RPWG
V

IMPACTS UPON FISHERIES OF PRINCE WILLIAM SOUND AND NEARBY WATERS CAUSED BY THE EXXON VALDEZ OIL SPILL

Written Testimony of

Kenneth Adams
Cordova District
Fishermens United

Presented to:

The House Interior Subcommittee on Water, Power and Offshore Energy Resources

Valdez, Alaska
May 7, 1989

A. INTRODUCTION

"The Prince William Sound (P.W.S.) Region encompasses 38,000 square miles. Natural resources of economic importance are abundant and include fisheries, wildlife, timber and minerals. The Region is comprised of three geographic entities: Prince William Sound drainages and estuary, the Copper River drainage and estuary and the Bering River drainage and estuary. Prince William Sound is a relatively deep, island studded embayment. The Copper River is Alaska's fifth largest river and drains large portions of interior Alaska as well as Canada. Its headwaters are heavily glaciated. The Bering River is a relatively short river, draining the Bering Glacier." (Comprehensive salmon plan)

There are five species of Pacific salmon (genus Oncorhynchus) to be found in these waters: pink (humpback), chum (dog), coho (silver), red (sockeye) and king (Chinook). It is upon this salmon resource that the economy of Cordova and to a lesser degree, the cities of Seward, Whittier, Homer and Valdez also depend. Total Prince William Sound fishery products were valued at 84 milliion dollars in 1988 and approximately 70 million of this total was due to salmon landings.

Cordova was ranked eighth among the nation's fishing ports on the basis of value of landings.

All salmon fishing in this region is closely managed by the Alaska Department of Fish and Game (A.D.F. & G.) and participation is restricted by the Commercial Fisheries Entry Commission (C.F.E.C.). A fisherman must own a limited entry permit analogous to a liquor or other business license. At present, there are three distinct salmon gear types in operation in this region and the following represents the numbers of permits fished in 1988 for each type: set gillnet (28 permits), drift gillnet (525), and purse seine (225 permits).

Basically, drift gillnet fisheries occur on the Copper and Bering Rivers where harvests of king and red salmon occur in the spring and coho salmon in the fall. This is a fishery that targets on the higher valued, relatively larger and less abundant species of salmon. There are no seining nor set gillnet fisheries in these areas.

Within Prince William Sound in contrast, all 3 gear types occur. Drift and set gillnet fisheries which target on red and chum salmon typically commence about June 20th and may proceed until September. These gillnet fisheries are confined to specific areas of Prince William Sound. Formerly, most gillnetters didn't harvest pink salmon but

there is a very definite trend toward harvest of pinks nowadays as the value of that species continues to increase.

The purse seine fishery targets mainly upon the abundant and relatively lower priced pink salmon which begin to arrive into Prince William Sound enroute to their natal streams for spawning as early as the end of June and will continue until about the end of the first week in September. Chum, red and coho salmon are also taken by seiners and the numbers taken increase annually, reflecting the enhancement successes of the Sound's hatchery programs.

Second only to salmon in value of product, herring are also harvested in Prince William Sound. The combined value of the 5 distinct herring fisheries was approximately 12 million dollars in 1988. The bulk of harvestable herring biomass is taken during the month of April and can be divided into 2 sac roe fisheries (sac roe refers to the mass of eggs within the females) and 2 roe on kelp fisheries, the products of which can contain kelp of several species covered with heavy, ideally uniform, layers of herring eggs. Roe on kelp fisheries products are harvested after the fish spawn while sac roe fisheries occur prior to spawning. An additional seine fishery occurs in late fall which harvests herring for bait and food purposes.

Next in order of economic importance is the winter tanner crab fishery. In 1988, 1.1 million dollars of tanners or "snow crab" were harvested during the month of January. Due to a marginal population size, this fishery was closed to fishing in January, 1989.

The last fishery of economic significance in Prince William Sound is the shrimp pot fishery worth a total of about $500,000 in 1988. The ADF& G has established a spring and fall fishery and set a harvestable quota. Approximately 80, mostly small boats, participate in this fishery.

In addition to the above, there are also landings of grey or Pacific Cod, rockfish and black cod in Prince William Sound, but the value of these landings is relatively insignificant.

At this time, it is well to note the emergence of a new fishing industry in Prince William Sound. Oyster mariculture has begun and three farms are presently established. The first harvestable crop was to have been delivered to market this summer, but their plans have been brought to a halt as a consequence of the Exxon Valdez spill. Additional discussion of that industry's problems will be presented later on.

