

# **FRED Reports**

A REVIEW OF ALASKA'S  
FISHERIES REHABILITATION, ENHANCEMENT  
AND DEVELOPMENT (FRED) PROGRAM

1971 - 1982

by

S. A. Moberly

Number 3



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

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Division of Fisheries Rehabilitation,  
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## INTRODUCTION

During the 1982 legislative session, considerable discussion took place concerning the source and stability of funding for the Fisheries Rehabilitation, Enhancement and Development program. Governor Hammond appointed a Hatchery Funding Steering Committee to investigate this matter and to provide recommendations. The 1982 Legislature requested that the Executive Branch re-evaluate the relationship between the State's aquaculture program and private nonprofit (PNP) hatcheries and that an overall State policy be presented to the 1983 Legislature. Governor Hammond elected to provide the requested policy through the Hatchery Funding Steering Committee. This Paper, prepared by the Department of Fish and Game, is intended to provide a perspective of the entire program; the operational funding for hatcheries and their relationship with private nonprofit hatcheries are only one part of that perspective.

Originally, the purpose of this paper was to aid the Hatchery Funding Steering Committee. However, in accordance with the change of administration, this paper will be submitted to Governor Sheffield's newly appointed Task Force for Fisheries.

Rehabilitation and enhancement technologies are powerful tools in the hands of the Fisheries Resource Manager. The rehabilitation and enhancement of salmon stocks generally follow three strategies: (1) natural stock manipulation (harvest regulation), (2) aquaculture techniques, and (3) habitat alteration. The harvest management of the salmon resource is but one aspect of the "industry." The fishermen, processors, wholesalers, distributors, retailers, and all the other parts of the infrastructure make up the "fishing industry." This industry has a huge economic worth to the State. In return, the State funds a wide variety of activities to assist and stimulate this industry. The rehabilitation and enhancement program is one of the activities that the State has funded to assist in the stabilization of the fishing industry and to encourage its growth.

A rehabilitation and enhancement program requires a long-term commitment to capital and operational funding as well as to the understanding of the complexity of the program. Hatcheries and other rehabilitation and enhancement projects cannot be turned off and on from one year to the next, as they may require several years to reach their full potential.

## HISTORICAL PERSPECTIVE

The salmon industry in Alaska began in 1878 with a harvest of 56,000 fish. As the industry expanded and the canneries became more efficient, the harvest increased throughout the early part of the 1900's, reaching a peak of 126.4 million salmon in 1936. After 1941, the harvest declined steadily and reached a low in 1967 of less than 21 million salmon. The lowest four consecutive salmon harvests since the turn of the century occurred during 1972-1975. It was during this time of low harvests that the Legislature responded to the crisis by establishing the Division of Fisheries Rehabilitation, Enhancement, and Development (FRED)(1971); the Commercial Fisheries Limited Entry Commission (CFEC)(1972); and the Private Nonprofit (PNP) Hatchery Program (1974). The FRED Division was designed to rehabilitate and enhance depressed stocks and to help reduce the economic impact in years of low natural stocks. The PNP program was to join in this effort, and the CFEC was to control the fishing effort.

Adequate escapement for the respective brood years in conjunction with "better than average" marine survival have produced harvests averaging 110 million salmon during the past three years (1980, 1981, 1982). However, runs for some species are below desired levels in many areas. Rehabilitation and enhancement projects, initiated in the middle and late 1970's, are now beginning to contribute significant numbers of salmon to the harvest.

The annual production capability of all existing hatcheries in Alaska, when full capacity is reached, will be 14 million adult salmon for harvest. Table 1 lists the hatchery facilities by region for the State program and Table 2 lists them for the PNP program.

## PROGRAM DEVELOPMENT

The low harvest of the late 1960's and early 1970's prompted the establishment of the rehabilitation and enhancement program. Generally, rehabilitation activities are directed at restoring the salmon stocks to former levels, whereas enhancement activities and techniques are used to provide additional salmon. First priority is given to the protection and perpetuation of natural stocks. A balanced fisheries program includes the interrelated elements of stock allocation, stock rehabilitation, stock enhancement, habitat protection improvement, and research. From this background, the Division of Fisheries Rehabilitation, Enhancement and Development (FRED) has developed and expanded its program since its inception. Duties of the Division are given in the Alaska Statutes Title 16:

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

Table 1. Eggs taken in 1982 for FRED hatcheries.

	Eggs Taken In Thousands						ALL SPECIES
	<u>PINK</u>	<u>CHUM</u>	<u>COHO</u>	<u>CHINOOK</u>	<u>SOCKEYE</u>	<u>OTHER</u>	
<u>SOUTHEAST</u>							
Beaver Falls		7,125.6					7,125.6
Crystal Lake		76.2	2310.0	997.6		13.3	3,397.1
Deer Mountain			88.8	332.9		19.2	440.9
Hidden Falls		23,224.9		78.6			23,303.5
Klawock		13,802.7	1,200.0			33.3	15,036.0
Snettisham		<u>10,802.8</u>	<u>473.6</u>	<u>405.1</u>			<u>11,681.5</u>
Subtotals:	0	55,032.2	4,072.4	1,814.2	0	65.8	60,984.6
<u>PRINCE WILLIAM SOUND</u>							
Cannery Creek	23,141.8		188.3				23,330.1
Gulkana River					10,931.9		10,931.9
Main Bay		<u>9,859.3</u>					<u>9,859.3</u>
Subtotals:	23,141.8	9,859.3	188.3	0	10,931.9	0	44,121.3
<u>COOK INLET</u>							
Big Lake			3,500.1		12,909.2		16,409.3
Crooked Creek				162.8	22,627.1		22,789.9
Elmendorf			1,168.0	752.6		4,843.6	6,764.2
Ft. Richardson <sup>a/</sup>	0	0	0	0	0	0	0
Trail Lakes			1,243.3		4,644.3		5,887.6
Tutka Bay	<u>18,996.5</u>	<u>1,294.1</u>					<u>20,290.6</u>
Subtotals:	18,996.5	1,294.1	5,911.4	915.4	40,180.6	4,843.6	72,141.6
<u>KODIAK &amp; ALASKA PENINSULA</u>							
Karluk					13,633.3		13,633.3
Kitoi Bay	85,675.7	145.0	100.0	270.3			86,191.0
Russell Creek		<u>9,148.6</u>					<u>9,148.6</u>
Subtotals:	85,675.7	9,293.6	100.0	270.3	13,633.3	0	108,972.9
<u>ARTIC-YUKON-KUSKOKWIM</u>							
Clear		39.3	646.7			70.1	756.1
East Creek <sup>b/</sup>	0	0	0	0	0	0	0
Sikusuilag Springs		<u>741.7</u>					<u>741.0</u>
Subtotals:	0	781.0	646.7	0	0	70.1	1,497.8
<u>STATEWIDE</u>							
TOTALS	127,814.0	76,260.2	10,918.8	2,999.9	64,745.8	4,979.5	287,718.2

<sup>a/</sup> Closed in 1982 season for construction.

<sup>b/</sup> Closed in FY 82 because of budget shortfalls.



Table 2. 1982 private nonprofit hatchery egg takes.

	Eggs Taken In Thousands				ALL
	<u>PINK</u>	<u>CHUM</u>	<u>COHO</u>	<u>CHINOOK</u>	<u>SPECIES</u>
<u>SOUTHEAST</u>					
Burnett Inlet	4,206.0	605.0			4,811.0
Burro Creek	841.0	-----			841.0
Gunnuk Creek	1,019.0	832.0			1,851.0
Kowee Creek	3,510.0	323.0			3,833.0
Medvejie Creek	-----	2,963.0	240.0	46.5	3,249.5
Meyers Chuck	10.0	-----	-----		10.0
Port Armstrong	-----				
Sandy Bay	-----	267.0			267.0
Salmon Creek	1,046.0	3,860.0	410.0		5,316.0
Sheep Creek	15,297.0	783.0	-----		16,080.0
Sheldon Jackson	18,241.0	1,179.0	73.0		19,493.0
Whitman Lake	-----	<u>23,859.0</u>	<u>2,270.5</u>	<u>172.5</u>	<u>26,302.0</u>
Subtotal:	44,170.0	34,671.0	2,993.5	219.0	82,053.5
<u>PRINCE WILLIAM SOUND</u>					
Perry Island	104.0				104.0
Port San Juan	129,615.0 <sup>1/</sup>	10,484.0			140,099.0
Solomon Gulch	<u>8,410.0</u>	<u>1,880.0</u>	<u>115.0</u>		<u>10,405.0</u>
Subtotal:	138,129.0	12,364.0	115.0	0	150,608.0
<u>COOK INLET</u>					
Eklutna		1,291.0	102.0		1,393.0
STATEWIDE					
TOTALS	182,299.0	48,326.0	3,210.5	219.0	234,054.5

<sup>1/</sup> Includes 28.5 million eggs transferred to the Main Bay Hatchery.

"(2) encourage the investment by private enterprise in the technological development and economic utilization of the fisheries resources;

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

"(4) make a comprehensive annual report to the legislature, containing detailed information regarding its accomplishments under this section and proposals of plans and activities for the next fiscal year, not later than 20 days after the convening of each regular session."

The successful application of modern fish husbandry technology depended on a thorough knowledge of the ecosystem. The gathering of information on food webs, genetics, fish diseases, life histories, and survival criteria was a prerequisite for a successful program. Of equal importance was the development of an organizational structure that would be capable of molding together the disciplines of biology, engineering, genetics, pathology, fish culture, maintenance, limnology, planning, project management, and organizational management in a manner that permitted the maximal coordination, production, and quality control. This organizational structure is the foundation upon which the FRED Division has carried out its mandates.

In the ten-plus years since FRED Division was created, a modern and technologically advanced rehabilitation and enhancement program has been established. In addition to State projects and facilities, this program includes the PNP hatcheries, the regional aquaculture associations, as well as cooperative projects with other governmental agencies.

