Development of the Pink Salmon Enhancement Program in Prince William Sound, Alaska

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Program Conception

Rationale

The rationale for undertaking an ambitious pink salmon enhancement program in Prince William Sound is described in *Salmon Culture Program* by the Prince William Sound Aquaculture Corporation.[1] The primary author of this prospectus, Wally Noerenberg, identifies the following four reasons for utilizing salmon ranching technology to enhance the existing fishery.

1. A declining trend in fisheries production over the last 30 years (the period 1940-1970) and the high degree of interannual variability in returns of adult pink salmon to Prince William Sound. "Randomly strong, moderate, or weak annual salmon returns must be dealt with in an effort to obtain a reasonable catch share."
2. Real or potential habitat loss due to natural events such as the 1964 earthquake and emerging area use conflicts with other industries such as oil and gas, timber, and recreation. "With Prince William Sound emerging as a focal point for transportation of North Slope oil and gas, for major offshore oil and gas development, for increased timber production and recreational use by adjacent large population centers, lessening of the productive capability of the natural fish environments appears inevitable."
3. The fishery is a significant factor in the long range economies of local communities such as Cordova, Whittier, Valdez and the Native communities of Tatitlek and Chenega. At the low levels of returns that existed at the time of the development of the enhancement program, "substantial economic dependence upon the fishery has become nearly impossible."
4. "The increasing world demand for protein supplies require that

> major production zones, such as the Prince William Sound area fisheries represent, be brought to and maintained at maximum production levels."

Private Non-profit Concept

The decision by the State of Alaska to enter into a fishery rehabilitation program in the early 1970s was a response to years of declining salmon returns. The concept of a private non-profit (PNP) fishery enhancement program was intended to make the public (i.e. the resource users) active participants in this rehabilitation program. The president of the Prince William Sound Aquaculture Corporation (PWSAC), Armin Koernig, stated in *Salmon Culture Program*:

> Participation in the rehabilitation program by fisherman, processing industry and communities will bring a noticeable change in Alaskan fisheries, i.e. from a "managed public" to a responsive, knowledgeable, actively participating public which is willing to share the responsibility for our public fisheries resources.

The PNP concept, as opposed to the private for profit hatchery concept in Oregon and California, was intended to maintain the Alaskan philosophy of public ownership of natural resources. Koernig states:

> The non-profit concept is to serve everyone who fishes in the common property fishery and to assist the state in a common effort to rehabilitate our depressed fisheries.

Enabling Legislation

The legal basis for the PNP program is the Private Salmon Hatchery Act of the 1974 Alaska State Legislature, AS 16.10.400-470. This legislation says in part:

> It is the intent of this act to authorize the private ownership of salmon hatcheries by qualified non-profit corporations for the purpose of contributing, by artificial means, to the rehabilitation of the state's depleted and depressed salmon fishery. The program shall be operated without adversely affecting natural stocks of fish in the state and under a policy of management which allows reasonable segregation of returning hatchery-reared salmon from naturally occurring stocks.[2]

This Private Hatchery Salmon Act also provides for the formation of "regional associations." As a regional association a PNP must be composed of representatives of all interested user groups and possess a board of directors "which includes no less than one representative of each user group that belongs to the association." The concept of a regional association supports the idea of an "actively participating public" and a program that "is to serve everyone who fishes in the common property fishery."

During the winter of 1974-1975 users of the fishery in Prince William Sound including commercial fishing groups, fish processors, local city governments, and Native corporations formed a regional non-profit association, the Prince William Sound Aquaculture Corporation (PWSAC).

Past and Present Pink Salmon Production in Prince William Sound

Growth of Pink Salmon Hatcheries in Prince William Sound

In the prospectus *Salmon Culture Program* a target level of hatchery capacity of 300 million salmon eggs was set. Based on assumptions of survival to various life stages an annual average adult return of 5 million salmon was expected. With the average wild salmon return of 4 million and the expected hatchery production of 5 million, a total annual return of 9 million salmon was expected to Prince William Sound. It was envisioned that PWSAC would provide about two-thirds of the production or 200 million eggs and the state or other private corporations would provide the remaining 100 million.

