Regional Information Report No. 5J11-01

An Evaluation of the Kitoi Bay Salmon Hatchery for Consistency with Statewide Policies and Prescribed Management Practices

by

Jake Musslewhite

April 2011

Alaska Department of Fish and Game **Division of 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

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AN EVALUATION OF THE KITOI BAY 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 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 Kitoi Bay Hatchery is located on Afognak Island and produces pink, chum, coho, and sockeye salmon 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 Alaska policies and prescribed practices. Most of the recommendations made were to address administrative requirements, such as updating the basic management plan. The hatchery's programs appear to be consistent with statewide policies on genetics, fish health, and fisheries management. No otolith marking or coded wire tagging is used in the Kodiak region, and local fisheries managers have not requested marking or tagging programs. A cost-benefit analysis of marking and tagging programs was recommended, as they have been valuable in other regions.

Key words Kitoi Bay 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."

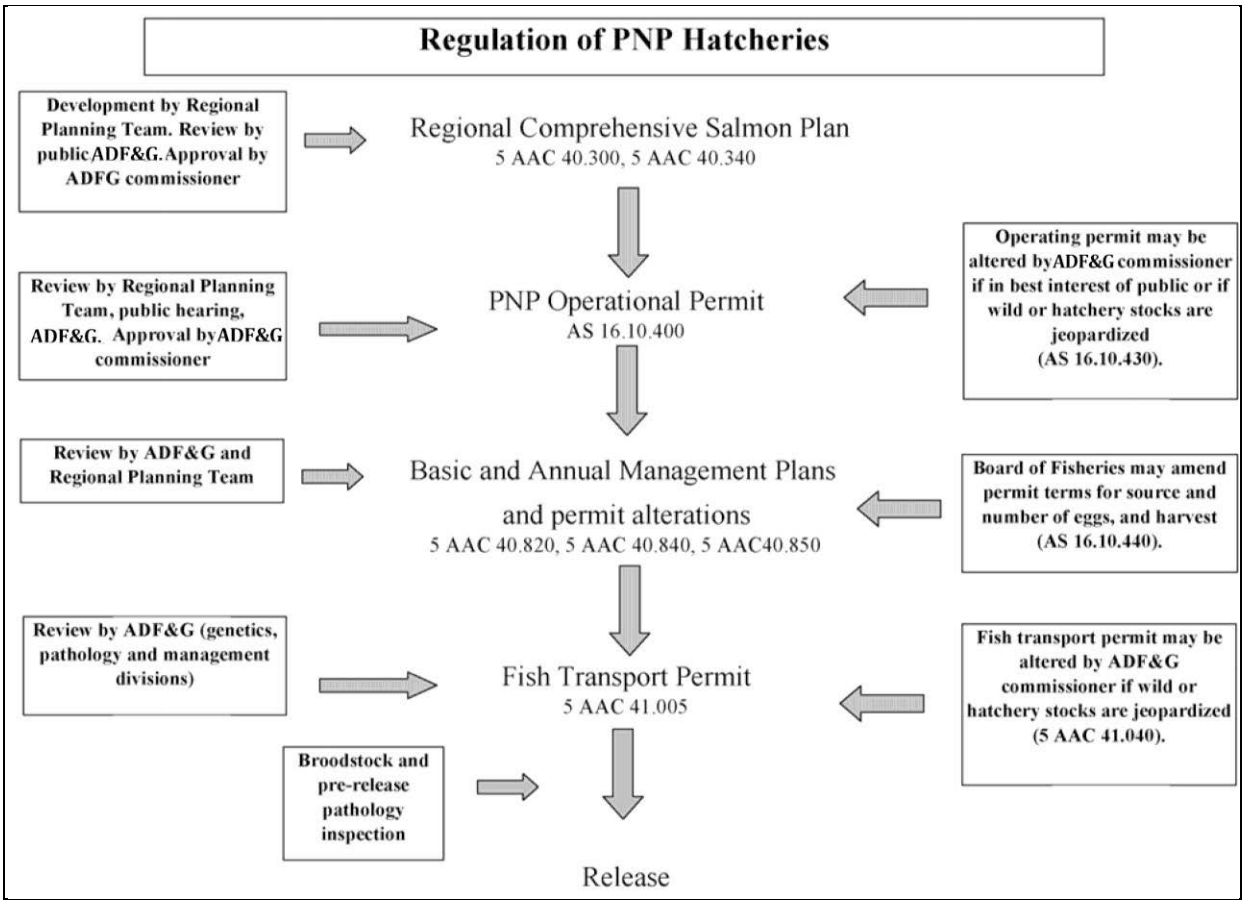

Figure 1.–Schematic of Alaska hatchery regulatory system (from McGee 2004).

This report is the first 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 is an independent nonprofit organization that certifies fisheries that have been demonstrated to be sustainably managed. The Alaska salmon fishery was certified by the Marine Stewardship Council in 2000, and recertified in 2007 (Chaffee 2007). The 2007 recertification was issued with some conditions (Knapman 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.

The policies and prescribed practices governing Alaska's salmon hatcheries have been implemented with a rigorous planning and permitting system. The first rotation of evaluations will focus on "housekeeping" under that existing system. This includes checking each hatchery's matrix of permits to make sure that all necessary permits are in place, that they are consistent with each other, and that they match the hatchery's actual practices. It could be likened to an audit of each hatchery's operation under the regulatory system.

Although the first round of evaluations will focus primarily on the administrative aspects of the program, it will also examine hatchery programs in the context of the policies underlying the permitting process. Those policies are used by ADF&G staff when making recommendations about permit alterations, fish transportation permits (FTP), or hatchery management plans. They include *Genetic Policy* (Davis et al. 1985), *Regulation changes, policies, and guidelines for Alaska fish and shellfish health and disease control* (Meyers 2010), and various fisheries management policies, such as the Sustainable Salmon Fisheries Policy (5 AAC 39.222).

The product of the evaluation process is this report, which details the findings of the review and makes specific recommendations to remedy any deficiencies found. It includes an overview of the permits and plans for the hatchery, and a species-by-species discussion of the hatchery's programs.

HATCHERY BACKGROUND/HISTORICAL OVERVIEW

The Kitoi Bay Hatchery (KBH) is the first hatchery to be evaluated under the department's hatchery evaluation program and is one of the oldest hatcheries in the state. It is located on Afognak Island near Kodiak (Figure 2). It was originally built in 1954 by the U.S. Fish and Wildlife Service as a sockeye salmon research facility. It was destroyed by the 1964 earthquake and was rebuilt and operated by the ADF&G beginning in 1965. The hatchery transitioned from a research facility and began functioning as a production facility beginning in 1972. In 1986, the Kodiak Regional Aquaculture Association (KRAA) began jointly funding the operation and in 1991 KRAA fully assumed the funding of the facility and programs, though an ADF&G biologist continued as hatchery manager until mid-1995. KRAA received private nonprofit (PNP) hatchery permit number 29 to cooperatively operate the KBH with the ADF&G Division of Fisheries Rehabilitation, Enhancement and Development on July 5, 1988. KRAA entered into a long term contract with the State of Alaska to operate the state-owned hatchery in 1993. The contract period ends November 16, 2031. Since 1995, KRAA has fully funded and operated the KBH facility. On May 1, 1998, PNP hatchery permit number 29 was amended to authorize KRAA as the sole operator of the KBH with production limited to "a total of no more than 215 million pink salmon eggs, 25 million chum salmon eggs, 2.3 million coho salmon eggs, and 300,000 sockeye salmon eggs" per year. A basic management plan was also approved as part of the amended permit. The hatchery permit was altered in 2005 to allow an increase in sockeye salmon eggs (to 600,000) and again in 2009 to allow an increase in chum salmon eggs (to 28 million).

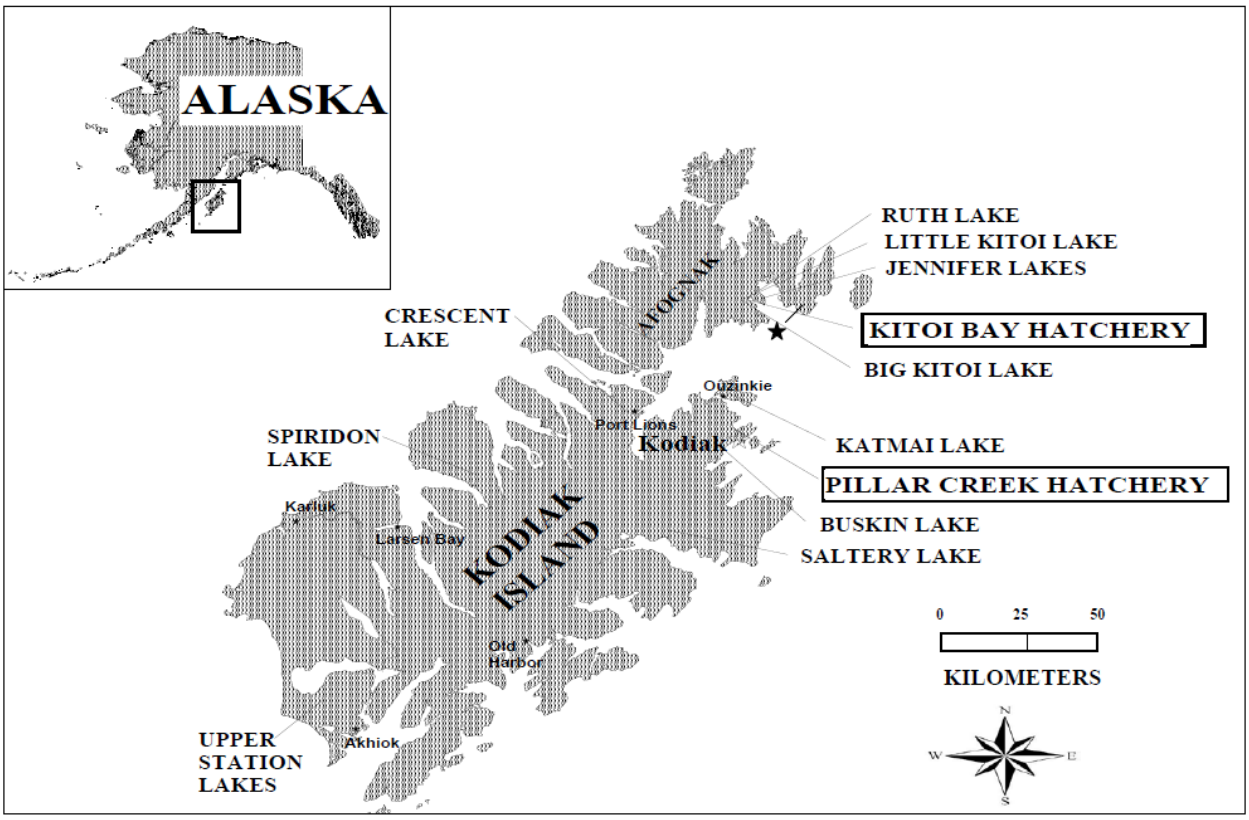

Figure 2.–Locations of salmon stocking and fishery enhancement projects associated with KBH on Kodiak and Afognak Islands (Schrof and Aro 2009).

