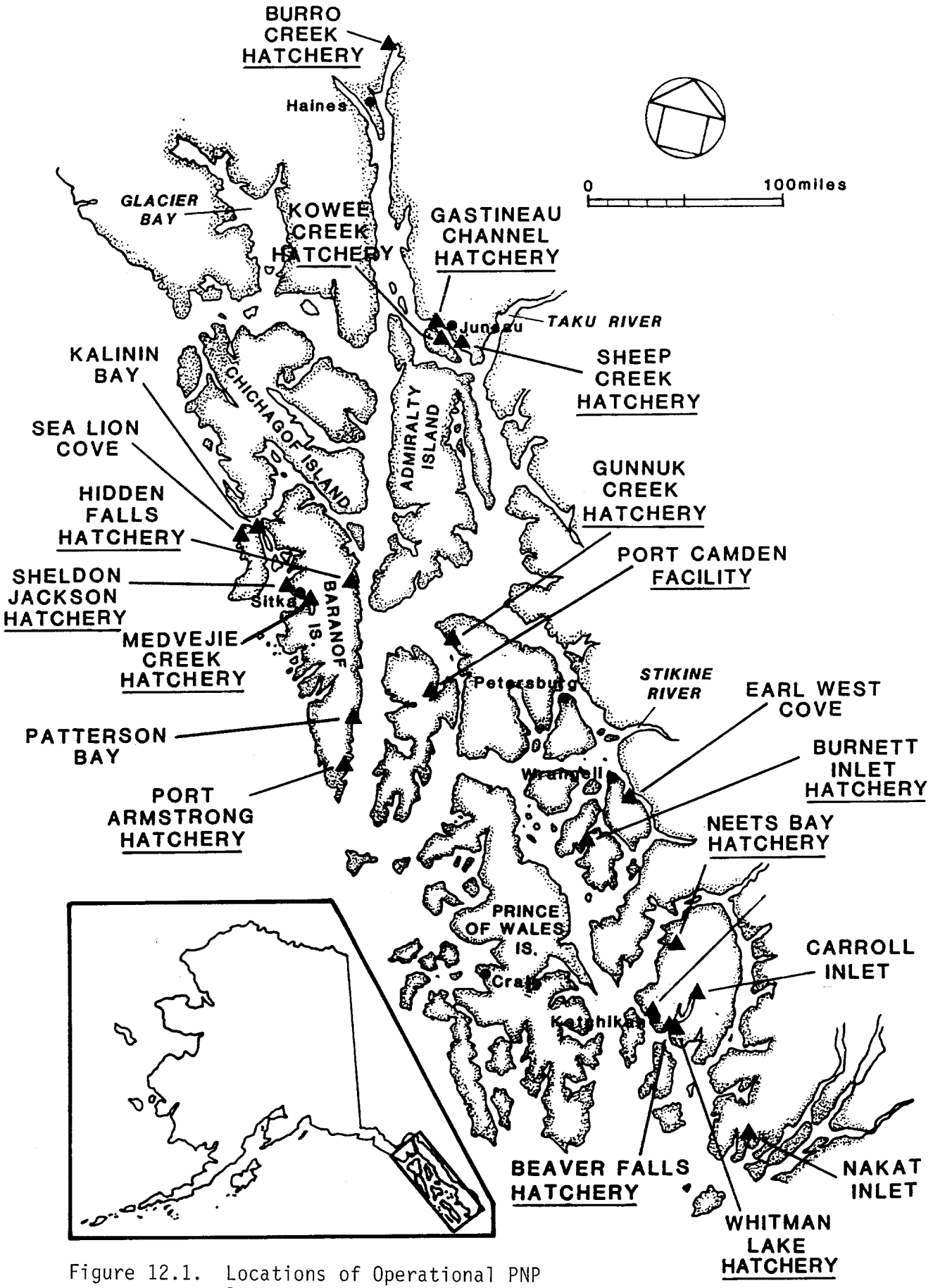

Figure 12.1. Locations of Operational PNP Programs in Southeast Alaska.

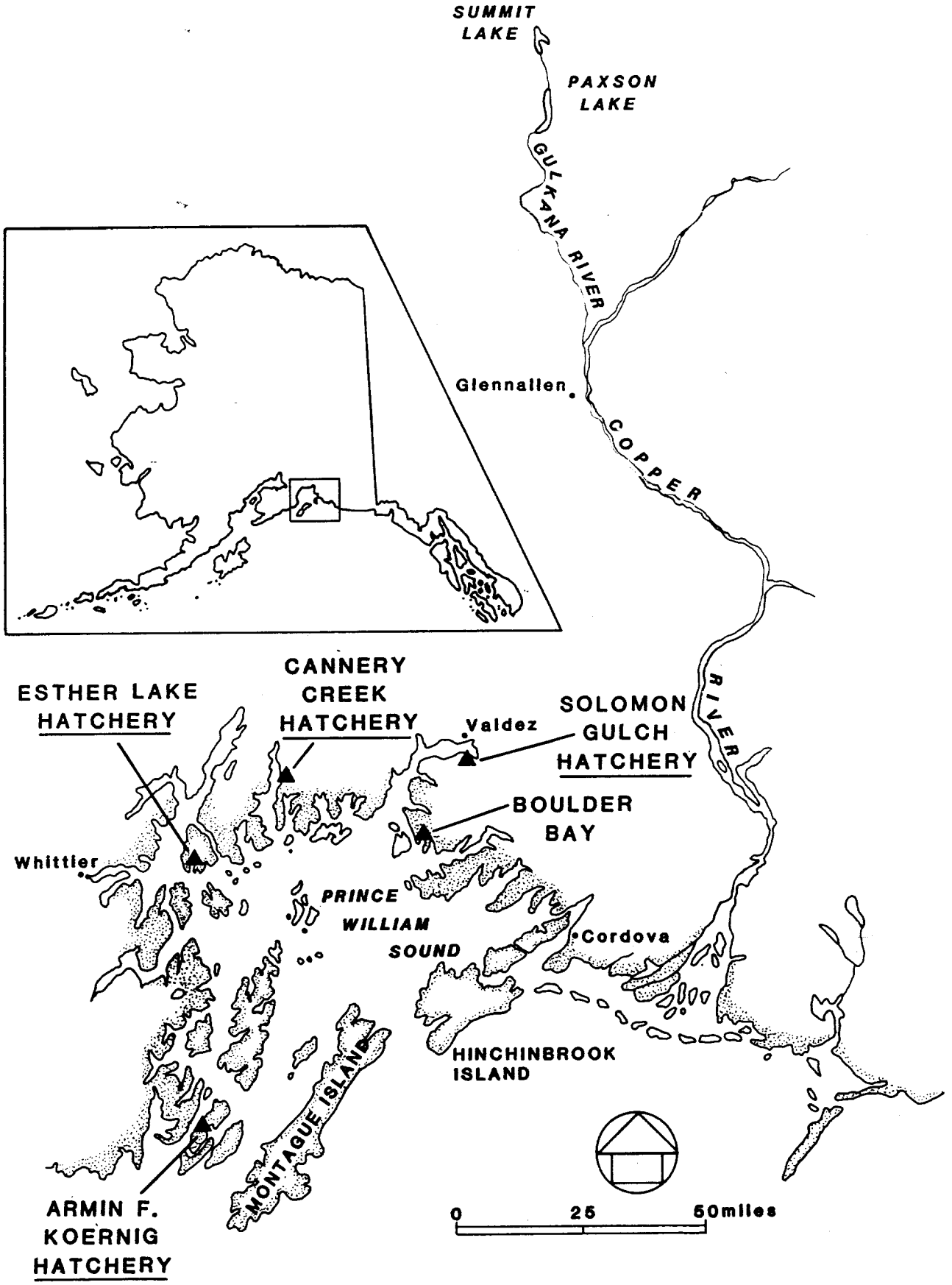

Figure 12.2. Locations of Operational PNP Programs in Prince William Sound.

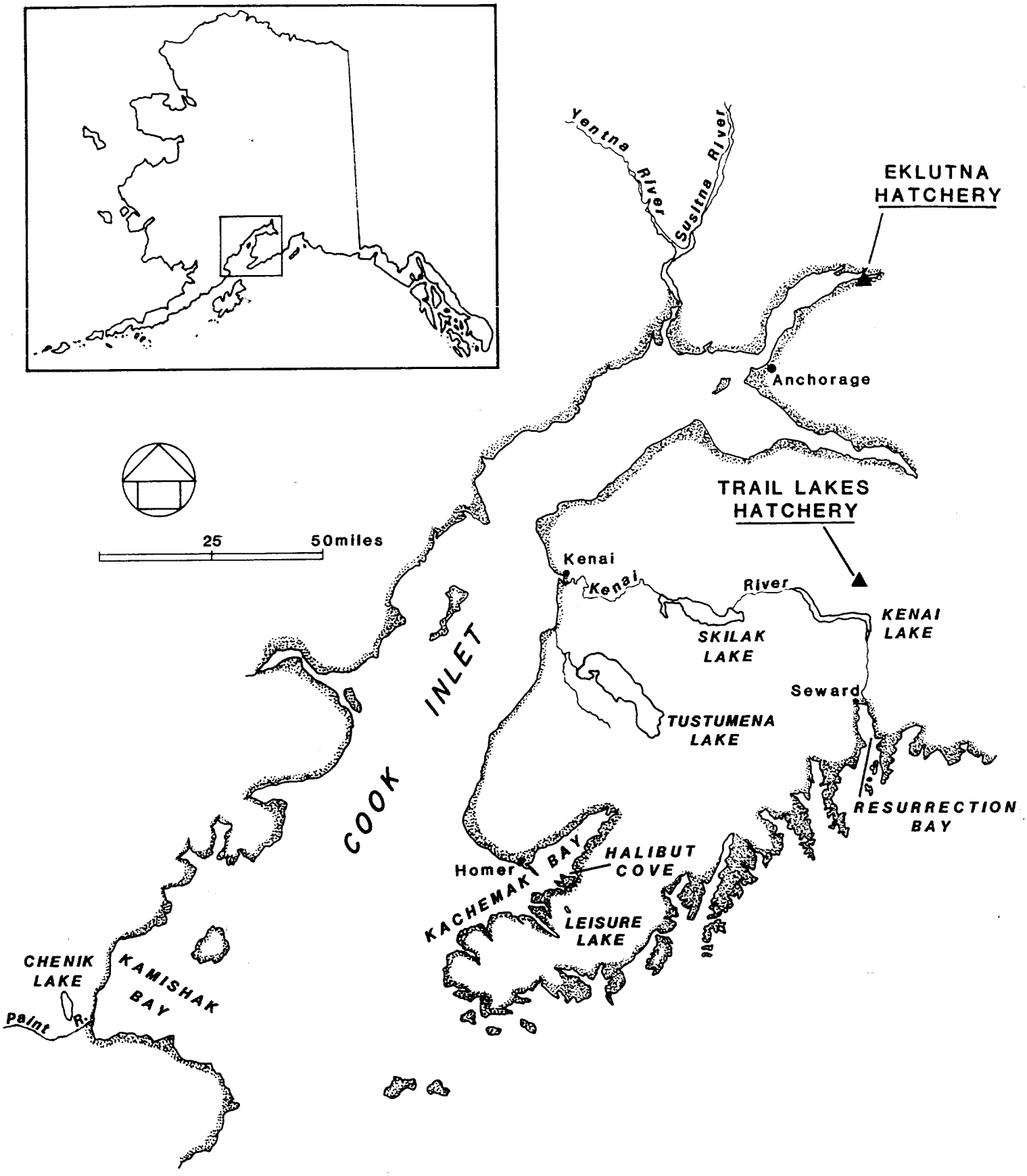

Figure 12.3. Locations of Operational PNP Programs in Cook Inlet.

