Regional Information Report No. 5J11-02

An Evaluation of the Pillar Creek Salmon Hatchery for Consistency with Statewide Policies and Prescribed Management Practices

by

Jake Musslewhite

April 2011

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

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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)

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

REGIONAL INFORMANTION REPORT NO. 5J11-02

AN EVALUATION OF THE PILLAR CREEK SALMON HATCHERY FOR CONSISTENCY WITH STATEWIDE POLICIES AND PRESCRIBED MANAGEMENT PRACTICES

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The Regional Information Report Series was established in 1987 and was redefined in 2006 to meet the Division of Commercial Fisheries regional need for publishing and archiving information such as project operational plans, area management plans, budgetary information, staff comments and opinions to Board of Fisheries proposals, interim or preliminary data and grant agency reports, special meeting or minor workshop results and other regional information not generally reported elsewhere. Reports in this series may contain raw data and preliminary results. Reports in this series receive varying degrees of regional, biometric and editorial review; information in this series may be subsequently finalized and published in a different department reporting series or in the formal literature. Please contact the author or the Division of Commercial Fisheries if in doubt of the level of review or preliminary nature of the data reported. Regional Information Reports are available through the Alaska State Library and on the Internet at http://www.adfg.alaska.gov/sf/publications/

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ABSTRACT

The salmon hatchery program in Alaska is governed by policies, plans, and regulations that emphasize protection of wild salmon stocks. A rotational series of hatchery evaluations will examine the consistency of each hatchery with those policies and prescribed management practices. The evaluation includes a review of the hatchery management plans and permits, an assessment of each hatchery program's consistency with statewide policies, and recommendations to address any deficiencies found. Management plans, permits, and similar documents were examined to determine whether they were up to date, consistent with each other, and accurately described actual hatchery operations. The consistency with policy was assessed by identifying applicable policies and aspects of hatchery programs relevant to those policies. The hatchery evaluation process began with hatcheries in the Kodiak region.

The Pillar Creek Hatchery is located on Kodiak Island and produces sockeye, coho, and Chinook salmon and rainbow trout to enhance local fisheries. The hatchery's management plans, permits, and operations were reviewed under the hatchery evaluation process. The evaluation of the hatchery's programs found that it was being operated in accordance with its permits and prescribed practices. The hatchery's programs appear to be consistent with statewide policies on genetics, fish health, and fisheries management. Most of the recommendations made are to address administrative requirements, such as updating the basic management plan. Recommendations were also made to consider establishing stable, conservative sockeye salmon stocking levels rather than using limnological data to determine stocking levels; and to consider a marking program to determine the contribution of Spiridon Lake sockeye salmon to fisheries.

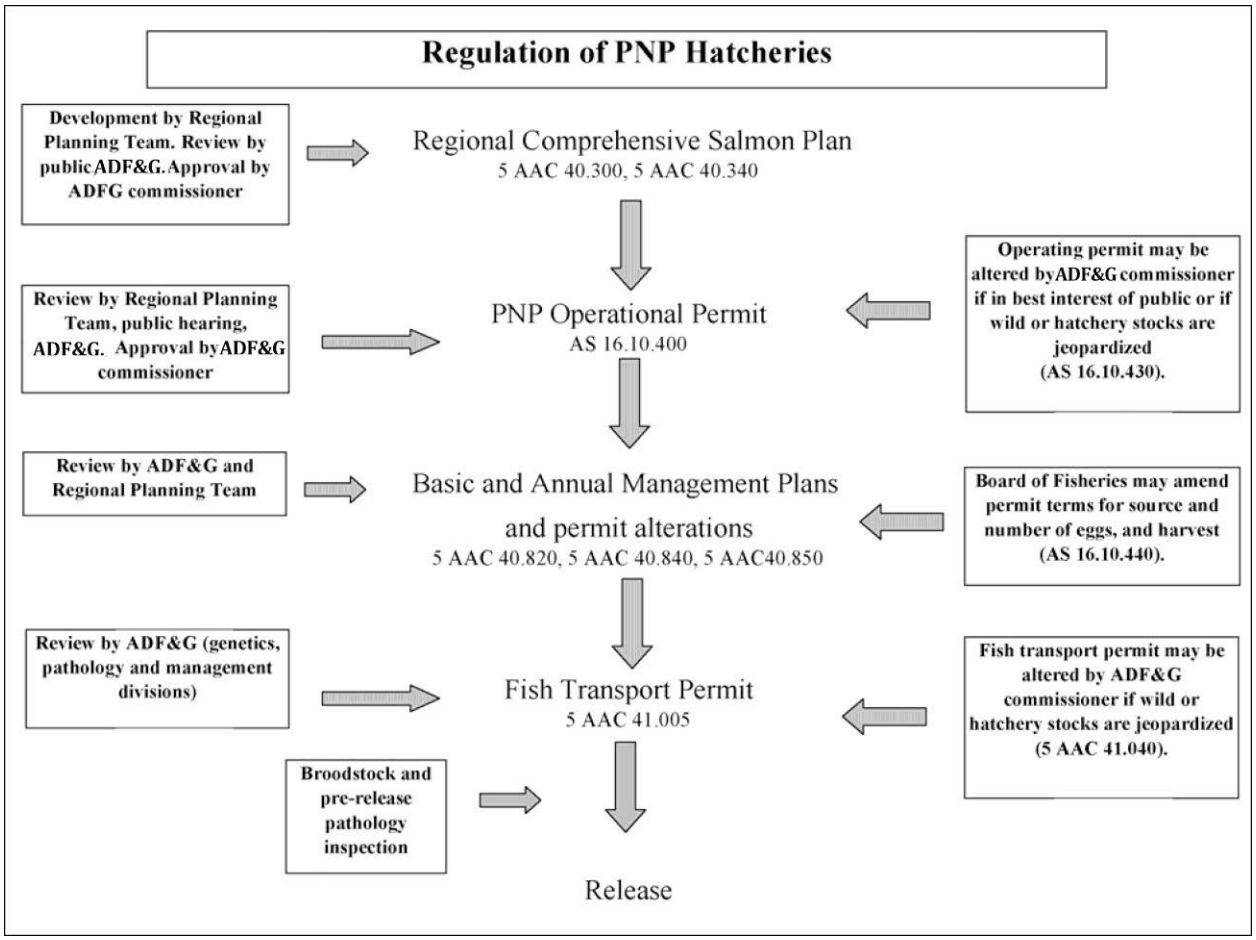
Key words: Pillar Creek Hatchery, hatchery evaluation, hatchery, Kodiak Regional Aquaculture Association, Kodiak, basic management plan, annual management plan, fish transport permit

INTRODUCTION

Salmon hatcheries have become an important contributor to Alaska's salmon fisheries, contributing 18% of the total exvessel value of the commercial salmon fishery in 2009 (White 2010). Despite their value to Alaska's fisheries, the use of salmon hatcheries to enhance fisheries has been controversial. Much of that controversy centers on the possible risks that hatcheries and similar enhancement efforts pose to wild stocks of salmon, such as loss of genetic diversity or negative ecological interactions.

In order to minimize potential adverse impacts to wild stocks from the enhancement program, numerous laws, regulations and policies have been developed by the Alaska Department of Fish and Game (ADF&G). These include regional planning of salmon enhancement activities; procedures for the permitting of salmon hatcheries and enhancement activities that require pathology, genetics, and fishery management reviews; and policies that protect wild stocks of salmon (Figure 1). This regulatory system has resulted in a hatchery program that contributes to salmon harvests while emphasizing protection of wild stocks. The design and development of the hatchery program in Alaska is described in detail in McGee (2004). As stated by McGee, "The success of the hatchery program in having minimal impact on wild stocks can be attributed to the development of state statutes, policies, procedures, and plans that require hatcheries to be located away from significant wild stocks, and constant vigilance on the part of ADF&G and hatchery operators to improve the program through ongoing analysis of hatchery performance."

Figure 1.–Schematic of Alaska hatchery regulatory system (McGee 2004).



This report is the second in a series of hatchery evaluations that will examine the consistency of Alaska hatchery programs with the policies and prescribed management practices that protect Alaska's salmon resources. The hatchery evaluation process was initiated as part of the state's *Action Plan to Address Conditions for MSC Recertification* (Bedford 2007). The Marine Stewardship Council (MSC) is an independent nonprofit organization that certifies fisheries that have been demonstrated to be sustainably managed. The Alaska salmon fishery was first certified by the MSC in 2000, and recertified in 2007 (Chaffee et al. 2007). The 2007 recertification was issued with some conditions (Knapman et al. 2009). One of the conditions (Condition 66) was to "Establish and implement a mechanism for periodic formal evaluations of each hatchery program for consistency with statewide policies and prescribed management practices. This would include a specific evaluation of each program relative to related policies and management practices."

A five-year regional rotational schedule was established for the formal review of hatchery programs. One region was scheduled for review each year, beginning with Kodiak in 2009/10. In subsequent years, hatcheries in Cook Inlet, Prince William Sound, Southern Southeast Alaska, and Northern Southeast Alaska will be evaluated.

Individual evaluations will be prepared for each hatchery, rather than for regional associations or regional programs. Under the regulatory system, permits are associated with a hatchery and not with a program or regional association, so the evaluations will follow that framework. This can create some complications in the evaluation process, as modern salmon culture techniques often

involve multiple hatcheries. Future evaluations may include a regional or programmatic perspective to assess any potential larger-scale effects of hatchery practices.

HATCHERY BACKGROUND AND HISTORY

Pillar Creek Hatchery (PCH) was built in 1990 as a cooperative project between ADF&G and the Kodiak Regional Aquaculture Association (KRAA). It was originally designed to serve as a central incubation facility to produce juvenile sockeye salmon for rehabilitation and fishery enhancement projects throughout the Kodiak region. Today, PCH continues to produce juvenile sockeye salmon for lake stocking projects, but also produces coho and Chinook salmon as well as rainbow trout to enhance fishing opportunities on the Kodiak road system.

The hatchery is located on the Kodiak road system, about seven miles north of the city of Kodiak (Figure 2). Its primary water supply is the Pillar Creek Reservoir, with two wells serving as a source for incubation and supplemental water. There are 16 raceways used for initial rearing of sockeye juveniles, usually to the fry or presmolt stage. A separate complex of five raceways is primarily used for rearing Chinook salmon and rainbow trout for the sport fish stocking programs. An additional offsite raceway facility at Monashka Creek is used for broodstock holding and additional rearing space for the Chinook program. Coho salmon can be reared in any of the hatchery's raceways, depending upon available space.

In 1993, KRAA contracted with the State of Alaska to be the sole operator of PCH, with an ADF&G biologist continuing to serve as hatchery manager until November 2003. In 1998, private nonprofit (PNP) permit 41 was issued to KRAA for the hatchery's operation. The original permit was for a total of 20 million sockeye salmon eggs and 500,000 coho salmon eggs, "subject to conditions of the basic management plan." While the permitted capacities for sockeye and coho salmon eggs have not changed, permit alterations have added Big Waterfall Lake as a release site for sockeye salmon and added Chinook salmon and rainbow trout programs. The current hatchery permit allows a maximum of 20 million sockeye salmon eggs, 500,000 coho salmon eggs, 450,000 Chinook salmon eggs, and 92,000 triploid rainbow trout eggs.

OVERVIEW OF PLANS AND PERMITS

The PNP hatchery permit, basic management plan, and annual management plan are the primary documents used to guide hatchery operations. The hatchery permit authorizes operation of the hatchery, and specifies the maximum number of eggs of each species that a facility can incubate onsite; as well as stocks that may be used and locations where fish may be released. The hatchery permit and basic management plan may be amended or revised after receipt and approval of a permit alteration request. The basic management plan is an extension of the hatchery permit, and outlines the general operations of the hatchery. In effect, the basic management plan describes the way in which the hatchery permit will be implemented. Because the basic management plan functions as part of the hatchery permit, the two documents are to be revised together when the permit is altered, and are considered complementary documents.

The annual management plan outlines the details of the operation for the current year of each permitted facility. It should "organize and guide the hatchery's operations, for each calendar year, regarding production goals, broodstock development, and harvest management of hatchery returns." (5 AAC 40.840) The annual management plan must also be consistent with the hatchery permit and basic management plan.

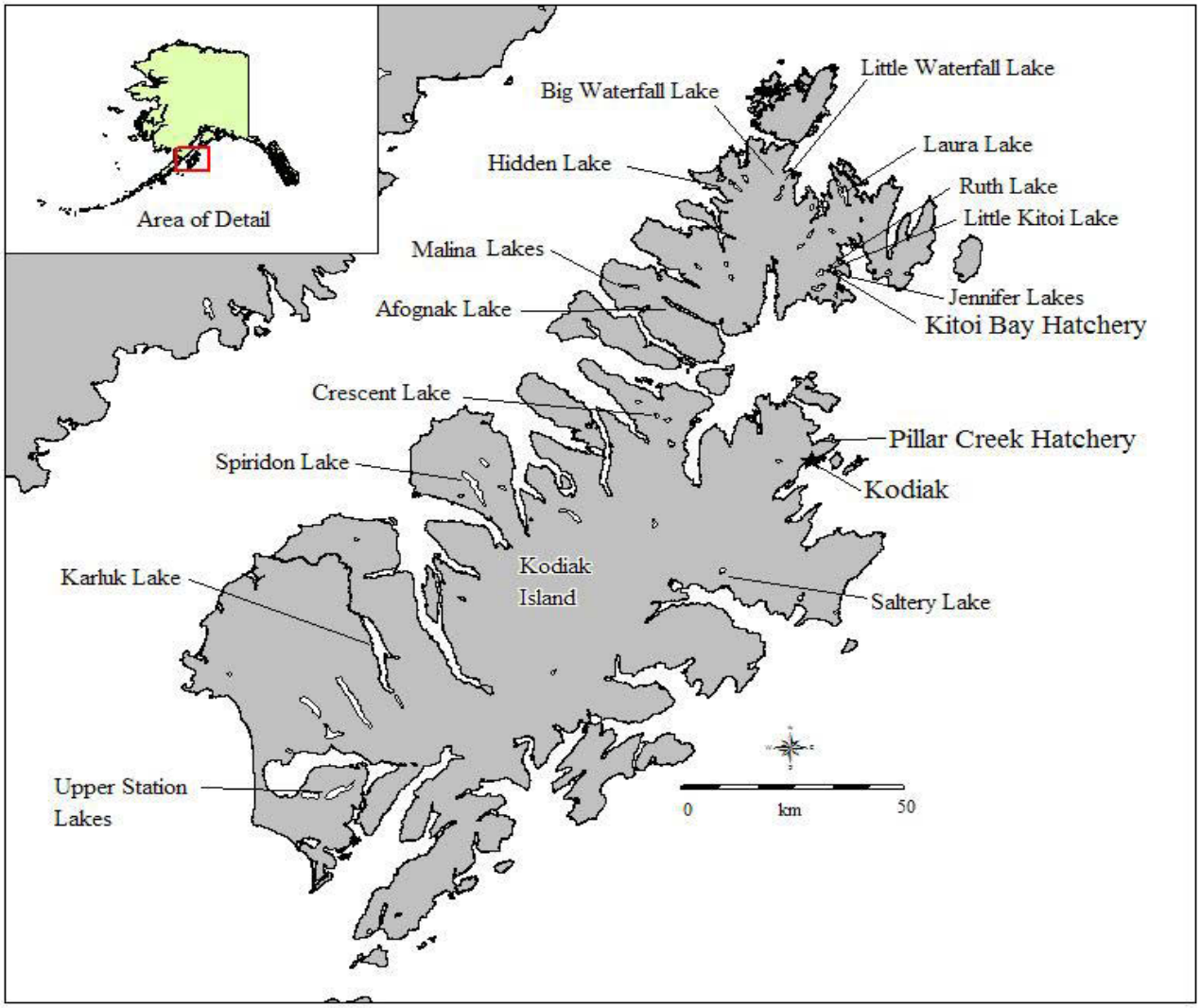


Figure 2.– Locations of PCH projects on Kodiak and Afognak Islands (Finkle and Byrne 2009).