OVERVIEW OF PERMITS AND PLANS

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 location where fish may be released. 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 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 hatchery permit and basic management plan may be amended, revised, or revoked by the commissioner. The operator may request a change in a hatchery permit or basic management plan by submission of a permit alteration request. The requested changes are reviewed by the regional planning team and a recommendation is then sent to the commissioner who approves or denies the requested change.

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.

These documents for KBH 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 evaluation of KBH began in the summer of 2009 with a site visit and preliminary review of the facility's permits. The review of the PNP hatchery permit and basic management plan showed that while the permit was current and operations were being conducted as permitted, the basic management plan had not been updated when the permit was amended in 2005 and again in 2009. The basic management plan had last been updated in 1998, when the permit was amended to designate KRAA as sole operator. There was some confusion regarding the need to update the basic management plan as language in the actual permit seemed to indicate that the annual management plan would take the place of the basic management plan after the first year. However, per 5 AAC 40.820 (c) the basic management plan "is an addendum to the permit" and therefore it needs to be updated whenever the PNP hatchery permit is amended in order to remain current. The changes in the basic management plan have already implicitly been made by the approved permit alterations, but the text has not been edited to reflect those alterations.

The annual management plan is intended to guide hatchery operations each year. The 2009 annual management plan, which was the most recent available, was not published until October 2009, after most of that year's activities had already occurred. Unlike other facilities annual management plans, the KBH and Pillar Creek Hatchery (PCH) annual management plans are published in the form of an ADF&G Fisheries Management Report. This practice originated when KBH was operated by ADF&G, and has continued under management by KRAA. The annual management plan is cooperatively prepared by both the KBH hatchery manager and the Kodiak regional resource development biologist. While the 2009 annual management plan was very well prepared and complete, it is not necessary to publish it as a formal report, especially if doing so further delays its completion.

The production goals or limits set out in each of the documents were compared to determine whether they were in agreement (Table 1). These were also compared to the numbers shown in recent annual reports to ensure that they accurately described current actual practices at the hatchery.

In most cases, the plans and current practices were in agreement. As noted above, the numbers in the basic management plan were out of date, and no longer matched the current hatchery permit, annual management plan, or current production. Amendments have been made through the permit alteration request process, but the basic management plan hasn't been revised to show those approved changes. The basic management plan lists separate coho salmon egg take numbers for each release site, with a total that is slightly in excess of the permitted number. While the most recent year (2009) of egg takes and releases are within permitted levels, in past years the numbers of chum salmon and sockeye salmon eggs incubated at KBH have exceeded the permitted maximum. Those overages are discussed later in this report.

Table 1.– Comparison of egg and juvenile production goals or limits listed in KBH permits and plans and actual production reported in the facility's most recent annual report. Permit/permit alteration requests refers to the facility's PNP operating permit and subsequent alterations.

	Permit/Permit Alteration Requests	Basic Management Plan	Annual Management Plan	Annual Report
Version	Permit alteration 4/10/2009	April 1998	October 2009	2009
Pink salmon				
Eggs	215 million limit	215 million limit	185 million	173.54 million
Releases	Not specified	165 million goal	150 million	153.71 million
Chum salmon				
Eggs	28 million limit	25 million limit	28 million	25.76 million
Releases	Not specified	23.5 million goal	22 million	22.17 million
Coho salmon				
Eggs	2.3 million limit	2.34 million limit	2.3 million	2.25 million
Releases	Not specified	1.89 million goal	1.46 million	1.4 million
Sockeye salmon				
Eggs	0.6 million limit	0.3 million limit	0.6 million	0.57 million
Releases	Not specified	0.25 million goal	0.515 million	0.52 million

While the hatchery permit defines limits, and the management plans guide hatchery operations, the specific actions of egg collection, transports, and releases must be additionally permitted under FTPs (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 each permitted activity, 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 transports, 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.

Salmon fisheries enhancement efforts are guided by comprehensive salmon plans for each region. 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, annual management plans and annual reports of hatchery performance.

The Kodiak Regional Comprehensive Salmon Plan Phase II Revision (1992) established goals and potential projects for salmon enhancement and rehabilitation 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 amended an earlier Phase II plan, approved in 1987, and a Phase I plan from 1984. The next phase (Phase III)[1] 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 basic management plan should be updated to reflect current permitted capacity.
2. The annual management plan should be completed and approved prior to egg collection activities commencing.
3. KRAA and the Kodiak ADF&G region staff should reconsider publishing the annual management plan as a Fisheries Management Report, or publish it only after it is completed and signed by the commissioner.

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* 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 Kitoi Bay annual management plan also states that *Genetic Policy* will be followed for all projects (Schrof and Aro 2009).

Genetic Policy calls for the identification and protection of "significant and unique" wild stocks on a regional and species basis. It also suggests that Regional Planning Teams are 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 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*

[1] Kodiak Regional Planning Team. 2010. Kodiak Regional Comprehensive Salmon Plan, 2010-2030: Phase III Revision. Alaska Department of Fish and Game, unpublished data. Office of the Commissioner, Juneau

Health and Disease Control (Meyers et al. 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 the *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 Kitoi Bay annual management plans (Schrof and Aro 2009).

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 for 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.

KBH's location immediately adjacent to the open North Pacific Ocean is advantageous to fisheries managers. Returning salmon do not have to travel extensively through migratory corridors, avoiding complications with mixed-stock fisheries (S. Schrof, Research Biologist, ADF&G, Kodiak, personal communication). This serves to both simplify management and help reduce the catch of wild stocks during fisheries targeting hatchery returns. The harvest of KBH stocks takes place primarily in Izhut, Duck, and Kitoi Bays. These bays are surrounded by steep slopes with small watersheds, so the wild stocks present are limited to a number of relatively small pink salmon and coho salmon runs in short streams. The combination of KBH's favorable location and the relative scarcity of proximate wild stocks allow a targeted harvest while minimizing the impact on wild fish.

KBH does not currently have any substantial marking programs in place. The use of a marking and recovery program would allow fisheries managers to more accurately determine the contribution of KBH production to fisheries and to evaluate interaction with natural stocks. The Sustainable Salmon Fishery Policy recommends the assessment of the "effects and interactions of introduced or enhanced salmon stocks on wild salmon stocks." Due to the location of KBH the department does not have strong concerns regarding wild stock interactions; however, a marking program for KBH salmon would facilitate a closer look at possible interactions.

The implementation of a marking program would require considerable funding for both application of marks and subsequent sampling. Because of that expense, a cost–benefit analysis of potential marking programs is recommended. The lack of a marking program is a likely point of criticism of KBH programs, and a formal analysis of the costs and benefits would help respond to that criticism.

The guidance provided by these policies is sometimes very specific, and sometimes less so. For example, the Alaska Fish Health and Disease Control Policy mandates the use of an iodophor disinfectant on salmon egg—a prescribed practice that requires little interpretation. In contrast, several policies prioritize the protection of wild stocks from the potential effects of fisheries enhancement projects 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. The key elements of the policies in each of those categories are summarized in Tables 2 through 4. These tables were then used as templates to identify and tabulate information on how each hatchery program fits within those policies. The completed tables are included in sections on each program later in the report.

General recommendations for policy consistency

1. KRAA and the department should conduct a cost/benefit analysis of marking programs for each species at KBH.

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

I. Stock Transport	
Use of appropriate local stocks	This element addresses Section I of the *Genetic Policy*, covering stock transports. The policy prohibits interstate or inter-regional 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 salmon 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* 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 for 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

PINK SALMON

Overview of program

The pink salmon program (Figure 3) at KBH uses Big Kitoi Creek stock pink salmon, which are the only salmon species indigenous to Big Kitoi Creek (Schrof and Aro 2009). The program began in the early 1970s with an eggtake of 5 million eggs from Big Kitoi Creek, and has since grown to a peak of 215 million eggs in 1989. While the current permit allows for 215 million green eggs to be collected, about 175 to 185 million eggs are normally taken for the program, due to limitations in incubation and rearing space. In 2009, KBH collected 173.5 million pink salmon eggs (White 2010).

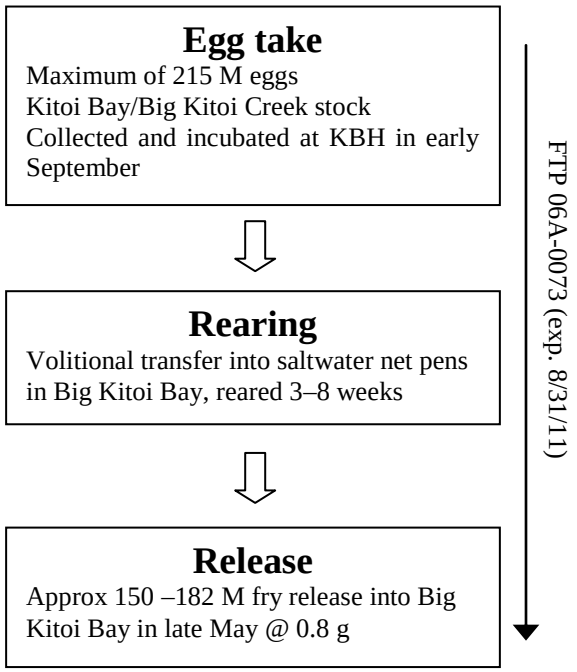

Figure 3.–Schematic of pink salmon production and related FTPs at KBH.

Broodstock collection is conducted in early September at the ladder on Big Kitoi Creek, adjacent to the hatchery. The eggs are incubated at KBH in Kitoi box style deep matrix incubators. The fry are transferred via pipelines into saltwater net pens in Big Kitoi Bay. They are reared in these net pens for three to eight weeks before being released in late May. Fed fry are released annually at a target weight of 0.8 g. In 2009, KBH released 154 million fry into Big Kitoi Bay, and has released a total of over 2.4 billion fry since 1993 (Appendix A1).

The average marine survival of Kitoi Bay pink salmon has varied between even and odd years. Managers use an assumed survival rate of 3.8% in even years and 5.9% in odd years. Using these assumptions, the planned release of 150 million fry would produce 5.8 to 8.8 million returning adults. The returning adults are harvested in common property (primarily seine) fisheries and used for cost recovery and broodstock at the hatchery. In 2009, an estimated 9.3 million adults returned from a 2008 release of 145 million fry. Of those, 6.7 million (72%) were harvested in common property seine fisheries, 2.2 million (24%) went to cost recovery, and 259,000 (2.7%) were used as broodstock. Since 1993, almost 108 million adult pink salmon have returned from KBH releases, of which 89.4 million have been harvested in common property fisheries (Appendix A2).

Fish transport permits

As a centralized and contained production program, the FTP requirements of the Kitoi Bay pink salmon program are relatively straightforward. A single FTP (06A-0073) covers the entire pink salmon program from egg take to release (Figure 3). The permit requirements are simplified because no transfers of eggs or fish are made to or from other facilities or locations. The permit

is currently up to date, but expires on August 31, 2011. It was issued on August 9, 2006 after a review process to ensure that it complied with applicable policies. In the review process, all reviewers agreed with the issuance of the permit, and no concerns were raised. A comparison of the permit and the reported activities in 2009 (White 2010) found that the permit accurately described the program as it is being conducted. The permit allows for a maximum eggtake of 215 million eggs, and subsequent release of up to 182 million fry, with an expected adult return of 8 million fish. The actual production in 2009 was somewhat lower, with 173.5 million eggs collected in BY09 and 154 million fry in BY08 released, but over 9 million adults in BY07 returned (White 2010).

