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Alaska Department of Fish and Game Internal Review of Prince William Sound Aquaculture Corporation

by

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Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye to fork	MEF
mideye to tail fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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FREQUENTLY USED ACRONYMS

ADF&G	Alaska Department of Fish and Game or department
PWSAC	Prince William Sound Aquaculture Corporation
SHA	Special Harvest Area
AMP	Annual Management Plan
BMP	Basic Management Plan
PWS	Prince William Sound
PNP	Private Nonprofit Hatchery
RPT	Regional Planning Team
AFK	Armin F. Koernig
CCH	Cannery Creek Hatchery
WNH	Wally Noerenberg Hatchery
MBH	Main Bay Hatchery
FTP	Fish Transport Permit
EO	Emergency Order
CPF	Common Property Commercial Fisheries Contributions
AMR	Annual Management Report
PAR	Permit Allocation Request
AR	Annual Report
SATF	Southeast Alaska Hatchery Allocation Task Force
PWSAC Board of Directors	Board
Prince William Sound Management and Salmon Enhancement Allocation Plan	PWS Allocation Plan
Prince William Sound and Copper River Phase 3 Comprehensive Salmon Enhancement and Development Plan	Phase 3 Plan Comprehensive Salmon Plan

ABSTRACT

The Alaska Department of Fish and Game (ADF&G) recognizes the importance of Prince William Sound Aquaculture Corporation (PWSAC) within the region and strongly supports the effective and continued operation of PWSAC hatcheries. However, PWSAC had established an extensive record of on-going problems. Despite ample opportunity and encouragement to address these issues, PWSAC had neither corrected nor explained most of these on-going problems. Due to the number and seriousness of unresolved problems, ADF&G initiated this internal review as the first step of a Performance Review (5 AAC 40.860) (Appendix A1). The goal of this internal review is to document problems and recommend corrective measures to help PWSAC improve operations and meet permit obligations. Permit compliance issues include: exceeding permitted stocking levels; substandard broodstock to egg take survival rate; withholding data required in permits; conducting cost recovery harvest outside Special Harvest Areas without emergency order authority; and refusing to fund required monitoring. General problems include: cost recovery shortfalls; large-scale straying and refusal to participate in straying evaluation; roe-stripping associated with excessive broodstock collections; inadequate reporting of roe sales; chum salmon *Oncorhynchus keta* otolith marking program failures; erratic management recommendations; lack of good faith negotiations; cooperative agreement problems; failure to report hatchery production/operational problems; unwieldy and unbalanced Board structure; lack of individual accountability among corporate officers and PWSAC Board of Directors members; and department failure to enforce compliance with permits, annual, and basic management plans. In accordance with 5 AAC 40.860 Performance Review this internal review found that PWSAC's performance violates some conditions under which their permits are granted.

Key words: Prince William Sound, salmon, *Oncorhynchus* hatchery, internal review, cost recovery, straying, permit, harvest, egg take, annual management plan.

EXECUTIVE SUMMARY

The Alaska Department of Fish and Game (ADF&G) recognizes the importance of Prince William Sound Aquaculture Corporation (PWSAC) within the region and strongly supports the effective and continued operation of PWSAC hatcheries. However, PWSAC had established an extensive record of on-going problems. Despite ample opportunity and encouragement to address these issues, PWSAC had neither corrected nor explained most of these on-going problems. Due to the number and seriousness of unresolved problems, the department initiated this internal review as the first step of a Performance Review (5 AAC 40.860, Appendix A1). The goal of this internal review was to document the problems and recommend corrective measures to help PWSAC improve operations and meet permit obligations.

PERMIT COMPLIANCE ISSUES

- Exceeding permitted stocking levels;
- Substandard broodstock to egg take survival rate;
- Withholding data required in permits;
- Conducting cost recovery harvest outside Special Harvest Areas (SHA) without emergency order authority; and,
- Refusing to fund required monitoring.

GENERAL PROBLEMS

- Cost recovery shortfalls;
- Large-scale straying and refusal to participate in straying evaluation;

- Roe-stripping associated with excessive broodstock collections;
- Inadequate reporting of roe sales;
- Chum salmon *O. keta* otolith marking program failures;
- Erratic management recommendations;
- Lack of good faith negotiations;
- Cooperative agreement problems;
- Failure to report hatchery production/operational problems;
- Lack of individual accountability among corporate officers and PWSAC Board of Directors (Board) members;
- Unwieldy and unbalanced Board structure; and,
- ADF&G failure to enforce compliance with permits, Annual Management (AMP) and Basic Management Plans (BMP).[1]

In accordance with 5 AAC 40.860 Performance Review this internal review found that PWSAC's performance violates the conditions under which their permits are granted. PWSAC does not meet the 70% broodstock survival rate for most stocks as defined in 5 AAC 40.860 (c) Minimum Hatchery Survival Standards. Large scale pink *O. gorbuscha* and chum *O. keta* salmon straying significantly impact wild stocks in a negative manner violating performance standard 5 AAC 40.860 (b)(4). The Gulkana Hatchery fails to meet performance standard 5 AAC 40.860 (b)(5) by not fulfilling the production objectives described in the terms of the hatchery permit. These failures include: exceeding permitted stocking numbers, withholding required data, and not completing required monitoring. Further, the failed chum salmon marking program and refusal to fund mark recoveries fails to meet performance standard 5 AAC 40.860 (b)(5).

Additionally, this internal review found that PWSAC disregards many basic requirements and guidelines outlined in cooperative agreements, permits, Annual Management, and Basic Management plans. This is demonstrated by the Gulkana stocking violations, conducting cost recovery outside of SHAs without department approval, the withholding of data, the lack of problem reporting, and resistance to monitoring programs, including mark recovery and straying evaluations. At times, PWSAC basically says 'No' when asked to comply with permit conditions or conduct required monitoring.

Over time, ADF&G (department) has allowed PWSAC to deviate from approved practices resulting in potential negative effects to Prince William Sound (PWS) fisheries. Two of the most serious problems are large-scale straying and substandard broodstock to egg-take survival rates. Both of these issues have complex negative effects on PWS fisheries. Large-scale straying has negative impacts on the genetic diversity of native PWS wild stock salmon, the PWS Allocation Plan, and hatchery cost recovery. The substandard broodstock survival rates violate regulatory standards and are more likely associated with roe-stripping than with egg-take levels required to

[1] Annual and Basic Management Plans are unpublished internal documents on file with ADF&G.

seed hatcheries. To date, there have been few if any consequences for PWSAC's lack of compliance with cooperative agreements, permits, AMP, and BMP requirements.

The department must take steps to correct these many problems; however, options that do not disrupt PWS commercial fisheries are limited. The Performance Review states that '*the commissioner will, in his or her discretion, consider a permit alteration, suspension, or revocation in accordance with AS 16.10.430.*' Any production level alteration has implications on the Prince William Sound Management and Salmon Enhancement Allocation Plan 5 AAC 24.370 (PWS Allocation Plan). Because of the limited number of options for addressing these problems, the department recommends the creation of an Oversight Committee. This Oversight Committee would set PWSAC production and broodstock levels and make recommendations to the Private Nonprofit (PNP) Hatchery Coordinator and commissioner regarding any permitted hatchery activities or further permit alterations.

The negative effects of large-scale hatchery salmon straying must be addressed by PWSAC. To that end, the suspension of chum salmon remote release permits would serve multiple purposes. First, it reduces the chum salmon straying source to a single location rather than 3 spatially separated sources and provides incentive for PWSAC to seriously address hatchery salmon straying. Second, it would also mitigate problems associated with the failure of PWSAC's chum salmon marking program. Third, it would be a first step to fulfill the department's responsibility to implement the genetics policy (GPRT 1985). Lastly, the remote release programs have a poor performance record with large-scale straying and poor returns.

Finally, PWSAC's performance jeopardized the financial viability of the regional aquaculture corporation. PWSAC management recommendations directly resulted in multiple cost recovery short falls despite the presence of adequate numbers of fish. PWSAC has more than $25 million in state funded loans. Multiple cost recovery short falls required PWSAC to take an additional $3 million short term state loan in 2004. PWSAC's problematic management recommendations call into question their ability to manage for cost recovery and broodstock collection goals. PWSAC management recommendations frequently have allocation implications, do not achieve cost recovery goals, and are of little use to the department.

RECOMMENDATIONS

The internal review recommended taking the following steps to address theses problems. Pursuant to AS 16.10.430, AS 16.10.380, and 5 AAC 40.860, the Commissioner should notify PWSAC and the Regional Planning Team (RPT) of PWSAC's noncompliance with its permits as well as its noncompliance with statutory and regulatory requirements and provide PWSAC with a reasonable period of 45 days in which to submit a plan to the department for resolving issues. The notice of noncompliance will also provide notice that the Commissioner is considering permit alteration if an adequate plan is not submitted, and provide an opportunity to PWSAC and the RPT to comment on proposed permit alteration terms. The notice should provide that if an adequate plan is not submitted, the Commissioner intends to alter PWSAC's permits under AS 16.05.430. This report included a set of recommendations (Appendix A2) that were ultimately modified and used as the basis to develop an action plan to address these problems (Appendix A3).

INTRODUCTION

To date, the Alaska Department of Fish and Game has never conducted a Performance Review of a regional aquaculture corporation (Appendix A1). The department has exhausted all other available options to obtain voluntary compliance with Prince William Sound Aquaculture Corporation permits and operations. The serious nature and extent of the problems with PWSAC has forced the department to take this next step. Several issues discussed in this review have significant negative implications for Prince William Sound fisheries. Straying of hatchery fish into wild streams potentially jeopardizes the goal of the ADF&G genetics policy (GPRT 1985) to conserve the genetic diversity of wild stocks. The cost recovery, broodstock survival rates, and implications on allocation affect a large sector of the fishing industry in PWS. The Gulkana Hatchery stocking rates and adult returns play a pivotal role in the health and management of the Copper River salmon fisheries. The department must decide the appropriate response to the problems outlined in this review.

ADF&G is the steward of fisheries resources in Prince William Sound. That stewardship is guided by a set of official policies, regulations and statutes. These are implemented from the highest levels such as the department mission 'to manage, protect, maintain, and improve the fish resources of Alaska', and the statewide Sustainable Salmon Policy, down to lower level Fish Transfer Permits. These guiding concepts act in concert to ensure long-term conservative and sustainable management of fisheries resources. Application and enforcement of these controls and policies has been inconsistent in PWS with regard to the management of PWSAC hatcheries. Over time, the department has allowed PWSAC to deviate from the approved practices resulting in potential negative effects to PWS fisheries resources.

The Prince William Sound and Copper River Regional Planning Team Phase 3 Comprehensive Salmon Enhancement and Development Plan which will be referred to as Phase 3 Comprehensive Salmon Plan in this document, is the primary document that guides the ongoing process of hatchery development and management (PWS/CR RPT 1994). The overall objective of the Phase 3 Plan is to assure economically viable hatchery development without negative impacts to wild stocks. The Phase 3 Plan identifies critical information and monitoring programs to evaluate impacts to wild stocks. Critical monitoring as outlined in the Phase 3 Comprehensive Salmon Plan (PWS/CR RPT 1994) and Basic Management Plans is subsequently required in Annual Management Plans, and Fish Transport Permits (FTP). Monitoring programs identified as essential include but are not limited to: straying studies, limnology data gathering, smolt emigration monitoring, and otolith marking and recovery. The department has asked PWSAC to conduct or participate in these monitoring programs, but PWSAC has been resistant to participate in some of the most basic programs.

ADF&G recognizes the importance of PWSAC operations in the region and strongly supports the effective and continued operation of PWSAC hatcheries. PWSAC produces approximately 15.5 million pink, 2.5 million chum, and 1.2 million sockeye salmon *O. nerka* annually. PWSAC salmon enhancement operations play a vital role in PWS commercial fisheries. Additionally, PWSAC has an expanded role in the new PWS Allocation Plan and has proposed to increase production through a new hatchery at Nelson Bay. However, PSWAC has established a record of on-going problems including but not limited to: cost-recovery short falls, straying, substandard broodstock survival rates, and multiple permit compliance issues. The department is extremely concerned about these problems and their effects on the health of PWS salmon fisheries. Despite

ample opportunity and encouragement to address these issues, PWSAC has not corrected or explained many of these on-going problems. Because of the number and seriousness of these unresolved problems the department has initiated an internal review as the first step of a Performance Review (5 AAC 40.860) (Appendix A1). The goal of the internal review, as part of the Performance Review, is to identify corrective measures for these problems and help PWSAC improve operations and meet the obligations of their expanded role in PWS.

MANAGEMENT RECOMMENDATIONS, COST RECOVERY FAILURES, AND ALLOCATION

PWSAC management recommendations have resulted in multiple cost recovery failures despite the availability of adequate numbers of fish. Their management recommendations and associated cost recovery shortfalls jeopardize PWSAC's financial viability. The department manages hatchery salmon harvest activities in PWS to ensure that PWSAC cost recovery and broodstock collection goals are efficiently completed. The department relies on PWSAC to make fishery recommendations that will ensure adequate hatchery fish are available for cost recovery and broodstock needs. In 2004, multiple problems with PWSAC operations and relations reached a point that required an official letter of concern from the area staff (Appendix A4). In 2004, PWSAC pursued a management strategy that did not support the achievement of cost recovery and broodstock goals, in spite of repeated warnings from department managers (Appendix A4). PWSAC subsequently fell more than $2 million short of their 2004 cost recovery goal and did not meet some broodstock collection goals. As a result, PWSAC had to take out additional state funded loans to address financial problems. Questionable PWSAC management recommendations continued in 2005 and resulted in cost recovery short falls despite record salmon runs. In 2006, PWSAC repeatedly made recommendations that did not support the common objective of efficiently achieving cost recovery. For example in 2006, PWSAC's management recommendations actively led to a cost recovery short fall for chum salmon and pink salmon.

Under the new PWS Allocation Plan, the Granite Bay Subdistrict is closed for the season if the purse seine gear group is allocated the Esther Subdistrict. The new plan specifies that in years when the purse seine fleet has exclusive access to the Esther Subdistrict from June 1 to July 21, the Granite Bay Subdistrict will remain closed to the common property fishery, unless deterioration of enhanced fish quality necessitates an opening. In late June 2006 approximately 250,000 chum salmon were holding in the Granite Bay Subdistrict, and chum salmon cost recovery was behind the anticipated level. The department repeatedly encouraged PWSAC to request an emergency order (EO) to conduct cost recovery in the Granite Bay Subdistrict. However, PWSAC refused to go into the Granite Bay Subdistrict, first because they were worried about wild stock interception. Next, they informed the department that they would go into Granite Bay only if the department waived the required $300 fee for additional sampling of cost recovery harvests outside the SHA as detailed in the AMP. Deteriorating chum salmon quality was a concern and the department notified PWSAC that if they did not harvest those fish for cost recovery, the area would be opened to Common Property Commercial Fisheries Contributions (CPF) per the Allocation Plan. PWSAC again declined, the department opened the area, and ~280,000 fish were harvested from the Granite Bay Subdistrict. PWSAC subsequently

was unable to complete their cost recovery goal. It is unclear why PWSAC refused to harvest those fish when they were required for cost recovery.

Also in 2006, PWSAC failed to meet their pink salmon cost recovery goal. The department was not informed of this until it was announced at the October 2 PWSAC Board of Directors meeting. Pink salmon returns in 2006 were late and weaker than forecast. Because of the run entry pattern, all CPFs were delayed until PWSAC announced it had completed 100% of cost recovery. The department and public are left to wonder what happened that resulted in PWSAC later announcing they had not achieved the cost recovery goal.

In the past, the department was hesitant to overrule a PWSAC recommendation regarding commercial fishing within hatchery subdistricts. However, the department has been forced to ignore many PWSAC recommendations because they were irrelevant to the facts at hand or were in conflict with stated department policies. For example, at one point in 2006 the department clearly stated that wild stock escapement concerns precluded any fishing effort outside terminal hatchery subdistricts. Yet PWSAC's next recommendation was to focus effort on areas outside terminal areas where wild stocks are susceptible to interception. When informed, again, that these areas were not acceptable options, PWSAC recommended delaying the opening of some hatcheries subdistricts and leaving the Esther Subdistrict closed. There was no explanation for the delays and closure despite the completion of over 90% of cost recovery and adequate broodstock collection. Later in 2006, PWSAC had completed most of the egg take and had surplus fish in the SHAs yet would not recommend opening these areas to CPF. PWSAC ended up roe stripping an unknown number of these surplus pink salmon. The department has experienced similar problems with PWSAC since 2004. These erratic recommendations call into question PWSAC's ability to manage for the cost recovery and broodstock collection goals. PWSAC has developed a record of making recommendations that are counter to the prosecution of an orderly fishery and of little use to department. Frequently, PWSAC management recommendations appear to support goals other than achieving cost recovery and broodstock collection. Many recommendations appear to be driven by allocation issues rather than the achievement of cost recovery goals.

ALLOCATION

PWSAC management recommendations also impact the allocation of PWS fisheries. Under 5 AAC 24.370. Prince William Sound Management and Salmon Enhancement Allocation Plan. (g) *the department will consult with the hatchery operator to address making proportional adjustments in cost recovery during the applicable year to correct the ex-vessel value allocation percentages to the drift gillnet and purse seine gear groups*. This regulation was developed after a review of operations and negotiations between the Alaska Board of Fisheries, the department, and PWSAC. That review determined that PWSAC had the capacity to make the appropriate proportional adjustments to correct for drift gillnet and purse seine allocation disparities from 45% to 47%. If PWSAC is unable to meet their own cost recovery goals, it is unlikely they will be able to adjust cost recovery to correct a 2% allocation disparity. Their ability to adjust cost recovery is further complicated by the inconsistent return of the various hatchery stocks. Finally, the individuals the make up PWSAC management have an inherent conflict of interest because they are largely composed of gear group representatives.

LACK OF GOOD FAITH NEGOTIATIONS

Each year Annual Management Plans are developed and reviewed by the department, PWSAC, and the Regional Planning Team. For the past several years PWSAC has not acted in good faith in the development of the AMPs. PWSAC consistently makes hidden changes in the text. The changes are not highlighted so that the department must make a sentence-by-sentence comparison with the previous year's AMP. This also occurs in the cooperative agreement process. The hidden changes include the deletion of monitoring requirements and changes to broodstock and cost recovery goals. Monitoring requirements are stipulations of the permits and require a Permit Allocation Request (PAR) for alteration or deletion. PWSAC was notified by the RPT that hidden changes and omissions are unacceptable. Yet PWSAC again failed to act in good faith in the development of the 2006 AMPs.

In 2006, the department again identified multiple hidden changes in the AMPs. The department notified PWSAC that no AMPs would be approved at the annual RPT meeting because of these unilateral changes. This is an unprecedented measure due to the complete breakdown of the normal AMP review process. The department corrected these unilateral changes in the 2006 AMPs and resubmitted them to PWSAC. All departmental changes and corrections were clearly identified in the Track Changes feature of *MS Word*[2]. PWSAC did not respond to the edits of the AMPs and subsequently distributed their original version with all the unilateral changes to RPT members.

An additional example of PWSAC's lack of good faith is their refusal to supply the department with their Fish Culture Manuals. The department has no knowledge of how PWSAC operates many aspects of their programs. Prior to 2006, the Fish Culture Manuals were referenced in AMPs if more detail was required. The department repeatedly requested to review the Fish Culture Manuals to better understand hatchery operations. PWSAC repeatedly refused to give the department the Fish Culture Manuals stating that they were 'proprietary'. In 2006, PWSAC eliminated all reference to Fish Culture Manuals in the AMPs. In many instances a single sentence to describe a complex process replaces the reference to Fish Culture Manuals.

COOPERATIVE AGREEMENT PROBLEMS

Continuous problems with cooperative agreements cost the department extensive staff time and money. The department generally develops cooperative agreements with PWSAC each year to contract the duties and financial responsibilities for collaborative work. This work includes marking programs, remote release evaluations, and various other projects. PWSAC has failed to act in good faith during the development of these agreements. PWSAC has repeatedly made hidden unilateral changes to the agreements with no explanation. These hidden changes frequently eliminate programs or costs that PWSAC does not agree with. Even when the changes are noted, no explanation of the alterations is provided. PWSAC's lack of good faith in this process costs the department money and time in the development of what should be standard documents.

The department has experienced additional problems with cooperative agreements. In the Gulkana Hatchery cooperative agreements, PWSAC is required to send blind test samples to the

[2] Product names used in this report are included for scientific completeness, but do not constitute a product endorsement.

Cordova office. Blind test samples are used to check preparation procedures and ability to detect strontium chloride marks by the University of Alaska laboratory in Fairbanks. PWSAC failed to send blind test samples as stipulated in the cooperative agreement and as requested in emails, phone calls and meetings. Similarly, PWSAC is required to supply thermal marked otolith samples to the Cordova office each year for blind tests for mark detection and identification. Blind tests of readers are important to ensure that the marks are being detected correctly and management decisions are based on accurate information. There have been consistent problems with these samples. They are generally delivered late, not preserved correctly (rotten), and have incomplete labeling. This results in additional time and expense to the department. The department has been unable to complete the blind tests because of these problems.

Additional problems consistently occur with cooperative agreements. Frequently deadlines are set in cooperative agreements. Deadlines are required to allow time for hiring, equipment purchases, and sample processing. PWSAC consistently misses deadlines and is evasive in submitting required notification, samples, and funding. This has required department local, regional, and headquarters staff to make multiple emails and phone calls to get payment stipulated in cooperative agreements. Again, this behavior costs the department time and money.

COST RECOVERY HARVEST PROBLEMS

PWSAC has harvested fish cost recovery outside of the Main Bay Subdistrict Special Harvest Areas without notifying the department or having an emergency order (Appendix A5), in violation of the Private Nonprofit Salmon Hatchery General Regulation 5 AAC 40.005. Special Harvest Area boundaries may be altered by emergency order if necessary for proper management of hatchery stocks 5 AAC 40.005 (e). The department was only made aware of these harvest activities through informal conversation with PWSAC staff.

The department views PWSAC achieving its revenue goals in a timely and efficient manner as beneficial for maintaining fish quality and providing increased CPF fishing opportunity. The department regularly issues emergency orders to conduct cost recovery outside a SHA to facilitate cost recovery or maintain fish quality. The department generally approves expanded cost recovery area requests the same day the request is made. Frequently the proposed areas are outside of prescribed cost recovery special harvest areas; therefore there is concern over the interception of wild stock salmon. Because of PWSAC's activities the department created the following conditions for expanded SHAs to assure that wild stocks are not impacted the department stipulated in the AMPs the following requirements:

- PWSAC will agree to pay all costs associated with the sampling, otolith preparation, and reading of otoliths from the permitted cost recovery harvest(s).
- PWSAC will notify the department with reasonable time prior to any cost recovery operations to request an emergency order permitting the activity and to provide notice for the scheduling of sampling personnel.
- All emergency orders issued permitting cost recovery operations will be for the specific dates that PWSAC has requested.
- Cost recovery harvest(s) from these areas will not be mixed with any other harvest at anytime until after sampling. No sorting of cost recovery harvest(s) is permitted until after sampling.

- No future emergency orders permitting cost recovery operations will be issued until the previous harvest has been evaluated for wild stock interception.
- The department may discontinue permitted cost recovery operations at anytime.

The conditions of cost recovery operations outside SHAs are clearly defined in AMPs to prevent cost recovery harvest of wild stocks and to assure that PWSAC operates according to regulation. PWSAC has resisted complying with these stipulations. In 2006 PWSAC unilaterally eliminated these requirements from the draft AMPs.

Additionally, PWSAC frequently changes cost recovery and broodstock collection goals mid-season without department approval or providing a justification. Cost recovery and broodstock collection goals are reviewed and approved by the RPT and PNP Coordinator each year. Repeatedly the department finds out about altered goals when they are mentioned during management recommendation discussions. PWSAC does not request the alterations or inform the PNP Coordinator of changes.

COST RECOVERY PERCENTAGES

From 2000–2005, the total value of pink, chum, and sockeye salmon produced at PWSAC's Armin F. Koernig (AFK), Cannery Creek (CCH), Wally Norenberg (WNH), and Main Bay (MBH) hatcheries and harvested in the commercial common property and cost recovery fisheries was $113,456,385. The value of contributions to the commercial common property fisheries totaled $72,676,506. According to hatchery Annual Reports, the value of cost recovery harvests (including roe sales) totaled $40,779,879. If the production of PWSAC's Gulkana I (GH I) and Gulkana II (GH II) sockeye salmon hatcheries and WNH coho salmon *O. kisutch* were included (even though small by comparison) the value of PWSAC's contribution to the common property fisheries would increase slightly.

During this period, PWSAC harvested an average of 54% of the total value of WNH pink salmon production for cost recovery, followed by 43% of the value of AFK pink salmon production, 40% of the value of WNH chum salmon production, 39% of the value of CCH pink salmon production, and 12% of the value of MBH sockeye salmon production (Appendix A6). Overall, PWSAC harvested 36% of the total value of their production from these hatcheries for cost recovery, which is within the Phase 3 Comprehensive Salmon Plan (PWS/CR RPT 1994) recommendation that "the long-term average cost of hatchery operation, management, and evaluation must remain below 50% of the value of hatchery production." If the value of GH I and GH II sockeye salmon and WNH coho salmon contributions to the common property fisheries were included, the percent of production value harvested by PWSAC for cost recovery would be ~34%.

Viewing the cost recovery proportions as a percentage of the 6-year total value provides an unweighted result. When evaluated on an annual basis (each year weighted equally) the cost recovery proportions are greater. For example the WNH cost recovery has taken a large percentage of pink salmon. The cost recovery proportion of the WNH pink salmon return from 2000 through 2005 was 44%, 76%, 75%, 31%, 95% and 53% or an average of 62%. Similarly, CCH pink salmon annual cost recovery percentages for 2000 through 2005 were 26%, 65%, 59%, 40%, 95%, and 27% or an average of 52%. These calculations do not include the value of broodstock which would increase the percentage of cost recovery to an average of 58% for CCH

and 66% WNH pink salmon. While PWSAC is within the PWS/CR Research Planning Team 50% average cost recovery proportion of total value, on an annual basis, they are at or above that level at 3 of 5 hatcheries.

FISH MARKING AND MARK RECOVERY

PWSAC has refused to fund otolith mark recovery required in their permit and the chum salmon marking program has failed. PWSAC has been otolith marking 100% of their production for over 5 years. The quality of their marks has been generally good, with only a few cases of marks that had variations. They use thermal cycling to mark all of their fish with one exception; sockeye salmon from the Gulkana Hatchery are marked with strontium chloride, a chemical that is absorbed into the otolith and can be seen with an electron microscope. The main criticism of their marking program concerns the chum salmon from Wally Noerenberg Hatchery. Chum salmon from this hatchery are released at 3 different sites and each site is supposed to have a unique mark. This objective was only met for 2 of 5 recent brood years (2000–2004). The release of chum salmon with the same marks at multiple sites has severely compromised evaluation of the different release sites. The second criticism is PWSAC's resistance to funding mark recovery. Finally, PWSAC fails to report marking problems internally and does not relay any information about marking problems to ADF&G.

In 2003, all age classes of Port Chalmers remote release chum salmon had thermally marked otoliths, making complete identification of hatchery fish and release sites possible for the first time. Otolith sampling provides an opportunity for accurate and economical monitoring and evaluation of enhanced salmon fisheries. Understanding remote release migration patterns and the possibility of straying may have important implications on the management of current and future remote releases. Until 2005, PWSAC refused to fund chum salmon mark recovery although it is a condition of the WNH permit. PWSAC contended that if the data is not used for inseason management, they were not interested in funding it. The additional funding increment for chum salmon otolith recovery in 2004 was an estimated $7,000. The department offered to pay 50% ($3,500), but PWSAC again declined to participate.

The department uses the analysis of thermally marked otolith data to determine origins of salmon in harvests and escapements. In the BMP, permit, and cooperative agreements, PWSAC is required to fund the recovery and analysis of otoliths in common property fisheries. These data provide estimates of total hatchery returns and harvest contributions used to manage wild and hatchery returns. Further, allocation monitoring is dependent on quantifying gear group specific harvests of enhanced salmon and the harvest locations. Until 2005 PWSAC refused to participate in chum salmon otolith recovery despite the fact that it is a condition of their permit. The department was forced to pay for the collection and analysis of these otoliths. During this time the department did nothing about this permit violation beyond request that they adhere to the permit requirements. In 2005 PWSAC submitted a PAR to increase chum salmon production and decrease pink salmon production at WNH. The department made chum otolith sampling, as already required in their permit, a PAR approval contingency. Only after the department tied the sampling to a PAR that PWSAC had requested, did they fund the sampling that was clearly required in their permit (Memorandum from ADF&G to PWSAC March 21, 2005).

The release of chum salmon with the same marks at multiple sites has severely compromised evaluation of the different release sites. The most complete review of marking problems is the

'Potential Mixing of Otolith Marks between Port Chalmers, AFK, and WNH Release Locations' report by Christine Mitchell and Timothy VanGelderen (Appendix A7). This report documented that PWSAC mark tracking data (Otolith Report, Thermal Schedule Worksheet, Thermal Mark Release Information Form) showed inconsistencies among all brood years. The review concludes:

> Although the data from some years was better than that from other years there was not a year without missing data making it more difficult to determine what mark or release strategy they belonged to. It is known that several times in the last few years the transfer schedule changed after marks were placed so that the marks intended for release in one location were actually sent to another. Obviously this requires careful documentation that was not found anywhere with in the data.

The report then details how fish were accidentally released in the wrong locations, accidentally held in salt water, and many other transfer problems. In summary, there was not a single year without missing data used to track where marked fish were released. The report concludes that marks intended for one location were released at another location multiple times. Further, there was incomplete documentation to track the program and problems were not documented anywhere.

Discussions about marking and release sites between the department and PWSAC have not been informative. PWSAC apparently knew about some of these problems but refused to provide any relevant information to the department. The department only became aware of this marking report when it was referred to at PWSAC board meetings. Department staff then asked to see the report but PWSAC ignored department requests to review the report. At the 2006 RPT meeting, the department requested that each RPT member be sent a copy of the report. The report still was not forthcoming, but department staff was eventually given a single hard copy (Appendix A7) when at the PWSAC office on other matters. When asked about marking procedures, PWSAC repeatedly refers to Fish Culture Manuals but will not let the department review them. This is another example of PWSAC withholding information that the department requires to review and understand hatchery practices. The failed chum salmon marking program and refusal to fund mark recoveries is part of a continued pattern of uncooperative behavior with meeting performance standard 5AAC 40.860 (b)(5).

The department has experienced additional problems with PWSAC marking programs. In the Gulkana Hatchery cooperative agreements (IHP-94-004), PWSAC is required to send blind test samples to the Cordova office. Blind test samples are used to check preparation procedures and ability to detect strontium chloride marks by the University of Alaska laboratory in Fairbanks. PWSAC failed to send blind test samples as stipulated in the cooperative agreement and as requested in emails, phone calls and meetings. Similarly, PWSAC is required to supply thermal marked otolith samples to the Cordova office each year for blind tests for mark detection and identification. Blind tests of readers are important to ensure that the marks are being detected correctly and management decisions are based on accurate information. There have been consistent problems with these samples. They are generally delivered late, not preserved correctly (rotten), and have incomplete labeling. This results in additional time and expense to the department. The department has been unable to complete the blind tests because of these problems.

The marking problems have detrimental effects on the department's management of PWS fish resources. The department is unable to track allocation of hatchery fish intended for a specific gear group because of compromised harvest contribution estimates. The department is also

unable to determine if there is a difference in the straying rates between remote releases and hatcheries. Thus, the department is left to wonder at anomalous data results that could be explained if PWSAC had supplied relevant information.

HATCHERY PRACTICES

The department has been unable to review basic hatchery practices because PWSAC refuses to supply requested information. The operation of each hatchery is based on an AMP reviewed annually and FTPs reviewed as needed by the RPT. In these plans and permits, PWSAC repeatedly refers the reader to their fish culture procedures manual. Despite repeated requests from the department PWSAC refuses to provide these manuals. When asked why the department cannot see the manuals PWSAC claims that the information is proprietary. PWSAC's refusal to supply that information has made a review of basic methods impossible. PWSAC eliminated all text referring the reader to their Fish Culture Procedures Manual in their draft 2006 AMPs. An incomplete description of methods, as little as one sentence, was substituted for the reference to the fish culture procedures manual. When asked to provide more detail, the PWSAC general manager suggested the department get some hatchery text books.

PWSAC also appears to be selecting for later timed runs with their broodstock collection procedures. The majority of the broodstock appears to be collected late in the run. The broodstock collection data supplied by PWSAC makes the timing difficult to review. PWSAC refuses to provide additional information about broodstock collection timing. Because of inadequate information, the department is unable to review the broodstock collection timing. Later timing of PWSAC runs reduces value to the fleet. Additionally, later timed strays are maladapted to environmental conditions and, if successfully interbreeding with wild stocks may reduce their viability.

Another area of concern is the broodstock and cost recovery goals. Broodstock and cost recovery goals are reviewed and approved by the department and the RPT each year. PWSAC frequently changes cost recovery and broodstock goals without notifying the department or providing justification. Because of this CPFs are delayed due to the increase in required number of fish for hatchery uses and interferes with the department's ability to operate an organized fishery.

HATCHERY SALMON STRAYING

The department has documented large scale PWSAC pink and chum salmon straying throughout PWS (Appendices A8 and A9). Escapement in some streams was composed of over 90% stray hatchery salmon. Large scale pink and chum salmon straying significantly impact wild stocks in a negative manner violating performance standard 5 AAC 40.860 (b)(4). PWSAC has refused to participate with any work associated with hatchery salmon straying. The Phase 3 Comprehensive Salmon Plan delineates a set of studies determined to be '*necessary to evaluate the effect of remote release programs on wild stocks*' (PWS/CR RPT 1994). An evaluation of hatchery fish straying is identified as one of the required evaluations in the Phase 3 Comprehensive Salmon Plan. Funding of chum salmon otolith marking, recovery, and analysis is also a condition of PWSAC's permit. The Phase 3 Comprehensive Salmon Plan (PWS/CR RPT 1994) and the Genetics Policy (GPRT 1985) state hatchery salmon straying rates should not exceed 2% of the total wild stock escapement. The department became concerned about PWSAC hatchery chum salmon straying in 2002 and 2003 when 92% and 87% of recovered otoliths at the Eshamy River

weir were of hatchery origin. As a result, a pilot study was initiated in 2004 to more closely examine hatchery chum salmon straying rates in PWS. In 2004, 10 of 14 (71%) sampled streams had straying rates of hatchery chum salmon greater than 2%. In 2005, 12 of 17 (71%) selected streams had greater than 2% hatchery chum salmon strays. PWSAC was sent memos and annual reports detailing the results of each of these studies (Appendices A8 and A9). The department has funded and conducted 3 years of straying studies for PWSAC hatchery chum salmon. Area staff presented PWSAC with an operational plan for this study for their comment and they have been repeatedly invited to participate. In the development of enhanced stocks, straying is identified as a potential negative impact that must be monitored and funded by PWSAC.

The department has also documented large scale pink salmon straying Joyce and Evans (unpublished data[3]), Joyce and Evans (1999), and Joyce et al. (unpublished data[4]). The studies found that

> The proportion of hatchery salmon in stream escapements was greatest in the streams located adjacent to hatcheries in all years often reaching 100% by the final sampling event. Proportions of hatchery pink salmon were also high in southwestern streams distant from production hatcheries; proportions in the final sampling event ranged from 31% in Snug Harbor to 91% in Loomis Creek in 1997, and from 14% in Snug Harbor to 83% in Loomis Creek in 1998. No further studies were conducted to evaluate straying rates in other areas or even years.

The department has largely ignored the results of this study.

It is unclear why the authors, one of whom was the PWS Area Management Biologist, did not follow up on the results of this study. The authors write

> We have reported very high percentages of hatchery salmon in streams, especially in the southwestern region of Prince William Sound, and have commented briefly on the effects they may have on wild populations. We might ask how the hatchery permitting agencies of the State of Alaska allowed the current situation to arise.

This internal review questions how the authors allowed the problem continue without comment for the next decade. The authors recommend that further study is needed to estimate the number of stray hatchery pink salmon in each fishing district and that studies need to be conducted on the effects these stray salmon have on the reproductive potential of natural stream escapements. They also recommend more comprehensive oversight of future hatchery programs. That oversight may include resolutions to maintain lower ratios of hatchery to wild fish stocks and mandated removal of unharvested hatchery fish. None of these recommendations were acted on.

PWSAC never completed a straying study to evaluate the Port Chalmers release location as required in Cooperative Agreement COOP-94-060. There is no record as to why this evaluation was not completed. Various sections of the Phase 3 Comprehensive Salmon Plan contain requirements to conduct straying studies by hatchery facilities in the state of Alaska. Straying of hatchery-reared salmon into wild-stock streams may reduce wild-stock productivity, because genetic variability among wild stocks is reduced.

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[3] Joyce, T. L., and D. Evans. *Unpublished*. Determining the scope and magnitude of hatchery stray pink salmon in Prince William Sound, 1995. Alaska.

[4] Joyce, T. L. and D. Evans. *Unpublished*. Using thermal marked otoliths to aid the management of Prince William Sound Pink Salmon, 2001. Alaska.

Straying was recognized a having potentially serious negative affects on wild stocks. It is identified, reviewed, and mitigation steps discussed multiple times in various documents.

For example the Phase 3 Comprehensive Salmon Plan (PWS/CR RPT 1994) states on page 23-25 section 4.10

> Recognizing Optimum Production The PWS/CR RPT recommended that 5 biological and economic criteria be employed to recognize optimum production as the hatchery program in PWS is further developed and fine tuned. …2) The proportion of hatchery salmon straying into wild-stock streams must remain below 2% of the wild-stock escapement over the long term. The Phase 3 Comprehensive Salmon Plan further states on page 26 Section 4.30 Maintain Straying Rates Below Threshold. Since the late 1980s, hatchery salmon have greatly outnumbered wild salmon in Prince William Sound. Under these conditions, even relatively low straying rates of enhanced stocks may cause reduced genetic variability among affected wild stocks, because the straying rate as a proportion of wild-stock escapement is relatively high. At the present time, the straying rate of hatchery salmon in wild-stock streams is not known. A monitoring program should be implemented to periodically estimate the rate of hatchery-salmon straying into wild-stock streams, and to better define genetic stock boundaries in PWS. If it is determined that the rate of straying is significantly greater than the acceptable threshold of 2%, the PWS/CR RPT will determine whether and to what extent the hatchery program in PWS should be modified to reduce the rate of straying. Hatchery operational strategies that may minimize straying or the effect of hatchery-salmon straying should also be examined.

The Phase 3 Comprehensive Salmon Plan further recommends in the Hatchery Salmon Remote Release Site Evaluations and Recommendations on page 7, section 1.42 Genetics.

> Proposed remote releases of salmon must not compromise the genetic integrity of the wild stocks. Therefore, in evaluating remote release programs, priority should be given to those sites or projects that: 1)are barren of wild stocks of the same species; 2) use local stocks as brood; or, 3) result in adult returns (run timing curves) which do not overlap those of local stocks. In addition to management and genetic guidelines, specific topic areas are recommended for evaluation such as early life history and cost/effects. The Phase 3 Comprehensive Salmon Plan further recommends in section 1.43 Evaluation Studies. The RPT recognizes that studies will be necessary to evaluate the effect of remote release programs on wild stocks. The set of studies needed will likely differ depending on characteristics of specific remote release sites. The following types of studies may be necessary to evaluate specific remote release programs. 1. …3. Straying of hatchery stocks into streams Remote released stocks may stray into wild stock streams along migration routes or at the releases site.

STRAYING AND WILD STOCK ISSUES

Large-scale straying of the PWSAC enhanced chum salmon also has negative implications on wild stock management. The department manages for wild chum salmon escapement goals based on aerial survey counts of fish in streams. All fish counted in streams are assumed to be wild stock fish. The presence of a high proportion of stray hatchery fish in streams artificially inflates wild stock escapement estimates. Inflated wild stock escapement numbers may mislead management into believing that the escapement goals have been met. The department then opens

districts to harvest wild stock fish assumed to be excess to escapement goals. However, the escapement goal may not have been met because of the large number of hatchery strays in the aerial survey escapement estimates. Additionally there are significant genetic concerns associated with hatchery strays interbreeding with wild stocks.

One of the department's greatest concerns are the implications to the genetic integrity of wild populations and to fishery management. Local adaptations among wild pink salmon populations have been demonstrated. Hatchery salmon are believed to become genetically distinct from the originating native population(s), and concern arises from the belief that the fitness of locally-adapted wild populations is reduced upon genetic integration with domesticated hatchery salmon.

Utilizing the relation between hatchery chum salmon straying rates and total instream chum salmon abundance, we interpolated ~40,000–45,000 hatchery chum salmon strayed into wild stock streams throughout PWS in 2005. The calculation was made using streams with observed chum salmon from the 208 index streams in 2005 (n=80). This is ~25% of the (175,000 mid point) 2005 Sustainable Escapement Goal used for managing wild stock chum salmon in PWS, ~21% of PWSAC's annual chum salmon brood collection, and ~5% of the total PWSAC hatchery chum salmon contribution to the CPF harvest using a 5-year average (Appendices A8 and A9).

STRAYING AND ALLOCATION ISSUES

Large-scale hatchery chum salmon straying also has negative implications for the Prince William Sound Management and Salmon Enhancement Allocation Plan (5 AAC 24.370). Potentially thousands of hatchery chum salmon may be harvested by unintended gear groups or in unintended locations that, depending on the number of strays, may influence gear specific exvessel values. As part of the PWS Allocation Plan, Port Chalmers remote release chum salmon are intended to be harvested by the seine fleet in the Montague District. The 2003 projected Port Chalmers remote release chum salmon return was 989,000. Approximately 323,000 Port Chalmers remote release chum salmon were identified in the Coghill District harvest, representing a potential 30% straying rate. At least 130,000 of these seine allocated fish were harvested by the gillnet fleet in the Coghill District. Thus, straying increased the disproportionate harvest by the gillnet fleet in 2003. PWSAC has been unable to provide any explanation for this number of fish returning to WNH rather than Port Chalmers. The 2003 return had the largest number of fish harvest by a gear group other than that for which it was intended. During other years the number has been smaller (~50,000 fish) but still potentially problematic (Ashe et al. 2005). Considerable scrutiny and concern about allocation issues required an out-of-cycle Alaska Board of Fisheries meeting in early 2004.

STRAYING AND COST RECOVERY ISSUES

The straying of large numbers of PWSAC fish also has negative implications for cost recovery. In years when few hatchery salmon return, hatchery strays may exacerbate a run shortfall and could ultimately lead to PWSAC not achieving cost recovery or brood collection goals. PWSAC has repeatedly experienced species specific cost recovery short falls in the past 3 years. A portion of the shortfalls may be due to straying of fish. Straying fish do not return to the hatchery terminal areas where cost recovery harvests occur. As the number of straying fish increase less fish are available for cost recovery harvest.

GULKANA HATCHERY BACKGROUND

The Gulkana Hatchery consists of 2 incubation facilities (Gulkana I and II) located above Paxson Lake on the east fork of the Gulkana River approximately 260 miles from the Gulf of Alaska. ADF&G developed this facility; however, PWSAC assumed operation of the Gulkana Hatchery in 1993 and currently operates the facility under contract with the State of Alaska. For the past 5 years an average of 165 thousand Gulkana Hatchery sockeye salmon were harvested in the commercial fishery representing 13% of the annual Copper River sockeye salmon commercial harvest. The accepted program goal of the Gulkana Hatchery Facility (BMP section 2.2) "is to provide an annual average return of 300,000 adult sockeye salmon without jeopardizing delta and upriver wild stock escapements. Hatchery production will contribute to all common property fisheries including commercial, personal use, subsistence, and sport".

As the Gulkana Hatchery program expanded there was growing concern over the department's ability to achieve wild stock escapement goals. The Gulkana Hatchery Policy Paper was produced when the hatchery run was estimated as 250,000 and 300,000 adults. The policy paper as well as the current BMP identifies evaluation projects that would enable the department to better achieve wild stock escapement goals for both upriver and delta components of the Copper River sockeye salmon run. These projects focus on escapement enumeration; age, sex, and size sampling; stock identification, nursery lake evaluations, and data analysis. Since 1990 enhanced sockeye salmon runs have averaged above the prescribed 250,000 to 300,000 goal of returning adults, with a 10-year (1995–2004) average estimated run of 382,700 enhanced sockeye salmon (Ashe et al. 2005). These large hatchery runs continue to complicate harvest and wild stock management in the Copper River District.

The primary recommendation of both the Gulkana Hatchery Policy Paper and the Gulkana Hatchery BMP was that production would not be increased until an adequate evaluation program was in place to address management concerns. All enhanced sockeye salmon fry since brood year 1999 have been otolith marked using strontium chloride. The BMP calls for 2 complete brood year returns with successful otolith marks applied as fry before any consideration of adjusting stocking levels to achieve the target production of 300,000 adults. Additionally, nursery lakes evaluations were originally identified in the Gulkana BMP to assess fry-to-smolt survival and to determine appropriate stocking levels through monitoring of zooplankton at Summit, Paxson, and Crosswind Lakes. Zooplankton analysis will provide information about the availability of food for juvenile sockeye salmon and prevent overgrazing of this food source. The permit and BMP stipulate that these evaluations are to be funded solely by PWSAC and the results provided to the department in a timely manner.

PERMIT COMPLIANCE ISSUES

The Gulkana Hatchery fails to meet performance standard 5 AAC 40.860 (b)(5) by not fulfilling multiple production objectives described in the terms of the hatchery permit. The Gulkana Hatchery operation has experienced a number of operational problems and has been out of compliance with permit, BMP, and cooperative agreement requirements for multiple years. These failures include violating permitted stocking numbers, withholding required data and not completing required monitoring. Further, the failed chum salmon marking program and refusal to fund mark recoveries fails to meet performance standard 5 AAC 40.860 (b)(5). The department has repeatedly encouraged PWSAC to address the lack of compliance with multiple permit requirements (Appendix A10). PWSAC has violated the permit requirement of timely delivery of

limnology data for 6 years, despite repeated written and verbal requests for the data. The Crosswind Lake permitted stocking level of 7.6 million fry has been exceeded in 4 of the last 5 years. The delivery of otoliths from broodstock escapements and funding of Personal Use otolith analysis, as outlined in cooperative agreements, has also been problematic. PWSAC has also never completed the smolt out-migration monitoring permit requirement on Paxson Lake as outlined in the BMP. The Gulkana Hatchery fails to meet performance standard 5 AAC 40.860 (b)(5) by not fulfilling the production objectives described in the terms of the hatchery permit. These failures include violating permitted stocking numbers, withholding required data and not completing required monitoring. Permit Requirement 3 states that 'the Annual and Basic Management Plans are conditions of the permit and must be followed and adhered to at all times'.

LIMNOLOGY SAMPLING

Limnology monitoring (zooplankton sampling) is required in the Gulkana Hatchery AMP and BMP. This standard information is used to evaluate sockeye salmon nursery lakes carrying capacity and assure that stocking does not negatively affect the forage base. PWSAC has been out of compliance with the limnology monitoring required in the Gulkana Hatchery permit for 6 years. The department requested this information multiple times over that time period. Requests were made at meetings, through phone calls, emails, and at annual Regional Planning Team meetings. PWSAC repeatedly refused to supply that data or confirm that it had been collected. PWSAC stated that the limnology data had been 'used against them' in the past to adjust stocking numbers to levels that they disagreed with. During this time the department did nothing about this permit violation beyond making repeated requests for the data. PWSAC had been pursuing a Permit Alteration Request (PAR) to increase the stocking numbers at Crosswind Lake for 2 years (Appendices A10 and A11). Only after the department tied the limnology data to the approval of that PAR did PWSAC deliver the zooplankton data.

The limnology/zooplankton sampling conflict has a long history dating back to a 1995 memo from ADF&G employee Gary Kyle and a 2000 memo from ADF&G employee Jim Edmondson (Appendices A12 and A13). Mr. Kyle states that:

> the stocking of Paxson, Summit, and Crosswind lakes with sockeye salmon fry from Gulkana Hatchery is being done without zooplankton assessment. According to Gary Martinek (Gulkana Hatchery Manager), they have collected zooplankton samples since taking over the hatchery operations but have not had them analyzed because of no available funding.

However, the Gulkana Hatchery AMPs and BMP require PWSAC to fund that analysis. The memo goes on to state that overstressing the rearing area can have long-term effects on the zooplankton community. Furthermore, it is the department's responsibility to match the rearing capacity of the lake with stocked fry densities so as to prevent the collapse of the zooplankton forage base from overstocking fry. The collapse of the zooplankton forage base may have negative effects on wild stocks.

That may be the situation that has developed since that time. When the department finally received and analyzed the zooplankton data it was apparent that PWSAC had not been using the appropriate fry stocking strategy. The data showed that Crosswind Lake consistently has the lowest fry stocking densities and highest available food resources per fry among the 3 lakes (Appendix A14 and A15). Based on this pattern, PWSAC had been stocking the highest fry

density into the lakes with the least available forage. However, because PWSAC had been withholding that data, the rearing conditions of the lakes remained unknown. During this time PWSAC was unable to attain their broodstock for 5 consecutive years (2000–2004). It is unclear if this is related to the stocking rates or what impact stocking rates may have had on wild stocks.

PWSAC had been advocating an increase of the number of fry stocked into Crosswind Lake (Appendices A10 and A11). However, the department could not make an informed decision about adjusting the stocking numbers without evaluating the limnology. A PAR in 2004 to increase the stocking levels at Crosswind Lake was not approved and resubmitted in 2005. A review of the Gulkana Hatchery stocking history, as part of this internal review, found that PWSAC had been consistently exceeding the permitted stocking numbers at Crosswind Lake (see Stocking Violations section). After the evaluation, the department agreed that increasing stocking levels into Crosswind Lake would be appropriate. The FTP was altered to reflect that change and included stipulations that 1) the limnology data be supplied each year by a January 15 deadline, 2) PWSAC fund Personal Use otolith analysis, and supply the broodstock otoliths by 15 October; 3) define the maximum numbers to be stocked into each lake, and 4) that the FTP be issued for 3 years. This restrictive time frame was selected to encourage compliance with the stipulations in addition to monitoring the possible effects of altered stocking levels.

SMOLT ENUMERATION

PWSAC has completed smolt emigration work on Summit and Crosswind lakes as required in the BMP. The smolt emigration monitoring permit requirement on Paxson Lake as outlined in the BMP has never been completed. The department and PWSAC are equally responsible for the lack of completion of this work. Smolt emigration from Paxson Lake is complicated by the presence of wild stocks and enhanced sockeye smolt that enter Paxson Lake from Summit Lake. At the 2006 RPT meeting the department and PWSAC agreed to evaluate the feasibility and cost of this work.

STOCKING VIOLATIONS

PWSAC has repeatedly violated the stocking conditions of the Gulkana I & II Hatchery permit. PWSAC exceeded the maximum permitted total number of 24.91 million fry to be released by approximately one million fry in 3 of the last four years (Appendix A15). Additionally, PWSAC violated the conditions of their Gulkana Hatchery FTP by exceeding the permitted level of fry stocked into Crosswind Lake on 5 separate occasions (1997, 1998, 2002, 2003, and 2004), Paxson Lake on 2 occasions, and Summit Lake on 2 occasions (Appendix A15). A total of 3.1 million sockeye salmon fry were illegally stocked. The overstocking of Crosswind Lake appears to be intentional. Paxson and/or Summit lakes were not stocked to the permitted level while Crosswind Lake permitted levels were exceeded. It is relevant to note again that PWSAC had been pursuing an increase the stocking numbers at Crosswind Lake during the time that stocking permit violations occurred. The stocking also appears intentional because it specifically requires an additional airplane trip. Crosswind Lake fry are dropped into the lake by an aircraft equipped with a 500 gallon, oxygen supported tank that can carry a maximum of 1.0 million fry per load. The number of fry transported has varied from year to year and the 1.0 million fry is top end. According to hatchery manager, Gary Martinek, 665,000 is closer to average with 325,000 being low end. The Crosswind Lake permitted stocking number was exceed by an average of 624,000 fry.

According to 5 AAC 41.005 Permit Required:

> No person may transport, possess, export from the state, or release into the waters of the state, any live fish unless the person holds a fish transport permit issued by the commissioner or his authorized designee, and the person is in compliance with all conditions of the permit and the provisions of this chapter. Also, any changes made to the original issued permit require an amendment to reflect such changes. PWSAC has usually complied with this regulation.

However, no application for an amendment was ever filed by PWSAC or received by ADF&G to change their FTP to stock excess fry into Crosswind Lake.

SUBSTANDARD BROODSTOCK SURVIVAL RATES AND ROE STRIPPING

Each of the hatcheries in this review had broodstock to egg-take survival rates that violate the 70% minimum survival standard for the period (1996–2005) as defined in 5 AAC 40.860 (c) Minimum Hatchery Survival Standards. In 1996 and 1997, the actual survival rates were determined from broodstock captured and broodstock used data from the Annual Reports. Due to incomplete PWSAC reporting, broodstock survival rates had to be estimated using data from Annual Reports (ARs) and AMPs after 1997. A detail review of broodstock survival rates is available in Appendix A17.

From 1998 to the present, hatcheries have been required to report the number fish captured, but not used for broodstock, in the "other" and "excess" categories on AR Schedule C.[5] However, since 2000, AFK has reported "excess or other" pink salmon only once. The same is true for CCH. MBH has not reported excess or other sockeye since 1998. WNH last reported excess or other pink salmon in 1999 and their last reported excess/other chum salmon was in 1997.

It will not be possible to determine the actual survival/use of captured broodstock until PWSAC starts reporting un-used broodstock. With the available data, we can only estimate broodstock survival by determining the number of fish required to meet egg-take goals based on fecundity rates and spawning ratios and comparing that number with the number of fish captured for broodstock. More accurately stated this is an estimate of the percent of captured ***broodstock used*** for seeding the hatchery, not a "survival rate." PWSAC management defines broodstock used as "all the fish placed behind barrier nets," which differs from the department's interpretation of broodstock used as "all the fish used to seed the hatchery."

Since the number of fish PWSAC captures for broodstock far exceeds the number of fish used to seed the hatchery, the resulting broodstock survival estimates are well below the minimum survival standards set in regulation. PWSAC management was informed of this discrepancy in broodstock and reporting deficiencies and asked to correct it, but they have yet to comply.

Despite the lack of reported excess fish PWSAC reports roe harvests every year. From 1994 to 2005, PWSAC reported an average of 58,000 lbs of pink salmon roe harvest with a high of over 250,000 lbs in 2005. Similarly, from 1994 to 2005, PWSAC reported an average of 30,000 lbs of chum salmon roe harvest with a high of over 118,000 lbs in 1996. The only approved roe

[5] This is a standard reporting form in the Hatchery Annual Report from the PNP Hatchery Office Headquarters.

harvests are from green and over ripe females in the egg-take process. Any other roe sales must be requested by PWSAC and approved by the department. Due to the large volumes it is unlikely that all roe comes from green females during egg-take. The department has not received or approved requests for additional roe harvests nor been able to determine the source (green, over ripe, excess, etc.) of these roe harvests.

COMMERCIAL CONTRIBUTIONS

The department requires all PNP hatcheries to report CPF contributions to the different gear groups in numbers of fish. From this, the percent of total production contributed to the CPF can be determined. PWSAC provides these numbers, but their cost recovery operations, which directly impacts CPF contributions, are based on achieving preseason revenue goals, not on harvesting a fixed percentage of their return. This cost recovery strategy requires harvesting a higher percentage of their production during years of low prices, while the opposite is true when prices are high.

There are no regulations regarding what percent of hatchery production should be contributed to the CPF, rather each PNP determines this internally. The findings from a Southeast Alaska Hatchery Allocation Task Force recommended to the Alaska Board of Fisheries that a 70%:30% CPF to cost recovery split be followed for PNP hatcheries receiving salmon enhancement taxes. For PNPs that do not receive enhancement taxes, the recommended CPF to cost recovery split was 60%:40%.

The rationale used in setting these percentages was based on the belief that hatchery production should primarily benefit fishing groups. While the Southeast Alaska Hatchery Allocation Task Force recommendations do not apply to the Prince William Sound area, they are used here for comparison. It should be noted that not all Southeast hatcheries comply with this recommendation.

With the exception of MBH, all of the PWSAC hatcheries in this review had CPF contributions below the level recommended by the Southeast Alaska Hatchery Allocation Task Force for PNP hatcheries receiving salmon enhancement taxes. The overall CPF contribution rates were 62%, 68%, and 78% for AFK pinks, CCH pinks and MBH sockeye, respectively. WNH contributed 53% of their pinks and 58% of their chum salmon production to the CPF after broodstock. The CPF percentages would likely rise if the broodstock survival rates increased.

PWSAC BOARD OF DIRECTORS AND EXECUTIVE COMMITTEE

In 1996 PWSAC developed a Business Plan that identified long term financial and biological problems and a lack of clear direction (Appendix A18). A decade later many of these problems continue. The Business Plan found that the PWSAC mission is production oriented, lacking sound biological, ecological and market development strategies. The plan stated that PWSAC was not a viable business at that time because of a deficit net worth and large long-term debt and operating losses over 7 of the past 11 years. It determined that if PWSAC were to require a cost recovery rate higher than 40% of its fish production, it would not be in the best interests of the permit holders to support its future financial requirements. Additionally, it found that PWSAC support was threatened by dissatisfaction with fish culture and ocean survival problems, falling

fish prices, allocative issues, the rise in hatchery cost recovery percentages, and fishery management issues forcing harvesters into postage stamp harvest areas.

The 1996 plan recommended that any efforts PWSAC undertakes to alter current production must be made with the intent of improving wild stock health and productivity. In particular, changes should be directed toward improving the opportunity for ADF&G to manage for wild-stock harvest and escapement, and substantially reduce the opportunity for interaction between hatchery and wild fish. Setting objectives and implementing procedures that conform to sound ecological practices will rebuild PWSAC's credibility with ADF&G.