Significant hatchery contributions to the State's salmon fisheries are now being realized. More than 4.5 million adult hatchery salmon returned in 1981, at least 6.7 million returned in 1982, and it is estimated that 8 million hatchery produced salmon will return in 1983. When operating at capacity, the State and private hatcheries that exist now will produce about 14 million salmon annually. This is approximately 25% of the long-range goal for aquaculture.

In 1974, the Alaskan Legislature passed a statute, authorizing the Department of Fish and Game to issue hatchery permits to "qualified" PNP corporations. The consensus was that their contributions to the salmon fishery would augment the State's rehabilitation program's contributions and, moreover, would provide additional employment opportunities to Alaskans.

Since the inception of the PNP program, 20 PNP salmon hatchery permits have been issued and one permit has been rescinded (19 total). Sixteen of the permitted hatcheries are in operation, and 12 of these have already had returns of adult salmon.

The establishment and growth of these hatcheries are contributing to the State's effort to enhance salmon. The hatcheries are planned and managed to allow reasonable segregation of returning hatchery fish from natural stocks.

The PNP legislation was amended in 1976 so that a regional salmon enhancement program could be established. These amendments authorized the creation of aquaculture associations, and, to this date, seven regional associations have been organized. Moreover, the Kodiak region is currently involved in the process of organizing one more. Four of these associations are holders of PNP permits. Regional aquaculture associations are comprised of representatives of commercial fishermen, sport fishermen, subsistence fishermen, processors, and members of local communities. The associations are dominated, however, by commercial fishermen and their interests.

The 1976 Legislature also directed the Commissioner of the Department of Fish and Game "to develop and amend as necessary a comprehensive salmon plan for each region, including provisions for both public and private nonprofit hatchery systems." As they are written and approved, these regional plans will supercede the 1975 Alaska Salmon Fisheries plan which was produced independently by the Department. This Plan has established goals and objectives for salmon enhancement and rehabilitation and has suggested "example" projects.

The comprehensive plan for each region will be written by Regional Planning Teams (RPT). The teams in each region are comprised of three members from the Regional Association and three members from the Alaska Department of Fish and Game (ADF&G). The teams also review all hatchery permit applications from private nonprofit corporations and report their findings to the Commissioner.

The 1979 Legislature provided grants of \$100,000 for each RPT. These funds are administered by the Commissioner. In 1979, the grants were issued to four RPT's representing the Cook Inlet Aquaculture Association (CIAA), Northern Southeast Regional Aquaculture Association (NSRAA), Prince William Sound Aquaculture Corporation (PWSAC), and the Southern Southeast Regional Aquaculture Association (SSRAA). The Northern and Southern Southeast RPT's jointly produced a 20-year comprehensive salmon plan for Southeast Alaska, which has been approved by the Commission. The Cook Inlet RPT plan, "Cook Inlet Regional Salmon Enhancement Plan, 1981-2000," was approved in March, 1982. The plan covering Prince William Sound has not been completed.

## PROGRAM STATUS

### Rehabilitation

Rehabilitation is a strategy for rebuilding depressed natural stocks to harvestable levels. Regulatory activities are directed towards the restriction of harvests to ensure optimal allocation of total runs to harvest and escapement. Non-regulatory activities are directed at increasing the survival of debilitated broodstocks. These activities may include removal of migration blocks, stream restoration, incubation and subsequent planting of eyed eggs or juveniles, lake fertilization, and predator-competitor control.

There are freshwater areas in Alaska that had once produced salmon, but because of environmental changes or conflicting uses of the habitat few fish are now produced. Log jams in streams, road building, logging and mining activities, and excessive beaver dam construction are examples of these changes. Reclaiming this once productive habitat for salmon is commonly known as habitat restoration. Projects to remove log jams and beaver dams have allowed adult salmon to reach spawning areas that had been previously inaccessible; e.g., a log jam clearance project conducted at Humpy Creek in 1978 yielded approximately 28,000 adult pink salmon during 1981 and another 38,000 during 1982.

At certain sites, the control of salmon predators increases the survival of juveniles and, therefore, increases the adult return. For example, in 1980 and 1981, FRED impounded an estimated 30,000 to 40,000 Dolly Varden char in the Russell Creek Hatchery near Cold Bay on the Alaska Peninsula. This prevented the char from feeding on millions of chum and pink salmon fry. After the salmon fry had migrated downstream into salt water, the char were released. In the Haines area, a series of landlocked ponds were connected to the Chilkat River to provide additional rearing habitat for juvenile coho salmon, and to separate them from predator populations that occupied the main stem of the river. Alaska has strong laws that protect salmon habitat, but habitat is still lost each year to conflicting uses. Habitat restoration, alteration, and predator control are important elements of the salmon rehabilitation program.

Lake fertilization is a technique that is based on a theory which maintains that formerly productive sockeye systems are no longer productive because of the greatly diminished nutrient supplies that had formerly entered the systems via salmon carcasses. The lake fertilization technique is a process of controlled ecosystem manipulation, whereby known amounts of phosphorus and nitrogen are added to lakes by application of commercial grade fertilizers. The theory and process is identical to the fertilization of farm crops. For years, farmers have applied fertilizers to the soil to enhance the growth of their crops. The principle is the same when applying fertilizer to water to encourage the growth of microscopic plants and animals that are desirable fish feed. This addition of fertilizer increases the food supply in the lake, resulting in increased growth and survival of the juveniles in fresh water. This means that more as well as larger smolts will migrate to the ocean. Accordingly, this will increase their chances of survival in the marine environment, and more fish will return as adults.

Three lakes were fertilized during 1982. Fertilization feasibility studies were conducted on more than 15 lakes during 1981, but these studies were eliminated because of budget cuts in Fiscal Year 1983. The lake fertilization program is carried out in cooperation with regional aquaculture associations and the Forest Service in some areas of the State.

#### Enhancement

Enhancement is the strategy designed to supplement the harvest of natural freshwater and anadromous (salmon) species. Enhancement activities

employ artificial or semi-artificial production systems and often increase the amount of productive natural habitat available to fish stocks. In Alaska there are many freshwater areas that produce no salmonids or support only small populations because of environmental limitations. Such areas include lakes which are relatively close to the ocean, are not high in elevation, have vast volumes of water, but are either inaccessible to salmon or have only limited spawning and rearing area at the outlets. Salmon populations in these areas are enhanced by fish stocking. Also, high or low water stream conditions can prevent salmon from reaching prime spawning areas; fishways are an effective method for providing access to these spawning sites. The FRED Division, in cooperation with the Forest Service and other land managers, is involved in the operation and maintenance of 19 fishways as well as the planning and construction for future fishways.

During 1981, more than 800,000 adult salmon utilized fishways in Alaska. The well-known Frazer River fishway alone passed 380,000 salmon, primarily sockeyes, into Frazer River. The numbers of harvested fish resulting from "fishway enhancement" are difficult to determine because funds have not been available for detailed mark and recovery studies. Salmonids utilizing these fishways are chum, pink, chinook, coho, and sockeye salmon, and steelhead trout.

Fish hatcheries are another way to enhance salmonid populations. They offer a maximal amount of protection for the early life stages of the salmon, thereby producing more salmon than would be possible from natural production. Given the same number of eggs, a hatchery can roughly produce eight times more fry than the natural environment. This level of production is primarily accomplished by providing sufficient water quantity and quality, by controlling predators and disease, and by feeding the fry to increase their size. Finally, when the conditions are optimal, the fry are released into their natural environment, and a greater production of adults is realized.

The FRED Division operates 20 facilities that employ hatchery techniques (two of these are stream-side incubation facilities). The facilities produce chum, pink, chinook, coho, and sockeye salmon, rainbow and steelhead trout, grayling, and sheefish. During 1981, nearly 2.5 million adult salmon were produced from juveniles that were released at FRED hatcheries during previous years. FRED hatcheries addressed the recreational fishery by releasing more than 500,000 rainbow trout, 10,000 steelhead, 400,000 grayling, and 100,000 sheefish juveniles during 1981. Additionally, many salmon were harvested by anglers. In 1982, rainbow trout production increased to about 1.6 million.

The PNP Hatchery Program operates 16 hatcheries that produce chum, pink, chinook, and coho salmon. During 1981, slightly more than 2.5 million pink salmon returned to Prince William Sound Aquaculture Corporation's Port San Juan Hatchery. The remainder of the PNP hatcheries had a combined return of around 300,000 fish.

#### Economic Planning

Most public investment planning, including fisheries development investments, involve treatment of both efficiency and equity issues. Efficiency

issues are frequently thought of as those which are quantifiable in dollar terms through an accounting of national income. In social terms, it is "achieving the greatest benefit for a given cost, or conversely, a given objective at minimum cost" (Morley 1982). Equity issues, on the other hand, are concerned primarily with distribution of impacts between groups and with the "fairness" of certain allocations or investments. While the science of economics does not attempt to make judgements on issues of fairness, it does employ a number of methods which measure both the changes in efficiency and the impacts of specific resource investments and actions.

While other economic methods may be helpful in dealing with equity considerations, benefit-cost analysis deals strictly with efficiency related issues and is a widely used analytical tool, which yields useful information on public investment alternatives. In terms of fishery resource applications, the goal of benefit-cost analysis is to expend public funds in a manner that will effectively further social and economic objectives through efficient allocation of resources among competing groups or projects<sup>1/</sup>. This methodology differs from traditional forms of government budgeting in that it concentrates on the consequences of a government activity, rather than solely on the monetary resources required to implement that activity. Benefit-cost analysis is the emphasis of FRED Division's current and developing economic methods, and in 1981-1982, it resulted in the development of an in-house computer simulation model designed to evaluate public salmon and trout enhancement alternatives.

Essentially, the methodology of this form of incremental analysis is identical to the methodology of many of the more familiar applications of benefit-cost analysis, such as the Susitna-Hydro feasibility study (Yould, 1982).

