Regional Information Report No. 5J13-07

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

by

Mark Stopha

July 2013

Alaska Department of Fish and Game **Division of Commercial Fisheries**

Symbols and Abbreviations

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

Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

Mathematics, statistics

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

REGIONAL INFORMATION REPORT NO. 5J13-07

AN EVALUATION OF THE MAIN BAY HATCHERY FOR CONSISTENCY WITH STATEWIDE POLICIES AND PRESCRIBED MANAGEMENT PRACTICES

by
Mark Stopha
Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau

Alaska Department of Fish and Game
Division of Commercial Fisheries
333 Raspberry Road, Anchorage, AK 99518

July 2013

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/

Mark Stopha,
Alaska Department of Fish and Game, Division of Commercial Fisheries,
1255 W. 8th St. P. O. Box 115526, Juneau, AK 99811-5526, USA

This document should be cited as:
Stopha, M. 2013. An evaluation of the Main Bay salmon hatchery for consistency with statewide policies and prescribed management practices . Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 5J13-07, Anchorage.

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF APPENDICES (Continued)

LIST OF APPENDICES (Continued)

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 each hatchery for consistency with those policies and prescribed management practices. The evaluation includes a review of 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 and permits were examined to determine whether they were current, consistent with each other, and accurately described hatchery operations.

This report reviews the Main Bay Hatchery operated by the Prince William Sound Aquaculture Corporation. The facility is a sockeye salmon hatchery located in Main Bay about 40 air miles southeast of Whittier. The original broodstocks for the hatchery were from Prince William Sound. Sockeye salmon gametes are collected from adults returning to the facility and placed in incubators fed by water from Main Lake. Each incubator has its own water source to reduce the risk of disease transmission.

The hatchery is currently permitted to collect up to 12.4 million sockeye salmon eggs. Eggs are collected in August for incubation, rearing, and release as smolt approximately 22 months later. The lower bound of sockeye salmon escapement goals to Eshamy Lake and Coghill Lake, wild stock systems harvested during fisheries targeting Main Bay Hatchery returns, were met in most years since the first significant returns to the hatchery in 1990. The basic management plan for the hatchery should be updated with a description of current permit conditions and operations to comply with regulation.

Key words: Main Bay Hatchery, hatchery evaluation, hatchery, sockeye salmon, Prince William Sound Aquaculture Corporation

INTRODUCTION

Alaska's constitution mandates that fish are harvested sustainably under Article 8, section 4: "Fish, forests, wildlife, grasslands, and all other replenishable resources belonging to the state shall be utilized, developed and maintained on the sustained yield principle, subject to preferences among beneficial uses."

Due in part to historically low salmon harvests, Article 8, section 15 of Alaska's Constitution was amended in 1972 to provide tools for restoring and maintaining the state's fishing economy: "No exclusive right or special privilege of fishery shall be created or authorized in the natural waters of the State. This section does not restrict the power of the State to limit entry into any fishery for purposes of resource conservation, to prevent economic distress among fishermen and those dependent upon them for a livelihood and to promote the efficient development of aquaculture in the State." Alaska's salmon hatchery program was developed under this mandate and designed to supplement—not replace—sustainable natural production.

Alaska's modern salmon fisheries enhancement program began in 1971 when the Alaska Legislature established the Division of Fisheries Rehabilitation Enhancement and Development (FRED) within the Alaska Department of Fish and Game (ADF&G; FRED Division 1976). In 1974, the Alaska Legislature expanded the program, authorizing private nonprofit (PNP) corporations to operate salmon hatcheries: "It is the intent of this Act to authorize the private ownership of salmon hatcheries by qualified nonprofit corporations for the purpose of contributing, by artificial means, to the rehabilitation of the state's depleted and depressed salmon fishery. The program shall be operated without adversely affecting natural stocks of fish in the state and under a policy of management which allows reasonable segregation of returning hatchery-reared salmon from naturally occurring stocks" (Alaska Legislature 1974).