Prescribed practices

The Kitoi Bay basic and annual management plans describe the methods to be used to produce pink salmon and manage the resulting returning adults. As described previously, the basic management plan is part of the hatchery permit, so that any prescriptive actions called for in the plan are effectively conditions of the permit. Typically, these include such things as adherence to regional plans, fish culture considerations, and harvest management strategies. FTPs may also carry stipulations such as evaluation plans or use of disease control practices. The basic management plan, 2009 annual management plan, and FTP 06A-0073 were reviewed to determine the prescribed practices specific to pink salmon, and whether they were consistent between each of the documents.

There are minor differences between the 1998 basic management plan and the most recent (2009) annual management plan, mostly in the area of harvest and broodstock management. There are differences in the specified number of broodstock necessary, the expected timing of common property fisheries, the timing of cost recovery fisheries, and the fishing closures used to assure broodstock goals, among others. Most of the differences probably stem from the fact that the basic management plan has not been recently updated, and does not reflect current management practices. For example, the basic management plan states that cost recovery may occur from July 27 to August 1 (or only six days) "as identified in KBH's annual management plan." However, the 2009 annual management plan says that cost recovery "will most likely occur between August 1 and August 20." This and other discrepancies between the basic management plan and annual management plan could be resolved with an updated 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. For pink salmon, the harvest goal for supplemental pink salmon was an annual harvest of 11.5 million fish. In order to achieve that goal, it called for an expansion of production capacity at KBH through additional incubation and rearing space.

The planned increases in capacity did occur, but they have not realized the supplemental harvest goal set out in the 1992 Phase II plan. From 1999 to 2008, an average of 8.8 million supplemental pink salmon were harvested in odd years, and an average of 4.1 million were harvested in even years. The harvest objective was met twice in that period, once in 2001, when 13.1 million KBH pink salmon were harvested, and again in 2005, with a harvest of 13.6 million pink salmon. Some of the harvested fish were taken in the hatchery's cost recovery fishery, which harvested an average of 31% of the supplemental harvest.

Consistency with Policy

As described earlier, templates identifying the key elements of state policies on salmon genetics, fish health and disease, and fisheries management were used to illustrate how the Kitoi Bay pink salmon program meets each policy element (Tables 5 through 7).

Genetics

No obvious inconsistencies with the *Genetic Policy* were found. Kitoi Bay uses the pink salmon stock native to the hatchery watershed, which provides for a locally-adapted stock. Small runs of pink salmon are present in some nearby streams, and these may receive some strays. However, no formal straying studies have been undertaken. The large-scale pink salmon program uses hundreds of thousands of fish for broodstock, which provides for a very large effective population size. The single FTP needed for this program was reviewed and approved by the geneticist, who did not note any concerns.

Fish Health and Disease

All of the requirements of the fish health and disease policies have been met. The facility has regularly been inspected by the pathology section, and no major issues have been identified. The only concern noted was the high incubator densities used, which has been addressed with the partial reuse of water to achieve higher flows and good survivals. The pathologist has reviewed and approved the FTP, and found no fish health concerns.

Fisheries Management

The KBH pink salmon program appears to pose little risk to wild populations, but there is little information to assess any potential impacts. The favorable location of KBH allows use of targeted terminal and near-terminal fisheries on hatchery stocks, minimizing mixed stock harvests in migratory corridors. These terminal fisheries occur in areas with relatively few wild stocks thought to be present. This combination probably minimizes the harvest of nonhatchery fish, but without a marking program the actual catch composition cannot be determined. Currently, pink salmon catch in Kitoi, Izhut, and Duck Bays is assumed to be from hatchery production (Dinnocenzo et al. 2010). While the pink salmon catch in the terminal areas includes an unknown number of wild fish, additional hatchery-bound pink salmon are likely harvested in other areas, presumably "balancing" the contribution estimates.

Marking experiments to determine the hatchery contribution to fisheries in the area of KBH were conducted in the late 1970s and early 1980s. While the original reports are not available, memos discussing the studies indicate that local managers and Fisheries Rehabilitation, Enhancement and Development biologists disagreed on the hatchery's contribution to pink salmon catch in outer areas such as Duck and Izhut Bays. No studies to determine the composition of recent catches have been conducted recently, and local fishery managers have not requested any marking of KBH pink salmon or other species.

Pink salmon escapements to local streams appear to be stable, though data is sparse because few significant pink salmon producing streams are in the area and survey effort is directed elsewhere (S. Schrof, Research Biologist, ADF&G, Kodiak, personal communication). There are no escapement goals for individual streams near KBH; in the Kodiak area the escapement goals are set for larger areas. Escapement goals for the Kodiak area overall have consistently been met (Wadle 2007).

Recommendations for KBH pink salmon program

1. The current FTP for pink salmon production appears to limit the release to 182 million; this limit should be removed or altered to "resultant progeny" when the FTP is renewed.
2. The basic management plan should be updated to reflect current practices, especially in broodstock and harvest management.

Table 5.–The Kitoi Bay pink salmon program and its consistency with elements of the ADF&G *Genetic Policy* (See Table 2).

I. Stock Transport	
Use of appropriate local stocks	Unlike most hatcheries, KBH was built on a stream with an existing run of pink salmon. The indigenous run was used as the donor stock for the hatchery. In addition to the hatchery production, about 15,000 pink salmon are allowed to spawn naturally in Big Kitoi Creek.
II. Protection of wild stocks	
Interaction with or impact on significant wild stocks	No significant wild stocks have been designated in this area. Straying is addressed with intensive harvest of returning fish. The Eastside Afognak Management Plan (5 AAC 18.365) targets enhanced production from KBH. An Unplanned Cost Recovery Operational Plan has been established to ensure that returning fish are harvested.
Identification of significant or unique wild stocks	No significant wild stocks have been designated in this area. Pink salmon are present in some small streams in Kitoi and Izhut Bays.
Use of indigenous stocks in watersheds with significant wild stocks	The indigenous stock was used as a donor stock for the hatchery. However, it has not been designated as significant. In addition to the hatchery production, about 15,000 pink salmon are allowed to spawn naturally in Big Kitoi Creek.
Establishment of wild stock sanctuaries	No wild stock sanctuaries have been designated in the area.
III. Maintenance of genetic variance	
Maximum of three hatchery stocks from a single donor stock	The donor stock has been used only at KBH.
Minimum effective population size	Large effective population size with random spawning. About 215,000 fish were spawned for broodstock in 2009.
Use of all segments of donor stock run timing	The initial donor stock egg takes were conducted by ADF&G employees, beginning in 1976. According to the 2009 annual management plan, current hatchery protocol is to collect broodstock throughout the run, once it is composed of at least 60% female fish.
Genetics review of FTPs (5 AAC 41.010 – 41.050)	
Review by geneticist	In the review of FTP 06A-0073, the principal geneticist stated that "This ongoing hatchery project should not create any negative genetic impact," and approved the FTP.

Table 6.–The Kitoi Bay pink 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	Egg disinfection for pink salmon is not used at KBH, under a waiver from the Pathology Section. This waiver is permitted for large scale pink and chum salmon hatcheries under 5AAC 41.080(b).
Hatchery inspections	Hatchery inspections were conducted every other year from 2000 to 2008. A review of these reports indicated no health or disease problems with pink salmon. Several of the reports recommended reducing the incubation loading densities of green eggs or investigating the possible re-use of incubation water. The 2008 report mentions that head boxes had been added to allow the use of some effluent water from the top stack of incubators to the bottom stack, and that dissolved oxygen levels remained good with the re-use.
Disease reporting	No reportable diseases were noted in pathology inspection reports.
Pathology requirements for FTPs (5AAC 41.010)	
Disease history	The pink salmon disease history was reported as complete in pathology inspections from 2000 to 2008.
Isolation measures	No fry are transported to any other location. Fry emigrate volitionally within PVC pipelines from the hatchery to saltwater net pens in Big Kitoi Bay.
Broodstock inspection	Broodstock inspection is not required, as the disease history of this stock is complete.
Pathology review of FTPs	In the review of FTP 06A-0073, the pathologist stated, "There are no fish health concerns with the renewal of this FTP for the pink salmon program at KBH. The disease history for this fish stock is current."

Table 7.–The KBH pink 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 tagging study in was conducted in the 1980s to determine the catch distribution of Kitoi Bay pink salmon. The results of that study are not available. No marking program is currently used, and no formal straying studies have been conducted.
II. Use of effective management systems	
Assessment of wild stock impacts for new proposals	KBH was built before current permitting procedures were established. Subsequent permit alterations and FTPs have been properly reviewed and approved.
III. Conservative management	
Use of precautionary approach	Overall production levels in the Kodiak region have been small relative to other regions. The hatchery harvest has averaged about ¼ of the overall Kodiak-area pink salmon harvest (Wadle 2007).
Salmon Escapement Goal Policy (5 AAC 39.223)	
Establishment of escapement goals	No pink salmon escapement goals have been set for streams near KBH, but local escapements appear stable. Escapement goals have consistently been met for Kodiak-area pink salmon streams. An informal escapement goal of 15,000 is set for Big Kitoi Creek.
Mixed Stock Salmon Fishery Policy (5 AAC 39.220)	
Wild stock conservation priority	Salmon returning to KBH do not travel through extensive migratory corridors, limiting their mixing with other stocks. This facilitates an intensive harvest on hatchery stocks with limited wild stock impacts.
Fisheries management review of FTPs (5 AAC 41.010 – 41.050)	
Review by management staff	The FTP for Kitoi Bay pink salmon production was approved by all reviewers.

CHUM SALMON

Overview of program

The chum salmon program (Figure 4) at KBH was begun in 1980, using broodstock from the Sturgeon River (Anadromous Waters Catalog 256-40-10010) on Kodiak Island. Egg takes have occurred at the hatchery since 1986. Before 2009, the hatchery was permitted to incubate up to 25 million chum salmon eggs. Because KRAA and the department have focused on release numbers and adult returns, the hatchery routinely collected over 25 million eggs between 1991 and 2008, with as many as 30.58 million collected in 2000. During this period there were only three years when over 22 million fry were released. KRAA became aware of the discrepancy in the winter of 2008 and immediately requested a permit alteration request to rectify the situation. The request was approved, and the permitted capacity for chum salmon eggs was increased to 28 million in April 2009. This increase was requested to improve the ability of KBH to meet the release goal of 22 million fry. In 2009, KBH reported collecting 25.76 million chum salmon eggs (White 2010).