#### Application of Enhancement Benefit-Cost Analysis

The principal capabilities of the present model are as follows:

- 1) Identifies the value<sup>2/</sup> of an existing program or of a proposed investment such as a capital or operational budget request.
- 2) Compares investment or operating strategies within a given hatchery or between two or more hatcheries to determine the approach which will produce the greatest net benefits over a period of time. A typical option would be to compare hatchery capacities by species and lake stocking vs. smolt release.
- 3) With input from other economic studies, it identifies the distribution of user benefits to specific sectors of the fisheries

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<sup>1/</sup> Efficient production can only be achieved through efficient allocation of resources if the analyst's objective is pareto-optimization in the presence of mutually exclusive investment alternatives.

<sup>2/</sup> Value in this manuscript refers to present value.

industry, as well as the impact on wages and employment from both direct and induced sources.

### General Structure of Models

The enhancement economic feasibility model is comprised of two separate systems of computer programs. Both systems involve input of data for 200 to 300 variables in a given simulation. The Hatchery Brood-stock Development (HBD) system projects future salmon production on the basis of plans for expansion, life-stage survival assumptions, and fishery harvest expectations. The Facility Benefit-Cost (FBC) system is the economic simulation program which uses harvest predictions from a given (HBD) simulation and combines these with economic assumptions to generate predictions for a benefit and cost series<sup>3/</sup>, resulting from salmon and/or trout enhancement.

The Facility Benefit-Cost system has two separate components. The first is a price index model which adjusts past nominal costs and benefits to base year dollars for dealing with the part of the investment that has already taken place. The second is a future oriented program which estimates present values for a number of benefit and cost series alternatives. This component applies to commercially and recreationally harvested salmon or trout which are directly attributable to a given enhancement project.

### Salmon Fishery Benefits and Associated Costs

Evaluation of the efficiency of an investment for a specific project requires the analyst to estimate the gross benefits and gross costs involved for increasing the available salmon resource. In the Facility Benefit-Cost (FBC) model, the primary benefits to the private sector can be estimated as either the incremental value to the commercial fishery or as the incremental value to both the processing industry and the commercial fishery. In the first case, the gross benefit to the commercial fishery from enhancement-produced fish is measured as the ex-vessel value of the product. The gross cost is measured as all of the resources which have been used by the fleet to catch the enhancement-produced fish. In the second case, the gross benefit to the processing industry is the market value of the increased catch or the first wholesale value. The processing costs are the value of the resources which have been used to both process and harvest the enhancement-produced catch.

### Sport Fish Valuation

Many of the projects and facilities in FRED Division currently produce salmon and trout, which are highly valued by sport fishermen. The product of some facilities are targeted almost entirely at sport fishermen. The recreation benefits are discussed in the Documentation for the Enhancement Benefit-Cost Model (Hartman and Rawson, 1982). The analysis method presented in that text is solely intended to serve the purpose of the enhancement program evaluation.

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<sup>3/</sup> In this case, a "series" refers to an income or cost stream extending into the past or future for a specific number of years.

Although recreational evaluation procedures can encompass program benefits other than those directly received by Alaskan fishermen, the primary purpose of the valuation process is to identify the change in consumer surplus for a given recreational fishing investment. Consumer surplus is a measure of the satisfaction that people enjoy from their consumption of a commodity, and it is based on what they would be willing to pay for it. In the area of enhancement investments, consumer surplus is the amount that people are willing to pay for the opportunity to fish for the increase in the available stock.

#### Alaskan Impact Assessments Input

If a decision maker were only interested in a single objective (e.g., the maximization of fishing income), then the economic evaluation need not go beyond benefit-cost analysis. However, if the decision maker is also interested in dealing with distributional effects of an investment, it will be necessary to expand the scope of the work to include impact analysis. This process must be dealt with separately from efficiency considerations, and its purpose is to measure changes in local or regional employment, labor force participation, income distribution, and business and industrial activity in Alaska. The facility benefit-cost routine (FBC) can account for these interactions within the economy by indirectly incorporating values from impact models. These models are capable of generating multipliers that are relevant to the salmon fishing and processing industry. Such models take one of two forms. The first form is the input-output model, which is based upon a detailed accounting of the flow of goods and services at a given point in time. A second form is the econometric model, which may be used for the prediction of changes in employment and income from salmon that have been produced through enhancement or rehabilitation programs.

One model used by the Division of Budget produced a data set for the salmon industry that was based on a hypothetical increase in the salmon harvest of 10 percent over the naturally-produced base level (Kreinherder and Teal, 1982). This increase resulted in an income multiplier for the seafood industry of approximately 1.84. The estimate indicates that for each dollar of processing income produced, an additional 84 cents is produced in the form of induced wages to Alaskans.

#### What Constitutes an Efficient Return on Investment for an Enhancement Project?

If investment resources are limited, the undertaking of any public investment (e.g., transportation, hydro-electric power generation, permanent fund, or a salmon enhancement facility) will divert resources from an alternative use. The benefit-cost concept essentially compares the gross benefits of the proposed project with all of the anticipated costs of that project, including all social and opportunity costs.

Clearly, if the value of the benefits of the proposed project exceeds all of the costs<sup>4/</sup> that are associated with the project's existence, then the project is in society's best interest--based on a measure of efficiency.

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<sup>4/</sup> Including opportunity cost of investment.



In practice, external investment opportunities cannot always be directly included in the analysis, so a listing of benefit-cost ratios or estimates of return on investment for Alaskan public hatcheries may not provide as much familiar information to the decision maker as a broader, formalized comparison of the rate of return from public hatcheries versus rate of return from some selected Alaskan investment alternatives. While current State policy does not require a formal benefit-cost analysis for all public expenditures, comparison with anticipated returns for a few notable public investments will help shed light on the efficiency of a typical enhancement investment.

Preliminary estimates from enhancement economic analysis suggest a typical hatchery investment benefit-cost ratio would fall between a range of 2:1 and 3:1, with a typical return of investment of approximately \$20 million over the anticipated economic life. While an explicit comparison of specific site cases, with and without the proposed investment, would be required to identify all the alternative opportunities for any public project, it can be generally demonstrated that enhancement projects compare favorably with existing as well as proposed public investments.

#### Program Costs

Past expenditures for the State (FRED) program can be documented. However, a funding history for the PNP and regional aquaculture associations is more difficult to ascertain. Much of the donated labor and materials cannot be quantified. Much of the private sector program is financed by State-guaranteed loans and grants. These amounts have been included in Table 3 to help give a perspective of the amount of money committed to the PNP program. The amount of dollars authorized for the FRED program is given in Table 4.

Prior to 1970, the aquaculture program included three hatcheries. Two were dedicated to enhancement of the recreational fishery, and the third facility conducted research on salmon. FRED Division received \$6 million in 1974 to start to develop various opportunities for enhancement and rehabilitation, and also to expand research. In 1976, voters approved a \$28 million hatchery bond issue in the general election. Additional capital appropriations and bond issues of 1978 and 1980 included funds for hatcheries and brought the total to nearly \$80 million. Hatcheries dominated the capital improvement projects in the expenditure of these funds. Because of the urgency to get the program under way, early hatchery construction was put on a "fast track basis." Delays experienced before and during construction and especially during times of high inflation, caused several of the projects to cost more than originally estimated.

Even though the harvest of salmon in 1980-1982 was near 110 million salmon annually, there was a shortage of available broodstock for many of the hatcheries. Most of the commercial harvests centered on species which were not targeted in the enhancement program or were in locations where there were no hatcheries.

This shortage of brood stock dictated that the new facilities would not or could not be "filled to capacity" within the first one or two years. Therefore, several of the facilities were only partially constructed.

Table 3. State loans secured for capital construction and operational costs and revenues generated by assessments and fish sales for 14 private nonprofit (PNP) hatcheries, FY 1983. (3 PNP corporations have not secured State loans.)

Permits	State Loans		Funds Generated by Assessments or Sale of Fish
	For Capital Construction	For Operations	
<u>SOUTHEAST</u>			
(1,2) Northern Southeast Regional Aquaculture Association (2)	\$ 959,209	\$ 822,869	\$ 495,443 <u>1/</u>
(3) Southern Southeast Regional Aquaculture Association	\$ 4,935,000	\$ 917,600	\$1,456,930 <u>1/</u>
(4) Alaska Aquaculture Foundation, Inc.	\$ 304,530	\$ 342,025	
(5) Burro Creek Farms, Inc.	\$ 191,375	\$ 92,000	
(6) Kake Nonprofit Fisheries Development Corp.	\$ 364,900	\$ 104,500	
(7,8) Douglas Island Pink and Chum Corp. (2)	\$ 476,000	\$ 379,500	
(9) Sheldon Jackson College	\$ 177,254	\$ 61,370	
(10) Tlingit and Haida Fisheries Development Corp.	\$ 1,553,860		
(11) Armstrong-Keta, Inc.	\$ 474,045		
<u>PRINCE WILLIAM SOUND</u>			
(12) Prince William Sound Aquaculture Corp.	\$ 5,755,500		\$1,084,806 <u>3/</u> \$ 169,175 <u>2/</u>
(13) Valdez Fisheries Development Corp.	\$ 2,582,530	\$ 387,000	
<u>COOK INLET</u>			
(14) Cook Inlet Regional Aquaculture Association	\$ 1,348,881	\$ 444,755	\$ 487,934 <u>1/</u>
<hr/>			
TOTALS	\$19,105,084	\$3,551,619	\$3,694,288
		 -----	
	TOTAL	\$22,656,703	

- 1/ 3% mandatory assessment tax collected from fishermen.  
2/ 2% voluntary assessment tax collected from fishermen.  
3/ Revenue from sales of fish captured at hatchery.

Table 4. FRED's operational budgets, capital spending, and egg capacities of hatcheries, FY 1971-1983.