In overview, Prince Willliam Sound clearly stands out by virtue of the strength of its salmon fisheries. There

are an estimated 800-900 anadromous wild stock spawning streams in Prince William Sound, primarily for pink salmon, but also for chums and red. These streams were forecasted by ADF & G to produce a harvest of greater than 18 million salmon in 1988 alone (not to mention the harvestable contribution of the PWS hatcheries!), but fish production from wild stock fish has not occured with regularity. These streams are exposed to sometimes severe environmental factors such as hard winter freezes, which can kill the young salmon burrowed down into the spawning stream's gravel or the earlier spawned eggs could be flushed out by heavy rains in autumn. To moderate these environmental perturbations, the hatchery enhancement program was begun in 1974. A discussion of the now extremely successful hatchery program in Prince William Sound will follow.

B PRINCE WILLIAM SOUND HATCHERY SYSTEM

Hatcheries are very important components of the Prince William Sound salmon production system. Prince William Sound is one of the largest pink salmon producing areas in the world: the Sound harvests for the last two years have averaged 50% of the state-wide pink harvest. This summer, the Department of Fish and Game predicts a Prince William Sound harvest of 46 million pink salmon, the largest on record, and more than half of the statewide pink salmon projections.

Of that 46-million harvest, over half will be pink salmon produced by the hatchery system in Prince William Sound. Prior to the oil spill, the ex-vessel value of hatchery-produced salmon was expected to be about $50 million.

Fishermen - during the recent battle against the spreading oil - defended successfully and as their highest priority marine waters near all hatcheries and other sensitive wild stream salmon producers.

No hatchery existed in Prince William Sound prior to 1975.

During the early 1970's salmon runs statewide had declined to an alltime low. Wild salmon runs had been decimated by adverse environmental conditions aggravated in part by past practices of overexploitation. In Prince William Sound the years 1972 and 1974 produced unfishable low returns.

The state of Alaska under the leadership of Governor Egan, and from 1974 to 1982 of Governor Hammond, and with a farsighted and productive Legislature, embarked on a major effort directed at restoration of the Alaska salmon fisheries. The Fisheries Rehabilitation, Enhancement and Development (FRED) Division was created within the Alaska Department of Fish and Game in 1971, and a constitutional amendment provided the basis for Limited Entry legislation for commercial salmon fisheries and for passage of the private non-profit Hatchery Act in 1974.

A group of commercial fishermen in Cordova initiated the formation of Prince William Sound Aquaculture Corporation (PWSAC) in December, 1974. Recognizing the formidable size of the job ahead and the importance of its success to various user groups, industries and communities, they chose to organize under a regional concept. They provided board seats for representatives of commercial, subsistence, sport and personal use fisheries, for fish processors, Prince William Sound communities and the Native village and regional corporations of this area.

The State adopted this user group structure in a 1976 amendment to the private non-profit hatchery statutes.

Today, besides "regular" PNP hatchery operators, seven regional aquaculture associations from Southeast Alaska to Kodiak produce salmon for common property fisheries.

Within 14 years, six major hatcheries were built in Prince William Sound, broodstocks taken from local salmon populations, and the system brought to near full capacities, approaching 3/4 billion fry and smolt production of all five species of Pacific salmon.

These hatcheries are:

Gulkana Springs	upper Copper River, owned and operated by the State
Main Bay	PWS, owned and operated by the State
Cannery Creek	PWS, owned by the State and operated by PWSAC
Armin F. Koernig	Port San Juan, PWS, owned and operated by PWSAC
Esther Island	PWS, owned and operated by PWSAC
Solomon Gulch	Valdez, PWS, owned and operated by Valdez Fisheries Development Association

All of these hatcheries are actually "ocean ranches," incubating pink and chum salmon to the fry stage within about eight months and incubating and freshwater rearing king, coho and sockeye to smolt stage over a 20-month period. The fry and smolt are then released into the estuaries to graze the "ocean pastures" on their lifecycle migration routes before coming back to their place of origin, these hatcheries in Prince William Sound.

Whereas State owned and operated facilities are supported by the State General Fund, private non-profit hatcheries receive their funding from a State Enhancement Loan Fund provided for capital construction and start-up operations, from sales of a portion of returning hatchery fish, and in the case of the regional associations, from a self-imposed tax of commercial salmon fishermen - 2% of the gross in PWS.

Private hatchery companies in Alaska make no profits. By design and statutes they are allowed to recover operating and capital expenses and associated costs for research and development, expanding the production system including wild stock rehabilitation work and other tasks of regional associations. The system is designed to provide benefits to the common property resource users and not for the hatchery companies themselves.

The objective for distribution of the adult returns between hatchery operators and common property fisheries is a minimum of 70% to common property fisheries and a maximum of

30% for brood stock and cost recovery sales fish to hatchery operators. State facilities at present only recover fish needed for brood stock. At PWSAC, 80% of the operating revenues presently come from the sales of hatchery fish, and 20% from the enhancement tax.

The major objectives of the PWS hatchery system are: to increase and stabilize catches of all species meeting the current and future needs of commercial, subsistence, sport and personal use fisheries as they exist or develop; to ensure that no annual salmon runs will be unfishable, and that desired species are provided in desired places and at desired times for the benefit of all user groups; and to produce high quality seafood for expanding world markets.