Today PWSAC has consistent cost recovery shortfalls largely attributable to poor management decisions. PWSAC debt issues have not improved. Many other problem areas have seen little improvement or have gotten worse. These areas include fish culture and ocean survival problems, the rise in hatchery cost recovery percentages, and fishery management issues forcing harvesters into postage stamp harvest areas. PWSAC's expanded involvement and influence on allocative issues exacerbates those problems. Many of these ongoing problems occur with the knowledge and approval of PWSAC's Board of Directors and Executive Committee.

PWSAC's governing structure is partly responsible for these continuing problems. The PWSAC Board of Directors is the largest board of any aquaculture association in the state with 45 members. The large board size contributes to a lack of individual accountability among corporate officers and Board members. The Board of Directors generally meets only twice a year. Because of the size of the board and infrequent meeting schedule most major decisions are delegated to the Executive Committee. Therefore the numerous problems at all levels of PWSAC operations are largely attributable to the Executive Committee and General Manager. The General Manager and Executive Committee have demonstrated an inability or unwillingness to comply with permit conditions.

PWSAC recognized the unwieldy size of the Board as a problem and contacted the Foraker Group to make recommendations regarding a reduction in Board membership (Appendix A16). The Foraker Group recommends reducing the Board of Directors from 45 to 16 members. The Foraker Group stated that the decreased Board size would more fully engage board members rather than delegating the major decision making to the Executive Committee. It would further make the Board more efficient, reduce operating costs, increase personal responsibility, and maintain fair representation of commercial fishers in the region, and give other user groups an opportunity for effective participation.

SUMMARY

PWSAC's performance jeopardizes the financial viability of a regional aquaculture corporation and negatively affects wild salmon. In accordance with 5 AAC 40.860 (a) Performance Review this internal review finds that PWSAC's performance violates the conditions under which their permits are granted. PWSAC does not meet the 70% broodstock survival rate for most stocks as defined in 5 AAC 40.860 (c) Minimum Hatchery Survival Standards. Large scale pink and chum salmon straying significantly impact wild stocks in a negative manner violating performance standard 5 AAC 40.860 (b)(4). The Gulkana Hatchery fails to meet performance standard 5 AAC 40.860 (b)(5) by not fulfilling the production objectives described in the terms of the hatchery permit. These failures include violating permitted stocking numbers, withholding required data

and not completing required monitoring. Further, the failed chum salmon marking program and refusal to fund mark recoveries fails to meet performance standard 5 AAC 40.860 (b)(5).

Additionally, this internal review finds that PWSAC operates with little regard to many basic requirements and guidelines outlined in cooperative agreements, permits, AMPs, and BMPs. This general disregard is demonstrated by the Gulkana stocking violations, conducting cost recovery outside of SHAs without department approval, the withholding of data, the lack of problem reporting, and resistance to monitoring programs including mark recovery and straying evaluations. At times, PWSAC basically says 'No' when asked to comply with permit conditions or conduct required monitoring.

Over time, the department has allowed PWSAC to deviate from the approved practices resulting in potential negative effects to PWS fisheries. Two of the most serious problems are large-scale straying and substandard broodstock to egg take survival rates. Both of these issues have complex negative effects on PWS fisheries. Large-scale straying has negative impacts on PWS wild stock salmon, the PWS Allocation Plan, and hatchery cost recovery. The substandard broodstock survival rates violate regulatory standards and are associated more with roe-stripping than with egg-take levels required to seed hatcheries. To date, there have been basically no consequences for PWSAC's lack of compliance with cooperative agreement, permit, AMP, and BMP requirements.

PWSAC's financial viability is jeopardized by erratic management recommendations and associated cost recovery shortfalls. PWSAC management recommendations have resulted in multiple cost recovery short falls despite the presence of adequate numbers of fish. PWSAC carries a >$25 million state funded loan. Multiple cost recovery short falls required PWSAC to take an additional state funded loan. PWSAC loan default is possible due to repeated cost recovery shortfalls. PWSAC's questionable management recommendations call into question their ability to manage for cost recovery and broodstock collection goals. PWSAC management recommendations are frequently counter to the prosecution of an orderly fishery, do not achieve cost recovery goals, and are of little use to the department.

Departmental monitoring and management of PWSAC activities place significant time demands on ADF&G staff and fiscal burden on the state. At times, PWSAC is uncooperative in completing, funding, or responding to inter-organization activities. PWSAC is resistant to monitoring programs required by permits and management plans. PWSAC's lack of cooperation compromises the department's ability to complete required activities. The department is largely unable to work with the PWSAC general manager. The PSWAC general manager has created an antagonistic relationship with every commercial fisheries biologist in the Cordova office for the past 5 years. That hostile atmosphere has led, in part, to the high turn-over rate of department staff in the Cordova office. Department staff have repeatedly experienced a breakdown in communication with the PWSAC general manager. Timely communication and information exchange is critical to the department's inseason management. This issue was addressed in the 2004 letter of concern. However, PWSAC continued to be unresponsive in communication with the ADF&G staff. On multiple occasions, ADF&G email and phone messages regarding fisheries decisions went unanswered. Lack of communication compromises the department's ability to effectively manage hatchery harvests and escapement needs. Local and regional staff has met with the PWSAC general manager and members of the executive committee several times to address this problem. These meetings have resulted in temporary improvements of communications. However, when the department pressures PWSAC to meet the monitoring

requirements their general manager does not like, the department once again is faced with unanswered phone calls and emails.

The chum salmon straying, one of the most serious problems has several possible responses. Regardless of the accuracy of the straying evaluation, the evaluations clearly indicate that the straying rate is well above the 2% guideline in the genetics policy (GPRT 1985). Department has many action options including the suspension or reduction of all chum salmon production, suspension or reduction of remote chum salmon releases, development of a release strategy evaluation to determine if homing can be improved, and continued straying monitoring. The chum salmon program has been in operation for multiple generations and it is not possible to quantify the potential negative impact that may have already occurred on wild chum salmon stocks in Prince William Sound. Wild chum salmon stocks in the vicinity of the WNH have declined and remain depressed. Chum salmon populations have also increased in several locations where limited numbers of chum salmon were previously found (Port Chalmers, Eshamy, Gunboat, etc). It is likely that these are either straying hatchery fish or progeny of hatchery strays that have successfully established a returning population. Cordova office staff continues to be concerned that Port Chalmers and WNH chum salmon are not effectively returning to the release site. Furthermore, the department has little confidence in PWSAC's marking program as a tracking tool.

A variety of problems should be expected in an operation the size of PWSAC. However, instead of informing the department of problems and working together to resolve them PWSAC suppresses information about problems. The department has extensive expertise to aid PWSAC in problem resolution. The suppression of information hinders the development of appropriate mitigating actions and hurts the cooperative relationship of the department and PWSAC. Not only does PWSAC not report problems to the department they do not document problems internally.

RECOMMENDATIONS

The department must take steps to correct these many problems; however, options that do not disrupt PWS commercial fisheries are limited. The Performance Review states that '*the commissioner will, in his or her discretion, consider a permit alteration, suspension, or revocation in accordance with AS 16.10.430.*' Any production level alteration has implications on the PWS Allocation Plan. The least disruptive permit alteration options are associated with hatchery operations that do not have cost recovery activities. PWSAC is not dependent on any Gulkana Hatchery or chum salmon remote release production for cost recovery. Therefore, the Gulkana hatchery and chum salmon remote release programs are the most appropriate programs for permit alterations.

The alteration or suspension of chum salmon remote release permits would serve multiple purposes. First, it reduces the chum salmon straying source to a single location rather than 3 spatially separated sources and provides incentive for PWSAC to seriously address hatchery salmon straying. The negative effects of large scale hatchery salmon straying must be addressed by PWSAC. Second, it would also mitigate problems associated with the failure of PWSAC's chum salmon marking program. Third, it would be a first step to fulfill the department's responsibility to implement the genetics policy (GPRT 1985). Finally, the remote release programs have a poor performance record with large scale straying and poor returns.

Because of the limited number of options for addressing these problems, the department recommends the creation of an oversight committee. This oversight committee would set broodstock levels, manage cost recovery harvests, monitor marking programs and assure permit compliance. Additionally, some type of penalty system such as fines (to be used to fund required monitoring) and/or incremental production reductions (5% by species or hatchery) may serve as incentive to comply with permits requirements. The department further recommends that a department representative be a mandatory member of the PWSAC Executive Committee and Board of Directors. The department should have complete access to all PWSAC documents, discussions and decisions.

The operation of PWSAC is guided by the Board of Directors and Executive Committee. The PWSAC has the largest number of board members (45) of all the aquaculture corporations in the state. The membership is composed of 60% commercial fishing permit holders; 10 purse seine, 10 drift gillnet, 6 dual permit holders and 1 set gillnet representatives. In recognition of problems associated with the large Board of Directors, PWSAC contracted the Foraker Group to make recommendations about decreasing the number of board members. The Foraker Group recommends reducing the Board of Directors from 45 to 16 members (Appendix A16). The Foraker Group recommends that those members will be composed of 60% commercial fishing permit holders; 3 purse seine, 3 drift gillnet, 2 dual permit, 1 set gillnet, and 1 processor representative. The review lists many benefits of decreasing the size of the board including increased board decision making instead of delegating to the Executive Committee. The Executive Committee is accountable for many of the problems detailed in this review. When the Board of Directors was presented with the Foraker Group analysis they voted not to implement any of the recommendations.

Because PWSAC has failed to act to correct governing problems the department recommends that PWSAC hatchery permits will be reissued with the requirement that the PWSAC Board of Directors be restructured by April 15, 2007. The restructure will be largely designed according to the Foraker Group recommendations; reducing the Board of Directors from 45 to 15 members. Those members will be composed of 4 purse seine, 4 drift gillnet, 1 set gillnet, and 1 processor representative. The elimination of 2 dual permit holders limits the potential for biased representation. The additional members will be composed of 6 general members; people who are interested in the enhancement of salmon in PWS but are not commercial fishers or processors.

Several of the problems detailed in this report are criminal offenses that were not prosecuted. At the time of the violations the department elected not to prosecute in order to maintain the working relationship with PWSAC. That strategy did not work as PWSAC only continued violations and the working relationship deteriorated. In the future the department should pursue criminal prosecution of regulatory violations.

Many of the problems detailed in this report are easily corrected with the cooperation of PWSAC. There should be no operations, discussions, or documents that PWSAC should conceal from the department. PWSAC must have transparency in reporting of activities and the open sharing of all information. This adjustment would aid in the correction of many problems. PWSAC would benefit from the use of department resources and expertise to guide operations.

The chum salmon straying rate raises questions about straying of other hatchery species. The department should consider requiring straying evaluations of all species. The Phase 3 Comprehensive Salmon Plan states that PWSAC should be responsible for funding all additional

evaluations. Additionally, if PWSAC is to be held to these criteria the same will be true for the Valdez Fisheries Development Association.

Additionally, the State genetics policy recommends that 'drainage's should be established as wild stock sanctuaries on a regional and species basis (GPRT 1985). These sanctuaries will be areas in which no enhancement activity is permitted except gamete removal for brood stock development.' The department should consider if there are areas within Prince William Sound (areas in the Eastern District) that the establishment of a wild stock sanctuary would be appropriate.

The cost recovery, broodstock survival rates, and implications on allocation need to be addressed to ensure an economically viable hatchery system, limit abuse of roe stripping associated with egg take, and tighten control and management of allocated fisheries. Currently, cost recovery approaches the maximum allowable proportion. Future cost recovery recommendations must ensure goals are met while permitting the maximum common property harvest. Broodstock collection goals need to be adjusted in AMPs to the minimum number required to seed the hatchery and all roe harvests need to be reported on fish tickets so that effective tracking is possible. Currently the department has no means by which to track the number of fish PWSAC roe strips each year. When asked to provide roe numbers PWSAC states that there is no reporting requirement and declines to provide the numbers. These numbers are within the department's purview and should be readily available upon request. It is likely that PWSAC suppresses roe stripping numbers because they may be viewed as excessive. In the future all PWSAC roe stripping information should be required reporting.

The department must have access to complete reporting of any activities for effective monitoring and evaluation. The department should be immediately informed of all hatchery problems so that the best possible response can be implemented protecting wild stocks and perpetuating an effective hatchery operation.

PWSAC has been working towards expanding production with either a remote release or hatchery in Nelson Bay. Considering that the department has been forced to conduct this Performance Review because of extensive permit and operational problems this expansion should not be approved. Additionally, the unaddressed straying problems, lack of permit compliance, and the disregard of departmental authority are further reasons to not approve any PWSAC expansion.

PWSAC needs to take steps to correct marking program problems and assure that they do not occur in the future. Considering PWSAC's record of problems and noncompliance, the department may want to monitor and provide oversight of the marking programs. The ADF&G Mark and Tag Laboratory director Ron Josephson recommends the inclusion of a detailed mark/release plan in AMPs.

The Gulkana Hatchery Crosswind Lake permitted stocking level is contingent on 3 stipulations. If any of those stipulations are not met the department should decrease the Crosswind Lake permitted stocking level back to 7.6 million fry with no increase in Paxson or Summit lakes.

EPILOGUE

This internal review was conducted in 2006 as the first step of a Performance Review (5 AAC 40.860). After development and review by area, regional, headquarters staff, and Department of Law, the internal review was forwarded to the Private Nonprofit Hatchery (PNP) Coordinator at ADF&G Headquarters. The PNP coordinator issued a memo to the Commissioner recommending that the department act to establish a new course of action because of the egregiousness of the problems (Appendix A19). The Commissioner contacted the Prince William Sound Aquaculture Corporation on December 1, 2006 (Appendix A20) requesting that they address the problems. After requesting a meeting and an extension on the time allowed for a response, PWSAC submitted an action plan to the department. Unfortunately, rather than addressing the problems, their response on February 7, 2007 (Appendix A21) was to debate and justify past violations. In their action plan PWSAC did not take responsibility for any problems nor suggest any meaningful solutions. The Commissioner's Office modified their proposed Action Plan on March 7, 2007 (Appendix A22), removing editorial comments and providing a clear set of actions intended to rectify each of the non-compliance issues. In addition, the department provided action items to prevent recurrences of the 'general problems' documented in the Performance Review. The department felt that this plan contained fair and workable solutions to the problems identified in the Performance Review and incorporated points of agreement from discussions with PWSAC. The Commissioner requested the Action Plan be returned with a signature which would indicate an agreement had been reached to resolve the problems. The department was disappointed that rather than accepting the Action Plan, PWSAC continued to seek additional modifications. In an effort to move beyond the dispute the department determined, after consultation with counsel, that a formal signed agreement was not required. PWSAC was notified on April 5, 2007 (Appendix A3) that the department expects compliance with the substance of the plan in order to ensure compliance with statutory and regulatory authorities and with its permits. PWSAC continued to disregard many items in the Action Plan throughout the 2007 season. In response to a legislative inquiry, the department drafted a memo on January 24, 2008 (Appendix A23) detailing PWSAC's lack of compliance with the Action Plan. PWSAC responded to that memo on February 13, 2008 with a document, too lengthy to be included here, which continued to debate and justify past problems. Department staff and PWSAC representatives met on March 10, 2008 to further address the non-compliance issues. PWSAC sent a memo intended to summarize that meeting on March 21, 2008 to the department, cc to the legislature, incorrectly stating that a consensus was reached and that action items had been addressed and completed. Since that time PWSAC has begun to comply with many of the non-compliance issues identified in that letter. However, the relationship remains strained and communication and data requests are still problematic and PWSAC has not participated in any straying projects.

ACKNOWLEDGMENTS

This document was prepared with the input, review and hard work of the following Cordova, Regional and Headquarters staff: Bert Lewis, Jeremy Botz, Richard Brenner, Steve Moffitt, and Glenn Hollowell, Cordova office; Dan Gray, Jeff Regnart, and Sean Palmer, Anchorage office; and Craig Farrington and Bruce White, Juneau office.

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APPENDICES

5 AAC 40.860. Performance review.

(a) Based upon a department internal review, the PNP coordinator will notify the commissioner if a hatchery operator's performance is inadequate, according to the conditions under which the permit was granted.

(b) The commissioner will, in his or her discretion, consider a permit alteration, suspension, or revocation in accordance with AS 16.10.430. If the commissioner decides to consider a permit alteration, suspension, or revocation, the coordinator will notify the appropriate regional planning team. The regional planning team may make a written recommendation to the commissioner on the proposed alteration, suspension or revocation. The regional planning team shall use the following performance standards in their review, evaluation and recommendation to the commissioner, including whether:

(1) survivals in the hatchery are more than the minimum standards described in (c) on this section for a period of greater than four years

(2) the transport of broodstock from wild sources does not continue for longer that one cycle of the particular species without reevaluation of hatchery operations;

(3) the hatchery contributes to the common property fishery;

(4) the hatchery does not significantly impact wild stocks in a negative manner;

(5) the hatchery fulfills the production objectives described in the terms of the hatchery permit; and

(6) there are any mitigating circumstances which were beyond the control of the hatchery operator.

(c) Minimum Hatchery Survival Standards are as follows:

Survival for Cumulative this state Survival For captured broodstock to egg take 70% Green egg to eyed egg 80% 80% Eyed egg to emergent fry 85% 68% Emergent to fed fry 1 90% 61% Fed fry to fingerling 2 90% 55% Fingerling to smolt 75% 41%

1 Fry achieving up to 25% weight gain from swim-up.

2 Fry achieving substantially more than 25% weight gain from swim-up.

1) An oversight committee of department personnel shall be *ex officio* members of the PWSAC Board of Directors (Board) and Executive Committee. The oversight committee will have delegated authority from the commissioner under AS 16.10.445 and 5AAC 40.840 to set PWSAC production and broodstock levels. The oversight committee will make recommendations to the PNP Coordinator and Commissioner regarding any permitted hatchery activities or further permit alterations. Oversight committee members shall be notified of and given reasonable opportunity to attend and participate in all Board and Executive Committee meetings, and shall have access to all PWSAC documents and records.

2) The PWSAC Board of Directors will be restructured by April 15, 2007 in order to make the Board more efficient, reduce operating costs, increase personal responsibility, and maintain fair representation of commercial fishers in the region, and give other user groups an opportunity for effective participation. The restructure should be designed to achieve a final structure in accordance with the Foraker Group recommendations with the exception that the 2 dual permit holders will be replaced by 1 purse seine and 1 drift gillnet representative. The Foraker Group recommends reducing the Board of Directors from 45 to 16 members. Those members will be composed of 4 purse seine, 4 drift gillnet, 1 set gillnet, and 1 processor representative. The additional members will be composed of 6 general members; people who are interested in the enhancement of salmon in PWS but are not commercial fishers or processors. Additionally, because current hatchery problems are largely attributable to the Executive Committee, and because the Executive Committee has demonstrated its inability or unwillingness to comply with permit conditions, and because a rapid restructuring of the Board is needed, the revised permits should include conditions requiring the resignation or removal of all current Board Members by April 15, 2007, and prohibiting any cost recovery fishing or juvenile salmon releases until all current Board Members have resigned or been removed. Members of the Board could immediately run for seats in the new Board structure.

3) In order to correct its corporate culture of noncompliance with statutory, regulatory and permit conditions, PWSAC shall adopt a policy prohibiting the indemnification of any employee or officer from civil suit or criminal action if the employee's actions involve reckless or intentional violations of statute, regulation, or permit conditions and shall warn its employees and officers that violation of statutes, regulations, and permits may result in personal as well as corporate liability.

4) PWSAC will provide the department with a detailed written plan within 60 days, of adjustments to broodstock goals to meet the 70% broodstock to egg-take survival rate regulation. This plan will be reviewed and approved by the Oversight Committee. That egg-take goal should be the number of eggs required to seed each hatchery according to production levels set in the Annual Management Plan. The number of fish required to meet that goal will assume a 15% pre-spawn mortality and 10% green/over mature fish. No roe recovery associated with carcass disposal other than the incidental recovery of green or overripe roe during broodstock operations will be allowed. In no case shall incidental roe recovery exceed 10% of the broodstock goal.

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5) Suspension of the Port Chalmers and Armin F. Koernig (AFK) Hatchery chum salmon remote release permits to reduce the chum salmon straying source to a single location rather than 3 separate sources. This step may reduce the geographic area of straying, increasing compliance with AS 16.10.420(10), 5 AAC 40.860(b)(4), and permit conditions; and will also provide incentive for PWSAC to address hatchery salmon straying and mitigate problems associated with the failure of PWSAC's chum salmon marking program. This suspension will remain in effect until PWSAC has demonstrated the ability to comply with permit conditions and correct problems detailed in this review.

6) Upon departmental request, any and all documents, records, or materials related to PWSAC hatchery operations shall be made available within 7 days. Any failure to provide documents in a reasonable time period shall be grounds for immediate permit alteration or revocation.

7) All roe harvests/sales must have prior approval by department oversight committee and be reported to the department within 7 days of harvest. All carcass disposals, including broodstock disposals made pursuant to 5 AAC 93.390(d), shall be logged and reported to the department as required under 5 AAC 93.310 on a weekly basis. PWSAC shall warn its employees, that any unauthorized sale of roe associated with disposal of salmon carcasses may result in personal as well as corporate liability for violation of AS 16.05.831 and 5 AAC 93.310.

8) The department should officially reject the proposal for Nelson Bay production expansions because of permit and performance standard violations and large scale straying problems. No production expansions should be granted until PWSAC has demonstrated the ability to comply with permit conditions and correct problems detailed in this review.

9) PWSAC will fund hatchery salmon straying evaluations to be operated by the department and within 60 days provide the department with a detailed written plan to evaluate different strategies to improve homing of hatchery salmon. This plan will be reviewed and approved by the Oversight Committee.

10) Within 60 days, PWSAC will provide the department with a detailed written plan of how the chum salmon thermal otolith marking program problems will be corrected. This plan will be reviewed and approved by the Oversight Committee.

Appendix A3.–Departments final Action Plan, April 2007.

STATE OF ALASKA

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DEPARTMENT OF FISH AND GAME

OFFICE OF THE COMMISSIONER

April 5, 2007

David Reggiani, General Manager
PWSAC Corporate Office
PO Box 1110
Cordova, AK 99574

Dear Mr. Reggiani:

We received your March 20, 2007, letter, and while we are pleased Prince William Sound Aquaculture Corporation (PWSAC) agreed with the majority of the substance of the Alaska Department of Fish and Game (ADF&G) March 7, 2007, final action plan and created an *ex officio* position on the PWSAC Board for a department representative, we were disappointed that the Board continues to seek additional changes to that action plan.

We want to move beyond this dispute and have determined, after consultation with counsel, that we do not need a formal signed agreement at this time. We believe ADF&G and PWSAC have reached agreement on the majority of issues. ADF&G expects and understands PWSAC will comply with the substance of the March 7 plan in order to ensure compliance with statutory and regulatory authorities and with its permits. The one exception to this is that the Review Committee will expect to receive written materials two weeks prior to their due date rather than by February 1. This change should alleviate any concern about having to prepare materials for the Regional Planning Team meeting, which often occurs in April, too far in advance. Permit Alteration Requests, on the other hand, would still be due by February 1, two weeks before the February 15 deadline. This change has been made in the attached final action plan.

Based on this understanding, ADF&G will not implement unilateral permit modifications at this time, but will move forward with establishing the review committee. In the event PWSAC does not comply with the revised (April 4, 2007) final action plan, as provided by ADF&G, or in the event ADF&G's review committee determines the action plan has been unsuccessful in resolving compliance or communication issues, please be assured that ADF&G will update the performance review and provide PWSAC and the regional planning team with an additional opportunity to comment prior to making any unilateral permit modifications.

ADF&G's staff and review committee will continue to work with PWSAC to try to improve communications and will work with PWSAC to develop and implement cooperative agreements and annual management plans to resolve ongoing operational issues.

Please feel free to contact Craig Farrington at 907-465-6154 should you have questions or wish further clarification.

Sincerely,

Denby S. Lloyd
Commissioner

-continued-

Final Action Plan to Address Problems Identified in the Performance Review (5AAC 40.860) of the Prince William Sound Aquaculture Corporation

Prepared by
Alaska Department of Fish and Game
April 4, 2007

PERMIT COMPLIANCE ISSUES:

1. Exceeding permitted stocking levels
2. Substandard broodstock to egg-take survival rates
3. Withholding data required in permits
4. Conducting cost-recovery harvest outside SHA without emergency order authority
5. Problems with conducting and/or funding monitoring required by permits

1. Exceeding permitted stocking levels

ACTION: The department will allow PWSAC to release up to the permitted number of fish for all hatcheries. The permitted numbers are maximum not-to-exceed stocking levels listed in the permits. PWSAC will not exceed any permitted stocking level and is subject to the regulations under 5 AAC 40.100—40.990.

2. Substandard broodstock to egg-take survival rate

ACTION 1: PWSAC will adjust broodstock goals for each salmon hatchery. These adjustments will be reflected in the Annual Management Plan for each salmon hatchery, and will detail any allowances for pre-spawn mortality, and for green and/or over-ripe fish. The allowances are to be included in calculating minimum hatchery standard survivals in 5AAC 40.860. In no case will the total of the allowances lead to a calculated survival rate that is less than the minimum hatchery standard survival prescribed for "captured broodstock to eggtake" in 5AAC 40.860.

ACTION 2: PWSAC will provide updated broodstock summaries for the years 1996–2006 as requested by ADF&G to include the numbers for hatchery broodstock specific to the working definition established at the February 14, 2007, meeting. PWSAC will provide ADF&G with the annual report required of all salmon hatcheries under AS 16.10.470, which will include the numbers of hatchery broodstock specific to the working definition established at the February 14, 2007, meeting. PWSAC is subject to 5 AAC 40.100—40.990, and will provide ADF&G with any basic biological information requested.

3. Withholding data required in permits

ACTION 1: PWSAC will provide limnology data from Crosswind, Summit, and Paxson lakes as required in the Gulkana Hatchery AMP, BMP, and Permit No. 42. PWSAC is to submit the data annually to ADF&G by March 1.

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ACTION 2: PWSAC is subject to the regulations under 5 AAC 40.100—40.990, and any PWSAC documents, records, or materials related to hatchery operations shall be made available to the department upon request.

4. Conducting cost recovery harvest outside SHAs without ADF&G emergency order authority

ACTION: PWSAC will obtain emergency order authorization from ADF&G prior to conducting cost recovery operations outside a hatchery SHA.

5. Problems with conducting and/or funding monitoring required by permits

ACTION: PWSAC is subject to the regulations under 5 AAC 40.100—40.990 and will conduct and/or fund all monitoring required by permits.

GENERAL PROBLEMS:

1. Cost recovery shortfalls and management recommendations
2. Failure to address chum salmon straying issues
3. Excessive broodstock collections and inadequate reporting of roe sales
4. Chum salmon otolith marking program failures
5. Transparent negotiations and communication problems
6. Cooperative agreement problems
7. Compliance with permits, Annual and Basic Management Plans

1. Cost recovery shortfalls and management recommendations

ACTION: PWSAC will submit written management recommendations with clear justifications as to how the recommendations support achieving cost recovery and/or broodstock collection goals. Each recommendation, in the form of a brief email, will include but not be limited to current harvest data, bay estimates, actual and anticipated run entry, and actual and anticipated cost recovery progress. Each recommendation will also include a summary of actual and anticipated broodstock collection progress.

2. Failure to address chum salmon straying issues

ACTION: It is expected that PWSAC will participate in the current studies being conducted by ADF&G, which will begin to assess whether there is straying from the remote releases of hatchery chum salmon from both Port Chalmers and Sawmill Bay. The detailed arrangements are to be covered by a cooperative agreement between ADF&G and PWSAC. PWSAC will be expected to participate fully in future workshops to be held by ADF&G on salmon straying and in development of plans to address any straying problems that may be identified in these workshops. Workshops will include evaluation of the data collected by ADF&G in the studies done in 2004, 2005, and 2006, and data collected in future studies performed under the cooperative agreement established between ADF&G and PWSAC.

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3. Excessive broodstock collections and inadequate reporting of roe sales

ACTION: In no case shall incidental roe recovery, associated both with the extraction of milt or eggs for use as broodstock and with broodstock carcass disposal, exceed 10 percent of the broodstock goal, unless specifically authorized by regulation. No roe recovery associated with carcass disposal other than the incidental recovery of green or overripe roe during broodstock operations will be allowed unless specifically authorized by regulation. All roe harvests/sales must be reported to the department within 7 days of harvest. All carcass disposals, including broodstock disposals made pursuant to 5 AAC 93.350(d), shall be logged and reported to the department as required under 5 AAC 93.310(d); weekly summaries will be provided to the department. PWSAC shall warn its employees and contractors that any unauthorized sale of roe associated with disposal of salmon carcasses may result in personal as well as corporate liability for violation of AS 16.05.831 and 5 AAC 93.310.

4. Chum salmon otolith marking program failures

ACTION: Within 60 days, PWSAC will provide the department with a written plan explaining in detail how the chum salmon thermal otolith marking program problems have been addressed and will be corrected.

5. Transparent negotiations and communication difficulties

ACTION: All proposed changes to documents, which are in draft form and are being edited by both the department and PWSAC (i.e., Annual Management Plans and Cooperative Agreements), will be made with some form of "track changes" mode, where additions and deletions are readily apparent and supported with an explanation of the changes. Both ADF&G and PWSAC agree that PWSAC's general manager will speak for the corporation and that the PWSAC Board Chairman will speak for the Board.

6. Cooperative agreement problems

ACTION: All cooperative agreements will be submitted by the identified deadlines. All stipulations will be met on time or written justification will be provided outlining why they will not be met on time. Cooperative agreements will be designed to last three years, without annual revision, except where ADF&G and PWSAC agree that a project is of short duration or where ADF&G determines that a three-year duration is not appropriate. ADF&G and PWSAC will modify all existing cooperative agreements as appropriate. Nothing in this paragraph prohibits revision of cooperative agreements prior to expiration if necessary due to changed circumstances, but both ADF&G and PWSAC will attempt to minimize the need for revisions.

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7. Compliance with permits, Annual and Basic Management Plans

ACTION: The department will form a review committee to closely monitor PWSAC activities and report to the commissioner on PWSAC's performance relative to this agreement as well as applicable statutes or regulations. The committee, composed of department personnel, will review all PARs, production and planning activities, and cost recovery planning. PWSAC will provide committee members with access to all PWSAC meetings, documents, and records, and shall notify committee members as far in advance as is practicable of all PWSAC meetings. In order to allow sufficient time for review, all written materials in draft form associated with the permits or the annual spring Regional Planning Team meeting will be submitted to this committee two weeks prior to their due date or the meeting, respectively. The committee will make recommendations to the commissioner regarding any permitted hatchery activities or permit alterations.

Appendix A4.–ADF&G letter of Concern to PWSAC.

STATE OF ALASKA

FRANK MURKOWSKI, GOVERNOR

DEPARTMENT OF FISH AND GAME

DIVISION OF COMMERCIAL FISHERIES

P.0. BOX 669
CORDOVA, ALASKA 99574
PHONE: (907) 424-3212
FAX: (907) 424-3235

1 July 2004

To: Dave Reggiani
General Manager
Prince William Sound Aquaculture Corporation

Through: Jeff Regnart
Regional Supervisor
CF, Region II
Anchorage

From: Dan Gray & Dan Ashe
PWS Area Management Biologists
CF, Region II
Cordova

Date: July 7, 2004

The Alaska Department of Fish and Game manages hatchery salmon harvest activities in Prince William Sound to ensure that PWSAC cost recovery and brood collection goals are efficiently completed. In the past the Department has relied on PWSAC to make fishery recommendations that will ensure adequate hatchery escapement. The department is concerned over recent hatchery management recommendations made by PWSAC regarding the chum salmon run to Wally Noerenberg Hatchery and the sockeye salmon run to Main Bay Hatchery.

To summarize the department's concerns:

1) PWSAC recommended a 12-hour purse seine period in the Esther Subdistrict on June 17, even after the department informed PWSAC that the total enhanced chum salmon run might not meet hatchery escapement needs. The department recommended against this fishing period. The harvest from this period was over 220,000 chum salmon and placed the WNH cost recovery and broodstock goal in jeopardy.
2) PWSAC has repeatedly recommended 24-hour periods in the Eshamy District excluding only the THA and SHA. The department has recommended a more conservative approach in which the Main Bay Subdistrict would be closed during these periods to facilitate hatchery escapement because of increasing effort and the allowance of deep gillnet gear in the district.

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3) The department is extremely concerned with the disruption of regularly scheduled fisheries in the Eshamy District because of cost recovery shortfalls stemming from PWSAC's disregard for the departments' continued concerns. A prolonged closure of the Eshamy District compromises the department's ability to spread the drift gillnet fleet and to hold a significant portion of that fleet on the west side of PWS in order to harvest Coghill River sockeye stocks.
4) The department is also concerned with the allocative implications of PWSAC's cost recovery management recommendations. By fishing both the Wally Noerenberg chum salmon and the Main Bay sockeye salmon fisheries to the point of cost recovery closures, allocation between gear groups will be affected.

These PWSAC recommendations do not support the common objective of efficiently achieving cost recovery and brood collection goals. The recommended strategy calls into question PWSAC's ability to manage for the cost recovery and brood stock collection goals. While the department would be hesitant to overrule a PWSAC recommendation regarding commercial common property fishing within hatchery subdistricts, it is within the departments' authority to do so. PWSAC should inform the Department of any change in cost recovery policy or revenue goals that are guiding the recent recommendations.

The Department is also concerned about a breakdown in communication with PWSAC personnel. Timely communication and information exchange is critical to effective inseason management. Over the course of the 2004 fishing season to date, the PWSAC general manager has been unresponsive in communication with the area staff. On several occasions, Department staff members have left messages regarding fisheries decisions that have gone unanswered. Lack of communication compromises the Department's ability to manage for those needs. The Department must have timely communication with PWSAC staff to ensure that the hatchery escapement needs are met.

Appendix A5.–PWSAC fishing in closed waters e-mail from ADF&G to Dave Reggiani.

From: Dan Ashe [mailto:dan_ashe@fishgame.state.ak.us]
Sent: Friday, July 09, 2004 3:18 PM
To: Dan Gray; James Brady; Jeff Regnart; Steven D. Moffitt; David Reggiani
Subject: Main Bay Cost Recovery

Dave,

I was taken aback when you informed me today that PWSAC had been conducting cost recovery operations in Falls Bay. The department had indicated preseason that we were open to the idea but there were stipulations that were also stated - clean samples from any Falls Bay harvest would be provided to the department in a timely manner and that PWSAC would notify the department when such operations were desired to allow scheduling of sampling personnel. PWSAC has failed to do so. In order for PWSAC to conduct cost recovery operations in Falls Bay first requires a request from you for an emergency order to be made and for a sampling schedule to be implemented. The wild stock contribution for the Falls Bay area is unknown, thus PWSAC could potentially be harvesting wild fish to contribute to cost recovery goals. As it stands now PWSAC is in violation of fishing in closed waters. Upon thought on the matter I will not now subsequently issue PWSAC an emergency order to continue cost recovery in Falls Bay. PWSAC has shown a lack of understanding and communication on this matter and I cannot be satisfied that PWSAC will comply with our request for samples or notification. FWP will be notified that PWSAC has been fishing in closed waters and to enforce the area restrictions for cost recovery as stated in the Main Bay Hatchery Management Plan. If you would like to discuss the possibility of expanding the Main Bay HA to include the Main Bay Subdistrict I would be open to discussion.

Dan Ashe

David Reggiani reply:

Dan,

On May 25th, you and I met to discuss the management strategy for the upcoming MBH harvest season as we were both getting inquiries from the fleet. During that conversation, you informed me that your thoughts were to have the commercial openings restricted to the Main Bay Subdistrict and that PWSAC could do cost recovery in the SHA and Falls Bay. Also, the expanded SHA during closures in the Main Bay Subdistrict. You'll remember that I reiterated my comments made during the Salmon Harvest Task Force speaking in favor of earlier openings in the Crafton Island Subdistrict. I assumed that you authorized PWSAC to conduct the test fishery in Falls Bay at that time. PWSAC does not receive copies of EOs on a regular basis and therefore I was unaware that you hadn't written one. PWSAC is interested in conducting a test fishery in Falls Bay. Please forward a sampling schedule so that we may begin.

Take care.
Dave

Commercial Common Property and Cost Recovery Harvest Values From Select Prince William Sound Aquaculture Association (PWSAC) Hatcheries During the Period 2000-2005.

By: Bert Lewis, Bruce White

From 2000-2005, the total value of pink, chum, and sockeye salmon produced at PWSAC's Armin F. Koernig (AFK), Cannery Creek (CCH), Wally Noerenberg (WNH), and Main Bay (MBH) hatcheries and harvested in the commercial common property and cost recovery fisheries was $113,456,385. The value of contributions to the commercial common property fisheries totaled $72,676,506. According to hatchery Annual Reports, the value of cost recovery harvests (including roe sales) totaled $40,779,879. If the production of PWSAC's Gulkana I (GH I) and Gulkana II (GH II) sockeye hatcheries and WNH coho were included (even though small by comparison) the value of PWSAC's contribution to the common property fisheries would increase slightly.

During this period, PWSAC harvested 54% of the total value of WNH pink salmon production for cost recovery, followed by 43% of the value of AFK pink production, 40% of the value of WNH chum production, 39% of the value of CCH pink production, and 12% of the value of MBH sockeye production (Table 1). Overall, PWSAC harvested 36% of the total value of their production from these hatcheries for cost recovery, which is within the PWS/CR RPT recommendation that "the long-term average cost of hatchery operation, management, and evaluation must remain below 50% of the value of hatchery production." If the value of GH I and GH II sockeye and WNH coho contributions to the common property fisheries were included, the percent of production value harvested by PWSAC for cost recovery would be below 36%.

Table 1.–Production values for PWSAC hatcheries during the period 2000-2005.

Hatchery	Species	Common Property	Cost Recovery	Total	% of Production Value Harvested for Cost Recovery
Armin F. Koernig	Pink	$8,674,170	$6,602,241	$15,276,411	43
Cannery Creek	Pink	$8,010,369	$5,094,857	$13,105,226	39
Wally Noerenberg	Pink	$9,019,378	$10,453,825	$19,473,203	54
Wally Noerenberg	Chum	$22,363,013	$15,115,001	$37,478,014	40
Main Bay	Sockeye	$24,609,576	$3,513,955	$28,123,531	12
Total		**$72,676,506**	**$40,779,879**	**$113,456,385**	**36**

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Potential Mixing of Otolith Marks between Port Chalmers, AFK Hatchery, and WNH Hatchery Release Locations

Christine M. Mitchell
Hatchery Support Manager,
Prince William Sound Aquaculture Corporation

Timothy J. VanGelderen Jr.
WNH Assistant Hatchery Manager,
Prince William Sound Aquaculture Corporation

Abstract.-This study is being conducted at the request of General Manager – David Reggiani to confirm and verify all otolith marks applied to Wally Noerenberg Hatchery (WNH) Chum Salmon *Oncorhynchus keta* were accurately marked, and released to their intended locations. This study will look at all otolith, incubation, out migration, and release data for brood year (BY) 1998-2003. All data will be examined to make sure that it was properly recorded on all data forms for both PWSAC and ADF&G. We will also review all fish culture practices and identify any potential areas that may compromise any otolith mark/release data.

PWSAC's concern in recent years over peculiarly low return numbers of Port Chalmers (PC) chum salmon coupled with Alaska Department Fish and Game preliminary suggestions of straying interested PWSAC prompting them to look for plausible explanations. This study was conducted by PWSAC staff at WNH in conjunction with other PWSAC employees to help get a clean, concise picture of the marked fry through out their life cycle from eggs to fry release. This study will show the discrepancies and errors made, in both judgment and data recording of improperly documented release sites

Findings

DATA

Upon first review of the data from otolith marking to release, nothing stood out in our findings that would support an outright error in data showing a release mark accidentally ending up at a release site for which it was not intended. All reports and data forms essentially looked as they should. However, as we looked at all of the data we had not specifically followed the mark from start to finish. As we started this task with this approach errors began to appear in the data.

The Otolith Report for all brood years showed inconsistencies from one brood year to the next. There was also a lack of complete data listed on all forms that PWSAC requires. Any missing data, no matter how small, makes reviewing the data a difficult task, if not impossible. One such example would be the Thermal Schedule Worksheet. The module might be listed but the lot numbers corresponding to that module were not included. This might seem small and insignificant but can actually be the deciding factor between resolving a conflict or not. Comparing a Thermal Mark Release Information Form that states lot 1-10 are early releases and lot 11-15 are late releases to an Egg Lot Tracking Form that states lots 1-10 went to early release and lots 10-15 went to a late release group

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causes conflicting data and the impossible task of trying to determine which data form is correct in its observations. Lack of complete data was the most common reporting error encountered by the study group, as well as different transfer and release numbers between reports and forms. Unfortunately, because there was conflicting data we cannot be sure which set of data was correct. Assumptions can be made on which data forms would be correct but that is all it will be, an assumption. Because of this, it is impossible to say with 100% certainty that no errors were made in the release of marked fry going to their correct locations. Some confusion involving reporting which lots receive which mark could be the possible result of having more than one mark within a lot. Seldom does the exact number of fish for a particular mark correspond with the end of a lot exactly. Because of this, it is even more imperative to accurately record the data on all forms so that when there is an overlap the data will match and not become an issue. Although the data from some years was better than that from other years there was not a year without missing data making it more difficult to determine what mark or release strategy they belonged too. It is known that several times in the last few years the transfer schedule changed after marks were placed so that the marks intended for release in one location were actually sent to another. Obviously this requires careful documentation that was not found anywhere within the data.

The following is a summary of all data found and the issues arising from this data for each brood year from BY98-BY03:

BY98 –

On the Incubation\ Rearing Report, it is stated in III. Procedures, B. Rearing, 2. "The Port Chalmers transfers were delayed frequently due to weather. It ended up taking 19 days (including weather delays) to move the eight pens worth of fry. In good weather, it takes only eight days to move the fry. This year we had one trip where the transfer vessel was loaded with fry, and then had to return to WNH due to heavy seas south of Perry Island. These fry were off loaded at WNH into a saltwater pen. The following week the fry were dipped out of the pen and into the hold of the transfer vessel. The transfer vessel was tanked down with half-shallow intake fresh water and half seawater. The transfer vessel helped to crowd the fry up into one end of the net, and the entire process took less than one hour. The fry all arrived at Port Chalmers looking fine." The deviation of this event from normal procedure should have been followed by several things. 1) The corporate office should have been immediately notified; 2) a "detailed" segment should have made its way into the State Annual Report and PWSAC's Incubation\Rearing Report, and 4) because a procedural change was necessary a PWSAC Exception Report should have been generated. Of these four actions, only the above paragraph from the Incubation\Rearing Report was found or communicated.

Ultimately 2,918,476 fry were sent to fresh water raceways on 3/8/99, transferred to PC on 3/10/99 then returned and placed into saltwater pens on the same day, 3/10/99. They were held in this pen until 3/17/99 when they were removed and transferred to PC. This may have had an effect on their ability to imprint correctly to PC.

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Also noted on the otolith report form was one sentence stating that 100,000 fry marked for PC spilled into Lake Bay on 3/8/99. It is claimed that the fry were preyed on by birds. This is the only notation any where on this incident. The other conflicting issue on this statement was that these fish were preyed upon but all other incidents that year where fish escaped the nets had the fry doing fine and feeding well. It is believed that some poor assumptions were made by hatchery staff that year most likely because fry marked PC spilled in the wrong release location and the other fry were spilled at their intended release sites. A spill of approximately 100,000 fry marked PC into Lake Bay so there is a possibility that these fry will impact the return data for both PC and WNH as it was not documented correctly.

Annual Report 1999 showed no comments on this incident or anything else.

BY99 -

Data is missing on virtually all forms. Comparing numbers from one form to another produces conflicting numbers. Nothing within this data shows any major errors or mishaps with transfers and the conflicting numbers and data stated is something that we must deal with internally for past as well as present information.

Annual Report 2000 showed no comments on this incident or anything else.

BY00 -

Some data for BY00 shows lots 16, 18, 19, 20, and 21 going to PC. What happened to Lot 17? Other data has lot 17 included. Once again we have a multitude of reports and forms all showing different data and numbers.

There were no significant errors noted with regards to marking and fish released to specific sites.

Annual Report 2001 showed no comments on this incident or anything else.

BY01 –

Again there is conflicting data between forms. Of greater concern however is that the data shows only A-mod being marked PC1:1.3 with the Historic Rearing Sheet showing 26,175,219 fish transferred to PC from WNH. Using standard Bio Criteria for chums and number of incubators per module at WNH it is highly improbable that 26 million fish came from A-mod with the proper mark. Each incubator (using standard assumptions) can hold 181,440 emergent fry. WNH has had the basic floor plan for incubators for as long as any of us can remember. Using that assumption there are 108 incubators in a full module. At 108 incubators A-mod can only hold 19,595,520 emergent fry. Subtracting the 26,175,219 transferred fry leaves us with 6,579,699 fry that we have absolutely no idea what marks they received. The assumption has to be that they were marked WNH since only A-mod was marked PC and transfers to AFK did not occur that year. All other

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modules show being marked WNH. Assuming this we have 6,579,699 fry reared at PC with a WNH mark. Obviously this will skew all data for this brood years return.

Annual Report 2002 showed no comments on this incident or anything else.

BY02 -

Although noted in the comments column of the Egg Lot Tracking Sheet there was no other mention of an incubator, marked for PC, being dropped. This resulted in an unknown, but assumed, number of 183,000 Chum fry marked for PC being swept to the bay at WNH. According to the Assistant Hatchery Manager, the Manager determined that the fry did not survive and documented them as incubation mortality rather than listing them as possible WNH released fry.

An error of much larger consequence for BY02 is with paperwork showing that lots 1-5 were released at PC and marked 1:1.3 on the State Thermal Mark Release Information Form. However, on the Thermal Schedule Worksheet the back stacks (PC) are shown to be lots 1-3 marked 1:1.3 and E-module lots 3-6 marked 1:1.3,2.4. It would appear that part of lot 3, all of lot 4 and all but 3 incubators of lot 5 were marked WNH but transferred to PC.

There is a discrepancy of 48,064 fry between the Historic Rearing Sheet and the Historic Egg Lot Tracking Sheet. Assuming a correction factor of 48,064 fry the following assumptions are based on the PWSAC Historic Rearing Sheets. A total of 23,640,436 fry (lots 1-5) were sent to PC. Approximately 10,886,400 of these were from back stacks (lots 1-3), and not a designated module. The remaining 12,754,036 fry (lots 3-5) were from E-module which as previously stated on the Thermal Mark Schedule Worksheet received the WNH mark of 1:1.3,2.4. (See attached: BY02 Thermal Mark Release Information Form, Chum Thermal Schedule Worksheet, Temperature Graphs, Egg Lot Tracking Form, and Pen Load Plan) In conclusion, there were mistakes made both in marking and data reporting for this BY. This would have affected the return data for both PC and WNH this year (CY05) as a small percentage of 3 yr olds returned. Next year will see an even larger error as the much larger percentage of 4 yr olds return. Since all data point to an error in marking we will resubmit fry from BY02 for lots 4 and 5 to the otolith tag lab in Juneau and correct release data with Fish and Game. Form standardization will go a long way toward accurate tracking of data and it is hoped to have all necessary forms with instructions in place by this winter.

Annual Report 2003 showed no comments on this incident or anything else.

BY03 –

This is the cleanest BY as far as data goes. No outstanding errors noted, and almost all forms had all the needed data. Even the numbers matched closely from one report and form to another.

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Annual Report 2003 showed no comments or incidents.

In summary all reports and forms that have been reviewed are all due at different times of the year. PWSAC has always had standard forms required for all projects that are used as official reporting forms. As is evident from this report all personnel need to make a greater effort in comparing all numbers on all official and unofficial forms since the hatcheries tend to use the unofficial numbers as their working numbers for the year. We are in the process of increasing the amount of data required to be kept on site as well as included in the report forms. Items such as the incubation room maps are a vital working tool to the hatchery but for some reason never make it into any of the filed reports. This one tool would have helped out greatly in the review of data for this report. It would have helped confirm some of the data that was in question. We now need to review all working data from all sites share this knowledge and make sure to emphasize to all sites that working data forms in the reports are just as important data as the official forms.

FISH CULTURE PRACTICES

In light of these data issues and discrepancies, a detailed assessment of culture procedures revealed some abuses as well as practices in need of reviewing. There were also some unpreventable, or difficult to prevent, accidents where the crew did the best they could to minimize each occurrence. There are many factors contributing to the loss (release) of fry. The following are areas where staff personally witnessed actual situations or where conditions were right for the situations to occur: Abuse (practices were ignored or knowingly done incorrectly without PWSAC Fish Culture Review Committee authorization); Revision (errors that were preventable but not viewed as an issue); and, Accident (items we attempt to prevent but are not 100% preventable or/and caused by human error).

A. Abuse:

1. Release of fry, marked PC or AFK, into Lake Bay were left in the raceway after the last transfer of the year. This has been a yearly error. Proper procedure was in place to destroy the remaining fish in the raceway. In older versions of company policies & procedures, the correct procedure was to destroy the fry with bleach. It has recently come to our attention that in the current version of company policies & procedures, policy says to destroy the fish but does not state how to destroy them. During the next review session the old version of the procedures will be re-instated to make sure the fish are destroyed by chlorination.
2. Left over fry in the raceway at the switch of otolith marks from AFK to PC or vice versa. Again, a yearly error during transfers resulting in AFK marks at PC or PC marks at AFK. As in the previous paragraph, procedures should be in place to chlorinate before filling with the other mark.
3. There have been mishaps over the years but just how many remains a mystery due to lack of documentation. Just this year, BY04, there were between 25-50K fry spilled out of a hold during transport over rough water midway through a transfer.

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4. BY98 the transfer boat returned with the fish, unable to transfer due to poor weather. The fry were pumped into a net pen in Lake Bay, and when transfers commenced they dip netted the fry from the pen back into the boat hold. There is no record of fry loss from this operation, but considering the act undertaken, there is a high probability that there was fry loss into the bay. There is also the probability that the entire boat load may have imprinted to Lake Bay.
5. There was a lack of proper documentation of issues that occurred due to; dropped incubators from Big Joe on the way to the dump tank, using saltwater from Lake Bay for the transfer hold of the boat, fry spilling during the transfers, and fry loss on the way to transfer location due to sloshing over the side during poor weather. Many issues have happened where only little notes are made instead of following through on all forms to document those issues.

B. Revision:

1. Release of fry into Lake Bay from the hose after the seiner leaves with the fry. When most of the fry have been put in the hold and the seiner is told all fry have been sent from the raceway, they top off with water. Following that they place the hose on the net pens and leave. The pipe at this stage will have excess fry in it that are being siphoned from the raceway, so any excess fish still in the pipe are released into Lake Bay. Both PC and AFK marks have been released into Lake Bay. This potentially happens on every transfer for every year we have done transfers via seiners. The numbers may be small but over the course of the transfers could end up being greater than 10K fish per year. This needs to be documented when it happens. The fact that it happens while undesirable is not detrimental to the data, so long as we make sure that all forms have the proper documentation listing these incidents.
2. The practice of raising the salinity of transfer water with Lake Bay saltwater or somewhere else in the sound other than PC. Fine food grade salt should be used rather than seawater and should be listed in the fish culture procedures.

C. Accident:

1. There have been end screen leaks some years and BY03 fry were smaller than average .28 vs. .34gram as average. This allowed the smaller fry to go through the screen into the tailrace. BY04 had leaks that could not be located or stopped so there were small amounts of fry leaking out through the end screen into the tailrace on a daily basis. How many other years this happened again we do not know since there is no documentation.
2. Staff recalls several losses where the fry pump box overflowed, resulting in fry spilling into the bay at high tide or onto the rocks at low tide.
3. There is incidental fry loss onto the incubation room floor every day. Cleaning screens or cleaning them only after they have begun to overflow results in fry spillage. There are several areas of the outmigration system that cause fry loss. When incubators are moved to the dump tank there is subsequent sloshing resulting in loss. When the saddle substrate and fry separate after dumping

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inevitably some fry remain trapped in the substrate only to be washed into the drain system. If an incubator is dumped too quickly, the dump tank can over flow and unfortunately this happens frequently. All these result in small quantities of fry from all release groups constantly going into Lake Bay.

4. Another form of accidental fry loss is the spilling of an incubator off Big Joe onto the floor and out the incubation effluent. Although this does not happen often, an average of one incubator is lost each year by this method. Personal history puts at least one incubator during BY02 transfers being dropped onto the incubation room floor. One small notation is made in the Egg Lot Tracking Sheet; no other notation is found in reports or forms and this was a PC marked incubator.
5. When we first started the PC and AFK transfers, there was confusion on which section of out-migration (OM) would be sent to PC or AFK. Once determined usually a portion of the fry would come from multiple modules. Due to this, there was a significant amount of tygon being run from one module to another. This was done because some of the fry needed to have the marks from one module while others needed to have the marks of a different module. Nothing states there were errors in sending the wrong fish to the wrong place however four months later we could not say with certainty that, for example a stack in module A marked to go with module B to Port Chalmers was not dumped with module A into Lake Bay. The reverse is also possible. A stack marked for WNH might accidentally be sent with the module marked and sent to Port Chalmers. For the past several years the Manager has marked the incubation room map with color coding to designate which stacks belong to which mark. All Fish Culturists receive a copy of this map so that otolith marking supervisors and OM supervisors are aware of which fish are designated for each release site. OM tracking sheets lists every incubator by number as well as which pen they are destined for. Incubators are flagged with surveyor tape before OM starts so the crew knows where one pen begins and ends. These measures reduce the possibility of mistakes. Changes made to the transfer schedule after the marks are made can confuse things as this also means changes to a plan and a map that have been in place for months.
6. Another method for PC or AFK fry to be released into Lake Bay is the overflowing of a raceway. This year it was discovered that overflowing a raceway is actually quite easy. When transferring, the flow must be turned up on a raceway to compensate for the siphon hose to the seiner. As discovered when fish are being crowded and the siphon is lost, the fish will become a dam on the end screen causing the water to rise over the end screen. Although the likelihood of the fish actually going over the end screen is small, it is possible. Quick thinking by the supervisor to release the crowd will prevent fish from being released down the tailrace. We are not aware of this situation occurring but felt it realistic enough to point out that the possibility is present.
7. One last possible accident scenario that could occur is the marking of the wrong module with the wrong otolith mark. Again, this is a possibility which is not supported by any documentation but is a potential issue to consider. All practices and procedures must be monitored and recorded on a yearly basis with all data compared for all modules and incubators to ensure this does not occur. Marking

-continued-

supervisors are instructed on which stack receives which marks; temporary loggers confirm the temperature in the appropriate trough and the intended mark to be used. On occasion the valves for each individual stack need to be opened or closed which allows room for human error but this type of mistake cannot be substantiated. Additionally, random temperature checks of various stacks during marking are performed periodically. Voucher samples are collected and sent to ADF&G to confirm the applied otolith marks.

Conclusion

Hatchery practices must evolve and be adaptable to the ever changing variables from one year to the next. These changes ultimately have an effect on long term data and reporting systems. In order to conduct proper research and compare brood year data, the data must be available and accurate. One theme repeating itself throughout this study was that data has not been correctly recorded leaving inaccurate records. Additionally, forms must be standardized where specific criterion are required thereby ensuring an overlap with other data forms to prevent data from being missed or lost.

In addition to making sure that all expected data is recorded properly and correctly we need to continue reviewing and revising fish culture procedures and practices for the hatcheries. There are many procedures hatcheries and personnel are required to follow, but as seen above there are times when proper procedures are not followed. We must ensure that all personnel understand and are held accountable for following them.

Practices have been improved however, this is an ongoing endeavor. For the past four years, a Fish Culture Review Committee has been in place. The Committee consists of the five Hatchery Managers, the Hatchery Support Manager, and the General Manager. The Remote Programs Manager has recently been added to this Committee. Procedures are being reviewed with the goal of having approval from all members of the Committee for use of the same procedures at all sites. The review process is going well, but it will be a long process to get through the procedures for each site and agree on changes to make the procedures consistent throughout the organization. Advancing procedures is an open-ended project. Steps are being taken to formalize procedures and place them in PWSAC Procedures binders for all sites with strict instructions that no changes are to be made without first going through the Fish Culture Review Committee for approval.