Fiscal Year	Cumulative Egg Capacity (Millions)		<u>Capital Funding for Hatcheries</u> (Thousands \$)			Annual Operational Budget (Thousands \$)	
	Actual	Design	CIP	BOND	Cumulative Capital Funds	Actual Dollars	Adjusted to 1976 Dollars <sup>3/</sup>
1971	8.6 <sup>1/</sup>	8.6 <sup>1/</sup>	0	-	0	-	-
1972	12.1	14.4	70.0	-	70.0	464.6	666.1
1973	22.1	24.4	349.8	-	419.8	749.8	1,015.1
1974	22.1	24.4	1,645.1	-	2,064.9	941.4	1,127.0
1975	22.1	24.4	1,763.5	6,099.4	9,927.8	1,407.9	1,499.1
1976	32.1	34.4	249.0	-	10,176.8	3,482.8	3,482.8
1977	107.6	109.9	2,575.1	28,040.0	40,791.9	3,217.3	3,041.3
1978	109.6	111.9	1,688.8	-	42,480.7	6,975.1	6,001.2
1979	139.6	141.9	1,712.5	25,743.0	69,936.2	9,267.8	7,333.7
1980	209.6	346.9	-	-	69,936.2	7,978.8	5,764.0
1981	347.1	550.1	3,075.0	3,500.0	76,511.2	9,673.4	6,503.5
1982	351.5	550.1	3,180.0	-	79,691.2	12,926.9	8,516.3
1983	458.5	672.1 <sup>2/</sup>	0	-	79,691.2	12,196.9	7,579.5
			16,308.8	63,382.4	79,691.2		

<sup>1/</sup> Eggs in existing hatcheries prior to FRED legislation.

<sup>2/</sup> Additional funding is required to enable several existing facilities to reach their design capacities.

<sup>3/</sup> Adjusted using the Anchorage Consumer Price Index. The 1983 amount was adjusted assuming an annual CIP increase of 0.06.

As the brood-stock development continues, these hatcheries are scheduled for a completion date that will coincide with returning adult fish. If construction of the facilities is not completed, they will not reach design capacity in the planned time frame. The hatchery components generally lacking are those that were not necessary for start-up such as "adult fish holding structures," "egg taking facilities," and "personnel support facilities."

The FRED Division also provides a wide variety of associated services both to the public sector and the private sector. A well-balanced salmon rehabilitation and enhancement program includes much more than just hatcheries. Scientific laboratories, quality control, and evaluation functions are essential elements to a well-balanced program.

The FRED Division budget can be divided into four major categories. These are listed along with the percentage of the program that each major category represents to give a perspective of the relative proportions of the program.

- |  |     |
|--|-----|
| 1. Management, Administration,<br>and Strategic Planning, including<br>Planning and Permitting for the<br>Private Sector                                 | 15% |
| 2. Supplemental production (Enhancement)   | 59% |
| 3. Rehabilitation  | 6%  |
| 4. Scientific Support and Evaluation<br>(Including services provided to<br>the private sector and investigations<br>preceding rehabilitation activities) | 20% |

The largest operational expenditures are, of course, the collective operation of 20 hatchery facilities. Operational dollars that are spent at each facility are measured against fish production which provides a benefit-cost analysis. Much of the scientific support (research and evaluation) is devoted to improving technology and thus increasing production of adult fish. As facilities reach their maximal design capacity and new technology is transferred to them, the benefit-cost ratio improves. These ratios are the most meaningful for (1) comparing the performance of a facility from one year to the next, and (2) comparing one facility to another when the assumptions used in the analysis are accepted as the most likely scenario for development. In general, a good manager will select a facility with a higher benefit-cost ratio, all other things being equal. (Refer to Economic Planning Section, page 9.)

Many of the expenditures in FRED's budget provide important, required services to the private sector and other governmental agencies. All of the scientific services and new technologies that have been developed by the FRED Division are in the public domain and, as such, are available to the private sector. This assistance is provided by the State without charge. The technological functions of limnology, pathology, genetics, engineering, biology, fish culture, and tag recovery analysis are utilized by all fishery divisions within the Department as well as by federal agencies and the private sector.

These services and hatchery production are being cut back further because of budget cuts in fiscal year 1983. The Fiscal Year 1983 budget is slightly more than \$12.2 million, which is \$1.7 million less than requested. At the same time (FY 83), three new hatcheries, Main Bay in Prince William Sound, Sikusuilaq Springs, north of Kotzebue, and Trail Lakes, south of Anchorage, began operations in 1982.

Also, the reconstructed Fort Richardson Hatchery was brought back on line in 1982. These additional expenses, which came at a time of budget reductions, have altered the FRED program and have resulted in the layoffs of several permanent personnel, the closing of the East Creek Hatchery near Dillingham, and the curtailment or reduction in scope of several research and rehabilitation projects.

In 1976, enhancement planners established an annual production goal of 25 million salmon. The estimated cost to accomplish this goal was \$235 million to be provided by the public sector for capital construction. Subsequent planning exercises have raised the enhancement goal to 51 million salmon annually. To date, the State has appropriated \$80 million. Figure 1 illustrates the relationship of capital appropriations, planned and actual, since 1976.

The first capital funding for the FRED Division was in 1972. During the next 11-year period (1972-1982), the State spent \$6.4 billion on capital projects. Capital funds for enhancement, allocated to the FRED Division over the past 11 years (since the start of the program), have been about 1.2% of the total dollars allocated for all capital projects.

Table 4 gives the annual operational budget for the FRED Division since 1971. Also given are those amounts which have been adjusted to 1976 dollars. During the period of 1979 to 1982, 10 new hatchery facilities were brought on line, and the Fort Richardson Hatchery was completely reconstructed. Referring to Table 4, it can be seen that operational dollars, from the perspective of their actual purchasing power, have increased very little and in some years have decreased.

#### Present and Projected Salmon Production

The commercial harvest of salmon in the past three years has been of record proportions. Consequently, the urgency for full implementation of the State's salmon enhancement program has been questioned. Even though the FRED program continues to expand as a result of voters' approval of bond issues, the FRED operational budget has not increased correspondingly. Instead, greater emphasis has been placed on the precision with which the commercial harvests are regulated. Since 1979, the budget to increase this precision has increased by over 110% (from \$9 million to nearly \$19 million). The funds allocated for the enhancement program during the same period has increased only by 33%, and inflation during this period has taken its toll. During this same period (FY 80-82), seven new facilities that were previously authorized were brought on line.

With the record harvest of the past three years, the overall salmon production picture in Alaska is bright. The mix of species harvested,

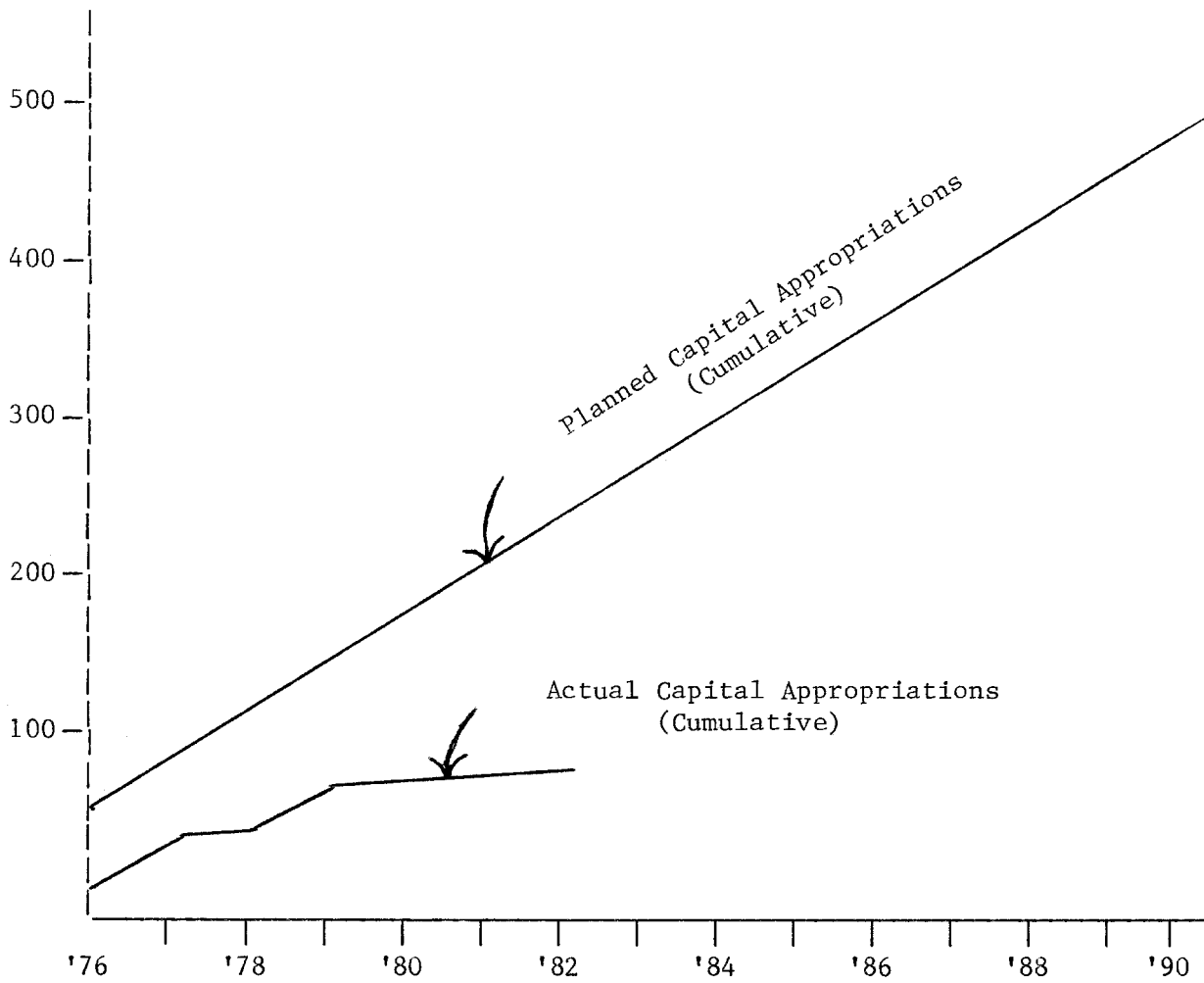


Figure 1. Relationship between capital and operational appropriations. Dollars have been adjusted to 1976 dollars.

however, leaves considerable room for adjustment and shifting emphasis. Over half of the current harvest is pink salmon, which has the lowest per-fish value of the salmon species. The FRED Division program addresses the need for more production of chinook, coho, and chum salmon. Alaskans are not satisfied with the status quo of the natural stocks. The 30-year consecutive mean, high-annual catch is 82 million salmon. The long-term plan for salmon in Alaska calls for nearly 143 million fish for harvest annually, of which 51 million are to be produced by enhancement and rehabilitation techniques. Included within this harvest of 51 million are 25 million chum, 8 million sockeye, 1.5 million coho, and 300,000 chinook salmon; the remainder will be made up of pink salmon.