As the program came on line it became apparent that the fish culture technology would permit production levels much higher than the original 300 million egg concept. The location of operating pink salmon hatcheries in Prince William Sound is shown in Figure 1.

Table 1 depicts the expansion of the pink salmon hatchery program in Prince William Sound in terms of fry releases. The program began in 1975 with the conversion of a salmon cannery on Evans Island to hatchery production of pink salmon. In 1976 the first release of 1.0 million pink salmon fry occurred at the Armin F. Koernig (AFK) Hatchery, formerly Port San Juan. Releases increased annually with increased hatchery production capabilities and knowledge regarding the culture of pink salmon.

The Alaska Department of Fish and Game (ADF&G) Fisheries Rehabilitation, Enhancement and Development (FRED) division began construction of the Cannery Creek Hatchery (CCH) as a 100 million egg

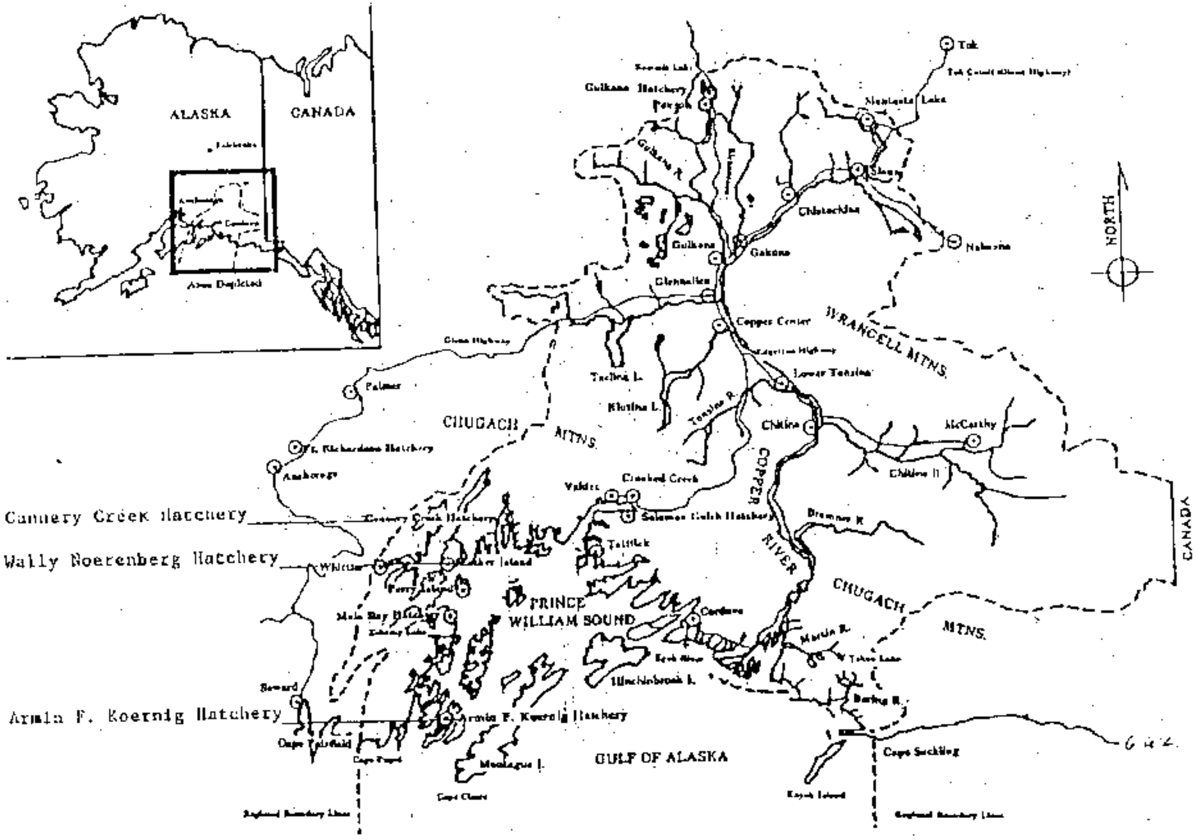

Figure 1. Map of the Prince William Sound area.