To achieve the objectives of the Prince William Sound hatchery system many prerequisites to success must be recognized, met and maintained. Some of these prerequisites are:

** cohesive participation of the user groups during program development in political and economic theaters

** protection of basic environmental qualities necessary for fish production while other resources are developed in the area

** application of leading edge technologies in fish culture, including genetic monitoring and disease control, basic and applied research activities to cover the biological spectrum of salmon life-cycles

**application of management strategies during harvest of adult returns to achieve preservation and health of wild stocks while making harvestable surpluses to escapement needed for both hatchery and wild systems available to the various fisheries in a manner to satisfy high quality market demands and to achieve user group satisfaction

** recognition of carrying capacities of estuarine, inshore and offshore ocean pastures within existing ecosystems

** to maintain economic and financial feasibility by balancing operational and capital cost with magnitude and value of adult fish production

** last mentioned but foremost to all the above prerequisites to success, the necessity to maintain highest quality of fresh and marine waters

From ground zero, the State together with the private sector - on the way to the described goals - have built world-class facilities in Prince William Sound which in conjunction with the many streams and lakes in the region produce all five

species of salmon in increasing abundance for the benefit of multiple user groups, support industries and communities.

A major role could be assigned to the PWS hatchery system, employing rehabilitation and enhancement strategies in an effort to mitigate adverse impacts by the oil spill.

To assist in the natural process of regeneration, fisheries pressure on impacted wild streams will have to be reduced by closures over any necessary length of time. Possible restocking of damaged systems could be achieved via use of incubation facilities.

To offset longterm losses that may be suffered by user groups during this time of recovery, investments in the expansion and versatility of the PWS hatchery system could bring substantial economic relief to fisheries user groups during this time of healing.

The attached statistics demonstrate productivity to date, and the projected magnitude of future returns to the existing hatchery system.

C. SHORT TERM IMPACTS ON PWS FISHERIES CREATED BY THE EXXON VALDEZ OIL SPILL.

Almost immediately after the oil spill, the spring pot shrimp and black cod fisheries in Prince William Sound were closed and shortly afterwards, all spring herring fisheries were likewise closed. The concern of both ADF&G and fishermen was to maintain the stable and previously healthy herring biomass, which this year was estimated at 54,000 tons. Because herring traditionally spawn in the same areas and some of these areas were heavily oiled, subjecting the biomass to the additional stress of a harvest appeared unjustifiable, especially in view of the uncertainty of the effect of exposure of adults and spawn to crude oil hydrocarbons. Health of the resource in succeeding years is a desire of all fishermen. Exxon has stated they will compensate fishermen for the value of our lost fisheries and it has been reported that payments have recently been received by some individuals for this year's herring pounding fishery.

The status of our salmon fisheries is currently the subject of much discussion. The gillnet fisheries in the Copper and Bering River districts are expected to occur as in normal years, but the Prince William Sound fisheries will definitely not occur in the normal manner. Meetings of a group called the "PWS Salmon Harvest Task Force" are underway with the goal of establishing contingency plans for salmon fisheries. Fishermen are represented at these meetings by the Cordova District Fishermen United (C.D.F.U.), the Prince William Sound Seiner's Association and other members of the fishing community.

Representatives of the fish processors are also present and Mr. James Brady, area management biologist for the ADF&G chairs these meetings and is a non-voting member. We are also working closely with the Alaska Department of Environmental Conservation (D.E.C.), through its seafood inspection program to insure that no oil contaminated fishery product will be allowed to be harvested or marketed.

Basically, we must address the problem of how to harvest uncontaminated salmon from the biggest forecasted return in the history of Prince William Sound fisheries. A discussion of specific problems and possible solutions follows.

First. A large number of fishing vessels has responded to the general oil spill clean up effort and have become oiled themselves. The vessels need to be cleaned, inspected and certified by the D.E.C. prior to involvement in any fisheries operation. Boat cleaning stations are currently being developed, but this has been a slow process.

Another concern we have is that the cleaning stations themselves will have negative environmental impacts and, for this reason, it has been suggested that cleaning stations be established in Prince William Sound areas which have already sustained oil damage and do not pose any additional threats to our fisheries, etc. There has been no action along these lines yet.

Second Large areas of Prince William Sound have been oil impacted and will be closed to fishing. Most likely, the Southwest, Montague, Main Bay/Eshamy and Nellie Juan districts as well as Culross and Perry Islands will be closed. This reduction in area presents problems. About 30% of the Prince William Sound wild stock streams occur in the "off limits" areas. Consequently, fishermen will be unable to harvest these fish even if they are uncontaminated. Further, fishermen will be more heavily concentrated in Prince William Sound in areas which are not oil impacted and are open for fishing. It has been estimated that 50% of Prince William Sound is clean and may be fished. The concentration of vessels, however, poses the probability of conflicts, particularly in those areas where drift gillnet and seine can be used simultaneously.