With the preceding in mind, one point becomes apparent; the gap between actual and desired production for most species, in most geographical areas, has closed considerably during the past three years. Natural stocks have accounted for a large share of the total in a shorter time than was originally thought possible. Part of this increase was due to better regulation of the harvest. However, much of the increase was due to unusually high survivals both in fresh and marine waters. It is likely that severe weather and other environmental conditions will periodically depress adult salmon production, especially wild stocks. Artificial enhancement of salmon stocks, which circumvents many of the problems encountered by wild stocks, will reduce the impact of years with low natural production. A pertinent point to be remembered is that, regardless of the recent good years, the fishery user groups still desire an aggressive action program in salmon enhancement and rehabilitation. A review of current catch information reveals that users desire (even in a record fishing year) more pinks, chums, and chinooks in Southeast Alaska; chinooks and pinks in Cook Inlet; cohos in Prince William Sound; chums and cohos in Kodiak; and chums and chinooks along the Interior rivers--just to mention a few examples. Also, much of the recreational opportunities that are afforded to Alaskans, in areas of high population densities, result from the enhancement program. The demand for more lake and stream stocking of rainbow trout, coho, and grayling is increasing throughout the State.

Available funds for the rehabilitation and enhancement program is a subject that has led to the formation of a special steering committee appointed by the Governor. The "spending limit" is often identified as the villain associated with reduced emphasis on the program, when in fact there has simply been a shift in priorities. Budget cuts for the FRED Division in Fiscal Year 1983 were the result of reprogramming within the Department of Fish and Game and among departments Statewide. During the time that new facilities were coming on line, the operational fundings were not correspondently increased. Consequently, it became necessary to stop other activities. No bond proposals were placed before the voters in 1982, nor was the FRED Division allocated any capital improvement monies in Fiscal Year 1983. Thus, during recent years, when the availability of capital improvement monies has been greater than ever before, the FRED program has been shrinking.

## INTERNATIONAL PERSPECTIVE

Alaska has the greatest potential for anadromous fisheries enhancement of all the regions of the North Pacific Rim. However, we lag behind other countries in the artificial propagation of salmon. Japan and the Soviet Union have aggressive salmon enhancement programs, and their combined long-term goals exceed by twice the combined goals of the remainder of the salmon-producing countries.

### Japan

Japanese hatcheries released approximately 1.1 billion juvenile salmon in 1982, and in 1983 they expect to release even more. Returns from these hatchery releases make up the majority of the domestic Hokkaido coastal chum catch. In 1982, the coastal catch of chums off Hokkaido reached an all time high of almost 23 million adults. It is predicted that the catch will be up to 30 million by 1985. Even with the success of the chum hatchery program, Japan relies upon its high seas salmon fisheries and upon imports from the U.S. and Canada for about 50% of the country's salmon demand. The number one desired salmon product in Japan is "ocean bright" sockeye.

### Russia

The USSR is currently releasing about 1 billion young salmon (pink and chum) annually from its facilities. The Soviet's long-term goal is to place more emphasis on chum salmon production and to release nearly 5 billion juvenile salmon by the year 2000. To accomplish this, they plan to build 52 more salmon hatcheries along the western Pacific and Bering Sea.

### British Columbia

The goal for the Salmonid Enhancement Program of British Columbia is to increase the commercial catch of salmon by 27 million adults. To meet this goal, they need to produce about 1.8 billion juvenile salmon by 1993. In 1981, the Salmonid Enhancement Program produced 267 million juvenile salmon. Approximately 80% of this production was attributed to spawning channels and lake fertilization projects.

### United States

More than 435 million juvenile salmon were released in 1981 from the Pacific Coast states, excluding Alaska. The largest proportion of these (320 million) were released from the state of Washington, while Oregon released more than 80 million juveniles, California approximately 30 million, and Idaho nearly 6 million (chinook) smolts. The Alaskan enhancement program released 231 million juveniles during 1981.

### Summary

The following table gives the planned releases of juvenile salmon from enhancement projects of the North Pacific Rim nations and states for the years 1981 and 200:



RELEASES IN BILLIONS

	<u>1981</u>	<u>2000</u>
Japan	1.10	2.3
USSR	1.00	5.0
B.C.	.27	1.8
Alaska	.23	2.5
Wash., Ore., } Cal., Idaho }	.44	?

The United States canned 222 million pounds of salmon in 1981, and it produced another 147 million pounds for the fresh and frozen market. Salmon from Alaska made up more than 95 percent of the U.S. total canned salmon production, and at least 86 percent of the fresh and frozen salmon production. British Columbia processed nearly 170 million pounds of salmon in 1981, with just over 50 percent being canned. Both the United States and British Columbia are competing for the Japanese and European salmon market.

Another highly competitive area will be in the allocation of "grazing" rights of the North Pacific pasture. If the Japanese and Soviets adhere to their proposed schedule of production, we will begin to see the effects of surpassing the ocean's rearing capacity within a decade or so. As we approach that time, the salmon-producing countries of the North Pacific will be negotiating for these "grazing" rights and for the establishment of quotas for release of artificially-propagated salmon. Alaska's position at the bargaining table, no doubt, will be strengthened if we also have a history of stocking the ocean with large numbers of juvenile salmon.

Alaska's salmon industry is the State's largest employer and has an economic worth at first wholesale value estimated to be near \$4 billion. If Alaska intends to secure its position in the world market place, the salmon rehabilitation and enhancement program must keep pace.

OPPORTUNITIES

Of the entire North Pacific Rim, Alaska has the greatest potential for producing salmon through habitat protection, enhancement, and rehabilitation efforts. Its nearly 600,000 square miles of land and water, 33,000 miles of shoreline, and an estimated 6,000 salmon-producing streams is unequalled.

Fishery scientists generally agree that regulation of the harvest alone cannot produce the numbers and mix of salmon species desired by the user groups, especially when the user groups demand that the production be in specific geographical areas. Economics of the industry cause resistance to the curtailments of harvests, which are necessary to restore depleted stocks. Some stocks are so decimated that regulation of the harvest, by itself, is no longer effective. Harsh environmental conditions often negate the best management practices. Enhancement and rehabilitation

techniques, e.g., hatchery propagation of fish, fishway construction, lake fertilization, lake stocking, and habitat alteration, in concert with good harvest regulation, will enable salmon production goals to be achieved and maintained.

The Alaska Salmon Fisheries Plan lists a long-term objective of 51 million supplementally-produced adult salmon for harvest. The plan contains some assumptions that are based upon incomplete information. The plan correctly recognizes that certain areas in the State have greater potential for employing enhancement and rehabilitation techniques than others. Several examples are given of the type of projects that can be pursued as the Salmon Plan is implemented.

To help put the plan in perspective, part of the long-term goal was to have been achieved by hatcheries, and to accomplish this part of the goal, it was estimated that it would have required 51 hatcheries of approximately 60 million eggs each. While these projects and examples have helped to lend a perspective to the task ahead, several people have interpreted the examples to be real. Considering available technology, Alaska does not have 51 sites for hatcheries this size. The lack of sites, however, can be offset somewhat by advances in hatchery technology and habitat alteration techniques. For example, two to four times as many salmon fry are now being produced in the same amount of water and space that was assumed to be possible in the mid 1970s. Additionally, increased natural production of salmon in lakes through nutrient addition (lake fertilization) was not included in the original Salmon Plan as one of the techniques to be used in the rehabilitation and enhancement effort.

#### Southeast

Although "ideal hatchery sites" may not be as numerous as originally thought, sites with adequate volumes of water but with marginal water quality may be usable with new water purification techniques. Alaska still has many excellent hatchery sites that have not been developed. Many of these sites are located in Southeast Alaska. Using present technology, these Southeastern sites could produce between 5 to 10 million adult salmon per year in addition to the 4 to 5 million supplementally-produced salmon now scheduled. If potential fishways are included along with lake fertilization, lake stocking, stream improvement, and streamside incubation, the total supplemental production in Southeastern Alaska is considerably greater than that coming only from hatchery facilities in existence and those called for in the 1975 Salmon Plan.

#### Prince William Sound

Prince William Sound possesses several excellent sites for hatcheries, fishways, lake stocking, lake enrichment, and releases of sport and commercial species. Considerable opportunities exist for enhancement of the sport fishery. There is a large demand for increased coho and chinook production for recreational purposes, utilizing all of the rehabilitation and enhancement techniques.

### Cook Inlet

Cook Inlet has the potential to produce more than 5.5 million adult salmon through artificial production technology. Hatchery production could be increased even more if hatcheries are constructed with hydroelectric power site development.

The Upper Cook Inlet area has a high demand for recreational fishing opportunities and requires a significant increase in numbers of artificially-produced chinook salmon, coho salmon, and rainbow trout. Although the Anchorage area hatcheries and those along the Kenai Peninsula will fulfill some of this need, more projects for sport fish enhancement are required.