These documents for PCH were reviewed to determine that they met the following guidelines:

- They are current.
- They are consistent with each other.
- They are an accurate description of current hatchery practices.

The PCH basic management plan was prepared in 1998 as part of the original hatchery permit, but has not been updated since then. Several subsequent permit alterations have been approved, most notably the additions of the Chinook salmon and rainbow trout programs, but the basic management plan has not been edited to incorporate those alterations. The basic management plan also includes operational details that have changed since it was written. For example, it describes rehabilitation projects at Malina and Laura lakes that have since concluded with the successful rehabilitation of those stock hatchery permit, and to describe the hatchery's current programs.

The production goals or limits in the hatchery permit and the 2009 annual management plan (Finkle and Byrne 2009) were compared to determine whether they were in agreement (Table 1). These were also compared to the numbers shown in the 2009 annual report of egg takes and releases.

The planned (annual management plan) and reported (annual report) production was well within the limits of the hatchery permit. The reported sockeye salmon egg take of 3.9 million is only about 20% of the permitted maximum of 20 million, and was short of the goal of 6.75 million, itself about a third of the permitted maximum. While a Chinook salmon egg take of the permitted maximum of 450,000 eggs was planned, only 67,000 eggs were actually collected. The shortfall in Chinook salmon eggs resulted in more rearing space being available, so additional coho salmon eggs were collected to allow productive use of that space. A total of 280,000 coho salmon eggs were taken, exceeding the goal of 110,000 in the annual management plan, but still well under the permitted maximum of 500,000. While there were differences between the planned and actual production, those differences were due to responsive adjustments in production goals that are well described in the annual management plan. The transfer of rainbow trout eggs and subsequent release of fingerlings was very close to the goals in the annual management plan and within the hatchery permit.

While the hatchery permit defines limits and the management plans guide hatchery operations, the specific actions of egg collection, transports, and releases are also additionally permitted under fish transport permits (FTP) (5AAC 41.001–41.100). An FTP is required for any collection, transport, or release of fish or eggs. The FTPs are an authorization to conduct the permitted activities, and they should be consistent with the hatchery permit and management plans. Before an FTP is issued, it is subject to an extensive review process to ensure that the action complies with all applicable policies and regulations. An FTP is issued for a fixed time period and includes both the specifics of the planned operation and any conditions added by ADF&G. For some programs that involve multiple facilities or transfers, a number of individual FTPs are needed for a single release of fish. Because of the complexity of some of the permit requirements, the reviews of FTPs are discussed in more detail in separate sections for each species, rather than in this overview. Similarly, the basic management plans and annual management plans typically include stipulations, prescribed practices, or include other details that are also reviewed later in this report.

PCH operates cooperative programs with ADF&G Division of Sport Fish to conduct stocking of Chinook salmon, coho salmon, and rainbow trout in areas along the Kodiak road system. The permitting for these programs differs somewhat from typical hatchery programs. FTPs for these programs are issued to the Division of Sport Fish rather than KRAA. These FTPs are based on the Statewide Stocking Plan (ADF&G 2010) rather than the hatchery permit and can have multiple release sites on a single FTP.

Salmon fishery enhancement efforts in each region are guided by comprehensive salmon plans. These plans are developed by regional planning teams composed of representatives from the department, fishermen's groups, and other stakeholders. The plans identify enhancement goals and the strategies to achieve those goals. The regional planning teams also review hatchery permit applications, permit alteration requests, and annual reports of hatchery performance, and provide recommendations to the commissioner.

The Kodiak Regional Comprehensive Salmon Plan Phase II Revision (1992) established goals and potential projects for salmon fishery enhancement in the Kodiak region. This plan, approved in April 1992, set harvest goals to be achieved by 2002 through research and improved management, enhancement projects and habitat protection. The 1992 revision superseded an earlier Phase II plan, approved in 1987, and a Phase I plan from 1984. The next phase (Phase III) of the Kodiak Regional Comprehensive Salmon Plan is in draft form, and is planned to be completed in 2011. The Phase III plan will set new harvest and enhancement goals and strategies for 2010 to 2030. The goals and strategies set forth in the current (1992 Phase II revision) plan are discussed later in the report.

General recommendations for permits and plans

1. The PCH basic management plan should be updated to reflect approved permit alterations and changes in PCH programs that have occurred since the plan was written.

Table 1.– Summary of (a) permitted capacity, (b) 2009 planned production, and (c) 2009 actual production at PCH.

(a) Hatchery Permit and permit alterations		Permitted Capacity (green eggs)			
Date	Description	Sockeye salmon	Coho salmon	Chinook salmon	Rainbow trout
5/1/98	Original hatchery permit/basic management plan 9 sockeye release sites using 3 stocks 7 coho release sites	20 million	0.5 million		
4/22/99	Added Big Waterfall Lake sockeye release site; no change to permitted capacity.				
1/5/2000	Allowed 0.3M Karluk Lake Chinook salmon eggs for release into Monashka Creek			0.3 million	
4/19/07	Allowed transfer of 65,000 eyed rainbow trout eggs from Ft. Richardson Hatchery for road system stocking projects in 20 lakes.				65,000
4/27/08	Increased rainbow trout capacity to 92,000 eggs				92,000
4/22/09	Increased Chinook salmon capacity to 0.45 million			0.45 million	
Current Permit		20 million	0.5 million	0.45 million	92,000

		Production (green eggs or juveniles)			
(b) 2009 Annual Management Plan		Sockeye salmon	Coho salmon	Chinook salmon	Rainbow trout
	2009 egg take goal	6.75 million	0.11 million	0.45 million	90,000
	2009 release goal	2.33 million	0.079 million	0.19 million	67,500
(c) 2009 Production (from 2009 Annual Report)		Sockeye salmon	Coho salmon	Chinook salmon	Rainbow trout
	2009 egg take	3.9 million	0.28 million	0.067 million	89,500
	2009 release	2.16 million	0.083 million	0.185 million	61,042

OVERVIEW OF POLICIES

Alaska hatchery programs are guided by plans and policies that protect salmon stocks and provide for effective fisheries management. The permitting process is closely linked to these policies, as fisheries managers, pathologists, and geneticists use them when making decisions about permits and hatchery management actions.

The State of Alaska ADF&G *Genetic Policy* (Davis et al. 1985) protects the genetic integrity of Alaska's wild and enhanced salmon stocks. The policy sets out restrictions and guidelines for stock transport, protection of wild stocks, and maintenance of genetic variance. This policy is used to guide the decisions of the ADF&G principal geneticist when reviewing FTPs. The PCH annual management plan also states that the *Genetic Policy* will be followed for all projects (Finkle and Byrne 2009).

The Alaska Fish Health and Disease Control Policy (5 AAC 41.080) is designed to protect fish health and prevent spread of infectious disease in fish and shellfish. The policy and associated guidelines are discussed in *Regulation Changes, Policies, and Guidelines for Fish and Shellfish Health and Disease Control* (Meyers 2010). It includes regulations and guidelines for wild fish transports, broodstock screening, disease histories, and transfers between hatcheries. The *Alaska Sockeye Salmon Culture Manual* (McDaniel et. al. 1994) also specifies practices and guidelines specific to the culture of sockeye salmon. As with *Genetic Policy*, these regulations and guidelines are used by the principal pathologist to review FTPs. The use of the fish health policy and guidelines is also mandated in the PCH annual management plans.

The Alaska Policy for the Management of Sustainable Salmon Fisheries (5AAC 39.222) mandates protection of wild salmon stocks in the management of salmon fisheries. Other applicable policies include the Policy for the Management of Mixed-Stock Salmon Fisheries (5AAC 39.220), the Salmon Escapement Goal Policy (5AAC 39.223), as well as local fishery management plans (5AAC 39.200). These policies require biologists to consider the interactions of wild and enhanced salmon stocks when managing hatchery returns as well as when reviewing hatchery management plans, FTPs, or hatchery permit alteration requests. All proposed FTPs are reviewed by the regional supervisors of the Divisions of Commercial Fisheries and Sport Fish, the deputy director of Commercial Fisheries, and the local Regional Resource Development Biologist before being considered for approval by the commissioner of ADF&G.

The guidance provided by these policies is sometimes very specific, and sometimes less so. For example, the fish health and disease policy mandates the use of an iodophor disinfectant on salmon eggs; a prescribed practice that requires little interpretation. In contrast, several policies prioritize the protection of wild stocks from the potential effects of salmon enhancement, without specifying how to assess those effects. These less specific policies provide the principles or priorities to be used in decision making, and require managers to use professional judgment to adhere to them. The permit review process, where those policy principles are used to approve or deny a specific action, is an example of that professional judgment at work.

Evaluating the hatchery program's consistency with those policies presents a similar challenge. For example, while it is clear that a key principle of Alaska policy is to protect wild salmon stocks, the interactions of enhanced and wild stocks are not completely understood. Examining a particular hatchery program and making an unambiguous determination that the principle of protecting wild stocks is being met is difficult under those circumstances. For that reason, in the initial rotation of evaluations, consistency with policy will be evaluated by (1) confirming that

permits have been properly reviewed using applicable policies, and (2) identifying information relevant to each program's consistency with state policies.

The policies governing Alaska hatcheries were divided into three categories: genetics, fish health, and fisheries management. Tables 2 through 4 summarize the key elements of these policies in each of those categories. These tables were then used as templates to organize and identify information on how each hatchery program fits within those policies. The completed templates are included in the separate sections on each species.

Table 2–.Key elements of the ADF&G *Genetic Policy*.

I. Stock Transport	
Use of appropriate local stocks	This element addresses Section I of *Genetic Policy*, covering stock transports. The policy prohibits interstate or interregional stock transports, and uses transport distance and appropriate phenotypic characteristics as criteria for judging the acceptability of donor stocks.
II. Protection of wild stocks	
Interaction with or impact on significant wild stocks	Priority is given to protection of wild stocks from harmful interactions with introduced stocks. Stocks cannot be introduced to sites where they may impact significant or unique wild stocks.
Identification of significant or unique wild stocks	Significant or unique wild stocks must be identified for each region and species. The policy's guidelines and justifications suggest that Salmon Enhancement Regional Planning Teams should establish criteria for determining significant stocks and recommend such stock designations.
Use of indigenous stocks in watersheds with significant wild stocks	A watershed with a significant wild stock can only be stocked with progeny from the indigenous stocks. The policy also specifies that no more than one generation of separation from the donor system to stocking of the progeny will be allowed.
Establishment of wild stock sanctuaries	Wild stock sanctuaries should be established on a regional and species basis. No enhancement activities would be allowed, but gamete removal would be permitted. The guidelines and justifications describe the proposed sanctuaries as gene banks of wild-type variability.
III. Maintenance of genetic variance	
Maximum of three hatchery stocks from a single donor stock	A maximum of three hatchery stocks can be derived from a single donor stock. Offsite releases, such as for terminal harvest, should not be restricted by this policy if the release sites are selected so that they do not impact significant wild stocks, wild stock sanctuaries, or other hatchery stocks.
Minimum effective population size	The policy recommends a minimum effective population size (Ne) of 400. It also recognizes that small population sizes may be unavoidable with Chinook and steelhead.
Use of all segments of donor stock run timing	To ensure all segments of the run have the opportunity to spawn, sliding egg take scales for donor stock transplants will not allocate more than 90% of any segment of the run for brood stock.
Genetics review of FTPs (5 AAC 41.010 – 41.050)	
Review by geneticist	Each application is reviewed by the geneticist, who then makes a recommendation to either approve or deny it. The geneticist may also add terms or conditions to the permit to protect wild or enhanced stocks.

Table 3.–Key elements of Alaska policies and regulations pertaining to fish health and disease.

Fish Health and Disease Policy (5 AAC 41.080; amended by Meyers 2010)	
Egg disinfection	Within 48 hours of taking and fertilizing live fish eggs or transporting live fish eggs between watersheds, all eggs must be treated with an iodine solution. This requirement may be waived for large scale pink and chum facilities where such disinfection is not effective or practical.
Hatchery inspections	Each fish hatchery or fish rearing facility must be inspected by the department's Fish Pathology Section at least once every other year. Additional inspections may be required in response to disease issues. The Pathology Section produces a written report summarizing the findings of each inspection.
Disease reporting	The occurrence of fish diseases or pathogens listed in 5AAC 41.080(d) must be immediately be reported to the department's Fish Pathology Section. The list of reportable pathogens was updated in Meyers (2010).
Pathology requirements for FTPs (5 AAC 41.010 – 41.050)	
Disease history	Applications for FTPs require either a complete disease history of the stock or a broodstock inspection and certification if the disease history is not available.
Isolation measures	Applications must also list the isolation measures to be used during transport, including a description of containers, water source, depuration measures, and plans for disinfection.
Broodstock inspection	Broodstock inspection and certification by pathology is required for stocks without a complete disease history.
Pathology review of FTPs	Each application is reviewed by the pathologist, who then makes a recommendation to either approve or deny it. The pathologist may also add terms or conditions to the permit to protect fish health. Transports of fish between regions are discouraged.
Sockeye Salmon Culture Policy	
Alaska Sockeye Salmon Culture Manual	The Sockeye Salmon Culture Policy is designed to control the occurrence of infectious hematopoietic necrosis virus (IHNV) in Alaska. The policy specifies the use of a virus-free water supply; rigorous disinfection procedures; compartmentalization of eggs and fry; and immediate destruction of infected fish, followed by disinfection. The *Alaska Sockeye Salmon Culture Manual* (McDaniel et al. 1994) prescribes procedures and fish culture practices developed to control IHNV.

Table 4.–Key elements of Alaska fisheries management policies and regulations relevant to salmon hatcheries and enhancement.