Salmon fishery restoration efforts came in response to statewide annual salmon harvests of 30 million fish, among the lowest catches since 1900 (Figure 1, ADF&G 2013). The FRED

Division and PNPs engaged in a variety of activities to increase salmon production. New hatcheries were built to raise salmon, fish ladders were constructed to provide adult salmon access to previously nonutilized spawning and rearing areas, lakes with waterfall outlets too high for adult salmon to ascend were stocked with salmon fry, log jams were removed in streams to enable returning adults to reach spawning areas, and nursery lakes were fertilized to increase the available feed for juvenile salmon (FRED 1975). A combination of favorable environmental conditions, limited fishing effort, abundance-based harvest management, habitat improvement, and hatchery production gradually boosted salmon catches, with recent commercial salmon harvests (2003–2012) averaging 171 million fish (Vercessi 2013).

In Alaska, the purpose of salmon hatcheries is to supplement natural stock production for public benefit. Hatcheries are efficient in improving survival from the egg to fry or smolt stage. In natural production, estimates for pink salmon *Oncorhynchus gorbuscha* survival in two Southeast Alaska creeks ranged from less than 1% to 22%, with average survivals from 4% to 9% (Groot and Margolis 1991). Under hatchery conditions, egg to fry survival is usually 90% or higher.

Alaska hatcheries do not grow fish to adulthood, but incubate fertilized eggs and release resulting progeny as juveniles. Juvenile salmon imprint on the release site and return to the release location as mature adults. Per state policy, hatcheries generally use stocks taken from close proximity to the hatchery so that any straying of hatchery returns will have similar genetic makeup as the stocks from nearby streams. Also per state policy, Alaska hatcheries do not selectively breed. Large numbers of broodstock are used for gamete collection to maintain genetic diversity, without regard to size or other characteristic. In this document, *wild* fish refer to fish that are the progeny of parents that naturally spawned in watersheds and intertidal areas. *Hatchery* fish are fish reared in a hatchery to a juvenile stage and released. *Farmed* fish are fish reared in captivity to market size for sale. Farming of finfish, including salmon, is not legal in Alaska (Alaska Statue 16.40.210).

Hatchery production is limited by freshwater capacity and freshwater rearing space. Soon after emergence, all pink and chum salmon *O. keta* fry can be transferred from fresh water to salt water. Most Chinook *O. tshawytscha*, sockeye *O. nerka*, and coho salmon *O. kisutch* must spend a year or more in fresh water before fry develop to the smolt stage and can tolerate salt water. These three species require a higher volume of fresh water, a holding area for freshwater rearing, and daily feeding. They also have a higher risk of disease mortality due to the extended rearing phase. There are economic tradeoffs between the costs of production versus the value of fish at harvest. Although Chinook, sockeye, and coho salmon garner higher prices per pound at harvest, chum and pink salmon are more economical to rear in the hatchery setting and generally provide a higher economic return.