At present, two harvest strategies are being discussed: to allow the normal, competitive style of fishery to occur or develop a cooperative fishery and come to some agreement as to how the proceeds will be distributed among the fishermen. This co-op concept presents some formidable obstacles not only to fishermen, but to processors, also. The co-op concept, at this time, is receiving favorable attention. It is very likely the Main Bay/Eshamy combined set and drift gillnet fisheries will be closed and a co-op fishery be held there to harvest the 250,000 chum salmon returning to the Main Bay hatchery, but it remains to be seen if this concept will be adopted for the general seine-gillnet pink salmon fishery in Prince William Sound.

Third Seepage of oil from impacted beaches will most likely continue to release oil sheen due to the fluctuations of tidal levels and also to rain runoff down the beaches. Further, the refloating of beach debris, including rock week, sea grasses and kelp, etc. will present additional problems. These materials accumulate on the water surface and respond to wind, waves and currents. They can conceivably be distributed throughout the Sound. Drifting debris and sheen present contamination threats to our boats and gear. Our nets are 150 fathoms long (900 ft.) and are at risk. Restriction of fishing to clean areas is the obvious first step to take, but we must address the decontamination of gear--by cleaning--as a practical, realistic solution to this problem. Replacement of gear is expensive and impractical. Seines are not "off the shelf"

items, but are expensive ($10,000 to $15,000) and tailor made to suit the boat. This problem of gear decontamination has not been adequately addressed yet.

Fourth The problem of a "soft" market with consequent lowering of Prince William Sound seafood values is yet another problem confronting us. It has both short and long term aspects.

From the beginning, we must assure that only top grade fish are harvested and delivered. We must regain our former status as producers of only the highest quality seafood. The Alaska Seafood Marketing Institute (ASMI) must do their part in correcting the bad market image of Prince William Sound seafood and we, as fishermen, must do our part by only delivering highest quality fish.

D. LONG-TERM IMPACTS ON PWS FISHERIES CREATED BY THE EXXON VALDEZ SPILL

Comments made regarding short term market problems apply here equally. Basically, we will have to work to regain the consumer's confidence that our seafood products are pure. This can be done over time, even if we have to harvest our fish in small, closely regulated areas--perhaps for seasons beyond this immediate 1989 season. Only time will tell. Likewise, time will tell what the rate of recovery of the now-contaminated portion of Prince William Sound will be and there are a number of fishery and general environmental concerns I would like to address at this time.

First, let us look at pink salmon. Some spawning streams have been heavily oiled, especially in the Southwest district and oil has penetrated into the gravel in which fish used to spawn. When will these streams recover and be able to accomodate spawning adults? We don't know.

Further, with expected continued leaching of oil residues into the water, will the homing behavior of returning adult salmon be upset? A study done by Martin, et al. (1989) suggests this may be possible. We may have at least a behavioral problem here but morphological problems associated with exposure to the hydrocarbon benzene have been observed in juvenile pink salmon by Babcock (1984). She observed changes in olfactory rosette histology. Have pink salmon fry released in Prnce William Sound been exposed to potentially damaging water soluble crude oil fractions which might also produce olfactory morphological changes? Is there a possible alteration of the pink salmon "homing" apparatus? This subject should receive research attention and it is not clear at this time if this is so.

There is also the threat of direct mortality and other problems of susceptibility to crude oil that need to be look

into. Rice, et al. (1975) observed that out migrating pink fry were quite susceptible to crude oil. Wild stock pink fry were emerging from the gravel in heavily oil-impacted areas during the latter part of the month of April. We don't know how they or the hatchery-released fry will fare as they run through oil-contaminated waters.

Another question related to salmon and exposure to crude oil concerns the food chain and effects upon the plankton. It was recently stated by Dr. Ted Cooney in the Cordova Fact Sheet (May 4) that there was no evidence of contamination of plankton by the spill. However, Dr. Cooney's remarks seem to be directed toward the large open expanses of Prince William Sound. Surprisingly, Dr. Cooney, et al. (1981) had earlier observed that pink salmon fry released from the AFK hatchery didn't frequent large open waters initially, but remained along shallow shorelines of nearby islands and coves. It seems possible that heavily oiled shores may continue to leach hydrocarbons into near shore waters. Do these fractions pose a threat to young salmon and their food sources?

Further, in the program called "Association of Primary Producers and Recruitment in a Subarctic Ecosystem" (APPRISE) which is jointly run by NMFS Auke Bay lab, University of Alaska at Fairbanks and Juneau...it has been observed that benthic crustacea, especially harpacticoid copepods are important food items in the diet of pink salmon fry. We have direct evidence that intertidal and subtidal substrates have been oiled (these observations have been made by the D.E.C.). It remains to be seen what effect this oiling will have upon benthic copepods and other crustecea. Can we expect food chain linked biological magnifications of contaminants in host organisms?