Table 1. Prince William Sound Aquaculture Corporation pink salmon fry releases.

Brd Yr	AFK	CCH	WHN	VFDA	MBH	TOTAL
1975	1,000,000					1,000,000
1976	11,010,577					11,010,577
1977	16,950,784					16,950,784
1978	22,774,739					22,774,739
1979	21,500,000					21,500,000
1980	69,787,000	21,289,000		22,000		91,098,000
1981	70,118,000	13,933,000		7,400,000		91,451,000
1982	87,384,533	22,123,000		5,400,000		114,907,533
1983	76,746,000	31,200,000		8,390,000	41,900,000	158,236,000
1984	103,531,000	36,500,000		51,280,000		191,311,000
1985	112,527,515	56,200,000	34,437,214	54,670,000		257,834,729
1986	116,117,645	42,600,000	75,932,715	59,739,413	2,130,000	296,519,773
1987	110,962,557	95,396,455	195,321,335	130,990,000		532,670,347
1988	160,471,718	59,088,345	159,920,122	128,414,000	10,518,470	518,412,655
1989	113,842,866	143,662,511	233,627,908	122,203,000		613,336,285
1990	115,748,552	141,513,625	205,728,325	130,000,000	9,235,054	602,225,556
1991	112,828,924	132,166,249	163,571,419	190,000,000		598,566,592
1992	117,000,000	139,000,000	167,000,000	207,000,000		630,000,000
1993	117,000,000	139,000,000	167,000,000	207,000,000		630,000,000
1994	117,000,000	139,000,000	167,000,000	207,000,000		630,000,000
1995	117,000,000	139,000,000	167,000,000	207,000,000		630,000,000

Data through brood year 1991 from hatchery annual reports; brood years 1992-1995 based on hatchery capacity and assumed survivals.

AFK=Armin F. Koernig Hatchery; CCH=Cannery Creek Hatchery; WNH=Wally Noerenberg Hatchery; VFDA=Valdez Fishery Development Assoc.; MBH=Main Bay Hatchery

facility in the late 1970s. Production began in 1981 with a release of 21 million pink salmon fry. ADF&G maintained operation of CCH until 1988 when falling state revenues required that some hatchery operations be contracted to the private sector. PWSAC entered into a contract with the state of Alaska in 1988 to operate CCH as a 147 million egg hatchery.

Plans for a world class multi-species salmon hatchery on Esther Island was among the original concepts for a hatchery program in Prince William Sound. By the early 1980s planning and ultimately construction began on a 300 million egg facility of which 200 million eggs would be pink salmon. The first release of 34 million pink salmon fry from the Wally Noerenberg Hatchery (WNH) occurred in 1986. Pink salmon production at WNH peaked in 1990 when over 233 million pink salmon fry were released.

As a local PNP hatchery operator, the Valdez Fisheries Development Association (VFDA) began operating the Solomon Gulch Hatchery in Valdez in 1981. Their first release of 22,000 pink salmon fry occurred in 1980. Production increased to over 130 million pink salmon fry by 1987. Currently, VFDA is capable of releasing over 200 million fry.

Current Hatchery Capacity

Table 2 defines the current hatchery capacity of pink salmon in terms of green eggs and adult returns for Prince William Sound. At the present production level of 696 million green eggs, an annual adult return of over 27 million hatchery pink salmon is expected.

Table 2. Prince William Sound Aquaculture Corporation pink salmon hatchery production levels.

Site	Green Eggs	Adult Return
AFK	126,000,000	5,700,000
CCH	152,000,000	6,100,000
WNH	188,000,000	9,000,000
VFDA	230,000,000	6,400,000
Total	696,000,000	27,200,000

AFK=Armin F. Koernig Hatchery
WNH=Wally Noerenberg Hatchery
CCH=Cannery Creek Hatchery
VFDA=Valdez Fisheries Development Assoc.