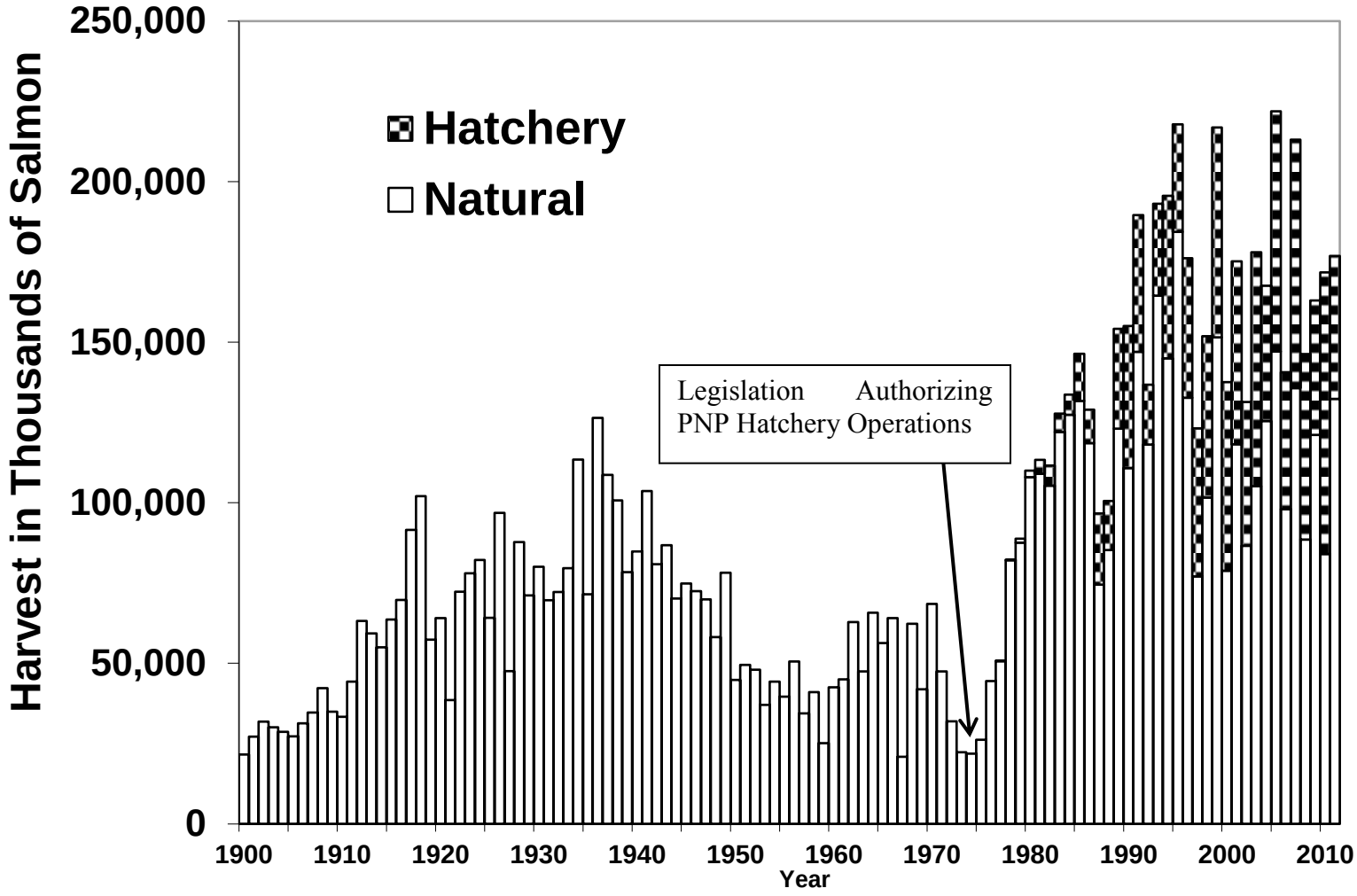

Figure 1.–Commercial salmon harvest in Alaska, 1900–2011.

Pink salmon have the shortest life cycle of Pacific salmon (two years), provide a quick return on investment, and provide the bulk of Alaska hatchery production. From 2003 to 2012, pink salmon accounted for an average 73% of Alaska hatchery salmon returns by number, followed by chum (20%), sockeye (4%), coho (2%) and Chinook salmon (<1%) (Farrington 2003, 2004; White 2005–2011; Vercessi 2013).

The salmon marketplace has changed substantially since the hatchery program began. As the first adult salmon were returning to newly built hatcheries in 1980, Alaska accounted for nearly half of the world salmon supply, and larger harvests in Alaska generally meant lower prices to fishermen. Some believed the increasing hatchery production in some parts of the state was depressing salmon prices in others (Knapp et al. 2007). By 1996, rapidly expanding farmed salmon production surpassed the wild salmon harvest for the first time (Knapp et al. 2007) and wild salmon prices declined precipitously as year-round supplies of high quality fresh farmed salmon flooded the marketplace in the U.S., Europe, and Japan. The Alaska fishing industry responded to the competition by improving fish quality and implementing intensive marketing efforts to differentiate Alaska salmon from farmed salmon. By 2004, these efforts paid off through increasing demand and prices.