### Kodiak

The Kodiak area offers opportunities for increased salmon production at several potential hatchery sites, some of which may be related to hydroelectric power development. The opportunities for additional fishways also exist. The Kitoi Hatchery could be improved through expansion, rebuilding, and gradual development of its chum and coho stocks. It could also supply the Kodiak area with rainbow trout for lake and stream stocking. The Karluk sockeye system is in the initial stages of rehabilitation and could be accelerated by increasing the scope of the stream-side incubation project on the Thumb River, a tributary to the lake. This work is being done in cooperation with the U.S. Fish and Wildlife Service.

### Bristol Bay

Rehabilitation in Bristol Bay is somewhat more controversial than in other parts of Alaska. Enhancement and rehabilitation in this area would result in a much smaller percentage change in adult salmon numbers. However, enhancement could help to temper the effects of poor years in the cycles of wild sockeye salmon, such as the lower than expected run in 1982. Strategically-located fishways, such as on the Newhalen River, will positively affect the potential of many of the sockeye-producing lakes. Areas with poor spawning habitat but with good rearing areas could be stocked with hatchery fry. Becharof and Naknek Lakes are examples. The FRED program could increase adult sockeye numbers by about 4 million fish per year in the Bristol Bay area.

### Alaska Peninsula

Enhancement opportunities on the Alaska Peninsula are few. The hatchery at Russell Creek is hampered by design flaws and cannot fulfill its present production goals. The State has won a multi-million-dollar suit from the design consultant, which will pay for some of the reconstruction. The verdict, however, is being appealed. Another consultant estimates that with appropriate reconstruction, the facility could return 1.4 million adult salmon for harvest annually. Although other good hatchery sites are not abundant along the Alaska Peninsula, stream and habitat improvement could be effective in producing more salmon.

## Interior & Arctic-Yukon-Kuskokwim

Of all areas in the State, the Arctic-Yukon-Kuskokwim (AYK) is least understood in regard to salmonid enhancement potential, largely because of the constraints of applying known technology in areas of extreme environmental conditions. FRED hatcheries near Kotzebue and Fairbanks are testing the "meshing" of fish culture technology and engineering under extreme environmental conditions. If successful, opportunities for chum or chinook enhancement in AYK will be great.

### Summary

Except for possibly the AYK area, present technology is not the obstacle to expanded rehabilitation and enhancement in Alaska. FRED utilizes the most up-to-date methods that are available and continues to be the world's leader in advancing the technology. In some cases, brood-stock availability controls the rate of development. Availability of funds, by and large, is the governing influence on the speed at which the enhancement goals are reached. Decision makers must balance salmon rehabilitation and enhancement with other programs.

Alaska can significantly improve the economy and stability of its fisheries. Alaska is in the best position of all the salmon-producing countries because of its non-renewable resource wealth. This excellent financial condition is complemented by Alaskan citizens who have consistently supported every fishery bond from 1974 to 1980 in which about \$80 million have been allocated for construction of rehabilitation and enhancement facilities and projects. Considering British Columbia's commitment to spend \$200 million on the same type of programs and Japan's and the Soviet Union's long range goals, Alaska needs to adhere to its plans if it hopes to achieve a healthy, stable, and competitive fishery in the future and compete in the world market place.

### PROGRAM CONSTRAINTS/OPTIONS

Table 5 shows a series of projections through 1998 including: (1) the state's revenues, (2) the amount permitted for appropriation under the spending limit, and (3) the amounts available for capital and operating appropriations as a result of the spending limit and the level of revenues. These support the following conclusions: Beginning in 1988, there will be less revenues available for appropriation than the spending limit allows to be spent for both the operating and capital budget. However, the spending limit will still constrain the operating budget's growth because it requires that at least 1/3 be appropriated to capital projects. For example, without the spending limit, the operating budget could be as high as \$3.9 billion (although it is unlikely that either the Governor or Legislature would use all available funds for the operating budget). With the spending limit, the operating budget cannot exceed \$2.6 billion.

The financial issue centers on deciding just how much the State wishes to expend on its rehabilitation and enhancement program. There are

Table 5. Revenue projections 1983-1998.

DATE = 11/16/82 TIME =09:58

STATE OF ALASKA  
OFFICE OF THE GOVERNOR  
DIVISION OF BUDGET AND MANAGEMENT  
SJR4

ALL COMPONENTS IN NOMINAL DOLLARS

FISCAL YEAR	FISCAL SPENDING LIMIT	AVAILABLE FOR APPROPRIATION	FUNDS IN EXCESS OF LIMIT	MINIMUM AVAILABLE FOR CAPITAL/LOAN APPROPRIATION	MAXIMUM AVAILABLE FOR OPERATING APPROPRIATION	OIL/GAS REVENUE	NON OIL/GAS REVENUE	PERMANENT FUND INCOME	PERMANENT FUND BALANCE	AVAILABLE FOR APPROPRIATION PER CAPITA DOLLARS
1983	2745.92	3216.46	470.54	915.31	1830.62	3357.80	337.00	171.23	3639.37	7376.72
1984	2974.85	3035.84	60.99	991.62	1983.23	3226.20	336.64	248.01	4186.53	6770.39
1985	3237.74	3054.29	0.00	1295.62	2036.19	3252.00	350.39	330.24	5067.25	6623.64
1986	3523.85	3569.56	45.70	1174.62	2349.23	3844.00	365.27	405.04	5790.29	7527.50
1987	3835.25	3895.68	60.43	1342.07	2556.83	4342.00	278.79	466.48	6677.36	7988.60
1988	4174.17	3929.75	0.00	1309.92	2619.83	4436.00	293.77	542.80	7598.00	7836.15
1989	4543.04	4286.64	0.00	1468.47	2857.76	4870.00	308.00	626.30	8673.14	8312.00
1990	4944.51	3644.31	0.00	1214.77	2429.54	4169.00	324.58	717.21	9696.56	6871.55
1991	5381.45	3210.21	0.00	1075.95	2140.14	3703.00	335.30	812.29	10736.72	5886.05
1992	5857.00	3055.24	0.00	1018.41	2036.82	3575.00	348.10	912.89	11847.31	5447.55
1993	6374.58	2749.66	0.00	917.35	1833.11	3260.00	363.57	1018.01	13006.76	4767.28
1994	6937.90	2583.90	0.00	861.30	1722.60	3087.00	378.83	1126.88	14220.85	4355.30
1995	7551.00	2364.17	0.00	788.16	1576.11	2843.00	395.93	1239.46	15479.89	3875.89
1996	8218.28	2127.23	0.00	709.08	1418.15	2596.00	413.56	1357.20	16802.89	3391.23
1997	8944.52	2198.98	0.00	733.01	1465.99	2689.00	432.08	1480.88	18227.91	3408.91
1998	9734.94	2250.59	0.00	750.20	1500.40	2762.00	453.66	1611.40	19763.66	3392.67

ASSUMPTIONS

- 1: ANNUAL GROWTH RATE IN ANCHORAGE CPI = .060
- 2: ANNUAL GROWTH RATE IN ALASKAN POPULATION = .028
- 3: AVERAGE RATE OF RETURN ON PERMANENT FUND = .100
- 4: AVERAGE ANNUAL DEBT SERVICE = 541
- 5: FUNDS IN EXCESS OF LIMIT: 50% PERMANENT FUND, 50% VOTER APPROVED CAPITAL EXPENDITURES
- 6: 30 PERCENT REVENUE FORECAST, DEPARTMENT OF REVENUE, OCTOBER 82

PREPARED BY THOMAS CHESTER  
OFFICE OF THE GOVERNOR  
DIVISION OF BUDGET AND MANAGEMENT

constraints imposed by the availability of funds. It is true that funds can always be reprogrammed from other State programs to support aquaculture. It is unlikely that enough reprogramming would be done to be sufficient to maintain the program at present levels, much less expand during a decade when overall revenues are declining.

Another part of the financial issue is to determine whether or not certain portions of the program are in need of State subsidy and, if so, how the State will seek repayment. Often when General Fund investments in public hatcheries are discussed, opponents claim that harvesters of hatchery production, i.e., sport or commercial fishermen, are the exclusive beneficiaries of that production and, therefore, are responsible for paying the development and operational costs of hatcheries. A simplified version of the real system is portrayed (Figure 2) strictly as a reminder that a multitude of industries receive benefits and pay taxes on those benefits. Commercial fishermen and sportsmen are not the sole beneficiaries of that investment, nor are the processing and retail service industry. Furthermore, infusion of non-renewable resource revenues through the general fund into hatcheries will flow into many different areas of the economy, not just to fishermen and processors.

If the rate at which the rehabilitation and enhancement program develops is to be increased or the size of the program is to be increased, then the "pool" of funds must be increased. This point should not be confused with how monies are put into the "pool" or drawn out. The rehabilitation and enhancement program has always competed with other public programs and should continue to do so. One important factor needs to be reinforced, however, and that is that most projects, such as hatcheries, do not achieve results instantaneously. They must be operated continuously to be effective. Funding and maintaining the program is a long-term commitment. This necessitates long-range planning, such as that being done by some of the regional planning teams referred to earlier. However, these planning efforts must be coordinated Statewide and in accord with other aspects of the industry. The proposed Alaska Commercial Fisheries Policy and Coordination Task Force could serve as the Statewide coordination point.

There have been several schemes suggested to increase revenues for the program. Some of these are as follows: have the State sell fish; give the hatcheries away; provide for selective private take-over of the hatcheries; reprogram State funds; fund hatcheries via the Renewable Resource Development Fund; contract the operations; increase enhancement tax or other taxes; establish a new tax; establish an endowment fund and use the interest for operations. However, only a few of the suggestions carry the possibility of increasing the amount of funds "dedicated" to the fisheries rehabilitation and enhancement program. The current program is supported by General Fund monies which are derived in part from specific taxes; in some cases these taxes take the form of a voluntary or a mandatory assessment on those who "benefit most." Most of the program, however, is funded by oil and gas revenues.