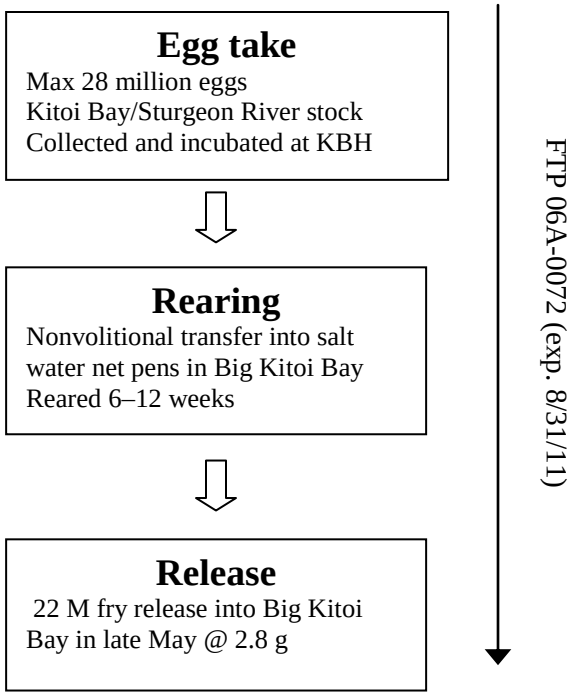

Figure 4.–Schematic of chum salmon production and related FTPs at KBH.

Broodstock collection takes place at the hatchery, with egg takes beginning in mid-July and continuing into early August. The eggs are incubated in Nopad incubators. After an infectious hematopoietic necrosis virus outbreak required the destruction of the 1990 brood year, a UV light system was installed to disinfect incubation water for chum salmon. The treatment has been successful as no further outbreaks have occurred. After incubation, most fry are nonvolitionally transferred (ponded) into saltwater net pens in Big Kitoi Bay, but about 5% are allowed to migrate volitionally to the pens. The fry are reared for six to twelve weeks before being released at a target weight of 2.8 g. About 22 million fry are released into Big Kitoi Bay in late May. In 2009, KBH achieved their release goal of 22 million fry. Over 296 million chum salmon fry have been released by KBH between 1993 and 2009 (Appendix A1).

The marine survival of KBH chum salmon releases is assumed to be 2.5% for forecasting purposes. At this survival rate, the release of 22 million fry would produce a return of 550,000 adults. The surviving chum salmon return in multiple age classes, with the majority (76%) assumed to return at age four.

The returning adults are harvested in common property (primarily seine) fisheries and used for broodstock and limited cost recovery at the hatchery. In 2009, an estimated 153,236 adults returned from previous releases, the majority of which probably came from the BY05 release of

17.57 million fry. Of those, 99,220 (65%) were harvested in common property seine fisheries, 1,779 (1%) went to cost recovery, 43,852 (29%) were used as broodstock, and 4,385 (2.9%) went to "other" uses (White 2010). From 1993 to 2009, a total of 3.1 million adult chum salmon have returned from KBH releases, and over 2.4 million of those were harvested in common property fisheries (Appendix A2).

Fish transport permits

As with pink salmon, the Kitoi Bay chum salmon program is centralized and contained, which simplifies the FTP requirements. A single FTP (06A-0072) covers the KBH chum salmon program from incubation to release (Figure 4). This permit was originally issued in August 2006, and was amended in July 2009 to reflect a permit alteration that increased capacity from 25 million to 28 million green eggs. The permit was reviewed both when it was originally issued in 2006 and when it was amended in 2009, and no concerns were raised in the reviews. The incubation and release numbers permitted in the FTP agree with the hatchery permit and the most recent annual management plan, but the outdated basic management plan does not reflect the increase in incubation capacity. A comparison of the FTP and the reported activities in 2009 found that the program was being conducted as described in the FTP.

Prescribed practices

The basic management plan, 2009 annual management plan, and FTP 06A-0072 were reviewed to determine the prescribed practices specific to chum salmon, and whether they were consistent between each of the documents. No major discrepancies were found in this review. There are a few minor differences (the assumed marine survival is 2% in the basic management plan but 2.5% in the annual management plan, for example), but they are informational, rather than prescriptive.

Regional Comprehensive Salmon Plan

The Kodiak Regional Comprehensive Salmon Plan Phase II set an annual harvest objective of 1.1 million supplemental chum salmon by the year 2002. The plan identified upgrades to KBH as a high priority project to achieve harvest goals, and those upgrades were completed. However, the harvest goal was not achieved, as an annual average of only 203,000 supplemental chum salmon were harvested between 1999 and 2008. Achieving the current supplemental harvest goal would require a substantial increase in hatchery production.

Consistency with policies

Tables 8 through 10 summarize the consistency of the KBH chum salmon program with applicable policies on genetics, fish health, and fisheries management.

Genetics

No inconsistencies with the *Genetic Policy* were found. There are no chum salmon producing streams near KBH. The KBH chum salmon program uses a local (within ~ 100 miles) broodstock that was selected for its early run timing. This serves both to segregate the hatchery stock from other wild stocks, and provides an important early-season fishing opportunity. KBH is the only facility where Sturgeon River chum salmon were used as a donor stock. The program requires over 30,000 fish for broodstock, a large effective population size. The single FTP needed for this program was reviewed and approved by the geneticist, who did not note any concerns.

Fish Health and Disease

All of the requirements of the fish health and disease policies have been met. The facility has regularly been inspected by the pathology section, and no major issues have been identified. While an infectious hematopoietic necrosis virus (IHNV) outbreak in 1991 required the destruction of an entire brood year, the use of UV disinfection has successfully prevented further problems. The pathologist has reviewed and approved the chum salmon FTP, and found no fish health concerns.

Fisheries Management

Fisheries on KBH chum salmon are situated to minimize the potential for impact on wild stocks. Returning chum salmon are harvested in a terminal fishery in an area with very few wild chum salmon runs. The stock's early run timing serves to further reduce the potential for wild stock impacts. There is no stock identification program for chum salmon produced at KBH.

No escapement goals have been set for chum salmon in the Afognak District (Honnald et al. 2007). However, overall escapement goals for the Kodiak Management Area have generally been met (Wadle 2007).

Recommendations for KBH chum salmon program

1. The basic management plan should be updated to reflect the permit alteration to 28 million chum salmon eggs. Any revisions to the basic management plan should reflect the current practices of the KBH chum salmon program.

Table 8.–The Kitoi Bay chum 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 KBH chum stock is derived from Sturgeon River donor stock, on nearby Kodiak Island. This stock's early run timing provides a harvest opportunity early in the season, and serves to segregate them from other wild stocks.
II. Protection of wild stocks	
Interaction with or impact on significant wild stock	No significant wild stocks have been designated in this area, and only five streams with chum salmon have been identified in the Afognak District. Straying is addressed with intensive harvest of returning fish. The Eastside Afognak Management Plan (5 AAC 18.365) targets enhanced production from KBH. An Unplanned Cost Recovery Operational Plan has been established to ensure that returning fish are harvested.
Identification of significant or unique wild stocks	No significant wild stocks have been designated in this area.
Use of indigenous stocks in watersheds with significant wild stocks	No significant wild stocks have been designated in this area. No chum salmon were historically present in Big Kitoi Creek.
Establishment of wild stock sanctuaries	No wild stock sanctuaries have been designated in the area.
III. Maintenance of genetic variance	
Maximum of three hatchery stocks from a single donor stock	The donor stock has been used only at KBH.
Minimum effective population size	Large effective population size with random spawning. About 38,000 fish were spawned for broodstock in 2009.
Use of all segments of donor stock run timing	The initial donor stock egg takes were conducted by ADF&G employees, beginning in 1980. Broodstock are collected throughout the run.
Genetics review of FTPs (5 AAC 41.010 – 41.050)	
Review by geneticist	In the review of FTP 06A-0072, the principal geneticist stated "No genetic concerns. The requested increase falls within the hatchery's operating plan," and approved the FTP.

Table 9.–The Kitoi Bay chum 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	Chum eggs are water-hardened with 1:100 Betadine for one hour, according to pathology inspection reports.
Hatchery inspections	Hatchery inspections were conducted every other year from 2000 to 2008. A review of these reports indicated no health or disease problems with chum salmon. All chum salmon incubation is done with UV-treated water.
Disease reporting	No reportable diseases were noted in pathology inspection reports.
Pathology requirements for FTPs (5AAC 41.010)	
Disease history	The chum salmon disease history was reported as complete in pathology inspections from 2000 to 2008.
Isolation measures	No fry are transported to any other location. Fry emigrate nonvolitionally from the hatchery to saltwater net pens in Big Kitoi Bay.
Broodstock inspection	Broodstock inspection is not required, as the disease history of this stock is complete.
Pathology review of FTPs	In the review of FTP 06A-0072, the pathologist stated, "This is a renewal FTP for a successful chum salmon program at Kitoi Bay Hatchery made possible by UV depuration of the hatchery water supply, " and agreed with the permit. He noted that the disease history was outdated and requested ovarian and kidney samples from spawned broodstock. The FTP was amended in 2009 to reflect the permit alteration increasing the egg take to 28 million. In the review of this amendment, the pathologist noted "There are no fish health concerns."

Table 10.–The Kitoi Bay Hatchery chum 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	No marking program is currently used, and no formal straying studies have been conducted. The use of targeted terminal harvest and an early-timed stock reduce the potential harvest of wild fish.
II. Use of effective management systems	
Assessment of wild stock impacts for new proposals	KBH was built before current permitting procedures were established. Subsequent permit alterations and FTPs have been properly reviewed and approved.
III. Conservative management	
Use of precautionary approach	The chum salmon release has been limited to 22 million, which is small compared to many other chum programs. The modest size of the release limits the potential for negative effects.
Salmon Escapement Goal Policy (5 AAC 39.223)	
Establishment of escapement goals	The Kodiak area-wide chum salmon escapement goals have consistently been met (Wadle 2007). No escapement goals have been set for streams near KBH, and few wild chum stocks are present (S. Schrof, Research Biologist, ADF&G, Kodiak, personal communication). An informal escapement goal of 2,000 fish is set for Big Kitoi Creek.
Mixed Stock Salmon Fishery Policy (5 AAC 39.220)	
Wild stock conservation priority	Salmon returning to KBH do not travel through extensive migratory corridors, limiting their mixing with other stocks. This facilitates an intensive harvest on hatchery stocks with limited wild stock impacts. The early run timing of Kitoi Bay chum also helps to avoid mixed-stock harvest.
Fisheries management review of FTPs (5 AAC 41.010 – 41.050)	
Review by management staff	The FTP for Kitoi Bay chum salmon production was approved by all reviewers.

COHO SALMON

Overview of program

The coho salmon program (Figure 5) at Kitoi Bay began in 1982, using wild broodstock from Little Kitoi and Buskin Lakes. In the initial years, coho salmon fry were stocked into various Kodiak road system lakes, Buskin Lake (Buskin Lake broodstock), and Little Kitoi Lake (Little Kitoi Lake broodstock). In 1990, coho salmon fingerling releases into Kitoi Bay were used to develop a hatchery broodstock. Since 1993, returns of Little Kitoi Lake stock coho salmon to the hatchery have provided enough eggs to meet production goals. The hatchery is permitted to incubate 2.3 million eggs, and all of these are collected at the hatchery. In 2009, KBH reported taking 2.25 million eggs, nearly their full permitted level.

After incubation, all coho salmon fry are initially reared in UV-treated water at KBH. Those held beyond fingerling stage are switched to raw water from the hatchery's Big Kitoi Lake pipelines. After initial rearing, the fry are used for several stocking projects.