Let's change species and focus on tanner crabs. We have an established tanner crab fishery on Montague Strait. This body of water has been one of the main routes for oil exiting Prince William Sound. Has oil sunk to the 100+ fathom depths and contaminated bottom sediments as has been observed in shallow waters? (Oil contaminated sediments have been observed even within Sawmill Bay on Evans Island, the site of the AFK hatchery.) Karinen and Rice (1974) noted that tanner crabs were susceptible during moult to crude oil and tended to autotomize limbs in the laboratory. Could there be similar effects on tanner crabs and other benthic life in Prince William Sound?

Further, and with particular reference to the newly emerging oyster mariculture industry in Prince William Sound, Berthou, et al. (1987) observed abnormalities in oysters even seven years following the Amoco Cadiz crude oil spill in 1978 along the Brittany Coast of France.

Aside from oyster growers, other organisms relying on mollusks for food might also suffer long term contamination threats...Calkins (1978) observed that mollusks were important items in the diet of sea otters. There is also evidence that bottom dwelling flat fish can also become contaminated and exhibit long term oil-related effects (Haensly, et al., 1982) Does this have relevance for Prince William Sound rockfish, halibut and other bottom fish?

So, there is evidence of long term negative effects from exposure to crude oil spills. Clearly, we need to be cautious and avoid statements that our environment is quickly healing and that all will soon be well. Our Prince William Sound environment demands the best attention to reclaim the residual surface oil and realistic beach clean-up efforts. Of course, continued scientific study must be provided so we can determine the full impact of the spill. What we can do beyond this to aid the restoration of our Prince William Sound environment is unknown.

What we must do, however, is direct our energies toward <u>prevention</u> of this ever happening again...in Prince William Sound or elsewhere. We must make adequate, safeguarding, environmentally aware legislation. It is not only Prince William Sound that is threatened in the future, but every bit of coastline in the country. Until the oil industry can be regulated in an environmentally sound manner, the environments in which we recreate, work and live our lives will be in jeopardy. We must take political action to insure this protection comes to pass.

BIBLIOGRAPHY

Babcock, M. 1984
Morphology of olfactory epithelium of pink salmon Oncorhynchus gorbuscha and changes following exposure to benzene: a scanning electron microscope study. In Gray, J. and M. Christiansen (Ed.) Marine Biology of polar regions and effects of stress on marine organisms.
John Wiley and Sons. London.

Berthou, F., G. Balouet, G. Bodennec, and M. Marchand, 1987
The occurrence of hydrocarbons and histopathological abnormalities in oysters for seven years following the wreck of the Amoco Cadiz in Brittany (France)
Marine Environ. Res. 23:103-133.

Calkins, D., 1978
Feeding behavior and major prey species of the sea otter Enhydra lutris, in Montague Strait, Prince William Sound, Alaska.
Fishery Bull. 76:125-131.

Cooney, R. T., D. Urquhart, and D. Barnard, 1981
The Behavior, Feeding biology and growth of hatchery-released pink and chum salmon fry in Prince William Sound, Alaska.
AK Sea Grant Rept. 81-5, 114 P.

Haensly, W., J. Neff, J. Sharp, A. Morris, M. Bedgood and P. Boem, 1982.
Histopathology of Pleunonectes plotessa L. from Aber Wrac'h and Aber Benoit, Brittany, France: long term effect of the Amoco Cadiz crude oil spill.
Jour. Fish Disease 5: 365-391

Karinen, J. and S. Rice, 1974
Effects of Prudhoe Bay crude oil on moulting Tanner crabs, Chionoecetes bairdi.
Mor. Fish. Rev. 36:31-37

Martin, D., D. Austin, C. Whitmus, L. Brocklehurst, and A. Nevissi, 1989
Response of a migrating adult pink salmon to a simulated oil spill.
Unpublished report.

Prince William Sound - Copper River Comprehensive Salmon Plan. PWS Planning Team, 1983. 176 p.

Rice, S., D. Moles and J. Short, 1975.
The effects of Prudhoe Bay crude oil on survival and growth of eggs, alevins, and fry of pink salmon Oncorhynchus gorbuscha. In: Conf. on Prevention and Control of Oil Pollution, proc. pp. 503-507.
Amer. Petrol. Institute.

SHELLFISH MARICULTURE IN PRINCE WILLIAM SOUND

History:

Private, for profit shellfish mariculture in P.W.S. is in its infancy. See attached information from Etolin Island Pilot Study which provides general/legislative history.

UNDERSEA FARMS is a family-owned oyster mariculture operation located in Deep Bay, approx. 3.5 miles northwest of Cordova. We also have oyster stocks at a secondary site located around Salmo Point on the back side of Hawkins Island. Like many of the aquatic farmers in Alaska, we are not a giant corporation, with many investors, etc. This is a privately owned farm. We have received a small rural development loan through C.E.D.C. (Community Enterprise Development Corp. of Anchorage), otherwise all funding for this operation has come from money earned as a herring roe on kelp pound fisherman.