-continued-

THERMAL MARK RELEASE INFORMATION FORM

ALASKA DEPARTMENT OF FISH AND GAME

TODAY'S DATE:	6/29/03
SPECIES:	CHUM
BROOD YEAR:	2002
FACILITY:	WNH
STOCK:	WELLS RIVER
AGENCY:	PWSAC
MARKING SUPERVISOR:	ANDERSON
RBr CODE:	1:1.3
LOT NUMBERS:	1-5
EXPERIMENTAL NARRATIVE:	
RELEASE DATE:	4/27/03
RELEASE TIME:	16:00
RELEASE SIZE:	1.6
RELEASE STAGE:	Fry
RELEASE LOCATION:	PORT CHALMERS
TOTAL LIVE FISH RELEASED:	4,488,321
COMMENTS:	

-continued-

THERMAL MARK RELEASE INFORMATION FORM

ALASKA DEPARTMENT OF FISH AND GAME

TODAY'S DATE:	6/29/03
SPECIES:	CHUM
BROOD YEAR:	2002
FACILITY:	WNH
STOCK:	WELLS RIVER
AGENCY:	PWSAC
MARKING SUPERVISOR:	ANDERSON
RBr CODE:	1:1.3
LOT NUMBERS:	1-5
EXPERIMENTAL NARRATIVE:	
RELEASE DATE:	5/8/03
RELEASE TIME:	16:00
RELEASE SIZE:	2.31
RELEASE STAGE:	Fry
RELEASE LOCATION:	PORT CHALMERS
TOTAL LIVE FISH RELEASED:	9,533,368
COMMENTS:	

-continued-

THERMAL MARK RELEASE INFORMATION FORM

ALASKA DEPARTMENT OF FISH AND GAME

TODAY'S DATE:	6/29/03
SPECIES:	CHUM
BROOD YEAR:	2002
FACILITY:	WNH
STOCK:	WELLS RIVER
AGENCY:	PWSAC
MARKING SUPERVISOR:	ANDERSON
RBr CODE:	1:1.3
LOT NUMBERS:	1-5
EXPERIMENTAL NARRATIVE:	
RELEASE DATE:	5/16/03
RELEASE TIME:	16:00
RELEASE SIZE:	2.65
RELEASE STAGE:	Fry
RELEASE LOCATION:	PORT CHALMERS
TOTAL LIVE FISH RELEASED:	9,533,368
COMMENTS:	

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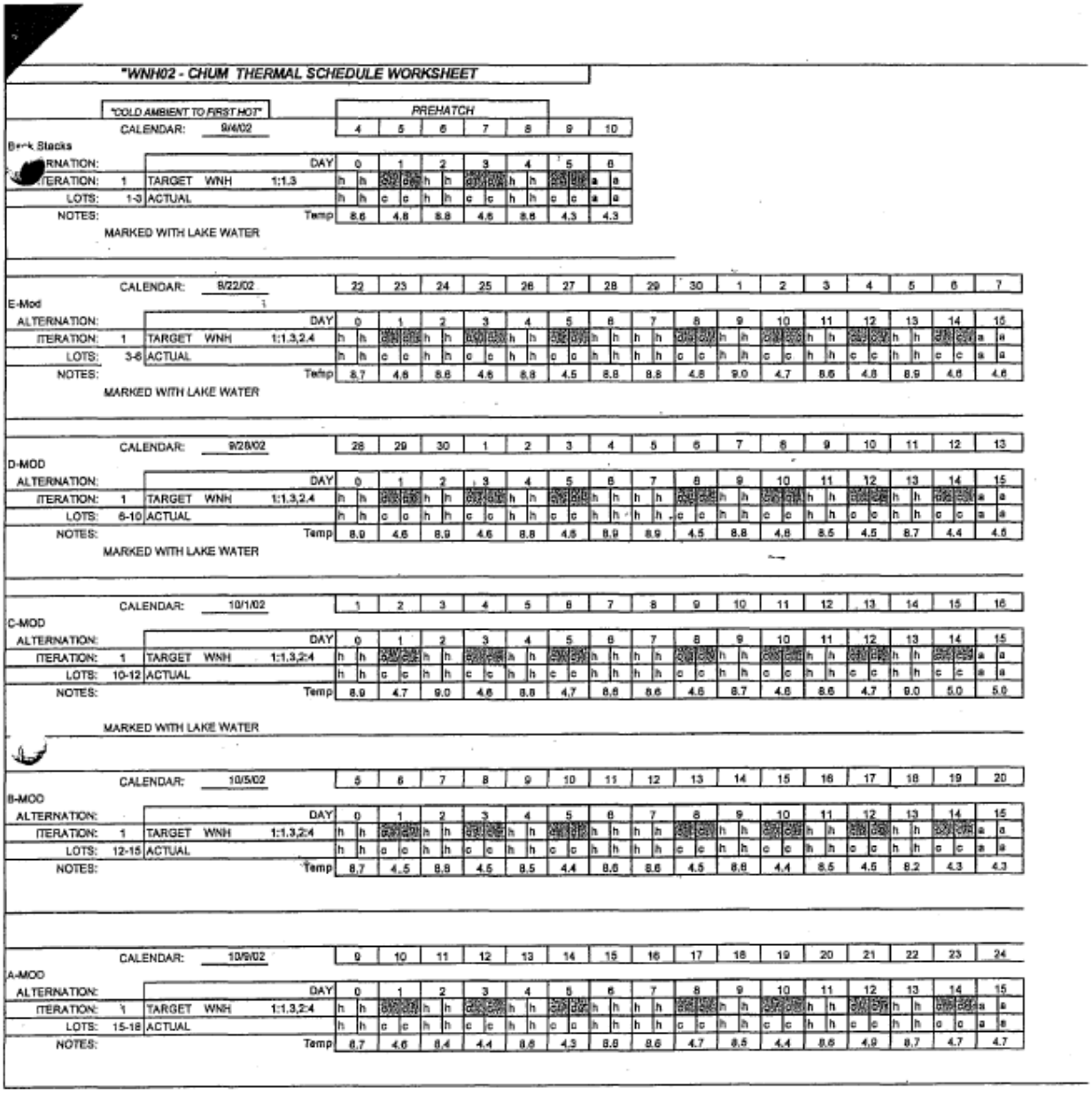

"WNH02 - CHUM THERMAL SCHEDULE WORKSHEET

"COLD AMBIENT TO FIRST HOT"

PREHATCH

CALENDAR: 9/4/02 — 4 5 6 7 8 9 10

Berk Stacks

ALTERNATION: DAY 0 1 2 3 4 5 6

ITERATION: 1 TARGET WNH 1:1.3 — h h h h h h h h a a

LOTS: 1-3 ACTUAL — h h c c h h c c h h c c a a

NOTES: Temp 8.6 4.8 8.8 4.6 8.8 4.3 4.3

MARKED WITH LAKE WATER

CALENDAR: 9/22/02 — 22 23 24 25 26 27 28 29 30 1 2 3 4 5 6 7

E-Mod

ALTERNATION: DAY 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

ITERATION: 1 TARGET WNH 1:1.3,2,4 — h h h h h h h h h h h h h h a a

LOTS: 3-6 ACTUAL — h h c c h h c c h h c c h h h h c c h h c c h h c c h h c c a a

NOTES: Temp 8.7 4.8 8.8 4.6 8.8 4.5 8.8 8.8 4.8 9.0 4.7 8.6 4.8 8.9 4.6 4.6

MARKED WITH LAKE WATER

CALENDAR: 9/28/02 — 28 29 30 1 2 3 4 5 6 7 8 9 10 11 12 13

D-MOD

ALTERNATION: DAY 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

ITERATION: 1 TARGET WNH 1:1.3,2,4 — h h h h h h h h h h h h h h a a

LOTS: 6-10 ACTUAL — h h c c h h c c h h c c h h h h c c h h c c h h c c h h c c a a

NOTES: Temp 8.9 4.6 8.9 4.6 8.8 4.6 8.9 8.9 4.5 8.8 4.8 8.5 4.5 8.7 4.4 4.6

MARKED WITH LAKE WATER

CALENDAR: 10/1/02 — 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

C-MOD

ALTERNATION: DAY 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

ITERATION: 1 TARGET WNH 1:1.3,2:4 — h h h h h h h h h h h h h h a a

LOTS: 10-12 ACTUAL — h h c c h h c c h h c c h h h h c c h h c c h h c c h h c c a a

NOTES: Temp 8.9 4.7 9.0 4.6 8.8 4.7 8.8 8.6 4.6 8.7 4.6 8.6 4.7 9.0 5.0 5.0

MARKED WITH LAKE WATER

CALENDAR: 10/5/02 — 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

B-MOD

ALTERNATION: DAY 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

ITERATION: 1 TARGET WNH 1:1.3,2:4 — h h h h h h h h h h h h h h a a

LOTS: 12-15 ACTUAL — h h c c h h c c h h c c h h h h c c h h c c h h c c h h c c a a

NOTES: Temp 8.7 4.5 8.8 4.5 8.5 4.4 8.6 8.6 4.5 8.8 4.4 8.5 4.5 8.2 4.3 4.3

CALENDAR: 10/9/02 — 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

A-MOD

ALTERNATION: DAY 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

ITERATION: 1 TARGET WNH 1:1.3,2:4 — h h h h h h h h h h h h h h a a

LOTS: 15-18 ACTUAL — h h c c h h c c h h c c h h h h c c h h c c h h c c h h c c a a

NOTES: Temp 8.7 4.6 8.4 4.4 8.6 4.3 8.8 8.6 4.7 8.5 4.4 8.6 4.9 8.7 4.7 4.7

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"WNH99 - CHUM THERMAL SCHEDULE WORKSHEET

"COLD AMBIENT TO FIRST HOT

PREHATCH

A-MOD

CALENDAR: 9/10/99

ALTERNATION:

ITERATION: 1

LOTS:

NOTES:

CALENDAR	10	11	12	13	14	15	16	17	18	19	20	21							
DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
TARGET WNH 1:1.5	h h	c c	h h	c c	h h	c c	h h	c c	h h	c c	a a	...							
ACTUAL	h h	c c	h h	c c	h h	c c	h h	c c	h h	c c									
Temp	8.8	5	9	4.8	9	4.9	8.8	4.9	8.9	4.5	4.5								

B-MOD

CALENDAR: 9/19/99

ALTERNATION:

ITERATION: 1

LOTS:

NOTES:

CALENDAR	19	20	21	22	23	24	25	26	27	28	29	30							
DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
TARGET WNH 1:1.5	h h	c c	h h	c c	h h	c c	h h	c c	h h	c c	a a	...							
ACTUAL	h h	c c	h h	c c	h h	c c	h h	c c	h h	c c									
Temp	8.4	4.6	8.6	4.8	8.3	4.6	8.5	4.5	8.6	4.4	4.4								

D-MOD

CALENDAR: 9/27/99

ALTERNATION:

ITERATION: 1

LOTS:

NOTES:

CALENDAR	27	28	29	30	1	2	3	4	5	6	7	8							
DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
TARGET WNH 1:1.5	h h	c c	h h	c c	h h	c c	h h	c c	h h	c c	a a	...							
ACTUAL	h h	c c	h h	c c	h h	c c	h h	c c	h h	c c									
Temp	8.6	4.5	9.2	4.5	8.9	4.3	8.8	4.5	8.6	4.4	4.4								

E-MOD

CALENDAR: 9/29/99

ALTERNATION:

ITERATION: 1

LOTS:

NOTES:

CALENDAR	29	30	1	2	3	4	5	6	7	8	9	10							
DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
TARGET WNH 1:1.5	h h	c c	h h	c c	h h	c c	h h	c c	h h	c c	a a	...							
ACTUAL	h h	c c	h h	c c	h h	c c	h h	c c	h h	c c									
Temp	9	4.4	8.9	4.3	8.7	4.3	8.5	4.4	9	4.5	4.5								

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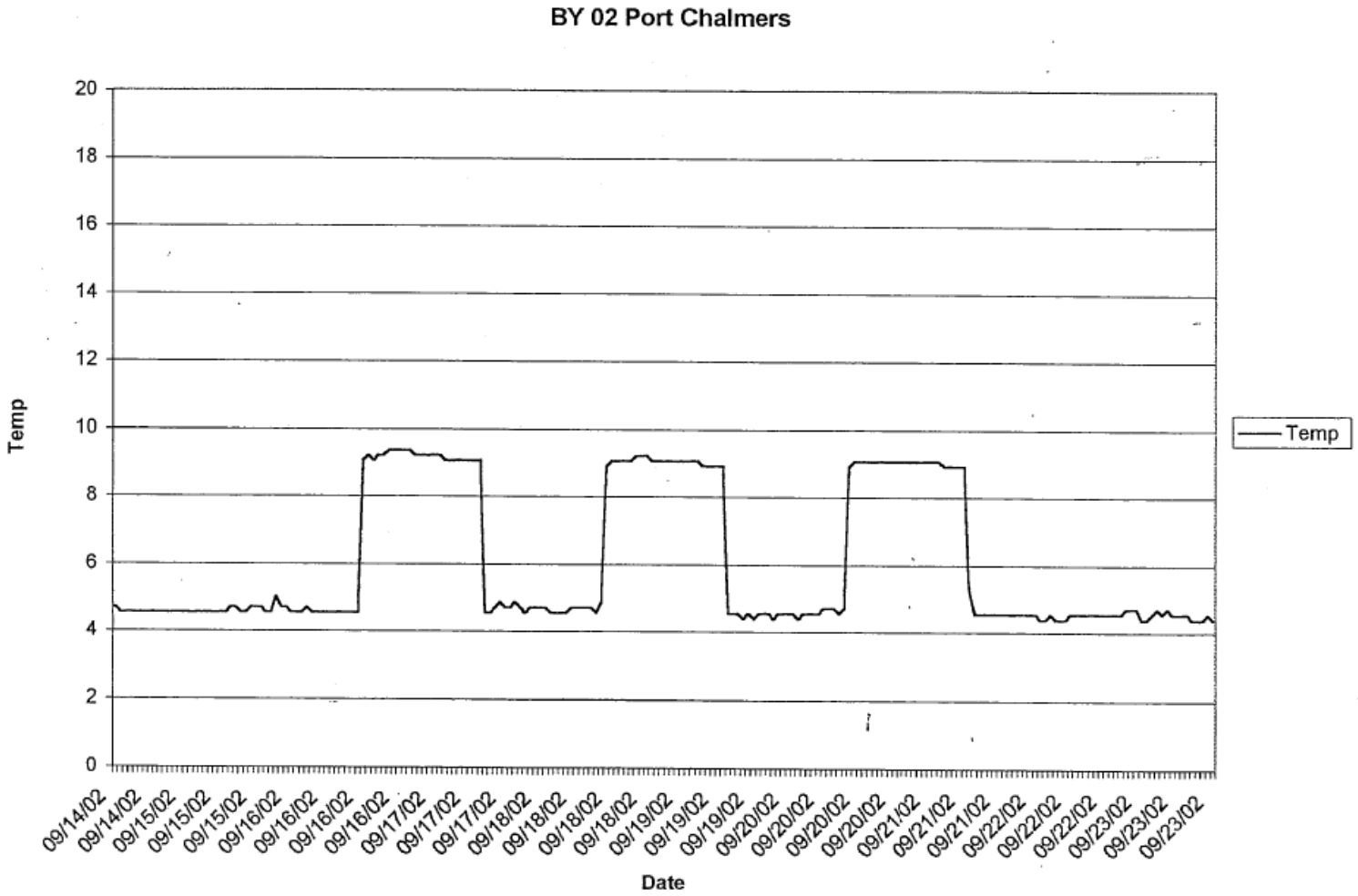
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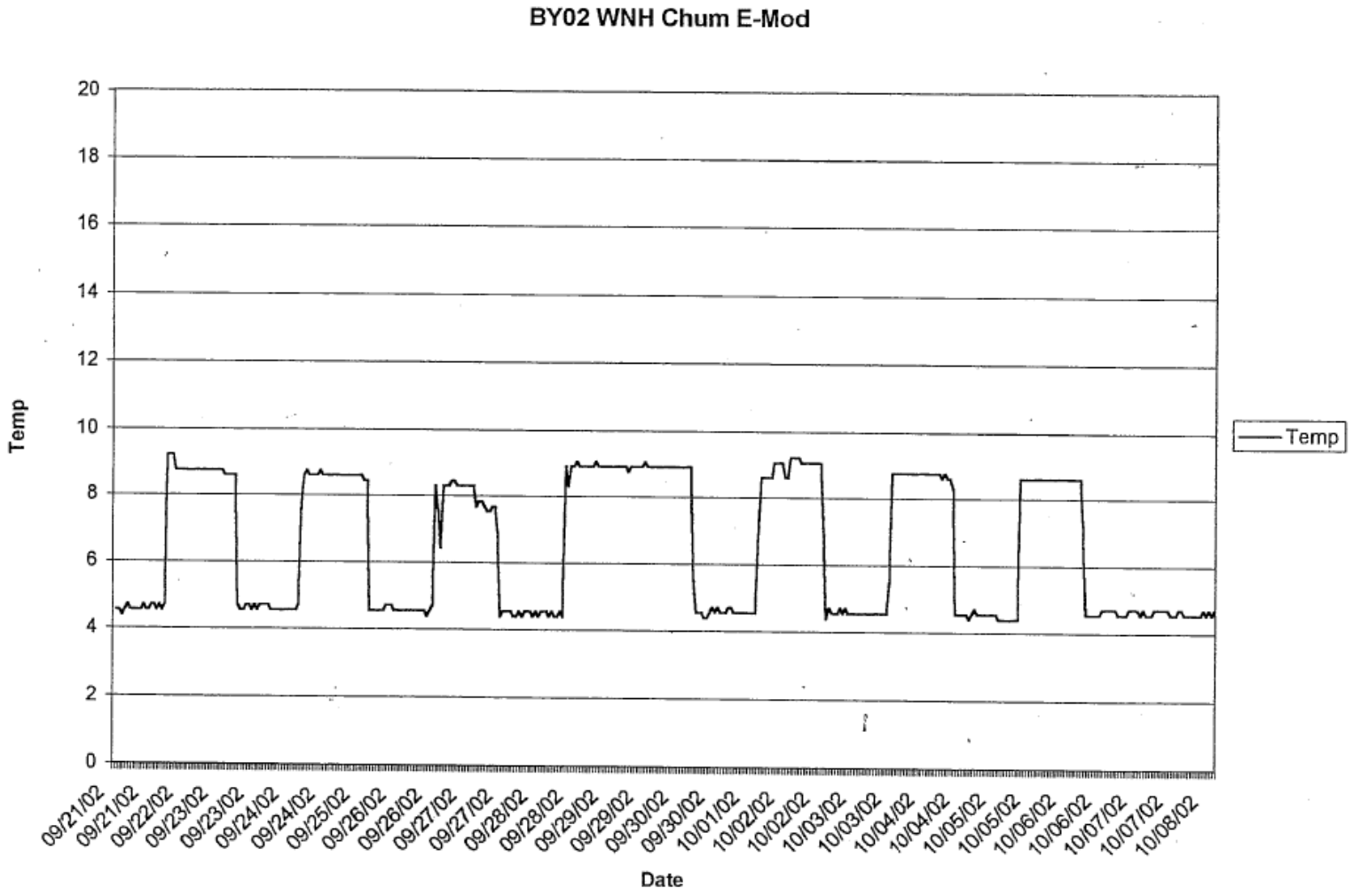
BY02 WNH Chum E-Mod
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10/08/02

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WALLEY NOERENBERG BY02 CHUM 02WO[illegible].xls 10[illegible]03

Date	Lot #	Total Eyed Eggs	Mort Grn-Hatch	Total Alevin	Mort Hatch-Emerg	Total Emergent	Survival Grn-Eye	Survival Eye-Hatch	Survival Grn-Hatch	Survival Grn-Emerg	Comments
07/05/02	1	3,077,890	245,638	3,047,111	91,413	2,955,698	93.5%	99.0%	92.5%	89.8%	Port Chalmers
07/06/02	2	5,267,489	708,185	5,214,814	156,444	5,058,370	88.9%	99.0%	88.0%	85.4%	Port Chalmers
07/07/02	3	5,761,412	737,796	5,703,798	171,114	5,532,684	89.4%	99.0%	88.5%	85.9%	Port Chalmers (Dropped an Incubator)
07/08/02	4	5,404,339	634,360	5,350,296	160,509	5,189,787	90.3%	99.0%	89.4%	86.7%	Port Chalmers
07/09/02	5	5,813,585	598,694	5,755,449	172,663	5,582,786	91.5%	99.0%	90.6%	87.9%	5,132,652 PC, 450,134 WNH
07/10/02	6	6,356,308	633,844	6,292,745	188,782	6,103,963	91.8%	99.0%	90.8%	88.1%	
07/11/02	7	7,098,348	845,011	7,027,365	210,821	6,816,544	90.2%	99.0%	89.3%	86.6%	
07/12/02	8	3,314,803	353,933	3,281,655	98,450	3,183,205	91.2%	99.0%	90.3%	87.6%	
07/13/02	9	7,285,767	750,924	7,212,909	216,387	6,996,522	91.5%	99.0%	90.6%	87.9%	
07/14/02											
07/15/02	10	8,351,228	916,094	8,267,716	248,031	8,019,685	90.9%	99.0%	90.0%	87.3%	2,123,478 AFK, 5,896,207 WNH
07/16/02	11	8,473,432	912,355	8,388,698	251,661	8,137,037	91.1%	99.0%	90.2%	87.5%	3,118,847 AFK, 5,018,190 WNH
07/17/02	12	7,261,893	749,332	7,189,274	215,678	6,973,596	91.5%	99.0%	90.6%	87.8%	5,476,612 AFK, 1,496,984 WNH
07/18/02	13	3,477,761	413,920	3,442,983	103,289	3,339,694	90.2%	99.0%	89.3%	86.6%	ALL AFK
07/19/02											
07/20/02	14	7,921,432	809,592	7,842,218	235,267	7,606,951	91.6%	99.0%	90.6%	87.9%	1,681,483 AFK, 5,925,468 WNH
07/21/02											
07/22/02	15	6,647,397	804,948	6,580,923	197,428	6,383,495	90.0%	99.0%	89.1%	86.4%	
07/23/02											
07/24/02	16	1,876,343	188,007	1,857,580	55,727	1,801,853	91.7%	99.0%	90.8%	88.1%	
07/25/02											
07/26/02											
07/27/02	17	7,508,060	805,619	7,432,979	222,989	7,209,990	91.1%	99.0%	90.2%	87.5%	
07/28/02	18	4,244,769	438,402	4,202,321	126,070	4,076,251	91.5%	99.0%	90.6%	87.8%	
07/29/02											
07/30/02											
07/31/02											
08/01/02											
08/02/02											
08/03/02											
08/04/02											
08/05/02											

Total Emerg	100,968,111
PC Bound	23,869,191
AFK Bound	15,740,114
LB Bound	61,358,806

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WALLEY NOERENBERG BY02 CHUM 02WOV...G.xls 1... 2003

Date	Lot #	Green Eggs	Shock Date	Shock CTU	Days Shock	Start Hatch	Start Hatch CTU	Days Hatch	End Hatch	End Hatch CTU	Days End Hatch	Start Emerg	Start Emerg CTU	Days Emerg	% Yolk Sac	Grn Eggs at Eye	Placed In Hatchery	Mort Grn-Eye
07/05/02	1	3,227,184	9/11	344.8	68	10/12	503.9	100	10/18	532.3	106	2/18/2003	1025.7	229	4.2%	3,292,749	3,292,749	214,859
07/06/02	2	6,158,930	9/12	344.4	68	10/12	498.5	99	10/18	526.9	105	2/19/2003	1023.5	229	4.1%	5,922,999	5,922,999	655,510
07/07/02	3	6,127,245	9/13	344.9	68	10/15	508.0	101	10/19	527.2	105	2/20/2003	1022.2	229	3.8%	6,441,594	6,441,594	680,182
07/08/02	4	5,943,753	9/17	360.8	71	10/16	508.9	101	10/24	547.2	109	2/22/2003	1024.8	230	3.9%	5,984,656	5,984,656	580,317
07/09/02	5	5,941,870	9/18	360.7	71	10/17	508.5	101	10/23	537.3	107	2/24/2003	1025.3	231	3.9%	6,354,143	6,354,143	540,558
07/10/02	6	6,589,974	9/19	360.6	71	10/18	528.8	101	10/25	562.4	108	2/24/2003	1041.4	230	4.3%	6,926,589	6,926,589	570,281
07/11/02	7	7,587,185	9/20	361.3	71	10/18	524.6	100	10/25	558.2	107	2/25/2003	1040.3	230	4.3%	7,872,376	7,872,376	774,028
07/12/02	8	3,591,775	9/23	370.0	73	10/19	523.7	100	10/26	557.4	107	2/28/2003	1044.1	232	4.1%	3,635,588	3,635,588	320,785
07/13/02	9	7,547,111	9/24	369.4	73	10/19	518.3	99	10/26	552.0	106	2/28/2003	1038.7	231	4.0%	7,963,833	7,963,833	678,066
07/14/02		N/A																
07/15/02	10	8,789,997	9/25	365.2	72	10/21	518.7	99	10/29	557.7	107	3/2/2003	1036.2	231	3.6%	9,183,810	9,183,810	832,582
07/16/02	11	8,883,683	9/27	371.4	73	10/21	515.3	98	10/31	566.6	108	3/4/2003	1039.6	232	3.9%	9,301,053	9,301,053	827,621
07/17/02	12	7,947,494	9/28	369.4	73	10/25	529.0	101	10/31	560.2	107	3/5/2003	1036.5	232	3.6%	7,938,606	7,938,606	676,713
07/18/02	13	4,090,790	9/30	363.2	75	10/26	522.7	101	11/1	554.8	107	3/5/2003	1025.7	231	3.6%	3,856,903	3,856,903	379,142
07/19/02		N/A																
07/20/02	14	8,272,018	10/1	358.2	72	10/28	522.9	101	11/1	545.0	105	3/6/2003	1050.5	230	2.9%	8,651,810	8,651,810	730,378
07/21/02		N/A																
07/22/02	15	7,165,314	10/2	364.3	72	10/28	519.7	99	11/4	558.6	106	3/19/2003	1056.6	241	2.3%	7,385,871	7,385,871	738,474
07/23/02		N/A																
07/24/02	16	1,998,506	10/3	359.4	71	11/1	532.7	101	11/7	563.9	107	3/28/2003	1072.4	248	1.6%	2,045,587	2,045,587	169,244
07/25/02		N/A																
07/26/02		N/A																
07/27/02	17	7,882,851	10/3	354.6	68	11/3	539.7	100	11/7	559.1	104	3/28/2003	1067.6	245	1.5%	8,238,598	8,238,598	730,538
07/28/02	18	4,079,969	10/7	358.4	71	11/3	524.5	99	11/7	543.9	103	3/30/2003	1058.7	246	1.4%	4,640,723	4,640,723	395,954
07/29/02																		
07/30/02																		
07/31/02																		
08/01/02																		
08/02/02																		
08/03/02																		
08/04/02																		
08/05/02																		

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PEN LOAD PLAN BY02

Lot	Inc	total eggs	% mort trayed	viable/inc	Net Pen	Sum by pen
1	31	189,011	0.167%	188,695	PC1	188,695
1	32	189,011	0.167%	188,695	PC1	377,391
1	33	189,011	0.167%	188,695	PC1	566,086
1	34	189,011	0.167%	188,695	PC1	754,781
1	35	189,011	0.167%	188,695	PC1	943,477
1	36	189,011	0.167%	188,695	PC1	1,132,172
1	37	189,011	0.167%	188,695	PC1	1,320,867
1	38	189,011	0.167%	188,695	PC1	1,509,563
1	39	189,011	0.167%	188,695	PC1	1,698,258
1	40	189,011	0.167%	188,695	PC1	1,886,954
1	41	189,011	0.167%	188,695	PC1	2,075,649
1	42	189,011	0.167%	188,695	PC1	2,264,344
1	43	189,011	0.167%	188,695	PC1	2,453,040
1	44	189,011	0.167%	188,695	PC2	188,695
1	45	189,011	0.167%	188,695	PC2	377,391
1	46	189,011	0.167%	188,695	PC2	566,086
1	47	58,863	0.167%	58,765	PC2	624,851
2	47	130,150	0.241%	129,836	PC2	754,687
2	48	189,012	0.241%	188,556	PC2	943,244
2	49	189,012	0.241%	188,556	PC2	1,131,800
2	50	189,012	0.241%	188,556	PC2	1,320,357
2	51	189,012	0.241%	188,556	PC2	1,508,913
2	52	189,012	0.241%	188,556	PC2	1,697,469
2	53	189,012	0.241%	188,556	PC2	1,886,026
2	54	189,012	0.241%	188,556	PC2	2,074,582
2	55	189,012	0.241%	188,556	PC2	2,263,139
2	56	189,012	0.241%	188,556	PC2	2,451,695
2	57	189,012	0.241%	188,556	PC3	188,556
2	58	189,012	0.241%	188,556	PC3	377,113
2	59	189,012	0.241%	188,556	PC3	565,669
2	60	189,012	0.241%	188,556	PC3	754,226
2	25	189,012	0.241%	188,556	PC3	942,782
2	26	189,012	0.241%	188,556	PC3	1,131,339
2	27	189,012	0.241%	188,556	PC3	1,319,895
2	28	189,012	0.241%	188,556	PC3	1,508,452
2	29	189,012	0.241%	188,556	PC3	1,697,008
2	30	189,012	0.241%	188,556	PC3	1,885,565
2	19	189,012	0.241%	188,556	PC3	2,074,121
2	20	189,012	0.241%	188,556	PC3	2,262,678
2	21	189,012	0.241%	188,556	PC3	2,451,234
2	22	189,012	0.241%	188,556	PC4	188,556
2	23	189,012	0.241%	188,556	PC4	377,113
2	24	189,012	0.241%	188,556	PC4	565,669
2	13	189,012	0.241%	188,556	PC4	754,226
2	14	189,012	0.241%	188,556	PC4	942,782
2	15	46,740	0.241%	46,627	PC4	989,410
3	15	142,259	0.370%	141,733	PC4	1,131,142
3	16	189,007	0.370%	188,308	PC4	1,319,450
3	17	189,007	0.370%	188,308	PC4	1,507,758
3	18	189,007	0.370%	188,308	PC4	1,696,065
3	7	189,007	0.370%	188,308	PC4	1,884,373
3	8	189,007	0.370%	188,308	PC4	2,072,681

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PEN LOAD PLAN BY02

3	9	189,007	0.370%	188,308	PC4	2,260,988
3	10	189,007	0.370%	188,308	PC4	2,449,296
3	11	189,007	0.370%	188,308	PC5	188,308
3	12	189,007	0.370%	188,308	PC5	376,615
3	1	189,007	0.370%	188,308	PC5	564,923
3	2	189,007	0.370%	188,308	PC5	753,231
3	3	189,007	0.370%	188,308	PC5	941,538
3	4	189,007	0.370%	188,308	PC5	1,129,846
3	5	189,007	0.370%	188,308	PC5	1,318,154
3	6	189,007	0.370%	188,308	PC5	1,506,461
3	61	189,007	0.370%	188,308	PC5	1,694,769
3	62	189,007	0.370%	188,308	PC5	1,883,077
3	63	189,007	0.370%	188,308	PC5	2,071,384
3	64	189,007	0.370%	188,308	PC5	2,259,692
3	65	189,007	0.370%	188,308	PC5	2,448,000
3	66	189,007	0.370%	188,308	PC6	188,308
3	67	189,007	0.370%	188,308	PC6	376,615
3	68	189,007	0.370%	188,308	PC6	564,923
3	69	189,007	0.370%	188,308	PC6	753,231
3	70	189,007	0.370%	188,308	PC6	941,538
3	71	189,007	0.370%	188,308	PC6	1,129,846
3	72	189,007	0.370%	188,308	PC6	1,318,154
3	73	189,007	0.370%	188,308	PC6	1,506,461
3	74	189,007	0.370%	188,308	PC6	1,694,769
3	75	159,346	0.370%	158,756	PC6	1,853,525
4	75	29,668	0.528%	29,511	PC6	1,883,037
4	76	188,980	0.528%	187,982	PC6	2,071,019
4	77	188,980	0.528%	187,982	PC6	2,259,001
4	78	188,980	0.528%	187,982	PC6	2,446,983
4	79	188,980	0.528%	187,982	PC7	187,982
4	80	188,980	0.528%	187,982	PC7	375,964
4	81	188,980	0.528%	187,982	PC7	563,947
4	82	188,980	0.528%	187,982	PC7	751,929
4	83	188,980	0.528%	187,982	PC7	939,911
4	84	188,980	0.528%	187,982	PC7	1,127,893
4	85	188,980	0.528%	187,982	PC7	1,315,875
4	86	188,980	0.528%	187,982	PC7	1,503,857
4	87	188,980	0.528%	187,982	PC7	1,691,840
4	88	188,980	0.528%	187,982	PC7	1,879,822
4	89	188,980	0.528%	187,982	PC7	2,067,804
4	90	188,980	0.528%	187,982	PC7	2,255,786
4	91	188,980	0.528%	187,982	PC7	2,443,768
4	92	188,980	0.528%	187,982	PC8	187,982
4	93	188,980	0.528%	187,982	PC8	375,964
4	94	188,980	0.528%	187,982	PC8	563,947
4	95	188,980	0.528%	187,982	PC8	751,929
4	96	188,980	0.528%	187,982	PC8	939,911
4	97	188,980	0.528%	187,982	PC8	1,127,893
4	98	188,980	0.528%	187,982	PC8	1,315,875
4	99	188,980	0.528%	187,982	PC8	1,503,857
4	100	188,980	0.528%	187,982	PC8	1,691,840
4	101	188,980	0.528%	187,982	PC8	1,879,822
4	102	188,980	0.528%	187,982	PC8	2,067,804

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PEN LOAD PLAN BY02

4	103	188,980	0.528%	187,982	PC8		2,255,786
4	104	111,917	0.528%	111,326	PC8		2,367,112
5	104	77,071	0.444%	76,729	PC8		2,443,841
5	105	188,986	0.444%	188,147	PC9		188,147
5	106	188,986	0.444%	188,147	PC9		376,294
5	107	188,986	0.444%	188,147	PC9		564,441
5	108	188,986	0.444%	188,147	PC9		752,588
5	109	188,986	0.444%	188,147	PC9		940,735
5	110	188,986	0.444%	188,147	PC9		1,128,881
5	111	188,986	0.444%	188,147	PC9		1,317,028
5	112	188,986	0.444%	188,147	PC9		1,505,175
5	113	188,986	0.444%	188,147	PC9		1,693,322
5	114	188,986	0.444%	188,147	PC9		1,881,469
5	115	188,986	0.444%	188,147	PC9		2,069,616
5	116	188,986	0.444%	188,147	PC9		2,257,763
5	117	188,986	0.444%	188,147	PC9		2,445,910
5	118	188,986	0.444%	188,147	PC9		2,634,057
5	119	188,986	0.444%	188,147	PC10		188,147
5	120	188,986	0.444%	188,147	PC10		376,294
5	121	188,986	0.444%	188,147	PC10		564,441
5	122	188,986	0.444%	188,147	PC10		752,588
5	123	188,986	0.444%	188,147	PC10		940,735
5	124	188,986	0.444%	188,147	PC10		1,128,881
5	125	188,986	0.444%	188,147	PC10		1,317,028
5	126	188,986	0.444%	188,147	PC10		1,505,175
5	127	188,986	0.444%	188,147	PC10		1,693,322
5	128	188,986	0.444%	188,147	PC10		1,881,469
5	129	188,986	0.444%	188,147	PC10		2,069,616
5	130	188,986	0.444%	188,147	PC10		2,257,763
5	131	188,986	0.444%	188,147	PC10		2,445,910
5	132	188,986	0.444%	188,147	PC10		2,634,057
5	133	188,986	0.444%	188,147		1	188,147
5	134	188,986	0.444%	188,147		1	376,294
5	135	92,861	0.444%	92,449		1	468,743
6	135	96,133	0.444%	95,706		1	564,449

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To: Dave Reggiani

From: Christine Mitchell

Re: Marking check list

Afternoon Dave,

Here is the follow up to my report on Potential Mixing of Otolith Marks between Port Chalmers, AFK Hatchery, and WNH Hatchery Release Locations. This checklist will be implemented for the upcoming season of BY06 fish. We will continue to adapt and improve all data and reporting for otolith marks as we review each season's data to make sure all went well and what if any issues there were during the marks.

Any questions or feedback please let me know.

Thanks, Chris

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Checklist for Reporting and Documenting Otolith Marks and Release Sites

Pre-Project Action List

- ☐ Receiving of finalized marks from ADF&G Mark, Age, and Tag Lab (ADF&G MATL)
- ☐ Completion of eyed egg and green egg incubator loading maps
- ☐ Marking of incubator valving for Port Chalmers and AFK incubator stacks
- ☐ Otolith marking plan and eyed egg loading map is reviewed and discussed by the Hatchery Manager, Assistant Hatchery Manager and Otolith Marking Supervisor
- ☐ Two weeks before otolith marking Hobo temperature loggers are installed in head boxes and troughs
- ☐ As soon as first ½ mod is loaded with eyed eggs Otolith Supervisor and Hatchery Manager or Assistant Hatchery Manager are notified and marking can commence
- ☐ All PC incubators are to be marked front and back
- ☐ All AFK incubators are to be marked front and back
- ☐ Schedule for Mod being marked is double checked with Hatchery Manager or Assistant Hatchery Manager before being turned on
- ☐ ADF&G Mark, Age, and Tag Lab procedures are to be followed and voucher samples retrieved prior to marking day 0

During Marking Phase Action list

- ☐ Thermal Schedule Marking Form is used and temps recorded daily
- ☐ Hourly temperatures for all heated Mods are recorded during the working day
- ☐ Valving for mark turned on at proper time as per the Thermal Marking Schedule Form
- ☐ 24 vs36 hour mark: Historical deep and shallow temperatures are monitored daily to ensure that the temperature will not drop below the 4° threshold before mark is complete
- ☐ Temperatures checked on adjacent troughs to marked troughs to ensure proper temping of all troughs
- ☐ Hatchery Manager or Assistant Hatchery Manager are also to be advised of mark taking place and will do daily walk through to ensure proper valving on all Mods and troughs

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Post Mark Action List

- ☐ Two weeks after mark is complete hobo's are removed and down loaded
- ☐ Temperature graphs are then checked against Thermal Mark Form and mark required for those Incubators
- ☐ The following standard data is required on all paperwork and each page; incubator #'s, Module letters, mark sequence, and intended release site for that mark
- ☐ On the CTU's tracking sheet the hot cycle needs to be shaded for appropriate dates
- ☐ Hatchery Manager and Hatchery Support Manager or Remote Programs Manager will review hobo graphs, thermal marking schedules, and incubation map to back check proper recording of mark and data before release
- ☐ The Incubator/Release spreadsheet should be filled in with pen #'s and release sites
- ☐ Incubator dumping schedule is projected
- ☐ At the beginning of each OM day incubators being dumped will be double checked by Incubation Supervisor and Hatchery Manager or Assistant Manager
- ☐ All incubators to be dumped for day are flagged at end of pen and start of pen
- ☐ Spirofelx for dumping location for day is double checked by OM Supervisor and Hatchery Manager or Assistant Hatchery Manager
- ☐ Incubation Supervisor and Big Joe Operator walk through and mark all pens to be dumped that day
- ☐ Incubation Supervisor double checks Incubation/Release spreadsheet and with Hatchery Manager or Assistant Hatchery Manager for proper destination of incubators being dumped for day
- ☐ Incubation Supervisor retrieves otolith sample vouchers from lots being dumped that day. Incubation Supervisor and Hatchery Manager or Assistant Hatchery Manager assure that all ADF&G MATL Procedures are being followed for retrieval, as well as PWSAC's procedures on retrievals of sample vouchers
- ☐ Spreadsheet updated nightly on incubator numbers, Mod letters, pen numbers filled and location site dumped for the day
- ☐ After all chums are out of Incubation room and before the Rearing Report is complete the Hatchery Manager or Assistant Hatchery Manager and the Hatchery Support Manager or Remote Programs Manager are to review all documents for all data to make sure nothing is missed and all marks went to the location stated

ALASKA DEPARTMENT OF FISH AND GAME

COMMERCIAL FISHERIES DIVISION

MEMORANDUM

TO: Steve Moffitt
PWS/CR Area Research Biologist

DATE: November 22, 2004

FROM: Richard Merizon
PWS/CR Research Biologist

SUBJECT: PWS chum salmon straying study, 2004

This memo provides a review of the results of our chum salmon straying work completed in 2004. This memo is a draft of the study results. Prior to publication, this document will have to go through ADF&G peer review.

INTRODUCTION

The Prince William Sound Aquaculture Corporation (PWSAC) operates the Wally Noerenberg Hatchery (WNH) on southern Esther Island in northwestern Prince William Sound (PWS; Figure 1). All PWSAC chum salmon *Oncorhynchus keta* broodstock are collected and reared at this facility. Juvenile chum salmon are released onsite at WNH and at two remote release locations: 1.) in Port Chalmers on north Montague Island (~55 water miles distant) and 2.) at the Armin F. Koernig (AFK) Hatchery on Evans Island in the Southwestern District (~60 miles distant; Figure 1). Since 1995, PWSAC has released ~72 million juvenile chum salmon at the WNH facility and ~23 million at Port Chalmers each year (ADF&G 2004). The five-year average total run estimate indicates these broodstock releases yield ~3.1 million adult chum salmon at WNH and ~800 thousand at Port Chalmers each year (Gray et al. 2003). In 1997 and 1998 small releases (~4 million juveniles) occurred at AFK. These releases produced returns averaging ~200,000 adult chum salmon. The last returns from releases in 1997 and 1998 occurred in 2003. In the spring of 2003, PWSAC began releasing ~15 million juvenile chum salmon at AFK with a five year fish transport permit (FTP).

Broodstock for PWSAC's chum salmon enhancement program was collected from Wells River and Beartrap Creek. Wells River in Wells Bay provided approximately three quarters of the parent broodstock and Beartrap Creek at the northeast end of Port Gravina provided the remainder. Broodstock was first collected at Wells River in 1989 (ADF&G 2004). Currently there are no means to separate the two stocks during broodstock collection at WNH.

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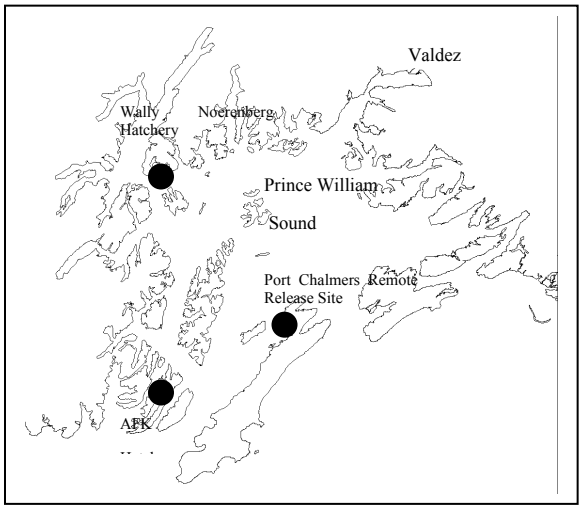

Figure 1. Location of chum salmon releases in Prince William Sound.

The Alaska Department of Fish and Game (ADF&G) operates a full picket weir at Eshamy River to enumerate adult sockeye salmon *O. nerka*. In 2002 the weir crew began counting a higher number of chum salmon than historically observed and collected otoliths to determine stock of origin. The majority (68 of 74) of the chum salmon sampled were of hatchery origin (10 - AFK, 10 - Port Chalmers, and 48 - WNH). Chum salmon otoliths collected at Eshamy River weir in 2003 provided similar results; most (66 of 76) were of hatchery origin (15 – Port Chalmers, 51 – WNH).

Eshamy River weir is ~28 water miles from WNH, ~39 water miles from AFK, and ~53 water miles from Port Chalmers (Figure 1). In 2001, ADF&G personnel collected otoliths from 33 chum salmon in Gumboat Creek in Eshamy Bay and the majority (29 of 33) were of hatchery origin (21 – AFK, 1 – Port Chalmers, 7 – WNH).

In March 2002 ADF&G began a review of chum salmon escapement goals for PWS in preparation for the Board of Fisheries meeting. These analyses showed that aerial estimates of chum salmon escapements increased considerably in chum salmon remote release areas (Table 1). Annual escapement estimates in the Montague District increased from an average of 357 chum salmon (n = 12 years) prior to hatchery remote releases to an average of 14,353 (n = 8 years) during years when hatchery chum salmon returns were occurring (Bue et al 2002). In the Southwestern District there was a similar pattern of increased escapement during years of hatchery returns (Table 1). The largest annual escapement estimates to the Southwestern District since 1984 occurred during years when hatchery chum salmon were returning to AFK hatchery (11,690 in 1989; 11,440 in 2000; and 12,373 in 2003). The 1984 – 2003 average escapement in the Southwestern District excluding 1989, 2000, and 2003 was 2,596 (n = 17 years).

ADF&G became concerned about straying of PWSAC chum salmon as a result of the escapement goal analysis in 2002, otolith samples collected at remote locations in PWS from 2001 to 2003, and work completed by Joyce and Evans (unpublished data), Joyce and Evans (1999), and Joyce et al. (unpublished data). These studies suggested hatchery pink salmon *O. gorbuscha* strays comprised a high proportion of the escapements in streams near western PWS hatcheries. Therefore, in July 2004 ADF&G began identifying streams in northwestern PWS with a significant abundance of chum salmon (>250 fish). In August 2004, ADF&G collected otoliths from streams in the Eastern (1), Northern (7), Unakwik (1), Coghill (2), Northwestern (3), and Eshamy Districts (1; Figure 2).

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Table 1.–Total hatchery origin chum salmon releases and estimated total run by release location, and estimated escapement by district, 1984–2004.

	Wally Noerenberg		Coghill Dist. Wildstock	Armin F. Koernig		SW District Wildstock	Port Chalmers		Montague Dist. Wildstock
Year:	Release: [a]	Run [b]	Escapement [e]	Release: [a]	Run [c]	Escapement [e]	Release: [a]	Run [d]	Escapement [e]
1984			19,690	7,654,292		20			0
1985	12,466,732		22,140	10,944,308		620			0
1986	15,172,261		13,140	2,039,750	NA	1,890			0
1987	36,478,818	378,094	24,510		NA	1,690			0
1988	68,388,803	456,992	39,240		NA	2,350			500
1989	79,845,649	400,343	22,680		NA	11,690			0
1990	47,495,780	441,282	26,020		NA	80			1,050
1991	76,834,313	166,119	6,070		NA	2,800			925
1992	98,044,672	378,826	10,003			2,940			783
1993	108,026,724	1,205,844	8,430			1,300			30
1994	82,029,558	1,044,469	14,176			2,225	18,078,640		0
1995	72,254,939	724,086	11,596			2,250	24,211,065		1,000
1996	79,543,524	1,802,517	19,669			2,231	22,771,006	0	5,216
1997	69,963,572	1,680,225	3,101	8,524,584		800	17,272,475	185,400	4,000
1998	77,838,928	1,039,049	22,764	10,121,106		1,602	22,105,799	204,536	10,690
1999	75,020,785	2,126,498	5,057		8,268	2,393	24,273,399	638,932	8,725
2000	76,306,351	3,350,040	20,488		419,133	11,440	23,995,577	992,253	66,202
2001	57,712,566	2,126,398	13,388		219,799	5,187	18,403,759	442,317	10,408
2002	75,341,899	5,237,624	7,430		54,464	3,985	25,913,467	1,071,478	565
2003	59,454,741	2,787,662	19,729	15,656,521		12,373	23,555,057	890,248	9,015
2004	NA	NA	NA	NA		NA	NA	~326,000	NA
Count:	19	17	20	6	4	20	10	8	20
5-yr.Ave.	68,767,268	3,125,644	13,218	15,656,521	175,416	7,076	23,228,252	807,046	18,983
Minimum:	12,466,732	166,119	3,101	2,039,750	8,268	20	17,272,475	0	0
Maximum:	108,026,724	5,237,624	39,240	15,656,521	419,133	12,373	25,913,467	1,071,478	66,202

[a] Data taken from the ADF&G Tag lab website (www.tagotoweb.adfg.state.k.us).

[b] Total run estimates are calculated as: total Coghill and Eshamy commercial CPF harvests (DGN, PS, and SGN), hatchery cost recovery and brood harvest minus the estimated "wild" contribution for Coghill (145,543) and Eshamy Districts (6,164) (these "wild" estimates were calculated as the average commercial harvest prior to hatchery influence, 1970 - 1986). There is a high degree of uncertainty in these estimates.

[c] Total run estimates are calculated as: all chum salmon caught in subdistrict 61 and 62. There is a high degree of uncertainty in these estimates.

[d] Total run estimates are calculated as total CPF harvest in the Montague District, assuming zero wildstock chum salmon are harvested.

[e] Chum salmon escapement estimates are based on observations from weekly aerial surveys and calculated using area under the curve with 17.5 days stream life.

STUDY AREA

Chum salmon otoliths were recovered in the northern and northwestern bays and fjords of PWS (Figure 2) and one tributary of the Rude River in Nelson Bay. Historically, the selected streams have had modest chum salmon escapements (>250 chum salmon). However, in 2004 hatchery and wild stock chum salmon runs were weak Sound-wide. All streams sampled were away from the straight line migration corridor from the Gulf of Alaska to WNH (McCurdy 1984, Templin et al. 1996; Figure 2).

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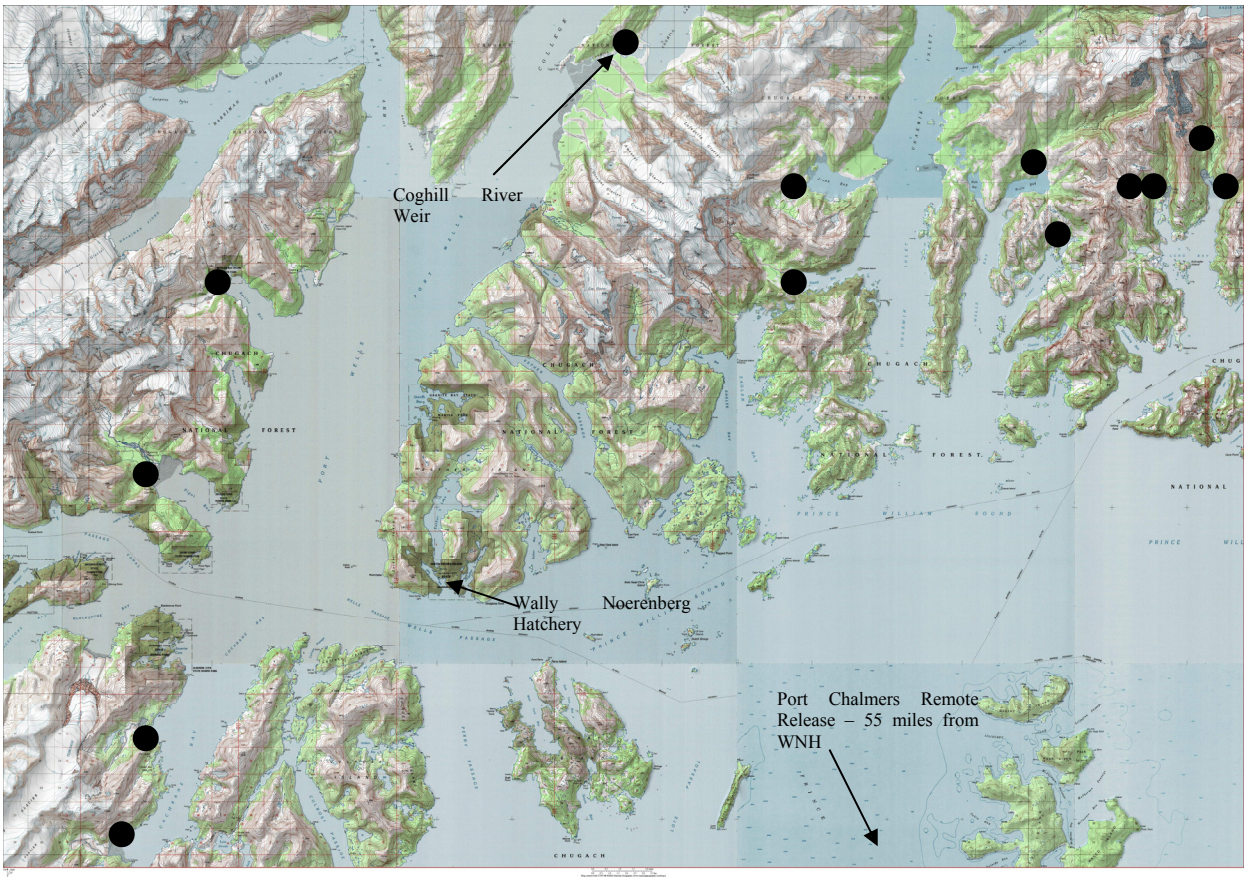

Figure 2.–Chum salmon otolith recovery locations in northwestern Prince William Sound (PWS), 2004. Stream mouths are marked with a solid black dot. This map does not include one tributary of the Rude River where three chum salmon otoliths were collected.

METHODS

In 2004 otoliths were collected from chum salmon escapements by ADF&G personnel in established field camps and by ADF&G personnel that flew to remote streams. Crews at sockeye salmon weir camps collected otoliths from adult chum salmon in nearby streams. Weirs on Eshamy and Coghill Rivers were operated by the ADF&G Division of Commercial Fisheries (Figure 2). The weir at Billy's Hole Creek in Long Bay was operated by ADF&G Sport Fish Division (Figure 2). The Coghill River weir crew collected chum salmon otoliths from the Coghill River about 1.5 miles upstream of the mouth. The Billy's Hole Creek weir crew collected chum salmon otoliths in streams of Long Bay (Table 2). There were insufficient numbers of chum salmon in Eshamy River or nearby streams for sampling in 2004.

Remote sampling locations were selected based on adequate escapement (>250 chum salmon) documented by aerial surveys. On 12 August, four ADF&G personnel were flown by Cordova Air in a De Havilland Beaver to Wells River, Cedar, Jonah, and Siwash Creeks in northern PWS (Table 2; Figure 2). On 20 August, five ADF&G personnel were flown to Mill, Swanson, Park, and Halferty Creeks in western PWS (Table 2; Figure 2).

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Each crew was equipped with a grab stick, first-aid kit, shotgun, and a complete otolith sampling kit. Crews of two or three people were transferred to successive streams. The otolith collection goal was 96 otoliths from each stream. Most samples were collected from carcasses; however, 20 live chum salmon were collected in Siwash Creek using a grab stick. Because few carcasses were available in most streams on 20 August, a full otolith sample was collected only from Mill Creek (Table 2). On 6 August, chum otoliths were collected (n = 3) from a tributary of the Rude River (221-10-10160-2011) in Nelson Bay.

Table 2.–Stream names and location of remote chum salmon otolith recovery in 2004.

District		Stat	Stream			Date	Nr. otoliths
Nr.	Name	Area	Number	Bay	Name	Sampled	collected
222	Northern	20	12340	Wells Bay	Wells River	8/12	96
222	Northern	20	12290	Cedar Bay	Cedar Creek	8/12	96
222	Northern	20	12640	Siwash Bay	Siwash Creek	8/12	92
222	Northern	50	12580	Jonah Bay	Jonah Creek	8/12	96
222	Northern	10	12157	Long Bay	W. Long Bay	8/7	48
222	Northern	10	12140	Long Bay	E. Long Bay	8/6	86
222	Northern	10	12170	Long Bay	"Hotsprings" Ck.	8/7	48
222	Northern	10	12130	Long Bay	"Bear" Ck.	8/7	8
223	Coghill	10	14210	Bettles Bay	Mills Creek	8/20	96
223	Coghill	10	14320	Pigot Bay	Swanson Creek	8/20	30
223	Coghill	30	13220	Port Wells	Coghill River	6/5-7/15/04	6
224	Northwestern	10	14540	Cochrane Bay	Halferty Creek	8/20	29
224	Northwestern	10	14580	Cochrane Bay	Park Creek	8/20	46
221	Eastern	10	10160-2011	Nelson Bay	Rude River trib #1	8/6	3
						Total:	**780**

RESULTS

Hatchery origin chum salmon were found in 11 of 14 sampled streams (Table 3). All otoliths (n = 3) recovered from the unnamed Nelson Bay stream were of hatchery origin (1 from WNH, 2 from Port Chalmers). Over 30% of the sampled otoliths were of hatchery origin in Siwash Creek, East Long Bay Creek, and Coghill River; however, the sample size in Coghill River was small (6 otoliths). Over 15% of the observed strays in East Long Bay Creek and Coghill River were released at Port Chalmers. Port Chalmers is ~57 water miles from East Long Bay Creek and 79 water miles from Coghill River (Appendix A-1).

The 2004 Commercial Common Property Fishery (CPF) harvested hatchery origin chum salmon in areas outside of the straight line migration corridors to either WNH or Port Chalmers. Approximately 5,000 chum salmon released at Port Chalmers were harvested in the Eshamy District during periods 4, 5, 7, and 8. In the Coghill District, more than 12,000 chum salmon released at Port Chalmers were harvested during periods 5 and 9. The Eshamy and Coghill Districts are ~45 and 49 water miles from the release site at Port Chalmers. In the Montague District, Port Chalmers Subdistrict, ~1,700 WNH origin chum salmon were harvested during period 6 from 5 to 11 July.

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Table 3.–Stock of origin and stream distance from release facility, 2004.

Stream Name	Estimated Escapement [a]	Percentage				TOTAL Hatchery	Distance from (mi.) [b]	
		Wild	Hatchery	WNH	Pt. Chalm		WNH	Pt. Chalm
Wells River	18,969	97.9%	2.1%	2.1%	0.0%	398	30	56
Cedar Creek	2,500	99.0%	1.0%	1.0%	0.0%	25	28	54
Siwash Creek	2,852	64.1%	35.9%	26.1%	9.8%	1,024	29	56
Jonah Creek	4,000	97.9%	2.1%	2.1%	0.0%	84	33	58
W. Long Bay	NA	89.6%	10.4%	4.1%	6.3%	NA	38	57
E. Long Bay	1,449	68.6%	31.4%	12.8%	18.6%	455	37	57
"Hotsprings" Ck.	417	100.0%	0.0%	0.0%	0.0%	0	36	54
"Bear" Ck.	4,000	87.5%	12.5%	12.5%	0.0%	500	35	54
Mills Creek	1,245	100.0%	0.0%	0.0%	0.0%	0	17	67
Swanson Creek	1,800	96.7%	3.3%	3.3%	0.0%	59	11	63
Coghill River	5,000	66.7%	33.3%	16.7%	16.7%	1,665	27	79
Halferty Creek	3,461	100.0%	0.0%	0.0%	0.0%	0	13	64
Park Creek	3,452	87.0%	13.0%	10.9%	2.2%	449	18	68
Nelson Bay	50	0.0%	100%	33.0%	67.0%	50	90	72
Total:	**49,195**					**4,709**		

[a] Escapement estimates are based on Area Under the Curve (AUC) for all streams except Nelson Bay (Rude River trib #1) is based on peak count from observations on 6 August, 2004.

[b] Distance was measured as the shortest distance over water in miles. Software used to measure the distance was TOPO version 3.2.0, produced by National Geographic 2002.

DISCUSSION

This study adds to the increasing documentation of hatchery strays in PWS escapements (Joyce and Evans 1999; Sharp et al. 1993; Joyce and Evans unpublished data). ADF&G and PWSAC should address issues related to hatchery strays outlined by the Sound Science Review Team in 1999. The "seven initial questions" posed by the Science Review Team are all related to one question: Do hatchery fish have negative impacts on wild stocks?

The information from this study and the previous work by Sharp et al. (1993) and Joyce and Evans (1999) suggest 1) PWS hatchery pink and chum salmon may stray at high rates into streams, and 2) the department has been overestimating the escapement of wild pink and chum salmon in PWS. This study documented chum salmon strays from PWS hatcheries and remote releases comprising up to ~36% of the sampled otoliths in streams with sample sizes > 90 otoliths (Table 3). Chum salmon strays from WNH releases were documented in streams as far as 90 water miles from their release site and strays from Port Chalmers releases were documented ~79 water miles from their release site. The department has assumed that all salmon counted during aerial surveys are wild stocks. Commercial fisheries management of wild pink and chum salmon stocks is based on the assumption that the average productivity of these stocks is known (fixed escapement goal policy). Stream escapements with high proportions of hatchery fish have an unknown productivity. If hatchery stocks do successfully spawn in wild systems, this may result in altered run timing and reduced genetic fitness of existing wild stocks (MacKey et al. 2001).