The largest portion of the coho salmon production (1.3 million of the total 2.3 million eggs) is used for smolt releases into Big Kitoi Bay. These coho salmon are reared in freshwater to smolt stage at KBH, then transferred to saltwater net pens in Big Kitoi Bay, near the mouth of Big Kitoi Creek. The smolts are transferred in late April and reared in the saltwater pens until their release around the first of June at a target size of 18g. The target release of one million smolts is expected to produce approximately 157,000 adult coho salmon back to Big Kitoi Bay, based on an assumed survival rate of 15%. About 6,000 adults are required for broodstock; the rest are available for harvest in common property fisheries. In 2009, KBH released 1.03 million smolts into Big Kitoi Bay. Over 12.6 million smolts have been released to Big Kitoi Bay from 1993 to 2009 (Appendix A1).

The remaining one million coho salmon eggs are used for lake stocking projects at various life stages and locations (Table 11). After initial freshwater rearing, fingerlings (approx. 0.7 g) are released into Jennifer Lake, Ruth Lake, and Crescent Lake. Larger presmolts (7.5 g) are released into Katmai Lake. The release goals are based on the surface areas of the lakes, and may be adjusted in response to zooplankton biomass trends. The lakes used for stocking have barriers that prevent returning coho salmon from migrating back to the lake, so all returns from the lake stocking are available for harvest. Much of the harvest is intended for sport, subsistence, and personal use users in nearby communities, but also contributes to common property commercial fisheries. A total return of 9,300 adult coho salmon is projected from the lake releases.

Table 11.–Lake releases of juvenile coho salmon from KBH, as described in the 2009 Kitoi Bay annual management plan.

Release location	Number released	Lifestage	Expected survival	Projected adult return
Jennifer Lake	200,000	fingerling	2%	4,000
Ruth Lake	30,000	fingerling	2%	600
Crescent Lake	165,000	fingerling	2%	3,300
Katmai Lake	28,000	presmolt	5%	1,400
Total	423,000			9,300

In 2009, an estimated 167,686 coho salmon returned to KBH and the various lake stocking projects. Most of these (127,486) were harvested in the common property seine fishery. The rest were used for cost recovery (27,076), broodstock (3,354), personal use, subsistence and sport fisheries (2,766), and other uses (7,004; White 2010). There is typically no directed cost recovery coho salmon fishery, but in most years some coho salmon are taken incidentally in pink salmon cost recovery fisheries. From 1993 to 2009, 2.3 million coho salmon have returned from KBH releases, and over 2 million of those were harvested in common property fisheries (Appendix A2).

Fish transport permits

Because the Kitoi Bay coho salmon program uses a number of release sites, the FTP requirements are more complex than for the KBH pink or chum salmon programs. Five separate FTPs are required—one for each of the release sites (Figure 5). These FTPs were reviewed for consistency with the basic management plan, the most recent annual management plan, and with actual practice as reported in the most recent annual report.

While the total number of eggs or released fish was similar in these documents, the distribution of the production between the sites was different (Table 12).

The largest differences are in the planned Jennifer and Crescent lakes releases. The basic management plan allows a release of 600,000 into Jennifer Lake and 300,000 into Crescent Lake. The 2009 annual management plan, however, lists a planned release of 200,000 into Jennifer Lake and 165,000 into Crescent Lake. Not surprisingly, the annual management plan is more consistent with the program as it is currently reported in the annual report, and permitted by FTPs. Because it has not been recently revised, the basic management plan no longer accurately describes the current coho salmon program. The sum of coho salmon egg takes listed in the basic management plan also slightly exceeds the permitted maximum of 2.3 million. The changes that have been made in the KBH coho salmon program and associated FTPs should be incorporated into the basic management plan.

Table 12.–KBH planned (annual management plan, basic management plan), permitted (FTPs), and reported (annual report) coho salmon egg takes and releases, in thousands.

	Basic Management Plan		2009 Annual Management Plan		FTPs		2009 Annual Report
Release location	Eggs	Release	Eggs	Release	Eggs	Release	Release
Big Kitoi Bay	1,100	900	1,300	1,000	1,300	1,000	1,030
Jennifer Lake	750	600	300	200	300	250	180
Ruth Lake	75	60	60	30	60	50	30
Crescent Lake	375	300	600	165	600	500	150
Katmai Lake	37.5	30	40	28	40	30	10
Total	2,337.5	1,890	2,300	1,423	2,300	1,830	1,400

While the current FTPs do not match the basic management plan, their incubation and release numbers largely agree with the current hatchery permit, the most recent annual management plan, and the activity in the annual report. The FTPs are current, all expiring in 2012. Each FTP was reviewed for agreement with applicable policies, and no concerns were identified by the reviewers.

The only substantial issue found was a large discrepancy between the number of eggs reported taken for Crescent Lake plants and the resulting release. The 2009 annual management plan lists a planned eggtake of 600,000 eggs for Crescent Lake plants, and the associated FTP also allows for 600,000 eggs. However, the FTP permits a release of 500,000 fingerlings from those eggs, where the annual management plan expects a release of only 165,000 fish. This would amount to an egg-to-fingerling survival of only 27.5%, well below the standard of 55% set out in 5 AAC 40.860. The planned release of 165,000 fingerlings is based on the capacity of the aircraft used to transport the fish to Crescent Lake, and reflects the actual number of fish released. The number of eggs reported used to produce those fish, however, appears to be based on the relative proportions of the *permitted* release sizes, and not on the *actual* releases. Because the Crescent Lake release of 165,000 is much less than the permitted 500,000, it misleadingly appears to have particularly poor survival. In reality, the actual survival to fingerling is the same as for the other fingerling releases.

In this case, the practice of portraying each release group as if it were completely independent from the others is misleading. In the future, KBH should report egg take and release numbers in a way that allows clear assessment of the actual practices and performance of the coho salmon program.

While it is not described in the 2009 annual management plan, the procedure for the Katmai Lake releases has recently changed. In 2010, a portion of the KBH coho salmon program was transferred to PCH The access trail to the lake has deteriorated, making transport of juveniles to the lake via the trail impossible. Under the new plan, 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.

Prescribed practices

The basic management plan and the most recent annual management plan describe the methods to be used for coho salmon production at KBH. The basic management plan, the 2009 annual management plan, and current FTPs were reviewed to determine any prescribed practices specific to coho salmon, and whether they were consistent between the documents. As with other species, the basic management plan lists a short window (September 1–5) as the time period for cost recovery harvest of coho salmon, "as identified in KBH's annual management plan." However, the annual management plan does not mention cost recovery on coho salmon, as there is typically no directed coho salmon cost recovery fishery. The harvest management section in the basic management plan (Section 4.1) is based on the Eastside Afognak Management Plan (5 AAC 18.365), which is the source of most of the specific dates and management periods. The annual management plan describes coho salmon harvest management in general terms, using few specific dates.

There are also some differences in the evaluation plans. In the basic management plan, "grab samples" to collect age and size data of outmigrating smolts are planned, along with similar samples from Kitoi Bay smolts before they are released from net pens. Smolt sampling is planned for Jennifer and Ruth lakes, but not for Crescent or Katmai lakes, possibly due to their distance from the hatchery. The "Evaluation" section of the annual management plan does not mention smolt sampling, but it does call for repeated saltwater challenges of small numbers of smolts to determine appropriate timing for transfer to saltwater. The FTPs for the lake releases

say that "A specific report is not required to report evaluation of eggtake or release," but that production will be reported in annual management plans. The FTP application for the Kitoi Bay release discusses the reasons for the lack of a marking or tagging program, but says that "Juveniles released at KBH are enumerated only." The differences between the evaluation plans in the basic management plan, annual management plan, and FTPs make it difficult to determine what evaluation is actually occurring, and should be reconciled. Since the evaluation plans may change from year to year, the annual management plan is the best place for those plans to be detailed; the basic management plan should refer to the annual management plan when describing them.

Regional Comprehensive Salmon Plan

The Kodiak Regional Comprehensive Salmon Plan Phase II Revision (1992) set an annual harvest objective of 382,000 supplemental coho salmon by the year 2002. This goal was not achieved; an annual average of 163,000 supplemental coho salmon were harvested between 1999 and 2008. The plan put a high priority on developing coho salmon fishery enhancement projects through fish passes in various lakes and production at KBH. This strategy is essentially the one used in the current program. However, the present set of KBH coho salmon lake stocking projects was not explicitly recommended in the plan. The table of "5-year projects" in Chapter 4 lists "Kotoi (sic) lakes stocking" as an ongoing coho salmon project, but those lakes are not named.

Consistency with policy

Tables 13 through 15 summarize the consistency of the KBH coho salmon program with applicable policies on genetics, fish health, and fisheries management.

Genetics

The KBH coho salmon program uses a local broodstock, derived from Little Kitoi Lake donor stock. The use of local lakes with anadromous barriers for coho salmon stocking projects avoids interaction with other coho salmon stocks, while providing rearing habitat that the donor stock is probably well adapted for. Using lake systems with a barrier prevents colonization by hatchery-origin coho salmon. Returning adults are harvested in intensive fisheries that target enhanced production. In the event those fisheries do not occur, KBH will use the existing unplanned cost recovery operational plan to harvest them to prevent straying.

Each of the five FTPs necessary for the KBH coho salmon program have been reviewed and agreed to by the principal geneticist. In the Kitoi Bay release FTP (02A-0007), he noted, "Continuation of this project should not have any negative genetic impacts. Fish cultured and released in hatchery water undergo a strong imprinting process reducing the probability of the adults straying when they return to fresh water."

Fish Health and Disease

All of the requirements of the fish health and disease policies have been met. The facility has regularly been inspected by the pathology section, and no major issues have been identified. In the review of the Kitoi Bay release FTP (02A-0007), the principal pathologist noted, "There are no apparent fish health concerns with permit renewal for release of Kitoi Hatchery coho salmon to continue several ongoing successful enhancement programs." All five FTPs were approved, and the same comments were made on FTPs covering the lake stocking projects.

Fisheries Management

Coho salmon returning to KBH, Ruth Lake, and Jennifer Lake are primarily harvested in seine fisheries in Kitoi, Izhut, and Duck bays. Those returning to Crescent and Katmai lakes are intended to provide for sport and subsistence harvest by nearby communities, and are harvested in or near the outlet streams. The use of terminal fisheries minimizes the additional catch of wild stocks that would occur in a mixed-stock fishery. The effectiveness of this strategy is difficult to measure, however, as KBH coho salmon are not coded-wire-tagged, which prevents assessments of catch composition or straying.

No escapement goals have been set for coho salmon streams in the Eastside Afognak District. The Kodiak area-wide coho salmon escapement goals have consistently been met (Wadle 2007).

Recommendations for KBH coho salmon program

1. Revise the basic management plan to reflect the current coho salmon program.
2. The present basic management plan and annual management plan treat each lake stocking program as if it operates completely independently, with separate egg take numbers for each site. This doesn't accurately describe the actual practices of the program, and can be confusing. Future annual management plans and any revisions to the basic management plan should use a system that better captures the way coho salmon production is allocated to each stocking site.