We began business in 1986, spent approximately 1 and 1/2 years obtaining permits, etc. and planted our first oyster spat in Spring, 1987.

We currently have approx. 700,000 oysters in the water. Planting schedule for late June, 1989 is for placement of 500,000 spat. (Spat must be ordered one year in advance--our supplier is Westcott Bay SeaFarms, of Friday Harbor, WA. By July, 1989, we will have over one million oysters in stock. According to Mike Kaill (Mariculture Coordinator for State of Alaska Dept. Fish/Game (F.R.E.D.), our farm is the largest commercially viable for profit operation in the State.

The growth of our business has been an uphill battle--not for the oysters, they are growing ahead of schedule! But, it has been a battle in terms of permitting, obtaining information, Federal/State agency miscommunications, etc. Regulatory agencies are still designing systems for dealing with shellfish mariculture. We have volunteered our time and funds (the legislature has yet to appropriate money to accompany the most recent mariculture bill it passed) in order to help agencies design effective systems for dealing with shellfish mariculture. Even before the spill, agencies have been understaffed for dealing with shellfish growers; since the spill, we wonder if they remember that this industry exists.

There are two other primary oyster growers in P.W.S. On Fairmont Island, there is an operation with about 600,000 oysters (some are market ready). Another small operation with approx. 30,000 18 month-old oysters is located on Perry Island. There are also mussel growers to the west in Seldovia and Halibut Cove.

UNDERSEA FARMS has oysters which are market size, and immediately prior to the spill we had stepped up our bacteriological test (P.S.P., fecal coliform, etc.) program in order to prep the oysters for marketing. We had hoped to have our first sales in late June/July, 1989.

Markets identified were interested in handling our gourmet quality oysters for the half-shell market. A primary marketing/pricing strategy was to supply the trade and consumers with a year-round supply of oysters from the "Pristine Waters of P.W.S."--on 5/2/89, we talked with Buyer who said "product is polluted in the eyes of the consumer"--he is not interested in selling our product at this time and is also concerned regarding the liability issue.

Steps We've Taken Since The Spill

(This is not a complete list--see ledger for complete info.)

1. 3/25/89; ordered boom from Unitec to protect stocks we had at Fairmont (we had approx. 34 stacks of 10 at this other grower's site)...boom ordered same day as PWSAC ordered and our boom lost in shuffle...

2. 3/26/89; went to Fairmont to move oysters from there back to Deep Bay.

3. 4/2/89; with help of City of Cordova, we got boom to protect Deep Bay site. On 4/3/89, we boomed off second site (Salmo Point).

4. From 4/2/89 to present; kept contacting various agencies, etc. to make aware of mariculture sites in Sound--FINALLY reached Exxon consultants DAMES AND MOORE on 5/1/89 and they might be interested in FIELD studies of sites in Sound. NOAA/NMFS team began assessments on oyster sites in Sound with our assistance on 4/13 and 4/14.

5. 4/15/89; (see map) Wendell Jones (pilot) observed sheen by site #2--also documented by Troy Tirrell and Andy Wills from gillnetter...see map...???ballast water sheen from Knowles Head tankers?

MAJOR PRINCE WILLIAM SOUND FISHERIES VALUES

	1985	1986	1987	1988	1989 Projection
SALMON	47,250,623	28,873,965	72,367,497	72,330,910	168,098,479
Herring	5,838,772	10,216,512	7,864,235	10,518,661	13,156,000
TANNER CRAB		609,959	685,770	1,100,000	CLOSED FISHERY
POT SHRIMP		711,282	681,289	510,000	

PRINCE WILLIAM SOUND SALMON FISHERIES

TOTAL VALUE OF LANDINGS

	1985		1986		1987		1988	
	Lbs.	$	Lbs.	$	Lbs.	$	Lbs.	$
SEINE	91,479,611	$23,132,557	44,202,510	$11,649,907	100,215,572	$44,960,323	37,054,374	$33,922,44
DRIFT GILL NET	23,641,831	$24,051,015	14,652,336	$17,174,657	18,409,358	$27,054,623	21,700,799	$36,848,15
SET GILL NET	158,786	$71,438	198,323	$51,502	709,212	$355,038	1,397,015	$1,560,31
TOTAL LBS.	115,280,228		59,053,169		119,334,142		60,152,188	
TOTAL $		$47,255,010		$28,876,128		$72,369,984		$72,330,91

TANNER CRAB

	1985	1986	1987	1988
LARGE BOAT	NA	609,959	685,770	1,100,000
SMALL BOAT	NA	NA	507,324	COMBINED
TOTAL		609,959	1,193,094	1,100,000