Sustainable Salmon Fishery Policy (5 AAC 39.222)	
I. Management principles and criteria	
Assessment of wild stock interactions/impacts	As a management principle, the effect of enhanced stocks on wild stocks should be assessed. Wild stocks should be protected from adverse impacts from enhanced stocks. (5AAC 39.222 (3)(c)(1)(D))
II. Use of effective management systems	
Assessment of wild stock impacts for new proposals	The Board of Fisheries should ensure that proposals for salmon enhancement assess and document any information needed for sustainable management of wild stocks. (5 AAC 39.222 (3)(J-K))
III. Conservative management	
Use of precautionary approach	Managers should use a conservative approach, taking into account any inherent uncertainty and risks. (5 AAC 39.222 (5))
Salmon Escapement Goal Policy (5 AAC 39.223)	
Establishment of escapement goals	Management of fisheries is based on scientifically-based escapement goals that result in sustainable harvests.
Mixed Stock Salmon Fishery Policy (5 AAC 39.220)	
Wild stock conservation priority	The conservation of wild stocks consistent with sustained yield is the highest priority in management of mixed-stock fisheries.
Fisheries management review of FTPs (5 AAC 41.010 – 41.050)	
Review by management staff	All proposed FTPs are reviewed by the regional supervisors of the Divisions of Commercial Fisheries and Sport Fish, the deputy director of Commercial Fisheries, and the local Regional Resource Development Biologist before being approved or denied by the commissioner of ADF&G. Department staff may recommend approval or denial of the permit, or recommend permit conditions.

HATCHERY PROGRAMS

EARLY-RUN SOCKEYE SALMON

Overview of program

The PCH early-run sockeye salmon program began in 1991, soon after the completion of the hatchery. Originally, three separate early-run stocks were cultured at PCH; two (Malina Lake and Laura Lake) as rehabilitation projects, and one (Afognak Lake) as an enhancement project. The Malina and Laura lakes projects were discontinued after 2002 after those stocks were successfully rehabilitated (McCullough and Clevenger 2002). The current early-run sockeye salmon program uses eggs collected at Afognak Lake to produce juveniles for stocking into Hidden, Big Waterfall, Little Waterfall, and Crescent lakes (Figure 3). Malina Lake is used as an alternate broodstock source in the event that poor escapement to Afognak Lake precludes an egg take (Figure 4).

Egg take and release goals used for these sockeye salmon projects are determined by the limnological conditions in the lakes to be stocked, but poor escapements into the donor systems may limit or preclude egg takes. A biological escapement goal range of 20,000 to 50,000 has been established for Afognak Lake (Nemeth et. al 2010), and a sustainable escapement goal range of 1,000 to 10,000 for Malina Lake (Nelson et. al 2005). The escapement goals and broodstock removal guidelines (Honnold and Byrne 2005) are used to determine the allowable number of fish that can be used for broodstock. In rare cases "backstocking," or planting of juveniles into the donor system, may be used to compensate for the removal of spawners at lower escapement levels. Egg takes are prohibited if the escapement is less than 50% of the lower bound of the escapement goal range. The egg take and release goals may also be adjusted in response to zooplankton populations in the lakes to be stocked. In 2009, 694,000 green eggs from 540 adults were collected at Afognak Lake.

Eggs collected at the remote sites are transported to PCH for incubation and initial freshwater rearing. Juveniles are stocked as both fry (about 0.4 g) and presmolt (about 8–12 g) into each of the stocked lakes. These juveniles complete their freshwater growth in the lakes before migrating to sea as smolts. The use of presmolt releases reduces the rearing time in the lakes, also reducing the dependence on the resident zooplankton populations (Schrof and Honnold 2003). In 2009, about 680,000 fry and presmolt were released into the four lakes. A total of over 18.5 million early-run sockeye salmon have been released by PCH between 1993 and 2009 (Appendix A1).

Returning adults are harvested in terminal fisheries near each lake outlet. Special Harvest Areas (SHA) have been designated at Foul Bay (Hidden Lake), Settlers Cove (Crescent Lake), and Waterfall Bay (Big and Little Waterfall lakes). The use of SHAs allows a directed harvest on these returns as well as the possibility of cost recovery. The run timing is similar to the Afognak and Malina lake donor stocks, beginning in late May, peaking in early June, and tapering off throughout July. Fishing openings are designed to allow complete harvest of adult returns while minimizing the incidental harvest of wild stocks. In 2009, 6,508 sockeye salmon were harvested in the Foul Bay SHA (Hidden Lake) and an additional 2,234 in the Waterfall SHA. No commercial fish tickets were reported from the Settlers Cove/Crescent Lake SHA, and the subsistence harvest statistics were not available for the 2009 Annual Report. An additional unknown number of early-run sockeye salmon from the lake stocking projects were likely caught outside of the SHAs. Between 1995 and 2009, over 620,000 early-run sockeye salmon have

returned to PCH barren lake stocking projects, with the vast majority harvested in commercial fisheries (Appendix A2). An unknown additional number also returned from other releases, such as to Malina and Afognak lakes.

Fish transport permits

The multiple donor stocks, release locations and life stages used for the early-run sockeye salmon program require a considerable number of FTPs (Figures 3 and 4). The egg takes are permitted under two separate FTPs, one for Afognak Lake and another for the Malina Lake alternate broodstock source. These FTPs permit the collection of up to 4.1 million green eggs and transport to PCH for incubation and rearing. An additional sixteen FTPs permit the release of juveniles into Hidden Lake, Big and Little Waterfall lakes, and Crescent Lake. Twelve of those FTPs are used for Afognak stock, one for each combination of release site and three lifestages (fry, fingerling, and presmolt). The Malina stock releases use only four FTPs to permit the same pattern of releases, as they each permit a combination of the three lifestages.

Each of these FTPs was issued after a review process to ensure that they complied with applicable policies. In his review of FTP 10-0116, the geneticist discussed the use of two stocks (Afognak and Malina) for the same project, and that hybridizing stocks was undesirable, but approved the permit because the use of barriered lakes reduced the possibility of spawning in the wild.

Prescribed practices

As noted earlier, the basic management plan is outdated and no longer reflects the current early-run sockeye salmon program. While Malina Lake is now an alternate broodstock source, the basic management plan still refers to it as a rehabilitation project. It also describes projects at Laura Lake and Sorg lakes that have been discontinued. The basic management plan also prescribes stocking excess juveniles back into Afognak Lake if survivals are high or if stocking levels in the other lakes are reduced due to zooplankton levels. This backstocking is not currently recommended or permitted. Because of these inconsistencies with current practices, the basic management plan should be updated to accurately describe the current PCH program.

The egg take and release goals for early-run sockeye salmon are identified in the annual management plan, and limits for each action are identified in the associated FTPs. However, these goals and limits are also adjusted in response to the escapement of the donor stocks and zooplankton levels in the lakes to be stocked. Egg take guidelines have been established to determine whether broodstock removals can be allowed, as well as the requirements for replacement backstocking. These guidelines are clearly defined in the annual management plan, and are also referred to in the FTPs for egg takes at Afognak Lake (09A-0044) and Malina Lake (10A-0116). These guidelines are currently being reevaluated. While the basic management plan contains similar guidelines for broodstock removals, they are not the same as listed in the annual management plan, and should be updated. The methods used to determine release goals based on zooplankton data are not as explicitly described, but the annual management plan and each FTP specify that releases will be adjusted based on recommendations from ADF&G staff. The basic management plan mentions that egg inventories may be constrained by limnological recommendations, but does not provide much additional detail. The history and methods used to determine annual stocking recommendations are described in Schrof and Honnold (2003).

The early-run program is intended to produce sockeye salmon for harvest, primarily in terminal areas. No escapement is required to the barriered, nonanadromous lakes used for the stocking projects, so all returning sockeye salmon are available for harvest. In some cases, barrier nets or weirs have been used to block access to the outlet streams, making fish more accessible to harvesters. The 2009 annual management plan calls for a barrier net at the mouth of Little Waterfall Creek, but not for the other early-run systems. The basic management plan states that adult weirs were in use at Hidden Lake, (Little) Waterfall Lake, and Sorg Lake, but not at Crescent Lake, to allow subsistence harvest in the outlet stream. The use of barrier nets or weirs at these sites is not discussed in the FTPs. The references to any adult weirs that are no longer in operation should be removed from the basic management plan.

Regional comprehensive salmon plan

The Kodiak Regional Comprehensive Salmon Plan Phase II Revision (1992) established goals and potential projects for salmon enhancement in the Kodiak region. Sockeye salmon were considered the highest priority species for enhancement, based on the preferences of local user groups. A list of potential long-term projects to improve sockeye salmon production was included in the comprehensive plan. All of the current early-run projects were identified as high-priority opportunities in that list. The plan's general strategy for sockeye salmon fishery enhancement focused on stocking barren lakes, lake fertilization, construction of fish passes, and similar projects that use natural habitats. PCH was expected to serve as a central incubation facility for those projects. Enhancement activities since the plan was completed have followed this general strategy.

The plan set an annual harvest objective of 1.7 million supplemental sockeye salmon by the year 2002. An average of 551,000 supplemental sockeye salmon was harvested annually between 1999 and 2008, short of the goal. Recently, sockeye salmon production has been limited by decreased zooplankton production in the lakes used for rearing, so meeting the production goals will require additional projects and/or improved conditions in the lakes that are presently used.

Consistency with policy

As described earlier, the key elements of state policies on salmon genetics, fish health and disease, and fisheries management were used to create a template to illustrate how the PCH early-run sockeye salmon program meets each policy element (Tables 7 through 9).

Genetics

The early-run sockeye salmon program uses Afognak Lake donor stock, with Malina Lake stock as an alternate broodstock source. Both of these stocks are local to the area. Straying assessments have been conducted at the Hidden and Waterfall lakes projects (Baer and Honnold 2002; Wadle and Honnold 2000) and found minimal to no straying occurring. Straying is minimized by intensive harvest of returning fish. Egg takes typically take place on just one or two days, but the broodstock collected in the lake represent a much wider range of the run timing.

The FTPs for these projects have been reviewed and approved by the geneticist, who discussed the hybridization of the two donor stocks: "Genetics does not support the hybridization of salmon stocks in an enhancement project. This permit will, however, authorize using two separate brood stocks, Afognak and Malina, for enhancement of this system because (1) eggs will be taken from a wild stock source, (2) no eggs will be taken from adults returning to the stocking site, and (3) no returning adults will spawn with local fish. KRAA must be prepared to

harvest all returning adults if commercial fishermen are unable or unwilling to do so. This permit is approved with the understanding that if for whatever reason that returning adults are not cleaned up then this permit will be canceled."

Fish health and disease

Pathology inspection reports from 2000 to 2008 document some fish health concerns, but most of those have been addressed. In the 2002 report, the pathologist noted concern about infectious hematopoietic necrosis virus (IHNV) transmission due to the proximity of starting troughs used for sockeye and Chinook; these problems had been resolved by the 2004 inspection. Incubation mortality associated with the use of remote egg takes was also noted, with temperature shock suspected as a factor. Delayed fertilization has been used for remote egg takes in the past, but switching to on-site fertilization appears to have improved survival. The trend appears to be towards improving practices, as the 2006 report says "…the facility is very clean and much more organized than I have ever seen it before."

Fisheries management

The management strategy for early-run sockeye salmon is designed to selectively harvest enhanced returns and minimize the incidental catch of wild stocks. Intensive terminal fisheries in designated SHAs are used to completely harvest fish returning to each release location. The program uses wild donor stocks, which are protected by escapement monitoring with weir counts and use of broodstock removal guidelines. Escapement goals have been established for both the Afognak Lake and Malina Lake donor systems. Recent escapements to Afognak Lake have been below or just above the lower end of the escapement goal range (Baer 2010). The Malina Lake alternative broodstock source was used in 2005 and 2006 in response to low escapements to Afognak Lake.

Recommendations for PCH early-run sockeye salmon program

1. KRAA should reevaluate the Waterfall Lakes projects, as recent adult returns have been poor. Limnological data from those lakes also suggests that they may be less than ideal for rearing sockeye salmon (unpublished data obtained from S. Schrof, ADF&G, Kodiak).

2. KRAA and the department should reconsider the use of annual stocking goals based on limnological conditions. Those goals are intended to be responsive and biologically defensible, which is desirable, but they also create planning complications. An alternative would be to maintain a conservative and consistent stocking level, continue monitoring, and evaluate the long-term results. The number, age composition, and size of outmigrating smolt could be used to evaluate the success of the stocking levels used.

3. KRAA and the department should investigate potential locations to establish an early-run sockeye salmon broodstock run to replace Afognak and Malina lakes. Alternatively, if the Afognak/Malina broodstock sources are to be used in perpetuity, that plan should be included in the basic management plan.

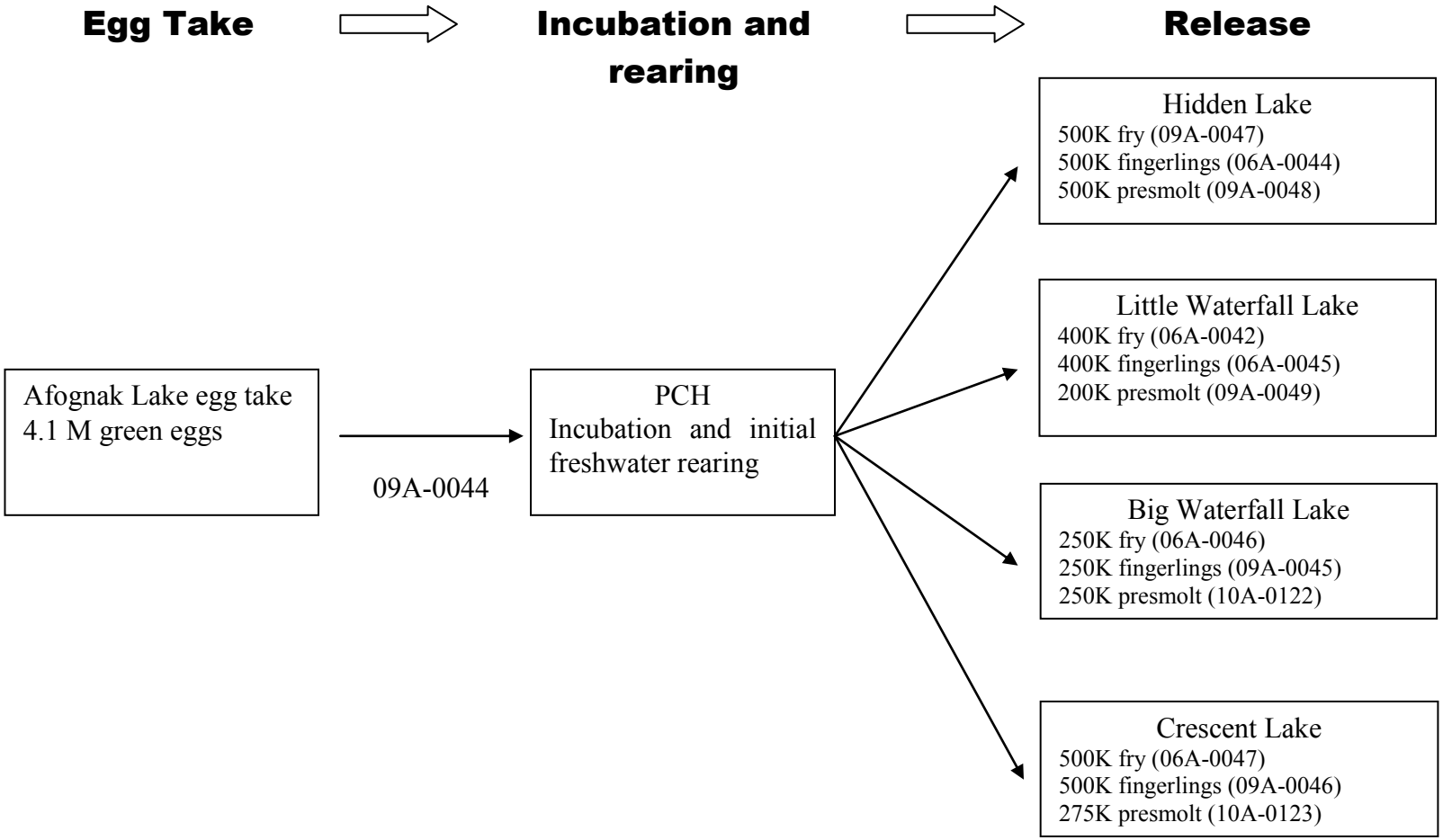


Figure 3.– Schematic of the PCH early-run sockeye salmon program and associated FTPs, using the preferred Afognak Lake stock.