Table 12.2. 1990 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		69,321	63,955	39,169		172,445	(note 1)
- Neets Bay		202,543	291,630	15,217		509,390	(note 1)
- Beaver Falls					216	216	
NSRAA - Hidden Falls		479,731		738		480,469	(note 1&4)
- Medvejie Creek		118,950	60,949	2,429		182,328	(note 1&4)
AAI - Burnett Inlet	235,642	50,069	825			286,536	(note 1&2)
A-K - Port Armstrong	1,113,413	1,319		1,076		1,115,808	(note 1&2)
BCF - Burro Creek	2,404	82	20			2,506	(note 2)
DIPAC - Sheep Creek	5,907	180,783				186,690	
- Kowee Creek	685	1,105				1,790	
- Gastineau	58,893	6,151	3,445	138		68,627	(note 1&2)
KNFC - Gunnuk Creek	194,655	48,168				242,823	(note 2)
SJC - Indian River	7,250	1,000	1,210	351		9,811	(note 1&3)
SOUTHEAST TOTALS	1,618,849	1,159,222	422,034	59,118	216	3,259,439	
PRINCE WILLIAM SOUND							
PWSAC - Armin F. Koernig	8,952,035					8,952,035	(note 1&4)
- Esther Lake	15,089,718	372,896	171,779	608		15,635,001	(note 1&4)
- Cannery Creek	3,239,883					3,239,883	(note 1&4)
VFDA - Solomon Gulch	11,019,426	48,000	84,703			11,152,129	(note 1&4)
PWS TOTALS	38,301,062	420,896	256,482	608	0	38,979,048	
COOK INLET							
CIAA - Eklutna		52,421	2,664			55,085	(note 2)
- Trail Lakes			10,500		101,000	111,500	
COOK INLET TOTALS	0	52,421	13,164	0	101,000	166,585	
KODIAK							
KRAA - Kitoi Bay	Listed under FRED hatchery production					0	
KODIAK TOTALS	0	0	0	0	0	0	
STATEWIDE TOTALS	39,919,911	1,632,539	691,680	59,726	101,216	42,405,072	

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.

Statewide production data since 1975 for combined species, including adult returns and harvests, are presented in Table 12.3. Preliminary estimates by the PNP corporations indicate that common-property harvests of the 1990 return were almost 30 million fish. This represents an increase of 17 million fish over 1989 in common-property harvests due primarily to a large return of hatchery-produced pink salmon in Prince William Sound. Cumulative data for chum salmon produced by PNP corporations since 1975 are presented in Table 12.4. Similar data for sockeye, pink, coho, and chinook salmon are presented in Tables 12.5, 12.6, 12.7, and 12.8, respectively.

Egg takes and fry or smolt stocking are regulated by ADF&G through FTPs and are administered by the PNP Program. During 1990 fry and smolt releases increased to over 925 million juvenile fish, an increase of over 65 million (or 8%) from 1989 levels (Table 12.9). 1990 egg takes for PNP hatcheries totaled almost 1.25 billion green eggs, up 140 million (or 13%) from 1989 levels. The largest egg take of 1990 was at Esther Lake Hatchery where over 329 million pink, chum, coho, and chinook salmon eggs were taken for incubation (Table 12.10). This was followed by the Valdez Fisheries Development Association's Solomon Gulch Hatchery with over 163 million pink, chum, and coho salmon eggs, PWSAC's Cannery Creek Hatchery with over 151 million pink salmon eggs, and PWSAC's Armin F. Koernig Hatchery with over 127 million pink salmon eggs. In total, more than 679 million salmon eggs were taken by PNP operators in Prince William Sound in 1990. In southeast Alaska, DIPAC took over 133 million pink, chum, chinook, and coho salmon eggs for its 3 facilities, NSRAA took over 121 million chum, coho, and chinook salmon eggs for its 3 hatcheries, and SSRAA took over 93 million chum, coho, chinook, and sockeye salmon eggs for its 3 hatcheries.

Significant progress was made in 1990 in initiating sockeye salmon production from PNP hatcheries. Releases of juvenile sockeye salmon totaled over 8.1 million in 1990. Sockeye salmon egg takes totaled 11.8 million eggs at PNP hatcheries in 1990. Significant increases in chinook, chum and coho salmon production also were made in 1990. The most noticeable increase was in chum salmon production in the Southeast and Prince William Sound Regions. In 1990 hatchery operators in these regions took 158 million more chum salmon eggs (59%) than were taken in 1989. Pink salmon egg takes decreased slightly compared to 1989 because the Esther Lake and Cannery Creek facilities in Prince William Sound took fewer eggs.

Many PNP hatcheries are currently in the process of broodstock development and, consequently, have not reached their permitted capacities. Permitted capacities for PNP hatcheries now total over 1.71 billion eggs, an increase of 125.6 million from 1989 levels (Table 12.11). Potential returns from statewide PNP hatchery-originated production at the 1.7 billion-egg level should approach 30 million adults, assuming FRED Division 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, 39% for chum salmon, and 7% for steelhead trout, sockeye, coho, and chinook salmon.

Projected returns to PNP facilities for the 1991 season are presented in Table 12.12. Approximately 92,000 chinook salmon, 462,000 coho salmon, 1,990,000 chum salmon, and

Table 12.3. 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
	Cumulative hatchery revenue from special harvest:				$67,996,673.74

Table 12.4. 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

Table 12.5. 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

Table 12.6. 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

Table 12.7. 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

Table 12.8. 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

Table 12.9. 1990 releases from PNP hatcheries in millions.

REGION/LOCATION	Pink	Chum	Coho	Chinook	Sockeye	TOTAL
SOUTHEAST						
SSRAA - Whitman Lake		2.09	1.61	1.08	*	4.78
- Neets Bay		32.58	2.20	1.61		36.39
- Beaver Falls				0.03	0.62	0.65
NSRAA - Hidden Falls		62.51	0.06	0.38		62.95
- Medvejie Creek	0.02	34.41	1.86	0.92		37.21
- Port Camden		0.73				0.73
AAI - Burnett Inlet	11.50	2.20	0.06	0.19		13.95
A-K - Port Armstrong	22.42	0.14	0.12	0.14		22.83
BCF - Burro Creek	0.98	0.01	0.01			0.99
DIPAC - Kowee Creek	*	*				0.00
- Sheep Creek	17.96	0.15	*			18.11
- Gastineau	9.67	22.84	1.08	0.10		33.69
KNFC - Gunnuk Creek	3.88	5.64				9.53
SJC - Indian River	5.40	0.27	0.04	0.10		5.81
SOUTHEAST TOTALS	71.83	163.56	7.05	4.56	0.62	247.61
PRINCE WILLIAM SOUND						
PWSAC - Armin F. Koernig	113.84	*				113.84
- Esther Lake	233.26	46.98	2.39	0.14	*	282.77
- Cannery Creek	143.66	*				143.66
VFDA - Solomon Gulch	122.20	3.10	0.81			126.12
PWS TOTALS	612.97	50.09	3.20	0.14	0.00	666.39
COOK INLET						
CIAA - Eklutna	*	3.21	0.05	*		3.26
- Trail lakes			0.43	*	7.52	7.95
COOK INLET TOTALS	0.00	3.21	0.48	0.00	7.52	11.21
KODIAK						
KRAA - Kitoi Bay	Listed under FRED hatchery production					
KODIAK TOTALS	0.00	0.00	0.00	0.00	0.00	0.00
STATEWIDE TOTALS	684.79	216.86	10.73	4.70	8.14	925.21

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 12.10. 1990 egg takes for PNP hatcheries in millions.

REGION/LOCATION	Pink	Chum	Coho	Chinook	Sockeye	TOTAL	Comments:
SOUTHEAST							
SSRAA - Whitman Lake		24.72	3.80	1.50	*	30.02	(note 1)
- Neets Bay		60.27	0.41	1.43		62.12	
- Beaver Falls				0.03	0.94	0.97	
NSRAA - Hidden Falls		78.33	0.24	2.95		81.52	
- Medvejie Creek		33.79	2.31	1.20		37.30	
- Port Camden		2.68				2.68	
AAI - Burnett Inlet	11.30	20.00	0.04	0.32		31.66	
A-K - Port Armstrong	53.71	0.86	0.26	0.16		54.98	
BCF - Burro Creek	2.11	0.03				2.13	
DIPAC - Kowee Creek	*	*				0.00	(note 1)
- Sheep Creek	*	29.23	*			29.23	(note 1)
- Gastineau	32.23	70.63	1.11	0.21		104.18	
KNFC - Gunnuk Creek	7.17	14.32				21.49	
MCAA - Meyers Chuck	*	*	*			0.00	(note 1)
SJC - Indian River	2.94	0.35	0.11	0.16		3.55	
SOUTHEAST TOTALS	109.46	335.20	8.27	7.95	0.94	461.82	(note 2)
PRINCE WILLIAM SOUND							
PWSAC - Armin F. Koernig	127.86	*				127.86	
- Esther Lake	240.10	85.30	3.04	0.84	*	329.28	
- Cannery Creek	151.85	*				151.85	(note 1)
VFDA - Solomon Gulch	159.45	1.86	2.22	*		163.53	(note 1)
PWS TOTALS	679.25	87.16	5.26	0.84	0.00	772.51	(note 2)
COOK INLET							
CIAA - Eklutna	*	3.05	0.14	*		3.19	(note 1)
- Trail Lakes			0.80	*	10.84	11.64	(note 1)
COOK INLET TOTALS	0.00	3.05	0.93	0.00	10.84	14.82	(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	788.71	425.41	14.47	8.79	11.78	1249.16	
			ALL SPECIES TOTAL: 1,249,160,000				

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.

Table 12.11. Permitted egg capacities, in millions, of PNP hatcheries within the planning regions, 1990.