KING CRAB

no data

DUNGENESS

outside fishery

SHRIMP

	1985	1986	1987	1988
LARGE BOAT	NA	57,529	48,667	NA
SMALL BOAT	NA	711,282	681,289	510,000
TOTAL		768,811	729,956	510,000

PRINCE WILLIAM SOUND HERRING FISHERIES TOTAL VALUES
OF LANDINGS

HERRING	1985	1986	1987	1988	1989
FOOD/BAIT	101,821	529,282	290,207	NA	440,000
SAC ROE SEINE	4,816,005	7,986,031	4,930,462	5,937,352	6,275,000
SAC ROE GILLNET	296,766	383,098	509,803	456,278	367,000
SPAWN ON WILD KELP	54,239	162,229	297,583	293,062	324,000
SPAWN ON POUND KELP	569,941	1,155,872	1,836,180	3,831,969	5,750,000
TOTAL	5,838,771	10,216,512	7,864,235	10,518,661	13,156,000

Table 1. Forecasted common property harvest of salmon for Prince William Sound and the Copper and Bering River Districts, 1989.

	Harvest Point Estimate	Harvest Forecast Range	
		Lower	Upper
PINK SALMON			
Wild Stocks	18,750,000	12,100,000	-32,050,000
Hatchery Stocks			
Solomon Gulch	4,970,000	3,660,000	- 6,280,000
Cannery Creek	3,520,000	2,570,000	- 4,460,000
Armin F. Koernig	4,240,000	3,120,000	- 5,350,000
Esther Island	7,810,000	5,970,000	- 9,740,000
Wild + Hatchery	39,290,000	27,420,000	-57,880,000
CHUM SALMON			
Wild Stocks	566,500	0	- 1,176,500
Hatchery Stocks			
Solomon Gulch	31,500	26,800	- 36,100
Main Bay	244,800	220,300	- 269,300
Armin F. Koernig	80,300	72,200	- 88,300
Esther Island	226,500	193,800	- 259,100
Wild + Hatchery	1,149,600	513,100	- 1,829,300
SOCKEYE SALMON			
Coghill District	343,189	122,703	- 572,675
Copper River District			
Wild Stocks	844,900	753,300	- 936,500
Hatchery Stocks			
Gulkana	126,900	101,500	- 152,300
Copper River Wild + Hatchery	971,800	854,800	1,088,800
COHO SALMON			
Copper River District	304,500	134,600	- 429,100
Bering River District	135,900	0	- 127,600
Copper/Bering Combined	440,400	134,600	556,700
CHINOOK SALMON			
Copper River	42,100	34,100	- 50,100

1988 AREA E
HATCHERY PRODUCED SALMON RETURNS

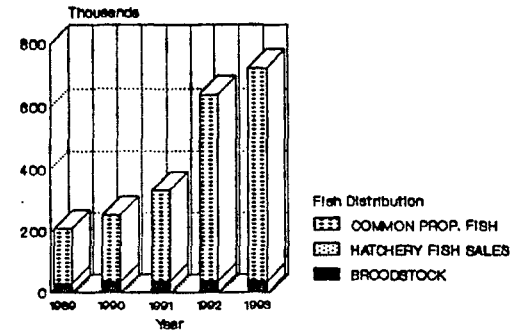
HATCHERY	SPECIES	ESTIMATED C.P.F. COMM. CATCH (no. fish)	ESTIMATED C.P.F. VALUE ($)	HATCHERY SALES HARVEST (no. fish)	HATCHERY SALES VALUE ($)	BROODSTOCK (no. fish)	TOTAL RETRUN	% MARINE SURVIVAL	EGGS TAKEN (millions)
A.F.K.									
	Pink Salmon	5,148,000	15,315,300	646,833	2,358,796	281,660	6,076,493	5.2	218.7
	Chum Salmon	73,000	502,240	31,772	330,758	14,452	119,224	0.6	4.3
ESTHER									
	Pink Salmon	3,200,000	9,520,000	443,828	1,718,650	222,790	3,866,618	5.1	151.7
	Early Chum Salmon	200,000	1,376,000	4,208	79,787	88,827	293,035	3.4	101.5
	Late Chum Salmon	0	0	6714	0	0	0	-	0
	Coho Salmon	55,000	979,000	0	0	1,824	56,824	15.1	2.8
	Chinook Salmon	231	10,395	0	0	77	308	-	0.3
	Sockeye Salmon	0	0	0	0	0	0	-	3.4
CANNERY CREEK									
	Pink Salmon	100,000	297,500	0	0	127,688	227,688	0.5	66.9
	Chum Salmon	2,300	15,824	0	0	2,874	5,174	<0.5	0.4
MAIN BAY									
	Pink Salmon	21,300	63,368	0	0	0	21,300	1.0	0.0
	Chum Salmon	200,000	1,376,000	0	0	0	200,000		0.0
SOLOMON GULCH									
	Pink Salmon	160,000	476,000	544,000		212,164	916,164	1.5	152.4
	Chum Salmon	4,000	27,520	0	0	1,727	5,727		3.3
	Coho Salmon		0	7,350	107,000			15.0	1.6
GULKANA									
	Sockeye Salmon		0	0	0		0		
TOTAL		9,163,831	29,959,147	1,684,705	4,594,991	954,083	11,788,555		707.3