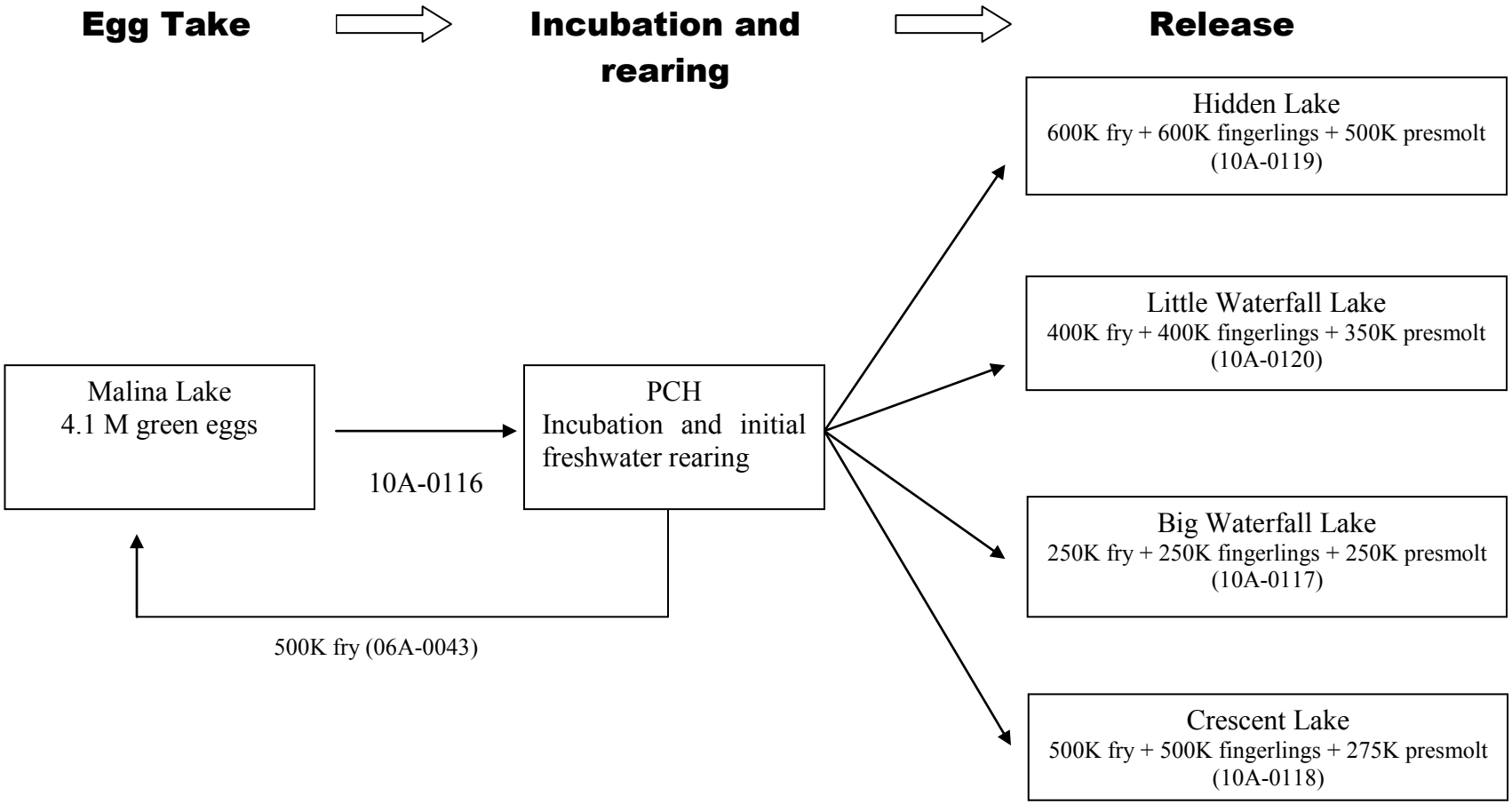


Figure 4.– Schematic of the PCH early-run sockeye salmon program and associated FTPs, using the alternate Malina Lake stock.

Table 5. The PCH early-run sockeye salmon program and its consistency with elements of the ADF&G *Genetic Policy* (See Table 2).

I. Stock Transport	
Use of appropriate local stocks	Both the Afognak and Malina Lakes donor stocks are local to the Kodiak region. Their early run timing allows a directed harvest on enhanced production while minimizing the incidental catch of other stocks.
II. Protection of wild stocks	
Interaction with or impact on significant wild stocks.	No significant wild stocks have been designated in the Kodiak region. Studies of straying (Baer and Honnold 2002; Wadle and Honnold 2000) at Hidden and Waterfall Lakes found minimal to no straying occurring.
Identification of significant or unique wild stocks	No significant wild stocks have been designated in the Kodiak region.
Use of indigenous stocks in watersheds with significant wild stocks	No significant wild stocks have been designated in the Kodiak region. "Barren" lakes with barriers to anadromous fish are used for the stocking projects; no wild stocks are present.
Establishment of wild stock sanctuaries	No wild stock sanctuaries have been designated in the Kodiak region.
III. Maintenance of genetic variance	
Maximum of three hatchery stocks from a single donor stock.	The donor stock is used only at PCH. The use of multiple off-site releases from a single donor stock is acceptable under the policy.
Minimum effective population size	Broodstock is collected from a large naturally-spawning population.
Use of all segments of donor stock run timing	Broodstock is typically collected in one or two days. The capture of fish holding in the lake probably collects fish from across a larger portion of the run timing, however.
Genetics review of FTPs (5 AAC 41.010 – 41.050)	
Review by geneticist	The FTPs for early-run sockeye have been reviewed and approved by the geneticist. The geneticist that the use of two stocks was not generally supported due to concerns about hybridization, but that the permit was approved because wild fish were used for broodstock and the resulting fish would not be spawned.

Table 6. The PCH early-run sockeye salmon program and its consistency with elements of Alaska policies on fish health and disease (See Table 3).

Fish Health and Disease Policy (5AAC 41.080; amended by Meyers 2010)	
Egg disinfection	Eggs are water-hardened in Betadine at 1:100 concentration for an hour, as recommended.
Hatchery inspections	The hatchery was inspected every other year from 2000 to 2008. The inspections reports noted some problems, but most have been addressed. No serious issues specific to early-run sockeye were noted. The most recent reports indicated that the hatchery was clean and well-organized, and that water supply problems are the hatchery's most significant issue.
Disease reporting	Some mortality from fusobacteria and *Pseudomonas* was reported in 2004.
Pathology requirements for FTPs (5AAC 41.010)	
Disease history	The 2008 pathology report indicated that the Afognak stock disease history was complete.
Isolation measures	The FTPs for the Afognak and Malina egg takes describe the isolation measures to be used. Eggs are taken in a remote egg take, placed in plastic bags containing UV-sterilized lake water, and transported in disinfected coolers. Additional disinfection with Betadine takes place at the hatchery.
Broodstock inspection	Broodstock inspection is not required, as the disease history of this stock is complete.
Pathology review of FTPs	The FTPs for the early-run sockeye salmon program have been reviewed and approved by the pathologist.
Sockeye Salmon Culture Policy	
Alaska Sockeye Salmon Culture Manual	The pathology inspection report from 2002 was critical of the methods used to isolate sockeye and chinook salmon, but recent reports indicate that appropriate sockeye culture techniques are being used. Sockeye salmon are incubated and reared in separate facilities from other species.

Table 7. The PCH early-run sockeye salmon program and its consistency with elements of Alaska fisheries management policies and regulations (See Table 4).

Sustainable Salmon Fishery Policy (5 AAC 39.222)	
I. Management principles and criteria	
Assessment of wild stock interactions/impacts	Straying studies (Baer and Honnold 2002; Wadle and Honnold 2000) found little or no straying into nearby systems. Broodstock removals are based on escapement counts into the donor system.
II. Use of effective management systems	
Assessment of wild stock impacts for new proposals	The early-run sockeye salmon program predates the Sustainable Salmon Fishery Policy, so is not a new proposal.
III. Conservative management	
Use of precautionary approach	Egg takes and releases are adjusted in response to donor stock escapement and limnological conditions.
Salmon Escapement Goal Policy (5 AAC 39.223)	
Establishment of escapement goals	No escapement is required for enhanced runs. Escapement goals have been set for the Afognak and Malina donor systems. Escapement is counted at weirs, and egg take goals are adjusted in response. Recent escapements to Afognak Lake have been below or just above the lower end of escapement goal ranges (Baer et al. 2009).
Mixed Stock Salmon Fishery Policy (5 AAC 39.220)	
Wild stock conservation priority	SHAs near each outlet stream are used to selectively target enhanced production and minimize incidental catch of wild stocks.
Fisheries management review of FTPs (5 AAC 41.010 – 41.050)	
Review by management staff	All FTPs for this project were reviewed and agreed to by fisheries management staff.

LATE-RUN SOCKEYE SALMON

Overview of program

The PCH late-run sockeye salmon program began in 1991, and originally used Upper Station Lake as a brood source to stock Spiridon Lake and Little Kitoi Lake. The broodstock source was changed to Saltery Lake in 1997, because the earlier run timing of that stock would reduce their overlap with returns of pink and chum salmon. While egg takes have been conducted at Saltery Lake since then, Little Kitoi Lake has also been stocked with the goal of developing a broodstock source to replace Saltery Lake (Figure 5). When egg takes at Little Kitoi Lake prove to be successful, they will be used as the preferred broodstock source, with Saltery Lake as an alternate site. To date, egg takes at Little Kitoi Lake have not been sufficient to meet egg take goals, so Saltery Lake has continued to serve as the primary source. In 2009, 3.86 million green eggs were collected from Saltery Lake, and an additional 676,000 were collected from Little Kitoi Lake.

The general techniques used for the late-run program are similar to the early-run program. Eggs are collected at remote sites, transported to PCH for incubation and initial rearing, and then transported to the stocking locations as fry or presmolts. After release into the lake, they complete their freshwater rearing and migrate to the sea as smolts. A smolt bypass system at Spiridon Lake allows outmigrating smolts to pass the lake's barrier falls.

Spiridon Lake is the primary stocking project for PCH late-run sockeye salmon, and is the largest of their lake planting projects. The egg take and release goals for this project are determined in part by the requirements of the Spiridon Lake management plan (Chatto 2000). Spiridon Lake lies within the Kodiak National Wildlife Refuge, and operation under the Spiridon Lake management plan is a condition of the project. Under this management plan, ADF&G biologists collect data on the lake's water quality and zooplankton abundance, smolt outmigration, juvenile stocking, and adult returns. Recommendations for juvenile stocking levels are made based on the results of that monitoring (Thomsen and Schrof 2009). The number of broodstock collected at the Saltery Lake remote eggtake is also subject to the broodstock removal guidelines discussed earlier.

Between 2000 and 2008, an average of about 1.8 million juveniles have been planted into Spiridon Lake each year. Late-run sockeye have also been stocked into Jennifer and Ruth lakes in Kitoi Bay, as well as into Little Kitoi Lake for the broodstock development program. The juveniles that are stocked into Little Kitoi Lake are collected by PCH crews and incubated to eye at PCH, but are transferred to KBH for final incubation and rearing. In 2009, about 1.48 million fry were released into Spiridon Lake, and almost 500,000 into Little Kitoi Lake, but no juveniles were released into Jennifer and Ruth lakes. Between 1993 and 2009, over 55 million juvenile late-run sockeye salmon have been released by PCH (Appendix A1).

The returning adults are harvested in both mixed-stock and terminal fisheries. Sockeye salmon returning to Spiridon Lake are harvested in mixed-stock fisheries in the Northwest Kodiak District and the Southwest Afognak Section ("Westside" fisheries). The Spiridon Bay SHA allows for the targeted harvest of any Spiridon sockeye salmon that are not harvested in those mixed-stock fisheries. The contribution of Spiridon Lake to Westside fisheries is estimated through scale pattern analysis (Nelson 1999; Foster 2010). Sockeye salmon returning to Ruth and Jennifer Lakes are harvested incidentally in terminal fisheries targeting salmon returning to KBH, and are taken along with returns to Little Kitoi Lake. In 2009, an estimated 155,000

sockeye salmon bound for Spiridon Lake were harvested in the Spiridon Bay SHA, the Northwest Kodiak District, and the Southwest Afognak Section (Foster 2010). While no estimates are available, minimal returns to Ruth and Jennifer lakes were expected, as those lakes were not stocked with brood year 2003 or 2004. Between 1995 and 2009, a total of more than 3.7 million late-run sockeye salmon returned to PCH lake-stocking projects at Spiridon Lake, Ruth Lake, and Little Kitoi Lake, of which almost all were harvested in commercial fisheries (Appendix A2).

Fish transport permits

The multiple egg sources, release sites, and release lifestages of the late-run sockeye salmon program require a number of FTPs (Figure 5). These FTPs were reviewed for consistency with the basic management plan, the 2009 annual management plan, and with the hatchery's recent activities.

The egg takes are covered under two separate FTPs, one for collection at Saltery Lake (09A-0052) and one for collection at Little Kitoi Lake (10A-0124). Both of these FTPs allow the collection of up to 11 million green eggs, which is considerably more than have historically been collected. The FTPs permit the eggtake and transport to PCH only; the releases are under separate FTPs. Most of those eggs are intended for Spiridon Lake production, with the remainder used for Ruth, Jennifer, and Little Kitoi lake releases. These FTPs were reviewed, and all reviewers agreed with the issuance of the permits. The geneticist noted that "while these fish are being transported over a fairly long distance, the fish are being released into areas with barren lake systems, so strays would not potentially influence wild populations." ADF&G Westward Region research staff also requested that the permits explicitly state that Little Kitoi Lake should serve as the primary brood source, and Saltery Lake only as a backup. Although the Little Kitoi Lake escapement has not to date been sufficient to meet eggtake goals, language to that effect is included in the project summaries for the FTPs. The FTPs also specify that the actual egg takes will depend upon escapement levels and stocking recommendations. Those requirements are outlined in the annual management plan, as well.