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		51.00	47.00	1.42	1.40		0.01	100.83
	total	51.00	152.80	9.82	6.94	4.00		224.56
NORTHERN SOUTHEAST								
Association Facilities		0.30	136.00	3.55	5.50			145.35
Non-Association Facilities		193.00	211.50	3.25	0.55		0.09	408.39
	total	193.30	347.50	6.80	6.05	0.00	0.09	553.74
YAKUTAT (no PNP facilities)								
	total	0.00	0.00	0.00	0.00	0.00		0.00
PRINCE WILLIAM SOUND								
Association Facilities		508.00	129.00	4.00	4.00	31.00		676.00
Non-Association Facilities		166.00	28.00	2.00	0.30			196.30
	total	674.00	157.00	6.00	4.30	31.00		872.30
COOK INLET								
Association Facilities		10.00	10.00	7.10	4.10	30.00		61.20
	total	10.00	10.00	7.10	4.10	30.00		61.20
STATEWIDE TOTALS		928.30	667.30	29.72	21.39	65.00	0.09	1711.80

Table 12.12. Projected adult returns, by species, to PNP hatcheries for 1991 (including common property harvests) as reported by operators.

REGION/LOCATION	Pink	Chum	Coho	Chinook	Sockeye	TOTAL
SOUTHEAST						
SSRAA - Whitman Lake		113,500	42,000	57,800		213,300
- Neets Bay		557,000	220,400	22,500		799,900
- Beaver Falls					6,000	6,000
NSRAA - Hidden Falls		680,000	4,300	3,150		687,450
- Medvejie Creek		140,000	80,000	4,800		224,800
AAI - Burnett Inlet	470,000	142,500	2,900	100		615,500
A-K - Port Armstrong	448,401	5,554	12,705	2,597		469,257
BCF - Burro Creek	20,000	100	1,500			21,600
DIPAC - Sheep Creek	359,243	156,975				516,218
- Kowee Creek						0
- Gastineau	193,397	98,651	96,929			388,977
KNFC - Gunnuk Creek	75,650	96,228				171,878
MCAA - Meyers Chuck						0
SJC - Indian River	16,500	900	1,100	1,000		19,500
SOUTHEAST TOTALS	1,583,191	1,991,408	461,834	91,947	6,000	4,134,380
PRINCE WILLIAM SOUND						
PWSAC - Armin F. Koernig	6,602,886					6,602,886
- Esther Lake	13,550,419	1,016,076	311,664	1,782		14,879,941
- Cannery Creek	8,045,101					8,045,101
VFDA - Solomon Gulch	7,571,888	68,378	80,315			7,720,581
PWS TOTALS	35,770,294	1,084,454	391,979	1,782	0	37,248,509
COOK INLET						
CIAA - Eklutna		132,000	5,428			137,428
- Trail Lakes			18,000		304,000	322,000
COOK INLET TOTALS	0	132,000	23,428	0	304,000	459,428
KODIAK						
KRAA - Kitoi Bay	3,106,716	100,000	525		1,370	3,208,611
KODIAK TOTALS	3,106,716	100,000	525	0	1,370	3,208,611
STATEWIDE TOTALS	40,460,201	3,307,862	877,766	93,729	311,370	45,050,928

1,583,000 pink salmon are expected to return to PNP hatcheries in southeast Alaska. Returns to PNP facilities in Prince William Sound are projected at 35,770,000 pink salmon, 1,084,000 chum salmon, and 392,000 coho salmon for 1991.

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

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 17 state and 22 PNP hatchery facilities prior to the 1991 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 broodstock 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.

CHAPTER 13

ALASKAN ENHANCEMENT PROGRAM

The statewide fisheries enhancement program continued to grow in 1990. More eggs were taken, more fish were released, and more fish returned than ever before. More than 1.5 billion eggs (Table 13.1) were taken by busy hatchery crews. These eggs are projected to provide more than 3,500 resident Alaskan jobs and $102 million to Alaska resident incomes. More than 1 billion fish (Table 13.2) were released from hatcheries from Kotzebue to Ketchikan. Nearly 49 million fish (Table 13.3) returned to Alaskan hatcheries. Pink salmon accounted for the largest return and contributed more than 29 million fish to the commercial fishery. "Other" fish, comprised largely of rainbow and steelhead trout, Arctic char, and Arctic grayling, were the largest contributor to

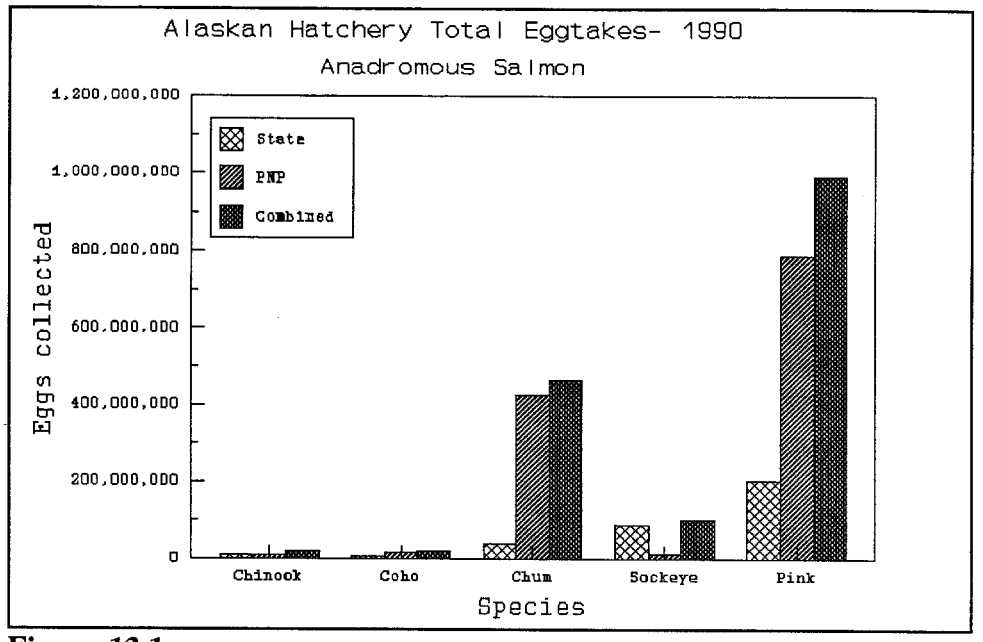

Figure 13.1

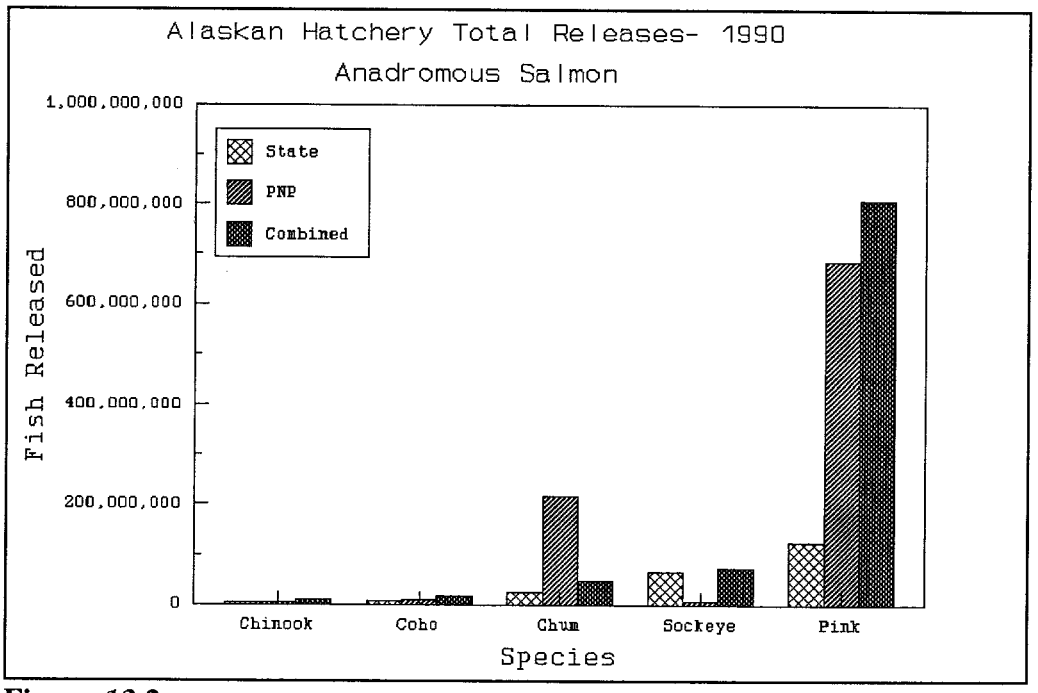

Figure 13.2

Table 13.1. 1990 eggtakes from Alaskan hatcheries (combined PNP + FRED)

Region	Pink	Chum	Coho	Chinook	Sockeye	Other	TOTAL
ARCTIC/YUKON/KUSKOKWIM							
FRED		9,193,000				4,707,000	13,900,000
	0	9,193,000	0	0	0	4,707,000	13,900,000
COOK INLET							
FRED	44,900,000	1,508,557	1,841,000	3,757,000	30,010,000	4,511,000	86,527,557
PNP		3,050,000	930,000		10,840,000		14,820,000
	44,900,000	4,558,557	2,771,000	3,757,000	40,850,000	4,511,000	101,347,557
KODIAK & AK PENINSULA							
FRED	156,000,000	24,713,000	1,343,000		7,240,000		189,296,000
	156,000,000	24,713,000	1,343,000	0	7,240,000	0	189,296,000
PRINCE WILLIAM SOUND							
FRED				47,000	37,204,000		37,251,000
PNP	679,250,000	87,160,000	5,260,000	840,000			772,510,000
	679,250,000	87,160,000	5,260,000	887,000	37,204,000	0	809,761,000
SOUTHEAST							
FRED		2,712,000	2,223,000	4,394,000	13,578,000	136,000	23,043,000
PNP	109,460,000	335,200,000	8,270,000	7,950,000	940,000		461,820,000
	109,460,000	337,912,000	10,493,000	12,344,000	14,518,000	136,000	484,863,000
STATEWIDE TOTALS	989,610,000	463,536,557	19,867,000	16,988,000	99,812,000	9,354,000	1,599,167,557

Table 13.2. 1990 releases from Alaskan hatcheries (combined PNP + FRED)

Region	Pink	Chum	Coho	Chinook	Sockeye	Other	TOTAL
ARCTIC/YUKON/KUSKOKWIM							
FRED		6,364,003				1,322,121	7,686,124
	0	6,364,003	0	0	0	1,322,121	7,686,124
COOK INLET							
FRED	30,300,803	1,508,557	4,388,450	2,253,314	26,684,166	2,776,022	67,911,312
PNP		3,210,000	480,000		7,520,000		11,210,000
	30,300,803	4,718,557	4,868,450	2,253,314	34,204,166	2,776,022	79,121,312
KODIAK & AK PENINSULA							
FRED	93,207,550	15,204,537	208,553		1,286,396		109,907,036
	93,207,550	15,204,537	208,553	0	1,286,396	0	109,907,036
PRINCE WILLIAM SOUND							
FRED					28,725,132		28,725,132
PNP	612,970,000	50,090,000	3,200,000	140,000			666,400,000
	612,970,000	50,090,000	3,200,000	140,000	28,725,132	0	695,125,132
SOUTHEAST							
FRED		2,644,263	2,631,294	3,183,669	8,552,413	52,798	17,064,437
PNP	71,830,000	163,560,000	7,050,000	4,560,000	620,000		247,620,000
	71,830,000	166,204,263	9,681,294	7,743,669	9,172,413	52,798	264,684,437
STATEWIDE TOTALS	808,308,353	242,581,360	17,958,297	10,136,983	73,388,107	4,150,941	1,156,524,041