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These samples were collected (6, 12, and 20 August) near the end of the run timing of the WNH cost recovery and broodstock harvests (5-year average mean harvest date of 23 June; ADF&G unpublished data). Therefore, these data may under estimate the contribution of hatchery origin chum salmon to the sampled streams. Also, 2004 had poor wild stock escapements and hatchery runs of chum salmon. In 2004, approximately 2.5 million chum salmon (hatchery and wild stock total run) returned to PWS. Total hatchery runs (Coghill District CPF, WNH hatchery cost recovery, WNH broodstock escapement and Montague District CPF harvest combined) fell 2.1 million short of the 4.1 million chum salmon preseason forecast (PWSAC 2004). Approximately 214 thousand chum salmon escaped into PWS index streams (ADF&G unpublished data), and this is within the PWS sustainable escapement goal range of 100,000 to 249,000 (Bue et al. 2002). The chum salmon remote release at Port Chalmers had a poor run in 2004 (326 thousand fish harvest versus a preseason forecast of 997 thousand). The relatively large percentages of Port Chalmers origin chum salmon in Eastern, Northern and Coghill District stream samples (67% in Rude River tributary, 18.6% in East Long Bay, 16.7% in Coghill River) are surprising given the low total run estimate.

Another question posed by these data is how does straying affect the PWS Management and Salmon Enhancement Allocation Plan (5 AAC 24.370)? There are now data that suggest the drift gillnet fleet may be harvesting chum salmon in the Coghill District that are allocated for the purse seine fleet in the Montague District.

Given the relatively high percentages and broad spatial distribution of chum salmon strays in 2004, a year with relatively low chum salmon abundance, a more complete straying study appears warranted.

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APPENDIX A

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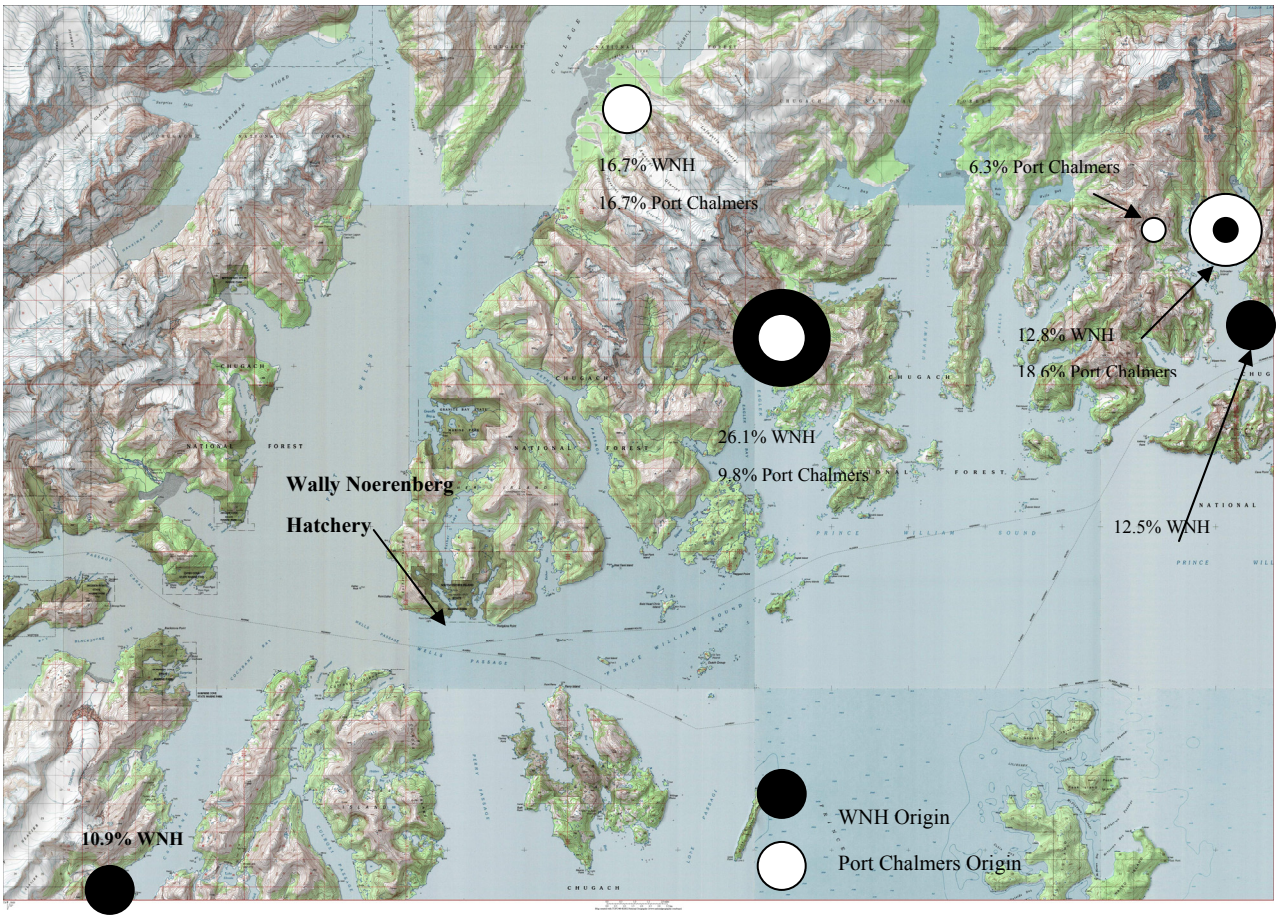

Appendix A-1.–Relative proportion of hatchery origin chum salmon stock by stream and release location, 2004. Only streams with >5% hatchery origin are shown except contributions from the Rude River tributary (221-10-10160-2011). An additional four streams had hatchery chum salmon represent <5% of the total escapement.

STATE OF ALASKA

Frank Murkowski, GOVERNOR

DEPARTMENT OF FISH AND GAME

COMMERCIAL FISHERIES DIVISION

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M E M O R A N D U M

TO: Dave Regianni, General Manager
Prince William Sound Aquaculture Corporation, Cordova

FROM: Rick Merizon, Research Biologist
CFD, Region II, Cordova

THRU: Dan Gray, Regional Management Biologist
CFD, Region II, Anchorage

DATE: 13 March 2006

SUBJECT: Summary of the 2005 hatchery chum salmon straying study

Enclosed please find the preliminary results for the 2005 hatchery chum salmon straying study completed in Prince William Sound. This study documented significant straying of PWSAC hatchery chum salmon in the majority of the sampled streams. Fourteen of the seventeen sampled streams had a hatchery chum salmon straying rate greater than 2%, (PWS/CR Phase 3 Comprehensive Salmon Plan 1994). Thirty five streams were initially selected based on a historical peak abundance of >1,000 chum salmon (aerial surveys). Of the 35 streams that met the original abundance criteria, streams were selected for sampling based on 2005 inseason, weekly aerial survey abundance estimates. We attempted to visit all streams twice during peak chum salmon abundance and collect a sample (n = 96 pairs) of otoliths. However, because of low abundance or inclement weather, several of the streams were visited only once or a full sample was not collected. Therefore, several streams have sample sizes that are lower than our goal (Table 1).

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Table 1.–Hatchery chum salmon straying rates throughout select streams in Prince William Sound, 2005.

Stream	Sample Size				Facility Specific Straying Rate		Overall	2004	Distance (km)	
Name	WHN	PC	Wild	Total	WNH	PC	Rate	Rate	WNH	PC
Beartrap Creek	0	0	373	373	0.0%	0.0%	0.0%	NA	120	90
Eshamy River	213	9	5	227	93.8%	4.0%	97.8%	NA	40	50
Koppen Creek	3	0	220	223	1.3%	0.0%	1.3%	NA	120	90
Hartney Creek	2	6	210	218	0.9%	2.8%	3.7%	NA	130	80
Constantine Creek	0	1	191	192	0.0%	0.5%	0.5%	NA	100	40
Long Creek	8	9	175	192	4.2%	4.7%	8.9%	10.4%	50	90
Olsen Creek	1	2	189	192	0.5%	1.0%	1.6%	NA	110	80
Wells River	5	0	187	192	2.6%	0.0%	2.6%	2.1%	50	90
Nuchek Creek	6	2	160	168	3.6%	1.2%	4.8%	NA	100	40
Siwash Creek	93	9	61	163	57.1%	5.5%	62.6%	35.9%	30	80
Mill Creek	19	2	127	148	12.8%	1.4%	14.2%	0.0%	20	100
Indian Creek	1	2	94	97	1.0%	2.1%	3.1%	NA	80	90
Coghill River	53	4	1	58	91.4%	6.9%	98.3%	33.3%	30	100
Swanson Creek	13	2	26	41	31.7%	4.9%	36.6%	3.3%	20	90
W. Finger Creek	1	1	29	31	3.2%	3.2%	6.5%	NA	30	80
Paulson Creek	5	1	18	24	20.8%	4.2%	25.0%	NA	20	80
Sunny River	3	1	14	18	16.7%	5.6%	22.2%	NA	100	90
Robinson Falls Ck	0	0	13	13	0.0%	0.0%	0.0%	NA	130	100
Humpback Creek	3	2	7	12	25.0%	16.7%	41.7%	NA	130	90
Halferty Creek	0	0	9	9	0.0%	0.0%	0.0%	0.0%	20	80

ADF&G is completing a literature review and ADF&G Fisheries Data Series report. The issues being examined include, straying rate as it relates to 1) distance from the release facility, 2) size of the estimated total escapement, and 3) temporal patterns, as well as examining differences between the intertidal and upstream zones, sexes, ages, and egg retention between wild and hatchery chum salmon. We anticipate a draft report by late-March that will be ready for peer review and publication.

ADF&G is planning additional work for the 2006 season. Local staff will duplicate sampling efforts similar to those in 2005 as well as possibly collect genetic tissue samples from select streams throughout PWS. Genetic samples would be paired with otolith collections for stock of origin determination. Samples would also be used to examine the feasibility of identifying the potential influence on existing wild stock chum salmon from the WNH brood stock. These data would be examined at the ADF&G Anchorage Genetics Lab.

These data document a significant hatchery chum salmon straying issue in PWS. However, provided there is an opportunity for open discussion and a review of existing rearing and release strategies ADF&G is confident these issues can be appropriately handled. The ADF&G welcomes a cooperative effort during the 2006 season. It is in the best interest of both ADF&G and PWSAC to promote healthy and sustainable hatchery and wild stock salmon in PWS.

cc.
Steve Moffitt,
Bert Lewis,
Glenn Hollowell,
Dan Gray,
Jeff Regnart,
Jim Seeb

Appendix A10.–Gulkana Hatchery PAR and permit compliance memo to PWSAC.

ALASKA DEPARTMENT OF FISH AND GAME

COMMERCIAL FISHERIES DIVISION

MEMORANDUM

To: Dave Reggiani, General Manager, Prince William Sound Aquaculture Corporation

Through: Jeff Regnart, Regional Supervisor, CF, Region II, Anchorage

From: Bert Lewis, Area Management Biologist, CF, Region II, Cordova

Date: March 7, 2006

Subject: PWSAC Permit Alteration Request for Crosswind Lake release numbers

PWSAC has submitted a Permit Alteration Request (PAR) for the Regional Planning Team (RPT) to consider at the annual spring meeting. The PAR seeks to increase the Crosswind Lake sockeye salmon fry stocking capacity from 7.6 million to 10 million. The PAR was originally considered at the 15 April 2005 RPT. At the 2005 meeting, the department stated that prior to consideration of any alteration to the current stocking plan the department needs the following information; 1) a review of at least 2 years (2005 and 2006) of complete otolith analysis data, including commercial, personal use, and subsistence harvests (less than required by the BMP), 2) limnology data from all lakes for all years and timely delivery of future limnology data (per the BMP), and 3) no net increase in annual returns beyond 300,000 fish (per the BMP). The department supports the PAR in concept, but requires the otolith contributions and limnology data to make an informed decision. The department agreed that an early 2006 RPT meeting would be scheduled if the data was provided to the department with sufficient time for review. An early date was agreed to so that, if the PAR was approved, PWSAC could implement the changes prior to stocking Crosswind Lake in 2006.

In November 2005, per that agreement, an early RPT was scheduled for 24 January 2006. PWSAC assured the department the limnology data would be available prior to the meeting. The otolith contributions were completed in 2005 with funding from PWSAC and the department. However, the meeting was canceled because PWSAC did not provide the limnology data. The department still does not have the limnology data from all lakes for all years as was agreed to at the spring 2005 RPT meeting. The PAR cannot be considered an action item for the 2006 RPT agenda until the conditions of the agreement are met.

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The department wishes to provide PWSAC every opportunity to have this PAR considered at the 2006 RPT meeting. If the limnology data are provided with sufficient time for department review, the PAR may be considered at the RPT meeting. As discussed, the department considers sufficient review time to be 4 weeks. The RPT meeting is currently scheduled for 18 April.

The department also encourages PWSAC to address the lack of compliance with several permit requirements. PWSAC has been out of compliance with the permit requirement of timely delivery of limnology data for 6 years, despite repeated requests for the data. PWSAC has also never completed the smolt out-migration monitoring permit requirement on Paxson Lake as outlined in the BMP. As outlined in Dr. Tom Quinn's analysis of Crosswind and Summit lakes data for PWSAC, smolt size and abundance data may provide information useful to evaluate stocking levels. The Crosswind Lake permitted stocking level of 7.6 million fry has been exceeded in 4 of the last 5 years. The delivery of otoliths from broodstock escapements as outlined in cooperative agreements has also been problematic. These ongoing problems interfere with the effective operation of PWSAC and impair the relationship between PWSAC and the department. The department hesitates to consider any PAR associated with the Gulkana Hatchery operations as long as these problems continue.

Appendix A11.–Memo concerning PWSAC Permit Alteration Request for Gulkana Hatchery.

STATE OF ALASKA

FRANK MURKOWSKI, GOVERNOR

DEPARTMENT OF FISH AND GAME

DIVISION OF COMMERCIAL FISHERIES

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1 July 2004

To: Dave Reggiani
General Manager
Prince William Sound Aquaculture Corporation

Through: Jeff Regnart
Regional Supervisor
CF, Region II
Anchorage

From: Dan Ashe
PWS / Copper River Area Management Biologist
CF, Region II
Cordova

Date: January 20, 2005

Subject: Comments concerning PWSAC Permit Alteration Request for Gulkana Hatchery

PWSAC submitted two Permit Alteration Requests (PAR's) for the Regional Planning Team to consider in the spring of 2005. These PAR's specifically request: 1) To increase the permitted stocking capacity of Gulkana Hatchery sockeye salmon fry into Crosswind Lake from 7.6 million to 10 million annually, and 2) Allow a permitted capacity of 1.2 million Chinook salmon eggs at the Gulkana II Hatchery with an intent of re-initiating broodstock development of Chinook salmon from the Gulkana River. This memo addresses each PAR separately.

Increase of Stocking Capacity of the Gulkana Hatchery Sockeye Salmon Fry into Crosswind Lake from 7.6 million to 10 million Annually

Background Information

A more detailed account of the Gulkana Hatchery Complex may be found in the Gulkana Hatchery Basic Management Plan (BMP). The Gulkana Hatchery Complex consists of two sockeye salmon incubation facilities (Gulkana I and II) located above Paxson Lake on the east fork of the Gulkana River. ADF&G initiated operations at this facility in 1973 and operated the hatchery complex until PWSAC assumed

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operation in 1993 under contract with the state of Alaska. Since hatchery operations and sockeye salmon fry releases began at the two hatchery sites, two remote release sites have since been included as part of the hatchery release program – Summit and Crosswind Lakes. Summit Lake is located upstream of Paxson Lake and sockeye salmon fry were first released into this system in 1980. Crosswind Lake is located along the west fork of the Gulkana River and the first sockeye salmon fry were released into this system in 1985. Crosswind Lake was added as a regular release site in 1988.

The current permitted green sockeye salmon egg take is 35 million for Gulkana I (since 1988) and 1.75 million for Gulkana II.

The current Gulkana Hatchery BMP permits the following sockeye salmon fry releases:

Release Location	**Maximum Fry Release**
Paxson Lake (Gulkana I on-site release)	10 million
Summit Lake	5 million (an additional 1 million may be released if egg to fry survivals are better than expected)
Crosswind Lake	7.6 million
Gulkana II (on-site release)	1.31 million

The accepted program goal of the Gulkana Hatchery Facility (BMP section 2.2) "is to provide an annual average return of 300,000 adult sockeye salmon without jeopardizing delta and upriver wild stock escapements. Hatchery production will contribute to all common property fisheries including commercial, personal use, subsistence, and sport".

As the Gulkana Hatchery program expanded there was growing concern over the department's ability to achieve wild stock escapement goals. The Gulkana Hatchery Policy Paper (Brady et al. 1990) was produced when the hatchery run was estimated as 250,000 and 300,000 adults. The policy paper as well as the current BMP identifies evaluation projects that would enable the department to better achieve wildstock escapement goals for both upriver and delta components of the Copper River sockeye salmon run. These projects focus on escapement enumeration, AWL sampling, stock identification, nursery lake evaluations, and data analysis. Since 1990 enhanced sockeye salmon runs have averaged above the prescribed 250,000 to 300,000 goal of returning adults, with a 10-year (1995-2004) average estimated run of 382,700 enhanced sockeye salmon adults. These large hatchery runs continue to complicate harvest management of the Copper River District even though wild sockeye salmon runs have also increased.

The primary recommendation of both the Gulkana Hatchery Policy Paper and the Gulkana Hatchery BMP was that production would not be increased until an adequate evaluation program was in place to address management concerns. All enhanced sockeye salmon fry since brood year 1999 have been otolith marked using strontium chloride. The BMP calls for two complete brood years to have returned that have had successful otolith marks applied as fry before consideration of adjusting stocking levels to achieve the target production of 300,000 adults. The first brood year return of otolith marked enhanced sockeye salmon fry was 2004. This reevaluation was anticipated at the time of the adoption of the current BMP to occur prior to the spring 2006 Regional Planning Team meeting.

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Management Concerns Over Increasing Crosswind Lake Sockeye Salmon Stocking Rates

Managing sockeye salmon escapement for the Copper River Delta is complicated by large returns of enhanced fish with similar run timing. The Gulkana Hatchery Policy Paper identifies five assumptions that must be met to successfully achieve escapement goals for both upriver and delta sockeye stocks returning to the Copper River Drainage. These assumptions are:

1. Abundance forecast of upriver and hatchery stocks are accurate.
2. Forecast of run timing for upriver and hatchery stocks is accurate.
3. Annual upriver exploitation rate is the same for all stocks and allows adequate delta run escapement.
4. Juvenile and marine survival rates are equal for wild and hatchery stocks.
5. Proportion of wild and hatchery stocks is accurately assessed during the season.

Forecast accuracy for Copper River sockeye salmon returns is highly variable. Since 1993, the first year of full returns of enhanced sockeye salmon at the current egg take capacity, forecast error has averaged 25% within the actual estimated run with a range of -0.7 % to 46.9%. The poorest correlations of forecast to actual run strength have been consistently in years of high estimated hatchery returns. The table below provides the forecasted run of sockeye salmon returning to the Copper River, the estimated actual run, the forecasted return of enhanced sockeye salmon, and the estimated actual return of enhanced sockeye salmon from 1993-2004.

Year	Total Run Forecast	Estimated Actual Run	Enhanced Run Forecast	Estimated Actual Enhanced Run	Percent Accuracy of Total Forecast vs. Actual Run
1993	1,624,500	2,315,789	221,000	97,250	29.9%
1994	1,349,100	1,989,958	235,000	69,750	32.2%
1995	1,650,100	1,972,079	315,000	65,640	16.3%
1996	2,050,000	3,341,895	307,000	121,000	38.7%
1997	2,234,000	4,210,084	250,300	403,300	46.9%
1998	2,740,000	2,338,532	410,000	671,125	-17.2%
1999	2,233,651	2,696,056	649,500	1,036,000	17.2%
2000	2,097,000	1,628,073	890,000	478,575	-28.8%
2001	1,464,736	2,261,559	553,500	307,875	35.2%
2002	1,617,151	2,175,059	420,000	425,400	25.7%
2003	2,016,409	2,002,862	350,000	241,400	-0.7%
2004	1,640,952	1,822,563	111,000	77,150	10.0%

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The assumption of accurate forecasting is important when the surplus component of the sonar goal is calculated. Enhanced sockeye salmon returning to Gulkana Hatchery or its remote release sites are mixed with wild stocks, making it impossible to target enhanced fish exclusively in any of the Copper River fisheries. To ensure that wild stocks are not over exploited a hatchery surplus component is part of the sonar goal. The surplus component is not intended or used to satisfy any fishery allocation goals. The surplus component is intended to ensure hatchery fish are exploited at the same rate as wild fish. In years that the enhanced sockeye run is less than forecasted the surplus component is higher than needed subtracting from surplus salmon that could have been available to commercial common property harvest. In years that the enhanced sockeye run is more than forecasted the surplus component is lower than needed exposing wild stocks to potential over exploitation rates by all fisheries.

Enhanced sockeye salmon are present throughout the run. Based on coded wire tag and marked otolith recoveries in the commercial fishery indicate the majority of enhanced sockeye salmon peak in abundance from late June to mid July.

The department is concerned over the exploitation rates of enhanced sockeye. The delta and upriver run follows the same run timing as that of the enhanced sockeye salmon run. The delta and late upriver sockeye salmon run is less robust than that of the upriver enhanced sockeye salmon run; therefore it cannot withstand the same harvest pressure that enhanced upriver stocks can withstand. With large abundances of enhanced sockeye salmon mixed with wild stocks it is imperative that accurate assumptions of exploitation rates be made. The assumption that exploitation rates are known becomes a greater concern when enhanced sockeye returns are more than forecasted. Both the Gulkana Hatchery Policy Paper and the BMP recommend an enhanced sockeye salmon run of 250,000 to 300,000 fish. This recommended threshold is to help manage for delta sockeye escapement goals that would be difficult to achieve with large abundances of enhanced sockeye in the fishery.

Currently the department assumes all Copper River fisheries have the same exploitation rate on wild and enhanced stocks. This assumption is flawed; however the only reliable available data to assign any exploitation rate assumptions comes from the commercial fishery. PWSAC advocates that the failure to achieve adequate brood stock from Paxson Lake is the result of over harvest in the upriver fisheries. Less than adequate returns to Paxson Lake despite adequate escapement past the Miles Lake sonar may very well indicate a higher than assumed exploitation rate occurring in the upriver fisheries that is not being accounted for in the sonar escapement goal (assuming forecasts are accurate to begin with). If this is indeed the situation a higher surplus component is needed annually for the sonar escapement goal. Evaluation studies to examine otoliths from upriver harvest and determine exploitation rates must be undertaken before an increase in stocking levels could be considered.

PWSAC has not achieved brood stock requirements from Paxson Lake for the past four years. Again, PWSAC advocates the reason for these shortfalls is due to over harvest occurring in the upriver fisheries. The department has reason to believe that other factors are at play to account for the less than desirable returns to Paxson and Summit Lakes. The department in collaboration with PWSAC evaluated limnological conditions in Paxson, Summit, and Crosswind Lakes until 2000 when PWSAC withdrew from the cooperative agreement and assumed this responsibility individually. The last available limnological assessment by the department reported some disturbing trends. In short the macrozooplankton biomass for both Summit and Paxson Lakes are very low given the current stocking levels with strong evidence of over grazing occurring. The limnology memo is attached for a more detailed review of the concerns that current stocking rates may be higher than optimal, resulting in poor fry to smolt survival. The BMP which is an addendum to PWSAC's Gulkana Hatchery Permit specifies

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that PWSAC fund limnology evaluations and provide the department all data and findings in a timely manner. The department has requested PWSAC's limnology data and findings repeatedly for three years with no compliance to date.

In essence there remain many questions surrounding Gulkana Hatchery enhanced sockeye salmon. The BMP calls for two brood year returns of 100% otolith marked enhanced fish and corresponding evaluations to account for exploitation rate, survival rates, and development of techniques to sample and examine otoliths. 2004 was the first brood year of marked enhanced sockeye salmon to return.

Area staff is strongly opposed to this proposal. This proposal violates the intent of the Policy for the Management of Sustainable Salmon Fisheries as well as the Gulkana Hatchery Complex Policy to not compromise wild stock management precision for increased harvests. PWSAC has failed to comply with its current BMP to provide limnological data and findings. PWSAC has failed to conduct necessary evaluation projects pertaining to its release of enhanced sockeye salmon. There is uncertainty in upriver exploitation rates and any increased production can exacerbate an already difficult goal of maintaining a sustainable fishery.

Allow a permitted capacity of 1.2 million Chinook salmon eggs at the Gulkana II Hatchery with an intent of re-initiating broodstock development of Chinook salmon from the Gulkana River

Background Information

The background information provided is a summary of documents produced by James Brady, Ken Roberson, Craig Whitmore, and Paul Krasnowski.

The Gulkana Hatchery Chinook program was originally proposed in 1986 and 1987. A report "Gulkana Hatchery Complex Development Proposal" was drafted by Ken Roberson in February 1987, outlining a long range development plan for both sockeye and Chinook salmon at the Gulkana Hatchery complex. The proposal outlined a four phase development plan, with each phase lasting approximately 5 years. Proposed production levels for Chinook were referenced at 250,000 eggs in Phase I and were to expand to 2.5 million by Phase III. The objectives during Phase I were; 1) evaluate Chinook salmon egg take, incubation, and rearing techniques; 2) evaluate potential in unutilized lakes; 3) development of a brood source.

An FTP was approved to take up to 60,000 Chinook salmon eggs from the Gulkana River for incubation at the hatchery and release at Monsoon Lake and later amended in 1989 to be effective through 1993. Review of the project by ADF&G in 1991 concluded the management risk and associated evaluation monitoring costs were not feasible to continue.

Management Concerns Over Enhanced Chinook Salmon in the Copper River

There is limited Chinook salmon brood stock source available at the Gulkana II Hatchery site. Genetic policy requirements will need to be satisfied for this matter.

The Chinook salmon enhancement endeavors caused much strife within the department. Ultimately when the project was canceled the department who was responsible for the Gulkana Hatchery Complex at the time had failed to produce a Basic Management Plan for the project and failed to properly evaluate releases.

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The concerns of the early 1990's are similar to those of today regarding enhancement of Chinook salmon in the Copper River Drainage.

The department is mandated to manage for a Chinook salmon spawning escapement of 24,000 or greater. At present the department has no means to assess Chinook salmon escapement inseason. In order to properly manage any mixed wild and enhanced fishery the five assumptions cited above will need to be satisfied. The department and the Native Village of Eyak have monitored spawning distribution, run timing, and inriver escapement for the past five years. Major stock components of Chinook salmon have distinct run timing characteristics, however there is temporal overlap of them all. The department has actively managed the commercial fishery to provide Chinook salmon escapement opportunity since the adoption of the Copper River Chinook Salmon Management Plan in 1996. Achievement of Chinook salmon escapement goals is at best moderate given the estimates and shortfalls of the monitoring projects.

As with enhanced sockeye salmon, enhanced Chinook salmon could only be harvested at the same exploitation rate as that of wild stocks. The Native Village of Eyak has just recently within the past one to two years begun to provide inriver escapement estimates that could be judged as reliable.

The commercial fishery Chinook salmon harvest is 75% complete by June 1, with the commercial fishing season commencing in mid May. Assuming any enhanced Chinook salmon are released, they would likely be done so with chemically marked otoliths, as is the case with enhanced sockeye salmon releases. It takes the department an average of ten days to ship sampled otoliths and to have them read with reported results. The time delay in reading otloliths to determine the enhanced contribution in a given harvest precludes any proactive management of the Chinook salmon fishery with enhanced contributions. To ensure exploitation rates of wild stocks are not jeopardized due to an abundance of enhanced fish makes prescriptive precautionary management practices a requirement as is the case with enhanced sockeye salmon and the surplus component of the sonar goal.

Area staff is strongly opposed to this proposal. This proposal violates the intent of the Policy for the Management of Sustainable Salmon Fisheries as well as the Gulkana Hatchery Complex Policy to not compromise wild stock management precision for increased harvests.

ATTACHMENT

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STATE OF ALASKA **Department of Fish and Game**

M E M O R A N D U M ***Division of Commercial Fisheries***

43961 Kalifornsky Beach Rd.
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FROM: Jim A. Edmundson
Fishery Biologist
Region Limnology
Soldotna

DATE: 10 March 2000

Central

TO: Ellen Simpson
Fishery Biologist
Central Region
Anchorage

SUBJECT: Evaluation of
Gulkana sockeye
enhancement project.

In response to your request, Central Region Limnology (CRL) has reviewed the limnological and fisheries data relative to the ongoing sockeye fry stocking programs conducted by Prince William Sound Aquaculture Corporation (PWSAC) at Summit, Crosswind, and Paxson Lakes. At issue is (1) the poorer than expected fry-to-smolt survival (FSS) in Summit Lake, (2) the recent (1999) increase in the number of holdovers (age-2 smolt) from Crosswind Lake, (3) the contribution of adult carcasses to the nutrient status of Crosswind Lake, (4) the lack of a juvenile sockeye assessment (smolt enumeration) program at Paxson Lake, and (5) continued limnological monitoring of all three lakes. In addition to these concerns, we have made specific recommendations concerning the stocking levels in all three lakes.

As to Summit Lake, of the 10 million fry that were stocked in 1998, only 100,000 smolt out migrated in the spring of 1999 (Figure 1). Due consideration must be given to the possibility that the apparent poor FSS (1%) for the 1997 brood-year fry may be accounted for by the production of a large number of age-0 sockeye which out migrated in the summer or fall of 1998. However, migratory activity of smolt was not monitored later in that year (1998) so the number of age-0 smolt produced, if any, is uncertain. Although smolts typically do not out migrate this late in the growing season, a few lakes in south-central Alaska that have been stocked with sockeye fry produce(d) significant numbers of age-0 smolt (e.g., Chelatna Lake, Bear Lake, and presumably Solf Lake). It has been suggested (PWSAC) that the relatively short growing season in Summit Lake would preclude sufficient fry growth necessary to achieve a threshold size (~2 g) in order to smolt. However, age-1 smolts from Summit Lake average nearly 6 g in mass (Figure 1) and it seems doubtful that much accessory growth of fry is put on over winter. Thus, it seems quite plausible that despite only a 4-5 month open water period, fry could grow to threshold size and leave the lake prior to freeze up.

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On the other hand, the idea of a large number of age-0 smolt being produced seems to be somewhat at odds with the general notion that, in years of high stocking densities and reduced growth (smaller sizes); achieving threshold size for smoltification would require a longer lake residence, not a reduced one. It seems to us that it is more likely that a large number of stocked fry remained in Summit Lake for an additional (second) winter. However, populations of age-2 smolt have not comprised a large proportion of the out migration in past years when stocking levels were also around 10 million. If there is a significant number of holdovers in the lake, this may be indicative of a reduced rearing capacity brought about by the cumulative effects on the forage base from the past 5 years of stocking relatively high numbers of fry (>8 million). The smolt enumeration project proposed by PWSAC this year (2000) which if continued during the adult weir operation, should resolve the issue of a possible shift in the age structure of smolt.

PWSAC also suggested (*see* memorandum 23 July 1999 from Nate Callis) the possibility of underestimating the abundance of the 1999 smolt out migration in Summit Lake. However, they documented that the smolt sampling began only about a week later than usual (due to ice cover) and there were no smolt observed near the outlet of the lake before the net was installed. In addition, the mesh size used was apparently small enough to prevent smolt from passing through the net. Assuming this is all true, and we have no reason to believe otherwise, we agree that the low smolt count for Summit Lake in 1999 was not the result of some sort of major sampling error.

In our previous letter of 26 June 1998 to Gary Martinek (PWSAC) regarding Summit Lake, we stated our (CRL) concern over the stocking of 10 million fry in the spring of 1998 because the mean standing stock of macrozooplankton the previous year (1997) was the lowest measured in 16 years. That is, we believed that continued heavy grazing by sockeye juveniles could trap the zooplankton biomass at low levels. Such a severe or persistent perturbation of the zooplankton community (forage base) could be difficult to undo even with lower stocking densities thereby resulting in poor FSS. Our analysis was based on several measured zooplankton responses (e.g., density, biomass, and species composition) to different levels of stocked fry. Rather than re-hash those discussions and analyses here we refer you to that letter. Simply put, crustacean zooplankton densities, biomass, and FSS in Summit Lake were negatively (and significantly) related to the number of stocked fry.

Herein, we have again attempted to model the inverse relationship between stocking level and macrozooplankton biomass inclusive of the 1998 data (Figure 2) using linear regression. The coefficient of the slope is significant (r^2=0.25; P=0.035) though we agree that there is a large amount of unaccounted for variation surrounding the regression line (Figure 3). Nonetheless, this is evidence of cropping. In addition, the zooplankton biomass density in 1998 remained very low (199 mg m^{-2}) being nearly identical to that of 1997 (187 mg m^{-2}). Because of high fry loading and heavy grazing pressure in 1997, zooplankton recruitment (i.e., a lack of ovigerous cyclopoids) may have been low enough to limit food availability for the fry stocked in 1998. Indeed, although the smolt abundance estimate for 1998 (which reared in the lake in 1997) revealed reasonably good FSS (i.e., 10%), only about 100,000 smolt (>99% age-1) left the lake in the spring of 1999 (having reared in the lake in 1998) resulting in a dismal FSS (i.e., 1%). In Summit Lake, FSS tends to decrease (r^2 = 0.37; P=0.07) with increasing stocking level (Figure 4) suggesting a density dependent mechanism is at work. There has also been a noticeable trend or change in the species composition of the zooplankton community in Summit Lake. In particular, populations of *Cyclops*, once the dominant plankter, have continually declined over the past 5 years. Prior to 1995, *Cyclops* represented >70% of the total macrozoplankton biomass, whereas in 1998 *Cyclops*

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biomass composed only 15% of the total macrozooplankton biomass (Figure 5). In the absence of change in trophic status, a re-structuring of the zooplankton community in terms of species composition is another indication of intense grazing pressure. Taken together, these data support the idea that the abundance of zooplankton for young sockeye, particularly in years when sockeye populations are large, may become an important limiting factor relative to fry growth and survival in Summit Lake.

In comparing the limnological and smolt data for Summit Lake with Crosswind Lake, the lower FSS for the former system is readily apparent (Table 1). On average, FSS is half that in Summit Lake (7%) compared to Crosswind Lake (14%) and this has raised questions by PWSAC concerning this difference in mortality schedules and size at age of smolt. We believe that this can be explained, at least in part, by the stocking density (fry per surface area) relative to the amount of plankton food supplies available to each young salmon in the two lakes. In particular, the stocking density in Summit Lake (0.46 fry m^{-2}) is twice as much as in Crosswind Lake (0.23 fry m^{-2}) and the long-term average zooplankton biomass is approximately half as much in the former (537 mg m^{-2}) compared to the latter (1,080 mg m^{-2}).

We have constructed a rough and approximate comparison of the feeding capacity of Summit, Crosswind, and Paxson lakes by calculating the amount of food available, represented as the mean standing stock of macrozooplankton, per individual (stocked) fry (Table 2). It is obvious that there is a great deal more plankton food available to each sockeye fry in Crosswind Lake (4.8 g fry^{-1}) compared to either Summit Lake (1.7 g fry^{-1}) or Paxson Lake (1.8 g fry^{-1}). When data for Summit and Crosswind lakes are considered together, there is a significant (r^2=0.44; P=0.004) positive relationship between food supply and FSS (Figure 6). With a greater quantity of food available, growth of sockeye juveniles is more rapid as evidenced by larger smolt sizes for Crosswind Lake (Figure 7) than in Summit Lake (Figure 1). Therefore, we disagree that there was some "catastrophic" environmental event, which caused the dramatic decrease in smolt production in Summit Lake. Instead, we believe it is more likely that there were significant losses occurring during the release and distribution of hatchery fry coupled with an inadequacy of plankton food supplies relative to the fry density. Thus, based on our analysis we recommend reducing the stocking level in Summit Lake from 10 million to 5 million fry. The stocking level of 5 million fry is consistent with our earlier (1997 and 1998) recommendations (4-6 million) to PWSAC. Furthermore, there is a lack of information on smolt production from Paxson Lake, at least since PWSAC has run the enhancement program, despite three decades of stocking (Figure 8). Nonetheless, the stocking density (0.77 fry m^{-2}) averages nearly twice that of Summit Lake and more than three times that of Crosswind Lake. In addition, the food supply in Paxson Lake is nearly that of Summit Lake, i.e. very low (Table 2). Hence, unless smolt data are collected and information on FSS is obtained from this system, which may alter our interpretation of the data presented here, we recommend that the stocking level in Paxson Lake also be lowered from the current 12 million to 6 million fry.

Regarding the smolt outmigration for Crosswind Lake in 1999, there was a slight increase in the proportion of age-2 smolt, which caused some concern for PWSAC about the lake's carrying capacity. However, the small percentage (1.1%) of the total out migration attributed to age-2 smolt is not alarming to us. In addition, the mean annual zooplankton standing stock for the past 7 years has been relatively consistent and robust (Table 2) rather than in any obvious decline. At this point in time and assuming there is a continued desire to stock, we are not recommending any change in stocking level for Crosswind Lake. Nonetheless, PWSAC suggested that the "20%" increase in the number of holdovers might indicate a smaller rearing capacity, and as such, there may be a need to increase the productivity of the system through carcass-derived nutrient loading, i.e. provide larger escapements into Crosswind Lake.

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This does not seem to be a valid argument because if there is concern over a reduction in the lake's rearing capacity, then the correct action would be to lower the stocking level, not increase fry recruitment. It is also our understanding that there was some concern by lake residents (the human kind) over nutrients and water quality in terms of aesthetics (rotting carcasses, algal blooms, unwanted bears, etc.) stemming from too much nitrogen and phosphorus.

Although we have historical water quality and nutrient information for Crosswind Lake prior to 1992, no data on nitrogen and phosphorus levels are available since then, so it is difficult to assess the recent contribution of carcass-derived nutrients to water column phosphorus and nitrogen. Moreover, we lack the necessary hydrological data to compute reasonably accurate nutrient inputs and outputs from various sources. Nonetheless, we can make some inferences about the potential nutrient contribution from salmon carcasses. For example, since 1992, when adult sockeye from the Gulkana enhancement program first entered Crosswind Lake, the sockeye escapement (less the number of spawners sold for cost recovery) averaged 40,000 (range 6,400 to 99,291). Assuming each adult sockeye liberates approximately 8 g of phosphorus (P) into the water column and using the averaged escapement, the estimated potential P-loading from spawners is about 8 mg P m^{-2} yr^{-1} (or 320 kg). However, the theoretical change in total-P concentration in the lake from the instantaneous release of nutrients from 320 kg equates to only about 0.5 µg L^{-1}. A 2-3 µg L^{-1} change in P concentration (given that P is the limiting nutrient) is necessary to stimulate productivity (measured as chlorophyll) in clear lakes. Crosswind Lake is not a clear lake, but is a stainy (highly colored) system having reduced light penetration (shallower photic depth), which limits photosynthesis. Thus, a measurable increase in nutrient concentration, primary production, and rearing capacity from an input of say as many as 80,000 carcasses rather than 40,000 is dubious and we see no justifiable reason based on the nutrient argument for increasing the escapement into Crosswind Lake. If there is genuine concern over trophic status of Crosswind Lake in relation to aesthetic values, then we are highly in favor of resuming a water-quality monitoring program to include the collection of environmental, water chemistry, nutrient, and chlorophyll samples in conjunction with the ongoing zooplankton-sampling program.

Finally, it has been brought to our attention that PWSAC may be considering an alternative laboratory for processing future limnological samples. To date, the cooperative agreement between ADF&G and PWSAC for FY 2000 has not been signed by PWSAC and we have not received any samples from the 1999 field season from Summit, Crosswind or Paxson lakes although we assume samples have been collected. Given that PWSAC is a private entity, we suspect this is all well and good. However, if ADF&G (CRL) is to continue evaluating the Gulkana sockeye enhancement project in terms of appropriate stocking levels to prevent overgrazing and attendant long-term impacts on the forage base for juvenile sockeye salmon, assessing changes in water quality, and addressing regional management concerns of hatchery versus wild sockeye stocks, then we strongly urge PWSAC to continue to utilize the

technical services of CRL. Otherwise, failure to use the standardized field and laboratory procedures that we have developed and applied statewide for more than two decades will make it much more difficult to compare future aspects of freshwater production with historical data. This will compromise our (ADF&G) ability to assess the effects of stocking and ensure a reasonably and biologically sound sockeye enhancement program.

In summary, CRL recommends the following: (1) reduce the stocking level in Summit Lake from 10 million to 5 million sockeye fry in order to take foraging pressure off of the zooplankton community and improve FSS, (2) reduce the stocking level in Paxson Lake from 12 million to 6 million sockeye fry to

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better balance fry densities with available forage and implement a smolt enumeration program, (3) maintain the current stocking level (10 million) at Crosswind Lake and conduct a synoptic survey this summer to obtain information on current nutrient and water quality conditions, (4) continue the environmental and zooplankton sampling programs at all three lakes, and (5) modify the fish transport permit (FTP) to reflect the revised recommendations for stocking. If you have any questions or require further information on Summit, Crosswind, and Paxson lakes, please feel fee to contact CRL any time.

Appendix A12.–Gulkana Limno Evaluation.

STATE OF ALASKA **Department of Fish and Game**

M E M O R A N D U M ***Division of Commercial Fisheries***

43961 Kalifornsky Beach Rd.
Soldotna, AK 99669
Phone: 262-9368; Fax: 262-4709

FROM: Jim A. Edmundson
Fishery Biologist
Region Limnology
Soldotna

DATE: 10 March 2000

Central

TO: Ellen Simpson
Fishery Biologist
Central Region
Anchorage

SUBJECT: Evaluation of
Gulkana sockeye
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As to Summit Lake, of the 10 million fry that were stocked in 1998, only 100,000 smolt outmigrated in the spring of 1999 (Figure 1). Due consideration must be given to the possibility that the apparent poor FSS (1%) for the 1997 brood-year fry may be accounted for by the production of a large number of age-0 sockeye which outmigrated in the summer or fall of 1998. However, migratory activity of smolt was not monitored later in that year (1998) so the number of age-0 smolt produced, if any, is uncertain. Although smolts typically do not outmigrate this late in the growing season, a few lakes in south-central Alaska that have been stocked with sockeye fry produce(d) significant numbers of age-0 smolt (e.g., Chelatna Lake, Bear Lake, and presumably Solf Lake). It has been suggested (PWSAC) that the relatively short growing season in Summit Lake would preclude sufficient fry growth necessary to achieve a threshold size (~2 g) in order to smolt. However, age-1 smolts from Summit Lake average nearly 6 g in mass (Figure 1) and it seems doubtful that much accessory growth of fry is put on over winter. Thus, it seems quite plausible that despite only a 4-5 month open water period, fry could grow to threshold size and leave the lake prior to freeze up.

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numbers of fry (>8 million). The smolt enumeration project proposed by PWSAC this year (2000) which if continued during the adult weir operation, should resolve the issue of a possible shift in the age structure of smolt.

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the stocking density (fry per surface area) relative to the amount of plankton food supplies available to each young salmon in the two lakes. In particular, the stocking density in Summit Lake (0.46 fry m^{-2}) is twice as much as in Crosswind Lake (0.23 fry m^{-2}) and the long-term average zooplankton biomass is approximately half as much in the former (537 mg m^{-2}) compared to the latter (1,080 mg m^{-2}).

We have constructed a rough and approximate comparison of the feeding capacity of Summit, Crosswind, and Paxson lakes by calculating the amount of food available, represented as the mean standing stock of macrozooplankton, per individual (stocked) fry (Table 2). It is obvious that there is a great deal more plankton food available to each sockeye fry in Crosswind Lake (4.8 g fry^{-1}) compared to either Summit Lake (1.7 g fry^{-1}) or Paxson Lake (1.8 g fry^{-1}). When data for Summit and Crosswind lakes are considered together, there is a significant (r^2=0.44; P=0.004) positive relationship between food supply and FSS (Figure 6). With a greater quantity of food available, growth of sockeye juveniles is more rapid as evidenced by larger smolt sizes for Crosswind Lake (Figure 7) than in Summit Lake (Figure 1). Therefore, we disagree that there was some "catastrophic" environmental event, which caused the dramatic decrease in smolt production in Summit Lake. Instead, we believe it is more likely that there were significant losses occurring during the release and distribution of hatchery fry coupled with an inadequacy of plankton food supplies relative to the fry density. Thus, based on our analysis we recommend reducing the stocking level in Summit Lake from 10 million to 5 million fry. The stocking level of 5 million fry is consistent with our earlier (1997 and 1998) recommendations (4-6 million) to PWSAC. Furthermore, there is a lack of information on smolt production from Paxson Lake, at least since PWSAC has run the enhancement program, despite three decades of stocking (Figure 8). Nonetheless, the stocking density (0.77 fry m^{-2}) averages nearly twice that of Summit Lake and more than three times that of Crosswind Lake. In addition, the food supply in Paxson Lake is nearly that of Summit Lake, i.e. very low (Table 2). Hence, unless smolt data are collected and information on FSS are obtained from this system, which may alter our interpretation of the data presented here, we recommend that the stocking level in Paxson Lake also be lowered from the current 12 million to 6 million fry.

Regarding the smolt outmigration for Crosswind Lake in 1999, there was a slight increase in the proportion of age-2 smolt, which caused some concern for PWSAC about the lake's carrying capacity. However, the small percentage (1.1%) of the total outmigration attributed to age-2 smolt is not alarming to us. In addition, the mean annual zooplankton standing stock for the past 7 years has been relatively consistent and robust (Table 2) rather than in any obvious decline. At this point in time and assuming there is a continued desire to stock, we are not recommending any change in stocking level for Crosswind Lake. Nonetheless, PWSAC suggested that the "20%" increase in the number of holdovers might indicate a smaller rearing capacity, and as such, there may be a need to increase the productivity of the system through carcass-derived nutrient loading, i.e. provide larger escapements into Crosswind Lake. This does not seem to be a valid argument because if there is concern over a reduction in the lake's rearing capacity, then the correct action would be to lower the stocking level, not increase fry recruitment. It is also our understanding that there was some concern by lake residents (the human kind) over nutrients and water quality in terms of aesthetics (rotting carcasses, algal blooms, unwanted bears, etc.) stemming from too much nitrogen and phosphorus.

Although we have historical water quality and nutrient information for Crosswind Lake prior to 1992, no data on nitrogen and phosphorus levels are available since then, so it is difficult to assess the recent contribution of carcass-derived nutrients to water column phosphorus and nitrogen. Moreover, we lack the necessary hydrological data to compute reasonably accurate nutrient inputs and outputs from various sources. Nonetheless, we can make some inferences about the potential nutrient contribution from salmon carcasses. For example, since 1992, when adult sockeye from the Gulkana enhancement program

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first entered Crosswind Lake, the sockeye escapement (less the number of spawners sold for cost recovery) averaged 40,000 (range 6,400 to 99,291). Assuming each adult sockeye liberates approximately 8 g of phosphorus (P) into the water column and using the averaged escapement, the estimated potential P-loading from spawners is about 8 mg P m^{-2} yr^{-1} (or 320 kg). However, the theoretical change in total-P concentration in the lake from the instantaneous release of nutrients from 320 kg equates to only about 0.5 μg L^{-1}. A 2-3 μg L^{-1} change in P concentration (given that P is the limiting nutrient) is necessary to stimulate productivity (measured as chlorophyll) in clear lakes. Crosswind Lake is not a clear lake, but is a stainy (highly colored) system having reduced light penetration (shallower photic depth), which limits photosynthesis. Thus, a measurable increase in nutrient concentration, primary production, and rearing capacity from an input of say as many as 80,000 carcasses rather than 40,000 is dubious and we see no justifiable reason based on the nutrient argument for increasing the escapement into Crosswind Lake. If there is genuine concern over trophic status of Crosswind Lake in relation to aesthetic values, then we are highly in favor of resuming a water-quality monitoring program to include the collection of environmental, water chemistry, nutrient, and chlorophyll samples in conjunction with the ongoing zooplankton-sampling program.

Finally, it has been brought to our attention that PWSAC may be considering an alternative laboratory for processing future limnological samples. To date, the cooperative agreement between ADF&G and PWSAC for FY 2000 has not been signed by PWSAC and we have not received any samples from the 1999 field season from Summit, Crosswind or Paxson lakes although we assume samples have been collected. Given that PWSAC is a private entity, we suspect this is all well and good. However, if ADF&G (CRL) is to continue evaluating the Gulkana sockeye enhancement project in terms of appropriate stocking levels to prevent overgrazing and attendant long-term impacts on the forage base for juvenile sockeye salmon, assessing changes in water quality, and addressing regional management concerns of hatchery versus wild sockeye stocks, then we strongly urge PWSAC to continue to utilize the technical services of CRL. Otherwise, failure to use the standardized field and laboratory procedures that we have developed and applied statewide for more than two decades will make it much more difficult to compare future aspects of freshwater production with historical data. This will compromise our (ADF&G) ability to assess the effects of stocking and ensure a reasonably and biologically sound sockeye enhancement program.

In summary, CRL recommends the following: (1) reduce the stocking level in Summit Lake from 10 million to 5 million sockeye fry in order to take foraging pressure off of the zooplankton community and improve FSS, (2) reduce the stocking level in Paxson Lake from 12 million to 6 million sockeye fry to better balance fry densities with available forage and implement a smolt enumeration program, (3) maintain the current stocking level (10 million) at Crosswind Lake and conduct a synoptic survey this summer to obtain information on current nutrient and water quality conditions, (4) continue the environmental and zooplankton sampling programs at all three lakes, and (5) modify the fish transport permit (FTP) to reflect the revised recommendations for stocking. If you have any questions or require further information on Summit, Crosswind, and Paxson lakes, please feel fee to contact CRL any time.

cc:
Sharp, D.
Joyce, T.
Willette, T.
Bue, B.
Regnart, J.
Fried, S.

STATE OF ALASKA

Steve Morstad

TONY KNOWLES, GOVERNOR

DEPARTMENT OF FISH AND GAME

DIVISION OF COMMERCIAL FISHERIES
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MEMORANDUM

August 7, 1995

RECEIVED
SEP 29 1995
CORDOVA
DEPT. OF FISH & GAME

To: Bob Burkett
Chief of T & D
Juneau

Subject: Stocking policy

From: Gary Kyle
Regional Limnologist
Soldotna

File:

The version of stocking policies that I have in my files include one dated and approved on 3/21/80 entitled "Lake Stocking with Salmon Juveniles for Marine Production" (signed by Bob Roys) and an undated policy entitled "Lake Stocking for Marine Production Specifically those Systems with Natural or Manmade Barriers to Upstream Migration" (signed by John McMullen). A 1991 draft Fish Stocking Policy never made it to final approval. As far as the use of these policies - Steve McGee has indicated to me that they have not been used to review existing or new stocking projects. In addition, he said that in order to require an evaluation program as part of the approval for a stocking project, a case would have to be made that such as program would be vital to protecting natural stocks before an issue of terminating an existing stocking project could be forced.

Recent projects that the Limnology Unit are aware of in which this policy was not considered are:

Southern Southeast Region

The lack of evaluation for sockeye stocking projects occurred primarily at Klawock Lake which had a wide range of both sockeye and coho release strategies. The releases with no evaluation took place while FRED was operating the hatchery. There was a pre-stocking data collection program completed by Limnology to define production potential and recommend stocking levels. This program was supported by US/Can funds, but the evaluation program ended when the funds were used up. The regional FRED staff continued a variety of large scale sockeye and coho releases into the lake for several years with no evaluation. A new evaluation program was initiated with the new hatchery operators this spring but that is now defunct. There were also several coho releases and at least one chinook release in this lake with no evaluation.

James Linda
Dennis Steve

-continued-

Northern Southeast Region

Fry were stocked in Sweetheart Lake in 1994 with no monitoring. Previous to 1994, the Limnology program conducted assessment of the annual stocking program. In 1994, the Region stocked approximately 1.6 million fry into this lake in May through July. Also, the Region is continuing to plan to stock pre-smolts into Crescent Lake with no evaluation.

Another troubling stocking plan is that NSRAA (which is planning to stock Chilkat Lake) only has US/Canada money for the first 3 years of this project. After the initial 3-year period NSRAA have no external funds to do any evaluation. Dave Barto originally tried to incorporate into the cooperative agreement that all years of stocking would require adequate evaluation; however, the Region said they could not require this beyond the first 3 years of the project. These were decisions made by the old FRED regional personnel.

Southcentral Region

The stocking of Paxson, Summit, and Crosswind lakes with sockeye salmon fry from Gulkana Hatchery is being done without zooplankton assessment. According to Gary Martinek (Gulkana Hatchery Manager), they have collected zooplankton samples since taking over the hatchery operations but have not had them analyzed because of no available funding.

To prevent and stop the above occurrences, the lake stocking policy needs to be updated and revised, and enforced to ensure lakes are not threatened with collapse of the zooplankton community from too many stocked/rearing fry. For the stocked lakes in the Kodiak and Cook Inlet areas we have a yearly assessment of zooplankton and smolt data trends in early summer to determine the subsequent egg-take and fry stocking level. This schedule of review prevents having too many fry available to stock the next year before all zooplankton data are collected and analyzed the previous season.

As you know from results of some of the stocking projects that overstressing the rearing area can have long-term effects on the zooplankton community. I believe it is our responsibility to do our best to match the rearing capacity of the lake with fry recruitment (both natural production and hatchery releases). In order to do this we need a policy that holds all agencies stocking lake-rearing fish (i.e., sockeye salmon fry) responsible for proper evaluation, and an updated document that is considered in the approval process for stocking projects (both existing and new projects). In reference to Steve's comment about the need for evaluation projects based on the issue of protecting natural stocks, I believe it is just as important to preserve the lake's zooplankton community from a major collapse due to hatchery stocking.

xc D. Schmidt
S. McGee

Appendix A14.–Gulkana Zooplankton data from Paxson, Summit, and Crosswind lakes.

Mean Seasonal Zooplankton Biomass (mg * m^{-2})

Year	Paxson	Summit	Crosswind
1992		0.0	0.7	1.2
1993		0.0	0.8	0.8
1994		0.0	0.6	1.2
1995		1.3	0.6	0.8
1996		26.0	11.0	54.7
1997		18.2	3.2	49.0
1998		27.5	3.4	37.2
1999		23.8	4.3	45.7
2000		12.0	8.3	46.0
2001		20.9	12.6	39.5
2002		28.5	13.9	45.6
2003		30.4	6.8	48.0
2004		20.7	9.5	39.4
Average		23.1	8.1	45.0

Available Forage (g * fry^{-1})

Year	Paxson	Summit	Crosswind
1992			0.1	0.2
1993			0.3	0.2
1994			0.1	0.1
1995		0.1	0.1	0.1
1996		1.9	1.3	5.6
1997		1.6	0.3	4.7
1998		2.2	0.4	3.5
1999		2.3	0.5	4.6
2000		1.1	2.5	5.5
2001		2.7	2.5	7.1
2002		2.4	2.4	5.6
2003		2.7	1.0	5.7
2004		1.7	1.4	4.7
10 year average		2.2	1.2	5.4

Appendix A15.–Gulkana Hatchery sockeye fry stocking numbers by lake.

Release Year	Gulkana (I&II) (Paxson Lake)[a]	Summit Lake[b]	Crosswind Lake[c]	Total[d]
1974	79,691			79,691
1975	785,110			785,110
1976	627,080			627,080
1977	514,922			514,922
1978	477,219			477,219
1979	940,974			940,974
1980	1,105,397			1,105,397
1981	3,368,642	1,340,660		4,709,302
1982	5,985,270	1,860,491		7,845,761
1983	5,470,056	2,047,947		7,518,003
1984	6,162,450	4,312,628		10,475,078
1985	9,261,785	4,741,759		14,003,544
1986	8,586,509	8,451,782	1,287,042	18,325,333
1987	9,905,907	14,999,085		24,904,992
1988	6,204,332	12,491,926	2,487,396	21,183,654
1989	10,105,238	12,026,642	3,130,373	25,262,253
1990	13,288,695	12,004,491	4,906,005	30,199,191
1991	10,522,819	6,455,011	5,469,759	22,447,589
1992	10,553,621	7,048,536	5,420,351	23,022,508
1993	5,295,017	2,651,542	4,495,966	12,442,525
1994	9,405,449	7,637,009	9,144,382	26,186,840
1995	10,317,116	7,418,311	9,973,600	27,709,027
1996	13,900,000	8,400,148	9,732,911	28,850,917
1997	11,589,845	10,162,655	10,512,299	32,264,799
1998	12,286,366	8,987,213	10,516,107	31,789,686
1999	10,198,541	9,191,217	9,984,392	29,374,150
2000	10,705,795	3,300,504	8,331,080	22,337,379
2001	7,870,334	493,516	5,585,665	13,949,515
2002	11,922,685	5,805,231	8,174,754	25,902,670
2003	11,284,330	6,599,519	8,360,966	26,244,815
2004	12,408,512	6,574,962	8,359,115	27,342,589
2005	1,874,585	NA	3,703,295	5,577,880
10 year average	10,404,099	6,612,774	8,326,058	24,363,440

[a] Maximum permitted number of fry to be released annually at Paxson Lake and Gulkana II on site is 11.31 million.

[b] Maximum permitted number of fry to be released annually at Summit Lake is 6 million.

[c] Maximum permitted number of fry to be released annually at Crosswind Lake was 7.6 million 2000-2005.

[d] Maximum permitted total number of fry to be released by Gulkana I & II hatcheries at all locations is 24.91 million.

PRINCE WILLIAM SOUND AQUACULTURE CORPORATION

BOARD OF DIRECTOR'S MEETING PACKET

MARCH 13, 2006

Addendum

-continued-

March 2, 2006

To: Prince William Sound Aquaculture Association
From: The Foraker Group

The Foraker Group was invited to consult with PWSAC regarding decreasing the board from 45 members. After careful consideration of the culture and mission of the organization, it is our recommendation that the board decrease in size to no more than 15 members. While this is a dramatic decrease, the percentages of fishermen to other interested parties will remain constant. PWSAC currently has the largest number of board members of all the Aquaculture associations in the state.