The releases of juveniles into Spiridon, Ruth, and Jennifer lakes are covered under six separate FTPs, two for each lake. The Spiridon FTPs allow the release of 7 million fry and 1 million presmolt (10A-0126) and 7 million fingerlings (09A-0050). As with the egg take FTPs, the permitted levels are maximums, and historical releases have been much smaller. While recent stocking trends have been lower (a maximum of 4.4 million fry in 2000), ADF&G recommendations for Spiridon Lake stocking in the 1990s consistently ranged from 5 to 7 million fry. The maximum number actually stocked was 6.7 million Upper Station Lake stock fry in 1997. While the limits in the two FTPs are additive (i.e. permitting the release of 7 million fry and 7 million fingerlings) they are intended to allow provide the flexibility to stock juveniles at a variety of lifestages, in various combinations. The actual stocking strategies are "dependent on annual ADF&G limnology analysis of Spiridon Lake, and subsequent stocking recommendations." These FTPs have been appropriately reviewed, and all reviewers agreed with issuance of the permits.

Prescribed practices

The egg take and stocking goals for late-run sockeye salmon projects are determined by zooplankton levels in the lakes to be stocked, but poor escapements into the donor system may limit or preclude egg takes. These requirements are clearly outlined in both the annual

management plan and in each FTP. While the basic management plan has prescribed egg take guidelines, they are not the same as the currently accepted guidelines in the annual management plan, and should be updated.

Regional comprehensive salmon plan

The Spiridon Lake project was listed as a high-priority project in the 1992 Kodiak Comprehensive Salmon Plan. When the plan was prepared, the project was in its initial stages of development, and the plan recommended it receive continued funding to reach full implementation. The project is now the largest sockeye salmon enhancement project in the region. The plan also recommended that the Saltery Lake weir continue operating. Operation of the Saltery Lake weir was resumed in 2008 with funding by KRAA, after being discontinued by ADF&G after the 2003 season (Dinnocenzo et al. 2010).

Consistency with policy

The policy summaries of the PCH late-run sockeye program are shown in Tables 10–12.

Genetics

The late-run program uses Saltery Lake stock, which is local to the region and was selected because its earlier run timing provides better separation from pink and chum salmon runs, reducing the incidental catch of those species. Straying of late-run sockeye salmon has not been studied directly, but studies of similar projects with early-run sockeye salmon found little straying (Baer and Honnold 2002; Wadle and Honnold 2000).

Fish health and disease

Relatively few fish health problems were noted in pathology reports from 2000 to 2008. The 2002 report noted inadequate separation of rearing Chinook and early-run sockeye salmon, mostly due to early hatching of the Chinook salmon. At the time of that inspection, the late-run sockeye salmon were still in incubators. According to more recent reports, the isolation measures have improved, and the main fish health concern is the quality and reliability of the water supply. That concern has been addressed by recent improvements to the hatchery pipeline. The use of onsite egg fertilization at Saltery Lake has improved survival over the delayed fertilization technique used in earlier years. All FTPs for the late-run program have been reviewed and approved by the pathologist.

Fisheries management

Late-run sockeye salmon returning to Spiridon Lake are caught in both Westside Kodiak mixed-stock fisheries and in terminal fisheries in the Spiridon Bay SHA. The contribution of Spiridon Lake to the Westside mixed-stock fisheries has been estimated through analysis of scale samples, using the distinctive scale pattern of Spiridon Lake sockeye salmon. From 1994 to 1997, scale sample analysis showed that an average of 41% of the Spiridon Lake sockeye salmon were harvested in the Spiridon Bay SHA (Nelson 1999). From 1998 to 2007, this proportion (41%) was used to estimate the number of additional Spiridon sockeye salmon harvested in the SW Afognak and NW Kodiak Districts (Foster 2010). The change in stock (from Upper Station Lake to Saltery Lake) and run timing may have altered the proportion of Spiridon-bound sockeye salmon caught in Westside mixed-stock fisheries. Despite the change in stock, the assumed proportion of Spiridon catch in the Westside fisheries did not change. In 2008 and 2009, a low abundance of Karluk Lake sockeye salmon altered the usual fishing pattern and stock

composition. In these years, the proportion of Spiridon Lake sockeye salmon in the catch was estimated directly through scale sample analysis (Foster 2010).

Escapement goals have been established for the Saltery Lake donor system, and escapement is monitored with aerial surveys or weir counts. The number of broodstock that can be taken from Saltery Lake is determined by the escapement using broodstock removal guidelines detailed in the annual management plan. Those guidelines are currently being reevaluated.

Recommendations for PCH late-run sockeye salmon program

1. The department should continue to investigate the best way to determine the contribution of Spiridon Lake sockeye salmon to Westside fisheries. One possible way is to continue annual scale pattern-based contribution estimates/run reconstructions of Spiridon Lake returns. However, using scale pattern analysis alone may not be reliable and an otolith marking program or other means of identifying Spiridon sockeye salmon should be considered. Because otolith marking and sampling would represent a considerable expense for both KRAA and the department, they should work together to determine the costs and benefits of any such programs.

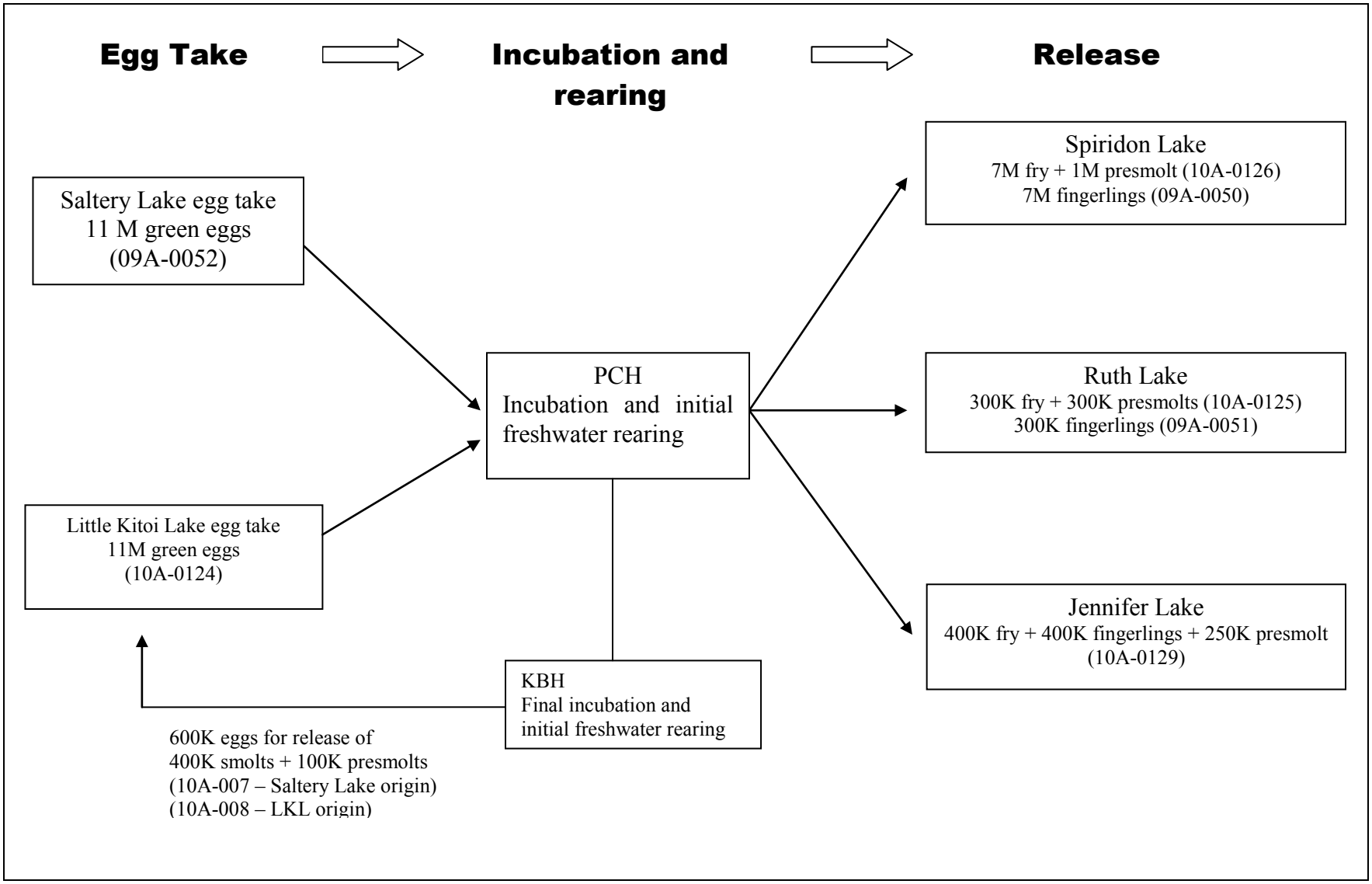


Figure 5.–Schematic of PCH late-run sockeye salmon program and associated FTPs.

Table 8.–The PCH late-run sockeye salmon program and its consistency with elements of the ADF&G *Genetic Policy* (See Table 2).

I. Stock Transport	
Use of appropriate local stocks	The Saltery Lake donor stock was selected for its run timing, which allows better segregation from nearby pink and chum salmon stocks, and reduces incidental harvest of those species. The stock is local to the Kodiak region, though the transport distances are fairly long.
II. Protection of wild stocks	
Interaction with or impact on significant wild stocks.	No significant wild stocks have been designated in the Kodiak region. The lakes selected for stocking have anadromous barriers, so no wild stocks are present. Straying is controlled through intensive harvest in the SHA and by allowing returning fish access to Telrod Creek.
Identification of significant or unique wild stocks	No significant wild stocks have been designated in the Kodiak region area.
Use of indigenous stocks in watersheds with significant wild stocks	No significant wild stocks have been designated in this area. The lakes selected for stocking have anadromous barriers, so no wild stocks are present.
Establishment of wild stock sanctuaries	No wild stock sanctuaries have been designated in the Kodiak region.
III. Maintenance of genetic variance	
Maximum of three hatchery stocks from a single donor stock.	The donor stock is used only at Pillar Creek and Kitoi Bay Hatcheries. The use of multiple off-site releases from a single donor stock is acceptable under the policy.
Minimum effective population size	Egg takes from Saltery Lake are from a large natural population. The effective population size will also be large when Little Kitoi Lake becomes primary broodstock source.
Use of all segments of donor stock run timing	Egg takes are typically completed in two to four one-day lots over a one to two week period. Broodstock are collected over a one to two week period prior to and during egg takes, from fish holding in the lake, which may aggregate spawners from different portions of the run.
Genetics review of FTPs (5 AAC 41.010 – 41.050)	
Review by geneticist	Each of the FTPs for the late-run sockeye program have been reviewed and agreed to by the principal geneticist.

Table 9.–The PCH late-run sockeye salmon program and its consistency with elements of Alaska policies on fish health and disease (See Table 3).

Fish Health and Disease Policy (5AAC 41.080; amended by Meyers 2010)	
Egg disinfection	Eggs are disinfected with Betadine when they are loaded into incubators at PCH.
Hatchery inspections	The hatchery was inspected every other year from 2000 to 2008. The inspections reports noted some problems, but most have been addressed. No serious issues specific to late-run sockeye salmon were noted. The most recent reports indicated that the hatchery was clean and well-organized, and that water supply problems are the hatchery's most significant issue.
Disease reporting	Some mortality from bacterial gill disease and flavobacteriosis was reported in 2008.
Pathology requirements for FTPs (5AAC 41.010)	
Disease history	The Saltery Lake stock disease history is complete, and begins in 1986.
Isolation measures	As described in FTP: "Eggs from 22 to 31 females will be pooled in a plastic bag, loaded in UV-sterilized lake water. Each bag will be placed in a Betadine-disinfected cooler, with ice to maintain stable temperature. Upon arrival at the hatchery, two to three bags will be loaded into each incubator; each incubator will be filled with a 1: 100 solution of buffered Betadine, with flow temporarily shut off to allow bags to be disinfected prior to decanting of eggs."
Broodstock inspection	Broodstock inspection is not required, as the disease history of this stock is complete.
Pathology review of FTPs	The FTPs for the late-run sockeye program have been reviewed and approved by the pathologist.
Sockeye Salmon Culture Policy	
Alaska Sockeye Salmon Culture Manual	The pathology inspection report from 2002 was critical of the methods used to isolate sockeye and chinook salmon, but recent reports indicate that appropriate culture techniques are being used. Sockeye salmon are incubated and reared in separate facilities from other species.

Table 10.–The PCH late-run sockeye salmon program and its consistency with elements of Alaska fisheries management policies and regulations (See Table 4).

Sustainable Salmon Fishery Policy (5 AAC 39.222)	
I. Management principles and criteria	
Assessment of wild stock interactions/impacts	A crew stationed at the Telrod Cove field camp monitors the commercial fishery in the SHA and escapement to Telrod Creek. Pink and chum salmon escapement to the Spiridon River drainage is monitored with aerial surveys.
II. Use of effective management systems	
Assessment of wild stock impacts for new proposals	The PCH late-run sockeye salmon program predates the Sustainable Salmon Fishery Policy, so is not a new proposal. Stocking of Spiridon Lake, within the Kodiak National Wildlife Refuge, required an environmental assessment and ongoing monitoring plan, including harvest and escapement monitoring.
III. Conservative management	
Use of precautionary approach	Stocking levels are determined through limnological monitoring, and are usually well under the maximum permitted by FTPs.
Salmon Escapement Goal Policy (5 AAC 39.223)	
Establishment of escapement goals	Escapement goals are not used for enhanced runs, as they are intended to be completely harvested. Saltery Lake has an established escapement goal, and escapement is monitored with weir counts. Broodstock removals must follow guidelines used to ensure adequate escapement to the donor system.
Mixed Stock Salmon Fishery Policy (5 AAC 39.220)	
Wild stock conservation priority	A substantial portion of Spiridon-bound sockeye salmon are caught in Westside mixed-stock fisheries, which are managed to protect wild stocks, most notably Karluk sockeye salmon. Catch composition is estimated with scale pattern analysis (Foster 2010).
Fisheries management review of FTPs (5 AAC 41.010 – 41.050)	
Review by management staff	All FTPs were reviewed and approved by fisheries management staff. They recommended that Little Kitoi Lake should serve as the primary brood source, with Saltery Lake serving as a backup.

COHO SALMON

Overview of program

The coho salmon program at PCH (Figure 6) is primarily intended to enhance sport fishing opportunities along the Kodiak road system, and is operated in cooperation with the ADF&G Division of Sport Fish. The program began in 1991 using Monashka Creek stock, with the resulting juveniles stocked back into Monashka Creek. In 1993, PCH began using Buskin River stock for stocking into Kodiak road system lakes, a program that was transferred from KBH.

Adult coho salmon are captured in Buskin Lake for use as broodstock, and local schoolchildren assist in the eggtake as part of an educational program. The egg take goal of 110,000 eggs requires less than 50 pairs of coho salmon. The egg take occurs in late October, and after collection at Buskin Lake, the eggs are transferred to PCH for incubation and initial freshwater rearing. In 2009, PCH reported collecting 277,500 green eggs from 116 Buskin Lake coho salmon, and 2,500 of those were used for classroom incubation projects.