Table 13.3. 1990 estimated returns to Alaskan hatcheries (combined PNP + FRED)

	Pink					Chum					Coho				
REGION	Commercial	Sport	Cost recovery	Other	TOTAL	Commercial	Sport	Cost recovery	Other	TOTAL	Commercial	Sport	Cost recovery	Other	TOTAL
ARCTIC/YUKON/KUSKOKWIM															
FRED					0	5,000			9,000	14,000		18,614			18,614
	0	0	0	0	0	5,000	0	0	9,000	14,000	0	18,614	0	0	18,614
COOK INLET															
FRED	167,400	2,800		106,700	276,900	1,000			1,000	2,000	7,450	42,618		8,170	58,238
PNP					0	46,812	2,440	1,445	1,724	52,421	1,332	3,769	6,474	1,589	13,164
	167,400	2,800	0	106,700	276,900	47,812	2,440	1,445	2,724	54,421	8,782	46,387	6,474	9,759	71,402
KODIAK & AK PENINSULA															
FRED	592,345			217,950	810,295	4,100			21,200	25,300	7,100	5,060		10,400	22,560
	592,345	0	0	217,950	810,295	4,100	0	0	21,200	25,300	7,100	5,060	0	10,400	22,560
PRINCE WILLIAM SOUND															
FRED					0	320,000			1,000	321,000		11,000			11,000
PNP	28,195,493	50,000	8,857,940	1,197,629	38,301,062	291,548		31,575	97,773	420,896	201,459	25,840	16,996	12,187	256,482
	28,195,493	50,000	8,857,940	1,197,629	38,301,062	611,548	0	31,575	98,773	741,896	201,459	36,840	16,996	12,187	267,482
SOUTHEAST															
FRED	167,300	1,100		32,161	200,561	12,194			3,375	15,569	57,797	4,323		23,632	85,752
PNP	331,386	4,867	988,424	294,172	1,618,849	395,869	5,332	336,965	421,056	1,159,222	286,398	8,248	117,258	10,130	422,034
	498,686	5,967	988,424	326,333	1,819,410	408,063	5,332	336,965	424,431	1,174,791	344,195	12,571	117,258	33,762	507,786
TOTALS	29,453,924	58,767	9,846,364	1,848,612	41,207,667	1,076,523	7,772	369,985	556,128	2,010,408	561,536	119,472	140,728	66,108	887,844

Table 13.3. Continued

REGION	Chinook					Sockeye					Other					GRAND TOTAL
	Commercial	Sport	Cost recovery	Other	TOTAL	Commercial	Sport	Cost recovery	Other	TOTAL	Commercial	Sport	Cost recovery	Other	TOTAL	
ARCTIC/YUKON/KUSKOKWIM																
FRED					0					0		77,019			77,019	109,633
	0	0	0	0	0	0	0	0	0	0	0	77,019	0	0	77,019	109,633
COOK INLET																
FRED	1,500	12,520		3,100	17,120	343,550	12,200		121,700	477,450		89,989		190	90,179	921,887
PNP					0	60,600		8,513	31,887	101,000					0	166,585
	1,500	12,520	0	3,100	17,120	404,150	12,200	8,513	153,587	578,450	0	89,989	0	190	90,179	1,088,472
KODIAK & AK PENINSULA																
FRED					0	2,291,150			982,900	3,274,050		1,235			1,235	4,133,440
	0	0	0	0	0	2,291,150	0	0	982,900	3,274,050	0	1,235	0	0	1,235	4,133,440
PRINCE WILLIAM SOUND																
FRED					0	149,700			93,500	243,200		7,612			7,612	582,812
PNP	235	9		364	608					0					0	38,979,048
	235	9	0	364	608	149,700	0	0	93,500	243,200	0	7,612	0	0	7,612	39,561,860
SOUTHEAST																
FRED	18,358	5,894		9,803	34,055	110,007	50		123,189	233,246		300		105	405	569,588
PNP	19,814	2,242	22,164	14,898	59,118				216	216					0	3,259,439
	38,172	8,136	22,164	24,701	93,173	110,007	50	0	123,405	233,462	0	300	0	105	405	3,829,027
TOTALS	39,907	20,665	22,164	28,165	110,901	2,955,007	12,250	8,513	1,353,392	4,329,162	0	176,155	0	295	176,450	48,722,432
									FRED		4,255,951	292,334	0	1,769,075	6,317,360	6,317,360
									PNP		29,830,946	102,747	10,387,754	2,083,625	42,405,072	42,405,072
									GRAND TOTAL		34,086,897	395,081	10,387,754	3,852,700	48,722,432	48,722,432

Note: "Other" includes subsistence harvests, broodstock capture, escapement.

the sport fisheries, adding some 194,000 fish to fishermen's creels. These factors combine to make Alaska's fisheries enhancement program the largest in North America and the second largest in the world. These fish provide benefits directly to commercial, sport, subsistence, and personal-use fishermen, as well as providing indirect benefits to fish processors, tackle shops, etc. The statewide enhancement program is tremendously successful and serves as an important role in economic diversification for the State of Alaska.

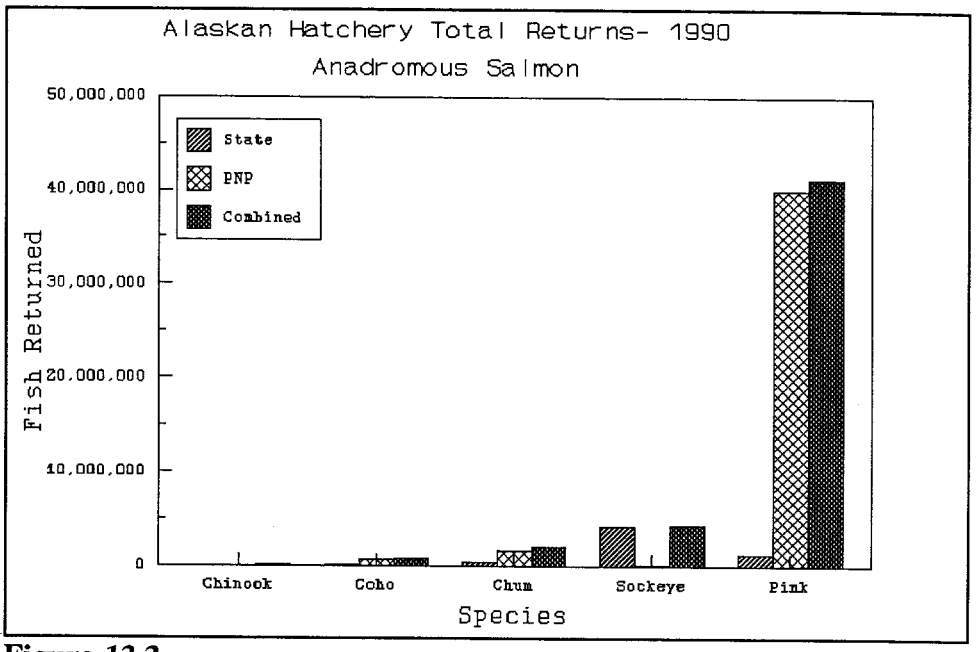

Figure 13.3

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CHAPTER 14

PROGRAM EXPENDITURES

Fiscal Year 1991 Operating Budget

The FRED Division operational budget is comprised of two budget request units (BRUs): the normal operating budget (FRED BRU) and a special projects budget (Special Projects BRU). In past years the FRED BRU has comprised the vast majority of the budget, usually around 96% of the total. In preparing the request for FY 91, FRED Division personnel were instructed to include potential receipts from U.S./ Canada special projects in the request rather than do a revised program when the receipts came in. This inflated the Special Projects BRU and the total budget by showing monies that were generally pass-through funds to other agencies. As such, over $4.7 million was requested in the FY 91 Special Projects BRU, accounting for approximately 24% of the total $19.8 million budget allocated by the Alaska State Legislature. That total was not to survive the Governor's veto, as he cut $2.349 million from the FRED Division's FY 91 budget, with instructions that $2 million specifically be targeted for hatchery operations. That veto, coming as it did 11 days into the budget year, was extremely problematical, causing the rapid contracting of as many hatcheries or hatchery programs to the private sector as possible. All but $900,000 of the $2 million loss was contracted. The FRED Division has been operating the 2 hatcheries for which contracts could not be negotiated in hope that a supplemental appropriation will bring those 2 hatcheries back into the budget.

The FY 92 Governor-approved FRED Division budget represents a 34% reduction from the FY 85 actual budget, in noninflation-adjusted terms.

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ACKNOWLEDGMENTS

The editor wishes to acknowledge the efforts of many people within the FRED Division that have contributed to this report. First, many area and hatchery personnel have assembled data reports that are the basis of this document. Second, a smaller number of individuals have compiled information from field reports and made their syntheses available. The following contributors had a great impact on the preparation of this report:

Report Section	Contributor
Production Report	William J. Hauser, Ph.D. Kenneth A. Leon, Ph.D.
Technology and Development	Robert D. Burkett, Ph.D.
Private Nonprofit Hatcheries	Steven G. McGee
Mariculture	James O. Cochran

Finally, a smaller group has assisted with editing and manuscript preparation. Thanks to Johnny Holland and Steve McGee for editing much of the manuscript, and to Katherine Aschaffenburg for her able assistance in editing and manuscript preparation.