PWSAC89 1989 AREA E HATCHERY RETURN PROJECTIONS

		COMMON PROPERTY FISHERY	BROODSTOCK	COST RECOVERY	TOTAL NO. FISH RETURNING	% RETURN TO C.P.F.
A.F.K. HATCHERY						
Pinks		4,235,000	210,000	1,605,000	6,050,000	70%
Chums		66,600	11,600	17,800	96,000	70%
CANNERY CREEK HATCHERY						
Pinks		3,521,000	275,000	1,234,000	5,030,000	70%
ESHTER HATCHERY						
Pinks		7,813,933	342,940	2,585,127	10,742,000	73%
Chums	-early	31,120	102,880	0	134,000	23%
	-late	115,450	10,300	27,250	153,000	75%
Coho		79,700	1,300	0	81,000	98%
Chinook		248	92	0	340	73%
SOLOMON GULCH HATCHERY						
Pinks		4,967,373	211,000	1,764,637	6,943,010	72%
Chums		23,400	14,400	0	37,800	62%
Coho		64,739	800	16,461	82,000	79%
MAIN BAY HATCHERY						
Chums		203,000	0	0	203,000	100%
GULKANA HATCHERY						
Sockeye		60,779	37,905	0	98,684	62%
TOTAL		21,182,342	1,218,217	7,250,275	29,650,834	71%

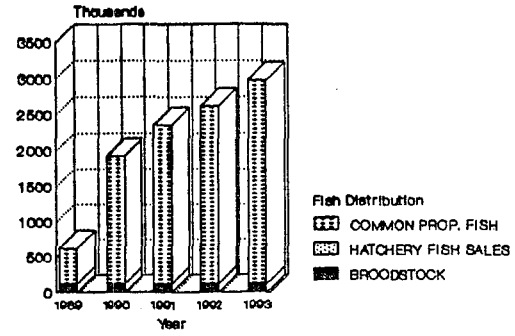
Master

PRINCE WILLIAM SOUND HATCHERIES
ESTIMATED SOCKEYE RUN BREAKDOWN



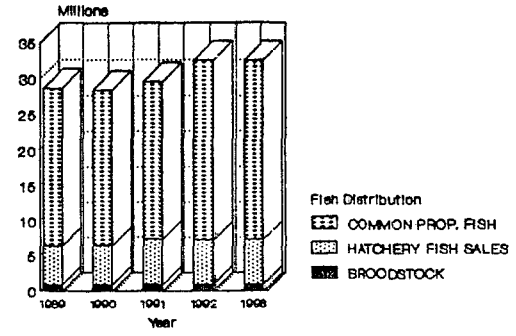
data: pweac and adf&g

PRINCE WILLIAM SOUND HATCHERIES
ESTIMATED CHUM RUN BREAKDOWN



data: pweac and adf&g

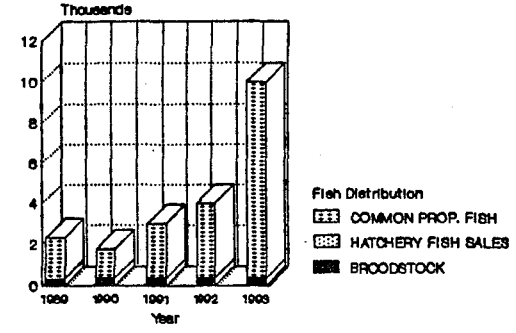
PRINCE WILLIAM SOUND HATCHERIES
ESTIMATED PINK RUN BREAKDOWN



data: pweac and adf&g

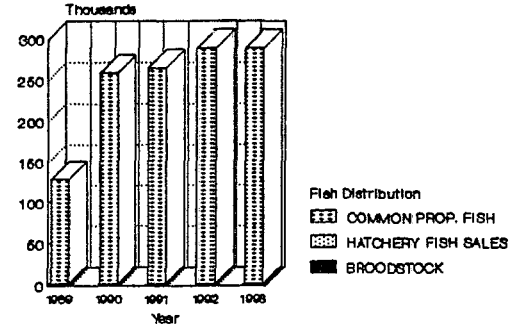
24

PRINCE WILLIAM SOUND HATCHERIES
ESTIMATED CHINOOK RUN BREAKDOWN



data: pweac and adf&g

PRINCE WILLIAM SOUND HATCHERIES
ESTIMATED COHO RUN BREAKDOWN



data: pweac and adf&g