The stocking strategy is determined to some degree by the amount of rearing space available. Most of the releases are of fingerlings, but some juveniles may be raised to smolt stage depending the on the rearing space available. A separate complex of raceways designated for sport fish cooperative projects is used for both the coho and Chinook salmon programs at PCH. Priority is given to rearing Chinook salmon; coho are substituted as necessary to offset unexpected shortfalls in production of Chinook smolts. Eight lakes are used for stocking, three of which are landlocked. Juveniles released into nonlandlocked lakes outmigrate after completing their freshwater rearing; those in landlocked lakes contribute to sport fishing in those lakes. Additional juveniles can also be released into Pillar Creek and into Monashka Creek. A total of 83,000 fingerling coho salmon were released into Kodiak road system lakes in 2009. Since 1993, PCH has released a total of over 1.3 million coho salmon (Appendix A1).

Returning adults are primarily harvested in sport and subsistence/personal use fisheries along the Kodiak road system. While accurate estimates of the total return are not available, the program has a goal of producing 1,600 coho salmon for harvest.

In 2010, a portion of the KBH coho salmon program was transferred to PCH. KBH had stocked Katmai Lake with presmolts since 1987, but the access trail to the lake has deteriorated, making transport of juveniles via the trail impossible. Under the new plan, about 40,000 Big Kitoi Creek stock coho salmon eggs from KBH are transferred to PCH for final incubation and rearing. The resulting juveniles can then be aerially stocked in Katmai Lake at the same time that PCH is stocking other lakes with sockeye salmon presmolts. This project is intended to benefit local fisheries.

Fish transport permits

The FTPs used for the Buskin Lake stock program are issued to the ADF&G Division of Sport Fish, as the program is operated cooperatively between ADF&G and KRAA.

The FTP for the egg take at Buskin Lake (04A-0004) allows for the collection of 75 spawning pairs of coho salmon, for the purpose of obtaining approximately 265,000 eggs. This FTP is unusual in that it specifies the maximum number of spawning fish to be collected, rather than the maximum number of eggs. This limit is appropriate because the egg take is small and remote, and it may be difficult to accurately estimate the number of eggs collected. PCH is permitted for

500,000 eggs so the limits in the FTP are well under the hatchery's permitted capacity. This FTP was appropriately reviewed, and all reviewers agreed to the permit. However, comments on the FTP contained somewhat contradictory recommendations. The commercial fisheries regional supervisor noted that "previous egg takes have resulted in more juvenile fish than necessary for the various stocking projects (due to taking extra eggs for possible below-average hatchery survivals)…" and that the number of eggs taken should correspond to the number of juveniles to be released. In contrast, the geneticist recommended using a minimum of 50 pair for the egg take to ensure diversity, and randomly culling any excess eggs or fish. The actual number of spawning pairs used has typically been less than 50, and has been determined by stocking goals.

An additional five FTPs permit the releases into Kodiak area lakes (Figure 6). One FTP (04A-0006) permits releases into Dark, Island, Mission, Potato, and Mayflower lakes. Five additional FTPs permit releases into landlocked lakes, using a separate FTP for each release site. The FTPs for both the anadromous and landlocked lake releases allow stocking at various sizes, from one to thirty grams, which allows PCH to use available rearing capacity to best advantage. The FTPs for releases into Monashka Creek (10A-0010) and Pillar Creek (10A-0009) allow only smolts, however. These FTPs were appropriately reviewed, and all reviewers agreed to the permits.

In 2010, KBH transferred the Katmai Lake portion of their coho salmon program to PCH. The stocking of Katmai Lake is permitted with FTP 10A-0115. This permit allows the transfer of up to 40,000 Big Kitoi Creek stock eggs from KBH to PCH for incubation and rearing, and the stocking of the resulting juveniles into Katmai Lake. The original application for this permit requested a limit of 60,000 eggs, but that limit was reduced to 40,000 due to uncertainty over the rearing capacity of Katmai Lake. It was also recommended that the lake's rearing potential be evaluated before approval of larger releases. Since 1991, about 15,000 presmolts have typically been released into Katmai Lake each year; recent goals have been for a release of 30,000 (Schrof and Aro 2009). While Katmai Lake is an approved release site for KBH, it has not been approved for PCH, so a permit alteration is needed for further PCH releases to Katmai Lake.

Prescribed practices

The cooperative ADF&G/PCH coho salmon program uses Buskin Lake as a broodstock source, and broodstock removals follow guidelines laid out in the annual management plan. The Buskin system has an escapement goal range of 3,200 to 7,200 (Honnold et al. 2007), and the escapement is monitored with weir counts. While a low escapement into the Buskin system could prevent an eggtake under the guidelines, escapements have consistently been more than adequate, especially with the small number of broodstock required for the program.

Regional comprehensive salmon plan

The 1992 Kodiak Comprehensive Salmon Plan identified both the road system stocking and the Buskin River weir as high-priority coho salmon projects in the Northeast Kodiak District. The plan noted that coho salmon runs along the road system were facing both increasing sport fishing pressure and declining escapements. The PCH program is designed to provide coho salmon for sport fisheries in the Kodiak area, helping to alleviate that problem. The specific stocking goals for this program are also identified in the Statewide Stocking Plan.

Consistency with policy

The policy summaries of the PCH coho salmon program are shown in Tables 13–15.

Genetics

The coho salmon program uses Buskin River stock, which is local to the area and has been used previously in other local enhancement projects. The donor stock is from a lake system similar to those used for stocking, so is probably well-adapted for the release sites. The native population provides for a large effective population size, but the small number of broodstock used would preclude its use for backstocking or broodstock development. The FTPs used for the program have been reviewed and approved by the geneticist, and no concerns were raised.

Fish health and disease

Coho salmon are incubated in a room separate from those used for sockeye stocks. According to pathology inspection reports, eggs are not disinfected immediately after fertilization and transport, but are disinfected at picking. Pathology inspection reports have indicated few fish health problems with PCH coho salmon. All FTPs have been reviewed and approved by the pathologist, with no concerns raised.

Fisheries management

The primary purpose of the coho salmon program is to provide sport fishing opportunities, and most returning adults are harvested in sport and subsistence/personal use fisheries. Coded wire tagging is not used, and harvest estimates are based on the statewide harvest survey and subsistence harvest reports. No escapement goals are used for enhanced runs, but an escapement goal has been set for the Buskin River broodstock source. The Buskin River escapement is counted at a weir, and broodstock removal guidelines determine the number that can be removed from the system.

Recommendations for Pillar Creek hatchery coho salmon program

1. KRAA should submit a permit alteration request to add Katmai Lake as a release site for PCH coho salmon.

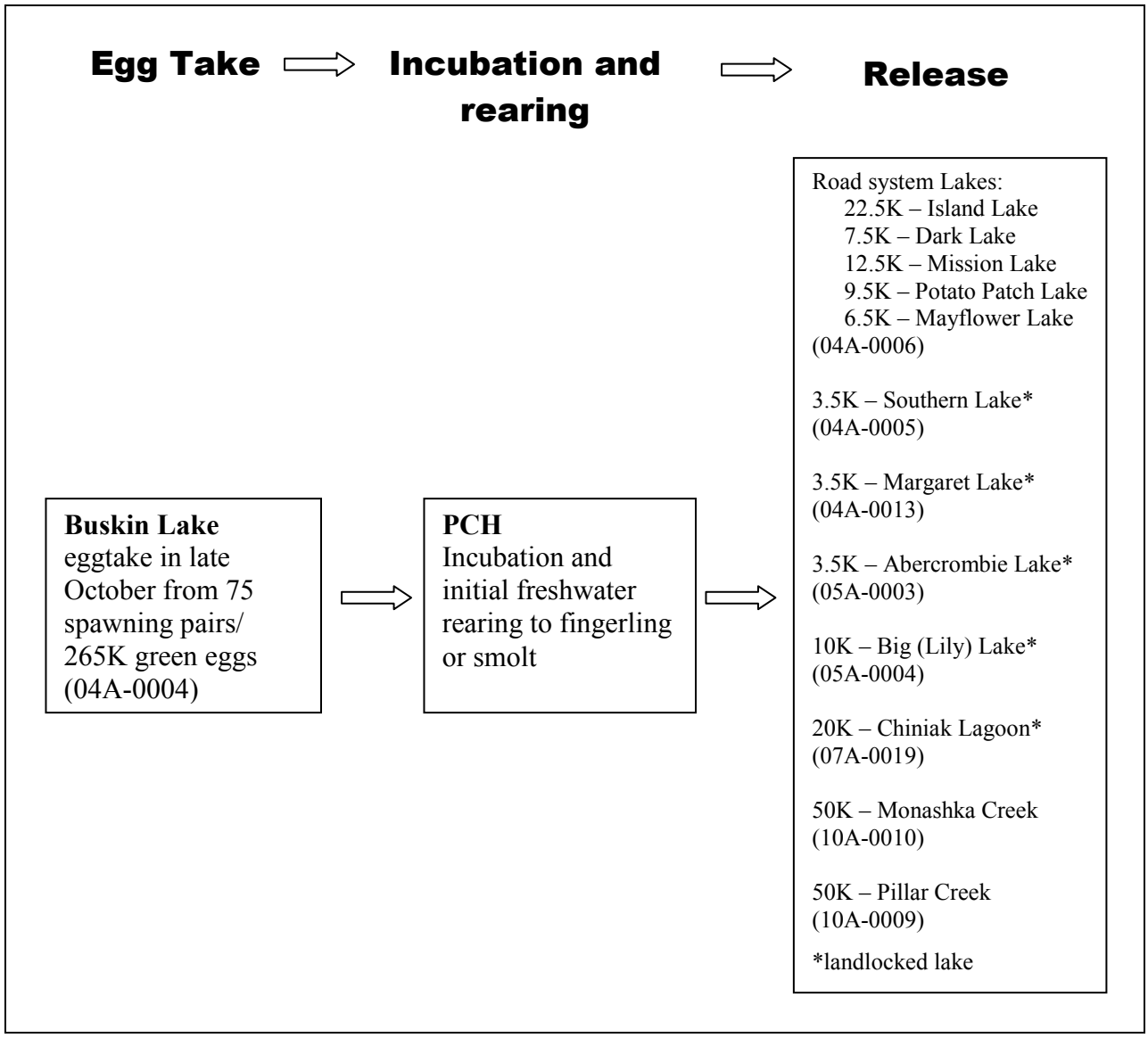


Figure 6. –Schematic of the PCH coho salmon program and associated fish transport permits.

Table 11. The Pillar Creek hatchery coho salmon program and its consistency with elements of the ADF&G *Genetic Policy* (See Table 2).

I. Stock Transport	
Use of appropriate local stocks	Buskin Lake, the donor system, is on the Kodiak road system, as are most of the release sites. The release sites are similar to the donor system (i.e. lake systems) so this stock is likely well adapted for them. The stock has also been used in previous enhancement efforts in the area.
II. Protection of wild stocks	
Interaction with or impact on significant wild stocks	No significant wild stocks have been designated in the Kodiak region. No native salmon stocks are present in the lakes used for stocking.
Identification of significant or unique wild stocks	No significant wild stocks have been designated in the Kodiak region.
Use of indigenous stocks in watersheds with significant wild stocks	No significant wild stocks have been designated in the Kodiak region. No native salmon stocks are present in the lakes used for stocking.
Establishment of wild stock sanctuaries	No wild stock sanctuaries have been designated in the Kodiak region.
III. Maintenance of genetic variance	
Maximum of three hatchery stocks from a single donor stock	The donor stock is used only at PCH. The use of multiple off-site releases from a single donor stock is acceptable under the policy.
Minimum effective population size	The program uses broodstock from a large natural population, which provides for a large effective population size. The relatively small number of fish collected (~50 pairs) would preclude its use for broodstock development, however.
Use of all segments of donor stock run timing	Broodstock are usually collected on a single day due to the small size of the program. However, the late-season collection in the lake probably collects holding fish from throughout the run timing.
Genetics review of FTPs (5 AAC 41.010 – 41.050)	
Review by geneticist	Each of the FTPs necessary for the PCH coho salmon program have been reviewed and agreed to by the principal geneticist.

Table 12. The PCH coho salmon program and its consistency with elements of Alaska policies on fish health and disease (See Table 3).

Fish Health and Disease Policy (5AAC 41.080; amended by Meyers 2010)	
Egg disinfection	Eggs are not disinfected at water hardening, according to pathology inspection reports. However, eyed eggs are disinfected at egg-pick.
Hatchery inspections	Hatchery inspections were conducted every other year from 2000 to 2008. The reports noted very few problems or issues specific to coho salmon.
Disease reporting	Some mortality due to bacterial cold water disease, *Trichodina*, and *Saprolegnia* was reported in 2004.
Pathology requirements for FTPs (5AAC 41.010)	
Disease history	The coho salmon disease history was reported as complete in pathology inspections from 2000 to 2008.
Isolation measures	As described in FTP: "The eggs will be fertilized on site in plastic buckets. The eggs will be transported to the Pillar Creek Hatchery via truck, a distance of approximately 8 miles. Coho fingerlings and presmolt will be loaded into an oxygenated aluminum tank on a hatchery truck, and trucked to the various road system lakes."
Broodstock inspection	Broodstock inspection is not required, as the disease history of this stock is complete.
Pathology review of FTPs	The FTPs for the program have been reviewed and approved by the pathologist, and no fish health concerns were identified.

Table 13. The PCH coho salmon program and its consistency with elements of Alaska fisheries management policies and regulations.

Sustainable Salmon Fishery Policy (5 AAC 39.222)	
I. Management principles and criteria	
Assessment of wild stock interactions/impacts	The number of broodstock that can be used is determined by established escapement-based guidelines. The escapement to Buskin Lake is counted at a weir, and broodstock is collected after having passed through the weir.
II. Use of effective management systems	
Assessment of wild stock impacts for new proposals	The PCH coho salmon program predates the Sustainable Salmon Fishery Policy, so is not a new proposal.
III. Conservative management	
Use of precautionary approach	The magnitude of possible adverse effects is limited by the use of small releases into lakes without native salmon runs.
Salmon Escapement Goal Policy (5 AAC 39.223)	
Establishment of escapement goals	No escapement goals are set for the enhanced runs. Buskin Lake has an established escapement goal, and escapement is monitored with weir counts. Broodstock removals must follow guidelines used to ensure adequate escapement to the donor system.
Mixed Stock Salmon Fishery Policy (5 AAC 39.220)	
Wild stock conservation priority	Most harvest of returning adults is in terminal sport fisheries that target the enhanced runs, rather than in mixed-stock fisheries.
Fisheries management review of FTPs (5 AAC 41.010 – 41.050)	
Review by management staff	All FTPs were reviewed and approved by fisheries management staff.

CHINOOK SALMON

Overview of program

The Chinook salmon program at PCH (Figure 7) is a cooperative project between KRAA and ADF&G, and is designed to enhance recreational fishing in the Kodiak area. Under this agreement, KRAA is compensated for providing aquaculture services, which includes spawning, incubating and rearing juveniles to smolt size. The department is responsible for collecting brood stock and imprinting/releasing smolts.