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GLOSSARY OF ACRONYMS

ADF&G	Alaska Department of Fish and Game
ADP	Alaska Dry Pellet (fish food)
AMP	Annual Management Plan
AMRPT	Area M Regional Planning Team
AYK	Arctic-Yukon-Kuskokwim Region
BDC	Broodstock Development Center, Fort Richardson Hatchery
BKD	Bacterial Kidney Disease (fish disease)
BRU	Budget Request Unit
BY	Brood Year
CIAA	Cook Inlet Aquaculture Association
CIF	Central Incubation Facility
CIP	Capital Improvement Project
CISA	Cook Inlet Seiners' Association
CJFAS	Canadian Journal of Fisheries and Aquatic Sciences
D-J	Dingell-Johnson (federal aid funding)
DEC	Alaska Department of Environmental Conservation
DGC	Division of Governmental Coordination, Governor's Office
DIPAC	Douglas Island Pink and Chum, Inc. (Juneau)
DNR	Alaska Department of Natural Resources
ELISA	Enzyme-Linked Immunoabsorbent Assay (pathology)
FAT	Fluorescent Antibody Test (pathology)
FRED	Fisheries Rehabilitation, Enhancement and Development Division, ADF&G
FY	State Fiscal Year (1 July-30 June)
IAMWG	Interagency Mariculture Work Group
IHN	Infectious Hematopoietic Necrosis Virus (fish disease)
KRAA	Kodiak Regional Aquaculture Association
NSRAA	Northern Southeast Regional Aquaculture Association
OMP	Oregon Moist Pellet (fish food)
OSIAR	Oil Spill Impact, Assessment, and Restoration Division, ADF&G
PNFHPC	Pacific Northwest Fish Health Protection Committee
PNP	Private Nonprofit
PWS/CR RPT	Prince William Sound/Copper River Regional Planning Team
PWSAC	Prince William Sound Aquaculture Corporation
RPT	Regional Planning Team
SMT	FRED Division Senior Management Team
SPSA	South Peninsula Sportsman's Association
SSRAA	Southern Southeast Regional Aquaculture Association
USFS	U.S. Forest Service
VHS	Viral Hemorrhagic Septicemia Virus (fish disease)
W-B	Wallop-Breaux (federal aid funding)

APPENDICES

APPENDIX 1

1990 Adult Returns

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Appendix 1. 1990 estimated adult returns to FRED facilities

REGION/LOCATION	Pink	Chum	Coho	Chinook	Sockeye	Other	TOTAL
ARCTIC/YUKON/KUSKOKWIM							
Clear			18,614			2,254	20,868
Ft Richardson						74,765	74,765
Sikusuilaq		14,000					14,000
	0	14,000	18,614	0	0	77,019	109,633
COOK INLET							
Big Lake			17,941		108,300		126,241
Clear						788	788
Crooked Cr			2,100		369,150	350	371,600
Elmendorf			13,580	15,130			28,710
Ft Richardson			24,617	1,990		89,041	115,648
Tutka Bay	276,900	2,000					278,900
	276,900	2,000	58,238	17,120	477,450	90,179	921,887
KODIAK & AK PENINSULA							
Kitoi Bay	730,150	25,300	14,060			1,046	770,556
Karluk					2,229,000		2,229,000
Clear						189	189
Frazer Fishpass					1,026,700		1,026,700
Afognak Fishpass	7,100		8,500		18,350		33,950
Waterfall Fishpass	52,845						52,845
Russell Cr	20,200						20,200
	810,295	25,300	22,560	0	3,274,050	1,235	4,133,440
PRINCE WILLIAM SOUND							
Clear						2,181	2,181
Elmendorf			1,000				1,000
Ft Richardson			10,000			5,431	15,431
Gulkana I					234,200		234,200
Main Bay		321,000			9,000		330,000
	0	321,000	11,000	0	243,200	7,612	582,812
SOUTHEAST							
Bakewell Fishpass					7,562		7,562
Beaver Falls					220,884		220,884
Cable Cr Fishpass			89				89
Chilkat Ponds			1,250				1,250
Crystal Lake			6,130	26,720			32,850
Deer Mountain			5,639	1,499			7,138
Dog Salmon Fishpass	28,200		182				28,382
Eliza Lake				95			95
Fish Cr channel		569					569

Appendix 1. Continued .

REGION/LOCATION	Pink	Chum	Coho	Chinook	Sockeye	Other	TOTAL
Irish Cr Fishpass			6,000				6,000
Jerry Myers Sci Ed				60			60
Ketchikan Cr Fishpass	76,600						76,600
Klawock			38,818		4,800	405	44,023
Marten R Fishpass				181			181
Slippery Cr Fishway			700				700
St John's Fishway			37				37
Snettisham		15,000	15,001	5,450			35,451
Sunny Cr Steeppass	95,761						95,761
Tahini R project				50			50
Tunga L Fishpass			5,659				5,659
Ward Cr Fishpass			6,247				6,247
	200,561	15,569	85,752	34,055	233,246	405	569,588
STATEWIDE TOTALS	1,287,756	377,869	196,164	51,175	4,227,946	176,450	6,317,360

APPENDIX 2

1990 Releases

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Appendix 2. 1990 releases from FRED hatcheries

REGION/LOCATION	Pink	Chum	Coho	Chinook	Sockeye	Other
ARCTIC/YUKON/KUSKOKWIM						
Clear						1,322,121
Sikusuilaq		6,364,003				
	0	6,364,003	0	0	0	1,322,121
COOK INLET						
Big Lake			2,584,101		10,815,319	
Crooked Cr			475,790		15,513,500	106,959
Elmendorf			632,232	1,306,510		
Ft Richardson			696,327	946,804		2,669,063
Tutka Bay	30,300,803	1,508,557			355,347	
	30,300,803	1,508,557	4,388,450	2,253,314	26,684,166	2,776,022
KODIAK & AK PENINSULA						
Kitoi Bay	84,907,550	1,502,501	173,533		1,286,396	
Russell Cr	8,300,000	13,702,036	35,000			
	93,207,550	15,204,537	208,533	0	1,286,396	0
PRINCE WILLIAM SOUND						
Gulkana I					25,155,021	
Gulkana II					828,613	
Main Bay					2,741,498	
	0	0	0	0	28,725,132	0
SOUTHEAST						
Beaver Falls					4,355,147	
Crystal Lake			642,824	1,417,211		12,581
Deer Mountain			136,181	151,629		18,225
Klawock			1,374,951		474,089	15,994
Snettisham CIF					3,723,177	
Snettisham		2,644,263	477,338	1,614,829		5,998
	0	2,644,263	2,631,294	3,183,669	8,552,413	52,798
STATEWIDE TOTALS	123,508,353	25,721,360	7,228,277	5,436,983	65,248,107	4,150,941

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APPENDIX 3

1990 Egg Takes

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Appendix 3. 1990 eggtakes from FRED hatcheries

REGION/LOCATION	Pink	Chum	Coho	Chinook	Sockeye	Other
ARCTIC/YUKON/KUSKOKWIM						
Clear						4,707,000
Sikusuilaq		9,193,000				
	0	9,193,000	0	0	0	4,707,000
COOK INLET						
Big Lake			996,000		15,200,000	
Broodstock Dev Center						4,400,000
Crooked Cr				1,600,000	14,810,000	111,000
Elmendorf			845,000	1,561,000		
Ft Richardson				596,000		
Tutka Bay	44,900,000					
	44,900,000	0	1,841,000	3,757,000	30,010,000	4,511,000
KODIAK & AK PENINSULA						
Kitoi Bay	151,000,000	18,713,000	1,083,000		2,140,000	
Pillar Creek					5,100,000	
Russell Cr	5,000,000	6,000,000	260,000			
	156,000,000	24,713,000	1,343,000	0	7,240,000	0
PRINCE WILLIAM SOUND						
Gulkana I					30,101,000	
Gulkana II				47,000	1,312,000	
Main Bay					5,791,000	
	0	0	0	47,000	37,204,000	0
SOUTHEAST						
Beaver Falls					1,473,000	
Crystal Lake			403,000	1,714,000		
Deer Mountain			244,000	453,000		25,000
Klawock			1,366,000		652,000	111,000
Snettisham CIF					11,453,000	
Snettisham		2,712,000	210,000	2,227,000		
	0	2,712,000	2,223,000	4,394,000	13,578,000	136,000
STATEWIDE TOTALS	200,900,000	36,618,000	5,407,000	8,198,000	88,032,000	9,354,000

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APPENDIX 4

Stocking Location by Species for Fish Released in 1990

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Appendix 4. Salmonids stocked by FRED Division in 1990

Includes releases as of 1 December 1990

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
HARDING L	AYK	ARCTIC CHAR	CLEAR H	FINGERLING	ALEK/DOMESTIC	50,000	5.855
HARDING L	AYK	ARCTIC CHAR	CLEAR H	SUBCATCH	ALEK/DOMESTIC	35,773	35.550
HARDING L	AYK	ARCTIC CHAR	CLEAR H	BROODSTOCK	ALEKNAGIK L	1,312	653.500
HARDING L	AYK	ARCTIC CHAR	CLEAR H	SUBCATCH	ALEKNAGIK L	18,561	53.350
RED DOG MINE	AYK	ARCTIC CHAR	CLEAR H	FINGERLING	ALEKNAGIK L	1,982	1.920
BENKA L	NCI	ARCTIC CHAR	CLEAR H	FINGERLING	ALEK/DOMESTIC	12,300	6.630
IRENE L	NCI	ARCTIC CHAR	CLEAR H	FINGERLING	ALEK/DOMESTIC	3,600	6.630
MARION L	NCI	ARCTIC CHAR	CLEAR H	FINGERLING	ALEK/DOMESTIC	11,300	6.630
CAMPBELL PT L	NCI	ARCTIC CHAR	CLEAR H	SUBCATCH	ALEKNAGIK L	1,000	110.100
CLUNIE L	NCI	ARCTIC CHAR	CLEAR H	SUBCATCH	ALEKNAGIK L	500	110.100
GWEN L	NCI	ARCTIC CHAR	CLEAR H	SUBCATCH	ALEKNAGIK L	500	110.100
MIRROR L	NCI	ARCTIC CHAR	CLEAR H	SUBCATCH	ALEKNAGIK L	500	110.100
THOMPSON L	NCI	ARCTIC CHAR	CLEAR H	SUBCATCH	ALEKNAGIK L	500	110.100
CROOKED CR	CCI	CHINOOK	ELMENDORF H	SMOLT	CROOKED CR	234,001	14.912
LOWELL CR	CCI	CHINOOK	ELMENDORF H	SMOLT	CROOKED CR	216,220	15.300
SEWARD LAGOON	CCI	CHINOOK	ELMENDORF H	SMOLT	CROOKED CR	112,831	13.920
CRYSTAL CR	CSE	CHINOOK	CRYSTAL LAKE H	SMOLT	CRYSTAL CR	542,258	9.500
EARL WEST COVE	CSE	CHINOOK	CRYSTAL LAKE H	SMOLT	CRYSTAL CR	501,252	8.540
OHMER CR	CSE	CHINOOK	CRYSTAL LAKE H	SMOLT	CRYSTAL CR	342,493	9.400
HARDING R	CSE	CHINOOK	CRYSTAL LAKE H	FED FRY	HARDING R	31,208	0.980
LAKE ISLAND L	KOD	CHINOOK	ELMENDORF H	SMOLT	CROOKED CR	110,400	12.100
HALIBUT COVE LG	LCI	CHINOOK	ELMENDORF H	SMOLT	CROOKED CR	112,458	14.190
HOMER SPIT	LCI	CHINOOK	ELMENDORF H	SMOLT	CROOKED CR	210,087	14.875
SELDOVIA HARBOR	LCI	CHINOOK	ELMENDORF H	SMOLT	CROOKED CR	98,525	15.000
NINILCHIK R	LCI	CHINOOK	FT RICHARDSON H	SMOLT	NINILCHIK R	215,804	12.800
EAGLE R	NCI	CHINOOK	ELMENDORF H	SMOLT	SHIP CR	109,465	14.530
SHIP CR	NCI	CHINOOK	ELMENDORF H	SMOLT	SHIP CR	102,523	14.380
BEACH L	NCI	CHINOOK	FT RICHARDSON H	SMOLT	WILLOW CR	3,104	98.000
CAMPBELL PT L	NCI	CHINOOK	FT RICHARDSON H	SMOLT	WILLOW CR	1,587	98.000
CHENEY L	NCI	CHINOOK	FT RICHARDSON H	SMOLT	WILLOW CR	3,030	98.000
CLUNIE L	NCI	CHINOOK	FT RICHARDSON H	SMOLT	WILLOW CR	4,096	98.000
DECEPTION CR	NCI	CHINOOK	FT RICHARDSON H	SMOLT	WILLOW CR	654,477	13.963
DELONG L	NCI	CHINOOK	FT RICHARDSON H	SMOLT	WILLOW CR	5,051	98.000
JEWEL L	NCI	CHINOOK	FT RICHARDSON H	FINGERLING	WILLOW CR	30,600	4.400
JEWEL L	NCI	CHINOOK	FT RICHARDSON H	SMOLT	WILLOW CR	7,530	98.000
MIRROR L	NCI	CHINOOK	FT RICHARDSON H	SMOLT	WILLOW CR	6,880	98.000
OTTER L (FT R)	NCI	CHINOOK	FT RICHARDSON H	SMOLT	WILLOW CR	5,014	98.000
SAND L	NCI	CHINOOK	FT RICHARDSON H	SMOLT	WILLOW CR	9,973	98.000
AUKE BAY	NSE	CHINOOK	SNETTISHAM H	SMOLT	CRYSTAL CR	175,341	18.100