Decreasing the size of the board will allow the organization to:

- Create meeting opportunities that fully engage all the board members rather than delegating the major decision making to the Executive Committee
- Decrease the cost of travel for meetings and instead allow funding for meetings to be held more regularly (monthly) and possibly in different locations throughout the region- to promote more regional interaction and representation.
- Increase the amount of trust and communication between board members due to more frequent meaningful interaction.
- Encourage the use of a board matrix recruitment approach that allows for more diversity of wisdom and experiences from the non-fishermen board representatives- creating a board who are willing to work toward common goals of the organization.
- Create opportunities to better engage the interested public through task-force committee process
- Create an opportunity for the smaller group to look at the future of the organization through a strategic planning process (very hard to do with a group of 45).
- Create separate opportunities for all interested groups to network outside of board service- social picnics, conferences, etc.

Decreasing the board would require:

- Rewrite of By-laws and Articles to reflect necessary changes
- Clear communication strategy with gear groups and other interested parties on the reasons for instituting change. The goal of this communication is to allay fears and to be transparent regarding the process.
- Clear job description of what it means to be on the board emphasizing :one voice of the mission
- Clear recruitment strategies in which the board would create a process to educate potential board members re: job description. Ideally creating a nominating structure within the gear group or some process to pre-select nominees to be voted on by membership. Non-gear group selection could ideally be internal using a board matrix– recruitment done by the board.
- Task force committees (as needed) and standing committees (finance and Board Improvement only- if possible) created to provide opportunities for non-board member participation. Task force process would be honored as sound advice and weighed carefully by the full board prior to approval of any recommendations.

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Proposed distribution of board members:

	2006	2007
Purse seiners	10	3
Dual Permit Holders	6	2
Drift Gillnetters	10	3
Set Gillnetters	1	1
Processors	4	1
General members- those who are interested in the enhancement of salmon in PWS: (not fishermen) Possible recruitment could come from the following groups- but is not limited by this list. • City governments: Cordova, Whittier, Valdez • Area Native subsistence • Conservation • Sport • Crew • Tour operator business • Chamber • Seafood Marketing • Education • Science	14	6
	45	15

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Timeline for Board Reduction

Date	Action	Leader
February 2006	recruit of task force: potential interested people (George, John, Rob, Mike, Tim, Bernie, Steve, Peter Kutell, EJ)	Dave R.
	draft matrix and rational	Laurie Wolf, Foraker Group
	statement of why to make the move all at once	Bill Cummings
	Research processor issue	Dave R.
	organizational advantages and process outline	Laurie Wolf, Foraker Group
March 2006	informational- board change	George- Board Chair
March – September	Form Task Force on Transition: executive committee, nominating committee, interested people	George- Board Chair
	Revise by laws	Task force on Transition, Bill(s), Dave
	Revise the articles	Task force on Transition, Bill(s), Dave
	Write job description	Task force on Transition, Laurie, Dave
	Outline nominations process- use board matrix	Task force on Transition, Bill(s), Dave, Laurie
	Write application for board service	Task force on Transition, Laurie, Dave
	Create task force or committee process- structure	Task force on Transition, Laurie, Dave
	Map out transition- officially	Task force on Transition, Bill(s), Dave
September meeting	Full Board presented with a package of by-laws etc. Present changes for all that are needed to make the change (include: explain the matrix- added value of full representation and align with statute). Vote.	Board Chair and Chair of Task Force. Laurie (if necessary)
Assuming a "yes" vote:		
September to March	Formation of Board Improvement Committee -- to implement nominating process	Chair of Committee, Laurie (if necessary)
	matrix to determine the general seats	Board Improvement Committee
	matrix for fishermen- put up a slate of candidates	Board Improvement Committee
January 07	fishermen seats up for election based on the candidates	
march 07	full 45 member board meeting	
	board meeting work including- announcement of new board (budget/revenue)	full 45 member board
	board selects the new general seats from a slate of candidates- vote	full 45 member board
	separate election for processor	
	announce the fishermen election- new board	
	new board sets meeting date of April 07- first job is to elect a chair, officers	new board
	adjourn for a picnic- networking opportunity	Dave and staff to coordinate
April 07	new board meets – monthly	
	Establish standing committees: finance, board development- set meeting schedule	

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DRAFT

Board Recruitment Matrix- PWSAC

(Derived from Strategic Plan Goals- pending)

Overall requirement of all board members: belief in the greater good/mission of PWSAC to enhance salmon in PWS

Categories to consider if relevant	Current Board Members													New Board Candidates						
Area of Expertise/Professional skills such as:																				
Organization and financial management																				
Administration																				
Advocacy																				
Business/corporate																				
Evaluation																				
Marketing - Public relations																				
Government relations																				
Style																				
Strategic-long range thinking																				
Doer																				
Linear thinker																				
Process thinker																				
Leader																				
Goal driven																				
Team player																				
Sound judgment																				
Sense of humor																				
Problem-solving skills																				
Decision-making skills																				
Age:																				
Under 40																				
From 41-55																				
From 56-70																				
Over 71																				
Gender:																				
Female																				
Male																				
Geographical distribution																				
Southwest PWS																				
Northwest PWS																				
Northeast PWS																				
Southeast PWS																				
Board Service Interest:																				
Board development committee																				

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Finance committee																				
Demonstrated understanding of org.																				
Shared values of org.																				
Participant in board discussion																				
Attends org. in past and present activities																				
Leadership positions on board																				
Length of past board service- other boards:																				
More than ten years																				
5-10 years																				
2-5 years																				
less than 2 years																				
Time commitments- not first year use																				
term expires																				
many absences of meetings																				
makes most meetings																				
User Groups																				
Purse Seiners																				
Dual Permit Holders																				
Drift Gillnetters																				
Set Gillnetter																				
Processor																				
Local government																				
Small business																				
Tribal government																				
Sport fisherman																				
Subsistence																				
Personal Use																				
Community leaders																				

This tool can be used in a variety of ways to help the Board Improvement Committee to know what skills and background and interests are necessary to help meet the strategic goals and annual goals of your organization. It is imperative to consider how each category helps meet your organization's long-term and short term goals; how it matches your organizations core values; and how it helps the organization represents the community that it serves. The Matrix will help to identity current gaps and desired characteristics of your board.

Tips: The focus should be on skills and experiences rather than individuals. This summary profile should then serve as a discussion piece for identifying gaps that you wish to be filled.

Instructions: Don't presume to know the complete skill sets possessed by your board. List your existing board members on the left hand column. Ask folks to fill in where they "fit" by placing an "x" in the appropriate box(es). The boxes left without a mark are the kinds of people who need to recruit for your board. One person recruited to the board should represent a "hand-full" of characteristics listed on your matrix.

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David Reggiani

From: William S. Cummings [wsc@anchorlaw.com]
Sent: Sunday, February 26, 2006 6:13 PM
To: David Reggiani
Cc: lwolf@forakergroup.org; A. William Saupe
Subject: Reducing Board in a single step

Dave,

As we discussed last week, I believe that if the PWSAC Board decides to reduce its size, it should do so in a single step, rather than in several smaller steps. My primary reasons for making this recommendation are administrative efficiency and cost. Any change in the number of the directors will require at least a change to the bylaws and possibly a change to PWSAC's articles of incorporation. If PWSAC reduces the overall size of its board in several steps, it will have to change these documents several times, which will require additional work each time, at some cost. Reducing board size in a single step will save this repeated effort and cost.

In addition, I also think that trying to reduce the board in several steps will be unnecessarily confusing, partially because of the multiple revisions of the bylaws that will be necessary, and partly because determining how each transition step in the process will function will be difficult. For example, I believe one of the advantages that the Board will achieve by reducing its overall size is the ability to meet as a full board on a regular basis. However, if the reduction is gradual, this will not be achieved until the final step. In the meantime, PWSAC will still need to find a way to govern itself on a monthly basis, whether through its current executive committee or some other way. Thus, the Board may be forced to reinvent the way it operates to serve only short transition periods. Further, during the transition, the more active involvement of the full board will be delayed. As a consequence, it may be hard for all board members to appreciate the eventual benefit of the process during this transition period.

If the Board decides to reduce its overall size, I believe it will be much simpler to effect the entire reduction in a single step. I can discuss this at the Board meeting if the Board has any questions.

Bill Cummings

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Anchorage, AK 99501

3/2/2006

Summary of Broodstock Survival Rates and Common Property Commercial Harvest Contributions from Prince William Sound Aquaculture Corporation's Armin F. Koernig, Cannery Creek, Main Bay, and Wally Noerenberg salmon hatcheries (1996-2005).

By: Bruce White

Introduction

This summary is a component of the internal department review on Prince William Sound Aquaculture Corporation (PWSAC) hatcheries requested by Region II Cordova department staff. The following is a ten year (1996-2005) analysis of estimated broodstock survival rates and common property commercial harvest contributions (CPF) of pink, chum, and sockeye salmon from PWSAC's Armin F. Koernig (AFK), Cannery Creek (CCH), Main Bay (MBH), and Wally Noerenberg (WNH) salmon hatcheries. Data used in this summary originated from hatchery Annual Reports (AR) and Annual Management Plans (AMP) submitted to the department by PWSAC.

Estimating Broodstock Survival

Inconsistencies in the data reported by PWSAC combined with changes in the department's hatchery Annual Report requirements made estimating broodstock survival rates problematic. After reviewing the available data, it was determined that a reasonable approach for estimating broodstock survival rates was to calculate the minimum number of fish required to meet annual egg-take goals using fecundity data and spawning ratios from the respective Annual Management Plans (AMP) and comparing the result with the actual number of fish captured for broodstock. Reviewers should note the actual fecundity and spawning ratios from year to year varied slightly from those used in the AMP.

During the first two years of this review (1996 and 1997), the department specifically collected "broodstock captured" and "broodstock used" data on Schedule A of the hatchery AR. From this, the actual survival or use rates were calculated. In 1998, the department decided to have the hatcheries report the number of "broodstock used" on Schedule A of the AR, and report the adults "captured for broodstock" on Schedule C. The number of excess males, holding mortalities, and broodstock with unviable gametes were also reported on Schedule C in the "excess" and "other" categories.

However, since this reporting change, PWSAC has almost always reported all of the "captured broodstock" (fish placed behind barrier nets) as "broodstock used." And, they almost always failed to report any "excess" or "other" fish. This type of reporting leads to low survival or "broodstock used" rates when compared to the minimum number of fish required to meet the egg-take goal. The actual survival rates (1996, 1997) are footnoted below the estimated survival rates in each

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broodstock survival table for comparison.

The number of broodstock required in the AMP, the number of broodstock used, the minimum number of broodstock required to meet the egg-take goal, and the number of broodstock required to meet the egg-take goal with a 70%-85% survival rate is shown graphically for each hatchery and species requested. The estimated percent of captured broodstock used for the egg-take is presented in tables for each hatchery and species. The actual percent of broodstock used during 1996 and 1997 is footnoted below each survival table. The 70% survival rate was chosen based on regulation (5 AAC 40.870) that states hatcheries with sub-standard survival rates (e.g. broodstock survival rates below 70%) are required to provide an incident report to the department. A performance review (5 AAC 40.860) is triggered if sub-standard survival rates "are not met for a period of greater than 4 years." The 85% survival rate was chosen because it's a common survival rate for captured broodstock resulting from holding mortalities, excess males, and unviable gametes.

For this review, "broodstock survival" and "percent of captured broodstock used for egg-take" are used interchangeably. Also, "broodstock" is defined as captured fish whose gametes are used to seed a hatchery.

Common Property Commercial Fisheries Contributions (CPF)

All PNP hatcheries are required to annually report the number of fish contributed to the common property fisheries and the number of fish harvested for cost recovery. Contributions to the common property commercial fisheries are determined based on the percent of the total return harvested in the CPF, after first subtracting the fish captured for broodstock. Broodstock is first subtracted because it does not financially benefit anyone directly (except for roe sales, carcass sales, etc.) and is viewed the same as escapement goals essential for continued production. The remainder of the return is harvested for cost recovery, with the exception in some cases of escapement and fish left in the water un-harvested.

PWSAC's contributions to the CPF are influenced by their cost recovery management that is based on achieving pre-season revenue goals rather than on harvesting a fixed percentage of their return. The following was taken from PWSAC AMP's.

> In 1997, the PWSAC Board of Directors elected to have corporate cost recovery based on revenue goals specific to the seine and gillnet salmon fisheries rather than a goal of harvesting a fixed percentage of the returning adults. PWSAC calculated these revenue goals by allocating the production costs between the seine and gillnet caught salmon fisheries. In addition, the PWSAC Board elected to harvest a minimum of 40% of the actual value of the return or the assigned revenue goals, whichever is greater. PWSAC coordinates with the department to ensure that 60% of the cost

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recovery goal is achieved before any CPF occur within the hatchery sub-districts.

This strategy requires harvesting a higher percent of the return when prices are low and a lower percentage when prices are high.

There are no regulations regarding the percent of return that hatcheries should contribute to the CPF, but there is a recommendation from the Southeast Alaska Allocation Task Force (SATF) to the Board of Fisheries that "PNP hatcheries receiving salmon enhancement tax (SET) revenues should over a minimum five-year period contribute 70% of their production (after broodstock) to the CPF." The rationale for this is "enhancement programs are primarily for the benefit of the CPF and not for the benefit of private or state ownership." This is one of the SATF recommendations that provide guiding principles for Southeast PNP hatchery allocations and "can be used by Regional Planning Teams as one element in the evaluation of permit requests and proposed production changes." It is used in this review for comparison only.

Armin F. Koernig Hatchery

Broodstock Survival (Pinks)

The combined estimated broodstock survival rate at AFK during this review period was 48%. The only year AFK's broodstock survival/use rate exceeded 70% was 2000 (Table 1).

During the first two years of this review, pink salmon eggs were not taken at AFK. In 1996 and 1997, pink and chum eggs were taken at WNH and transferred to AFK. While the pink salmon program continues at AFK, the chum program was dropped in 1998. AFK resumed pink salmon egg-takes in 1998, with an egg-take goal of 160,000,000 eggs. This egg-take goal remained the same until 2003, when it was increased to 190,000,000. Fecundity rates for pink salmon reported in AFK AMP's for all years in this review was 1,550 eggs/female combined with a male to female spawning ratio of 1:1.

Using these parameters, the egg-take goal could be met with a minimum of 206,452 fish during the years 1998-2002 assuming no losses from holding mortalities, or unviable gametes. With the same assumptions, 245,161 would be required to meet the higher egg-take goal of 190,000,000. Since it is not practical to assume there will be no broodstock mortalities, the number of pink salmon required to meet egg-take goals using survival rates of 70%-85% was calculated (70% is the department's minimum survival standard for captured broodstock and 85% is fairly a common rate). With a 70% survival rate, it would take 294,931 fish to meet the 160,000,000 egg-take goal. With a more common survival rate of 85%, 242,884 fish would provide enough eggs to meet the egg-take goal. From 2003-2005 (190,000,000 egg-take goal) 350,230 and 288,425 pink salmon would be required meet the egg-take goal with survival rates of 70% and 85% respectively (Figure 1).

It should be noted that according to the AMP's submitted by PWSAC, and approved by department personnel, 1999-2001 was the only period when the number of broodstock required to meet

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egg-take goals used broodstock survival rates equal to the minimum standard of 70%. The other years used survival rates below the minimum standard: 60% for 1998 and 55% for the period 2002-2005.

Fish captured for broodstock purposes but not used for the egg-take either died prior to egg-take, had unviable gametes, didn't meet run timing requirements, or were excess to production needs. Against the request of the department, PWSAC does not report their unused broodstock as "excess" or "other" fish in their Annual Reports.

Commercial Contributions (Pinks)

The average AFK CPF contribution for the review period was 62%, and ranged from a low of 25% in 2004 to a high of 100% in 1996. As previously mentioned, the SATF guideline for contributions to the CPF by Southeast PNP hatcheries receiving SET revenues is 70%. While this guideline does not apply to hatcheries operating in Prince William Sound, AFK contributions to the CPF during years of pink salmon abundance were very similar, 72%, 70%, 71%, 71% and 69% in 1998, 2000, 2002, 2003, and 2005, respectively. Contribution rates were determined after deducting broodstock from the total return.

As was previously shown, AFK captures considerably more pink salmon than needed for broodstock. These excess fish could potentially contribute to the CPF harvest. Yearly AFK contributions to the CPF are shown (Figure 2).

Figure 1. –Armin F. Koernig broodstock survival.

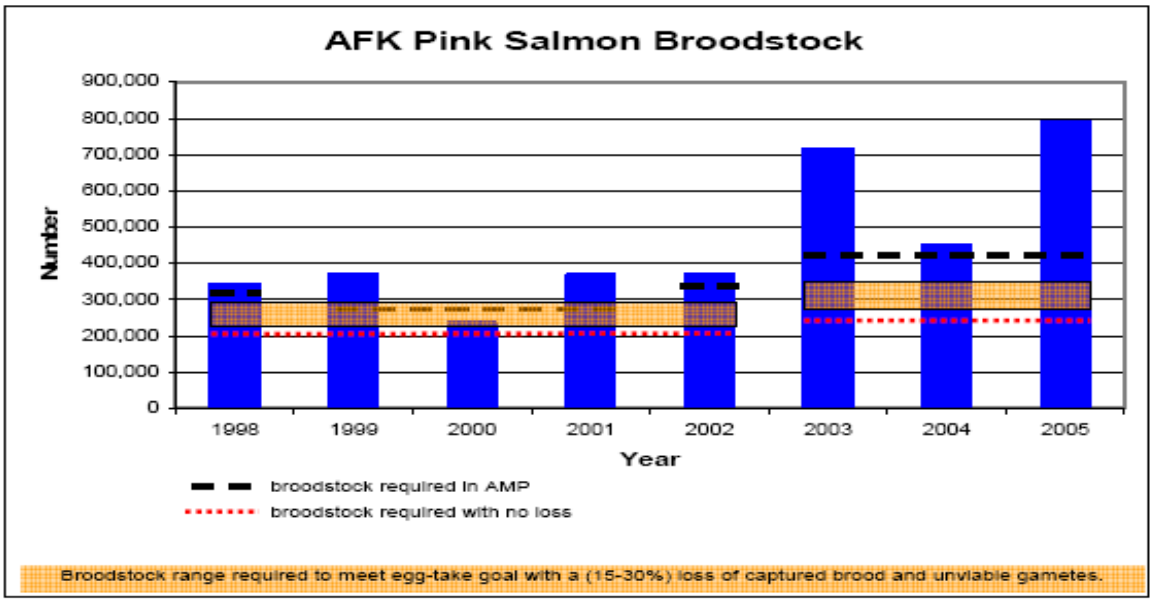

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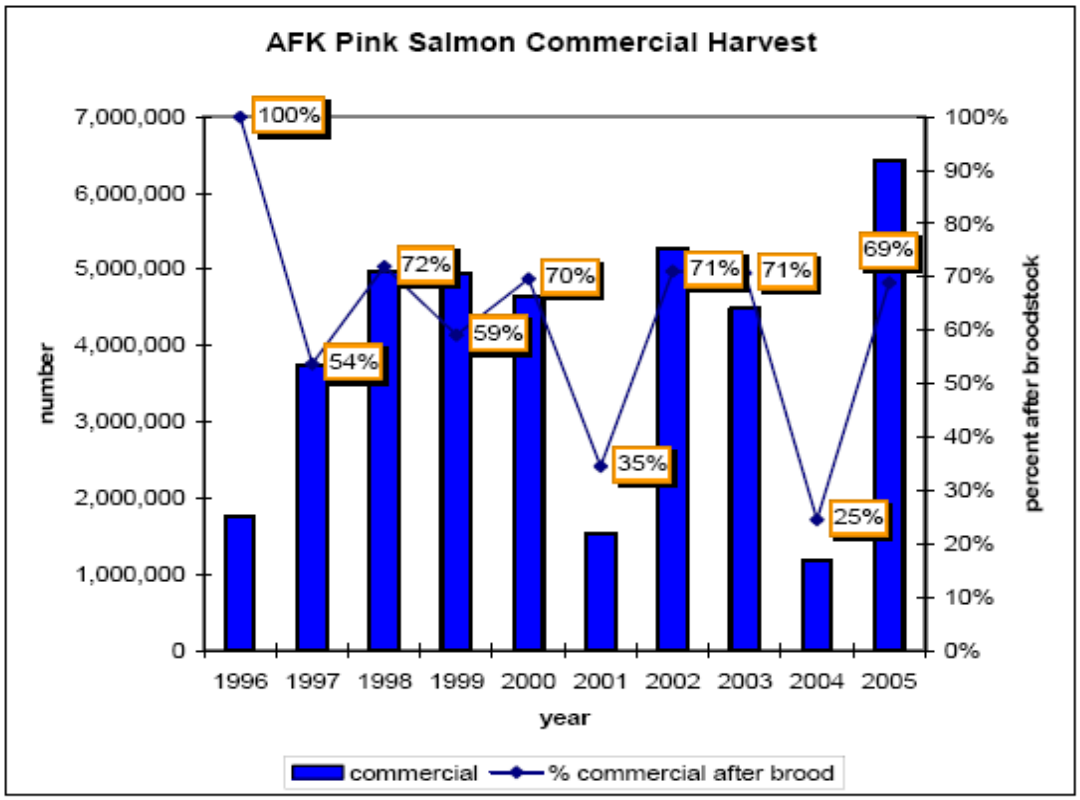
Table 1.-Armin F. Koernig pink salmon broodstock.

			Broodstock required (w/no loss)							Estimated % survival (captive brood used for egg-take)
Year	Egg-take goal	Fecundity	Male	Female	Total brood	Brood required with 85% survival	Brood required with 70% survival	Brood required in (AMP)	Brood captured (Annual Report)	
1996	-	-	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	-	-	na
1997	-	-	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	-	-	na
1998	160,000,000	1,550	103,226	103,226	206,452	242,884	294,931	318,000	344,049	60%
1999	160,000,000	1,550	103,226	103,226	206,452	242,884	294,931	286,000	369,480	56%
2000	160,000,000	1,550	103,226	103,226	206,452	242,884	294,931	286,000	235,813	88%
2001	160,000,000	1,550	103,226	103,226	206,452	242,884	294,931	286,000	368,706	56%
2002	160,000,000	1,550	103,226	103,226	206,452	242,884	294,931	347,000	368,694	56%
2003	190,000,000	1,550	122,581	122,581	245,161	288,425	350,230	418,000	714,927	34%
2004	190,000,000	1,550	122,581	122,581	245,161	288,425	350,230	418,000	451,000	54%
2005	190,000,000	1,550	122,581	122,581	245,161	288,425	350,230	418,000	793,048	31%
					1,767,742				3,645,717	48%

Figure 2.-Armin F. Koernig pink salmon commercial contributions after broodstock.



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Cannery Creek Hatchery

Broodstock Survival (Pinks)

The estimated broodstock survival/use rate averaged 56% for the review period and ranged from a low of 34% in 2005 to a high of 72% in 2000, which was the only year that broodstock survival was above the minimum standard 70% (Table 2). Based on CCH's AMP's, the fecundity rate for calculating broodstock requirements was 1,500 eggs/female with a male/female spawning ratio of 1:1 for all years.

For all years, the egg-take goal at CCH was 152,000,000 except for 1997, when the goal was reduced to 147,000,000 eggs. Broodstock requirements listed in the AMP's used survival rates of 60% for the review period except in 1996, when the AMP made the assumption that 25% of all the broodstock would die before spawning and that 50% of the females would be either over or under mature. As a result, the number of broodstock required to meet egg-take goal, as reported in the AMP's, was below the minimum broodstock survival standard, but was nonetheless signed off by department personnel.

All of the CCH AMP's list a pre-spawn mortality rate and an unviable female rate. There is no such accounting for green males, so that while highly unlikely, the assumption is made that all the males captured for broodstock are viable. For this review, the percent of pre-spawn mortality and the percent of females having unviable eggs listed in the AMP were combined to determine a total "survival/use" rate. The number of pinks captured for broodstock, the minimum number of broodstock required to meet the egg-take goal, a range of broodstock required to meet the egg-take goal using a 70-85% survival rate, and the number of broodstock required in the AMP is shown (Figure 3). Egg-take goals, fecundity, broodstock requirements and the estimated percent of captured broodstock used to seed the hatchery is shown (Table 2). Also shown are the actual broodstock survival rates determined from data contained in the 1996/1997 Annual Reports.

Commercial Contributions (Pinks)

The CPF contribution averaged 68% for the review period, which is very close to the 70% guideline recommended by the SATF. The CPF of CCH pink salmon after subtracting broodstock ranged from a low of 6% (135,122 pinks) in 2004 to a high of 81% (10,452,306 pinks) in 2005. The CPF contribution rates were 72%, 63% 73%, 69%, 75% and 68%, for the years 1996, 1997, 1998, 1999, 2000 and 2003, respectively. The CPF was 35% and 51% of the return during 2001 and 2002, respectively. The CCH CPF contributions are shown (Figure 4).

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Figure 3.-Cannery Creek pink salmon broodstock survival.

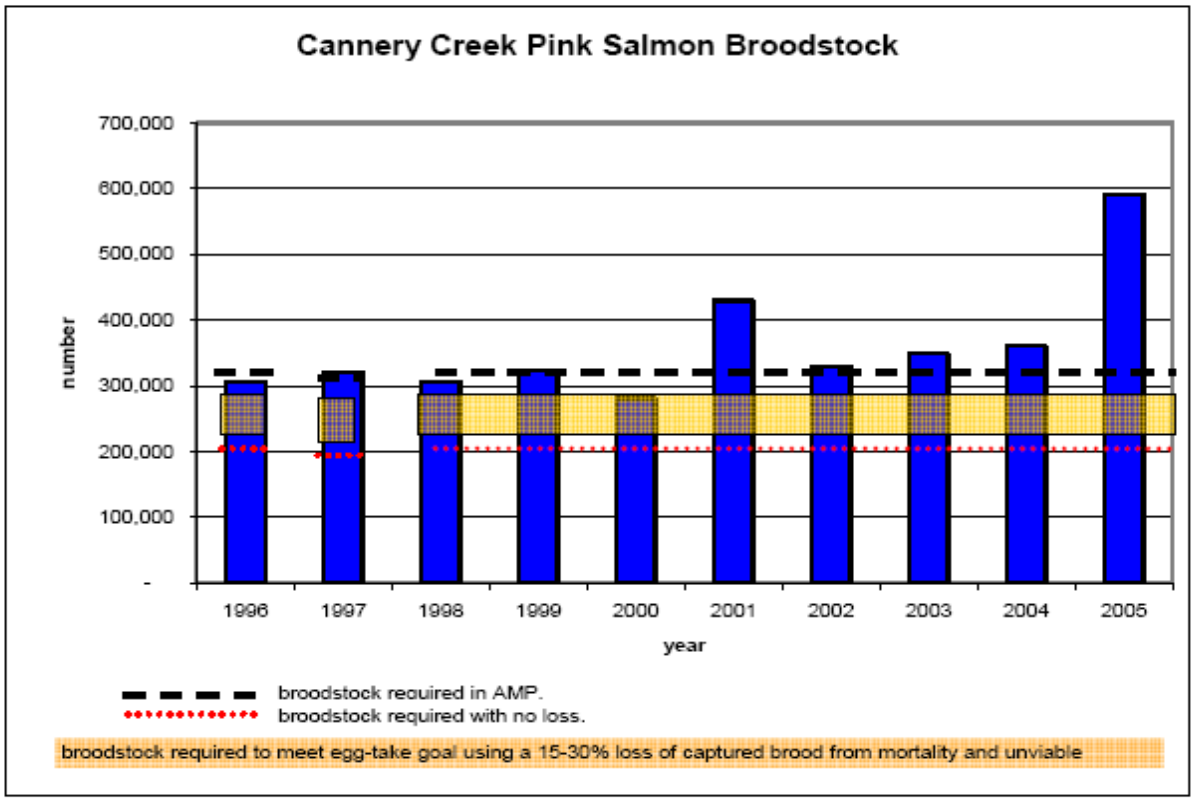

Table 2.-Cannery Creek pink salmon broodstock.

			Number required (w/no loss)							
Year	Egg-take goal	Fecundity	Male	Female	Total brood	Brood required with 85% survival	Brood required with 70% survival	Brood required in (AMP)	Brood captured (Annual Report)	Estimated % survival (captive brood used for egg-take)
1996[1]	152,000,000	1,500	101,333	101,333	202,667	238,431	289,524	318,000	305,195	66%
1997[2]	147,000,000	1,500	98,000	98,000	196,000	230,588	280,000	308,000	320,656	61%
1998	152,000,000	1,500	101,333	101,333	202,667	238,431	289,524	318,000	305,879	66%
1999	152,000,000	1,500	101,333	101,333	202,667	238,431	289,524	318,000	323,111	63%
2000	152,000,000	1,500	101,333	101,333	202,667	238,431	289,524	318,000	280,811	72%
2001	152,000,000	1,500	101,333	101,333	202,667	238,431	289,524	318,000	428,859	47%
2002	152,000,000	1,500	101,333	101,333	202,667	238,431	289,524	318,000	330,141	61%
2003	152,000,000	1,500	101,333	101,333	202,667	238,431	289,524	318,000	348,807	58%
2004	152,000,000	1,500	101,333	101,333	202,667	238,431	289,524	318,000	360,581	56%
2005	152,000,000	1,500	101,333	101,333	202,667	238,431	289,524	318,000	590,559	34%
					2,020,000				3,594,599	56%

[1] In 1996, 305,195 pinks were captured for broodstock and 148,475 were used (49%). Egg-take goal was met.
[2] In 1997, 320,656 pinks were captured for broodstock and 180,472 were used (56%). Egg-take goal was met.

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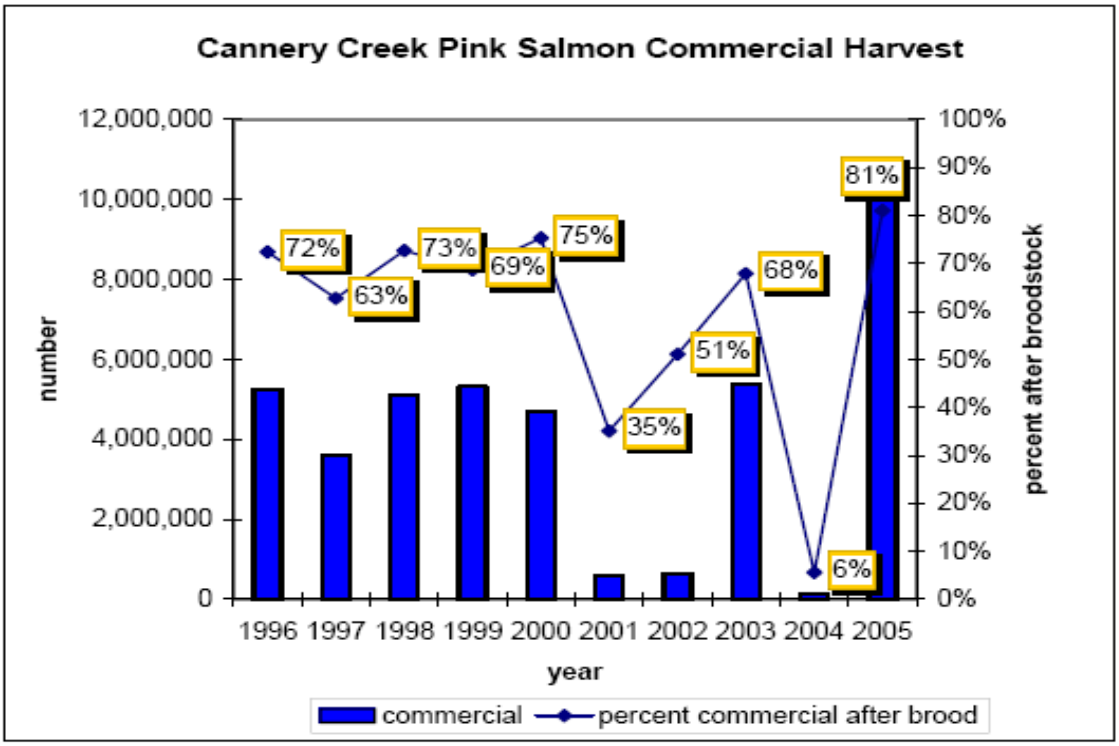
Figure 4.-Cannery Creek pink salmon commercial contributions after broodstock.



Main Bay Hatchery

Broodstock Survival (Sockeye)

The estimated broodstock survival rate for the review period was 44%. This was heavily weighted by the large number of fish captured for broodstock in 2004 and 2005 (Figure 5). The highest estimated survival rate was 91% in 2000, and the lowest was 13% in 2005. Estimated broodstock survival was equal to or better than the minimum survival standard in 1996, 1999, 2000, 2002, and 2003.

The MBH sockeye program during the first years of the review period used Eyak, Eshamy, and Coghill Lake stocks. In 1998, PWSAC changed production to the Coghill Lake stock only. In 2000, an off-site egg-take was planned at Coghill Lake to make up for low returns, a result of losing 100% of BY 94 and 80% of BY 95 from a waterline break in January 1996. From 2001 to the present, off-site egg-takes have not been necessary. During most years (1996, 1997, 2001, 2002, and 2004) the egg-take goal was 10,200,000. The egg-take goals ranged from a low of 9,525,000 in 1999 and 2000 to a high of 11,000,000 in 2005. Spawning ratios varied from 1:1 male to female during 1996-1997 to 2:3 male to female from 1998-2005. AMP fecundity rates were 2,900 in 1996, 2,950 in 1997, and 3,200 from 1998-2000 and 2002-

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2005. In 2001, fecundity was estimated Notably, the estimated survival rate for sockeye was only slightly less than the pink salmon survival rate at AFK, even though to comply with ADF&G egg-take protocol, injured sockeye are culled out before the egg-take. Estimated survival rates are shown (Table 3).

Commercial Contributions (Sockeye)

at 3,000 eggs per female. The MBH CPF contribution averaged 78% of the return for the review period. The CPF contributions ranged from a high of 99% of the return (339,305) in 2000 to a low of 52% (128,702) in 1998. The CPF contribution was more than 70% of the return in 7 out of the 10 years in the review period (Figure 6). This is the only PWSAC hatchery in the review that had an overall average CPF contribution rate at or above the SATF guideline.

Figure 5. Main Bay sockeye broodstock survival.

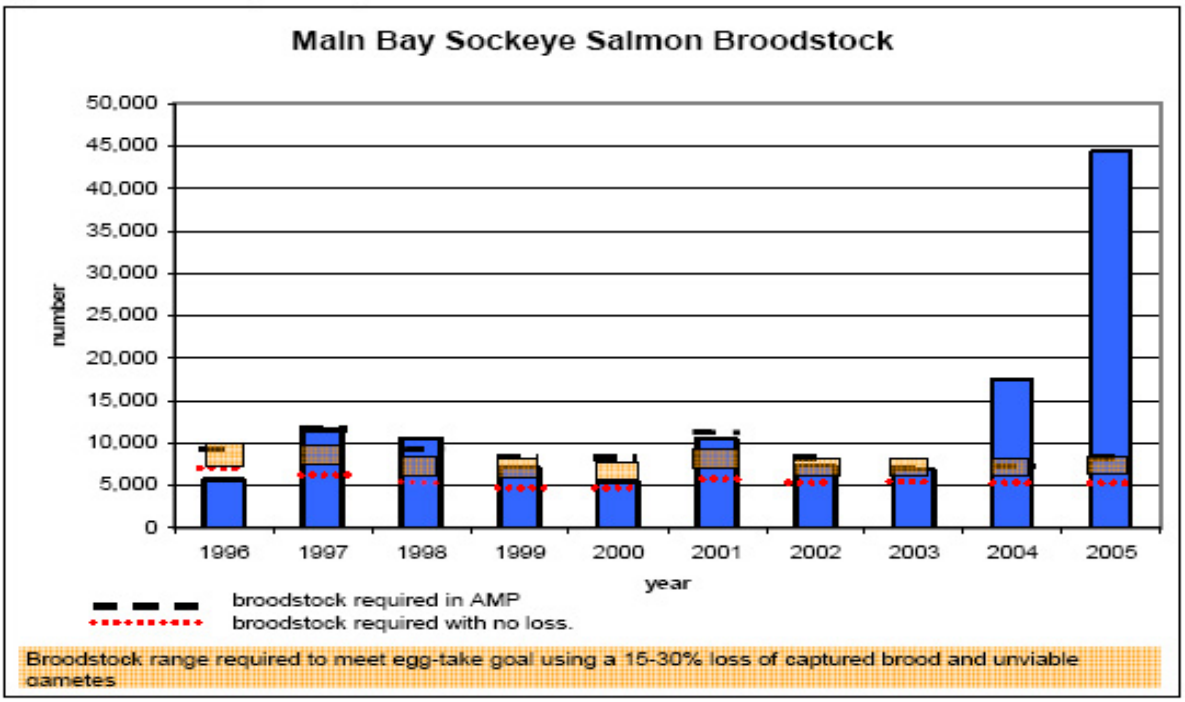

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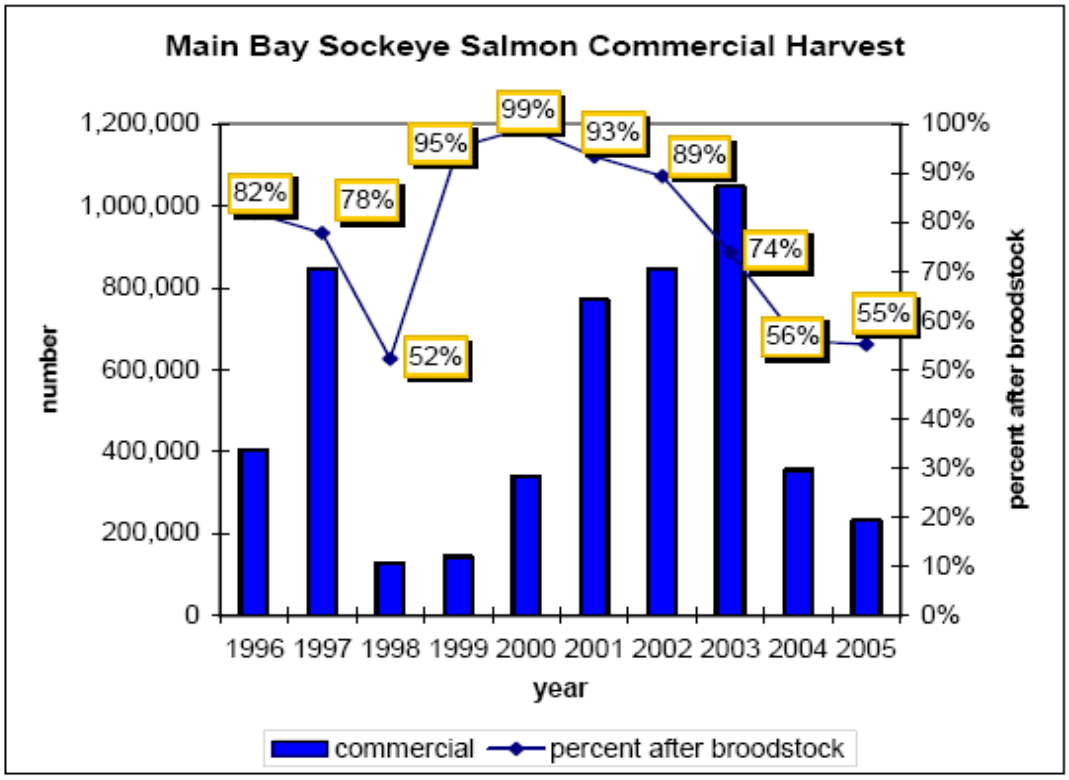
Table 3.-Main Bay sockeye broodstock.

Year	Egg-take goal	Fecundity	Number required (w/no loss) Male	Female	Total brood	Brood required with 85% survival	Brood required with 70% survival	Brood required in (AMP)	Brood captured (Annual Report)	Estimated % survival (captive brood used for egg-take)
1996[1]	10,200,000	2,900	3,517	3,517	7,034	8,276	10,049	9,736	7,539	93%
1997[2]	10,200,000	2,950	3,446	3,446	6,892	8,108	9,846	13,650	10,023	69%
1998	10,325,000	3,200	2,152	3,227	5,379	6,328	7,684	9,050	10,596	51%
1999	9,525,000	3,200	1,985	2,977	4,962	5,838	7,088	8,300	7,104	70%
2000	9,525,000	3,200	1,985	2,977	4,962	5,838	7,088	8,340	5,426	91%
2001	10,200,000	3,000	2,268	3,400	5,668	6,668	8,097	11,110	10,508	54%
2002	10,200,000	3,200	2,126	3,188	5,314	6,251	7,591	7,810	7,352	72%
2003	10,000,000	3,200	2,084	3,125	5,209	6,129	7,442	7,210	6,878	76%
2004	10,200,000	3,200	2,126	3,188	5,314	6,251	7,591	7,350	17,578	30%
2005	11,000,000	3,200	2,293	3,438	5,730	6,742	8,186	7,930	44,366	13%
					56,464				127,370	44%

[1] In 1996, 7,539 fish were captured for broodstock and 5,956 used (79%). Egg-take goal was not met (high levels of BKD).
[2] In 1997, 10,023 fish were captured for broodstock and 5,920 used (59%). Egg-take goal was met.

Figure 6.-Main Bay sockeye commercial contributions after broodstock.



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Wally Noerenberg Hatchery

Broodstock Survival (Pinks)

The average estimated pink salmon broodstock survival/use rate for the review period was 40%. Survival rates ranged from a low of 11% in 2005 to a high of 78% in 1997. 1997 was only year in which the estimated broodstock survival rate exceeded the department's minimum survival standard (Figure 7). The WNH pink salmon program during the start of this review period used stock originating from AFK. The egg-take goal at WNH ranged from a low of 93,000,000 eggs in 2005, to a high of 228,100,000 eggs in 1997. From 1996 to 2002, the number of pinks required for broodstock as reported in the WNH AMP was within the department's 70% survival range. From 2003 to 2005, the WNH AMP's listed required broodstock numbers that assumed survival rates below the minimum survival standard, but were signed off by department staff. The only year that broodstock survival was within the department's acceptable range was 1997. According to the 1997 Hatchery Annual Report, WNH not only met their highest egg-take goal during the review period (228,100,000 eggs), but also sold the roe from over 24,000 females, had an estimated 72,000 excess males, and listed 32,000 holding mortalities. WNH broodstock numbers are shown and (Table 4).

Commercial Contributions (Pinks)

From 1996-2005, the WNH contribution rate to the CPF was 53% of their production. During the review period, WNH produced over 78 million pinks and contributed over 41 million to the CPF. WNH contributions to the CPF after brood ranged from a high of 73% (12,422,082) in 2003 to a low of 4% (95,547) in 2004. 2003 was the only year that WNH contributed more than 70% of their return to the CPF. The annual WNH CPF contributions are shown (Figure 8).

Broodstock Survival (Chums)

The estimated broodstock survival rate averaged 63% for the review period. The broodstock survival rate ranged from a low of 47% in 1999 to a high of 100% in 2000. The 100% broodstock survival/use rate is likely a reporting error that went un-detected. The egg-take goal at WNH ranged from a low of 111,000,000 chum eggs during 1998-2002, to a high of 165,000,000 chum eggs in 2005. According to the AMP's, fecundities ranged from 2,100 to 2,170 eggs per female and spawning protocols called for a 1:1 male to female spawning ratio. 1997 and 2003 were the only years that the broodstock survival rate was above 70% (Figure 9). The estimated survival rates for WNH chum salmon broodstock are shown (Table 5).

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Figure 7.-Wally Noerenberg pink salmon broodstock survival.

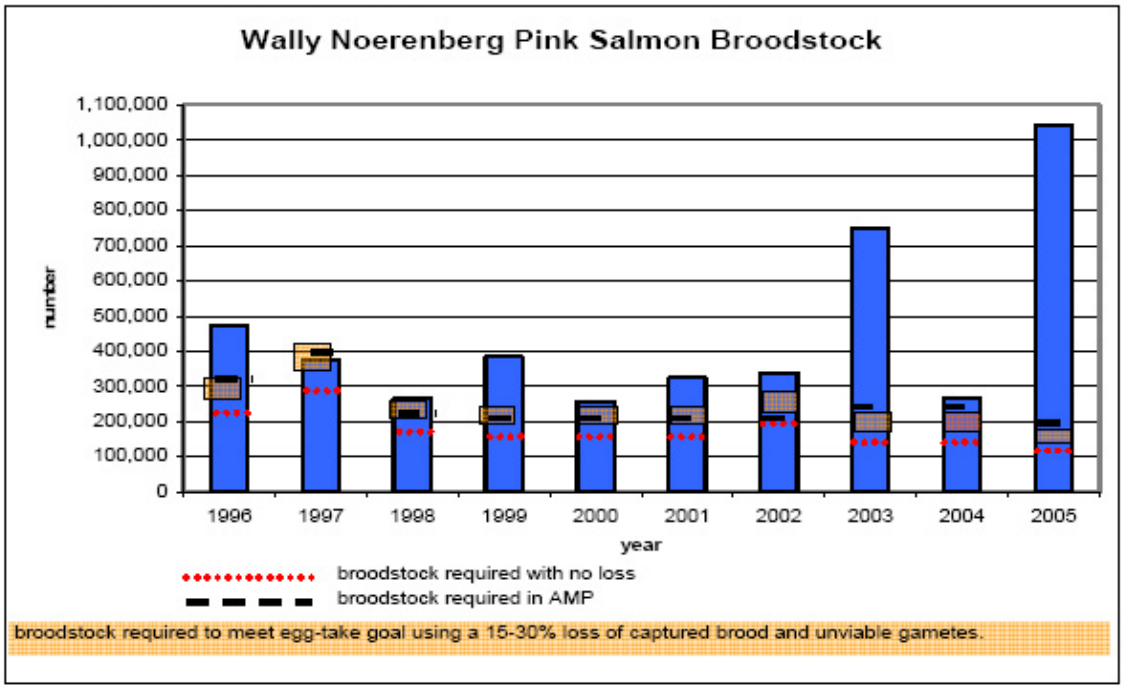

Table 4.-Wally Noerenberg pink salmon broodstock.

			Number required (w/no loss)							
Year	Egg-take goal	Fecundity	Male	Female	Total Brood	Brood required with 85% survival	Brood required with 70% survival	Brood required in (AMP)	Brood captured (Annual Report)	Estimated % Survival (captive brood used for egg-take)
1996[1]	176,000,000	1,550	113,548	113,548	227,096	267,173	324,423	312,000	471,730	48%
1997[2]	228,100,000	1,550	147,161	147,161	294,323	346,262	420,461	404,000	376,828	78%
1998	130,000,000	1,500	86,667	86,667	173,333	203,922	247,619	230,000	265,820	65%
1999	130,000,000	1,550	83,871	83,871	167,742	197,343	239,631	208,000	384,664	44%
2000	130,000,000	1,550	83,871	83,871	167,742	197,343	239,631	208,000	255,851	66%
2001	130,000,000	1,550	83,871	83,871	167,742	197,343	239,631	219,000	325,003	52%
2002	150,000,000	1,550	96,774	96,774	193,548	227,704	276,498	219,000	340,198	57%
2003	120,000,000	1,550	77,419	77,419	154,839	182,163	221,198	228,000	750,435	21%
2004	120,000,000	1,550	77,419	77,419	154,839	182,163	221,198	228,000	267,716	58%
2005	93,000,000	1,550	60,000	60,000	120,000	141,176	171,429	176,000	1,043,736	11%
					1,821,204				4,481,981	41%

[1] In 1996, 471,730 pinks were captured for broodstock and 188,531 were used (40%). Egg-take goal was met.
[2] In 1997, 376,828 pinks were captured for broodstock and 272,630 were used (72%). Egg-take goal was met.

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Figure 8.-Wally Noerenberg pink salmon commercial contributions after broodstock.

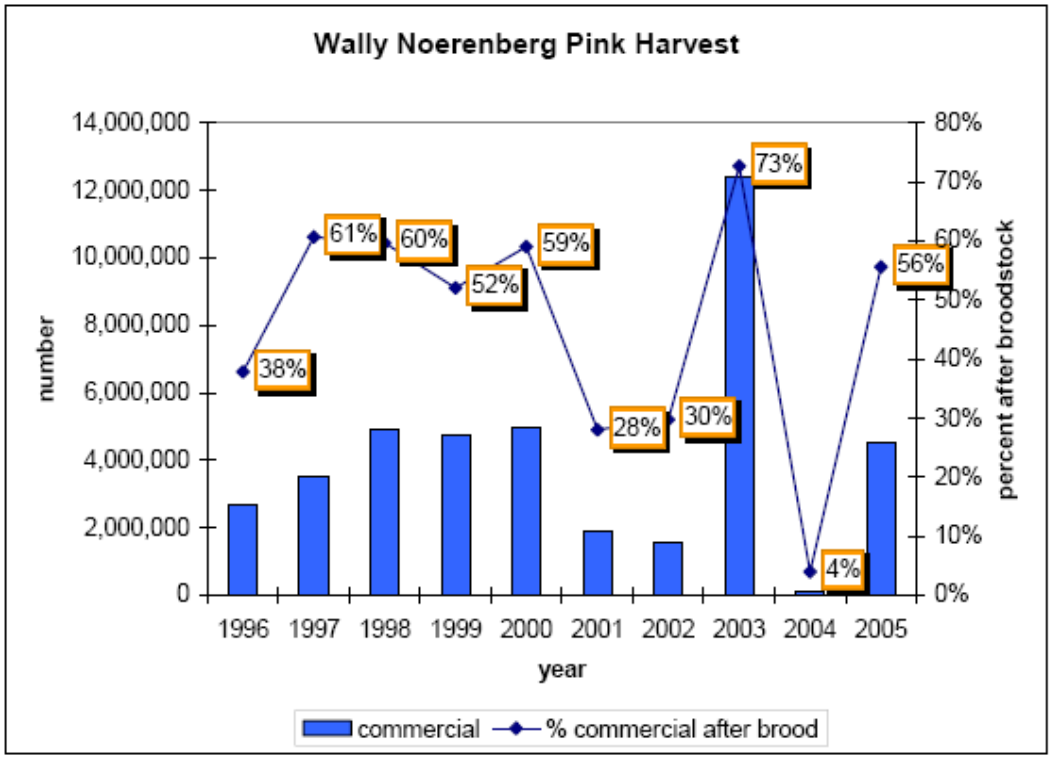

Figure 9.-Wally Noerenberg chum salmon broodstock survival.

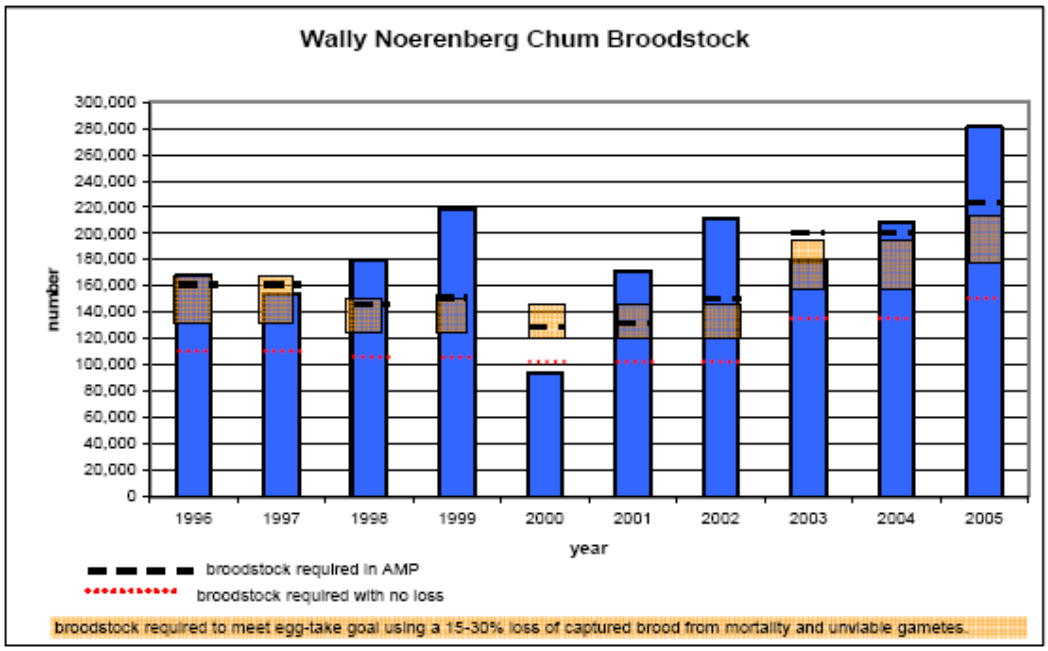

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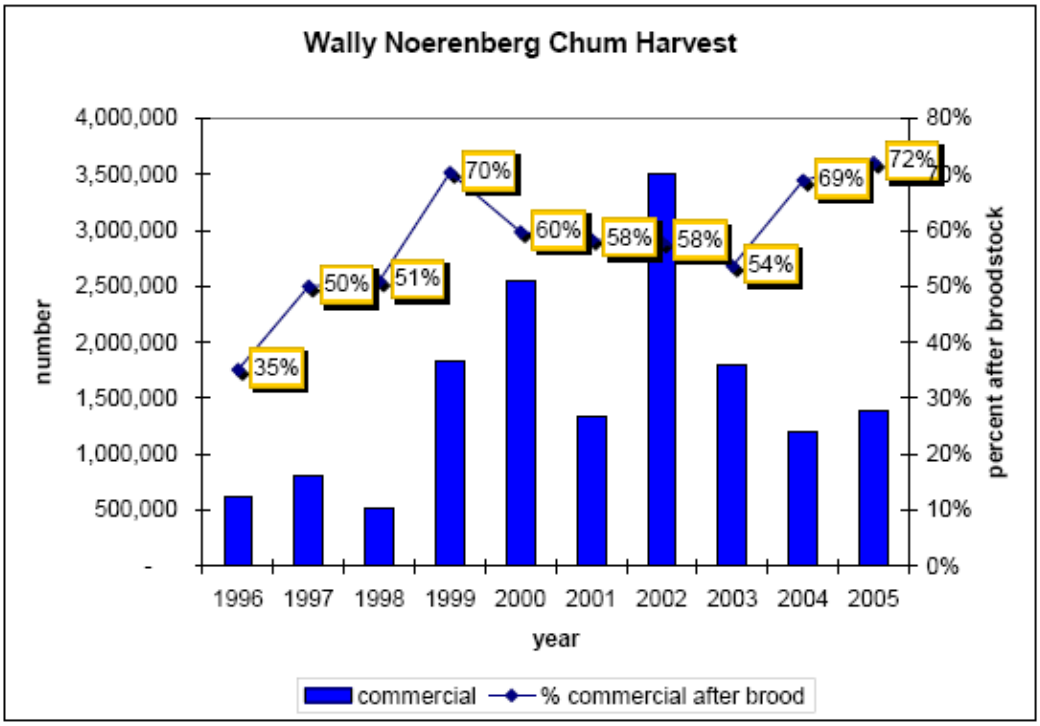
Table 5.-Wally Noerenberg chum salmon broodstock.

			Broodstock required (w/no loss)							
Year	Egg-take goal	Fecundity	Male	Female	Total brood	Brood required with 85% survival	Brood required with 70% survival	Brood required (AMP)	Brood captured (Annual Report)	Estimated % survival (captive brood used for egg-take)
1996[1]	122,000,000	2,100	58,095	58,095	116,190	136,695	165,986	160,000	167,979	69%
1997[2]	122,000,000	2,100	58,095	58,095	116,190	136,695	165,986	160,000	154,764	75%
1998	111,000,000	2,100	52,857	52,857	105,714	124,370	151,020	146,000	179,875	59%
1999	111,000,000	2,170	51,152	51,152	102,304	120,358	146,149	127,000	219,073	47%
2000[3]	111,000,000	2,170	51,152	51,152	102,304	120,358	146,149	127,000	93,412	100%
2001	111,000,000	2,170	51,152	51,152	102,304	120,358	146,149	134,000	171,046	60%
2002	111,000,000	2,170	51,152	51,152	102,304	120,358	146,149	150,000	211,833	48%
2003	147,400,000	2,170	67,926	67,926	135,853	159,827	194,075	200,000	178,142	76%
2004	147,400,000	2,170	67,926	67,926	135,853	159,827	194,075	200,000	208,795	65%
2005	165,000,000	2,170	76,037	76,037	152,074	178,910	217,248	223,000	280,811	54%
					1,171,091				1,865,730	63%

[1] In 1996, 167,979 chums were captured for broodstock and 94,386 were used (56%). The egg-take goal was met.
[2] In 1997, 154,764 chums were captured for broodstock and 116,265 were used (75%). The egg-take goal was met.
[3] In 2000, according to the annual report, 93,412 broodstock were captured and all were used. There is no record of excess or other fish. The egg-take goal was not met.

Figure 10.-Wally Noerenberg chum contributions after broodstock.



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Commercial Contributions (Chums)

WNH chum salmon CPF contributions averaged 58% of the total return for the review period. During this time, WNH contributed over 15,000,000 chums to the CPF out of a total production of more than 26,000,000 chums. There were two years 1999 and 2005, when the percent of the total return contributed to the CPF was 70% or above (1999 and 2005). The WNH CPF contributions ranged from a low of 35% (613,432) in 1996 to a high of 72% (1,383,287) in 2005. The yearly WNH CPF contributions are shown (Figure 10).

Summary

Broodstock Survival

Each of the hatcheries in this review had broodstock survival rates below the 70% minimum survival standard for the period (1996-2005). In 1996 and 1997, the actual survival rates were determined from broodstock captured and broodstock used data from the Annual Reports. Due to incomplete reporting, broodstock survival rates had to be estimated using data from AR's and AMP's after 1997.

From 1998 to the present, hatcheries have been required to report the number fish captured, but not used for broodstock, in the "other" and "excess" categories on AR Schedule C. However, since 2000, AFK has reported "excess or other" pink salmon only once. The same is true for CCH. MBH has not reported excess or other sockeye since 1998. WNH last reported excess or other pink salmon in 1999 and their last reported excess/other chum salmon was in 1997.