Hatchery and Wild Stock Production—Past and Present

The pink salmon hatchery program did not begin contributing significantly to the Prince William Sound fishery until the early 1980s, Table 3. Prior to that time wild pink salmon returns were highly variable and the fishery unstable. The average return of pink salmon to Prince William Sound for the 20 year period, 1960 to 1979, was 5.1 million. No seine fishery occurred in Prince William Sound in 1972 and 1974.

Table 3. Prince William Sound Aquaculture Corporation pink salmon total return summary.

Year	AFK	CCH	WNH	VFDA	MBH	All Hat	Wild	Hat + Wild
1960							3,193,223	3,193,223
1961							4,498,867	4,498,967
1961							8,762,206	8,762,206
1963							6,652,665	6,652,665
1964							6,049,124	6,049,124
1965							3,436,427	3,436,427
1966							4,122,588	4,122,588
1967							3,468,600	3,468,600
1968							3,608,678	3,608,678
1969							5,233,149	5,233,149
1970							3,789,216	3,789,216
1971							8,423,514	8,423,514
1972							695,963	695,963
1973							3,281,888	3,281,888
1974							1,406,893	1,406,893
1975							5,718,365	5,718,365
1976							3,945,255	3,945,255
1977	44,000					44,000	5,812,601	5,856,601
1978	154,620					154,620	4,049,172	4,203,792
1979	552,955					552,955	17,493,110	18,046,065
1980	1,493,489	90,300				1,583,789	14,139,808	15,723,597
1981	2,264,845	141,400				2,406,245	19,679,655	22,085,900
1982	5,134,363	764,200			35,000	5,933,563	17,122,211	23,055,774
1983	3,722,502	469,400		93,000	496,850	4,781,752	11,916,210	16,697,962
1984	2,800,000	1,139,000		200,000	1,200,000	5,339,000	21,037,567	26,276,567
1985	5,030,616	2,594,000		421,000	383,000	8,428,616	19,734,589	28,163,205
1986	4,964,000	853,000		1,240,000	232,000	7,289,000	5,482,529	12,771,529
1987	7,613,160	2,150,000	3,009,391	5,406,153	328,000	18,506,704	13,021,094	31,527,798
1988	6,076,493	227,688	3,866,618	1,057,996	100,000	11,328,795	1,765,936	13,094,731
1989	4,216,577	5,437,597	5,273,676	3,378,761	0	18,306,611	5,846,158	24,152,769
1990	6,804,001	2,505,346	13,497,258	11,019,426	500,000	34,326,031	12,410,753	46,736,784
1991	5,077,391	9,165,668	11,611,307	5,693,196	0	31,547,562	7,693,601	39,240,163
1992	2,655,200	1,706,467	2,079,068	2,121,641	0	8,562,376	2,182,294	10,744,670

Wild pink salmon return data from Alaska Department of Fish and Game annual reports for Prince William Sound. Hatchery pink salmon return data from hatchery annual reports.

AFK=Armin F. Koernig Hatchery; WNH=Wally Noerenberg Hatchery; CCH=Cannery Creek Hatchery; VFDA=Valdez Fisheries Development Association; MBH=Main Bay Hatchery

Hatchery production began increasing significantly after 1980 as the enhancement program came on line. Concurrent with this, wild pink salmon returns reached unprecedented levels, peaking at a record 21 million adults in 1984. Hatchery production peaked in 1990 at 34 million adult pink salmon. Wild stock returns for the 11 year period, 1980 to 1990, averaged 12.7 million adults or 2.4 times the previous 20 year average.

In 1992 production of both wild and hatchery pink salmon fell to 8 and 2 million adults, respectively. The exact cause of this sudden decline in performance is not known, but various investigations are, or have been, in progress gathering biological as well as oceanographic data for wild and hatchery pink salmon in Prince William Sound.