Today, Alaska typically accounts for just 12% to 15% of the global supply of salmon (Alaska Seafood Marketing Institute 2011). Alaska's diminished influence on world salmon production means that Alaska's harvest volume has little effect on world salmon prices. Prices paid to fishermen have generally increased over the past decade (2003–2012) despite large fluctuations in harvest volume (ADF&G 2013). The exvessel value[1] of the commercial hatchery harvest increased from $59 million in 2003 to $104 million in 2012, with a peak value of $204 million in 2010. First wholesale value[2] also showed an increasing trend, with the value of hatchery fish increasing from $188 million in 2003 to $387 million in 2012, with a peak value of over $500 million in 2010. Pink and chum salmon combined accounted for about 80% of both the exvessel value and the first wholesale value of the hatchery harvest from 2003 to 2012. During this period, hatcheries contributed about a third of the total Alaska salmon harvest, in numbers of fish (Farrington 2003, 2004; White 2005–2011, Vercessi 2013). With world markets currently supporting a trend of increasing prices for salmon, interest in increasing hatchery production by Alaska fishermen, processors, support industries, and coastal communities has increased as well. In 2010, Alaska salmon processors encouraged hatchery operators to expand pink salmon production to meet heightened demand (Industry Working Group, 2010).

Alaska's wild salmon populations are sustainably managed to ensure adequate numbers of adults spawn, and the wild harvest is arguably at its maximum, given fluctuations due to environmental variability and imperfect management precision. Unlike Pacific Northwest systems, such as the Columbia River, where habitat loss, dam construction and urbanization led to the decline of salmon stocks to the point of endangered species listings, Alaska's salmon habitat is largely intact. ADF&G's system of wild stock monitoring addresses declines of salmon populations that do not meet production expectations or sustainable escapement levels. ADF&G, with the

---

[1] Exvessel value for hatchery harvest is the total harvest value paid by fish buyers to fishermen for all salmon from http://www.adfg.alaska.gov/index.cfm?adfg=commercialbyfisherysalmon.salmoncatch (accessed 02/04/2012), multiplied by the hatchery percent of the commercial harvest in Farrington 2003, 2004; White 2005– 2011, and Vercessi 2013.

[2] First wholesale value is the price paid to primary processors for processed fish from ADF&G Commercial Operators' Annual Reports multiplied by the hatchery percent of the commercial harvest.

assistance and sacrifice of commercial, sport, personal use and subsistence users, has been successful in recovery of several populations identified as stocks of concern through restricted fishing and intensive spawning assessment projects. Alaska's salmon populations, overall, are considered among the healthiest in the world. Other than regulatory actions, such as reductions of salmon bycatch in other fisheries or changes in fishing methods that would allow more precise management of escapement, hatchery production is the primary opportunity to substantially increase the harvest.

Part of the reason for the rise in price of Alaska salmon was a message of the state's sustainable fisheries management to a growing audience of discriminating buyers. The Alaska Seafood Marketing Institute applied to the Marine Stewardship Council (MSC) for certification as a sustainably managed fishery. In 2000, the MSC certified the salmon fisheries managed by ADF&G as sustainably managed, and the state's salmon fisheries remained the only MSC certified salmon fishery in the world for nearly a decade. Salmon fisheries elsewhere (Annette Islands Indian Reserve salmon, British Columbia pink and sockeye salmon, and Iturup Island, Russia, pink and chum salmon) were later certified for much smaller geographic areas, and in some cases, only for specific salmon species (MSC 2012). Alaska's certification was MSC's broadest and most complex, covering all five salmon species harvested by all fishing gear types in all parts of the state. Achievement of statewide certification was a reflection of the state's commitment to abundance-based fisheries management and constitutional mandate to sustain wild salmon populations.

MSC-certified fisheries are reviewed every five years. When Alaska salmon fisheries were recertified in 2007 (Chaffee et al. 2007), a condition of certification 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" (Knapman et al. 2009).