It will not be possible to determine the actual survival/use of captured broodstock until PWSAC starts reporting un-used broodstock. With the available data, we can only estimate broodstock survival by determining the number of fish required to meet egg-take goals based on fecundity rates and spawning ratios and comparing that number with the number of fish captured for broodstock. More accurately stated this is an estimate of the percent of captured ***broodstock used*** for seeding the hatchery, not a "survival rate." PWSAC management defines broodstock used as "all the fish placed behind barrier nets," which differs from the department's interpretation of broodstock used as "all the fish used to seed the hatchery."

Since the number of fish PWSAC captures for broodstock far exceeds the number of fish used to seed the hatchery, the resulting broodstock survival estimates are well below the minimum survival standards set in regulation. PWSAC management was informed of this discrepancy in broodstock and reporting deficiencies and asked to correct it, but they have yet to comply.

Commercial Contributions

The department requires all PNP hatcheries to report CPF contributions to the different gear groups in numbers of fish. From this, the percent of total production contributed to the CPF can be determined. PWSAC provides these numbers, but their cost recovery operations, which directly impacts CPF contributions, are based on achieving

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pre-season revenue goals, not on harvesting a fixed percentage of their return. This cost recovery strategy requires harvesting a higher percentage of their production during years of low prices, while the opposite is true when prices are high.

There are no regulations regarding what percent of hatchery production should be contributed to the CPF, rather each PNP determines this internally. The findings from a Southeast Alaska Hatchery Allocation Task Force recommended to the Board of Fisheries that a 70%:30% CPF to cost recovery split be followed for PNP hatcheries receiving salmon enhancement taxes. For PNP's that do not receive enhancement taxes, the recommended CPF to cost recovery split was 60%:40%.

The rationale used in setting these percentages was based on the belief that hatchery production should primarily benefit fishing groups. While the SATF recommendations do not apply to the Prince William Sound area, they are used here for comparison. It should be noted that not all Southeast hatcheries comply with this recommendation.

With the exception of MBH, all of the PWSAC hatcheries in this review had CPF contributions below the level recommended by the SATF for PNP hatcheries receiving salmon enhancement taxes. The overall CPF contribution rates were 62%, 68%, and 78% for AFK pinks, CCH pinks and MBH sockeye, respectively. WNH contributed 53% of their pinks and 58% of their chum salmon production to the CPF after broodstock. The CPF percentages would likely rise if the broodstock survival rates increased.

PRINCE WILLIAM SOUND AQUACULTURE CORPORATION

BUSINESS PLAN 1996

DRAFT

August 31, 1995

Prince William Sound Aquaculture Corporation
P.O. Box 1110
Cordova, Alaska 99574

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Prince William Sound Aquaculture Corporation–Executive Summary

Founded in 1974, Prince William Sound Aquaculture Corporation (PWSAC) is a private, non-profit corporation engaged in ocean ranching (the rearing, release, harvest and sale) of Pacific salmon. Its operations include four hatcheries on Prince William Sound and one in the Interior on the upper reaches of the Copper-Gulkana river systems.

In the 21 years of PWSAC's existence, the State of Alaska has invested $27.5 million for capital construction in the business and $4.5 million in operating funds for a total of $32.3 million. The remaining operating funds, totaling $58.9 million, have been provided through a combination of the following:

- In-kind voluntary assistance from fishermen and community members;
- Voluntary contributions from fishermen and processors ($3.1 million);
- An annual "cost recovery" program in which 30% to 40% of the total hatchery returns are harvested and sold by the corporation ($47.4 million); and
- A self-imposed 2% enhancement tax paid by commercial fishermen on the gross harvest value of their annual salmon catch ($8.4 million).

The hatchery programs including Valdez Fisheries Development Association (VFDA) have contributed substantially to the economy of Prince William Sound communities. The gross value of their enhanced salmon harvested by the commercial fleet since 1975 exceeds $165 million.

Over the course of its life, the corporation has used its operating funds almost entirely to cover the costs of producing a steadily growing number of salmon. In 1995, releases totaled 542 million fish. PWSAC now has $32.3 million in debt, a deficit net worth of $2.1 million and operating losses over seven of the last 11 years. The inability of the corporation to generate a consistent positive cash flow has resulted in operating inefficiencies, nominal funding for research, and an ill-defined and inconsistent commitment to marketing.

The purpose of Business Plan '96 is to lay out a course for the corporation to assure its future by committing itself to living within the natural boundaries of the Prince William Sound ecosystem, and taking the steps necessary to become a viable, stand-alone, sustainable economic entity. Four sets of recommendations to the corporation's Board of Directors follow:

1. Change the **mission statement** to reflect the critical need to protect and assure the long term well-being of the wild salmon stocks in the Sound.

2. Change the **balance sheet** from one with 100% debt to an equity base (net worth) with a modest debt load commensurate with its inherent business risks.

3. Change management philosophy and priorities to acknowledge the need to **manage the corporation as a business enterprise** and thereby achieve financial stability in a highly volatile industry. Specifically this means…
   - **optimize the value** the corporation obtains from its biological, human and natural resources, and
   - aggressively lead the development of **alternative domestic and export markets** for Prince William Sound salmon and related products.

4. **Change the foundation of the corporation from being production-oriented to value-oriented through biological research and market development.**

The plan is intended to provide stakeholders and the State of Alaska with a well capitalized, not-for-profit corporation of high technical standing on a global scale. To merit this, PWSAC must be capable of sustaining itself financially, while minimizing its potential to adversely affect the environment in which it operates and on which all else depends.

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Prince William Sound Aquaculture Corporation–Statement of Purpose

I. BUSINESS PLAN '96 STATEMENT OF PURPOSE

To redefine the business and philosophy of PWSAC through fundamental revision of the corporate mission, restructuring of the balance sheet, redirected management priorities, and heightened responsiveness to environmental constraints and market opportunities.

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II. SITUATION ANALYSIS

Mission

The current mission is driven by the philosophy that greater production will lead to greater benefits, while subordinating ecological, financial and market implications.

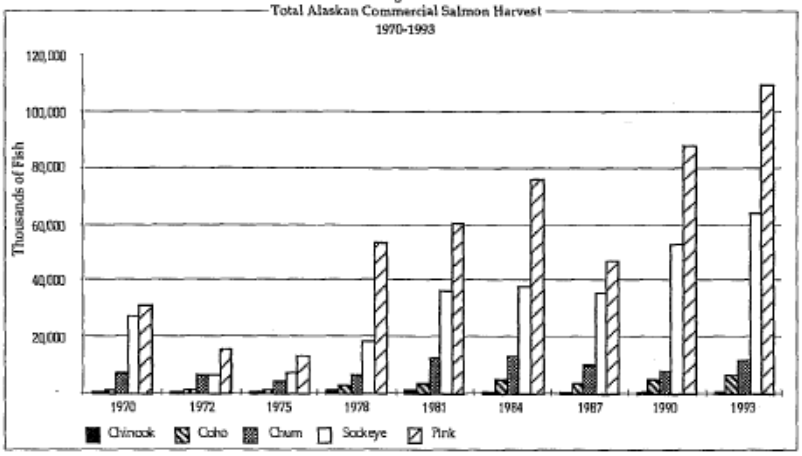
"To ethically and professionally optimize salmon production in Area E for the long term well being of all user groups."

Background

The PNP hatchery program has substantially contributed to a rise in Alaska's total salmon production.

The private non-profit (PNP) hatchery program was created in 1974 to rehabilitate and enhance depleted and depressed salmon fisheries in Alaska. As a result of hatchery technology, fishery management efforts, and favorable ocean conditions, Alaska's total salmon harvest has grown from low levels of approximately 70 million wild fish in 1970, to just over 190 million in 1993 (Fig. 1). In the Prince William Sound (PWS) area alone, harvest increased from 4.5 million wild fish in 1970 to nearly 40 million in 1991. The PWS increase is due almost entirely to pink salmon, predominantly hatchery produced pink salmon.

Figure 1
Total Alaskan Commercial Salmon Harvest
1970-1993



PWSAC operates four hatcheries in PWS and one on the Copper River.

The PWSAC hatchery program has added more than $138 million to the fleet's gross income.

The hatchery program in PWS was initiated by local fishermen and processors in 1974 with the founding of PWSAC. The first hatchery (Armin F. Koernig Hatchery: AFK) was constructed from an abandoned fish processing facility on Evans Island in 1975. PWSAC has since built the Wally Noerenberg Hatchery (WNH) and has taken over operations of three state hatcheries; the Main Bay Hatchery (MBH) and Cannery Creek Hatchery (CCH) in PWS, and the Gulkana Hatchery (GH) on the Copper River system. (A sixth PWS hatchery near the City of Valdez is operated by an independent PNP corporation.) Since its beginning, the PWSAC hatchery program has contributed more than $138 million in gross revenues to the fishing fleet (Appendix 3).

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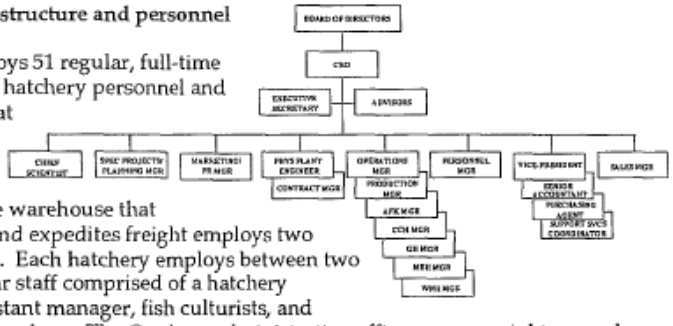
PWSAC employs 31 full time employees at its hatcheries and 18 in Cordova, and hires up to 175 seasonal employees each year for work at the hatcheries.

Organization structure and personnel



PWSAC employs 51 regular, full-time employees: 31 hatchery personnel and 18 office staff at the corporate headquarters in Cordova. An Anchorage warehouse that consolidates and expedites freight employs two staff members. Each hatchery employs between two and ten regular staff comprised of a hatchery manager, assistant manager, fish culturists, and maintenance workers. The Cordova administrative office manages eight general areas: operations, finance, planning/special projects, capital maintenance, marketing, public relations, purchasing, personnel and administrative support.

Temporary staff, which averages up to 175 people annually, are distributed among the hatchery sites. Each site, according to size, employs a maximum of 15 to 35 temporary workers, depending on fish harvests, egg-take and fry release work load.

Financial condition

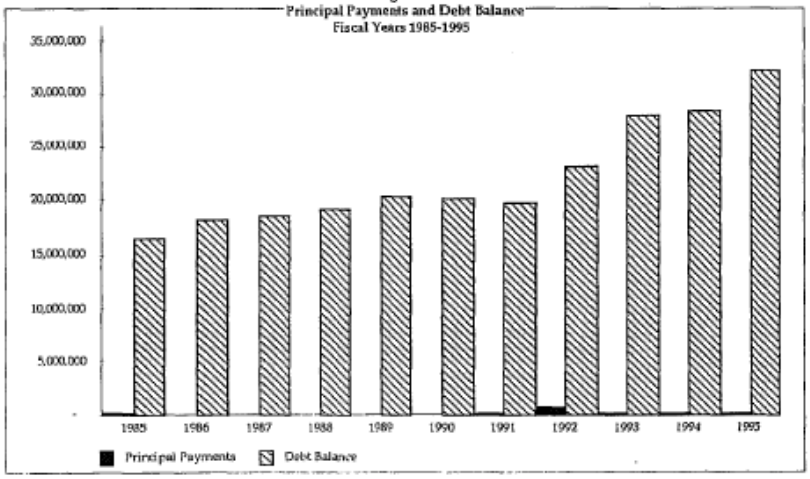
PWSAC currently owes $32.3 million to the State of Alaska.

With accrued interest, PWSAC's total debt will reach $70 million by 2022.

The AFK and WNH hatcheries were built with debt borrowed from the State Fisheries Enhancement Revolving Loan Fund established under 1976 legislation. The total principal obligation outstanding to the loan fund is $32.3 million (Fig. 2). To date PWSAC has made $1.8 million in principal payments and $0.0 in interest. (The average rate of interest being accrued is 9.2%.) Deferred interest and interest due through full term loan contracts commit PWSAC to a total payback (interest and principal) of nearly $70 million before the year 2022.

Commercial fishery limited entry permit holders in PWS agreed in 1985 to a 2% assessment on salmon harvest value for securing and repaying loans as stipulated under section 16.10.540 of the Fisheries Enhancement Loan Program. In addition to assessments which are channeled through the Department of Revenue back to

Figure 2
Principal Payments and Debt Balance
Fiscal Years 1985-1995



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Prince William Sound Aquaculture Corporation–Situation Analysis

PWSAC's revenue comes from fishermen (2% enhancement tax) and direct fish sales (cost recovery).

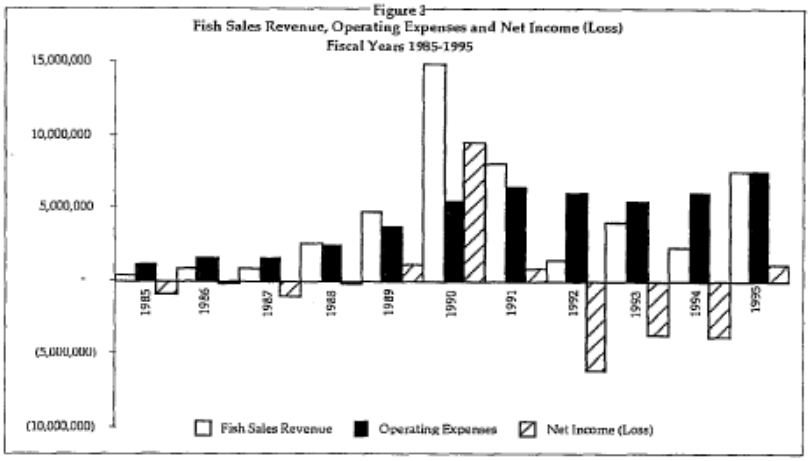
PWSAC, the corporation harvests and sells a portion of its production ranging over time from 30% to the current 40% from which it is expected to pay operating costs, debt, debt service and other allowable expenses.

Since 1985, fish sales revenues have fluctuated from less than $1 million to a high of $14 million (FY90). Due to declining ex-vessel prices paid for salmon and weak adult returns, however, revenues have fallen in recent years to less than an average $5 million annually (Fig. 3).

Revenue fluctuates widely because of variable prices and variable rates of marine survival.

Expenses increased when PWSAC assumed financial responsibility for 3 new state facilities. On the bottom line, PWSAC has earned a profit in only 4 of the last 11 years.

Figure 3
Fish Sales Revenue, Operating Expenses and Net Income (Loss)
Fiscal Years 1985-1995



Operating and capital expenses increased from $1.1 million in 1985 to over $6 million since 1990 as PWSAC took on the operation of three more facilities. For these and other reasons, the corporation has earned a net profit only four of the previous 11 fiscal years (1989, 1990, 1991, 1995). During these years, PWSAC experienced:

FY95 income augmented by grants and legal settlements totaling $4.5M

1. $1.13 per pound pink salmon in FY89;
2. the *Exxon Valdez* Oil Spill in FY90 when commercial fishing was restricted and PWSAC harvested large numbers of fish; and
3. the largest ever return of pink salmon to PWS in FY91.
4. FY95 income augmented by grants and legal settlements totaling $4.5M.

PWSAC's cash balance from fish sales revenue reached a high of $10 million in FY 1991. Although increasing expenses and a combination of weak returns and prices have brought the corporation's sales revenues down, the cash balance has been maintained at approximately $8 million as of June 30, 1995, including a $1 million Alyeska settlement , a $4.5 million state loan, and *Exxon Valdez* Oil Spill (EVOS) Trustee Council and Alaska Department of Environmental Conservation (ADEC) grants of $3.5 million (Fig. 4).

In 1994, the Board increased cost recovery to 40%.

In response to declining revenues and annual net losses, the PWSAC Board of Directors revised the cost recovery policy in 1993 to allow the corporation to harvest 35% of the hatchery production. In 1994, the Board again increased cost recovery to 40% as a condition precedent for restructuring the corporation's debt. Preliminary harvest results for 1995 indicate weak returns, with pink, chum and sockeye falling below forecast. Prices are low and revenue may fall as much as $3 million short of the company's $6.2 million projection for the current season.

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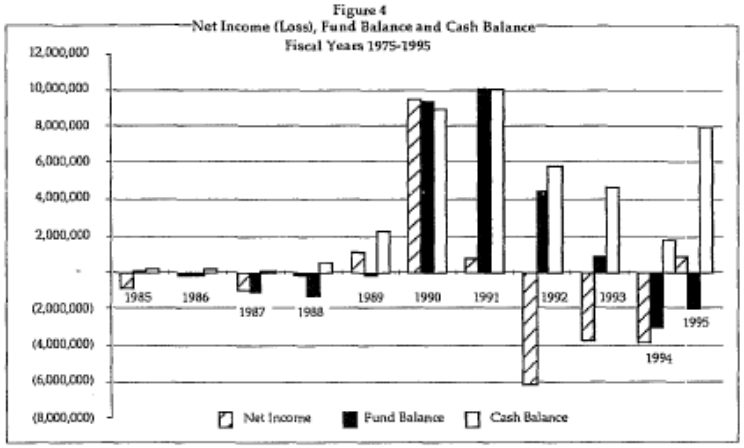
As income declined and expenses went up, the PWSAC Board revised the cost-recovery policy upward–giving more fish to the corporation and less fish to the fleet.

Figure 4
Net Income (Loss), Fund Balance and Cash Balance
Fiscal Years 1975-1995



Hatchery production status

PWSAC is the largest producer of hatchery salmon in North America.

PWSAC is the largest producer of hatchery salmon in North America. In 1995 PWSAC released a combined total of 542 million pink, chum, sockeye, chinook, and coho fry and smolt. Past and current operations have concentrated on pink salmon production (about 400 million were released in 1995), followed by chum, sockeye, coho and chinook (Table 1). Adult returns by species have varied among hatcheries and between years within hatcheries due to differences in the numbers of fish released and variable ocean survival. AFK has produced the greatest number of pink salmon (62 million), followed by WNH (47 million) and CCH (37.4 million).

The largest single return was 13.5 million at WNH in 1990, which also has the highest annual average (5.2 million). Chum returns to WNH have been similarly variable (average 486,000; range 126,000 to 1.3 million) as have coho (average 91,000: range 16,000 to 164,000) and chinook (average 2,500; range 800 to 4,000). Main Bay, which was converted to sockeye production in 1990 while under state management, has produced 1.8 million adults (brood year average 372,000; range 10,400 to 686,000) while the adult sockeye contribution of Gulkana Hatchery has been nearly two million (average around 100,000).

Marine survival has been highly variable between years.

Average marine survival of pink salmon has been relatively uniform among hatcheries (4.5%). The variability between years, however, has been high (<1% to 10%). Survival of coho at WNH (average 9.3%; range 2.7% to 16.8%) and sockeye at Main Bay (Coghill stock average 13.2%; range 3.2% to 19%) have been the most variable, whereas chinook (average 2%; range 1.3% to 2.8%) and chum (average 2.2%; range .28% to 5.9%) have been more consistent. Fry to adult returns from Gulkana Hatchery are difficult to estimate because of limited coded wire tag (CWT) data, but survival from the Crosswind Lake release appear to be more than double those from Summit Lake, around 1.4% and .6%, respectively. Although such variability is to be expected, there is no question that research and refinement of culture practices can stabilize and increase marine survival over the long term.

Environmental concerns

The growth of salmon enhancement in Prince William Sound has created a situation in which the hatchery contribution to pink returns has increased from less than 1%

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Prince William Sound Aquaculture Corporation–Situation Analysis

Table 1
PWSAC Historical Releases and Returns

Brood Year	PINK									CHUM			COHO			CHINOOK			SOCKEYE					
	AFK			CCH			WNH			WNH			WNH			WNH			NBH			GH		
	Release (x1000)	Return (x1000)	Percent	Release (x1000)	Return (x1000)	Percent	Release (x1000)	Return (x1000)	Percent	Release (x1000)	Return (x1000)	Percent	Release (x1000)	Return (x1000)	Percent	Release (x1000)	Return (x1000)	Percent	Release (x1000)	Return (x1000)	Percent	Release (x1000)	Return (x1000)	Percent
1972																						159	6.3	0.2
1973																						887	3	0.3
1974																						739	9	1.2
1975	1,008	44	4.4																			627	7	1.1
1976	11,010	155	1.4																			581	6	1.0
1977	16,951	553	3.3																			1,041	7	0.7
1978	22,775	1,493	6.6	2,816	90	3.2																1,646	13	0.9
1979	21,643	1,265	10.5	2,694	141	5.2																5,249	29	0.6
1980	69,787	5,134	7.4	21,289	756	3.6																8,033	57	0.7
1981	70,118	3,713	5.3	13,302	469	3.4																9,783	93	0.9
1982	97,385	7,888	8.1	22,312	1,129	5.1																16,594	160	0.9
1983	76,766	5,031	6.6	31,200	2,594	8.3				7,436	251	3.4										19,081	122	0.6
1984	102,531	4,964	4.8	36,500	853	2.3				12,466	126	1.0	99	16	16.3	60	0.7	1.2				13,587	198	0.8
1985	111,528	7,613	6.8	56,206	3,158	5.8	34,637	3,069	8.7	4,745	251	5.9	376	57	15.3	-	-	-				22,288	254	1.1
1986	116,138	6,076	5.3	42,600	228	0.5	35,933	3,867	5.1	23,485	331	1.4	898	139	13.5	65	1.2	1.7	330	18	5.0	18,933	223	1.1
1987	110,963	4,217	3.8	95,206	5,438	5.7	105,121	5,174	1.7	66,541	185	0.3	2,659	132	5.3	145	2.7	1.9	3,934	686	17.4	36,865	268	0.8
1988	160,672	6,894	4.3	59,888	2,595	4.1	159,923	15,497	8.4	79,846	1,057	1.3	2,297	93	3.9	139	3.9	2.8	2,616	498	19.0	25,289	255	1.0
1989	113,843	5,877	4.5	142,663	9,166	6.4	232,628	11,611	5.0	48,981	1,351	2.8	2,083	164	7.9	245	1.0	0.4	3,646	293	8.0	22,869	n/a	n/a
1990	115,749	2,655	2.3	161,538	1,706	1.1	206,728	2,079	1.0	76,841	n/a	n/a	1,564	42	2.7	275	n/a	n/a	3,663	n/a	n/a	17,880	n/a	n/a
1991	111,859	1,596	1.4	151,166	835	0.6	162,591	1,509	0.9	97,953	n/a	n/a	1,103	76	6.9	273	n/a	n/a	4,444	n/a	n/a	14,394	n/a	n/a
1992	103,510	1,787	1.6	140,029	9,451	6.7	171,879	6,894	3.5	107,991	n/a	n/a	1,183	n/a	n/a	295	n/a	n/a	6,743	n/a	n/a	27,812	n/a	n/a
1993	97,774	n/a	n/a	84,617	n/a	n/a	163,287	n/a	n/a	82,029	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total	1,534,701	63,987	4.3	1,015,841	37,519	4.0	1,460,104	46,940	3.8	605,316	3,395	1.4	12,251	701	5.7	1,572	10	1.2	33,276	1,697	14.3	286,702	1,553	0.4
Average	88,774	2,666	4.6	84,215	2,502	4.0	155,893	5,868	4.4	55,074	485	3.2	1,266	88	9.8	175	2	1.5	3,209	271	11.9	24,817	133	0.5

When compared to the 1980's, wild stock numbers are down, but not below historic levels.

in 1977, to more than 85% in 1988, and chum returns from around 1% in 1985 to 67% in 1994 (Figs. 5 and 6). Much of this trend can be attributed to the fact that expansion of the hatchery program coincided with record wild stock returns which have since declined and are now approaching pre-enhancement levels. Whether or not wild stocks have been negatively impacted by hatchery production is uncertain. Wild stock abundance in PWS fluctuated widely prior to 1975, and the statistical correlation between hatchery and wild stock returns within species is weak. Nevertheless, specific problems are apparent, including a downward trend in wild stock abundance of pink and chum from historic highs in the 1980's to pre-enhancement levels, and continued weak escapement of pink, chum and sockeye into the Northern, Northwestern and Coghill districts.

Figure 5
PWS Pink Salmon Harvest 1920-1992

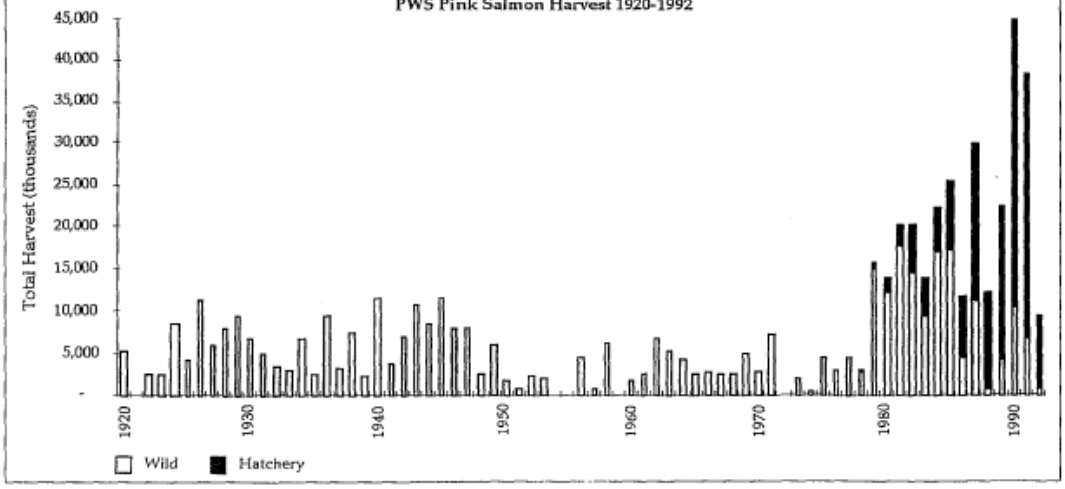

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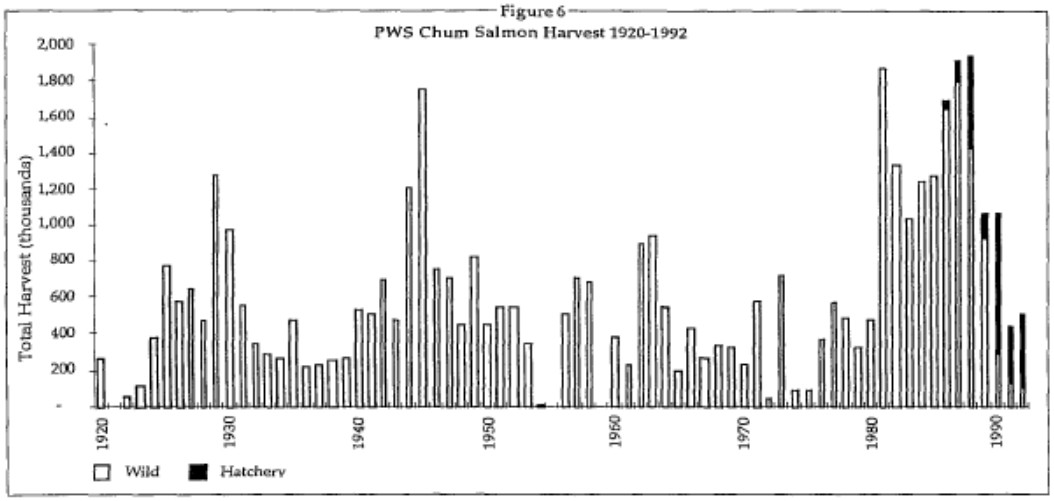
Figure 6
PWS Chum Salmon Harvest 1920-1992



Problems may relate to ecological interactions between hatchery and wild stocks.

Fishery biologists have suggested these problems may relate to ecological interactions between hatchery and wild stocks through competition during ocean residence, genetic impacts from hatchery fish straying and interbreeding with wild stock, and reduced ability to manage for wild stock escapement because of large hatchery returns.

Competitive interactions between wild and hatchery fish may take place either during early marine residence or in the ocean environment in the form of competition for food and space or predation. Genetic interactions result when hatchery fish stray into wild stock streams and interbreed with the native population, which can alter phenotypic characteristics important for local adaptation and reduce the productivity of the native population.

Harvest restrictions are likely to increase.

Finally, most hatchery and wild stocks of pink salmon returning to western PWS enter through the southwest corridor during mid- to late summer. This not only complicates the assessment of wild stock productivity, but creates a harvest conflict because the Alaska Department of Fish and Game (ADFG) manages for wild stock escapement into specific districts. The ADFG has implied that pressure to harvest more abundant hatchery stocks has led to declines in pink and chum escapement into the Northern, Northwestern and Coghill districts in PWS. If wild stock returns to PWS continue the recent trend downward toward pre-enhancement period levels, harvest restrictions are likely to be increased, and fishing opportunities may be further reduced.

Market conditions

A. Characteristics and marketability of current production

Salmon marketability is tied to quality.

The marketability of salmon for both live sales and processed products depends on the conditions under which the fish are harvested and delivered. Marketability also depends on intrinsic characteristics such as: run timing, size, color of skin and flesh, and flesh texture.

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PWSAC hires fishermen to harvest cost-recovery fish. The fish are delivered LIVE–a key factor in quality control.

Cost recovery fish are harvested by seine gear, operated by fishermen hired under contract to PWSAC. Harvest takes place in separately managed special harvest areas (SHA) in front of each hatchery site. The harvest nets roll fish directly into floating net pens. To maintain fish quality, the fish are held live until they are delivered within 24 hours of harvest.

Run timing and fish size are important for marketability.

In general, the earlier run fish are more marketable. The pink salmon that make up the AFK, WNH and CCH returns are from the later returning stocks, whereas the chum brood stock at WNH is one of the earliest in the Sound, returning as early as the second week of June, well before most chum returns in the state. The MBH supplies three distinct stocks of sockeye, with early (Eyak), middle (Coghill) and late (Eshamy) return timing.

In addition to early run timing, larger fish are generally more marketable: the larger the fish, the higher the percentage of recovery, particularly with pink. PWSAC-produced pink salmon range from 2.4 to 3.55 pounds, with an average weight of 3.13 pounds. Small fish (under three pounds round weight,) produce fillets of a less than desirable size and thickness; smaller headed-and-gutted (H&G) pink are also less desirable. PWSAC chum weigh an average 7.4 pounds, whereas Coghill-stock sockeye range from 5.1 to 5.99 pounds, Eshamy-stock sockeye average 4.9 pounds and Eyak stock sockeye average 6 pounds.

Salmon quality is rated in terms of size, appearance, color and texture.

Salmon are also graded by general outward appearance, skin color and flesh color and texture. Within a stock, fish returning earlier in the run are of the best quality, and more marketable. Quality declines as the run progresses and the fish become sexually mature: skin turns darker and flesh turns paler and softer. As the return of salmon progresses throughout the season, the percentage of females increases, and the percentage of roe by body weight in the females increases.

B. Sales and marketing

Dependence on processing capacity reached a peak in 1991 and resulted in the dumping of more than 2 million pink salmon.

PWSAC provides raw materials to the seafood processing industry, as do the majority of its commercial fishermen stakeholders. Until 1991, pink salmon were the major species sold. Sales were on the basis of daily bids from regional shore-based processors. From 1983 to 1990, PWSAC was able to sell pink salmon at an average 18% premium over the fishermen's grounds price because of the quality and volume of the fish, and convenience of the harvest/delivery system. However, like the fishermen, the corporation has been subject both to the cyclical variations of market and price, and to the variability and limitations of the processing capacity. Dependence on processing capacity reached a peak in 1991 when the corporation was forced to dump more than 2 million pink salmon back into PWS.

PWSAC's response in late 1991 was to establish a marketing/sales strategy designed to increase the number and variety of available processors/buyers by offering pre-season sales contracts for fish, on a short or long-term basis, at a given price; and to facilitate the development of pink salmon products other than cans by encouraging innovative processing and development programs.

The corporation, however, remained in the same business: selling raw material, with no control of processing and sales of final products. To change this, PWSAC began a program in 1993 to develop, custom process and market test further processed salmon products made from pink salmon. Products included H&G pinks, fillets, fillet and mince blocks, unprocessed (green) and processed roe–and a branded seafood product, salmon chowder, which was not profitable. (Appendix 4)

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The corporation continued to produce and sell green pink and chum roe from excess and unsaleable fish returning to the hatcheries in 1994. Coolers were installed at AFK, WNH and CCH, and a state-approved processing facility at WNH for egg removal.

For the 1995 season, PWSAC continued to sell the bulk of its production as raw material through combined pre-season contract sales and in-season daily bidding. The corporation also sold green roe from pink and chum, and developed samples of processed roe products at the hatchery site.

C. Global competition

World supplies have increased faster than demand.

The world markets are awash in salmon. Supply has increased faster than demand for salmon products. Further, the demand for some traditional salmon products (e.g., skin-on, bone-in canned salmon) is decreasing. The vast majority of the increased supply comes from farmed salmon (Table 2). This oversupply has impacted both PWSAC and the Alaska salmon fishing fleet.

Table 2
World supplies of wild and farmed salmon (in metric tons)

	1990	1991	1992	1993	1994
Wild	783,968	905,576	710,033	851,800	786,140
Farmed	297,000	329,000	323,000	376,000	446,000
Total	1,080,968	1,234,576	1,033,033	1,227,800	1,235,140

(source: Salmon Market Information Service)

Wild salmon is harvested in the waters of the USA (almost all Alaska), Canada, Japan and Russia. Farmed salmon comes from Norway, England/Scotland, Canada, and Chile, with lesser production from Ireland, Faroe Islands, Iceland, New Zealand, and Australia.

Farmed salmon has market advantages over wild salmon.

Farmed salmon is harvested on demand, and shipped fresh to markets worldwide. Most wild salmon, because of the seasonality of the fisheries, is either frozen or canned. However, the fact that farm production is currently outstripping demand has forced some farmed salmon producers to freeze some of their production. Although recent advances in fish chilling and air cargo now allow a greater fraction of the wild harvest to be shipped fresh, farmed salmon's advantages of constant availability of fresh fish, consistent high quality, and declining costs of production have permitted them to achieve significant gains against wild salmon in the world markets (Appendix 5). The world's over-supply of all salmon, plus the market advantages enjoyed by farmed salmon, directly impact the ex-vessel prices paid to the Area E fleet and throughout the Alaska salmon industry. (Table 3)

Table 3
Ex-vessel salmon prices in PWS, 1990–1994

(nominal, in$/lb)	1990	1991	1992	1993	1994	1994 as % of 1990
Seine pink	0.33	0.14	0.18	0.16	0.16	45.8%
Drift sockeye	2.19	1.38	2.20	1.27	1.26	57.5%
Seine chum	0.72	0.41	0.55	0.68	0.48	66.7%
Drift chum	0.76	0.68	0.55	0.68	0.48	63.2%
Drift coho	0.99	0.74	0.90	0.80	0.73	73.7%

(source: PWSAC)

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The trend is toward frozen and fresh products.

The product types and end-markets for PWS salmon differ by species. There is a clear trend away from canned salmon, toward frozen and fresh products (mostly H&G). For the three species of greatest concern to PWSAC, the trends are:

	main product	main market(s)	other products/markets
Sockeye	H&G frozen	Japan	H&G fresh & frozen / Asia
Pink	canned	USA & UK	increasing fresh/frozen/USA
Chum	H&G frozen&fresh	USA	some exported; some canned

(source: Salmon Market Information Service)

Roe is valuable.

Little roe is produced from farmed salmon. Products made from the roe of wild salmon, however, are valuable commodities, especially in the well-established Japanese markets, where the vast majority of salmon roe is consumed. Compared to prices for the fish themselves, prices for salmon roe products (sujiko and ikura) are relatively less variable.

The overall outlook for salmon markets is for continuing rapid growth in world supply. Even Norway, coincident with a multi-million dollar marketing campaign ($20M in 1995 alone), is expected to double its current production within the next 5 to 10 years.

Supply is outstripping demand.

Trends in the demand for salmon products are more mixed. Over the past year, Japanese consumption of all salmon has grown 3%. Per-capita consumption of salmon in the USA increased from 0.6 pounds in 1989 to over one pound by 1993. Further, salmon is now the fastest growing item in American retail seafood sales, having jumped from the seventh to the third best selling seafood in all types of American restaurants, and to first-place in the white-tablecloth segment. (source: Seafood Business)

These conditions (supply outstripping demand) will likely result in a continuation of the present low price levels. In view of these trends, most salmon producing companies and countries are expanding both their customer bases and product lines, for example:

new customers–fresh and frozen Atlantic and Pacific farmed salmon being sold in Taiwan and Hong Kong; Alaskan salmon penetrating the American Midwest under the guidance of the Alaska Seafood Marketing Institute (ASMI);

new products–salmon burgers and patties manufactured by both Atlantic and Pacific producers; chum salmon hams and sausages; fresh and frozen (not canned) wild Alaska pink salmon being sold in the USA; portion controlled, boneless fillets; salmon caviar;

both–the use of pink salmon mince and skinless/boneless fillet blocks as an ingredient in further-processed seafood products, such as the production of salmon nuggets from mince blocks for the American school lunch program.

Finally, there also are clear trends towards market segmentation, and better and more consistent product quality. (Appendix 6)

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Alliances

To serve its mission, PWSAC is built on the premise that its actions must contribute to the economy of the region. The corporation provides resources and opportunities to this end.

Support for the corporation is eroding.

Commercial fishermen and the shore-based processing industry are the primary beneficiaries of PWSAC's enhanced salmon production. Both economic needs and social expectations drive constituent support for PWSAC. **Legitimate concerns such as poor marine survival, weak prices, allocation disparities between gear groups, increasing corporate cost recovery percentage, and fishery management issues triggered by hatchery production are factors eroding support for the corporation.** In addition, the processing community has asserted that recent moves by PWSAC and hatchery associations statewide into further processing and marketing of their cost recovery fish and roe are inappropriate, and that hatchery production is intended for the use of the established regional processors.

PWSAC also provides fish for sports, subsistence and personal use fisheries. PWSAC's contributions to these user groups has been positive, creating new resources and harvest opportunities. Recent actions to curtail sport fishery releases of coho and king production at WNH are temporary and will be reversed by facility improvements and better fish health practices. Significant sport fisheries within and around the communities of Whittier and Cordova, as well as expanding opportunities in remote areas of PWS and road accessible areas along the Copper River are products of PWSAC's enhancement activities. User expectations and participation in these fisheries will increase and with it, pressure to expand these programs.

Scientific concerns are being raised.

The scientific community and management agencies continue to raise ecological/biological concerns which center around the widely-held view that PWS hatchery production and procedures are detrimental to the abundance and health of wild stocks. PWSAC played a significant role in developing the *Sound Ecosystem Assessment* (*SEA*) research program funded by the *Exxon Valdez* Oil Spill Trustee Council, and continues to be involved in this program to investigate significant fish species in PWS and their ecological interactions.

Changes to hatchery production to alleviate concerns.

PWSAC also recently hired a Chief Scientist to conduct necessary research into the preservation and rehabilitation of wild stocks, including possible changes to hatchery production directed at alleviating these concerns, together with improved rearing strategies aimed at lower costs and higher marine survival.

Regulatory considerations

The regulatory basis of PNP salmon aquaculture is established under state constitutional amendment and the PNP Hatchery Act with constitutional emphasis on maximum use of natural resources consistent with public interest, sustained yield of fish resources, and the efficient development of aquaculture. The ADFG commissioner issues permits to PNP hatcheries based on various analyses, needs and opportunities. A permit for a salmon hatchery "may not be issued unless the commissioner determines that the action would result in substantial public benefits and would not jeopardize natural stocks."

Due to recent fishery controversies additional regulations were adopted (1992) re-emphasizing that fish stocks in the state *shall* be managed consistent with sustained yield of wild fish stocks, adding they *may* be managed consistent with sustained yield of enhanced fish stocks. In addition, federal jurisdiction over forest

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lands (MBH, CCH) and state park restrictions (WNH) pose site specific limitations and exposure to public pressures over multiple-use issues.

Hatchery production has generated attention.

Large scale hatchery production and fishery price structures have generated legislative attention. Although no restrictive legislation has been approved, recent and ongoing roe sales and fish processing by hatcheries, viewed as competitive with private enterprise, have further politicized the issue of original PNP program legislative intent.

Summary

Mission
- The PWSAC mission is production oriented, lacking sound biological, ecological and market development strategies.

Organization
- The organization is managed and staffed by 51 full time employees and up to 175 seasonal employees.

Finance
- The debt burden carried by the corporation is large.
- Revenues generated by fish sales are weak due to inconsistent production successes, and declining fish prices.
- Income stream is highly variable and, on average, inadequate to meet operational costs, debt and debt service.
- There are inadequate cash reserves to make ongoing capital and operational changes to the program, or to support necessary research and market development.

Hatchery Production
- Returns of hatchery fish are variable and unpredictable.
- Weak wild stock returns are attributed by some to hatchery production and resultant harvest pressures.

Market Conditions
- PWSAC strategies to harvest and transfer cost recovery fish for sale and processing are well suited to maintain fish at high quality.
- Stocks produced by PWSAC are not in all cases the most desired for marketability.
- New buyers have been encouraged to participate in the market.
- PWSAC has ventured into processing and marketing of new products beyond the raw resource stage with no financial payback.
- International competition has flooded world markets which, in turn, has reduced prices.
- The farmed salmon industry provides stability in volume, availability, portion, quality and price.

Constituent Support
- PWSAC constituents, while continuing to benefit from PWSAC production, have been economically and operationally impacted by failures of the corporation and changes in the salmon industry.

Regulatory Considerations
- Political pressure by constituents, competitors and program opponents could result in legislation and regulation affecting the PNP hatchery program.

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III. DEFINING OPPORTUNITIES AND THREATS

Mission

Change to an organization's mission requires review of the philosophy and objectives set forth as the organization's founding principles. This draws into question the very existence of the organization, the business it is in, and the way it conducts its business. The environment in which PWSAC exists and operates suggests both opportunities that may help us grow the business in new dimensions over the long term, and threats that may impact the organization, restrict growth, and, clearly, even jeopardize its continued operations.

The crisis poses opportunity for change.

The current critical business situation from biological conflicts, an unserviceable debt burden, weak and variable revenues, to the new reality of intense, high quality international competition, indicates that the business we are in and how we do our business need to be critically examined. The crisis also poses opportunity for change.

Building the organization

PWSAC's survival depends on an environment which will demand the corporation's product. The product is produced by people who utilize their knowledge, skills and the available resources to meet that demand. It is the PEOPLE and the STRUCTURE within which they operate that will ultimately contribute to success or failure of the company.

PWSAC will be forced to redefine its structure.

Traditional organization structures embrace "accepted" behavior, wariness to accept new ideas and, to a large degree, stagnation. With a new mission and new goals, PWSAC will be forced to redefine its existing structure. Weaknesses will be forced to surface. Progressive ideas will be recognized. Hidden knowledge will be utilized. Human resources will be optimized by reduction or addition of expertise in appropriate areas. This will yield an efficient, well-tuned organization.

The objective is a relatively small number of highly motivated, highly skilled people capable of setting world class standards.

Achieving long term financial stability

As structured today, PWSAC is not a viable business.

PWSAC is not a viable business enterprise as presently structured. A corporation, whether for-profit or not-for-profit that is production driven will not survive if key ecological, financial and market considerations are subordinated or even lost to production "needs." Production without financial disciplines will consume cash until such time as the source of cash is no longer prepared to provide further funding or repayment holidays. Production without market disciplines will not produce products the market wants. Nor will it identify the most cost-effective and, hence, most profitable segments of the market. Finally, the current economic environment in the State of Alaska makes it highly unlikely that PWSAC will be able to solicit further funding to cover operating losses or capital funds (from the Revolving Loan Fund) for major plant maintenance or capital equipment, and that it would be a serious mistake to "bet" on the state granting any further debt deferments in the future.

PWSAC has deficit net worth.

A 21 year old corporation with a balance sheet that has a deficit net worth of $2.1 million and total long-term debt of $32.3 million is not going to dig itself out of a hole of that size (Fig. 7). A normal balance sheet for a manufacturing company in reasonably sound financial condition would not have long term debt in excess of

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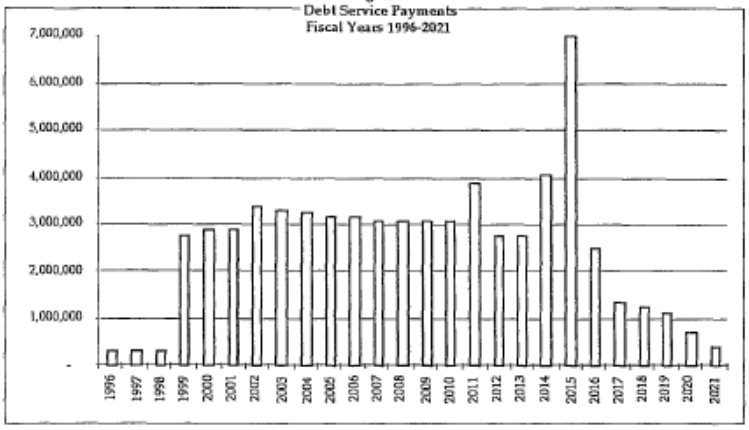
Prince William Sound Aquaculture Corporation–Opportunities and Threats

Figure 7
Debt Service Payments
Fiscal Years 1996-2021



Debt represents 107% of capitalization.

50% of its total capitalization (*). PWSAC's long-term debt now represents 107% of its total capitalization. A company with a history of highly uncertain revenue streams and increasing expenses is not going to turn itself around to produce the cash flow necessary to service its debt, much less position itself to compete with more cost-efficient domestic or foreign suppliers.

If PWSAC were to require a cost recovery rate higher than 40% of its total fish production, it would not be in the best interests of the permit holders to support its future financial requirements. In the long run they would be unlikely to earn a reasonable return on their own capital investments in vessels and gear.

PWSAC has two years of operating cash.

PWSAC has approximately two years of operating cash reserves in the bank as a result of the loan restructuring and the $4.5 million operating loan negotiated in 1994. This assumes that PWSAC will generate "normal" revenues during the 1996 and 1997 seasons. The restructuring contemplated therefore needs to take place in 1996.

PWSAC, with a 21 year history, has not been able to build a satisfactory financial base from which to operate. The corporation has been unable to demonstrate satisfactorily to its regulatory agencies that it is not a threat to its immediate environment (which they were formed constitutionally and by statute to preserve and sustain.) It is logical that PWSAC reassess its approach to doing business and the results its obtains.

Opportunity to compete and prosper...

With ongoing declines in oil revenues, the State of Alaska has a strong interest in seeing its renewable fisheries resources contribute substantively to its future economic well-being. Properly structured, PWSAC and the other PNP's (in partnership with the state) should be able to contribute significantly to that effort. It would appear that the State of Alaska's and PWSAC's long-term interests are one and the same.

It would also appear to be in the best interests of the state to work with PWSAC to restructure its balance sheet so that the corporation, if well managed, has a reasonably solid opportunity to not only survive but to compete and prosper in the global economy. If the state is prepared to consider itself a long-term investor in

(*) Capitalization defined: Long term debt plus net worth (or Fund Balance for a not-for-profit corporation)

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PWSAC rather than solely as a note holder, then a restructuring is possible. Conversely, if the state is not prepared to rethink its existing role as a banker and note holder, it is highly unlikely that it will recover its existing $32.3 million investment in the corporation.

PWSAC should not ask for debt forgiveness.

PWSAC management and its Board of Directors strongly believe that the company should not ask for forgiveness of its debt. It is not appropriate for the State to take a $32.3 million loss when alternative solutions exist.

Any additional debt deferment increases the likelihood of the eventual demise of the corporation.

Financial restructuring can achieve several objectives. The permit holders and PWSAC would gain by having a sufficiently well capitalized balance sheet for the corporation to stand on its own. Funding would be available for the essential research, and development of new markets to increase the value of the catch for the corporation and the fleet.

From the state's perspective it would gain by creating a real partnership with a strongly capitalized, not-for-profit corporation capable of achieving high technical standing on a global scale.

PWSAC needs to be value oriented.

Changing PWSAC from being production oriented to "value" oriented, plus the benefits expected to derive from financial restructuring, are intended to achieve profitable results and a positive cash flow in most years. Seven profitable years out of ten is the goal.

Building ecologically sound production

Reduce ecosystem impacts...

Production opportunities exist to begin PWSAC's transformation. The corporation must initiate a process of restructuring production in a manner that optimizes the *value* of resources (species, stocks, hatcheries, water supplies and people), while reducing wild stock and ecosystem impacts to an acceptable level. Without these efforts, wild stock populations will remain subject to pressures that reduce their contribution to the PWS ecosystem and, as a result, the fishing industry, PWS communities, PWSAC itself and processors will continue to experience economic adversity.

...and interactions with wild stocks.

Any efforts PWSAC undertakes to alter current production must be made with the intent of improving wild stock health and productivity. In particular, changes should be directed toward improving the opportunity for ADFG to manage for wild-stock harvest and escapement, and substantially reduce the opportunity for interaction between hatchery and wild fish. Operating from this assumption, production efforts should be directed toward alternatives that change hatchery returns in area through remote releases, or replace current late run pink salmon production with species or stocks that have either earlier or significantly later run timing. This approach is based on the assumption that diverting harvest pressure away from existing mixed stock fisheries will provide for more precise management of hatchery and wild stocks. Enhanced returns can then be harvested at rates that optimize their value and improve wild stock management to ensure levels of escapement needed for sustainable production.

Alternatives to modify the present production, however, are also subject to various constraints. Evidence suggests that remote releases or developing hatchery returns from non-local species or populations can lead to increased straying. Hatchery fish compete with wild stocks for the same resources, and species such as chinook and

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Reduce late pink production.	coho may prey on wild salmon fry, as well as larval/juvenile herring. In general, ecosystem responses to enhancement schemes are highly complex, and plans to modify production must involve careful assessment of the potential consequences. The basic goal for future production may include replacing a proportion (25-50%) of the dominant late run pink salmon production with species or stocks of either earlier or later run timing, and relocating hatchery runs by remote release into less sensitive areas.
Options are limited.	Potential changes in hatchery composition to achieve this goal are, for culture purposes, limited to the facilities where temperature control can be exerted. Opportunity is best at WNH because of the dual water intakes (i.e., shallow and deep), although AFK also has potential because of the capacity for water recirculation. Limitations on water availability at AFK, however, restrict species options to pink and chum, and may constrain brood development for early stocks. Chum production would also be constrained by water availability if freshwater rearing of fry is needed, although incubation of early chum or pink could be successful if the capacity to chill water is developed, or if eggs are transferred after the eyed stage. Cannery Creek is also subject to limited water availability and warm temperatures in the summer and early fall, which would prevent brood development of early run pink or chum, but possibly support a mid-run stock of either species.
Development of coho will require capital improvement.	Using the present design and established biocriteria, the observed minimum winter flow of 20 cfs at WNH would allow for production of around 4-5 million coho/chinook smolt or around 8-10 million sockeye (assuming all water was utilized for rearing with no drawdown of the lake.) Modification of the intake lines to provide for winter drawdown would allow for proportionate increases in production (intakes now allow for a maximum flow of 70 cfs.) WNH is presently permitted for sockeye and could better separate late run Eshamy sockeye from the local wild stock than releases from MBH. Sockeye production was considered briefly and dropped due to disease considerations and the resulting added safeguards for isolation (i.e., net pen rearing for chum, pink would require depurating sockeye incubation and rearing water effluent). Development of coho/chinook smolt production at WNH will require capital improvements, including modifications of the water supply, construction of additional rearing space, and improvements to adult capture and spawning facilities. Grants and/or other sources of outside funds for portions of the capital cost will be explored.
Gulkana has potential for increased contribution.	At Gulkana, fry plants are now directed to three lakes. CWT data indicate that fry planted in Crosswind Lake are larger at smolt migration and experience higher survival than fry planted in Summit Lake (i.e., Crosswind is more productive and has a longer growing season). This suggests there may be potential to increase the contribution from Gulkana by shifting a portion or all of the Summit Lake fry (around 6 million) to Crosswind or other lakes in the area. Gulkana II also appears to be under utilized for the available water and has yet to experience an IHN outbreak.
Remote release fish at Naked Island, Montague Island and Nelson Bays...	To better isolate hatchery fish from the vicinity of outmigrating wild salmon fry or returning adults, hatchery stocks can be remote released. Three areas have been identified by the Prince William Sound Regional Planning Team that have practical potential for remote release sites: Naked Island, Montague Island, and Nelson Bay. These sites were proposed largely because of the potential to minimize hatchery/wild stock fishery conflicts, increase harvest opportunity, and distribute fishing pressure over more area. Successful development of remote release projects, however, also depends on suitability of near shore environment for growth and survival of fry, logistic accessibility and adequate protection from severe weather.

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Port Chalmers appears to have significant potential.

PWSAC has established a remote release site in Chalmers Harbor on Montague Island and has been conducting rearing and test fishing operations there since 1994. Based on site conditions for growth of chum fry (i.e., water temperature, zooplankton abundance) Port Chalmers appears to have significant potential and should be considered for future expansion. The site has been integrated with *EVOS* Trustee *SEA* investigations as part of the ongoing effort to study physical and biological relationships between salmon and herring productivity in the PWS ecosystem, and information from the project will contribute to refining rearing and release strategies. Logistics for future releases at Montague would be improved by transfer of chum fry from AFK, which could be achieved by sending eyed eggs from WNH to AFK in the fall. Studies to evaluate the outmigration timing and transfer of chum fry directly to seawater would need to be conducted.

The other site of practical consideration is Naked Island, which is centrally located in PWS, and has numerous bays, but is exposed to open reaches of water. Wild stock presence is minimal, and the site is located within close proximity to CCH, WNH and MBH. Although the conditions for production of chum salmon appear less desirable than those at Port Chalmers, releases of pink, sockeye or coho may be effective to reduce competition with, or predation on other species and stocks. Early, middle or late stock releases could all be considered. Concerns are limited to the availability of freshwater for imprinting and possible interception of wild stock. Nelson Bay is similar to Montague Island with respect to abundant chum rearing habitat (i.e., broad, estuarine tidal flats) but is strongly influenced by glacial waters making it less desirable for growth because of colder temperature. Local stocks are middle to late run pink and chum, so early hatchery stocks are preferable from a management perspective. However, genetic concerns from using a non-local brood source would need to be addressed. The site is also well removed from any of the existing hatcheries, which would increase the cost and time for fish transport.

Production opportunities exist to meet facility and ecological constraints. Do these production changes result in greater market potential and more value?

Marketing opportunities

What can be done to reverse the cost recovery percentage trends?

Throughout its history, PWSAC has generated its income through "cost recovery" sales of a portion of the salmon that it produces. PWSAC has recently increased its income by taking a larger share (from 30% to 35% to 40%) of cost recovery fish. The decision to do so was made with great reluctance, however, because it left fewer fish for the common-property fishing fleet; the most significant group of PWSAC's stakeholders. What can be done to reverse that trend?

- Rather than simply taking more fish, how can PWSAC generate greater income (value) from the cost recovery fish that it harvests?
- How can it do so in an incremental fashion without undue financial risk, while minimizing disruptions to, and competition with, its stakeholders?
- How can it do so in a way which will maximize the benefits to the PWS fleet?

There is a wide range of products which can be produced from PWSAC salmon, and those products have the potential to enter a wide variety of domestic and international markets (Table 4). However, in the next three to four years of operation, PWSAC's opportunities are constrained by the species it currently produces and the characteristics of the existing runs of those species. Further, they are deliberately constrained by a need to minimize the capital expense and by the complexity of the operations. PWSAC thus intends to proceed in a careful, incremental fashion, using the cash flow it generates itself to the greatest extent possible.

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Prince William Sound Aquaculture Corporation–Opportunities and Threats

Table 4
Comparison of Market Opportunities

Species	Products	Processed by	Markets	Primary Constraint	Secondary constraint	Opportunity *
pink	blocks	custom-proc.	USA, Europe	none	none	near-term
pink	blocks	PWSAC	USA, Europe	high capital cost	short proc. season	uncertain
sockeye, chum, pink	fresh H&G/ princess	custom-proc.	USA, Asia	must learn details	none	near-term
sockeye, chum, pink	frozen H&G/ princess	PWSAC or ?	USA, Asia	high capital cost	need some knowledge	long-term
chinook, coho	fresh H&G/ princess	custom-proc.	USA, Asia	no fish available	none	long-term
chinook, coho	frozen H&G/ princess	PWSAC or ?	USA, Asia	high capital cost	no fish available yet	long-term
pink & chum roe	green roe	PWSAC	USA, Asia	none	none	near-term
pink & chum roe	sujiko & ikura (caviar)	PWSAC	USA, Asia	need experience	none	near-term
all species	fresh fillets & steaks	PWSAC or ?	USA	high capital cost	need knowledge	long-term
all species	frozen fillets & steaks	PWSAC or ?	USA	higher capital cost	need knowledge	long-term
pink, chum	tertiary products	PWSAC or ?	USA	very high costs	need much knowledge	uncertain
pink, chum	pet/livestock food	PWSAC or ?	USA	very high costs	need much knowledge	uncertain

* near-term = 3 to 4 years; long-term = > 3 years; uncertain = possibly in the far future, if ever

Unique selling points

Unique selling points distinguish products.

One of the most important aspects of marketing anything is identifying and using the unique selling points of the product. These are the factors that distinguish PWSAC's products from those of its competitors. They put the company in the position of accentuating the positive, and actively looking for ways to overcome negative perceptions. PWSAC's salmon have three kinds of unique selling points:

- unique selling points shared by all Alaska salmon;
- inherent unique selling points of PWSAC salmon; and
- unique selling points which may be created by PWSAC's marketing program.

These unique selling points (which are outlined in greater detail in the appendix to this plan) can form the foundation of PWSAC's marketing opportunities. Proper use of these advantages should enable PWSAC to market its processed fish in a competitive fashion, and to sell its products for higher-than-average prices.

Near-term opportunities

Over the next three years, PWSAC's cost recovery production will be essentially the same as it is now.