The Prince William Sound Model for Fishery Enhancement Planning

In terms of fish culture, the Prince William Sound pink salmon enhancement program has exceeded the dreams of even the most optimistic of early visionaries. As has been demonstrated, the potential exists to produce many times the pre-hatchery annual return of adult pink salmon. With this success has come a number of challenges. PWSAC in cooperation with ADF&G has developed a fishery planning program recognizing the continued health of the resource and industry is dependent upon many, sometimes opposing, goals.

Integrated Planning

Integrated enhancement planning recognizes that a viable, long term fishery is composed of three interrelated components which must be addressed concurrently. They are: (1) allocation (to all users), (2) production (of wild and hatchery salmon), and (3) resource management. This concept of program planning began in Prince William Sound in 1989.

The key to integrated enhancement planning is the accurate identification of various issues which comprise the above components. Because the PNP concept was developed to allow active public participation in the enhancement program, the public must be actively involved in the identification of issues. Ultimately, public involvement in, and support for, the enhancement program through involvement in the planning process is key to the program's success.

PWSAC Allocation Policy

As a result of the successful application of salmon culture technology, concerns and conflicts arose among the resource users. Public concern manifested itself at the 1989 Alaska Board of Fisheries meeting in Cordova, Alaska. "Numerous proposals submitted by individuals and organizations (to the Board of Fisheries) targeted congestion, gear separation, harvest redistribution and harvest opportunity as symptoms to address or solutions to resolve perceived problems."[3] However, due to the obvious complexity of issues and the unclear allocation implications, the Board of Fisheries took no action on the proposals. In addition, the Board of Fisheries chair charged PWSAC to go to its constituents for solutions.

PWSAC accepted the Board of Fisheries charge by creating the Allocation Task Force and initiating a major public process to identify, discuss, and prioritize enhanced salmon issues. Through this public process the task force members defined nine objectives relative to enhanced salmon in Prince William Sound: (1) reduce congestion in the fishery, (2) minimize impact on wild stocks, (3) promote highest possible fish quality, (4) maximize production, (5) minimize impacts to historical and traditional fisheries, (6) develop and support implementation strategies to achieve policy goal, (7) support subsistence, sport, and personal use needs, (8) encourage and support research, and (9) recognize healthy competition. These nine objectives are inherent in the PWSAC allocation policy statement:

> ...to equitably allocate enhanced salmon resources in Area E between all users through long term planning, production and dedication of financial and human resources.

Allocation of enhanced salmon to commercial fisheries is based upon the long-term historic economic balance that existed since statehood and prior to significant hatchery returns, as determined by ADF&G ex-vessel value records.

PWSAC Production Planning Committee

In June, 1990, the PWSAC board of directors approved the formation of a Production Planning Committee to develop a production plan that "will provide PWSAC management direction needed to produce and release salmon to achieve the corporate allocation goal and fishery objectives which include the development of an economically feasible fishery employing increased production, remote releases, species diversification, and run timing selection."[4] The committee was selected from

PWSAC board members and the public guided by the criteria that members be committed to the process, be willing to attend meetings, and be knowledgeable of the salmon fishery and gear group interests.

The Production Planning Committee created an extensive computer model to evaluate the economic opportunities provided by various production options. Indicative of the concept of integrated planning, the committee was guided by the intent of the allocation policy. The focus was on allocation, economic development, and increased fishing opportunity while considering wild stock management, fish quality, minimal disruption to historic and traditional fisheries, and reduced congestion.

Five objectives were defined by the committee for consideration when planning production options: (1) equitably distribute enhanced salmon as defined by the allocation policy, (2) maximize value to all users, (3) maximize opportunity for all users, (4) the plan is ecologically acceptable, and (5) the plan is achievable.

The Production Planning Committee meets annually to review the past year's production; changing conditions in production; political, marketing, and allocation issues; and to make recommendations for the production plan for the coming year. Recommendations for long term plans are due by January of each year.