Appendix 4. Salmonids stocked by FRED Division in 1990

Includes releases as of 1 December 1990

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
FISH CR (JNO)	NSE	CHINOOK	SNETTISHAM H	SMOLT	CRYSTAL CR	149,472	15.800
GASTINEAU H	NSE	CHINOOK	SNETTISHAM H	SMOLT	CRYSTAL CR	101,462	17.500
SHEEP CR	NSE	CHINOOK	SNETTISHAM H	SMOLT	CRYSTAL CR	101,847	21.500
SNETTISHAM INLT	NSE	CHINOOK	SNETTISHAM H	SMOLT	CRYSTAL CR	718,674	12.593
SNETTISHAM INLT	NSE	CHINOOK	SNETTISHAM H	SMOLT	KING SALMON R	19,724	12.600
SNETTISHAM INLT	NSE	CHINOOK	SNETTISHAM H	SMOLT	SNETTISHAM INLT	337,368	13.600
TWIN L	NSE	CHINOOK	SNETTISHAM H	SMOLT	SNETTISHAM INLT	10,941	54.000
KETCHIKAN CR	SSE	CHINOOK	DEER MOUNTAIN H	SMOLT	LPW (UNUK R)	85,553	22.400
THOMAS BASIN	SSE	CHINOOK	DEER MOUNTAIN H	SMOLT	LPW (UNUK R)	30,625	25.970
THORNE BAY	SSE	CHINOOK	DEER MOUNTAIN H	SMOLT	LPW (UNUK R)	35,451	21.800
RUSSELL CR	AKP	CHUM	RUSSELL CR H	FED FRY	RUSSELL CR	13,702,036	0.330
NOATAK R	AYK	CHUM	SIKUSUILAQ H	FINGERLING	NOATAK R	6,364,003	0.940
BIG KITOI CR	KOD	CHUM	KITOI H	FINGERLING	BIG KITOI CR	1,502,501	2.440
TUTKA CR	LCI	CHUM	TUTKA BAY H	FED FRY	TUTKA CR	1,508,557	0.299
LIMESTONE CR	NSE	CHUM	SNETTISHAM H	FED FRY	SNETTISHAM INLT	2,547,251	1.960
PORT SNETTISHAM	NSE	CHUM	SNETTISHAM H	FED FRY	SNETTISHAM INLT	50,086	1.000
SPEEL ARM	NSE	CHUM	SNETTISHAM H	FED FRY	SNETTISHAM INLT	46,926	1.000
RUSSELL CR	AKP	COHO	RUSSELL CR H	FED FRY	MORTENSON CR	35,000	0.500
28 MILE PIT	AYK	COHO	BIG LAKE H	FINGERLING	BIG L (BIG L)	500	2.700
BIRCH L	AYK	COHO	BIG LAKE H	FINGERLING	BIG L (BIG L)	131,000	2.700
JAN L	AYK	COHO	BIG LAKE H	FINGERLING	BIG L (BIG L)	8,800	2.700
L HARDING L	AYK	COHO	BIG LAKE H	FINGERLING	BIG L (BIG L)	3,600	2.700
QUARTZ L	AYK	COHO	BIG LAKE H	FINGERLING	BIG L (BIG L)	150,000	2.700
SOUTH JAN L	AYK	COHO	BIG LAKE H	FINGERLING	BIG L (BIG L)	21,000	2.350
LOWELL CR	CCI	COHO	ELMENDORF H	SMOLT	BEAR L	63,733	21.800
SEWARD LAGOON	CCI	COHO	ELMENDORF H	SMOLT	BEAR L	145,619	21.300
ARC L	CCI	COHO	CROOKED CR H	FINGERLING	CROOKED CR	5,000	2.000
CROOKED CR	CCI	COHO	CROOKED CR H	SMOLT	CROOKED CR	71,790	21.000
ENGINEER L-STER	CCI	COHO	CROOKED CR H	FINGERLING	CROOKED CR	46,000	2.000
PORTAGE L	CCI	COHO	CROOKED CR H	FINGERLING	CROOKED CR	5,000	2.000
ROGUE L	CCI	COHO	CROOKED CR H	FINGERLING	CROOKED CR	2,000	2.000
SCOUT L	CCI	COHO	CROOKED CR H	FINGERLING	CROOKED CR	19,000	2.000
UNION L	CCI	COHO	CROOKED CR H	FINGERLING	CROOKED CR	17,000	2.000
CROOKED CR	CCI	COHO	BIG LAKE H	FINGERLING	L SUSITNA R	78,000	1.040
CRYSTAL CR	CSE	COHO	CRYSTAL LAKE H	EMERGENT F	CRYSTAL CR	365,203	0.273

Appendix 4. Salmonids stocked by FRED Division in 1990

Includes releases as of 1 December 1990

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
CRYSTAL CR	CSE	COHO	CRYSTAL LAKE H	SMOLT	CRYSTAL CR	96,277	12.780
SLIPPERY CR	CSE	COHO	CRYSTAL LAKE H	FED FRY	SLIPPERY CR	144,613	0.680
ST JOHN'S CR	CSE	COHO	CRYSTAL LAKE H	FED FRY	ST JOHN'S CR	36,731	0.980
DARK L	KOD	COHO	KITOI H	FINGERLING	L KITOI L	7,500	1.750
ISLAND L (KOD)	KOD	COHO	KITOI H	FINGERLING	L KITOI L	8,500	1.750
KITOI BAY	KOD	COHO	KITOI H	SMOLT	L KITOI L	137,493	22.650
MAYFLOWER L	KOD	COHO	KITOI H	FINGERLING	L KITOI L	2,540	1.750
MISSION L	KOD	COHO	KITOI H	FINGERLING	L KITOI L	10,000	1.750
ORBIN L	KOD	COHO	KITOI H	FINGERLING	L KITOI L	7,500	1.750
HOMER SPIT	LCI	COHO	ELMENDORF H	SMOLT	BEAR L	122,945	24.203
CARIBOU L (HOM)	LCI	COHO	CROOKED CR H	FINGERLING	CROOKED CR	180,000	2.000
SELDOVIA L	LCI	COHO	CROOKED CR H	FINGERLING	CROOKED CR	50,000	2.000
BENKA L	NCI	COHO	ELMENDORF H	FINGERLING	BEAR L	33,073	2.960
CHRISTENSEN L	NCI	COHO	ELMENDORF H	FINGERLING	BEAR L	35,750	3.050
ECHO L	NCI	COHO	ELMENDORF H	FINGERLING	BEAR L	4,600	3.000
FINGER L	NCI	COHO	ELMENDORF H	FINGERLING	BEAR L	72,156	3.000
KNIK L	NCI	COHO	ELMENDORF H	FINGERLING	BEAR L	5,850	3.000
LOON L	NCI	COHO	ELMENDORF H	FINGERLING	BEAR L	21,450	3.000
MATANUSKA L	NCI	COHO	ELMENDORF H	FINGERLING	BEAR L	12,350	3.000
MEMORY L	NCI	COHO	ELMENDORF H	FINGERLING	BEAR L	17,550	3.000
ROCKY L	NCI	COHO	ELMENDORF H	FINGERLING	BEAR L	11,700	3.000
VICTOR L	NCI	COHO	ELMENDORF H	FINGERLING	BEAR L	6,700	3.000
WOLF L	NCI	COHO	ELMENDORF H	FINGERLING	BEAR L	13,650	3.000
BIG L (BIG L)	NCI	COHO	BIG LAKE H	SMOLT	BIG L (BIG L)	21,671	18.950
BLODGETT L	NCI	COHO	BIG LAKE H	FINGERLING	BIG L (BIG L)	46,000	1.060
COTTONWOOD CR	NCI	COHO	BIG LAKE H	FINGERLING	BIG L (BIG L)	202,000	1.060
FISH CR	NCI	COHO	BIG LAKE H	FINGERLING	BIG L (BIG L)	69,000	1.060
JIM CR	NCI	COHO	BIG LAKE H	FINGERLING	BIG L (BIG L)	163,000	1.060
MEADOW CR	NCI	COHO	BIG LAKE H	FINGERLING	BIG L (BIG L)	364,077	1.260
ROCKY L	NCI	COHO	BIG LAKE H	CATCHABLE	BIG L (BIG L)	426	95.000
TWIN LAKES	NCI	COHO	BIG LAKE H	FINGERLING	BIG L (BIG L)	25,000	1.060
WASILLA CR	NCI	COHO	BIG LAKE H	FINGERLING	BIG L (BIG L)	152,000	1.060
CASWELL CR	NCI	COHO	FT RICHARDSON H	SMOLT	CASWELL CR	143,102	22.400
INGRAM CR	NCI	COHO	CROOKED CR H	FINGERLING	CROOKED CR	80,000	2.000
BUTTERFLY L	NCI	COHO	BIG LAKE H	FINGERLING	L SUSITNA R	90,000	1.130
DELYNDIA L	NCI	COHO	BIG LAKE H	FINGERLING	L SUSITNA R	89,000	1.130
HOCK L	NCI	COHO	BIG LAKE H	FINGERLING	L SUSITNA R	40,000	1.130
HORSESHOE L	NCI	COHO	BIG LAKE H	FINGERLING	L SUSITNA R	344,000	1.040
JEWEL L	NCI	COHO	FT RICHARDSON H	FED FRY	L SUSITNA R	102,000	0.300
L SUSITNA R	NCI	COHO	FT RICHARDSON H	SMOLT	L SUSITNA R	106,242	22.300
MY LAKE	NCI	COHO	BIG LAKE H	FINGERLING	L SUSITNA R	23,000	1.130
NANCY L	NCI	COHO	BIG LAKE H	FINGERLING	L SUSITNA R	473,327	1.597
NANCY L	NCI	COHO	FT RICHARDSON H	SMOLT	L SUSITNA R	202,197	20.800
YOHN L	NCI	COHO	BIG LAKE H	FINGERLING	L SUSITNA R	26,000	1.130