The program began in 2000 with the first egg take of 124,000 eggs from the Karluk River donor stock. By 2005, adult returns to the Monashka Creek stocking location were sufficient to allow an egg take, and subsequent egg takes have taken place there. Additional broodstock may be taken from the American and Olds rivers if necessary, as those streams are also stocked. Initially, the hatchery was permitted to collect 300,000 eggs, but a permit alteration in 2009 increased the permitted capacity to 450,000 eggs. As the program has developed, a raceway facility has been built at Monashka Creek to provide space to hold broodstock and rear juveniles. In 2009, PCH collected almost 67,000 eggs at Monashka Creek.

The egg takes are conducted in mid- to late August, and the eggs are transported to PCH for incubation and initial freshwater rearing. Both the Sport Fish raceways at PCH and the Monashka Creek raceways can be used for rearing, which provides flexibility to achieve ideal rearing densities and manage water use. The juveniles are reared to the smolt stage, and released in Monashka Creek, the Olds River, and the American River in May and June. Smolts being held at the Monashka Creek raceways can be released directly into the creek; those released into the American and Olds Rivers are held in pens for two weeks before release to ensure imprinting. In 2009, PCH released 79,000 smolts into Monashka Creek, 51,000 into the American River, and 54,000 into the Olds River. More than 750,000 smolts have been released between 2002 and 2009 (Table 5).

The planned releases are projected to produce a total of about 2,600 returning adults, based on an assumed marine survival of 1.4%. The planned release levels have not been achieved yet, so actual returns have been substantially lower, averaging 265 between 2004 and 2009. Returning Chinook salmon are assumed to be primarily harvested in sport fisheries accessible from the Kodiak road system. The return timing is in June and early July, before most commercial fisheries, so commercial harvest is likely minimal. Between 2004 and 2009, an estimated total of 1,769 adult Chinook salmon have returned from PCH Chinook salmon releases, of which 649 have been harvested in sport fisheries (Table 6).

Fish transport permits

Because it is a cooperative program, the FTPs for the PCH Chinook salmon program are issued to the ADF&G Division of Sport Fish, rather than to KRAA. One FTP (05A-0050) permits the egg take at Monashka Creek, incubation and rearing at PCH, and smolt release at Monashka Creek (Figure 7). An additional FTP (10A-0128) permits the movement of juveniles from PCH to the Monashka Creek complex, as may be required to best use available rearing space. Two FTPs permit "backup" egg takes at the American (10A-0159) and Olds (10A-0161) rivers, with incubation and rearing at PCH, but do not include release sites. While a maximum of 450,000 eggs can be collected under each FTP, the total number cannot exceed the permitted capacity of

450,000. This combination effectively allows PCH to take their full capacity at any combination of the three possible sites.

The American River and Olds river releases are permitted under separate FTPs (07A-0017 for the American River and 07A-0020 for the Olds River). These FTPs each allow the release of the "smolt resulting from an egg take, which allows for the collection of up to 450,000 eggs," but that "it is unlikely that more than 100,000 smolt would be available for stocking at the release site." As with the egg take FTPs, these FTPs are intended to provide flexibility in stocking options by permitting the maximal release at each individual site.

Two FTPs (04A-0011 and 04A-0012) that permitted the emergency release of juvenile Chinook salmon to Island and Abercrombie lakes expired in 2006. These FTPs were intended to provide an option for emergency release of rearing Chinook smolts in the event of water system problems at PCH. In 2007, about 123,000 juvenile Chinook were released into those two lakes (113,000 into Island Lake, 10,000 into Abercrombie Lake).

Prescribed practices

There are several pathology-related requirements for the PCH Chinook salmon program. The permit alteration that allowed the initiation of the PCH program required that the Chinook salmon be incubated and reared in complete isolation from sockeye salmon. This requirement is intended to prevent the possible transmission of IHNV between stocks. Pathology reports from 2002, one of the initial years of the program, criticized the adequacy of the isolation. Later inspection reports found that the isolation practices had been improved and was adequate. The FTPs also require testing and family tracking for bacterial kidney disease, and any positive family groups must be destroyed. Incidence of bacterial kidney disease in PCH Chinook salmon has been low.

Regional comprehensive salmon plan

The 1992 Kodiak Comprehensive Salmon Plan set a goal of producing 3,000 supplemental Chinook salmon for harvest by 2002. The PCH program was intended to fulfill that goal. The program is projected to produce between 2,000 and 3,000 Chinook salmon for harvest in locations that are readily available to sport anglers. The specific stocking goals for this program are also identified in the Statewide Stocking Plan.

Consistency with policy

The policy summaries of the PCH Chinook salmon program are shown in Tables 16–18.

Genetics

The PCH program uses the Karluk River stock, which is one of few Chinook salmon stocks local to the Kodiak region. In his review of FTP 07A-0020, allowing releases into the Olds River, the geneticist summarized his reasons for approving the FTP: "Generally, proposals to stock salmon into nonnatal anadromous streams go under extra scrutiny under the genetics policy. In this case, a few factors mitigate the risk: (1) Karluk-origin Chinook are already being stocked into anadromous streams on the north end of Kodiak Island at Monashka Creek. (2) Although these new stocking locations are outside Monashka Bay, the closest and most likely place these fish would stray to is to the other stocked locations or the hatchery. Straying to these areas would not pose a genetics concern. (3) The stock proposed comes from the closest location where wild

Chinook salmon are found (Karluk). (4) The project is recommended in the Kodiak Comprehensive Salmon Management Plan and has support from Sport Fish staff."

Fish health and disease

The permit alteration authorizing the PCH Chinook salmon program required strict isolation from sockeye salmon, as a precaution against spread of IHNV. Pathology inspections in the first few years of the program found that isolation measures were inadequate, but those problems had been corrected by later inspections. Long transport times and delayed fertilization contributed to poor incubation survivals for a number of years. Those problems have been addressed with egg takes at Monashka Creek that reduce transport times. In recent years, egg take goals have not been met, largely due to broodstock mortality (23% in 2008, 53% in 2009) at the Monashka Creek facility.

Fisheries management

The primary purpose of the Chinook salmon program is to provide sport fishing opportunities, and most returning adults are harvested in sport and subsistence/personal use fisheries. Coded wire tagging is not used, and harvest estimates are based on the statewide harvest survey and subsistence harvest reports. The effects on the commercial fisheries are expected to be negligible, as the run is completed before commercial fishing in the area typically begins.

Recommendations

1. Recently, egg take goals have not been met due to excessive prespawn mortality of broodstock. In this program, broodstock collection is the responsibility of the department, which should continue working to reduce the mortality.

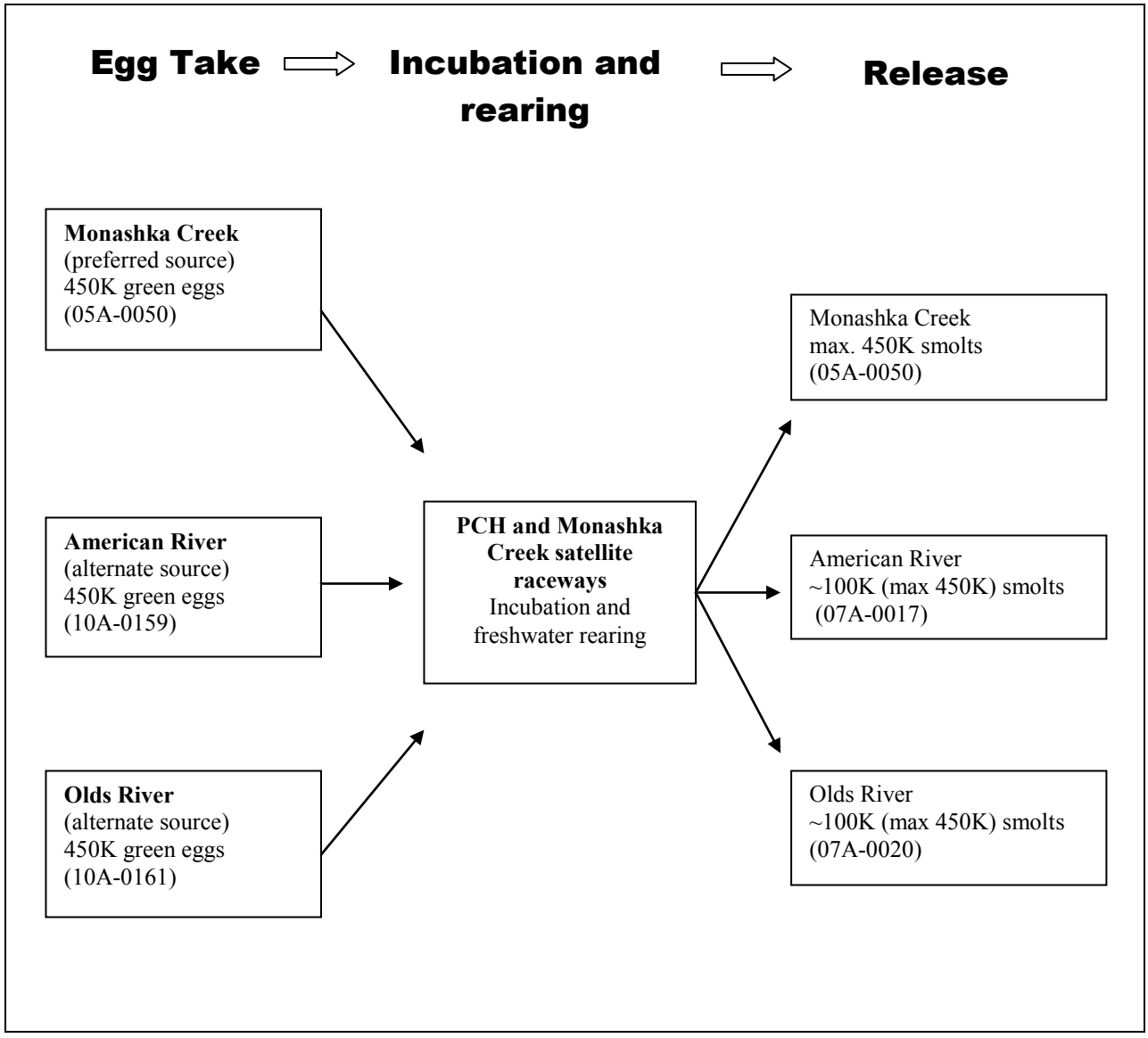


Figure 7. –Schematic of PCH Chinook salmon program and associated FTPs.

Table 14. The PCH Chinook salmon program and its consistency with elements of the ADF&G *Genetic Policy* (See Table 2).

I. Stock Transport	
Use of appropriate local stocks	The program uses Karluk River donor stock, which is the closest native stock. Earlier ADF&G enhancement efforts in the area used Chinook salmon stocks from Cook Inlet, and were unsuccessful.
II. Protection of wild stocks	
Interaction with or impact on significant wild stocks	No significant wild stocks have been designated in the Kodiak region. No other Chinook salmon stocks are present in the Kodiak road system area. The stocked streams have small runs of pink and coho salmon, which return after the Chinook salmon run is over.
Identification of significant or unique wild stocks	No significant wild stocks have been designated in the Kodiak region.
Use of indigenous stocks in watersheds with significant wild stocks	No significant wild stocks have been designated in the Kodiak region. The streams used for stocking have small runs of pink and coho salmon.
Establishment of wild stock sanctuaries	No wild stock sanctuaries have been designated in the Kodiak region.
III. Maintenance of genetic variance	
Maximum of three hatchery stocks from a single donor stock	The donor stock is used only at PCH. The use of multiple off-site releases from a single donor stock is acceptable under the policy.
Minimum effective population size	Recent egg takes have been less than the recommended effective population size of 400 (the 2009 egg take used 12 pair). The *Genetic Policy* recognizes that small effective population sizes may unavoidable in Chinook salmon programs.
Use of all segments of donor stock run timing	The original Karluk stock egg takes were conducted throughout the run.
Genetics review of FTPs (5 AAC 41.010 – 41.050)	
Review by geneticist	The FTPs for the Chinook salmon program have been reviewed and approved by the geneticist.

Table 15. The PCH Chinook salmon program and its consistency with elements of Alaska policies on fish health and disease (See Table 3).

Fish Health and Disease Policy (5 AAC 41.080; amended by Meyers 2010)	
Egg disinfection	According to pathology reports, eggs are water-hardened in Betadine at 1:100 concentration for one hour, as required.
Hatchery inspections	Hatchery inspections were conducted every other year from 2000 to 2008. This period coincided with the initiation and development of the Chinook salmon program. Earlier inspection reports noted problems with inadequate separation from sockeye salmon and poor incubation survival, but those problems had been resolved by the time of the 2008 inspection. The early use of remote egg takes was implicated in the poor incubation survival; eggs are now collected at the Monashka Creek facility, which has greatly improved incubation survival.
Disease reporting	Broodstock have been screened regularly under permitting requirements. Low levels of BKD (0-5%) have been recorded.
Pathology requirements for FTPs (5 AAC 41.010 – 41.050)	
Disease history	The disease histories for Karluk and Monashka Creek Chinook salmon are complete. Disease histories are also required for the new American and Olds Rivers egg take sites. In the reviews of those FTPs (10A-0159 and 10A-0161, reviewed 8/3/10) the pathologist requested samples to complete the disease histories for Chinook salmon returns to those watersheds.
Isolation measures	Fertilized Chinook salmon eggs will be placed in individual incubation trays with no shared water inflows. All spawned adults will be tested at spawning for the presence of pathogens and any positively associated egg groups will be destroyed as needed to comply with department standards.
Broodstock inspection	The egg take FTPs require screening of broodstock for BKD and IHNV, and any BKD-positive egg groups must be destroyed. The program must be suspended if IHNV is detected.
Pathology review of FTPs	All FTPs for the PCH Chinook salmon program have been reviewed and approved by the pathologist. The egg take FTPs require screening of broodstock for BKD and IHNV.

Table 16. The PCH Chinook salmon program and its consistency with elements of Alaska fisheries management policies and regulations (See Table 4).

Sustainable Salmon Fishery Policy (5 AAC 39.222)	
I. Management principles and criteria	
Assessment of wild stock interactions/impacts	The potential wild stock impacts were considered as part of the review of the permit alteration request for the program. Nearby streams have been monitored for strays, and the riparian areas are monitored for habitat damage.
II. Use of effective management systems	
Assessment of wild stock impacts for new proposals	The potential wild stock impacts were considered as part of the review of the permit alteration request for the program. The possibility of straying and competition with other species were discussed, and no serious concerns were identified.
III. Conservative management	
Use of precautionary approach	The magnitude of possible adverse effects is limited by the use of small releases at life stages that limit interactions with wild stocks.
Salmon Escapement Goal Policy (5 AAC 39.223)	
Establishment of escapement goals	There is no escapement goal for the enhanced Chinook salmon runs. Coho salmon escapement goals have been set for the American and Olds rivers, but not for Monashka Creek.
Mixed Stock Salmon Fishery Policy (5 AAC 39.220)	
Wild stock conservation priority	Returning Chinook salmon are primarily caught in terminal sport fisheries rather than mixed stock fisheries. The run is completed before commercial fisheries in the area open.
Fisheries management review of FTPs (5 AAC 41.010 – 41.050)	
Review by management staff	The FTPs for this program were reviewed and approved by fisheries management staff.