The program size and speed is controlled by the amount of money made available. The public has already spoken out against allowing private-for-profit hatcheries in Alaska; when one reviews the recent history

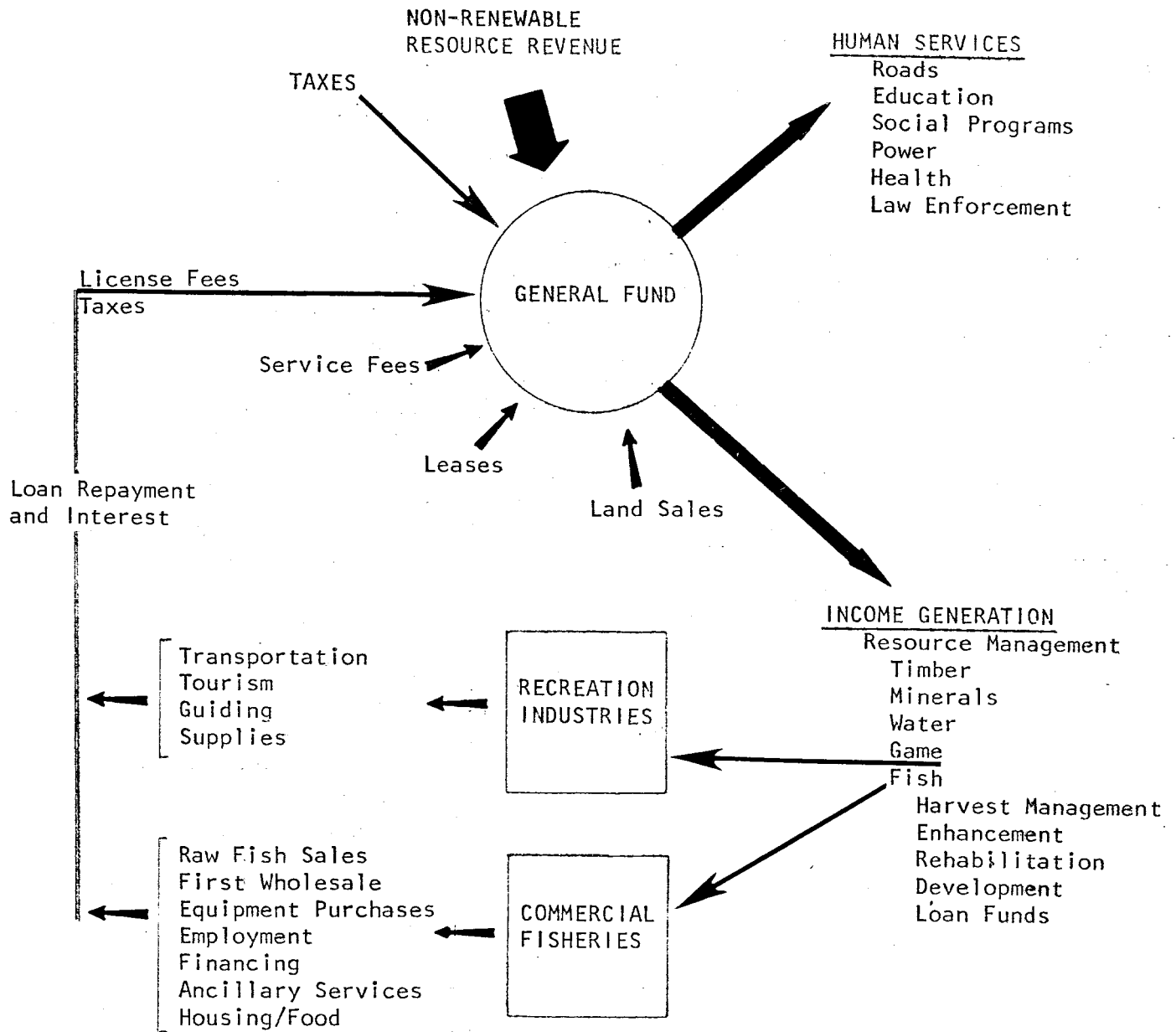


Figure 2. Fisheries dollars - cash flow.

of the Oregon experience and some of the fears expressed in British Columbia, the question of who controls the fish becomes closely linked to how the program is funded.

Current statutes mandate that the Department of Fish and Game (FRED Division) carry out a rehabilitation and enhancement program. These statutes also allow and encourage private sector (nonprofit) involvement and assistance in this program. Loan funds are provided to assist these "private" programs. Loan approval is made by the Alaska Department of Commerce and Economic Development, assisted by the Department of Fish and Game. The size of the State portion of the rehabilitation and enhancement program is largely controlled by the size of the FRED Division's budget. If the program is to increase in size, more money must be allocated. The only way to increase the size of this "pool" of money is by a greater commitment to the program. Funding this commitment can take several forms and can be applied disproportionately to the population. Generally, those who benefit most are "taxed" at a higher rate. There are also various schemes that have been suggested to make this "taxation" more palatable, such as voluntary assessments and selling of hatchery fish. The amount of funds appropriated from the General Fund for all fisheries rehabilitation and enhancement is but one part. To increase "dedicated" funds to cover the operational cost of hatcheries, reprogramming must occur from other service programs and/or from within the monies allocated to "Fisheries Programs."

#### BENEFIT/COST/RISK/CONTROL

At least four elements should be considered in any discussion concerning the future of the program. These are: (1) Benefit, (2) Cost, (3) Risk, and (4) Control.

Benefit - The present program has been designed to benefit all users: commercial, recreation, and subsistence. Most of the facilities are multi-species and some of each species are targeted to each user group. Some facilities benefit some users more than others. For example, a remote hatchery in Southeast Alaska raising primarily chum salmon may benefit a single gear group of commercial harvesters. Another example is that all of the FRED Division's extensive rainbow trout program is directed towards sport fishermen.

Cost - All segments of the resource management program have a cost. When specific projects are designed to exercise control over the fish, such as a hatchery does, then the cost rises. The product (benefit) of the project must be coupled with the cost to allow comparison to other public service programs. The political process will determine which programs continue and which do not. The only caution expressed is that decision makers must realize that the rehabilitation and enhancement program is a long-term commitment.



Risk - As with any animal husbandry program there are certain risks, especially concerning disease and genetics. These two factors are controlled in any animal population by the laws of nature. When man chooses to intervene and manipulate for his increased benefit, it is essential that adequate steps are taken to control disease and that good genetic principles are practiced in brood-stock development and maintenance. Of all the states, Alaska has the strongest disease laws. The spread of disease resulting from poor cultural practices could result in a higher incidence of disease in wild stocks. Certain destructive viruses that have been detected in wild stocks must be tightly controlled to prevent epidemics within hatchery stocks. Likewise, disregard for genetic considerations could result in reduced fitness of the cultured stocks.

Control - Management of the State's aquaculture program is currently done by the Alaska Department of Fish and Game (FRED Division). The private sector involvement is controlled via the permit process administered by the Department.

Harvest regulation of hatchery fish is administered by the Board of Fisheries. All statutes and mandates apply, and the program is adjusted annually via the political process through the executive and legislative branches of government. The FRED program is administered for the benefit of all the citizens of the State.

#### PUBLIC POLICY QUESTIONS

Joint planning between resource managers and resource users is essential to the overall success of the fisheries management program Statewide. Long-range planning should be orchestrated by a high level task force such as that appointed by Governor Sheffield. Managing and manipulating the fishery resource for the benefit of all Alaskans is a huge and complex undertaking. Responsibility for much of this task is outlined in Title 16 as mandates to the Department of Fish and Game. Sharing this responsibility with the private sector in the area of salmon enhancement has been successfully taking place since 1976 when the PNP legislation was enacted.

The 1982 Legislature requested the Administration to investigate the intricacies of transferring some State-operated fish hatcheries to private nonprofit regional associations. In pursuing this issue, the Department of Fish and Game requested assistance from the Department of Law. The opinion of the Department of Law on how the state might proceed is attached (Appendix A).

Transferring State-owned and operated hatcheries to the private sector is a complex issue involving millions of dollars in State funds and, as such, is a public policy decision that should be dealt with by the Administration and the Legislature.

Transferring public hatchery facilities to the private sector will affect the present infrastructure of the industry and the management regime for the fishery. Singling out aquaculture and, specifically, hatcheries for proposed separation from the remainder of the "tools" available to the management agency should be examined closely. Development of an aquaculture industry in Alaska will bring changes to the present methods of management, harvest, and processing of the resource. Alaska has huge potential for "farming and ranching" its aquatic and marine resources. Careful planning and execution will be required to develop these resources so that they will provide the greatest benefits for all Alaskans.

#### ACKNOWLEDGEMENTS

The author wishes to acknowledge the contributions of the FRED Division headquarters staff for their assistance in compiling the information for this report. Thanks also to Eric Laschever (Division of Budget and Management), Jeff Hartman and Kit Rawson (FRED Division Southcentral Region) for their assistance with the section on Economics, and Sid Morgan for his assistance with the editing.

Special thanks to Zodi Cardinal and her staff for typing the report.

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APPENDIX A

## MEMORANDUM

State of Alaska

TO: Earnest Greek  
Contracts & Facilities Officer  
Division of Administration  
Department of Fish & Game

DATE: September 9, 1982

FILE NO: 366-086-83

TELEPHONE NO: 465-3600

FROM: WILSON L. CONDON  
ATTORNEY GENERAL

SUBJECT: Authority to Transfer Hatcheries

By: John B. Gaguine <sup>JS</sup>  
Assistant Attorney General  
Department of Law

RECEIVED  
SEP 14 1982

You have asked several questions regarding ~~DIVISION OF FISH AND GAME~~ and Game's proposed transfer of three state hatcheries to non-profit regional aquaculture associations. Specifically, you wish to know whether there is any bar to a negotiated transfer to a selected transferee, and what types of transfer are permissible. We conclude that Fish and Game currently may not undertake any type of transfer, since no statutory authority for a transfer now exists. If the legislature does grant the necessary power to Fish and Game, it will be able to do a negotiated transfer, but will not be able to give up ownership without receiving fair value for the facilities.