Appendix 4. Salmonids stocked by FRED Division in 1990

Includes releases as of 1 December 1990

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
SHIP CR	NCI	COHO	ELMENDORF H	SMOLT	SHIP CR	64,006	24.100
FISH CR (JNO)	NSE	COHO	SNETTISHAM H	SMOLT	PAVLOF CR	27,280	29.000
DREDGE L	NSE	COHO	SNETTISHAM H	SMOLT	SNETTISHAM INLT	25,843	36.700
FISH CR (JNO)	NSE	COHO	SNETTISHAM H	SMOLT	SNETTISHAM INLT	20,366	25.000
INDIAN L	NSE	COHO	SNETTISHAM H	EMERGENT F	SNETTISHAM INLT	201,685	0.820
INDIAN L	NSE	COHO	SNETTISHAM H	FED FRY	SNETTISHAM INLT	202,164	0.770
JUNCTION L	PWS	COHO	ELMENDORF H	FINGERLING	BEAR L	1,100	3.000
PEANUT L	PWS	COHO	BIG LAKE H	FINGERLING	BIG L (BIG L)	3,700	4.300
STRELNA L	PWS	COHO	BIG LAKE H	FINGERLING	BIG L (BIG L)	59,000	2.230
FLEMING SPIT	PWS	COHO	FT RICHARDSON H	SMOLT	FLEMING SPIT	54,815	20.900
WHITTIER HARBOR	PWS	COHO	FT RICHARDSON H	SMOLT	FLEMING SPIT	87,971	20.900
CABLE CR	SSE	COHO	KLAWOCK H	SMOLT	CABLE CR	69,689	6.700
KLAWOCK L	SSE	COHO	KLAWOCK H	SMOLT	KLAWOCK L	1,280,000	6.700
BOLD ISLAND L	SSE	COHO	DEER MOUNTAIN H	SMOLT	REFLECTION L	39,269	23.700
KETCHIKAN CR	SSE	COHO	DEER MOUNTAIN H	SMOLT	REFLECTION L	42,988	25.585
WARD L	SSE	COHO	DEER MOUNTAIN H	SMOLT	REFLECTION L	53,924	14.898
RIO ROBERTS CR.	SSE	COHO	KLAWOCK H	FINGERLING	RIO ROBERTS CR.	25,262	8.500
180 PARKS HWY	AYK	GRAYLING	CLEAR H	FINGERLING	MOOSE L	1,000	5.310
31 MILE PIT	AYK	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	10,000	0.017
81 MILE PIT	AYK	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	5,000	0.017
BOLIO L	AYK	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	20,000	0.017
GRAYLING L	AYK	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	10,000	0.017
HARDING L	AYK	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	108,400	0.017
HARDING L	AYK	GRAYLING	CLEAR H	FED FRY	MOOSE L	30,000	0.246
HARDING L	AYK	GRAYLING	CLEAR H	FINGERLING	MOOSE L	30,000	1.780
JOHNSON PIT #2	AYK	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	10,000	0.017
LONG POND	AYK	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	10,000	0.017
LOWER TWIN L	AYK	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	90,000	0.017
OTTO L	AYK	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	30,000	0.017
ROUND POND	AYK	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	10,000	0.017
SANSING L	AYK	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	40,000	0.017
SANSING L	AYK	GRAYLING	CLEAR H	FINGERLING	MOOSE L	200	5.600
AUREL L	KOD	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	20,000	0.017
CASCADE L	KOD	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	10,000	0.017
CICELY L	KOD	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	10,000	0.017
HEITMAN L	KOD	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	30,000	0.017
17 MILE L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L	10,000	5.600
BEACH L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L	4,000	5.310
BRUCE L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L	2,700	5.130
CANOE L	NCI	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	21,200	0.017

Appendix 4. Salmonids stocked by FRED Division in 1990

Includes releases as of 1 December 1990

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
CANOE L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L	4,200	5.130
FARMER L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L	2,100	5.130
FINGER L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L	36,800	5.130
KEPLER-BRADLY L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L	11,200	5.130
KNIK L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L	5,000	5.130
LONG L	NCI	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	64,000	0.017
LONG L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L	10,600	5.600
LOWER FIRE L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L	7,000	5.310
MATANUSKA L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L	6,100	5.130
MEIRS L	NCI	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	56,700	0.017
MEIRS L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L	3,400	5.130
WALDEN L (FT R)	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L	4,000	5.310
WILLOW L	NCI	GRAYLING	CLEAR H	FINGERLING	MOOSE L	31,500	4.510
BEAVER L(SITKA)	NSE	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	15,000	0.017
SWAN L (SITKA)	NSE	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	15,000	0.017
28.5 MI L	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	10,000	0.017
ALAGANIK SL L	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	10,000	0.017
ARIZONA L	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	10,000	0.017
BEAR CUB L	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	10,000	0.017
CARIBOU L (PWS)	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	8,000	0.017
CONNER L	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	15,000	0.017
DICK L	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	10,000	0.017
ELBOW L	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	5,000	0.017
FORGOTTEN L	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	10,000	0.017
JUNCTION L	PWS	GRAYLING	CLEAR H	FINGERLING	MOOSE L	6,100	5.455
L JUNCTION L	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	5,000	0.017
MOOSE CR	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	50,000	0.017
MOOSE L	PWS	GRAYLING	CLEAR H	FINGERLING	MOOSE L	23,386	5.600
PIPELINE #1	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	10,000	0.017
PIPELINE #4	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	10,000	0.017
SHERIDAN DIKE 1	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	10,000	0.017
SHERIDAN DIKE 2	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	10,000	0.017
THREE MILE L	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	8,000	0.017
TOLSONA L	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	80,000	0.017
TOLSONA L	PWS	GRAYLING	CLEAR H	FINGERLING	MOOSE L	10,000	5.600
TWO MILE L	PWS	GRAYLING	CLEAR H	EMERGENT F	MOOSE L	5,000	0.017
HARDING L	AYK	LAKE TROUT	CLEAR H	FINGERLING	PAXSON L	73,700	4.600
LONG L	NCI	LAKE TROUT	CLEAR H	FINGERLING	PAXSON L	10,000	4.600
RUSSELL CR	AKP	PINK	RUSSELL CR H	EMERGENT F	RUSSELL CR	8,300,000	0.250

Appendix 4. Salmonids stocked by FRED Division in 1990

Includes releases as of 1 December 1990

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
BIG KITOI CR	KOD	PINK	KITOI H	EMERGENT F	BIG KITOI CR	967,802	0.262
BIG KITOI CR	KOD	PINK	KITOI H	FINGERLING	BIG KITOI CR	83,939,748	0.610
HALIBUT COVE LG	LCI	PINK	TUTKA BAY H	FED FRY	TUTKA CR	6,000,000	0.670
HOMER SPIT	LCI	PINK	TUTKA BAY H	FED FRY	TUTKA CR	300,000	0.490
TUTKA BAY	LCI	PINK	TUTKA BAY H	FED FRY	TUTKA CR	23,689,702	0.520
INGRAM CR	NCI	PINK	TUTKA BAY H	FED FRY	TUTKA CR	311,101	0.250
28 MILE PIT	AYK	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	800	1.600
BATHING BEAUTY	AYK	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	700	1.600
BIRCH L	AYK	RAINBOW	FT RICHARDSON H	SMOLT	SWANSON R	48,345	22.900
CHENA L	AYK	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	31,251	102.050
GRAYLING L	AYK	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	500	1.600
HARDING L	AYK	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	2,019	105.000
HARDING L	AYK	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	453,312	1.518
HARDING L	AYK	RAINBOW	FT RICHARDSON H	SMOLT	SWANSON R	10,061	22.900
HIDDEN L	AYK	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,600	1.600
JOHNSON PIT #2	AYK	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	2,000	1.600
L HARDING L	AYK	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	1,000	1.600
LOST L	AYK	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	1,000	1.600
MANCHU L	AYK	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	2,900	1.600
PILEDRIVE SL-BB	AYK	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	20,000	111.900
QUARTZ L	AYK	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	203,546	1.800
QUARTZ L	AYK	RAINBOW	FT RICHARDSON H	SMOLT	SWANSON R	33,843	22.900
RED DOG MINE	AYK	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	453	81.400
BARBARA L	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	11,000	1.600
CABIN L	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	15,000	1.600
CARTER L	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	10,096	0.900
CHUGACH ESTATES	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	6,000	1.600
COOPER L	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	50,000	1.300
ENCELEWSKI L	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	20,000	1.600
JEROME L	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,000	1.600
JOHNSON L-KASI	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	17,000	1.600
LONGMARE L	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	34,000	1.600
RAINBOW L	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	5,000	1.600
SPORT L	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	15,000	1.600
THETIS L	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	15,000	1.600
TIRMORE L	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	12,000	1.600
VAUGHT L	CCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	9,000	0.900
ABERCROMBIE L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,700	1.300
AUREL L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,000	1.300
BIG L (KOD)	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,600	1.300
BULL L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	2,000	1.300

Appendix 4. Salmonids stocked by FRED Division in 1990

Includes releases as of 1 December 1990

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
CAROLINE L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	1,400	1.300
CASCADE L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,300	1.300
CHIGNIK L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,600	1.300
CICELY L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	1,150	1.300
DOLGOI L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	5,150	1.300
DRAGONFLY L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	1,550	1.300
EAST TWIN L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	4,000	1.300
HEITMAN L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,250	1.300
HORSESHOE L-KOD	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	1,000	1.300
JACK L-KOD	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	1,000	1.300
JUPITER L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,600	1.300
LEE L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	2,800	1.300
LILLY POND	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	1,600	1.300
LONG L (KOD)	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,600	1.300
LUPINE L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	1,600	1.300
MARGARET L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	1,600	1.300
SATURN L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	2,400	1.300
TANIGNAK L	KOD	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	6,000	1.300
BIG L (BIG L)	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	BIG L (BIG L)	449,627	1.600
BLODGETT L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	BIG L (BIG L)	5,760	0.800
CLUNIE L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	BIG L (BIG L)	51	1000.000
DELONG L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	BIG L (BIG L)	151	1000.000
JEWEL L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	BIG L (BIG L)	20	1500.000
LUCILLE L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	BIG L (BIG L)	36,348	0.800
OTTER L (FT R)	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	BIG L (BIG L)	97	1000.000
SAND L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	BIG L (BIG L)	150	1000.000
SEYMOUR L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	BIG L (BIG L)	23,082	0.800
"X" L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	22,220	1.650
17 MILE L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	10,000	1.300
BARLEY L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,720	1.700
BEACH L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	SWANSON R	152	1000.000
BEACH L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	4,420	88.000
BEAR PAW L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	2,250	1.700
BENCH L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	5,200	1.700
BIG NO LUCK	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	6,800	1.000
CAMPBELL CR	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	7,277	92.800
CAMPBELL PT L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	5,175	100.000
CARPENTER L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	35,280	1.700
CHENEY L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	SWANSON R	200	1000.000
CHENEY L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	10,123	100.000
CHESTER CR	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	5,011	88.000
CHRISTENSEN L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	17,900	1.400
CLUNIE L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	8,239	99.000
COYOTE L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	608	100.000
CRYSTAL L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	52,772	1.900
DAWN L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	9,440	1.700