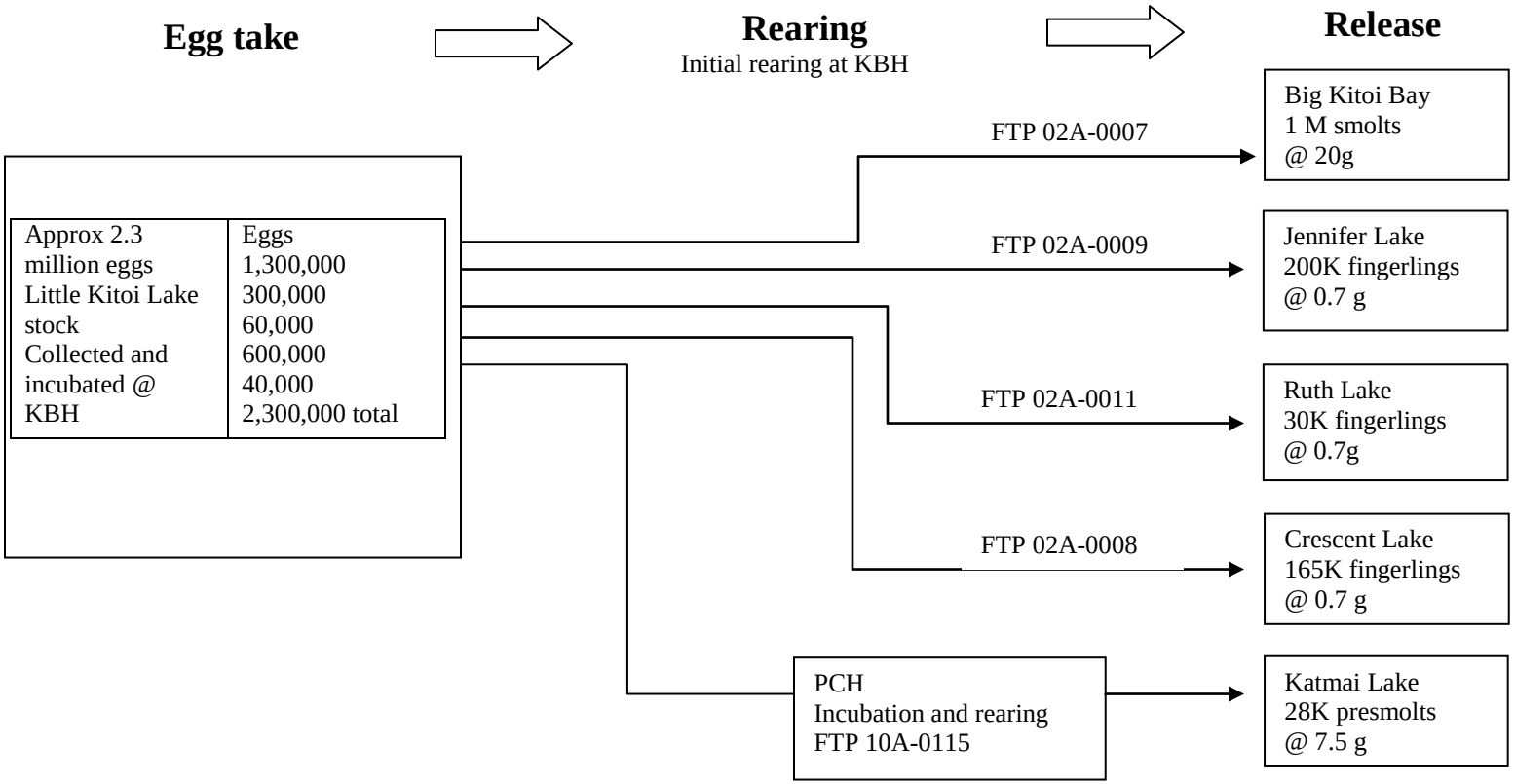

Figure 5.–Schematic of coho salmon production at KBH and associated FTPs.

Table 13.–The Kitoi Bay 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	The KBH coho salmon program uses an indigenous broodstock, derived from Little Kitoi Lake donor stock. The lake stocking programs use nearby lakes that are similar to Little Kitoi Lake.
II. Protection of wild stocks	
Interaction with or impact on significant wild stocks	No significant wild stocks have been designated in this area. The use of local lakes with anadromous barriers for coho salmon stocking projects avoids interaction with other coho stocks. Straying is addressed with intensive harvest of returning fish. The Eastside Afognak Management Plan (5 AAC 18.365) targets enhanced production from KBH. An Unplanned Cost Recovery Operational Plan has been established to ensure that returning fish are harvested.
Identification of significant or unique wild stocks	No significant wild stocks have been designated in this area.
Use of indigenous stocks in watersheds with significant wild stocks	No significant wild stocks have been designated in this area. The donor stock is from Little Kitoi Lake, about 0.25 miles from the hatchery. No KBH coho are stocked into Little Kitoi Lake, but about 500 are allowed to enter the lake and spawn naturally. The use of barriered lakes prevents colonization by hatchery stocks.
Establishment of wild stock sanctuaries	No wild stock sanctuaries have been designated in the area.
III. Maintenance of genetic variance	
Maximum of three hatchery stocks from a single donor stock	The donor stock has been used only at KBH. The use of multiple off-site releases from a single donor stock is acceptable under the policy.
Minimum effective population size	Large effective population size with random spawning. About 2,300 fish were spawned for broodstock in 2009.
Use of all segments of donor stock run timing	Broodstock are collected throughout the run.
Genetics review of FTPs (5 AAC 41.010 – 41.050)	
Review by geneticist	Each of the five FTPs necessary for the KBH coho salmon program have been reviewed and agreed to by the principal geneticist.

Table 14.–The Kitoi Bay 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	Coho salmon eggs are water-hardened with 1:100 Betadyne for one hour, according to pathology inspection reports.
Hatchery inspections	Hatchery inspections were conducted every other year from 2000 to 2008. No major disease issues were noted in these reports. In some years, there were some problems with flexibacteria and furunculosis, but those issues were relatively minor.
Disease reporting	Reports of flexibacteria problems were noted in pathology reports in 2000, 2002, and 2006.
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	Incubation is in an isolated room separate from pink and chum salmon incubators. All fry are reared in UV-treated water in small aluminum rearing units until reaching 2 g.
Broodstock inspection	Broodstock inspection is not required, as the disease history of this stock is complete.
Pathology review of FTPs	In the review of the Kitoi Bay release FTP (02A-0007), the principal pathologist noted, "There are no apparent fish health concerns with permit renewal for release of Kitoi Hatchery coho salmon to continue several ongoing successful enhancement programs." All five FTPs were approved, and the same comments were made on FTPs covering the lake stocking projects.

Table 15.–The KBH coho 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	Coho salmon are not coded wire tagged, which prevents assessments of catch composition or straying. Straying is addressed through intensive harvest in terminal areas. Wild coho salmon stocks in the hatchery vicinity are limited.
II. Use of effective management systems	
Assessment of wild stock impacts for new proposals	KBH was built before current permitting procedures were established. Subsequent permit alterations and FTPs have been properly reviewed and approved.
III. Conservative management	
Use of precautionary approach	Moderate release sizes limit the magnitude of possible adverse effects.
Salmon Escapement Goal Policy (5 AAC 39.223)	
Establishment of escapement goals	The Kodiak area-wide coho salmon escapement goals have consistently been met (Wadle 2007). No escapement goals have been set for individual coho salmon streams in the Eastside Afognak District.
Mixed Stock Salmon Fishery Policy (5 AAC 39.220)	
Wild stock conservation priority	Salmon returning to KBH do not travel through extensive migratory corridors, limiting their mixing with other stocks. This facilitates an intensive terminal harvest on hatchery stocks in an area with limited wild stocks. Coho salmon returning to stocked lakes are harvested near or in outlet streams.
Fisheries management review of FTPs (5 AAC 41.010 – 41.050)	
Review by management staff	The FTPs for Kitoi Bay coho salmon releases and lake plants were approved by all reviewers.

SOCKEYE SALMON

Overview of program

Efforts to establish a sockeye salmon broodstock at KBH began in 1988, when eggs were collected from Upper Station Lake sockeye salmon for stocking into Little Kitoi Lake. The intent of the program was to create an egg source for PCH, and subsequent stocking into Spiridon Lake. After further research by ADF&G, it was determined that the earlier run timing of Saltery Lake sockeye salmon would improve returns and harvest management (Honnold and Schrof 2001). Beginning in 1997, Saltery Lake stock has been used for development of a sockeye salmon broodstock at Little Kitoi Lake.

The hatchery was originally permitted to incubate a maximum of 300,000 sockeye salmon eggs, which was increased to 600,000 by a 2005 permit alteration. In 2009, KBH incubated 570,000 sockeye salmon eggs, which were collected by PCH and transferred to KBH at the eyed stage (White 2010). If development of the Little Kitoi Lake broodstock is successful, future egg takes are planned to be conducted at the lake. These eggs would be used to provide juveniles for stocking into Spiridon Lake as well.

The broodstock development program has used a number of rearing and stocking strategies to determine the most effective methods of producing sockeye salmon in Little Kitoi Lake. The low productivity and high turnover rate of the lake make it marginal habitat for rearing sockeye salmon (Schrof and Honnold 2003), and most of the strategies have attempted to address that issue. After experimenting with lake fertilization and different release strategies, KBH has developed a more successful method of producing sockeye salmon smolts in Little Kitoi Lake (Figure 6). A portion of the sockeye salmon (about 100,000) are released as presmolts in the fall directly into the lake, while the remainder (about 400,000) are placed in net pens the following spring, as smolts. The larger group is reared for about two and a half weeks in the lake before being released at the lake outlet at the same time as the natural smolt outmigration. The use of two release groups allows KBH to use the limited lake rearing capacity provided by Little Kitoi Lake, and still produce enough sockeye salmon smolts to meet broodstock needs. In 2009, KBH released 100,646 presmolts directly into Little Kitoi Lake, and 394,000 smolts were netpen reared in the lake before being released at the lake outlet. A total of nearly 7.5 million sockeye salmon smolts have been released between 1993 and 2009 (Appendix A1).

The releases are expected to produce an average return of about 70,000 adult sockeye salmon. In 2009, a total return of 91,518 sockeye salmon was reported, most of which (67,105) were harvested in common property fisheries (White 2010). The rest went to cost recovery (15,195), broodstock (8,962), and sport and subsistence fisheries (256). Between 1993 and 2009, a total of 714,035 sockeye salmon returned from KBH releases (Appendix A2).

The adults to be used for broodstock are allowed to enter the lake through a fish pass and ripen before being captured for egg take with beach seines. In order to collect the 3,000 adults necessary for an egg take, about 6,000 to 9,000 adults, or more, must be passed into the lake. The excess fish provide a buffer for natural mortality in the lake and to provide enough fish for efficient broodstock capture.

Fish transport permits

Two FTPs are used for the KBH sockeye salmon program (Figure 6). The first, 10A-0008, permits the collection of up to 600,000 eggs at Little Kitoi Lake, initial incubation at PCH, transfer of eyed eggs to KBH for further incubation and rearing, and release of the resulting juveniles into Little Kitoi Lake. The second FTP, 10A-0007, specifies an egg take location of Saltery Lake, but is otherwise identical. The combination of these two FTPs allows KBH to use either Saltery Lake or Little Kitoi Lake as egg sources to handle possible contingencies at either site. Even though each FTP allows up to 600,000 eggs, the combined total cannot exceed the maximum of 600,000 allowed under the KBH hatchery permit.