Lack of statutory authority. Fish and Game has no specific authority to dispose of property. AS 16.05.050(3) authorizes the commissioner to "design and construct" hatcheries, but not to lease or sell them. Similarly, both AS 16.05.020, the statute listing the commissioner's broad functions, and AS 16.05.092, the statute broadly defining the powers of the FRED division (which runs the hatcheries), are silent as to Fish and Game's and/or FRED's power to dispose of them. There is no Alaska constitutional provision or judicial decision expressly requiring that an executive department have explicit statutory authority before it may dispose of state property. But this is the general rule of law followed elsewhere, and one must presume that the rule applies in Alaska, too.

This general rule is reflected in the myriad of cases concerning disposition of state property (generally land) by sale or lease, virtually all of which discuss the statutory basis for the transfer. Many of these cases can be found under West's Key Number States 89. "It is a well settled principle of law that title to government property may pass only in the manner prescribed by the duly constituted legislative body and that title to any such property may not be forfeited through the oversight, carelessness, negligence or even intentional conduct of any of the agents of the government." State v. West, 229 S.E.2d 826, 831-32 (N.C. App. 1976), aff'd, 235 S.E.2d 150 (N.C. 1977). See also Finch v. State, 124 So.2d 825, 827 (Ala. 1960) (within

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Contracts & Facilities Officer  
Department of Fish & Game  
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constitutional limitations, legislature has power to provide for leasing of state property, and may set limits on length of leases and determine general policy concerning them); State Land Board v. Heuber, 548 P.2d 1323, 1328 (Or. App. 1976) (conveyance by state is valid only if done with proper statutory authority); 5B G. Thompson, Real Property § 2720 (1978 repl. ed.) (state may dispose of lands through the legislature; state officers may act only in accordance with constitution and statutes); 72 Am. Jur.2d States §§ 66, 67 (1974).

The necessary statutory authority to sell or lease cannot be found in general grants of power made by the legislature to state officials. Samsell v State Line Development Co., Inc., 174 S.E.2d 318 (W.Va. 1970), invalidated a mineral lease made in 1962 by the state director of natural resources. The legislature had in 1961 vested title to state land in the Public Land Corporation, of which the natural resources director was secretary, and the corporation had not ratified the lease. The court declined an invitation to uphold the lease on the basis of a general statute allowing the director to execute contracts and agreements in the name of the state.

Another instructive case is Central Advertising Co. v. Michigan State Highway Commission, 172 N.W.2d 432 (Mich. 1969). There the highway commission attempted to place a restrictive covenant banning roadside advertising on some excess land it was selling. In the absence of any statutory authority for this covenant, the court found, its inclusion was beyond the commission's power. Again the court declined to find the requisite authority for the covenant in the statute conferring general powers on the commission.

We would conclude, then, that before Fish and Game can transfer operation of its hatcheries to an aquaculture association, either by sale or lease, the legislature must specifically authorize Fish and Game to make such a transfer. Perhaps an amendment could be proposed to AS 16.05.050(3), which would allow the commissioner to lease or sell the "hatcheries, pipe lines, rearing ponds, fishways, and other projects beneficial for the fish and game resources of the state" that the subsection now empowers him to construct.

Incidentally, if the hatcheries could be regarded as surplus property, then the Department of Administration currently has the power to dispose of them, by sale or lease, under AS 44.71.010. If, say, the FRED division were unable to operate them because of manpower shortages caused by budget constraints, the hatcheries might be properly regarded as surplus property,

Earnest Greek  
Contracts & Facilities Officer  
Department of Fish & Game  
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and disposition under AS 44.71.010 might be appropriate. When, however, the decision to transfer operations to the aquaculture associations reflects a department policy determination, invocation of AS 44.71.010 would not in our opinion be proper.

Negotiated transfer. On this question, we refer you to a May 28, 1980 informal opinion of this office, which is attached to this memorandum. While that opinion is directly concerned with disposal of surplus property under AS 44.71.010 (discussed above), the principle is the same. Competitive bidding is required only when specified by statute. Since there is no statute here mandating such bidding, a negotiated transfer is permissible. We would repeat the observation contained in the 1980 informal opinion, though: any transfer agreement (assuming that the requisite statutory authority is obtained) should state why Fish and Game believes the transfer to be in the state's best interest.

Permissible types of transfer. On this question, too, we refer you to another recent informal opinion, this one dated March 30, 1982, and dealing with the very issue of hatchery transfers. That opinion is also attached to this memorandum, and we believe answers the question you pose. In addition, we note that any transfer without compensation of the hatcheries, either as an outright grant or under a "performance purchase" agreement (automatic transfer after a number of years of successful operation by the aquaculture association), would seem to be inconsistent with AS 16.10.500-.620, the fisheries enhancement loan program. AS 16.10.510 authorizes loans (not grants) to certified aquaculture associations to construct hatcheries (under AS 16.10.375-.475). It would be difficult to square this legislative directive with a Fish and Game decision to turn over gratis to the associations hatcheries that Fish and Game built with its own funds. While the legislature has made direct appropriations to aquaculture associations (e.g., § 3, ch. 42, SLA 1982), these grants have not been specifically for the purpose of constructing hatcheries. Of course, the legislature (subject only to constitutional public interest requirements) could authorize a transfer at less than fair market value.

To sum up, then, we believe that the three hatcheries cannot at present be either sold or leased by Fish and Game, because of the lack of statutory authority for hatchery transfer. If the legislature sees fit to confer such authority, then Fish and Game will be able to lease the hatcheries or sell them for fair value to an aquaculture association with which Fish and Game



Earnest Greck  
Contracts & Facilities Officer  
Department of Fish & Game  
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has negotiated an agreement. However, the department will not be able to transfer the hatcheries at less than fair market value in the absence of specific legislative authority to do so.

Please feel free to contact us if you have additional questions.

JBG:dln

Attachments

APPENDIX B

## MEMORANDUM

State of Alaska

TO The Honorable William R. Hudson      DATE: May 28, 1980  
 Commissioner  
 Department of Administration      FILE NO: J-66-737-80

TELEPHONE NO:

FROM AVRUM M. GROSS      SUBJECT: Negotiated sale of excess  
 ATTORNEY GENERAL      or surplus housing

By:  
 Rodger W. Pegues  
 Assistant Attorney General

You have asked whether you may dispose of surplus housing to employee-residents by negotiation.

No statute requires disposal by bid, and the applicable statute, AS 44.71.010, expressly allows for disposition "on the terms [you] consider for the best interests of the state." Some record of how the chosen terms serve the best interests of the state should be a part of the file. Otherwise, there are no other requirements.

The applicable regulations, 2 AAC 20.010(a)(1), allows either a negotiated or competitive sale.

There is no constitutional requirement for a competitive sale. Such requirements as exist are to be found in the statute. Libby v. City of Dillingham, \_\_\_ P.2d \_\_\_ (Alaska Sup. Ct. Op. No. 2097, May 23, 1980). Here, it is the best interests of the state which must be served.

RWP:cb

APPENDIX C

## MEMORANDUM

State of Alaska

TO: W.I. "Bob" Palmer, Coordinator  
Office of Special Projects  
Office of the Governor

DATE: March 30, 1982

FILE NO: J66-197-82

TELEPHONE NO: 465-3600

FROM: WILSON L. CONDON  
ATTORNEY GENERAL

SUBJECT: Transfer of operation  
of state hatcheries

By: *LDavis*  
Laura L. Davis  
Assistant Attorney General

This will confirm our telephone conversation in response to your memorandum of September 9, 1981. We see no problem with the transfer of responsibility for operation of state-owned fish hatcheries to the private nonprofit aquaculture associations whose membership is directly benefitted by the hatcheries' work. However, if ownership of the hatcheries is transferred, the state must receive fair value for the facilities. If the associations are unable to purchase the facilities, the state may lease them for a nominal fee and provide that the associations shall operate and maintain them. Our opinion is based upon the following legal principles and reasoning.

The Alaska Constitution prohibits the transfer of public property except for a public purpose. Alaska Const., art. IX, § 6. Generally, this requires that the state receive fair value for property which it disposes of. The Department of Administration is by statute responsible for disposing of surplus or obsolete property on terms which are "in the best interests of the state." AS 44.71.010.

The value of a salmon hatchery is in its ability to enhance the supply of fish to be caught by commercial and sport fishermen. Since the ownership of hatchery-produced fish is not retained after they leave the hatchery, the market value of a hatchery is difficult to determine. The establishment of a hatchery serves a public purpose by supporting both commercial and recreational fishing in the state. See Wright v. City of Palmer, 468 P.2d 326 (Alaska 1970), holding that encouraging industrial development is a public purpose. As a hatchery becomes productive, its economic benefit is realized directly by fishermen. In transferring responsibility for a hatchery to the people directly benefitted, the public purpose clause requires that the state obtain terms which recover as much of the public contribution as is reasonable under the circumstances.

We conclude that a simple transfer of ownership without compensation to the state would be suspect. If ownership

is transferred, the state should receive reasonable compensation for its costs. As an alternative, a lease of the hatchery for a nominal fee with the lessee paying for operation and maintenance and indemnifying the state from liability for any harm arising from operation of the hatchery would be consistent with the public purpose clause. See Lien v. City of Ketchikan, 383 P.2d 721 (Alaska 1963), regarding a similar lease of a public hospital to a nonprofit corporation.

We note that the general obligation bonds which were issued to pay for the hatcheries do not require the state to continue ownership or operation of the hatcheries. 1974 Alaska Sess. L., ch. 133; 1976 Alaska Sess. L., ch. 214; 1978 Alaska Sess. L., ch. 140; 1980 Alaska Sess. L., ch. 91. However, the money received from those bond issues may not be spent for any other purpose without an appropriation. There is a legal question as to whether money received from a bond issue but not spent for the purposes for which the bonds were authorized may be reappropriated for another public purpose or must be used to redeem the bonds. We will defer addressing this question until it is directly presented. We hope that this answers your questions.

LLD/pjg

cc: Hon. Jim Duncan  
House of Representatives

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