Appendix 4. Salmonids stocked by FRED Division in 1990

Includes releases as of 1 December 1990

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
DELONG L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	SWANSON R	201	1000.000
DELONG L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	10,085	106.400
DERBY POND	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	535	92.000
DIAMOND L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	55,600	1.900
E TWIN L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	4,110	1.000
ECHO L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	1,946	97.100
EKLUTNA L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	50,016	1.300
FINGER L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	23,890	1.800
FLORENCE L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	5,460	1.400
GOLF COURSE L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	57	111.000
GREEN L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	2,006	96.600
GWEN L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	4,776	94.000
HILLBERG L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	1,500	100.000
HONEYBEE L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	46,395	2.000
IDA L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	4,640	1.300
IRENE L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	2,216	100.000
JEWEL L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	SWANSON R	210	1050.000
JEWEL L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	14,067	102.967
JOHNSON L-PALM	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	9,874	101.000
KALMBACK L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	19,000	1.900
KASHWITNA L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	5,200	1.400
KEPLER-BRADLY L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	14,627	96.350
KNIK L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	3,986	97.100
L LONELY L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	44,820	2.000
LAKE OTIS	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	1,500	111.000
LITTLE NO LUCK	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,410	1.000
LOBERG L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	1,056	97.100
LONG L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	29,776	1.700
LOON L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	10,800	1.100
LORRAINE L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	6,620	1.700
LOWER BONNIE L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	12,010	1.800
LOWER FIRE L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	SWANSON R	206	1000.000
LOWER FIRE L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	5,014	94.200
LYNNE L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	7,000	2.000
MARION L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	11,300	1.100
MATANUSKA L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	14,356	96.350
MEMORY L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	8,300	1.100
MIRROR L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	SWANSON R	201	1000.000
MIRROR L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	10,072	89.800
MORVO L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	17,320	1.600
N FRIEND L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	8,140	1.400
OTTER L (FT R)	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	11,053	98.467
PORTAGE VALLY L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	5,215	88.000
PRATOR L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	4,900	1.700
RABBIT L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	1,010	110.000
RAVINE L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	2,500	1.300
REED L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,694	1.500

Appendix 4. Salmonids stocked by FRED Division in 1990

Includes releases as of 1 December 1990

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
ROCKY L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	5,870	1.100
S FRIEND L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	5,570	1.400
SAND L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	7,061	99.500
SIX MILE L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	1,498	96.600
SLIPPER L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	588	100.000
SOUTH ROLLY L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	12,770	1.400
SUNDI L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	1,508	111.000
TAKU CAMPBELL L	NCI	RAINBOW	FT RICHARDSON H	BROODSTOCK	SWANSON R	203	1000.000
TAKU CAMPBELL L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	4,043	102.700
THOMPSON L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	2,019	110.000
TIGGER L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	1,894	1.700
TRIANGLE L	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	1,028	100.000
TWIN ISLAND L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	15,100	1.500
VERA L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	11,050	2.000
WALBY L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	5,390	1.900
WALDEN L (FT R)	NCI	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	4,050	88.000
WEINER L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	4,140	1.300
WISHBONE L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	5,267	1.500
WOLF L	NCI	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	6,200	1.400
RUTH L (GLEN)	PWS	RAINBOW	FT RICHARDSON H	BROODSTOCK	BIG L (BIG L)	13	1000.000
TEX SMITH L	PWS	RAINBOW	FT RICHARDSON H	BROODSTOCK	BIG L (BIG L)	25	1000.000
BLUEBERRY L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	2,000	1.800
BUFFALO L	PWS	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	516	101.000
BUFFALO L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	2,417	1.200
CRATER L (CORD)	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	5,009	6.400
CRATER L (L LOU	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,200	1.700
DJ L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	400	1.700
GERGIE L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	9,000	1.700
GRANITE BAY 171	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	6,677	5.900
KETTLE L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	1,200	1.400
L CRATER L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	400	1.700
MIRROR L	PWS	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	516	101.000
MIRROR L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	9,000	1.700
NORTH JANS L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	11,600	1.700
OLD ROAD L	PWS	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	250	101.000
OLD ROAD L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	300	1.700
ROUND L	PWS	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	250	101.000
ROUND L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	400	1.700
RUTH L (GLEN)	PWS	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	715	105.500
SCULPIN L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	28,018	1.400
SQUIRREL CR L	PWS	RAINBOW	FT RICHARDSON H	CATCHABLE	SWANSON R	478	101.000
SQUIRREL CR L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	1,000	1.800
TEX SMITH L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	3,400	1.700
TOLSONA L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	81,140	1.500
TWO MILE L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	4,821	1.400
VAN L	PWS	RAINBOW	FT RICHARDSON H	FINGERLING	SWANSON R	80,000	1.400

Appendix 4. Salmonids stocked by FRED Division in 1990

Includes releases as of 1 December 1990

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
SANSING L	AYK	SHEEFISH	CLEAR H	BROODSTOCK	KOY-YUKON MIX	7	6100.000
		SOCKEYE		PRESMOLT		89,998	1.990
HARDING L	AYK	SOCKEYE	GULKANA I H	EMERGENT F	GULKANA E FORK	505,305	0.160
TUSTUMENA L	CCI	SOCKEYE	CROOKED CR H	FINGERLING	GLACIER FLATS	6,013,500	0.240
KITOI BAY	KOD	SOCKEYE	KITOI H	FED FRY	U STATION L	458,118	0.480
L KITOI L	KOD	SOCKEYE	KITOI H	EMERGENT F	U STATION L	337,932	0.180
L KITOI L	KOD	SOCKEYE	KITOI H	FED FRY	U STATION L	241,000	0.500
SPIRIDON L	KOD	SOCKEYE	KITOI H	FED FRY	U STATION L	249,346	0.200
ENGLISH BAY	LCI	SOCKEYE	TUTKA BAY H	FED FRY	ENGLISH BAY	355,347	0.266
BRUIN L	LCI	SOCKEYE	CROOKED CR H	FINGERLING	GLACIER FLATS	500,000	0.210
CHENIK L	LCI	SOCKEYE	CROOKED CR H	FINGERLING	GLACIER FLATS	3,250,000	0.210
ELUSIVAK L	LCI	SOCKEYE	CROOKED CR H	FINGERLING	GLACIER FLATS	500,000	0.210
HAZEL L	LCI	SOCKEYE	CROOKED CR H	FINGERLING	GLACIER FLATS	1,500,000	0.210
KERSHNER L	LCI	SOCKEYE	CROOKED CR H	FINGERLING	GLACIER FLATS	250,000	0.210
L PAINT L	LCI	SOCKEYE	CROOKED CR H	FINGERLING	GLACIER FLATS	500,000	0.210
LEISURE L	LCI	SOCKEYE	CROOKED CR H	FINGERLING	GLACIER FLATS	2,000,000	0.230
U PAINT L	LCI	SOCKEYE	CROOKED CR H	FINGERLING	GLACIER FLATS	1,000,000	0.210
MEADOW CR	NCI	SOCKEYE	BIG LAKE H	EMERGENT F	MEADOW CR	774,000	0.157
MEADOW CR	NCI	SOCKEYE	BIG LAKE H	FED FRY	MEADOW CR	10,041,319	0.206
CRESCENT L	NSE	SOCKEYE	SNETTISHAM CIF	EMERGENT F	CRESCENT L	215,576	0.230
SPEEL L	NSE	SOCKEYE	SNETTISHAM CIF	EMERGENT F	SPEEL L	2,465,844	0.200
TAHLTAN L	NSE	SOCKEYE	SNETTISHAM CIF	EMERGENT F	TAHLTAN L	1,041,757	0.128
MAIN BAY	PWS	SOCKEYE	MAIN BAY H	SMOLT	COGHILL L	2,600,306	15.398
ESTHER PASS L	PWS	SOCKEYE	MAIN BAY H	PRESMOLT	ESHAMY L	25,000	1.990
PASS L	PWS	SOCKEYE	MAIN BAY H	PRESMOLT	ESHAMY L	100,000	1.990
CROSSWIND L	PWS	SOCKEYE	GULKANA I H	EMERGENT F	GULKANA E FORK	4,906,005	0.160
PAXSON L	PWS	SOCKEYE	GULKANA II H	EMERGENT F	GULKANA E FORK	14,127,313	0.160
SUMMIT L (PAX)	PWS	SOCKEYE	GULKANA I H	EMERGENT F	GULKANA E FORK	6,445,011	0.160
BADGER L	SSE	SOCKEYE	BEAVER FALLS H	FED FRY	HUGH SMITH L	695,647	0.180
HUGH SMITH L	SSE	SOCKEYE	BEAVER FALLS H	FED FRY	HUGH SMITH L	1,480,800	0.180
KLAWOCK L	SSE	SOCKEYE	KLAWOCK H	SMOLT	KLAWOCK L	104,039	2.250
KLAWOCK R	SSE	SOCKEYE	KLAWOCK H	FED FRY	KLAWOCK L	99,652	0.180
MARGARET L	SSE	SOCKEYE	BEAVER FALLS H	FED FRY	MCDONALD LAKE	300,207	0.180
MCDONALD LAKE	SSE	SOCKEYE	BEAVER FALLS H	FED FRY	MCDONALD LAKE	989,700	0.180
VIRGINIA LAKE	SSE	SOCKEYE	BEAVER FALLS H	FED FRY	MCDONALD LAKE	888,798	0.180

Appendix 4. Salmonids stocked by FRED Division in 1990

Includes releases as of 1 December 1990

Stocking location	Area	Species	Hatchery	Lifestage	Broodstock	Number stocked	Average weight (gm)
CROOKED CR	CCI	STEELHEAD	CROOKED CR H	SMOLT	CROOKED CR	106,959	85.000
CRYSTAL CR	CSE	STEELHEAD	CRYSTAL LAKE H	SMOLT	CRYSTAL CR	9,981	20.910
OHMER CR	CSE	STEELHEAD	CRYSTAL LAKE H	SMOLT	CRYSTAL CR	2,600	20.910
MONTANA CR	NSE	STEELHEAD	SNETTISHAM H	SMOLT	PETERSON L	5,998	25.000
KETCHIKAN CR	SSE	STEELHEAD	DEER MOUNTAIN H	FINGERLING	KETCHIKAN CR	13,749	6.000
THOMAS BASIN	SSE	STEELHEAD	DEER MOUNTAIN H	SMOLT	KETCHIKAN CR	4,525	47.500
KLAWOCK L	SSE	STEELHEAD	KLAWOCK H	SMOLT	KLAWOCK R	15,824	44.900
KLAWOCK R	SSE	STEELHEAD	KLAWOCK H	SMOLT	KLAWOCK R	170	97.100