RAINBOW TROUT

Overview of program

The PCH rainbow trout program began in 2007 with the approval of a permit alteration request allowing the hatchery to receive eyed rainbow trout eggs from Fort Richardson Hatchery. Prior to that permit alteration, ADF&G had annually stocked triploid rainbow trout fry from the Fort Richardson Hatchery into landlocked lakes on the Kodiak road system. Adding permitted capacity for rainbow trout eggs to the PCH permit allowed those rainbow trout to be transported as eggs, and then raised to fingerling size at PCH. This approach is logistically efficient and allows for release of larger fry. A second permit alteration in 2008 increased the permitted capacity to 92,000 eggs. The first permit alteration had an expiration date of five years (i.e. 2012); that provision was carried over into the second alteration as a four year expiration period.

Captive broodstock at Fort Richardson Hatchery in Anchorage are used to produce all-female triploid eggs. Those eggs are incubated to the eyed stage of development at Fort Richardson before being shipped to PCH via air freight in late May. The eyed eggs are incubated further at PCH, and after hatching they are reared to fingerling (about 2 g) size and released into 18 landlocked lakes in late summer and fall. In 2009, PCH received 82,400 eggs and released 61,000 fingerlings into Kodiak-area lakes.

Fish transport permits

The FTPs for the cooperative rainbow trout program are issued to the ADF&G Division of Sport Fish, rather than to KRAA. The program requires a single FTP (08A-0054), which replaced the original FTP (07A-0029) issued after the initial permit alteration. Both the current and original FTP were reviewed and approved by department staff. There were some concerns over the presence of another IHNV-susceptible stock being reared in the presence of sockeye, which were addressed with stipulations on the FTP.

Prescribed practices

The permit alterations and FTPs both carry conditions for operation of the rainbow trout program. The permit alteration allowing incubation of rainbow trout eggs expires in 2012; after that time it must be evaluated "for prophylaxis of IHN disease before it will be allowed to continue." The pathology department also set out specific requirements in the FTP:

1. Incubation of Fort Richardson rainbow trout eggs at PCH must be done in an isolation module on virus-free water (sport fish incubation room) separate from the sockeye salmon and will require a footbath, separate utensils, etc

2. The rearing raceway for the rainbow trout must have adequate physical separation (19+ feet has been indicated) from the nearest sockeye rearing unit to prevent splash or carryover of spray from wind and must be covered with double mesh predator exclusion netting to eliminate all birds, etc.

3. Any significant juvenile rainbow trout mortality must be submitted to the Anchorage fish pathology lab for IHNV testing. A prerelease inspection for IHNV will be conducted prior to juvenile transport for lake stocking.

4. Detection of IHNV in any group of rainbow trout would require destruction of all juvenile fish of that stock and a re-evaluation of IHNV concerns for this project and other programs at the hatchery.

The facilities used to incubate and rear rainbow trout are described in the 2007 PAR, and meet the pathology requirements listed above.

Regional planning and consistency with policy

The regional salmon planning process does not address small stocking projects like the PCH rainbow trout program. Planning for these projects is described in the Statewide Stocking Plan (ADF&G 2010).

Similarly, the genetics and fisheries management concerns with recreational fish stocking projects are minimal, and fish health issues have been discussed earlier, so policy summaries were not prepared for rainbow trout. No specific recommendations were made for the rainbow trout program.

OTHER REQUIREMENTS

ANNUAL REPORTING AND CARCASS LOGS

All hatcheries are required to submit an annual report to ADF&G that summarizes their production and activities for the year (AS 16.10.470). The annual report must include "information pertaining to species; brood stock source; number, age, weight, and length of spawners; number of eggs taken and fry fingerling produced; and the number, age, weight, and length of adult returns attributable to hatchery releases, on a form to be provided by the department." The completed report is due on December 15. PCH has consistently turned in timely and accurate annual reports.

Alaska hatcheries are also required to document the disposal of the carcasses of salmon used for broodstock (5 AAC 93.350). The hatchery must record the number of males and females used each day, and whether they were fertilized, unused, or used for roe sales. A maximum of 10% of the total number of females can be used for roe sales without using the carcass; the proceeds from any excess must be surrendered to ADF&G. As with the annual reports, the Pillar Creek carcass logs have been turned in on time and complete.

The timely and accurate submission of annual reports and carcass logs shows that the hatchery staff maintains an adequate recordkeeping system and that hatchery operations are sufficiently well documented.

SUMMARY OF FINDINGS AND RECOMMENDATIONS

This report evaluates the salmon fishery enhancement programs at PCH in terms of their consistency with statewide policies and prescribed management practices. No significant problems were identified in the course of this evaluation, indicating that the operation of PCH has been largely consistent with state policies and prescribed management practices. Most of the recommendations are to correct minor administrative issues. For example, a permit alteration is needed for the Katmai Lake coho salmon release because that project has been transferred from KBH.

The PCH basic management plan has not been revised since it was originally approved, and no longer accurately describes the current PCH programs. This has not compromised the way in which the hatchery has been operated, as the annual management plans have served as the principal planning documents. The annual management plans for PCH are typically comprehensive and well written, and are subject to extensive review. However, as a fundamental

part of the hatchery's operating permit, the basic management plan should be accurate and consistent with the rest of the planning and permitting framework, and should be updated.

PCH operates two distinct types of enhancement programs, designed to benefit two user groups. The first type is primarily intended to benefit commercial fishermen, and consists of the early and late-run sockeye salmon programs. These programs use a general strategy of collecting eggs from wild fish, using the hatchery for incubation and early rearing, then releasing juveniles into barriered lakes to complete their freshwater rearing. This approach increases salmon production by utilizing freshwater habitat that is not otherwise available to anadromous fish, and also minimizes the degree of hatchery influence on the stocks. The Kodiak regional planning team clearly prefers this approach to more hatchery-intensive production techniques, as almost all of the sockeye salmon projects recommended in regional planning have been lake stocking projects.

These lake stocking programs depend on natural productivity for both their broodstock supply and juvenile rearing capacity. To protect that natural productivity, escapement-based egg take guidelines determine the number of broodstock that may be removed from donor systems, and release goals are based on limnological and zooplankton conditions. The guidelines for broodstock removals are clearly identified in annual management plans, and the escapement into the donor systems is well monitored with weir counts. Similarly, the limnological assessments used to set release goals are based on years of studies throughout the region. This system is designed to maintain sustainable wild salmon stocks and protect habitat while producing additional salmon for harvest, and has generally performed well.

There are some drawbacks to this system, however. The collection and transport of eggs from remote sites has contributed to relatively low survival in some years, but changes to eggtake and incubation practices have improved survival rates. Obviously, the use of wild broodstock removes spawners from the donor watershed. The development of a late-run sockeye salmon broodstock at Little Kitoi Lake may reduce the use of wild broodstock, but the program still relies on remote egg takes at Saltery Lake for the bulk of its eggs. The biggest obstacle to successful use of the Little Kitoi Lake broodstock appears to be attaining adequate escapement into Little Kitoi Lake and capturing broodstock that have been passed into the lake; KRAA should continue to make overcoming those obstacles a priority.

One of the provisions in the broodstock removal guidelines is for the use of backstocking, or the release of juveniles back into the donor system to compensate for removal of broodstock in years with low escapement. There has been much discussion as to whether backstocking should be used, and its use will be considered on a case-by-case basis. If backstocking is used, any juveniles that are planted back into the donor system should be marked to allow an evaluation of its effectiveness. Also, since backstocking is in response to poor escapements, it should only be used where the causes of the poor escapement are understood, and only if additional juveniles would not exacerbate the problem. For example, the backstocking of additional juveniles into a donor system with poor zooplankton levels would likely be counterproductive.

Unlike most regions of Alaska, hatchery salmon in the Kodiak region are not otolith marked or coded wire tagged. However, such a program could provide valuable information to improve fisheries management and assess the success of PCH releases. For example, a marking and sampling program would help identify Spiridon Lake sockeye salmon in run reconstructions of Westside fisheries. To date, local fisheries managers have not felt that the need for marking and sampling warrants its considerable expense. Given the utility that such programs provide in other regions, the use of marking in Kodiak should continue to be considered.

The second type of enhancement program at PCH is primarily intended to enhance sport and subsistence/personal use fishing, and consists of the coho and Chinook salmon and the rainbow trout programs. The numbers of fish produced in these programs is relatively small, but they are distributed over a number of release sites. Most of the fish are released into road-accessible lakes and streams where they can best contribute to local sport fisheries. These programs are cooperatively operated with the Division of Sport Fish, and many permits are issued to the Division of Sport Fish rather than KRAA.

These enhancement projects appear to produce salmon for local harvest with while posing little risk to wild stocks. The broodstock sources are from local systems (except for rainbow trout), and the releases are to areas where there is little or no spawning habitat for returning adults, so the genetic concerns are minimal. The harvest effort is mostly limited to sport and subsistence fishing in terminal areas, rather than in mixed-stock fisheries that might harvest other wild stocks and create management complications.

Broodstock mortality in the Chinook salmon may be the most pressing concern with the road system fisheries enhancement program. In 2009, poor survival of adults being held for broodstock at the Monashka Creek facility led to a shortfall in egg collection. The mortality was due to a combination of factors, including predation, poaching, and elevated water temperatures (Donn Tracy, Sport Fish Biologist, ADF&G, Kodiak, personal communication). These problems will need to be solved for the program to succeed. The broodstock mortality not only prevents achievement of the production goals, but reduces the effective population size. Recent FTPs permit the collection of broodstock at the American and Olds River release sites, and the ability to collect broodstock at all three release sites should help alleviate these problems.

The genetics policy calls for the identification and protection of "significant and unique" wild stocks on a regional and species basis. It also suggested that regional planning teams were the most appropriate body to designate those stocks. To date, no significant stocks have been designated in the Kodiak region. Similarly, the genetics policy also recommends the designation of watersheds to serve as wild stock "sanctuaries" to serve as gene banks to preserve genetic variability. No such sanctuaries have been yet been established in Kodiak. Because significant stocks and wild stock sanctuaries have not been identified, the consistency with these parts of the *Genetic Policy* could not be readily evaluated, or was not applicable.

The recommendations made in this report highlight the cooperative nature of the hatchery programs in Kodiak. While KRAA operates the hatchery, it does so in cooperation with ADF&G, and with the guidance of the regional planning team and the Comprehensive Salmon Plan. Most of the recommendations in this report involve both KRAA and the department to some degree. For example, it was recommended that KRAA and the department work together to determine the best way to determine the contribution of Spiridon Lake sockeye salmon in Westside Kodiak fisheries. That cooperation will be an important part of the continued success and improvement of salmon fishery enhancement in the Kodiak region.

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APPENDIX A: PILLAR CREEK HATCHERY SALMON RELEASE AND RETURN HISTORY

Appendix A 1.Releases of juvenile salmon produced at PCH, 1993–2009.

Early-run sockeye salmon	
Year	Number released
1993	1,279,600
1994	2,155,000
1995	578,800
1996	2,087,000
1997	1,978,500
1998	1,921,900
1999	1,574,700
2000	1,194,600
2001	1,181,300
2002	175,600
2003	140,048
2004	125,408
2005	350,025
2006	1,000,138
2007	1,158,805
2008	998,001
2009	679,466
Total	18,578,891

Late-run sockeye salmon	
Year	Number released
1993	4,246,000
1994	6,046,000
1995	4,799,000
1996	4,994,000
1997	7,305,000
1998	3,440,000
1999	3,630,500
2000	4,475,800
2001	1,700,600
2002	952,900
2003	1,417,519
2004	3,006,429
2005	1,290,500
2006	3,266,252
2007	2,275,381
2008	1,049,809
2009	1,475,160
Total	55,370,850

Chinook salmon	
Year	Number released
2002	60,400
2003	32,554
2004	11,252
2005	72,068
2006	29,153
2007	219,400
2008	148,280
2009	184,928
Total	758,035

Coho salmon	
Year	Number released
1993	9,000
1994	132,000
1995	65,045
1996	28,000
1997	137,200
1998	134,500
1999	120,000
2000	61,700
2001	70,400
2002	106,990
2003	48,265
2004	123,547
2005	56,910
2006	74,561
2007	65,912
2008	58,425
2009	58,791
Total	1,351,246

Appendix A 2.–Estimated number and use of adult salmon returning from PCH releases, 1995–2009.

(a) Early-run sockeye salmon (Hidden Lake, Crescent Lake, and Waterfall Lakes returns)

Return year	Commercial	Sport / subsistence/ personal use	Brood/ other/ escapement	Total
1995	67,842	200	0	68,042
1996	82,000	0	0	82,000
1997	57,145	0	0	57,145
1998	23,331	0	0	23,331
1999	53,551	0	0	53,551
2000	35,200	0	0	35,200
2001	49,722	0	0	49,722
2002	62,151	0	1580	63,731
2003	103,668	0	0	103,668
2004	44,604	0	0	44,604
2005	25,672	0	0	25,672
2006	819	0	300	1,119
2007	703	0	300	1,003
2008	5,698	0	0	5,698
2009	8,742	0	0	8,742
Total	620,848	200	2,180	623,228

(b) Late-run sockeye salmon (Spiridon Lake, Ruth Lake, and Little Kitoi Lake returns)

Return year	Commercial	Sport / subsistence/ personal use	Brood/ other/ escapement	Total
1995	18,000	0	236	18,236
1996	292,000	0	0	292,000
1997	132,524	200	0	132,724
1998	229,000	150	5000	234,150
1999	528,123	30	2000	530,153
2000	212,600	30	2000	214,630
2001	174,000	30	2000	176,030
2002	520,584	89	1800	522,473
2003	640,559	0	0	640,559
2004	187,198	0	0	187,198
2005	144,859	0	0	144,859
2006	88,944	0	0	88,944
2007	173,678	0	430	174,108
2008	244,414	0	0	244,414
2009	155,025	0	0	155,025
Total	3,741,508	529	13,466	3,755,503

(c) Coho salmon (Kodiak road system lakes returns)

Return year	Commercial	Sport / subsistence/ personal use	Brood/ other/ escapement[a]	Total
1995	1,000	500	5,847	7,347
1996			8,349	8,349
1997		600		600
1998				
1999		1,000	9,626	10,626
2000		1,000	9,634	10,634
2001		1,000	9,634	10,634
2002		1,000	10,649	11,649
2003		1,430		1,430
2004		1,600		1,600
2005		1,600		1,600
2006		1,600		1,600
2007		1,600		1,600
2008		1,600		1,600
2009		1,600		1,600
Total	1,000	16,130	53,739	70,869

[a] Includes both hatchery- and natural-origin spawners.

(d) Chinook salmon (Monashka Creek, American River, and Olds River returns)

Return year	Commercial	Sport / subsistence/ personal use	Brood/ other/ escapement	Total
2004		19	194	213
2005		185	195	380
2006		270	123	393
2007		20	141	161
2008		120	180	300
2009		35	109	144
Total		649	1,120	1,769