- CCH, AFK and WNH late run pink salmon in large numbers
- WNH, early run chum salmon in large numbers
- MBH, early, middle and late run sockeye salmon.

Further processing would be done incrementally.

PWSAC does have opportunities, however in both live fish and further processed product markets. Opportunities to further process and market PWSAC cost recovery fish can be undertaken in increments as management gains experience and proves its ability to do this profitably. However, the need will remain, particularly in the short term, to optimize the value realized through the sale of pink, chum and sockeye salmon live at the hatchery sites.

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Prince William Sound Aquaculture Corporation–Opportunities and Threats

A. Live fish marketing and sales

Options for selling live fish include sales by daily bid and pre-season contract. In general, bid sales bring higher than grounds prices in years of short supply, but can leave fish unsold or sold for extremely low prices in seasons of abundant supply.

Pre-season contracts

Initially used in a limited way, pre-season contract sales have become an alternate method of selling large numbers of PWSAC fish. Presently based on grounds price, the method for pricing pre-season contract sales remains controversial, with many fishermen fearing that PWSAC would "set the price" too low if authorized to write contracts based on a pre-determined price.

Pre-season contract sales provide several important benefits to the corporation: secure market for cost recovery fish; the opportunity to establish stable, long-term relationships with processors, and the practical potential for custom processing. Disadvantages include the possibility that PWSAC will not maximize the value of fish in a short-supply year by competitive bidding for cost recovery fish.

A third but related method of live sales is to form joint-venture relationships with buyers. Success with this option depends on the caliber of the processing partner, and on the terms of the agreement.

Factory trawlers can produce high quality products.

As the factory trawler participation in cost recovery has increased, so have the discussions regarding the extent of PWSAC's obligation to sell fish to the local processors. From a business standpoint, there is a long-term advantage to maintaining close relationships with the local processors. They are more likely to be long-term customers. Factory trawlers at this time have the ability, however, to produce products of higher quality than do shore-based processors. The once-frozen pink fillets and fillet block products produced by factory trawlers cannot currently be produced by shore-based processors in PWS.

The timing of existing stocks is a mixed prospect. All the pink salmon now produced have late return timing. This does not take advantage of the increased demand and price early in the season. PWSAC's chum are an early stock, and take advantage of increased demand for the first three weeks of their return. Currently, most of the PWSAC sockeye are mid-timed, but the MBH has the advantage of an early sockeye brood stock which is being produced in larger numbers each year, and has the potential to be marketed alongside Copper River sockeye, at a comparable value.

B. Processed

There are opportunities beyond live fish sales to process and sell fish products. For example, because of their high abundance and low price, pink salmon are capable of penetrating markets which are not open to most other salmon species, such as the increasingly popular skinless/boneless fillet blocks and mince blocks. These once-frozen blocks are used as raw material in an expanding array of finished products (e.g., nuggets, dinners, "fish sticks"). At present, most of the markets for blocks are in the USA and western Europe.

Production of blocks is capital-intensive, which denies PWSAC the ability to undertake this option directly. PWSAC has established a recent history of successfully selling live pinks to factory-trawlers. They are experienced in the production of blocks from pollock and cod, and lately, from pink salmon. These vessels, operating under contract to PWSAC, could custom-process PWSAC's pink salmon into fillet and mince blocks and fillets.

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Primary processed pink and chum have expanding markets.

Pink salmon, like chum and sockeye salmon have both established and expanding markets in their primary-processed forms, H&G and princess-dressed (gutted, head-on). Frozen H&G pink salmon are often sold wholesale to Asian re-processors who partly thaw the fish, and use them to manufacture twice-frozen blocks of fillets and mince. Fresh and frozen H&G salmon of all three species also serve significant retail markets in the USA and in Europe. Top quality fresh H&G salmon readily lend themselves to **brand identification, customer loyalty and "niche" marketing**, (like the high value troll-caught king and silver salmon of Southeast Alaska.) These strategies could enable PWSAC fish to compete effectively against farmed salmon. Finally, frozen H&G sockeye and chum salmon are sought by companies which produce controlled-portion fillets and steaks, and smoked salmon products.

PWSAC has significant opportunities to sell roe.

Roe products have well-established markets both as sujiko/ikura products in Japan, other Asian countries and ethnic/sushi bar markets in the USA and Europe, and as caviar products in the larger American cities and in Europe. In the last three years, PWSAC has sold green roe and has gained preliminary experience in processing roe into first-wholesale-ready products, and in selling those products. Opportunities include sockeye roe which could be processed from unharvested Gulkana Hatchery sockeye.

Production of processed salmon products can be accomplished on board floating processors anchored near PWSAC's hatcheries, on a custom-processing basis, for the next two or three years. PWSAC may elect to do some or all of this in-house in the future if the risks/benefits so dictate.

Longer-term opportunities

There is a wider range of longer-term opportunities. These opportunities are presented by potential changes in PWSAC's production, and by trends in domestic and international salmon markets. (Appendix 8) **PWSAC can address the long-term market opportunities, in an incremental, step-wise manner.** This would allow PWSAC to achieve both a stronger, more diverse presence in the seafood markets, and to attain greater cash flow and financial strength.

From the perspective of seafood marketing, the general marketability of PWSAC salmon is:

Coho salmon are readily marketable.

- *chinook and coho salmon* are readily marketable with little processing (e.g., H&G fresh), and typically command better prices than do chum or pink salmon
- *sockeye salmon* typically command good prices, and early-run sockeye usually fetch higher prices than do the later run (post-Bristol Bay) fish;
- *pink salmon* are also versatile and their markets are expanding, and early-run pink salmon usually command a better price than do the later-run fish, in the fresh H&G and fillet markets.

A. Live fish marketing and sales

PWSAC may continue in the longer-term to market and sell a portion of its production live at the hatchery sites. This can be accomplished by pre-season contract, in-season daily bid or joint venture style partnerships with buyers/processors. In addition, PWSAC live sales can be made to shore-based processors, factory trawlers or floating processors.

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Prince William Sound Aquaculture Corporation–Opportunities and Threats

Changing the pollock "B" season would open floating processor opportunities.

Opportunities to sell fish to factory trawlers would increase with the proposed change in the pollock "B" season from the current August 15 to September 1 or even later, to allow the trawlers' full participation in the pink salmon fishery in PWS. This would increase the ability of the corporation to seek custom processing arrangements with the factory trawl fleet.

B. Processed

If PWSAC was to produce fresh H&G and princess-dressed salmon for Asian and American markets, the next logical step would be the freezing some of those fish, for sale throughout the year. These frozen fish (all five species) would be sold to wholesalers and retailers in the USA and overseas, and frozen H&G pink salmon would also be sold to companies which produce twice-frozen blocks.

Similarly, the next logical step beyond custom-processing pink salmon into once-frozen fillet and mince blocks would be to produce those blocks "in house," at a PWSAC plant. Although such a step would be some years in the future, it would offer the potential advantage of allowing PWSAC to control its costs, know-how, and marketing strategy.

Additional opportunities will become apparent with experience.

As PWSAC processing and marketing programs gain strength and experience, and begin to generate positive cash flows, additional opportunities for further processing of all five salmon species will become apparent. Opportunities include secondary-processed products: portion-controlled fillets and steaks, fresh and frozen; whole fillets, fresh and frozen, pink-bone-in or -out, skinless or skin-on. Tertiary products, those requiring three processing steps, also offer opportunities: nuggets, fish sticks, breaded portions; smoked products such as whole fillets, jerky, ham, sausage, soup, spreads and paté.

PWSAC will also consider optimum product forms for the late-run pink and chum salmon with darker skin and paler meat. In addition, PWSAC will investigate the pet food market, the fish meal potential, and other uses of byproducts and fish carcasses.

As the company proceeds with incremental steps in growing its processing and marketing programs, the concept of in-house processing facilities at or near WNH and MBH may be explored. These two facilities have the highest potential as sites of processing facilities because of their low-cost electricity and fresh water.

Marketing strategies will benefit the commercial fleet.

Locally, PWSAC's efforts should be responsive to its constituents. Longer-term marketing strategies should include defining and implementing ways in which PWSAC's marketing experience and contacts can benefit the commercial fishing fleet. Opportunities include: bringing additional buyers to the Sound who will buy fishermen's fish in addition to cost recovery fish; encouraging strategic fish sales for the expansion of product forms and markets for salmon, benefiting the fishermen over the long term by increasing demand and value; providing fishermen lists of potential customers and contacts; providing detailed marketing information and consultation for both domestic and export related prospects.

An important additional area of opportunity lies in potential market and sales benefit to, and cooperation with, other private, non-profit hatchery corporations. Cooperative processing, marketing and/or sales ventures may benefit the associations by sharing costs and providing resources to increase stability of the supply of round fish and increased access to available markets, particularly overseas.

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Prince William Sound Aquaculture Corporation–Opportunities and Threats

Forming alliances

PWSAC's continued existence relies on strong alliances.

To take advantage of these opportunities, corporate goals and activities must reflect PWSAC's intent to actively guard and preserve the natural resources of the Sound's marine ecosystem, while continuing to acknowledge and respect the needs of the users of that ecosystem. PWSAC's continued existence relies on strong support from the commercial salmon permit holders of Area E and its other immediate stakeholders, and from a broad range of users and observers including sports, subsistence and personal use fishers; state regulatory agencies and lawmakers; scientific and environmental organizations; the press and the general public.

Strategic alliances based on mutual benefit have long been in place with the commercial fleet, but are threatened by dissatisfaction with fish culture and ocean survival problems, falling fish prices, allocative issues, the recent rise in the hatchery cost recovery percentage, and fishery management issues that force harvesters into postage stamp harvest areas. Opportunities for strengthening these traditional alliances can be built upon hatchery successes such as increased marine survival, producing stocks that do not conflict with wild stock management priorities, decreasing cost recovery requirements over time, and expanding fisheries in time and area through stock selection and release location.

Continued and improved alliances with the sports and personal use fishers in PWS and on the Copper River represent an important source of support for PWSAC. The corporation has developed coho and chinook sports fisheries in the Sound that are becoming increasingly important to the economies of Whittier and Cordova. Subsistence and personal use fishers depend on their upriver share of the sockeye produced at the Gulkana facility. The communities, the anglers and their fishing organizations will continue to show their support for PWSAC's programs as the corporation continues to provide them with benefits.

Sound ecological practices will rebuild PWSAC's credibility.

Setting objectives and implementing procedures that conform with sound ecological practices will rebuild PWSAC's credibility with ADFG and other regulatory agencies, scientific and environmental organizations, and the public. Recognition and regard for other users of the area's resources can help expand existing alliances and create new beneficial relationships. Support can be rekindled for successful and responsible salmon enhancement.

Facilitating change in statutes and regulations

Production objectives are intended to fill in the variable and low cycles of wild stock salmon production to help stabilize coastal community economies reliant on salmon harvests. The not-for-profit nature of the business stresses the role of the enterprise in assisting development of Alaska's resources for public benefit, and benefit of its stakeholders.

As PWSAC moves forward to grow its business, however, pressures are mounting from the processing industry which views PNP hatchery initiatives in processing and marketing as competitive threats to their industry. In order to continue to provide salmon enhancement services into the future–in fact, in order to continue to exist–hatchery operators must provide a level of substantial public benefit. As prices erode and market pressures increase, hatchery operators are faced with growing difficulty in securing needed operating and capital revenues to continue to operate and provide a reasonable level of benefit to the public. Although it is presently legal for a hatchery operator to process and sell salmon, the current political atmosphere of the industry requires PWSAC to affirm the role and business of PNP hatchery operators, including processing and marketing of their products.

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Prince William Sound Aquaculture Corporation–Opportunities and Threats

Beyond current hatchery statutes, regulations, and prospects for new initiatives, additional state law provides opportunities which can be utilized by PNP hatchery programs. Support for processing and marketing may be gained from the Division of International Trade which is established under authority of the Department of Commerce and Economic Development to foster growth and economic development of international trade.

The Alaska Industrial Development and Export Authority (AIDEA) provides means for financing enterprises and fostering Alaskan exports. The Fisheries Industrial Technology Center (FITC) and Alaska Seafood Marketing Institute (ASMI) are other agency institutions which provide indirect support to PNP hatchery programs through fisheries technology research and generic advertising and promotion efforts.

Sustained yield of wild stocks is vital.

But most critical to the future of the hatchery program is continued sustained yield of wild stocks. If the wild stocks in the PWS area decline outside of natural fluctuations, or there is evidence of damage to the wild stocks from hatchery practices, PWSAC will not be permitted to exist. Although there is opportunity to facilitate legislation and regulation to support hatchery activities, the program exists under the privilege of law which, if violated, can create severe detriment for the corporation.

Summary

Mission
- Ecological, financial and market considerations require that PWSAC's mission be re-evaluated.

Organization
- The current personnel and organizational structures need to change to serve changing corporate needs.

Finance
- Long term financial stability is requisite to survival. It cannot be achieved with the current balance sheet.

Production
- Large scale late run pink salmon production contributes to mixed stock fishery management difficulties and may be associated with wild stock escapement shortfalls.
- Alternatives exist to the current hatchery production mix of species, run timing and release locations which could relieve some of the current biological concerns and aid in marketing.

Marketing
- A wide range of products could be produced from PWSAC salmon.
- PWSAC salmon have unique selling points.
- Live fish sales will continue to provide important revenue.

Building Alliances
- Hatchery program alliances have been threatened by concerns for hatchery-wild stock interactions, fishery complications and price weakness.
- Old alliances can be affirmed and new alliances built by making ecologically sound decisions and providing desirable opportunities.

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Prince William Sound Aquaculture Corporation–Opportunities and Threats

- State agencies could provide support opportunities for research, processing and marketing.
- There is both need and opportunity to focus on hatchery objectives and practices that do not conflict with wild stock sustained yield.

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IV. SELECTING STRATEGIES

The purpose of Business Plan '96 is to lay out a course for the corporation that will assure its future by committing PWSAC to live within the natural boundaries of the Prince William Sound ecosystem, and by taking the steps necessary for it to become a viable, stand-alone, sustainable economic entity.

The first step requires a revised mission statement to guide the Board and management in making and implementing decisions.

Mission Recommendation

Mission Recommendation

1. **To optimize the value of the salmon resources produced in Prince William Sound (Area E) through ecologically responsible use of enhancement practices/technology and scientific research, and the successful marketing and sale of its products.**

With an updated mission, a set of strategies spanning major areas of corporate responsibility can now be recommended.

Evaluating options and recommending strategies

Adherence to sound ecological principles is prerequisite to marketing organizational and financial considerations. Therefore, prior to recommending strategies for those areas of concern, hatchery production must be described. This provides the framework for building the necessary organization, implementing appropriate marketing strategies, and structuring the required finances.

The evaluation process applied to selecting specific strategy recommendations that conform to the corporate mission resulted in a matrix of production potentials, opportunities and constraints (Table 5). PWSAC salmon hatchery **production potentials** are limited by physical plant design and hatchery site environmental constraints including water supply, volume and temperature. Biological and ecological considerations were the **primary** factors limiting site production potentials to a few, carefully selected **opportunities**. Secondary considerations included market potential, project costs and project implementation time frames, followed by regulations and fishery issues which further constrain the choice of specific production opportunities.

The production opportunities were then scored and ranked to come up with a prioritized list of recommendations (Table 6). The summary tables are followed by a detailed discussion of the recommendations including organizational, financial, processing, marketing and legislative changes required to implement the strategies being recommended.

Primary constraints are biological and ecological. For evaluation purposes, these constraints to enhanced salmon production are defined as wild stock sustained yield priority and hatchery-wild stock interactions (ecological and genetic).

Secondary constraints and considerations are defined as:

market–how favorable is the market demand or market potential for the production component, or further-processed products;

costs–to what degree are actions necessary to put the production component on-line reasonable within current financial constraints;

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Table 5
Production opportunities

Facility potential			Primary constraints and considerations	Production	Secondary constraints[1]					Total
Facility	Species	Stock	Biological - ecological - operational	Opportunity	Marketability	Costs	Timeframe	Regulation	Fishery	rating[2]
AFK[3]	Pink	late	Complicates wild stock management	Y	3	1	1	3	3	11
		early	Wild stock genetic interaction, remote release only	Y	1	3	4	4	1	13
	Chum	early	Possible wild stock genetic interaction, but few chums in SW district, possible constraints (H2O quantity, temp.) to brood development; may require remote release for CPF	Y	1	1	1	3	1	7
		late	Operational conflict with late pink return	N						
CCH	Pink	late	Complicates wild stock management	Y	3	1	1	3	2	10
		mid	Possible management conflict with Miner's Lake sockeye, Wells River chum, remote release to Naked Island	Y	2	2	3	4	2	13
	Chum	early	Management conflict with Wells River return, could remote release	Y	1	2	3	4	1	11
		late	Operational conflict with late pink return	N						
MBH	Sockeye	early	None	Y	1	1	1	1	1	5
		middle	Harvest conflict with wild stock return - Coghill Lake	Y	3	1	1	3	3	11
		late	Harvest conflict with wild stock return - Eshamy Lake	Y	2	1	1	3	3	10
WNH	Pink	late	Complicates wild stock management	Y	3	1	1	3	3	11
		early	Possible wild stock genetic interaction, operational conflict with early chum?	N						
		mid	Operational conflict with early chum	N						
	Chum	early	Complicates wild stock management (Coghill sockeye)	Y	1	1	1	3	2	8
		late	Operational conflict with late pink	N						
	Coho		None	Y	1	3	1	2	1	8
	Chinook		Operational conflict with early chum	Y	1	3	1	1	2	8
Gulkana	Sockeye	early	Greater harvest conflict with wild stock production	Y	1	1	1	4	1	8
		mid	None	Y	2	1	1	1	1	6

[1] Criteria rating (1-5)
1 = highly favorable
2 = favorable
3 = possible
4 = marginal
5 = least favorable

[2] Total rating is the sum of the criteria (secondary constraint) ratings

[3] Shaded block indicates existing production

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Table 6
Recommendations

Production opportunity Facility	Species	Stock	Rank[1]	RECOMMENDATIONS Production	Research	Capital	Market	Permits & Regulation	Fishery
AFK[2]	**Pink**[3]	**late**	6	Phased reduction starting @ 10M	Size & time @ release		Custom process fillet blocks, mince blocks, fillets, green & processed roe		
		early	7	Further research required			More desirable timing for mktg./sales		
	Chum	early	*3	Phased increase starting @ 24M for release @ Port Chalmers and 10M on-site	Seawater adaptation & growth			PAR; FTP; evaluation cooperative agreement	Settle allocation issues
CCH	**Pink**	**late**	5	No change	Size & time @ release		Custom process fillet blocks, mince blocks, fillets, green & processed roe		
		mid	7	If developed, remote release					
	Chum	early	6	If developed, remote release	Seawater adaptation & growth				
MBH	**Sockeye**	**early**	*1	Phased increase to full hatchery capacity	Time of seawater entry & release; genetic basis of marine survival; age at return		Develop processing and marketing program for fresh H&G sockeye concurrent with phased increase	Basic Management Plan; FTP; evaluation cooperative agreement; remote release site permitting	Select remote release site; settle allocation issues
		middle	6	Eliminate in BY97					
		late	5	Phased reduction or maintain at present level			Investigate market advantage of late sockeye return		
WNH	**Pink**	**late**	6	Phased reduction by 45-90 million	Size & time @ release		Phased processing and marketing program for fresh H&G pinks; roe proc.		
	Chum	**early**	*4	Phased increase, remote release @ Naked Island	Seawater adaptation & growth		Phased processing and marketing program for fresh H&G chums	PAR; FTP; remote release site permitting	Select remote release site; settle allocation issues
	Coho		*4	Increase to 3-4M	Time of seawater entry & release; genetic basis of marine survival; rearing density	$2-4 million: raceways, ladder, holding	Develop processing and marketing program for fresh H&G cohos concurrent with phased increase	PAR; FTP; remote release site permitting	Select remote release site; settle allocation issues
	Chinook		*4	Sport fish / subsistence release					
Gulkana	**Sockeye**	early	4	Remain @ present level			Make use of excess fish for roe products		
		mid	*2	Shift Summit L. plants to Crosswind L. or Ewan L.	Rearing capacity of stocked lakes		Make use of excess fish for roe products		

[1] Production priority rank: determined by order of total criteria rating from Table 1. The highest rank is 1which is based on the lowest (most favorable) rating achieved.
[2] Shaded block indicates recommended hatchery production increases.
[3] **Bold** character indicates existing production.
* Most favorable opportunities.

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time frames–how responsive will the time required to implement the change be to ecological concerns, financial needs and market considerations;

regulation–to what degree might regulatory or policy considerations prevent or impede the change;

fishery–at what level would fishery opportunities or impacts be rated as a result of production changes?

Hatchery Production and Research Recommendations

General hatchery production strategy

The general strategy will involve a phased reduction in lower value species and stocks that contribute to mixed stock fishery conflicts, and a shift to those species and stocks that increase separation between hatchery and wild stock returns, minimize fishery conflicts, and maximize harvest opportunity and market value. More specifically, we propose a reduction of around 25-50% of the late run pink production to be replaced by chum (AFK) and coho (WNH), and elimination of the middle, and possible late run sockeye stocks (MBH) in favor of the early run Eyak stock. We also recommend development of a production strategy capable of distributing production among species and stocks in response to continuously changing environmental and market conditions.

Armin F. Koernig Hatchery

Water availability at AFK limits species opportunities to pink and chum, but early returns of either species could be developed, particularly if a separate brood source is utilized to provide eyed eggs for incubation only. ADFG has expressed its opposition to the release of early pink salmon on site because of the potential for genetic interaction by the hatchery stock into the surrounding wild populations. Early run pink salmon, therefore, would most likely have to be released off site (i.e., Port Chalmers). Few chum stocks exist in the southwest district (1965-1992 escapement average <2000), therefore release of early chum on-site could be of less concern. The purpose of such a release would be for corporate cost recovery due to concerns of wild stock interception at this time, and since regulations prohibit fishing in the district before July 18. Late chum present an operational conflict with the late pink return and therefore were not considered further.

The specific recommendations for AFK are to:

AFK Recommendations

2. **transfer 24 million eyed chum eggs from WNH for the Port Chalmers remote release, and**
3. **an additional 10 million eyed chum eggs to evaluate return potential from on-site rearing and release.**

The technical feasibility for the change will be conducted this winter and spring. The final recommendation to implement the project will be provided in June 1996. Incubation capacity is available to accommodate the production, but a

4. **reduction in the pink egg take goals from 127 million to 110 million is recommended to offset the increase in chum eggs incubated for release on site.**

Recommendations for additional production of chum from AFK will be made after evaluation of adult returns to Chalmers (1977) and Sawmill Bay (2000).

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Improving marine survival of pink salmon at AFK, as well as WNH and CCH, will depend on our ability to

5. **determine the optimal time and size at release.**

The traditional strategy has been to allow volitional outmigration of fry, short-term rearing, and release into the spring plankton "bloom." More recently, an alternative approach of rearing larger fry (around 1+ grams) with a mid-June release has been developed. The initial CWT data from this summer indicate that larger fry may have experienced a better rate of survival. Producing larger fry, however, increases food and labor costs, and fails to utilize much of the available plankton. The management challenge, therefore, will be to develop a balance between strategies that consistently achieves high marine survival without unnecessary costs.

Cannery Creek Hatchery

Cannery Creek Recommendations

Water availability at CCH also limits species opportunities to pink and chum. Brood development for early runs of either species are constrained by water temperature, and potential management conflicts with Miner's Lake sockeye and Wells River chum. A mid-run pink stock could provide for a fishery between early returns to VFDA and late runs to western PWS, but would have similar harvest conflicts as early returns. Whereas remote release of early or mid-run stocks to Naked Island would address such concerns,

6. **no changes to production are recommended at this time.**

Main Bay Hatchery

Main Bay Recommendations

Completion of Main Bay Hatchery rebuild in 1997 will increase opportunity for multiple stock production. In particular, the addition of a second pipeline will alleviate water temperature conflicts for incubation, rearing and adult spawning. However, because of fishery harvest conflicts with native sockeye stocks, as well as operational concerns related to overlapping return timing, it is recommended that

7. **production of the Coghill stock be eliminated, and**
8. **that the Eshamy stock be eliminated or at most remain at the current level.**

Due to loss of the BY92 Eyak brood from IHN, substantial increases in egg availability for this stock will not occur until 1997. We recommend that

9. **all of the 1997 Eyak return be used for broodstock, that any deficit in 1997 be made up with by Eshamy stock, and**
10. **no Coghill stock eggs be taken. Future allocation of hatchery space between Eyak and Eshamy stock will be based on marine survival and market value.**

The factors that affect ocean survival in sockeye are complicated by the highly variable requirements for freshwater rearing within the species. In general, however, the basic factors include size, age (age 1 versus age 0 smolt) and time at release, rearing environment (the effect of short-term seawater rearing) and density. Size at release and rearing environment are now under evaluation. Future research will

11. **focus on rearing density, time of release, parental effects on survival (i.e., do all parents contribute equally to the return produced by their offspring),**
12. **and photoperiod (light) effects on growth.**

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Wally Noerenberg Hatchery

Water availability and dual water intakes at WNH provide the potential to culture any species or stock of salmon in PWS. Production is now dominated by early chum and late pink, with lesser numbers of coho and chinook. Six alternative opportunities were identified:

a. early pink
b. mid-run pink
c. late chum
d. increased coho production
e. increased chinook production
f. late sockeye.

Production of early or mid-run pink present operational and harvest conflicts with early run chum production and sockeye returns to Coghill Lake. Late chum conflict with late pink harvest and management, as would late sockeye, which also present disease concerns (IHN) for other species. Chinook also conflict with early chum, and to date have experienced relatively low ocean survival. Consequently, actual production opportunities were reduced to increasing early chum and coho.

The specific recommendations for WNH are to

Noerenberg Recommendations

13. **develop rearing facilities to produce 3 to 4 million coho smolt,**
14. **reduce late pink production by 45 to 90 million green eggs,**
15. **increase chum production and**
16. **apportion coho production to offset revenue lost by the seine fleet from reduced pink production, and**
17. **develop a remote release site at Naked Island for seine harvest of chum and coho.**

A capital cost of between $2-4 million for constructing facilities for rearing coho, as well as raceways and return ladder for adult capture and holding is anticipated. If approved, construction would begin in late summer 1996, or spring of 1997, with completion approximately one year later.

In addition to evaluating rearing and release methods for pink salmon,

18. **research at WNH will be directed at seawater adaptation and rearing in chum salmon, and**
19. **parental, density, release size and timing, and rearing environment influences in coho.**

Problems with seawater adaptation and growth in chum likely involve an interaction between rearing practices (i.e., feeding frequency and ration) and the stage of development at the time of seawater entry. The importance of seawater adaptation relates to temperature effect on growth. Seawater is typically warmer than freshwater in late winter and spring, fry grow more rapidly in warmer water, which contributes directly to their marine survival. These effects will be examined this spring. The need for freshwater rearing in coho is similar to that for sockeye, therefore many of the same factors influence ocean survival. Researchers have found that optimizing size with time at release can lead to significant gains in ocean survival, as can short term seawater rearing. Parental effects are largely unknown, but may provide an opportunity for increasing ocean survival through genetic selection.

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Gulkana Hatchery

Fry incubated at Gulkana I are apportioned into Paxon (around 10 million), Crosswind (around 10 million) and Summit (around 6 million). Limited data indicate fry planted at Crosswind produce larger smolt that have higher marine survival than smolt produced at Summit Lake. Further analysis will be needed to

Gulkana Recommendations

20. **determine whether Crosswind can support an increase in the number of fry stocked,**
21. **or whether other lakes in the area are suitable for stocking sockeye fry. If so,**
22. **we recommend a phased shift in fry plants away from Summit Lake. Because Gulkana II has not experienced an IHN outbreak,**
23. **we also recommended further evaluation of the site for incubation should studies support stocking of new lakes or increasing plants into existing lakes.**

Financial Recommendations

The replacement value of PWSAC's productive assets is approximately $50 million. (See Appendix 7). A normal balance sheet for a manufacturing company in reasonably sound financial condition would not have long-term debt in excess of 50% of its total capitalization. Given the inherent uncertainties in this industry, and the long lead time required to change the stocks and species through which improved operating and financial performance will be realized, it is proposed that

Financial Recommendations

24. **the corporation raise $25 million in new equity to reduce long-term debt by $15 million and to increase working capital by $10 million.**

	Current (*) (6/30/95)	Increase (Decrease)	Proposed
Cash	$8,000,000	$10,000,000	$18,000,000
Other assets (net)	25,300,000	0	25,300,000
Total assets	$33,300,000	$10,000,000	$43,300,000
Current liabilities	$3,100,000	$ 0	$ 3,100,000
Long-term debt	32,300,000	(15,000,000)	17,300,000
Fund balance (net worth)	(2,100,000)	25,000,000	22,900,000
Total liabilities and net worth	$33,300,000	$10,000,000	$43,300,000

*unaudited

This will reduce debt as a percent of capitalization from 107% to 43% ($17.3M as a percent of $40.2M. ($17.3M + $22.9))

The corporation should make a concerted effort to restructure the remaining $15 million of debt into two more standard forms of borrowing arrangements with its lender (or lenders) so that it is not earning 4.85% interest on its cash balances and paying out a much higher rate of interest on its borrowings. Several options are available. For example, one facility might be a line of credit for annual operating requirements (fish feed, seasonal wages, administrative expense, etc.) for approximately $6 million. Once this credit facility was established and the lender agreed to provide the desired funds, then PWSAC could use its reserve cash balance to pay down $6 million of its debt knowing that it had the ability to re-borrow the funds on an as needed basis while its operating expenses were accumulating during the winter and spring, and pay it back from sales proceeds over the summer. The process would then start again for the following year. PWSAC would pay a commitment fee to assure that the funds would be advanced in accordance with the terms of the loan agreement. In this manner, PWSAC would only be paying interest

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on the money it actually borrows but with complete assurance of knowing that those funds will be available on call. The manner in which PWSAC would handle seasons when revenues did not meet operating expenses would be negotiated with the lender. Options might include use of remaining reserve funds, in addition to the line of credit for capital loans (see below).

Similarly, PWSAC might establish a line of credit for 5 to 7 year notes for specific capital projects. For example, if filling in the brood pond and building raceways for coho production at WNH cost $2.5 million, PWSAC would secure a commitment for 7 year financing, would draw down the funds during construction and begin a quarterly repayment schedule over seven years on completion of the project. If the corporation were able to negotiate such a facility for, say $5 million, it could again use its cash reserves to retire an additional $5 million of its long-term debt with the full assurance that it could re-borrow the funds on an as-needed basis, again saving significant interest expense. As it paid back the WNH raceway loan it would free up a like amount of funds under the credit facility to use for other, similar kinds of long-term projects up to a ceiling of $5 million.

It is not known at this time which state agency would be prepared to undertake extending credit facilities of these kinds to PWSAC, or whether a state agency might guaranty the debt to a commercial bank. It is very unlikely that a commercial bank would entertain credit facilities of this kind without a state guaranty prior to at least two or three years of a proven track record of generating positive cash flows.

Marketing Recommendations

It is recommended that

Marketing Recommendations

25. **management analyze the legal and financial advisability of processing, marketing and sales of processed fish and roe products by Crystal Falls Seafoods, Inc., as a capitalized, for-profit subsidiary of PWSAC.**

PWSAC's marketing strategy will be a phased, incremental approach toward marketing its salmon in ways which will generate greater cash flow and stronger market positions for the company.

As a general consideration, it is recommend that

26. **the entire harvesting and live sales operations system be evaluated to determine the most cost-effective means of getting the fish out of the water at the hatchery sites, while continuing to maintain premium quality as a unique selling point.**

Cost-effectiveness and superior quality are inherent to the success of both the live fish sales program and processed salmon sales and marketing.

Near-term live fish marketing and sales

In the near term, large numbers of unprocessed live fish will continue to be sold at the hatchery sites, and the value of those live fish must continue to be maximized.

Near-term live fish marketing and sales recommendations

27. **To guide live fish sales, it is recommend that a written policy be developed by management as follows:**

    - **PWSAC will continue to sell live salmon by a combination of pre-season contract sales and in-season daily bid sales.**

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- **The percentage of pink, chum and sockeye salmon to be sold by each method should be determined prior to each season, based on the best available knowledge of returns and markets.**

Specifically for pinks and chums, the balance of contract and daily sales should guarantee sale of a percentage of the return in a large production year, while reserving a percentage for bid sales to maximize potential value in case of a short production year. Coghill- stock sockeye should be sold largely under contract, as there is normally less demand for those sockeye returning at the same time as Bristol Bay sockeye and other regional stocks around the state.

28. **It is recommended that as the early, Eyak-stock sockeye and the Noerenberg cohos reach harvestable numbers in 1999 and 2000, respectively, the corporation concurrently develop processing and marketing programs to retain the entire cost recovery production, and maximize its value in domestic and Asian markets.**

To ensure a competitive sales environment,

29. **PWSAC should continue to encourage the participation of a large range of salmon buyers and processors in PWS.**

As only the factory trawlers and other floating processors have the capability at present to produce high quality skinless, boneless fillets, fillet blocks and mince blocks from pink salmon at the hatchery sites, we recommend continuing to encourage their participation in buying and processing salmon in PWS and elsewhere. To increase that participation and allow factory trawlers to buy pinks throughout the PWS season, it is recommended

30. **PWSAC actively support the current proposal before the North Pacific Fisheries Management Council to move the beginning of the pollock "B" season from its present date of August 15 to September 1, or later.**

Near-term marketing of processed salmon and roe products

Near-term marketing of processed salmon and roe products recommendations

PWSAC's marketing program begins with the processing of some cost recovery salmon into readily marketable products, goes on to market those products in the best way possible, and then considers further, evolutionary steps. In the near term (the first 3-4 years), although PWSAC will certainly conduct multi-year planning and market development work, each year's processing and marketing can be clearly evaluated during and after the processing and sales season.

The specific recommendations, which flow directly from PWSAC's opportunities are presented as Table 7.

In the first three years, all processing will be performed by floating processors, working on a custom-processing basis, near the hatchery sites. This custom-processing will minimize PWSAC's investment and risk. All of the fish that are not processed and marketed by PWSAC will be sold live, as is currently done.

The roe of all the salmon processed by PWSAC will also be processed and marketed. In year one, based on cost/benefit analysis, PWSAC will determine the optimum combination of green eggs and eggs processed into sujiko (salted skeins) and ikura (single-egg caviar). In addition, PWSAC will also determine the optimum combination of custom processing and self-processing of roe products, with the first year's production likely to be largely custom processed and the succeeding years'

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Table 7
Fish Sales Recommendations

Species	Hatchery	Product	Markets		Year 1	Year 2	Year 3
pink	CCH	blocks	USA	% of CR *	25%	30%	30%
				round lbs **	845,126	1,272,571	1,530,653
pink	AFK	blocks	USA	% of CR *	25%	30%	30%
				round lbs **	705,798	1,118,961	1,340,691
pink	WNH	H&G, fresh	USA	% of CR *	5%	5%	10%
				round lbs **	207,261	270,820	646,551
chum	WNH	H&G, fresh	USA	% of CR *	5%	5%	10%
				round lbs **	177,280	263,875	585,024
sockeye	MBH	H&G, fresh	ASIA	% of CR *	15%	20%	25%
				round lbs **	188,464	291,123	375,271

* percentage of cost-recovery fish which are custom-processed and marketed by PWSAC
** round pounds of cost-recovery fish which are custom-processed and marketed by PWSAC

production becoming increasingly in-house. PWSAC will thereby gain processing and transportation experience and knowledge through in-house production of roe products.

The preliminary projected results of these recommendations, expressed in terms of gross profits and margins for the next three years, are illustrated in Tables 8a, 8b, and 8c on the next three pages.

Long-term live fish marketing and sales

Long-term live and processed marketing and sales

Live fish sales are likely to continue in some numbers even into the long term. As the sales and marketing program continues to evolve, PWSAC will further refine the optimum balance of pre-season and in-season sales methods. Also, additional consideration may be given to forming" joint venture" or "shared profit" relationships with processors. Such relationships would not be 50/50 arrangements, and would be controlled by PWSAC.

Long-term marketing of processed salmon

As PWSAC's processing and marketing operations gain strength and experience, and generate increasing cash for the company, PWSAC will carefully explore additional, longer-term markets and opportunities. These include:

- increasing the percentage of fish that are processed and marketed;
- possibility of PWSAC owning and/or long-term leasing a processing facility;
- producing secondary products such as frozen H&G and princess-dressed salmon, and portion-controlled fillets and steaks; and
- producing tertiary products, such as hams, sausages and smoked salmon.

It is important to keep in mind that PWSAC will approach both the near-term and long-term market opportunities in a methodical, incremental manner. The overall goal is to market PWSAC's fish in ways which will generate greater financial health for the company.

Organizational Recommendations

Board of Directors

The PWSAC Board of Directors has several standing committees. These committees should be examined, in particular the Production Planning Committee. We recommend that:

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Table 8A

Fiscal Year 1997
1996 Fishing Season

Marine Survival Assumptions:										
Pink	2.40%	Chum	1.00%	Sockeye	5.70%	Coho	N/A			

Option 1 - Live Fish Sales Only

	CCH Pink	AFK Pink	WNH Pink	WNH Chum	MBH Red	GKH Red	Total	% of Total
Average Wt.	3.1	3.2	3.0	8.2	5.5	6.1		
Round lbs Returning	3,380,502	2,913,587	4,348,132	3,545,605	1,239,768			
Price/lb $	$ 0.21	$ 0.21	$ 0.21	$ 0.55	$ 1.00			
Total Round $	$ 709,905	$ 611,853	$ 913,108	$ 1,950,083	$ 1,239,768		$ 5,424,717	
Total Live Fish Sales							$ 5,424,717	100.00%

Option 2 - Live and Processed Fish Sales

	CCH Pink Blocks	AFK Pink Blocks	WNH Pink H&G	WNH Chum H&G	MBH Red H&G	GKH Red Roe	Total	% of Total
Round lbs Returning	3,380,502	2,913,587	4,348,132	3,545,605	1,239,768			
Percentage Sold Live	75%	75%	95%	95%	85%			
Round lbs	2,535,377	2,185,191	4,130,726	3,368,325	1,053,803			
Price/lb $	$ 0.21	$ 0.21	$ 0.21	$ 0.55	$ 1.00			
Total Round $	$ 532,429	$ 458,890	$ 867,452	$ 1,852,579	$ 1,053,803		$ 4,765,153	
					Live Fish Sales		4,765,153	80.06%
Processed Fish								
Round lbs Returning	3,380,502	2,913,587	4,348,132	3,545,605	1,239,768			
Percentage Processed	25%	25%	5%	5%	15%			
Round lbs Processed	845,126	728,397	217,407	177,280	185,965			
Recovery Rate	15%	15%	73%	75%	75%			
Total Fish lb	126,769	109,260	158,707	132,960	139,474			
Price/lb $	$ 2.20	$ 2.20	$ 1.50	$ 1.80	$ 4.50			
Total Processed Fish $	$ 278,891	$ 240,371	$ 238,060	$ 239,328	$ 627,633		$ 1,624,284	27.29%
Roe								
Roe Recovery %	4%	4%	4%	6%	4%	4%		
lbs of Roe	33,805	29,136	8,696	10,637	7,439	19,520		
FOB Hatchery $/lb	$ 3.50	$ 3.50	$ 3.50	$ 5.50	$ 2.50	$ 2.50		
Total Roe $	$ 118,318	$ 101,976	$ 30,437	$ 58,502	$ 18,597	$ 48,800	$ 327,629	5.51%
Cost Recovery Roe								
Number of Fish	47,578	28,547	22,377	11,916	1,719			
Roe Recovery %	4%	4%	4%	6%	4%			
lbs of Roe	5,873	3,686	2,701	5,887	378			
FOB Hatchery $/lb	$ 3.50	$ 3.50	$ 3.50	$ 5.50	$ 2.50			
Total Cost Recovery Roe $	$ 20,556	$ 12,901	$ 9,454	$ 32,381	$ 945		$ 76,237	1.28%
Processed Fish & Roe Sales	$ 417,765	$ 355,248	$ 277,951	$ 330,212	$ 647,174	$ 48,800	$ 2,077,149	34.90%
Processing Costs	$ 138,797	$ 115,488	$ 168,464	$ 152,437	$ 310,203	$ 4,880	$ 890,269	
Gross Profit	$ 278,968	$ 239,759	$ 109,487	$ 177,775	$ 336,972	$ 43,920	$ 1,186,881	
Gross Profit %	66.78%	67.49%	39.39%	53.84%	52.07%	90.00%	57.14%	
Total Live and Processed Fish Sales	$ 950,194	$ 814,138	$ 1,145,404	$ 2,182,790	$ 1,700,977	$ 48,800	$ 5,952,034	100.00%

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Table 8B

Fiscal Year 1998
1997 Fishing Season

Marine Survival Assumptions:										
Pink	3.00%	Chum	1.50%	Sockeye	8.00%	Coho	N/A			

Option 1 - Live Fish Sales Only

	CCH Pink	AFK Pink	WNH Pink	WNH Chum	MBH Red	GKH Red	Total	% of Total
Average Wt.	3.1	3.2	3.0	6.2	5.5	6.1		
Round lbs Returning	4,241,902	3,820,266	5,619,318	5,277,506	1,498,018			
Price/lb $	$ 0.20	$ 0.20	$ 0.20	$ 0.55	$ 1.05			
Total Round $	$ 848,380	$ 764,053	$ 1,123,864	$ 2,902,628	$ 1,572,919		$ 7,211,844	
Total Live Fish Sales							$ 7,211,844	100.00%

Option 2 - Live and Processed Fish Sales

	CCH Pink Blocks	AFK Pink Blocks	WNH Pink H&G	WNH Chum H&G	MBH Red H&G	GKH Red Roe	Total	% of Total
Round lbs Returning	4,241,902	3,820,266	5,619,318	5,277,506	1,498,018			
Percentage Sold Live	70%	70%	95%	95%	80%			
Round lbs	2,969,331	2,674,186	5,338,352	5,013,630	1,198,415			
Price/lb $	$ 0.20	$ 0.20	$ 0.20	$ 0.55	$ 1.05			
Total Round $	$ 593,866	$ 534,837	$ 1,067,670	$ 2,757,497	$ 1,258,335		$ 6,212,206	
					Live Fish Sales		6,212,206	77.83%
Processed Fish								
Round lbs Returning	4,241,902	3,820,266	5,619,318	5,277,506	1,498,018			
Percentage Processed	30%	30%	5%	5%	20%			
Round lbs Processed	1,272,571	1,146,080	280,966	263,875	299,604			
Recovery Rate	15%	15%	73%	75%	75%			
Total Fish lb	190,886	171,912	205,105	197,906	224,703			
Price/lb $	$ 2.20	$ 2.20	$ 1.50	$ 1.80	$ 4.50			
Total Processed Fish $	$ 419,948	$ 378,206	$ 307,658	$ 356,232	$ 1,011,162		$ 2,473,206	30.96%
Roe								
Roe Recovery %	4%	4%	4%	6%	4%	4%		
lbs of Roe	50,903	45,843	11,239	15,833	11,984	19,520		
FOB Hatchery $/lb	$ 3.50	$ 3.50	$ 3.50	$ 5.50	$ 2.50	$ 2.50		
Total Roe $	$ 178,160	$ 160,451	$ 39,335	$ 87,079	$ 29,960	$ 48,800	$ 494,985	6.20%
Cost Recovery Roe								
Number of Fish	47,578	28,547	22,377	11,916	1,196			
Roe Recovery %	4%	4%	4%	6%	4%			
lbs of Roe	5,873	3,686	2,701	5,887	263			
FOB Hatchery $/lb	$ 3.50	$ 3.50	$ 3.50	$ 5.50	$ 2.50			
Total Cost Recovery Roe $	$ 20,556	$ 12,901	$ 9,454	$ 32,381	$ 658		$ 75,949	0.95%
Processed Fish & Roe Sales	$ 618,664	$ 551,559	$ 356,447	$ 475,691	$ 1,041,781	$ 48,800	$ 3,092,941	38.75%
Processing Costs	$ 207,958	$ 182,338	$ 220,973	$ 227,928	$ 479,094	$ 4,880	$ 1,323,171	
Gross Profit	$ 410,706	$ 369,220	$ 135,473	$ 247,763	$ 562,687	$ 43,920	$ 1,769,770	
Gross Profit %	66.39%	66.94%	38.01%	52.08%	54.01%	90.00%	57.22%	
Total Live and Processed Fish Sales	$1,212,530	$ 1,086,396	$ 1,424,117	$ 3,233,188	$ 2,300,116	$ 48,800	$ 7,981,976	100.00%

-continued-

Table 8C

Fiscal Year 1999
1998 Fishing Season

Marine Survival Assumptions:									
Pink	3.50%	Chum	1.75%	Sockeye	8.00%	Coho	N/A		

Option 1 - Live Fish Sales Only

	CCH Pink	AFK Pink	WNH Pink	WNH Chum	MBH Red	GKH Red	Total	% of Total
Average Wt.	3.1	3.2	3.0	8.2	5.5	6.1		
Round lbs Returning	5,102,178	3,895,731	4,971,622	5,850,244	1,419,818			
Price/lb $	$ 0.20	$ 0.20	$ 0.20	$ 0.55	$ 1.10			
Total Round $	$ 1,020,436	$ 779,146	$ 994,324	$ 3,217,634	$ 1,561,800		$ 7,573,340	
Total Live Fish Sales							$ 7,573,340	100.00%

Option 2 - Live and Processed Fish Sales

	CCH Pink Blocks	AFK Pink Blocks	WNH Pink H&G	WNH Chum H&G	MBH Red H&G	GKH Red Roe	Total	% of Total
Round lbs Returning	5,102,178	3,895,731	4,971,622	5,850,244	1,419,818			
Percentage Sold Live	70%	70%	90%	90%	75%			
Round lbs	3,571,525	2,727,012	4,474,460	5,265,219	1,064,864			
Price/lb $	$ 0.20	$ 0.20	$ 0.20	$ 0.55	$ 1.10			
Total Round $	$ 714,305	$ 545,402	$ 894,892	$ 2,895,871	$ 1,171,350		$ 6,221,820	
					Live Fish Sales		**6,221,820**	73.33%
Processed Fish								
Round lbs Returning	5,102,178	3,895,731	4,971,622	5,850,244	1,419,818			
Percentage Processed	30%	30%	10%	10%	25%			
Round lbs Processed	1,530,653	1,168,719	497,162	585,024	354,955			
Recovery Rate	15%	15%	73%	75%	75%			
Total Fish lb	229,598	175,308	362,928	438,768	266,216			
Price/lb $	$ 2.20	$ 2.20	$ 1.50	$ 1.80	$ 4.50			
Total Processed Fish $	$ 505,116	$ 385,677	$ 544,393	$ 789,783	$ 1,197,972		$ 3,422,940	40.34%
Roe								
Roe Recovery %	4%	4%	4%	6%	4%	4%		
lbs of Roe	61,226	46,749	19,886	35,101	14,198	19,520		
FOB Hatchery $/lb	$ 3.50	$ 3.50	$ 3.50	$ 5.50	$ 2.50	$ 2.50		
Total Roe $	$ 214,291	$ 163,621	$ 69,603	$ 193,058	$ 35,495	$ 48,800	$ 676,068	7.97%
Cost Recovery Roe								
Number of Fish	47,578	28,547	22,377	11,916	1,196			
Roe Recovery %	4%	4%	4%	6%	4%			
lbs of Roe	5,873	3,686	2,701	5,887	263			
FOB Hatchery $/lb	$ 3.50	$ 3.50	$ 3.50	$ 5.50	$ 2.50			
Total Cost Recovery Roe $	$ 20,556	$ 12,901	$ 9,454	$ 32,381	$ 658		$ 75,949	0.90%
Processed Fish & Roe Sales	$ 739,963	$ 562,199	$ 623,449	$ 1,015,222	$ 1,234,125	$ 48,800	$ 4,223,758	49.78%
Processing Costs	$ 249,715	$ 190,389	$ 402,776	$ 495,594	$ 617,555	$ 4,880	$ 1,960,909	
Gross Profit	$ 490,248	$ 371,810	$ 220,673	$ 519,628	$ 616,570	$ 43,920	$ 2,262,849	
Gross Profit %	66.25%	66.13%	35.40%	51.18%	49.96%	90.00%	53.57%	
Total Live and Processed Fish Sales	$ 1,454,268	$ 1,107,601	$ 1,518,341	$ 3,911,092	$ 2,405,475	$ 48,800	$ 8,484,669	100.00%

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Organizational Recommendations

31. the Board appoint a joint management/director Production Planning Committee, to include participation of the Chief Scientist, marketing manager and finance manager.

Part of the PPC's charge has been the revision of the Allocation Policy. To remove the inefficiencies, disruptiveness and costs brought on the corporation through its involvement in gear group allocation, we recommend that:

32. the Board identify or create an entity outside the corporation to take up and resolve gear group allocation issues.

Legislative recommendations

PWSAC has engaged Kent Dawson Company of Juneau to represent the corporation during the coming year in its interactions with both the legislative and executive branches of state government. On the executive side, PWSAC expects to work closely with the Department of Commerce and Economic Development. The issues that management believes will require legislative change and/or support include the following.

Legislative Recommendations

a. Processing and marketing by PNP hatchery operators

PWSAC currently removes roe from some of its salmon for sale into either the bait or human consumption markets. Business Plan '96 recommendations also outline various primary and further-processed fish opportunities, including roe, which will become important future revenue sources. Statutes and regulations do not clearly refer to the legality or illegality of PNP hatchery operators undertaking such fish processing activities, including disposal of carcasses. This has contributed to recent pressures at political, administrative and agency levels to clarify legislatively whether or not these activities are currently acceptable practice.

Several courses of action to clarify processing activities are optional for PWSAC.

33. Therefore, it is recommended that PWSAC evaluate supporting draft legislation which may be proposed by ADFG should it conform with needs of the hatchery program, or to actively develop and propose legislation channeled through the department or independently sponsored by local legislators.

Support could be gained for either approach through possible agreements with other PNP hatchery operators.

b. Change of corporate structure

In order to achieve the contemplated partnership between PWSAC as a Private-not-for-Profit and the state, it may be necessary to devise a different corporate vehicle and different financing options than those provided for by the existing PNP legislation. (Whatever legislative changes are enacted, the option of following this course should be available to all Regional Associations and other not-for-profit hatcheries.)

With the objective being to take "the steps necessary for [the company] to become a viable, stand-alone sustainable economic entity" it is clear that the only potentially interested investor at this stage in the corporation's history is the State of Alaska. Further, as the current lender to PWSAC through the DCED Revolving Loan fund, the state's only interest in altering the form of its investment to recapitalize PWSAC

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would be to the extent it contributed significantly to its objectives for the ongoing development of the commercial fishing industry as a major economic force in the state, plus the development of new, stable, long term, domestic as well as export markets.

The Plan addresses both issues. It has been in the state's interest to see the further development of the commercial fishing industry as an important producer of local revenues that directly benefit Alaska's coastal communities like Prince William Sound. Perhaps the most significant opportunity for the state is to foster the development of export markets for the fishing industry as a means of building long term demand and regaining market share lost to farmed salmon production. Alaska remains America's largest exporter of fish. By taking an active role in the development of new export markets, particularly in the Far East where Alaska enjoys a major freight advantage over European and South American sources, PWSAC has the potential to put a high quality "scale-perfect, wild fish" into competition with farmed fish in a large and rapidly growing market. The domestic US market also offers clear potential to expand sales of the same high quality wild salmon in competition with farmed fish. Working under the ASMI umbrella, it is very much the intent of this Plan for the corporation's export and domestic development efforts to lead other fishermen and other Regional Associations into higher value markets.

There is currently no precedent for the state taking a direct ownership interest in a not-for-profit entity. However, the state has capitalized other special purpose corporations, notably Alaska Commercial Fishing and Agricultural Bank (CFAB), through the issuance of non-voting stock without dividend rights under a long term repurchase agreement. This "equity" investment is used to support short to medium term borrowings (at rates ranging between 5.6% and 7.25%) that provide the bank with operating liquidity.

A conceptual precedent thus exists where the state has provided adequate capital to an organization whose purposes include providing "sources of credit for Alaskan agriculture and fishing business" and "to encourage utilization of the fisheries off the coast of Alaska that have been underutilized in the past by local fishermen" in order to bridge a gap left by normal commercial lending institutions. The intent is not dissimilar to PWSAC's current efforts to use focused research and marketing to bring Alaska's salmon ranching industry into a position of global competitiveness at a time in its history when it is clearly not yet "bankable" commercially. PWSAC's intent is to build the business in a way that would provide the opportunity, if well managed, to generate consistent earnings and, in time, allow for the repurchase of the state's ownership interest.

34. PWSAC will work with legal counsel to evaluate this and other financing options to identify and recommend a specific course of action.

Building Alliances

PWSAC's renewed health will be built on a foundation of strong and pro-active support from the corporation's immediate stakeholders: the salmon permit holders of Area E and the communities which derive economic benefit from our production. Sports, subsistence and personal users of PWSAC-produced fish form a source of support that is steadily growing in influence. The scientific and environmental communities, including the ADFG, drive public opinion and state policy by their stance on hatchery production in general and the degree of their support for PWSAC's programs in particular. PWSAC requires the advocacy of all these

Alliances
Recommendations

-continued-

constituencies to achieve the newly positive attitudes that will drive the public policy changes PWSAC seeks.

35. It is recommended that the necessary support structure be put in place by forming strategic alliances with:

- Commercial permit holders and regional communities, including Anchorage, based on production and marketing success and the resulting economic and social benefits;
- Sports fishers and their organizations, and subsistence and personal users, from PWS, Anchorage, and the Copper River Basin, based on economic, recreational and social benefits of production;
- Concerned scientific/academic/environmental entities, based on PWSAC's renewed commitment to impeccable biology within the PWS ecosystem;
- The ADFG, based on PWSAC's stringent adherence to hatchery regulation, continued commitment to fishery management solutions; and
- The Alaska Department of Commerce and Economic Development, and other state agencies and organizations, based on PWSAC's involvement in and contributions to the State's seafood industry.

The active support of these advocates will result in positive press and public opinion, and will drive the necessary alliances with legislators and the state administration to achieve legislative change.

PWSAC must earn this advocacy with renewed commitments to corporate performance and responsibility.

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V. PUTTING THE PLAN IN PLACE AND MEASURING RESULTS: 1996 AND NEAR TERM

Implementing the business plan will require commitment to change and action. During the first year major steps will be taken to change *what* PWSAC does as a business, and *how* it goes about implementing strategic decisions. Revisions to production objectives will be initiated with associated research programs, and advances made to marketing PWSAC's salmon, both live fish and further processed products. Changes will be required to structure a manageable policy level Board of Directors. A significant infusion of capital will be sought, requiring strong alliances, a practical and sensible plan to build our bottom line, and clarifying legislation.

PWSAC will implement the business plan by taking the following actions. These steps are not intended to be a detailed action plan, but rather represent the larger milestones or actions necessary to achieve the final objectives.

Many of the actions have measurable results. The bottom line for PWSAC is marine survival and profitability. Numeric objectives and timelines are listed reflecting these measures. This will allow management to track and evaluate accomplishments and to make course corrections as appropriate. This will further enable management to report to the Board of Directors information necessary for it to evaluate policy and performance. Business Plan '96 is intended to be a responsive and evolving document.

Mission

September 1995	The PWSAC Board of Directors adopts new mission statement, approving the business plan and recommended strategies.

Production

Armin F. Koernig Hatchery

Oct 1995-June 1996	• Conduct chum incubation, seawater adaptation and growth studies.
Fall 1995	• Submit Permit Alteration Request (PAR) and Fish Transport Permit (FTP) for chum.
Spring 1996	• Develop evaluation cooperative agreement for chum program.
Aug/Sept 1996	• Reduce AFK pink egg take goal by 17 million to 110 million.
Oct/Nov 1996	• Transfer 34 million eyed chum eggs from WNH to AFK.
1997-2002	• Evaluate: Port Chalmers and AFK chum releases.
1997-2002	• Provide recommendations for further production changes.

Main Bay Hatchery

Fall 1995	• Complete Basic Management Plan.
1996-1997	• Establish plan for complete hatchery construction.
June 1997	• Increase Eyak stock egg take goal to maximum available.
July 1997	• Eliminate Coghill stock egg take.
2002	• Evaluate: adult returns and impacts on fishery management.

Wally Noerenberg Hatchery

Fall 1995	• Submit PAR and FTP for chum egg transfer to AFK.
Fall 1995	• Pending approval, initiate design work for addition of smolt rearing facilities.
Spring 1996	• Initiate site evaluation studies for remote release at Naked Island.