Prince William Sound Salmon Management Plan

A complete enhancement plan requires that a fishery management plan be in place to define the framework for future allocation of enhanced salmon. A milestone in Alaskan fishery development occurred when the PWS Regional Planning Team, a state authorized fishery planning group consisting of ADF&G and PWSAC representatives, developed a Prince William Sound Salmon Management and Allocation Plan which was adopted by the Alaska Board of Fisheries in February, 1991.[5] As with the allocation policy, a public process was used to identify, discuss, and prioritize issues. The management plan, which ultimately gained the support of all users, defined a fishery management strategy which recognized the state's responsibility to protect wild salmon, was guided by the PWSAC allocation policy for enhanced salmon, and considered current and future production of wild and enhanced salmon.

Main Bay Hatchery Consensus Document

The Main Bay Hatchery sockeye program is indicative of PWSAC's commitment to integrated planning. Since the original Production Planning Committee document was completed, concern has been expressed within ADF&G that the development plan for Main Bay

Hatchery sockeye salmon production must be based on a knowledge of stock interactions. They urge that more time is needed to evaluate the effects of current Main Bay production in terms of fishery management and possible wild-hatchery stock interaction. In keeping with the spirit of integrated planning, the PWSAC board agreed to reconsider the Main Bay Hatchery development timeline and approved the Draft PWSAC and ADF&G Consensus Points document at their June 1992 board meeting. Seven consensus points are identified: (1) the conceptual production goal for the Main Bay Hatchery is 20 million smolt (4 million adults), (2) a 5-year evaluation program will occur at 6.5 million smolt production level, (3) future production will be determined after the 5-year evaluation program, (4) PWSAC and ADF&G will investigate options to reduce wild stock exploitation, (5) additional management staff will be needed to handle the added work load resulting from expansion, (6) periodic genetic monitoring of wild sockeye salmon populations will be required, and (7) PWSAC and ADF&G will meet annually to review data from the evaluation program.[6]

This document emphasizes the need for fishery evaluation at present sockeye production levels to address the management and biological concerns prior to proceeding with further production. The timeline for Main Bay Hatchery development has been necessarily lengthened by the need for more data to make wise production decisions for the future.

Summary

The Prince William Sound private non-profit pink salmon enhancement program began in the mid 1970s to reverse the trend of declining local fish runs. The concept of private non-profit enhancement was developed to allow active public involvement in the rehabilitation of the fishery resource. This concept was supported by the state of Alaska through the passage of the Private Non-Profit Hatchery Act of 1974. Currently, the enhancement program in Prince William Sound has the potential to produce approximately 27.2 million pink salmon annually.

In terms of fish culture, the Prince William Sound enhancement program exceeded all expectations. However, it became apparent as the program demonstrated its full potential in the late 1980s, that continued success would depend upon much more than quality fish culture. PWSAC, in cooperation with ADF&G, has developed the Integrated Enhancement Planning process. This process recognizes the continued health of the resource and industry is dependent upon the identification, through public involvement, of many sometimes opposing goals.

Integrated enhancement planning addresses allocation (to all users), production (of hatchery and wild salmon) and resource management. These three interrelated components must be considered in the context of various opposing goals such as maximizing production, while minimizing impact on wild salmon and assuring all users are allocated their share of the resource.

Endnotes

[1]Salmon Culture Program. Prince William Sound Aquaculture Corporation. 1975.

[2]Alaska Statutes and Regulations for Private Nonprofit Salmon Hatcheries. Alaska Department of Fish and Game. 1986.

[3]Enchanced Salmon Allocation Task Force Report Number Six. Prince William Sound Aquaculture Corporation. 1990.

[4]Production and Planning Committee Recommendations to the Board. Prince William Sound Aquaculture Corporation. 1991.

[5]Prince William Sound Management and Salmon Enhancement and Allocation Plan. Prince William Sound Aquaculture Corporation. 1991.

[6]PWSAC and ADF&G Consensus Points for the Main Bay Hatchery Program—Draft. Prince William Sound Aquaculture Corporation. 1992.