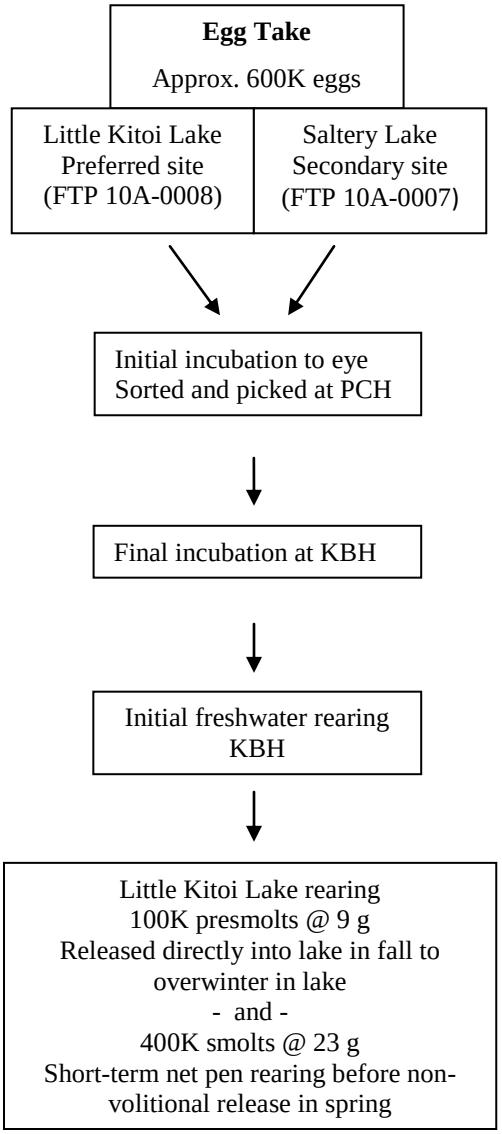

Figure 6.–Schematic of sockeye salmon production and associated FTPs at KBH.

Confusion over permitting has led to overages of sockeye salmon eggs until the recent past. During initial development of the current Little Kitoi and Saltery lakes broodstock program, the FTPs used to permit it were incomplete and somewhat contradictory. For example, the incubation of up to 1.2 million sockeye salmon eggs had been permitted by FTP 97A-0068, even though that number was in excess of the KBH hatchery permit. During the initial development period, the focus was on achieving release goals, and green egg limits were often exceeded to compensate for the relatively low survival of the remote egg takes.

The current FTPs were issued in December 2009 after it was found that the previous set of FTPs did not adequately cover the sockeye salmon program. The ADF&G Fisheries Monitoring and Permitting Section recommended that KRAA apply for FTPs that would properly permit the intended activities, and assisted KRAA in preparing the necessary applications. KRAA applied for the permits and they were approved after review, with an expiration date of January 1, 2014. All reviewers agreed with issuance of the permit, and no concerns were raised during the review. The current FTPs were carefully designed to accurately describe the program as it is being conducted. However, one of the recommended FTPs (transporting eggs directly to KBH without initial incubation at PCH) was apparently never issued and should be applied for as recommended in the memo. The identification of this permitting issue, and the way it was cooperatively resolved with both ADF&G and KRAA staff was the first example of the hatchery review process leading to correction of a permitting problem.

Prescribed practices

The basic management plan, the 2009 annual management plan, and current FTPs were reviewed to determine any prescribed practices specific to sockeye salmon, and whether they were consistent between the documents. Many of these relate to monitoring and evaluation, which is more extensive than for any of the other species at KBH.

Because of changes in the stock and rearing strategy over the past few years, the basic management plan doesn't accurately describe the current sockeye salmon program practices. It describes an anticipated change to Saltery Lake stock that is now complete, and lists only the presmolt releases directly into Little Kitoi Lake, not the more recent net pen reared smolt releases. It does state that a "full smolt and presmolt enumeration/sampling program at Little Kitoi Lake outlet has occurred annually since 1992 and will continue into the future." This program has continued, and is included in the annual management plan and FTPs. The annual management plan and FTPs also include plans for fin clipping of fall presmolt releases (also listed in the basic management plan), collection of scale samples from net pen release groups, collection of limnological data, and photographic monitoring of adult returns into the Little Kitoi Lake fish pass.

While it is not necessary to include the additional evaluation programs in the basic management plan, any revisions should provide the flexibility to provide for an evolving sockeye salmon program. Any changes in the evaluation and monitoring of the KBH sockeye salmon program should be clearly documented in that year's annual management plan.

Regional Comprehensive Salmon Plan

The Kodiak Regional Comprehensive Salmon Plan Phase II Revision (1992) set an annual harvest objective of 1.7 million supplemental sockeye salmon by the year 2002. An average of 551,000 supplemental sockeye salmon were harvested annually between 1999 and 2008, short of the goal. In the plan, KBH was not expected to be an important component of sockeye salmon fishery enhancement in the Kodiak region. Instead, the plan focused more on investigating lake stocking projects and construction of PCH for use as a sockeye salmon production facility. The successful development of Little Kitoi Lake as a broodstock source for KRAA stocking programs will be valuable for achieving future harvest goals.

Consistency with policy

Tables 16 through 18 summarize the consistency of the KBH sockeye salmon program with applicable policies on genetics, fish health, and fisheries management.

Genetics

The KBH sockeye salmon program uses Saltery Lake stock from nearby Kodiak Island. This program is intended to develop a late-run sockeye salmon broodstock source for PCH's Spiridon Lake enhancement program, and also to stock into Ruth and Jennifer lakes. The 2009 Annual Report reported that 352 fish were used as broodstock, but this eggtake was part of a larger eggtake at Saltery Lake that used over 2,000 fish. The FTPs needed for this program were reviewed and approved by the geneticist, who did not note any concerns.

Fish Health and Disease

All of the requirements of the fish health and disease policies have been met. The facility has regularly been inspected by the pathology section, and no major issues have been identified. The pathology reports noted that the hatchery staff is particularly vigilant in following prescribed sockeye salmon culture practices. The pathologist has reviewed and approved the FTPs, and found no fish health concerns.

Fisheries Management

Although the primary purpose of the KBH sockeye salmon program is to provide a broodstock source for Spiridon Lake stocking, returning sockeye salmon are harvested in KBH fisheries. Most of these are taken incidentally in fisheries directed at other species with overlapping run timing, especially chum salmon. The presence of KBH sockeye salmon in these harvests adds value for fishermen without creating additional harvest impacts on wild stocks.

Sockeye salmon runs in the Kodiak management area are intensively monitored, and major systems have individual escapement goals. Most are considered healthy. Escapement to the Saltery Lake donor system is monitored at a weir, and the escapement goal has consistently been met (Nemeth et. al. 2010).

Recommendations for KBH sockeye salmon program

1. The basic management plan should be updated to reflect the current operation of the sockeye salmon program.
2. KRAA should apply for an FTP permitting the Little Kitoi Lake eggtake with all incubation at KBH (bypassing PCH). This FTP was recommended but apparently overlooked after an earlier review of sockeye salmon FTPs.

Table 16.–The Kitoi Bay 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 KBH program uses Saltery Lake stock sockeye salmon, from nearby Kodiak Island. This stock has been used as the late-run sockeye salmon stock for PCH programs. The KBH program is intended to serve as a broodstock source to replace egg takes from Saltery Lake.
II. Protection of wild stocks	
Interaction with or impact on significant wild stocks	No significant wild stocks have been designated in this area. Straying is addressed with intensive harvest of returning fish. The Eastside Afognak Management Plan (5 AAC 18.365) targets enhanced production from KBH. An Unplanned Cost Recovery Operational Plan has been established to ensure that returning fish are harvested.
Identification of significant or unique wild stocks	No significant wild stocks have been designated in this area.
Use of indigenous stocks in watersheds with significant wild stocks	No significant wild stocks have been designated in this area. No sockeye salmon were historically present in Little Kitoi Lake.
Establishment of wild stock sanctuaries	No wild stock sanctuaries have been designated in the area.
III. Maintenance of genetic variance	
Maximum of three hatchery stocks from a single donor stock	The Saltery Lake stock has been used at several release sites, which is acceptable under the policy.
Minimum effective population size	Smaller effective population size due to number of eggs needed for the program goals. The 2009 egg take goals were met with 352 fish spawned for broodstock in 2009. However, over 2,000 fish were spawned in the Saltery Lake egg take, and a subset of those eggs were transferred to KBH. Depending on how those eggs were selected, the effective population size may be larger.
Use of all segments of donor stock run timing	Broodstock are collected throughout the run.
Genetics review of FTPs (5 AAC 41.010 – 41.050)	
Review by geneticist	In the review of FTP 10A-007 and 10A-008, the principal geneticist noted, "There are no genetic concerns in the continuation of these releases."

Table 17.–The Kitoi Bay sockeye 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	The pathology reports state that eyed sockeye salmon eggs received from PCH are disinfected in Betadine at 1:100 concentration for one hour on arrival.
Hatchery inspections	Hatchery inspections were conducted every other year from 2000 to 2008. Few health and disease problems were noted in the reports. The 2006 report noted poor survival to eye due to problems with delayed fertilization associated from remote egg takes. This problem is avoided with the onsite egg take at Little Kitoi Lake.
Disease reporting	There have been three pathology reports regarding Saltery Lake sockeye salmon juveniles at KBH. Two were of IHNV, in 1998 and 2001; and one was of coagulated yolk, in 1998.
Pathology requirements for FTPs (5 AAC 41.010 – 41.050)	
Disease history	The pathologist requested samples for an updated history in the 2000 pathology inspection report. All later reports listed the disease history as complete.
Isolation measures	Egg takes are conducted using methods from the *Alaska Sockeye Salmon Culture Manual*. The eggs are disinfected upon arrival. All sockeye salmon eggs and juveniles are reared in UV-treated water.
Broodstock inspection	Broodstock inspection is not required, as the disease history of this stock is complete.
Pathology review of FTPs	In the review of FTP 10A-007 and 10A-008, the principal pathologist noted, "There are no fish health concerns with the permitting of this project."
Sockeye Salmon Culture Policy	
Alaska Sockeye Salmon Culture Manual	Kitoi Bay uses the *Alaska Sockeye salmon Culture Manual*. In the 2000 pathology report, the pathologist noted that "Clearly, the sockeye salmon culture policy guidelines for containment and disinfection were taken very seriously by hatchery staff." Later reports have similar comments describing the strict use of sockeye salmon culture procedures.

Table 18. –The KBH 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	No substantial marking program is used. A limited marking (fin clip) program is used to measure survival of presmolt lake releases, but it is probably unsuitable to use for stock composition assessments.
II. Use of effective management systems	
Assessment of wild stock impacts for new proposals	KBH was built before current permitting procedures were established. Subsequent permit alterations and FTPs have been properly reviewed and approved.
III. Conservative management	
Use of precautionary approach	Release sizes are appropriate to meet the program goals.
Salmon Escapement Goal Policy (5 AAC 39.223)	
Establishment of escapement goals	Sockeye salmon runs in the Kodiak Management Area are intensively monitored, and escapement goals have been established for major systems. Overall, Kodiak Management Area stocks are healthy (Wadle 2007).
Mixed Stock Salmon Fishery Policy (5 AAC 39.220)	
Wild stock conservation priority	Salmon returning to KBH do not travel through extensive migratory corridors, limiting their mixing with other stocks. This facilitates an intensive harvest on hatchery stocks with limited wild stock impacts.
Fisheries management review of FTPs (5 AAC 41.010 – 41.050)	
Review by management staff	The FTPs for the Kitoi Bay sockeye salmon program were approved by all reviewers.