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Prince William Sound Aquaculture Corporation–Putting the Plan in Place

Spring 1996	• Submit PAR to increase chum egg take goal to 158 million.
July 1996	• Increase chum egg take goal to 122 million.
August 1996	• Pending increase in chum egg take goal, reduce pink egg take goal to 145 million.
Fall 1996	• Pending evaluation, submit FTP to transfer 24 million chum fry to Naked Island.
Fall 1996	• Begin construction.
Spring 1997	• Initiate chum fry remote release at Naked Island.
Fall 1997	• Complete construction.
October 1997	• Apply for FTP to increase coho egg take goal to 4 million.
August 1998	• Pending coho allocation decision, initiate further reduction in pink egg take.
Fall 1998	• Submit FTP to transfer coho smolt for remote release at Naked Island.
Spring 1999	• Pending allocation decision, remote release coho smolt at Naked Island.
2000	• Evaluate: adult returns and impact on fishery management.
	Gulkana Hatchery
Fall/Winter 1995-6	• Analyze historic limnological data for Crosswind Lake.
May-Sept 1996	• Initiate limnological studies for alternate stocking sites.
Spring 1997	• Pending evaluation, submit FTP for transfer of Summit Lake fry to alternative sites.
ongoing	• Evaluate: adult returns.
	Finance
Fall 1995	• Discuss equity partnership options with State of Alaska.
Summer 1996	• Secure equity ($25 million) from investor.
Summer 1996	• Reduce debt by repayment of 50% as condition of investment.
Summer 1996	• Establish two credit instruments (operating and capital) utilizing remaining equity (cash).
	Marketing and sales
	1. Processing and marketing subsidiary analysis:
Fall 1995	• Analyze the legal and financial aspects of for-profit subsidiary.
Winter 1995-6	• Recommend course of action to Executive Committee
Winter/Spring 1996	• Implement subsidiary.
Fall 1996	• Measure effectiveness.
	2. Harvesting and fish transfer operations analysis:
Fall 1995	• Evaluate cost effectiveness of harvesting, live fish transfer operations
Winter 1995-6	• Recommend any changes to Executive Committee for approval
Winter/Spring 1996	• Begin implementation of system changes
Fall 1996	• Measure effectiveness of system changes: reduced cost
	3. Live fish sales guidelines/policy:
Fall 1995	• Develop written policy for marketing and sales of live fish
Winter 1995-6	• Recommend policy to Executive Committee for approval
Spring 1996	• Begin implementation of policy, begin fish sales process
Fall 1996	• Measure effectiveness of policy results: optimum sales revenue
	4. Change in pollock B season:
Fall 1995	• Recommend support for change to Executive Committee for approval
Winter 1995-6	• Participate in building salmon industry support for change proposal
Winter 1996	• Testify at NPFMC if required
Spring 1996	• Measure effectiveness: change in "B" season approved

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Prince William Sound Aquaculture Corporation–Putting the Plan in Place

	Further processing and marketing
	1. Custom process and market pink fillet blocks, 1996:
Fall/Winter 1995-6	• Identify markets for pink fillet blocks, mince blocks
Winter 1995-6	• Identify custom processors, shippers
Spring 1996	• Negotiate and finalize custom process contract
Spring 1996	• Finalize block sales
Summer/Fall 1996	• Implement block production, sales, shipping
Fall 1996	• Measure effectiveness: higher net revenue than sale of equivalent round fish
	2. Custom process and market H&G fresh pinks and chums, USA, 1996:
Fall 1995, Spring 1996	• Develop domestic marketing and sales program
Winter 1995-6	• Identify custom processors, shippers
Spring 1996	• Negotiate and finalize custom process contract(s)
Summer 1996	• Implement production, sales, shipping
Fall 1996	• Measure effectiveness: higher net revenue than sale of equivalent round fish
	3. Custom process and market H&G fresh sockeye, Asia, 1996:
Fall 1995, Spring 1996	• Develop Asian marketing and sales program
Winter 1995-6	• Identify custom processors, shippers
Spring 1996	• Negotiate and finalize custom process contract(s)
Summer 1996	• Implement production, sales, shipping
Fall 1996	• Measure effectiveness: higher net revenue than sale of equivalent round fish
	4. Process and market roe products, 1996:
Fall 1995	• Determine optimum mix of products
Fall 1995	• Finalize sample program
Fall/Winter 1995-6	• Develop marketing and sales program
Winter 1995-6	• Identify custom processors, shippers
Spring 1996	• Negotiate and finalize custom process contract(s)
Fall 1995, Spring 1996	• Design and implement production facility
Summer 1996	• Implement production, sales, shipping
Fall 1996	• Measure effectiveness: net revenue analysis of each form
	5. Processing, marketing, sales, 1996 (and 1998):
Fall/Winter 1996	• From analysis of 1996 success, develop program for 1997
Spring/Summer 1997	• Implement program
Fall 1997	• Measure effectiveness: higher net revenue than sale of equivalent round fish
Fall 1998	6. Longer-term: develop processing and marketing program for Eyak sockeye and coho.
	Legislation
	1. Processing and marketing of salmon by PNP hatchery operators
Fall 1995	• Confer with Kent Dawson Company on issue and political strategy.
Fall 1995	• Management to research and recommend legislative language to Executive Committee.
Fall/Winter 1995-96	• Work with ADFG on legislative recommendations
Fall/Winter 1995-96	• Work with fishermen's organizations and other PNP's to inform and build support.
Fall/Winter 1995-96	• Follow through with legislative work to help assure passage of legislation.
	2. Change of corporate structure and financing options
Fall 1995	• Evaluate corporate structure with attorney based on investment needs, requirements and options available through existing models.

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Prince William Sound Aquaculture Corporation–Putting the Plan in Place

Fall 1995	• Confer with Kent Dawson Company on issue and political strategy.
Fall 1995	• Report to the Executive Committee on recommendations.
Winter 1996	• Report to the Board of Directors on recommendations.
Fall/Winter 1996	• Follow through with legislative work to assure passage of legislation including meetings with various legislators and delegations.
	Organization
September 1995	• Restructure Production Planning Committee and appoint members.
	Alliances
	[Note: this discussion focuses on building support for PWSAC's work to effect changes necessary to advance the goals of the business plan. It is understood that such support and cooperation must be ongoing.]
	1. Establish/maintain support of advocacy individuals and groups:
Fall 1995	• Identify and contact individuals, groups, organization.
Fall 1995	• Provide information in person and in writing regarding Business Plan '96.
Fall/Winter 1995-6	• Request input on, participative support for goals of Business Plan '96. How can we provide benefit, earn support?
Spring 1996	• Measure of effectiveness: active and useful support for Business Plan '96.
	2. PWSAC Advisory Committee:
Fall 1995	• Identify individuals, groups for participation.
Fall/Winter 1995-6	• Request participation in advisory capacity.
Winter/Spring 1996	• Measure of effectiveness: active participation in Advisory Committee.
	3. Form cooperative relationships:
Fall 1995	• Identify cooperative scientific research opportunities.
Fall/Winter 1995-6	• Identify cooperative product and market advancement opportunities.
Fall/Winter 1995-6	• Identify cooperative economic development opportunities.
Fall/Winter 1995-6	• Identify cooperative sport and subsistence development opportunities.
Spring 1996	• Measure of effectiveness: successful formation of relationships.
Fall/Winter/Spring 1995-6	4. Publicize advocacy, advisory and cooperative relationships.
Winter/Spring 1996	5. Coordinate advocates, appropriate legislative and administration entities.

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Prince William Sound Aquaculture Corporation–In Closing

VI. Close: To the Permit Holders of Area E:

August 27, 1995

For the last 20 years, PWSAC has used your money and its share of your fish to produce yet more salmon.

To survive, possibly even prosper over the next 20 years, PWSAC will now begin to reallocate the way it uses your money and the proceeds of its cost recovery to cover budgets for the research necessary to improve marine survival, and for the development of new market outlets both at home and abroad.

The staff and management of your company ask two things:

first...that we be judged not on the quantity of fish raised but rather on the value we create from raising high quality, marketable fish in the future, and

second...that you give us the go-ahead to start down this new, still somewhat ill-defined path and let us earn the right to stay the course by what we contribute to the bottom-line and by how closely we adhere to our new mission.

Respectfully submitted,

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Authors

Ted Achilles
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Coordination

Dede Srb

Peer Reviewers

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PWSAC Director

Armin F. Koernig
PWSAC Director

Gary Raymond
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STATE OF ALASKA

FRANK MURKOWSKI, GOVERNOR

DEPARTMENT OF FISH AND GAME

DIVISION OF COMMERCIAL FISHERIES

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MEMORANDUM

TO: McKie Campbell, Commissioner

THRU: Denby S. Lloyd, Director

FROM: Craig Farrington CWF
Development Program Manager, PNP Coordinator

DATE: November 8, 2006

SUBJECT: Department Internal Review of Prince William Sound Aquaculture Corporation

BACKGROUND

The PNP coordinator has been apprised that Region II Commercial Fisheries and Sport Fish staff have conducted a department internal review of the operations of salmon hatcheries run by the Prince William Sound Aquaculture Corporation (PWSAC). 5AAC 40.860. Performance Review specifies that the PNP Coordinator notify the Commissioner if a hatchery operator's performance is found to be inadequate. My preliminary finding is that aspects of PWSAC hatchery operations are inadequate, based on the extensive collection of facts and data presented in the full departmental internal review document. The executive summary of the department internal review is attached for your reference. This memo serves to summarize PWSAC's inadequate hatchery operations and makes recommendations of possible corrective measures to help PWSAC improve their respective operations. The intent is to help both the department and PWSAC meet the mutual obligations of our respective roles in PWS.

Five permit compliance issues and a long list of general problems are identified in the department internal review. Some of the permit compliance issues date back to 1997. By their very nature, the permit compliance issues are serious to the department. Some of the general problems are also considered egregious by department staff.

FINDINGS ON ISSUES *OF PERMIT COMPLIANCE*

PWSAC has failed to comply with permitted stocking levels. PWSAC operates the Gulkana Hatchery to enhance sockeye salmon, and part of their program is lake stocking sockeye fry into three separate lakes on the Copper River drainage. They have exceeded the permitted stocking levels into Crosswind Lake and Summit Lake in multiple years.

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PWSAC has failed to comply with minimum survival standards in the hatchery. The minimum standard for the survival rate from broodstock to egg take is 70% [5AAC 40.860.(c)], an exceedingly generous standard when applied to pink salmon. The Armin F. Koernig Hatchery, Cannery Creek Hatchery, and Wally Noerenberg Hatchery have not met this minimum standard in multiple years.

PWSAC has failed to comply with permit stipulations to provide data. PWSAC's permit to operate the Gulkana Hatchery stipulates that nursery lake evaluations be performed on Crosswind Lake, Summit Lake, and Paxson Lake. The nursery lake evaluations are to include specific limnology sampling and the resultant data are to be provided to the department. PWSAC has withheld limnology data from the department on several occasions.

PWSAC has potentially broken the law by conducting cost recovery harvests outside of a designated Special Harvest Area without authority granted from the department via emergency order.

PWSAC has failed to comply with permit stipulations to fund a project to monitor for hatchery straying. The department has proceeded unilaterally with projects to monitor for hatchery straying in Prince William Sound salmon systems. The data show large-scale straying of PWSAC pink and chum salmon into many wild stock systems in Prince William Sound. A significant amount of straying is in direct opposition to the department genetics policy, the department's policy for fish health and disease control (pathology), the department's salmon escapement goal policy, and the department's mission to protect and maintain the wild stock fish resources of the state.

Much of the permit noncompliance, as well as other problems detailed in the department internal review, can be rectified with the cooperation of PWSAC. However, a cooperative environment between the department and PWSAC has not been achievable for some years. Because of the egregiousness of the problems, it is important that the department act to establish a new course of action which will lead to correcting these problems. An ideal new course of action would be one that serves two purposes: 1) ensures compliance with department permits, and 2) fosters a better and lasting cooperative relationship between PWSAC and the department. In the executive summary, Region II staff have included a series of recommendations designed to both ensure permit compliance and elicit cooperation.

I have had extensive discussions with Region II staff on the particulars of each of the problems, and so I have been able to come to a thorough understanding of the nature and scope of the problems. I support the direction and tenor of the recommendations in the department internal review, and have incorporated them into my four principal recommendations later in this memo. The following statutes and regulations are applicable to the department internal review and to the findings by the PNP Coordinator, and are the basis of authority for the department to take a corrective course of action.

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AUTHORITY

Sec. 16.10.380 REGIONAL ASSOCIATIONS. (a) The commissioner shall assist in and encourage the formation of qualified regional associations for the purpose of enhancing salmon production. A regional association is qualified if the commissioner determines that it

(1) is comprised of associations representative of commercial fishermen in the region;

(2) includes representatives of other user groups interested in fisheries within the region who wish to belong; and

(3) possesses a board of directors that includes no less than one representative of each user group that belongs to the association.

(b) In this section "user group" includes, but is not limited to, sport fishermen, processors, commercial fishermen, subsistence fishermen, and representatives of local communities.

(c) A qualified regional association, when it becomes a nonprofit corporation under AS 10.20, is established as a service area in the unorganized borough under AS 29.03.020 for the purpose of providing salmon enhancement services. (§ 2 ch 161 SLA 1976; am §2 ch 59 SLA 1979)

Sec. 16.10.430 ALTERATION, SUSPENSION, OR REVOCATION OF PERMIT. (a) If a permit holder fails to comply with the conditions and terms of the permit issued under AS 16.10.400 - 16.10.470 within a reasonable period after notification of noncompliance by the department, the permit may be suspended or revoked, in the discretion of the commissioner after the regional planning team for the area in which the hatchery is located is notified and granted an opportunity to comment upon the proposed suspension or revocation.

(b) If the commissioner finds that the operation of the hatchery is not in the best interests of the public, the commissioner may alter the conditions of the permit to mitigate the adverse effects of the operation, or, if the adverse effects are irreversible and cannot be mitigated sufficiently, initiate a termination of the operation under the permit over a reasonable period of time under the circumstances, not to exceed four years. During the period of time that the operation is being terminated, the permit holder may harvest salmon under the terms of the permit but may not release additional fish. (§ 2 ch 111 SLA 1974; am § 4 ch 154 SLA 1977)

Sec. 16.10.443 DEPARTMENT ASSISTANCE AND COOPERATION. (a) Before and after permit issuance under AS 16.10.400 - 16.10.470, the department shall make every effort, within the limits of time and resources, to advise and assist applicants or permit holders, as appropriate, in the planning, construction, or operation of salmon hatcheries.

(b) Nothing in this section exempts an applicant or permit holder from compliance with AS 16.10.400 - 16.10.470 or from compliance with the regulations or restrictions adopted under AS 16.10.400 - 16.10.470. (§ 1 ch 97 SLA 1975).

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5 AAC 40.860 . Performance review.

(a) Based upon a department internal review, the PNP coordinator will notify the commissioner if a hatchery operator's performance is inadequate, according to the conditions under which the permit was granted.

(b) The commissioner will, in his or her discretion, consider a permit alteration, suspension, or revocation in accordance with AS 16.10.430. If the commissioner decides to consider a permit alteration, suspension, or revocation, the coordinator will notify the appropriate regional planning team. The regional planning team may make a written recommendation to the commissioner on the proposed alteration, suspension, or revocation. The regional planning team shall use the following performance standards in their review, evaluation, and recommendation to the commissioner, including whether:

(1) survivals in the hatchery are more than the minimum standards described in (c) of this section for a period of greater than four years;

(2) the transport of broodstock from wild sources does not continue for longer than one cycle of the particular species without reevaluation of hatchery operations;

(3) the hatchery contributes to the common property fishery;

(4) the hatchery does not significantly impact wild stocks in a negative manner;

(5) the hatchery fulfills the production objectives described in the terms of the hatchery permit; and

(6) there are any mitigating circumstances which were beyond the control of the hatchery operator.

(c) Minimum hatchery survival standards are as follows:

	Survival for this stage	Cumulative Survival
For captured broodstock to egg take	70%	
Green egg to eyed egg	80%	80%
Eyed egg to emergent fry	85%	68%
Emergent to fed fry1	90%	61%
Fed fry to fingerling2	90%	55%
Fingerling to smolt	75%	41%

1 Fry achieving up to 25% weight gain from swim-up.
2 Fry achieving substantially more than 25% weight gain from swim-up.

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RECOMMENDATIONS

The findings by the PNP Coordinator are extensive and serious in nature. It is recommended that the department take an equally serious course of corrective action. I make four principal recommendations: 1) issue a notice of noncompliance to PWSAC; 2) create an oversight committee for PWSAC operations; 3) require a restructuring of the PWSAC Board of Directors; and 4) suspend aspects of PWSAC PNP permits. The following are the expanded recommendations, with specific authorities cited, and with the rationale given for each recommendation:

Pursuant to AS 16.10.380.(a) (3) A regional association is qualified if the commissioner determines that it possesses a board of directors that includes no less than one representative of each user group that belongs to the association. This demonstrates the authority of the commissioner to determine an appropriate board composition for PWSAC. It is noted extensively in the department internal review that the current PWSAC Board of Directors, as led by its Executive Committee, is uncooperative with the department, and makes decisions which result in permit compliance issues. It is also noted in the study by the Foraker Group that with 45 current members, PWSAC has the largest board of all the aquaculture associations in the state, and that it should decrease in size to no more than 16 members. The unwieldy size of the PSWAC Board has contributed to a lack of personal accountability and an excessive concentration of power in the executive committee. The PNP Coordinator has found that decisions have been made by the PWSAC Board of Directors and its Executive Committee which have led directly to permit noncompliance. The department fully informed PWSAC of their noncompliance, and PWSAC has done nothing to rectify the noncompliance. This leads to the conclusion that the PWSAC Board of Directors, and its Executive Committee has been knowledgeable and culpable in their continuing permit violations. In order to achieve a better and lasting cooperative relationship between PWSAC and the department, it is recommended that the PWSAC Board of Directors be required to restructure. PWSAC has previously consulted with the Foraker Group on just such a restructuring, (see attachment). I recommend that the restructure should be done in basic accordance with the Foraker Group recommendations but on an accelerated schedule. Additionally, because the Executive Committee is the ultimate decision making body of PWSAC, and may be the most culpable for making the decisions which led to permit noncompliance, Executive Committee members should be required to step down and should not be eligible to serve on the Board for a period of time.

Pursuant to AS 16.10.430 (a) and 5 AAC 40.860, PWSAC should be notified that it is noncompliant with the department permits, and statutory and regulatory requirements. Within 45 days after notification, PWSAC would be required to submit a plan to the department for resolving each of the issues identified in the performance review and the comment on the recommendations in the executive summary of the department internal review. The notice of noncompliance should also provide notice to PWSAC that the department intends to alter or suspend its permit in accordance with any or all of the 10 recommendations in the executive summary if all compliance issues are not adequately resolved.

Pursuant to AS 16.10.430 (b), and 5 AAC 40.860, the PNP permits for chum salmon at both the Port Chalmers remote release site and the Armin F. Koernig Hatchery Sawmill Bay release site should be suspended in the best interest of the public, as a measure to curtail the straying of hatchery chum salmon in PWS. Suspension of the permits would need to be indefinite, until such time that

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the issue of hatchery chum salmon straying in PWS has been fully investigated and brought to conclusion. At that point, it may be possible to reinstate the permits in part or in full, depending on the results of the straying investigation and/or new concepts in hatchery culture techniques or technology brought forward by PWSAC.

Pursuant to AS 16.10.443 (a), the department can assist permit holders in the operation of hatcheries. The formation of a PWSAC Oversight Committee would be a very powerful means of assisting PWSAC to correct aspects of their operations which are inadequate. The PWSAC Oversight Committee could provide the direct week to week oversight of PWSAC operations, and make recommendations and reports to the commissioner thus greatly enhancing permit compliance. As envisioned by staff, the PWSAC Oversight Committee would be composed of department personnel, and be temporary in nature. When vested, the PWSAC Oversight Committee should closely monitor directives and decisions made by the PWSAC Board of Directors as a means to correct broodstock levels, correct stocking levels, correct gaps in required data, correct cost recovery harvesting, correct marking programs, and monitor all other aspects of permit compliance. The PWSAC Oversight Committee should also function as a liaison between PWSAC and the department for any issues related to permit compliance, including: making official department requests for documents, materials, records, and materials from PWSAC; acting as a clearinghouse for fish tickets, accounting documents on roe sales, and accounting documents on broodstock carcass disposal; and acting to coordinate efforts on salmon straying conducted in PWS.

All staff recommend a strong course of action be taken at this point in time as a way to secure cooperation with PWSAC. Cooperation from PWSAC is imperative to the welfare of the resources of Prince William Sound and to the communities of Prince William Sound served by both PWSAC and the department.

Cc: Patricia Nelson
Jeff Regnart

Attachments: Executive Summary of the Department Internal Review
Foraker Group recommendations to the PWSAC Board of Directors

STATE OF ALASKA

FRANK H. MURKOWSKI
GOVERNOR

DEPARTMENT OF FISH AND GAME

OFFICE OF THE COMMISSIONER

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December 1, 2006

Mr. George Covel, Chairman, Board of Directors
Mr. Dave Reggiani, General Manager
Prince William Sound Aquaculture Corporation
P. O. Box 1110
Cordova AK 99574

Dear Mr. Covel and Mr. Reggiani:

The Prince William Sound Aquaculture Corporation (PWSAC) provides a great service to fishermen, processors and communities of the Prince William Sound area, and the State of Alaska strongly supports the effective and continued operation of PWSAC salmon hatcheries and enhancement activities. PWSAC has produced millions of dollars worth of salmon for the commercial industry over the past several decades, greatly improving the economy and well-being of residents and workers in the area. There have been a number of operational difficulties, however, that we believe need to be addressed in order for PWSAC to maintain compliance with requirements of the State of Alaska.

Enclosed with this letter are: 1) a memorandum from Craig Farrington dated November 8, 2006, 2) the executive summary from an internal review of PWSAC's operations conducted by the Department of Fish and Game (ADF&G), and 3) the entire internal review conducted by ADF&G.

I encourage you to review this information in detail. There appear to be a number of noncompliance issues, with permit stipulations, regulatory requirements, and statutory requirements. We would like your response to these concerns, as well as a plan for dealing with them, within sixty days. My hope is that, during the 60-day period, PWSAC and the department will engage in free and positive communication, so that corrective measures can be designed and agreed upon.

My objective through this process is to bring the problems and issues forward with the hope that this action will serve to improve the relationship between PWSAC and my department. Together, both of our agencies can foster the sustainability of the salmon resource in Prince William Sound, including, protection of wild salmon stocks, enhancement of the common

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property fisheries, and achievement of cost recovery objectives leading to the long-term economic health of PWSAC.

I have copied all board members of Prince William Sound Aquaculture Corporation with this letter, along with the ADF&G memo of November 8. 2006, and executive summary from the department internal review. Board members wanting to have a copy of the full department internal review may contact the ADF&G Cordova Office or Craig Farrington at (907) 465-6154.

Sincerely,

McKie Campbell
Commissioner

Enclosures

cc: Steve Aberle, Board Member
Kenneth Adams, Board Member
Jack Babic, Board Member
Kory L. Blake, Board Member
John Bocci, Board Member
Michael K. Bowen, Board Member
Leroy L. Cabana, Board Member
EJ Cheshier, Board Member
Megan Corazza, Board Member
Guido Casciano, Board Member
David Clemens, Board Member
Bernie Culbertson, Board Member
Roderick Dexter, Board Member
Michael Durtschi, Board Member
Robert Eckley, Board Member
Bill Gilbert, Board Member
Michael Glasen, Board Member
Timothy L. Joyce, Board Member
Peter Kuttel, Board Member
Evtropil (Troy) Matveev, Board Member
Robert E. Maxwell, Board Member
Sharry Miller, Board Member
Thane Miller, Board Member
Timothy J. Moore, Board Member
Ray Neeley, Board Member
Jeff Olsen, Board Member

-continued-

Jerry Protzman, Board Member
Lisa Ragland, Board Member
Stephen C. Riedel, Board Member
Ken Roberson, Board Member
David Rosenhildt, Board Member
Tim Schmidt, Board Member
Scott Seaton, Board Member
P. Timothy Selanoff, Board Member
Steve Smith, Board Member
William W. Smoker, Board Member
Harold (Hap) Symmonds, Board Member
Robert Widmann, Board Member
Edward Zeine, Board Member

February 7, 2007

Denby Lloyd
Acting Commissioner
Alaska Department of Fish and Game
PO Box 25526
Juneau, Alaska 99802

RE: Action Plan to address non-compliance issues

Dear Mr. Lloyd,

Thank you for meeting with me and members of PWSAC's executive committee on January 11, 2007. We felt the meeting was productive and helpful in attaining a better understanding of the difference in points of view surrounding each of the issues referenced in the December 1, 2006 letter from Commissioner Campbell.

The enclosed document was developed to address your request for an action plan that summarizes our discussion and agreements. The ADF&G summary statements are from Patricia Nelson's January 10, 2007 memorandum, which was provided during our meeting.

PWSAC sincerely hopes that you and the Department of Fish and Game will find that this action plan accurately summarizes our respective points of view as well as the resolution that we all agreed upon at our meeting.

I believe that many, if not all, of these issues might have been avoided by better and more regular communication between our two organizations. For our part, PWSAC is willing to work harder to maintain regular communications and a free exchange of information with ADF&G. Although better communication will not necessarily prevent all disagreements, it will have the benefit of bringing them out in the open more quickly, which will allow quicker resolution. To that end, we would propose that the more regular face-to-face contacts be initiated. Ideas we think might work would be attendance by ADF&G at our monthly Executive Committee meetings, attendance at key committee and general board meetings, and bi-weekly meetings during the fishery management season.

Sincerely,

David Reggiani
General Manager

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PWSAC/ADF&G Action Plan
to Address Issues Brought Forward in Department's Internal Review

I. "PWSAC has failed to comply with permitted stocking levels … [at] Crosswind and Summit Lakes"

ADF&G Summary Statement

The PNP Permit for PWSAC to operate the Gulkana Hatchery was signed into effect on July 5, 2000. The PNP permit stipulates that the maximum number of fry for release at each project location (Crosswind Lake, Summit Lake, and Paxson Lake) are to be listed in the Basic Management Plan (BMP) [5 AAC 40.820.(b)]. Section 2.3 of the BMP contains a table of the maximum fry release numbers for each of the 3 lakes. Any number of fry released in excess of the maximum number listed in the BMP is above what is permitted and is a violation.

PWSAC Summary Statement

In 1993, PWSAC entered into an agreement with the ADF&G Fisheries Rehabilitation, Enhancement, and Development (FRED) Division to fund and operate the State-owned Gulkana Hatchery to continue its sockeye salmon enhancement project established in 1973. This project contributes approximately 300,000 sockeye salmon annually to the commercial, subsistence, personal use, and sport fisheries within the Copper River drainage.

During PWSAC's operational history, PWSAC has followed and has been within the long-standing established ADF&G FRED Division standard of ±10% of the annual targeted and permitted amount. The current Hatchery Manager (with 26 years at the hatchery) and two of our Fish Culturists were ADF&G FRED Division employees until 1993 when PWSAC began to operate the facility. This standard was implemented by the Division to provide for the annual variation in observed green egg to fry survival rates which can be significant with sockeye salmon culture.

It is important to understand and recognize that PWSAC reported the nursery lake fry stocking numbers to the ADF&G within the Gulkana Hatchery Annual Reports for each of the stocking years in question. These reports are reviewed and accepted by ADF&G prior to approval of the subsequent year's Annual Management Plan. Concerns regarding these stocking levels were first brought to our attention by a letter from Mr. Farrington, dated April 4, 2006, approximately four years after the initial noncompliance allegation.

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Agreed Upon Resolution

The ADF&G clearly articulated its current expectation that the Gulkana Hatchery fry release permitted numbers should be viewed as "not to exceed" levels rather than as a release target amount with an associated range.

PWSAC acknowledges ADF&G's expectation and will, for future fry releases into the nursery lakes, interpret these permitted fry release numbers as "not to exceed" levels. PWSAC will release fry up to the permitted number and destroy any fry produced above the permitted release number.

II. "PWSAC has failed to comply with minimum survival standards in the hatchery … broodstock to egg-take mortality"

ADF&G Summary Statement

If the department employs the broodstock numbers provided by PWSAC to calculate survival from captured broodstock to egg take, then they do not meet the 70% minimum standard [5 AAC 40.860.(c)]. According to the broodstock numbers provided in past annual reports and still advanced by PWSAC, 4 of 5 hatcheries operated by PWSAC; the Armin F. Koernig Hatchery, Cannery Creek Hatchery, Main Bay Hatchery, and Wally Noerenberg Hatchery; do not meet the minimum standard for survival rate.

PWSAC Summary Statement

PWSAC believes that this issue is not solely a matter of survival rates, but also a definitional and reporting issue. During the past couple of years, PWSAC and the ADF&G have interpreted the definition of "broodstock" differently. PWSAC's definition, combined with the ADF&G reporting requirements, leads to a misleading survival rate calculation.

The ADF&G hatchery Annual Report form states that excess males, holding mortalities, and broodstock with unviable gametes be listed within the "excess" or "other" categories rather than within the broodstock category. PWSAC is reluctant to use the term "excess" when it comes to describing a portion of its enhanced salmon production since it can limit our options when working with the department to utilize fish remaining in our SHA's following the completion of the common property harvests.

The definition PWSAC believes is more suitable to the realities of hatchery operations that "broodstock" means the segment of the returning adults collected for the purposes of perpetuating the hatchery production objectives. More specifically, broodstock is comprised of spawners, green/over-ripe spawners, pre-spawn mortality, and any other unused portions (i.e. surplus males). If this definition is used, PWSAC's survival rates consistently exceed the 70% percent minimum.

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Occasions where unharvested fish remain in front of the hatchery at the end of the commercial fishery further complicate this issue. These fish have been considered surplus hatchery broodstock by PWSAC and the ADF&G Fishery Management Biologists in the past, much like a wild stock fishery may have surplus escapement. These events are outside of the hatchery operators' control and are driven by fishery management practices, fishery markets, and in some cases harvesters (*e.g*. strikes).

Agreed Upon Resolution

The parties agreed that broodstock circumstances differ by year and by hatchery and that the ADF&G would consider modifying the broodstock terminology within the categories of the hatchery Annual Report form at the upcoming ADF&G and hatchery operators meeting to gain additional input from other hatchery operators. PWSAC will abide by the final decision reached on this issue.

The parties also acknowledged that the needs of the hatchery operator, the ADF&G, and potentially, the issue raised by the O'Callaghan Decision would have to be considered as we develop new and workable definitions related to broodstock.

The parties also agreed that PWSAC would revise and submit to ADF&G broodstock summaries for purposes of calculating survival from captured broodstock to egg-take for years 1996 – 2006 (see attached).

III. "PWSAC has failed to comply with permit stipulations to provide data … Gulkana Hatchery nursery lake limnology"

ADF&G Statement Summary

The PNP permit for PWSAC to operate the Gulkana Hatchery (signed July 5, 2000) stipulates that nursery lake evaluation be performed on each of the three project locations; Crosswind Lake, Summit Lake, and Paxson Lake. The nursery lake evaluations are to include specific limnology sampling with data and findings to be provided to the department. Recent agreement has been reached regarding the limnology data for Crosswind Lake, and this has allowed a permit alteration for increasing the stocking level of Crosswind Lake, signed into effect on May 1, 2006. However, the PNP permit requires limnology data from Summit Lake and Paxson Lake as well. From 2000 to 2005, PWSAC refused to provide the data for both Summit Lake and Paxson Lake. Had these data been available to the department on an annual basis as required, the department may have modified stocking levels in these lakes.

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PWSAC Statement Summary

This category represents a past disagreement with a long history that has subsequently been addressed and corrected. In our view, it is not appropriate to take action against PWSAC based on a dispute that has been resolved.

The May 1, 2006 Permit Alteration increasing the Crosswind Lake stocking level includes the stipulation that PWSAC is to collect and provide zooplankton data to the ADF&G by March 1 of each following year for all three nursery lakes.

It is PWSAC's understanding that this issue has been worked through with the ADF&G staff and that we are in full compliance with the permit stipulation. We do not understand why this issue is mentioned in the Farrington memorandum.

Agreed Upon Resolution

Both ADF&G and PWSAC agreed that this issue has been resolved and that PWSAC is in compliance.

IV. "PWSAC has potentially broken the law by conducting cost recovery harvest outside of a designated Special Harvest Area without authority granted from the department via emergency order"

ADF&G Statement Summary

While the concept of conducting a cost recovery test fishery within Falls Bay during the 2004 season was discussed on several occasions, it is not, and has never been department procedure to issue a blanket emergency order for conducting cost recovery outside of hatchery special harvest areas. Established practice is for the hatchery to request an EO and to provide specific dates and locations of operation. The department then issues an EO specific to the request. Typically, this is done by email or telephone call and the EO is issued the same day. PWSAC had no reason to assume this situation would be handled differently than any other.

PWSAC Statement Summary

This accusation apparently arises from an event in July 2004 in which PWSAC's contracted cost recovery vessel made two purse seine sets within a bay adjacent to the Main Bay Hatchery, as noted in the ADF&G Internal Review document.

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The concept of conducting a test cost recovery fishery within Falls Bay during the 2004 season was thoroughly discussed during four separate preseason planning meetings with the ADF&G staff and the ADF&G staff clearly indicated that this innovation to our cost recovery program was necessary and to be encouraged. As a result of these extensive discussions, PWSAC believed it was authorized to fish in Falls Bay as a Special Harvest Area (SHA), although it was later determined that no Emergency Order providing this authorization was ever issued.

A PWSAC contract seiner made two blind purse seine sets within Falls Bay on July 8, 2004 to establish whether there were sufficient fish in the area to support cost recovery operations. Each set yielded approximately 100 fish. All fish were released unharmed since there was an insignificant volume for cost recovery purposes. PWSAC had the intention and ample time to notify ADF&G upon any harvest to ensure the catch was sampled, as discussed preseason and, in fact, provided verbal notification to the Area Management Biologist 24 hours later.

This was a single incident, based on a misunderstanding, with no adverse consequences to the fishery. After receipt of the July 9, 2004 email from Mr. Ashe, PWSAC did not make any other sets. Since then, PWSAC has insisted upon receiving copies from ADF&G of each Emergency Order regarding the SHAs and established practices have been clarified and adhered to.

Agreed Upon Resolution

PWSAC will notify ADF&G when it needs to expand the hatchery SHA and obtain written authorization prior to conducting cost recovery operations.

V. "PWSAC has failed to comply with permit stipulations to fund a project to monitor for hatchery straying"

ADF&G Statement Summary

The March 17, 1994, alteration to the PNP permit for Wally Noerenberg Hatchery includes a condition for PWSAC to develop and fund a departmentally approved evaluation program. The cover letter to the alteration provides further clarification that the evaluation program include test fishing, coded wire tagging and subsequent tag recovery, analysis of straying from the release site into surrounding streams, and a management synthesis of the results of aerial and ground surveys. A cooperative agreement between PWSAC and the department was signed into effect on March 11, 1994, with provisions that both parties share in the conduct of the evaluation program. There was little actual cooperative work performed and the Cooperative Agreement expired December 31, 2001. The May 21, 2003, alteration to the PNP permit to WNH reference that all other conditions of the original PNP permit remain, as well as subsequent alterations (including the straying project). Near that point in time, the department approached PWSAC to engage in another cooperative agreement for further evaluation of straying. It was anticipated that PWSAC could

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fulfill its obligation for the straying evaluation by expanding its ongoing program to sample otoliths from the commercial harvest, a technology superior to the coded wire tags in the 1994 permit. PWSAC refused to participate, and the department unilaterally implemented the straying evaluation. The department has conducted its own evaluation in 2004, 2005, and 2006.

When the PNP permit was altered in 1994 to include a condition for evaluation, the department showed good faith in allowing a potential project to be permitted and proceed, despite the reservations over legitimate concerns it had.

PWSAC Statement Summary

The Cooperative Agreement 94-060 between PWSAC and ADF&G established a program to evaluate the effect of the Port Chalmers chum salmon remote release on PWS fisheries and wild salmon. The agreement established a Port Chalmers Evaluation Review Committee (PCERC) composed of PWSAC staff, the ADF&G Principal Geneticist, Regional Hatchery Manager, Area Resource Development Biologist, Area Management Biologist, Area Research Project Leader, and a Cordova Fish & Wildlife Protection Officer. The effective period of the Cooperative Agreement was March 11, 1994 through December 31, 2001. As such, this cooperative agreement expired nearly five years ago.

The agreement outlined that the PCERC was to meet each year in late autumn to prepare a written report outlining the committee's evaluation of the Port Chalmers remote release, and recommend modifications to the evaluation program if necessary. Final drafts of annual progress reports were to be completed by January 15 of each year. For projects recommend by the committee for implementation the following year, detailed project descriptions, including budgets and funding responsibilities, were to be included in the annual progress report. The agreement outlined that the Area Resource Development Biologist was responsible for completing the annual progress reports in cooperation with other committee members.

PWSAC is unaware of any annual progress reports. Copies were requested from Mr. Farrington on December 12, 2006. The straying studies contained within the evaluation plan were to be completed in 1998 and 1999.

PWSAC does have knowledge, however, that chum and pink salmon straying evaluations were conducted cooperatively by ADF&G staff, PWSAC staff, and PWSAC Board members; and that PWSAC provided a portion of the funding for air taxi travel to the sampling sites in 1998 and 1999.

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In addition, PWSAC provided ADF&G funds to recover coded wire tags and otoliths from 1997-2001. Joyce and Riffe (1998) reported that some of the commercial chum salmon harvests were scanned for coded wire tags in 1997 in the Northern and Eastern Districts looking for straying Port Chalmers chum salmon. The logic was that Port Chalmers tag codes in the commercial catch in these districts would indicate a potential for straying. Only one Port Chalmers tag code was found. Stream surveys were not conducted after the commercial fishery tag examination, as the likelihood of finding a coded wire tagged chum salmon in a stream was considered extremely remote.

It should also be noted, that since 1996, PWSAC has funded over $931,000 to the ADF&G evaluation programs through cooperative agreements. PWSAC has confirmed with the ADF&G Accounts Receivable Unit that there are no outstanding balances related to the cooperative agreement 94-060 (Attachment 18). With that, PWSAC is confident that it complied with and fulfilled its responsibilities under the 1994 WNH Permit Alteration and cooperative agreement 94-060.

PWSAC believes that it is unreasonable for ADF&G to rely on very general, boilerplate permit stipulations as a basis for a "violation," particularly in circumstances such as these, where a specific agreement with specific obligations was entered into between PWSAC and ADF&G and concluded. If the Department expects an aquaculture association to take particular initiatives to comply with its permit, ADF&G should clearly communicate those expectations, especially where joint action between ADF&G and the hatchery operator is necessary.

Agreed Upon Resolution

ADF&G believes that hatchery operators and the department should continue to investigate the effects of hatchery salmon releases on wild stock salmon populations and that the joint PWSAC/ADF&G effort in Prince William Sound will be the vanguard of studies eventually required of hatchery operators around the state. ADF&G explained that Prince William Sound was the logical starting place, since a comprehensive thermal otolith mark application and recovery program is already in place. ADF&G and PWSAC agreed to work cooperatively to design a straying evaluation study plan.

VI. General problems identified in the department internal review.

ADF&G Statement Summary

The performance of the salmon hatcheries operated by PWSAC is affected not only by the permit non-compliance problems but the other problems as well. The executive summary of the department internal review identifies these as 'general problems', and list the problems as: cost recovery shortfalls, large-scale straying, excessive broodstock collection for roe-stripping, inadequate reporting of roe sales, otolith marking failures, erratic management

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recommendations, lack of good faith negotiations, difficulties fulfilling cooperative agreements, failure to report hatchery operation problems, inadequate structure of the Board of Directors, and lack of individual corporate officer accountability. In aggregate, the problems create a large negative impact. PWSAC needs to respond to the Commissioner regarding all of the general problems, and provide explanation on how the specific conduct or activities relate to a successful hatchery program.

PWSAC Statement Summary

The items listed under the category of 'general problems' are derived from supposition, are not supported by the facts, and are opinion-based. Several of the listed items are related and therefore grouped together.

Cost recovery shortfalls, management recommendations

The ADF&G expectations of the hatchery operator regarding these issues remain elusive. The hatchery operator has an obligation to make commercial fishery management recommendations to the ADF&G regarding the enhanced returns to the hatchery. It is not unusual that, on occasion, the ADF&G and the hatchery operator may have professional differences of opinion and not agree upon a specific fishery management course of action. Moreover, as professionals, we should appreciate the value of differing opinions and lively discussion as vital component, rather than a shortcoming in our collaborative endeavors. In the final analysis, however, it is clearly outlined in regulation that the ADF&G is responsible for managing the hatchery specific Subdistricts to achieve the corporation's escapement goal (broodstock and cost recovery) [5 AAC 24.368 (a)].

Large-scale straying

It is well documented in the scientific literature that pink and chum salmon, both wild and of hatchery origin, exhibit significant rates of straying during their final migratory life stages. In a general sense, these behavioral traits were well understood and anticipated during the development of the salmon hatchery program in Alaska. The extent to which PWSAC salmon stray in Prince William Sound as well any effects on wild stocks remain unknown, and cannot be discerned from the reconnaissance level studies conducted thus far. It is our expectation that expanded understanding of the effects of hatchery salmon releases on the wild salmon stocks will come from the development of a comprehensive straying evaluation study plan and the requisite science-based investigations that follow.

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Excessive broodstock collection for roe-stripping

As previously stated, occasions where unharvested fish remain in front of the hatchery at the end of the commercial fishery complicate the broodstock classification issue. These fish have been considered surplus hatchery broodstock by PWSAC and the ADF&G Fishery Management Biologists in the past, much like a wild stock fishery may have surplus escapement. These events are outside of the hatchery operator's control, driven by fishery management practices, fishery markets, and in some cases harvesters (*e.g*. strikes). Broodstock collection is not precise. PWSAC has never intentionally collected too many brood fish for the purpose of roe-stripping.

Inadequate reporting of roe sales

The number of fish, pounds of roe sold, price per pound received, and total dollars received for each species of salmon has been consistently reported each year to the ADF&G within the hatchery Annual Reports.

According to a letter received from ADF&G's Seafood Industry Coordinator, dated January 17, 2006, PWSAC is not required to write ADF&G fish tickets for roe removal.

Otolith marking failures, failure to report hatchery operation problems

This issue refers to the Wally Noerenberg Hatchery (WNH) chum salmon thermal otolith marking program. It is fundamentally an audit and reporting issue and not one of marking failure, as the internal review incorrectly implies. All of the WNH chum salmon have been released with the ADF&G designated thermal otolith mark. However, fish marked with specific release location designations have been occasionally released in other locations.

The process of thermal otolith marking occurs at the hatchery while the fish are at the eye egg stage of development within the incubators. Hatchery operational issues during outmigration complicate the tracking and accounting of the different otolith marks compared to the coded wire tagging process. Many other hatchery operators have worked around these issues by applying only one mark for all release locations. PWSAC has attempted to establish differential otolith marks for each of its chum salmon release sites.

Recently, PWSAC has strengthened its hatchery tracking and reporting controls to more accurately estimate the number of fry released by mark and by release location. This will provide for better estimates of the anticipated proportion of marks by release location during the recovery process. This was completed in response to an in-house operational audit to investigate an unexpected amount of chum salmon reported to be harvested in the 2003 Coghill District commercial fishery with the mark intended for the Port Chalmers release. The operational audit identified weaknesses and inconsistencies in the hatchery's tracking and reporting controls. In some instances, no records were available. However, where errors were identified, corrected report forms were submitted to the ADF&G Otolith Mark Lab.

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Lack of good faith negotiations

PWSAC has always acted in good faith and professionally during its negotiations and development of planning documents with the ADF&G. It has been a standard practice during the last 10 years of starting the AMP drafting process with a clean document (without track changes turned on) updated from the previous year's approved version. PWSAC followed that practice in good faith, with no intent to deceive. This accusation is one of perception that could be addressed with more open communications and more frequent face-to-face interactions. Telephone calls can help to prevent these types of misunderstandings.

Difficulties fulfilling cooperative agreements

This is somewhat overstated and seems to be linked to an instance where the Gulkana Hatchery staff missed a detail in the cooperative agreement due to a confusing outline of tasks for each party. PWSAC has not had difficulties in fulfilling its cooperative agreement responsibilities and, given our record of mutual accomplishment through PWSAC/ADF&G cooperative agreements, we should not characterize the occasional breakdown in communications as representative of our past and potential working relationship.

Inadequate structure of the Board of Directors, Lack of individual corporate officer accountability

PWSAC is not certain that it fully understands this particular criticism. It is correct that PWSAC has a large general board. Consistent with AS 16.10.380 and its Articles of Incorporation, for over 30 years the general board has included representatives of the various commercial gear groups in Area E, processors, municipalities, subsistence, personal use, and sport fishing user groups. One benefit of this arrangement is that it promotes understanding of PWSAC's activities and encourages involvement and buy-in to PWSAC's mission across a broad spectrum of the community. The general board is responsible for setting broad, overall policies, hiring the General Manager, and electing the members of the Executive Committee. One drawback is that a 45 member general board is too large and too geographically diverse to effectively oversee PWSAC's day to day work, which is delegated to the Executive Committee and several other very active committees.

Responsibility for execution of the general board's and Executive Committee's policies is the responsibility of the General Manager. He is the responsible corporate officer who should be the primary point of contact for ADF&G in most instances. On significant issues, such as the present dispute, it is appropriate for the Executive Committee to participate. The Chairman of the Board is the responsible corporate officer who has been elected to speak on behalf of the general board and Executive Committee. As with any corporate organization, individual board members are not authorized to represent PWSAC in dealings with the ADF&G.

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PWSAC will concede that its organizational structure has both strengths and weaknesses. As your report notes, we commissioned the Foraker Group to help us analyze possible reforms, which we are now considering. There are several different points of view within the corporation. With respect, we believe that potential modification of PWSAC's corporate structure is an issue for which PWSAC itself is responsible.

Agreed upon Resolution

We agree that better communications between the organizations would help to strengthen the working relationship between PWSAC and ADF&G. Both parties also emphasized that the General Manager would speak for the Corporation and that the Chairman would speak for the Board of Directors.

Attachments:

PWSAC Pink Salmon Broodstock Summary

PWSAC Chum and Sockeye Salmon Broodstock Summary

Reference:

Joyce, T., and Riffe, R. 1998. Summary of Pacific Salmon Coded Wire Tag and Thermal Mark Application and Recovery, Prince William Sound, 1997. Alaska Department of Fish and Game. Regional Information Report.

STATE OF ALASKA

SARAH PALIN, GOVERNOR

DEPARTMENT OF FISH AND GAME

OFFICE OF THE COMMISSIONER

P.O. BOX 115526
JUNEAU, AK 99811-5526
PHONE: (907) 465-4100
FAX: (907) 465-2332

March 7, 2007

Mr. David Reggiani
General Manager
Prince William Sound Aquaculture Corporation
P.O. Box 1110
Cordova, AK 99574

Dear Mr. Reggiani:

Thank you for your February 14, 2007, letter providing the Alaska Department of Fish and Game (ADF&G) with the proposed Action Plan developed by Prince William Sound Aquaculture Corporation (PWSAC) to address permit violation issues. I value the willingness of PWSAC to work with ADF&G to begin to correct the permit violations and problems identified in the department's Performance Review.

We have taken the opportunity to modify this Action Plan by removing editorial comments and providing a clear set of actions intended to rectify each of the non-compliance issues. In addition, we have provided action items to prevent recurrences of the 'general problems' documented in the Performance Review (Attachment 1). The department feels that this plan contains fair and workable solutions to the problems identified in the Performance Review incorporating points of agreement from our discussions with PWSAC. I have committed ADF&G to follow this plan, and I expect that PWSAC will follow suit.

I look forward to receiving this Action Plan with your signature which will indicate to me that we have reached agreement and can move forward. I am confident that this course of action will serve us well, and by adhering to it, we will not repeat past mistakes and will avoid the need for unilateral permit alterations. I sincerely believe that the relationship between ADF&G and PSWAC will improve, and that the Prince William Sound salmon resources will benefit from this difficult but necessary process.

Please feel free to contact Craig Farrington at 465-6154, should you have questions or wish for any further clarifications.

Sincerely,

Denby S. Lloyd
Commissioner

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Final Action Plan to Address Problems Identified in the Performance Review (5AAC 40.860) of the Prince William Sound Aquaculture Corporation

Permit compliance issues:

1. Exceeding permitted stocking levels
2. Substandard broodstock to egg-take survival rates
3. Withholding data required in permits
4. Conducting cost recovery harvest outside SHA without emergency order authority
5. Problems with conducting and/or funding monitoring required by permits

1. Exceeding permitted stocking levels

ACTION: The department will allow PWSAC to release up to the permitted number of fish for all hatcheries. The permitted numbers are maximum 'not-to-exceed' stocking levels listed in the permits. PWSAC will not exceed any permitted stocking level and is subject to the regulations under 5 AAC 40.100 - 5 AAC 40.990.

2. Substandard broodstock to egg-take survival rate

ACTION 1: PWSAC will adjust broodstock goals for each salmon hatchery. These adjustments will be reflected in the Annual Management Plan for each salmon hatchery, and will detail any allowances for pre-spawn mortality, and for green and/or over-ripe fish. The allowances are to be included in calculating minimum hatchery standard survivals in 5AAC 40.860. In no case will the total of the allowances lead to a calculated survival rate that is less than the minimum hatchery standard survival prescribed for 'captured broodstock to eggtake' in 5AAC 40.860.

ACTION 2: PWSAC will provide updated broodstock summaries for the years 1996 – 2006 as requested by ADF&G to include the numbers for hatchery broodstock specific to the working definition established at the February 14, 2007, meeting. PWSAC will provide ADF&G with the annual report required of all salmon hatcheries under AS 16.10.470, which will include the numbers of hatchery broodstock specific to the working definition established at the February 14, 2007, meeting. PWSAC is subject to 5 AAC 40.100 - 5 AAC 40.990, and will provide ADF&G with any basic biological information requested.

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3. Withholding data required in permits

ACTION 1: PWSAC will provide limnology data from Crosswind, Summit, and Paxson lakes as required in the Gulkana Hatchery AMP, BMP, and Permit No. 42. PWSAC is to submit the data annually to ADF&G by March 1.

ACTION 2: PWSAC is subject to the regulations under 5 AAC 40.100 - 5 AAC 40.990, and any PWSAC documents, records, or materials related to hatchery operations shall be made available to the department upon request.

4. Conducting cost recovery harvest outside SHAs without ADF&G emergency order authority

ACTION: PWSAC will obtain emergency order authorization from ADF&G prior to conducting cost recovery operations outside a hatchery SHA.

5. Problems with conducting and/or funding monitoring required by permits

ACTION: PWSAC is subject to the regulations under 5 AAC 40.100 - 5 AAC 40.990 and will conduct and/or fund all monitoring required by permits.

General Problems:

1. Cost recovery shortfalls and management recommendations
2. Failure to address chum salmon straying issues
3. Excessive broodstock collections and inadequate reporting of roe sales
4. Chum salmon otolith marking program failures
5. Transparent negotiations and communication problems
6. Cooperative agreement problems
7. Compliance with permits, Annual and Basic Management Plans

1. Cost recovery shortfalls and management recommendations

ACTION: PWSAC will submit written management recommendations with clear justifications as to how the recommendations support achieving cost recovery and/or broodstock collection goals. Each recommendation, in the form of a brief email, will include but not be limited to current harvest data, bay estimates, actual and anticipated run entry, and actual and anticipated cost recovery progress. Each recommendation will also include a summary of actual and anticipated broodstock collection progress.

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2. Failure to address chum salmon straying issues

ACTION: It is expected that PWSAC will participate in the current studies being conducted by ADF&G, which will begin to assess whether there is straying from the remote releases of hatchery chum salmon from both Port Chalmers and Sawmill Bay. The detailed arrangements are to be covered by a cooperative agreement between ADF&G and PWSAC. PWSAC will be expected to participate fully in future workshops to be held by ADF&G on salmon straying and in development of plans to address any straying problems that may be identified in these workshops. Workshops will include evaluation of the data collected by ADF&G in the studies done in 2004, 2005, and 2006, and data collected in future studies performed under the cooperative agreement established between ADF&G and PWSAC.

3. Excessive broodstock collections and inadequate reporting of roe sales

ACTION: In no case shall incidental roe recovery, associated both with the extraction of milt or eggs for use as broodstock and with broodstock carcass disposal, exceed 10% of the broodstock goal, unless specifically authorized by regulation. No roe recovery associated with carcass disposal other than the incidental recovery of green or overripe roe during broodstock operations will be allowed unless specifically authorized by regulation. All roe harvests/sales must be reported to the department within 7 days of harvest. All carcass disposals, including broodstock disposals made pursuant to 5 AAC 93.350(d), shall be logged and reported to the department as required under 5 AAC 93.310(d); weekly summaries will be provided to the department. PWSAC shall warn its employees and contractors that any unauthorized sale of roe associated with disposal of salmon carcasses may result in personal as well as corporate liability for violation of AS 16.05.831 and 5 AAC 93.310.

4. Chum salmon otolith marking program failures

ACTION: Within 60 days, PWSAC will provide the department with a written plan explaining in detail how the chum salmon thermal otolith marking program problems have been addressed and will be corrected.

5. Transparent negotiations and communication difficulties

ACTION: All proposed changes to documents, that are in draft form and are being edited by both the department and PWSAC (i.e., Annual Management Plans and Cooperative Agreements), will be made with some form of 'track changes' mode, where additions and deletions are readily apparent and supported with an explanation of the changes. Both ADF&G and PWSAC agree that PWSAC's general manager will speak for the corporation and that the PWSAC Board Chairman will speak for the Board.

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6. Cooperative agreement problems

ACTION: All cooperative agreements will be submitted by the identified deadlines. All stipulations will be met on time or written justification will be provided outlining why they will not be met on time. Cooperative agreements will be designed to last three years, without annual revision, except where ADF&G and PWSAC agree that a project is of short duration or where ADF&G determines that a three-year duration is not appropriate. ADF&G and PWSAC will modify all existing cooperative agreements as appropriate. Nothing in this paragraph prohibits revision of cooperative agreements prior to expiration if necessary due to changed circumstances, but both ADF&G and PWSAC will attempt to minimize the need for revisions.

7. Compliance with permits, Annual and Basic Management Plans

ACTION: The department will form a review committee to closely monitor PWSAC activities and report to the commissioner on PWSAC's performance relative to this agreement as well as applicable statutes or regulations. The committee, composed of department personnel, will review all PARs, production and planning activities, and cost recovery planning. PWSAC will provide committee members with access to all PWSAC meetings, documents, and records, and shall notify committee members as far in advance as is practicable of all PWSAC meetings. In order to allow sufficient time for review, all materials in draft form associated with the annual spring Regional Planning Team meeting will be submitted to this committee by February 1. The committee will make recommendations to the commissioner regarding any permitted hatchery activities or permit alterations.

The parties hereby agree to the terms and conditions set forth above.

Prince William Sound Aquaculture Corporation

_____ _____

Dave Reggiani Date
General Manager

Alaska Department of Fish and Game

_____ _____

Denby S. Lloyd Date
Commissioner

STATE OF ALASKA

SARAH PALIN, GOVERNOR

DEPARTMENT OF FISH AND GAME

DIVISION OF COMMERCIAL FISHERIES

P.O. BOX 115526
JUNEAU, AK 99811-5526
PHONE: (907) 465-4210
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MEMORANDUM

TO:	John Hilsinger		Date:	January 24, 2008
	Director			
	Commercial Fisheries			
	Anchorage			
FROM	Jeff Regnart		Subject:	PWSAC compliance with Final
	Regional Supervisor			Action Plan
	Commercial Fisheries			
	Anchorage			

This memo documents ongoing issues with Prince William Sound Aquaculture Association (PWSAC) relative to compliance with the April 4, 2007 Final Action Plan. Below are listed Action Plan items, the action necessary to correct the issue and PWSAC's performance relative to that item. PWSAC is on record stating that the Final Action Plan is non-binding and that they do not accept it. As a result, there are still many outstanding issues between us.

ACTION PLAN ITEM 2. Substandard broodstock to egg-take survival rate

ACTION: PWSAC will provide updated broodstock summaries for the years 1996 – 2006 as requested by ADF&G to include the numbers for hatchery broodstock specific to the working definition established at the February 14, 2007 meeting. PWSAC will provide ADF&G with the annual report required of all salmon hatcheries under AS 16.10.470, which will include the numbers of hatchery broodstock specific to the working definition established at the February 14, 2007 meeting. PWSAC is subject to 5 AAC 40.100 - 5 AAC 40.990, and will provide ADF&G with any basic biological information requested.

ISSUE: Multiple data requests for broodstock information have received no response. This was discussed at the Regional Planning Team meeting and in subsequent verbal communications, e-mail, and phone messages. The department is unable to effectively evaluate hatchery performance without this data.

ACTION PLAN ITEM 3. Withholding data required in permits

ACTION: PWSAC is subject to the regulations under 5 AAC 40.100 - 5 AAC 40.990, and any PWSAC documents, records, or materials related to hatchery operations shall be made available to the department upon request.

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ISSUE: Multiple requests for cost recovery harvest data, roe harvest data, broodstock collection, egg take, run timing, and fry release information have received no response. Department is unable to effectively evaluate hatchery practices without this data.

ACTION PLAN GENERAL PROBLEMS ITEM 1. Cost recovery shortfalls and management recommendations

ACTION: PWSAC will submit written management recommendations with clear justifications as to how the recommendations support achieving cost recovery and/or broodstock collection goals. Each recommendation, in the form of a brief email, will include but not be limited to current harvest data, bay estimates, actual and anticipated run entry, and actual and anticipated cost recovery progress. Each recommendation will also include a summary of actual and anticipated broodstock collection progress.

ISSUE PWSAC stopped making management recommendations in 2007. The department could not get an explanation for PWSAC's continued cost recovery operations after cost recovery goals had been completed. PWSAC pursued a cost recovery strategy for AFK chum salmon that resulted in a cost recovery short fall, waste of the resource, and hatchery salmon straying.

ACTION PLAN GENERAL PROBLEMS ITEM 2. Failure to address chum salmon straying issues.

ACTION: It is expected that PWSAC will participate in the current studies being conducted by ADF&G….

ISSUE: PWSAC has declined to participate at any level in the ongoing evaluation of hatchery salmon straying in Prince William Sound.

ACTION PLAN GENERAL PROBLEMS ITEM 3. Excessive broodstock collections and inadequate reporting of roe sales.

ACTION: In no case shall incidental roe recovery, associated both with the extraction of milt or eggs for use as broodstock and with broodstock carcass disposal, exceed 10 percent of the broodstock goal…All roe harvests/sales must be reported to the department within 7 days of harvest….

ISSUE: PWSAC did not report any roe sales until the end of the season. PWSAC also declined to provide the egg take/broodstock collection summary used to evaluate hatchery operations.

ACTION PLAN GENERAL PROBLEMS ITEM 4. Chum salmon otolith marking program failures.

ACTION: Within 60 days, PWSAC will provide the department with a written plan explaining in detail how the chum salmon thermal otolith marking program problems have been addressed and will be corrected.

ISSUE: The dept has not received any information regarding how the chum salmon marking program is being improved.

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ACTION PLAN GENERAL PROBLEMS ITEM 5. Transparent negotiations and communication difficulties.

ISSUE: PWSAC repeatedly refusal to answer or return phone calls and e-mails relating to basic hatchery operations.

ACTION PLAN GENERAL PROBLEMS ITEM 7. Compliance with permits, Annual and Basic Management plans.

ISSUE: PWSAC repeatedly deviated from annual management plan cost recovery goals and did not comply with the AMP amendment requirements. The department asked for an explanation and PWSAC did not respond.