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. KBH 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 Kitoi Bay 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 evaluation of KBH was the first to be conducted as part of the action plan to address conditions for Marine Stewardship Council recertification. The action plan called for an evaluation of each of Alaska's hatchery programs for consistency with state policies and prescribed management practices. Development of the evaluation process is in response to the Marine Stewardship Council's set of conditions for recertification of Alaska salmon fisheries as sustainable. One of those conditions called for such a formal evaluation of Alaska hatchery programs.

No significant problems were identified in the course of this evaluation, indicating that the operation of KBH has been largely consistent with state policies and prescribed management practices. The recommendations made in the evaluation are to address minor administrative issues rather than hatchery practices. On the whole, the operation of KBH is covered under existing permits that have been reviewed for consistency with appropriate policies.

As described throughout the report, the KBH basic management plan has not been revised since 1998, and no longer accurately describes the current hatchery practices. However, 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 KBH 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. It is recommended that the basic management plan be revised to bring it up to date with current hatchery operations.

In any revisions, the basic management plan should be used to describe the general framework used to manage the hatchery, and care should be taken to avoid being unnecessarily specific. Each year's annual management plan can then be used to provide greater detail about that year's particular plans or projections. For example, there were discrepancies between the basic management plan and annual management plan in the planned monitoring and evaluation actions for both coho and sockeye salmon. The basic management plan should state that evaluation plans will be carried out as described in the annual management plan. Those plans would then be described in detail in the annual management plan, and could be more easily adapted as needed. This strategy avoids future inconsistency between the two management plans, while still requiring annual planning and review of the hatchery's operations.

Where the basic management plan and annual management plan lay out the framework for a hatchery's operations, FTPs are used for the "bricks." An FTP is required for each transport or release of fish, and is not issued until it has been reviewed for consistency with fish health, genetics, and fishery management policies. Nine FTPs are used to permit KBH programs, and all have been properly reviewed, with few concerns raised. They are consistent with the hatchery permit and annual management plans, and with the activities reported by the hatchery. One additional FTP is needed to fully cover the sockeye salmon program, but no other issues were noted.

The guiding plan for salmon enhancement in the Kodiak region is the Kodiak Comprehensive Salmon Plan. This plan set overall and supplemental harvest goals for the Kodiak region, and identified a number of projects to achieve those goals. The Phase II revision to the plan, published in 1992, set goals to be met by 2002; an update to the plan extending the timeframe to 2030 is now in draft form. KBH plays a major role in achieving the supplemental production envisioned in the plan. All of the supplemental pink and chum salmon, and most of the coho salmon, are produced at KBH.

Those supplemental production goals for the Kodiak region were not met, and in some cases the projects that were implemented are different from those listed in the plan. While the recent history of enhancement in the Kodiak region may not have exactly followed the 1992 Kodiak Comprehensive Salmon Plan, the differences are a result of evolving management. The Kodiak Regional Planning Team, which is responsible for developing the comprehensive plan, has been necessarily involved in steering KBH since that 1992 revision. Through recommending approval of permit alteration requests and review of annual management plans, the planning team has directed the activities of KBH. When it is completed, the updated Kodiak Comprehensive Salmon Plan will set new goals and identify the projects or strategies necessary to achieve them.

Alaska hatchery and enhancement programs are governed by a comprehensive permitting system designed to protect wild stocks and provide increased harvest opportunities for fisherman. The success of enhancement efforts depends on implementing that system and ensuring that its policies are being followed. The protection of wild salmon stocks is a key priority of those policies. To minimize the possible impact on wild stocks, KBH has taken advantage of its favorable location to create terminal fisheries in an area without substantial wild runs. This approach has probably been successful in fulfilling the state's goal of enhancing harvests without adversely affecting natural stocks, as envisioned in the Hatchery Act.

Even though there appears to be little potential for substantial adverse effects, the lack of assessment and monitoring makes it difficult to confirm that assumption. A frequent criticism of

hatcheries is the lack of concrete data with which to assess their interactions with wild fish. A better understanding of the stock composition of salmon caught in fisheries targeting KBH stocks, the degree and effects of straying, and the effectiveness of wild stock protection measures would improve the scientific defensibility of KBH programs. The most obvious tool to achieve that would be the use of marking and tagging.

The use of marking and tagging programs has been a valuable source of information for assessing stock composition, stray rates, and the success of hatchery practices. However, no substantial marking or tagging programs are in use by either of the two Kodiak region hatcheries. Such programs have not been required by the department to date, largely because of the long history of production at KBH with no apparent negative effects. The benefits of marking may not be worth the considerable added expense, but a thorough examination of the costs and benefits would help in any future considerations of marking programs.

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APPENDIX A: KITOI BAY HATCHERY SALMON RELEASE AND RETURN HISTORY

Appendix A1.–Releases of juvenile salmon produced at KBH, 1993–2009.

Pink salmon	
Year	Number released
1993	169,552,112
1994	163,192,575
1995	134,104,406
1996	144,045,245
1997	105,000,000
1998	150,600,000
1999	127,685,000
2000	137,702,154
2001	134,823,670
2002	152,990,900
2003	144,823,895
2004	154,073,358
2005	136,287,250
2006	115,661,940
2007	140,898,860
2008	144,920,820
2009	153,705,600
Total	2,410,067,785

Chum salmon	
Year	Number released
1993	10,101,986
1994	6,507,497
1995	9,738,069
1996	20,139,843
1997	23,500,000
1998	12,310,000
1999	6,859,982
2000	22,334,640
2001	20,032,140
2002	19,593,070
2003	18,721,700
2004	21,778,050
2005	21,578,500
2006	17,567,016
2007	21,648,839
2008	21,690,168
2009	22,173,160
Total	296,274,660

Coho salmon	
Year	Number released
1993	1,056,949
1994	261,653
1995	768,249
1996	1,072,932
1997	1,079,000
1998	1,146,000
1999	1,434,338
2000	1,253,668
2001	1,236,913
2002	1,452,149
2003	1,471,849
2004	1,379,483
2005	1,304,200
2006	1,343,298
2007	1,442,543
2008	1,414,897
2009	1,405,258
Total	20,523,379

Sockeye salmon	
Year	Number released
1993	232,418
1994	336,608
1995	1,268,490
1996	728,929
1997	652,000
1998	496,000
1999	205,395
2000	252,258
2001	282,089
2002	212,418
2003	102,822
2004	214,310
2005	299,962
2006	586,571
2007	536,444
2008	530,835
2009	518,249
Total	7,455,798

Appendix A2. –Estimated number and use of adult salmon returning from KBH releases, 1993–2009.

(a) Pink salmon

Return year	Commercial	Sport / subsistence/ personal use	Brood/ other/ escapement	Cost recovery	Total
1993	12,076,700	0	318,546	0	12,395,246
1994	2,051,375	0	240,416	3,288	2,295,079
1995	4,513,653	350	253,679	0	4,767,682
1996	974,400	0	292,779	0	1,267,179
1997	1,211,128	0	258,818	0	1,469,946
1998	6,272,000	0	388,300	0	6,660,300
1999	4,057,000	0	480,317	0	4,537,317
2000	3,659,698	0	302,836	0	3,962,534
2001	13,272,127	0	331,927	0	13,604,054
2002	6,696,774	0	376,386	0	7,073,160
2003	5,013,172	1,077	362,936	1,574,721	6,951,906
2004	2,052,846	0	367,522	1,909,575	4,329,943
2005	10,963,488	4,350	405,469	2,640,254	14,013,561
2006	1,840,106	1,123	331,816	2,318,003	4,491,048
2007	6,211,529	772	337,587	1,673,338	8,223,226
2008	423,745	0	364,286	1,694,647	2,482,678
2009	6,712,309	371	327,837	2,227,256	9,267,773
Total	89,392,750	8,043	9,434,795	20,839,521	107,792,632

(b) Chum salmon

Return year	Commercial	Sport / subsistence/ personal use	Brood/ other/ escapement	Cost recovery	Total
1993	4,600	0	9,477	0	14,077
1994	5,007	0	44,193	0	49,200
1995	215,311	0	48,430	0	263,741
1996	14,200	0	31,392	0	45,592
1997	11,021	0	18,082	0	29,103
1998	38,000	0	16,850	0	54,850
1999	140,900	0	32,814	0	173,714
2000	303,783	0	34,431	0	338,214
2001	216,625	0	27,683	0	244,308
2002	88,724	0	55,523	0	144,247
2003	459,815	0	40,701	6,390	506,906
2004	238,389	0	38,968	1,221	278,578
2005	91,814	0	33,145	0	124,959
2006	176,051	72	34,906	1,497	212,526
2007	209,446	0	35,413	11,280	256,139
2008	92,308	0	36,010	717	129,035
2009	99,220	0	52,237	1,779	153,236
Total	2,440,414	72	682,077	22,884	3,145,447

(c) Coho salmon

Return year	Commercial	Sport / subsistence/ personal use	Brood/ other/ escapement	Cost recovery	Total
1993	16,000	4,435	891	0	21,326
1994	45,884	4,500	8,297	900	59,581
1995	49,235	950	1,360	0	51,545
1996	56,850	800	6,675	0	64,325
1997	108,940	2,400	7,968	0	119,308
1998	149,833	1,050	6,876	0	157,759
1999	115,900	300	8,224	0	124,424
2000	133,238	500	9,558	0	143,296
2001	151,732	160	10,075	0	161,967
2002	209,259	160	12,428	0	221,847
2003	135,049	9,400	12,395	0	156,844
2004	128,269	100	0	9,867	138,236
2005	151,729	808	11,842	0	164,379
2006	152,143	1,243	5,683	16,062	175,131
2007	125,781	524	5,210	0	131,515
2008	116,543	300	8,732	3,823	129,398
2009	127,486	2,766	8,358	27,076	165,686
Total	1,988,811	113,097	150,301	57,728	2,309,937

(d) Sockeye salmon

Return year	Commercial	Sport / subsistence/ personal use	Brood/ other/ escapement	Cost recovery	Total
1993	15,000	0	4,900	0	19,900
1994	14,234	0	2,496	0	16,730
1995	12,826	32	1,092	0	13,950
1996	16,379	0	2,868	0	19,247
1997	49,118	400	0	0	49,518
1998	62,000	0	0	0	62,000
1999	54,478	30	0	0	54,508
2000	52,783	300	0	0	53,083
2001	49,290	250	0	0	49,540
2002	28,984	200	0	0	29,184
2003	28,155	147	1,500	0	29,802
2004	38,151	50	0	0	38,201
2005	44,705	211	1,000	0	45,916
2006	23,822	271	4,000	1,317	29,410
2007	33,088	277	1,870	455	35,690
2008	62,043	300	3,500	4,275	70,118
2009	67,105	256	8,962	15,195	91,518
Total	652,161	2,724	37,908	21,242	714,035

Source: Data from annual reports submitted to ADF&G.