The Alaska Seafood Marketing Institute changed to a new sustainable fishery certification under the Food and Agriculture Organization in 2011 (Global Trust Certification Ltd. 2011). The hatchery evaluations started under the MSC certification program continued as an important systematic assessment of Alaska salmon fishery enhancement and its relation to wild stock production at a time of heightened interest for increased hatchery production and potential impacts on wild salmon production. ADF&G established a rotational schedule to review PNP hatchery programs. Musslewhite (2011a, 2011b) completed hatchery reviews for the Kodiak region in 2011, Stopha and Musslewhite (2012) completed the hatchery review for Tutka Bay Lagoon Hatchery in Cook Inlet, and Stopha (2012a, 2012b, 2013a, 2013b, 2013c, 2013d) completed reviews of the Trail Lakes, Port Graham and Eklutna hatcheries in Cook Inlet and the Solomon Gulch, Gulkana and Cannery Creek hatcheries in Prince William Sound (PWS). This report is for the Main Bay Hatchery (MBH) in the PWS/Copper River region. Following completion of reviews of hatcheries in the PWS/Copper River region, reviews of hatcheries Southeast Alaska will follow.

OVERVIEW OF POLICIES

Numerous Alaska mandates and policies for hatchery operations were specifically developed to minimize potential adverse effects to wild stocks. The design and development of the hatchery program is described in detail in McGee (2004): "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." Through a comprehensive permitting and planning process, hatchery operations are subject to continual review by a number of ADF&G fishery managers, geneticists, pathologists, and the ADF&G commissioner.

A variety of policies guide the permitting of salmon fishery enhancement projects. They include *Genetic Policy* (Davis et al. 1985), *Regulation Changes, Policies, and Guidelines for Fish and Shellfish Health and Disease Control* (Meyers 2010), and fisheries management policies, such as the Sustainable Salmon Fisheries Policy (5 AAC 39.222). These policies are used by ADF&G staff to assess hatchery operations for genetic, health, and fishery management issues in the permitting process.

The State of Alaska ADF&G *Genetic Policy* (Davis et al. 1985; Davis and Burkett 1989) sets out restrictions and guidelines for stock transport, protection of wild stocks, and maintenance of genetic variance. Policy guidelines include banning importation of salmonids from outside the state (except US/Canada transboundary rivers); restricting transportation of stocks between the major geographic areas in the state (Southeast, Kodiak Island, PWS, Cook Inlet, Bristol Bay, Arctic-Yukon-Kuskokwim, and Interior); requiring the use of local broodstock with appropriate phenotypic characteristics; maintaining genetic diversity by use of large populations of broodstock collected across the entire run; and limiting the number of hatchery stocks derived from a single donor stock.

The *Genetic Policy* also requires the identification and protection of *significant and unique* wild stocks: "Significant or unique wild stocks must be identified on a regional and species basis so as to define sensitive and non-sensitive areas for movement of stocks." In addition, the *Genetic Policy* suggests that drainages be established as wild stock sanctuaries where no enhancement activity is permitted except for gamete removal for broodstock development. The wild stock sanctuaries were intended to preserve a variety of wild types for future broodstock development and outbreeding for enhancement programs.

These stock designations are interrelated with other restrictions of the *Genetic Policy*, including (1) Hatchery stocks cannot be introduced to sites where the introduced stock may have interaction or impact on significant or unique wild stocks; (2) A watershed with a significant stock can only be stocked with progeny from the indigenous stocks; and (3) Fish releases at sites where no interaction with, or impact on, significant or unique stock will occur, and which are not for the purposes of developing, rehabilitation, or enhancement of a stock (e.g., releases for terminal harvest or in landlocked lakes) will not produce a detrimental genetic effect. Davis and Burkett (1989) suggest that regional planning teams (RPTs) are an appropriate body to designate significant and unique wild stocks and wild stock sanctuaries. To date, only the Cook Inlet RPT has established significant stocks and wild stock sanctuaries.

Salmon fishery enhancement efforts are guided by comprehensive salmon plans for each region. These plans are developed by the RPTs, which are composed of six members: three from ADF&G and three appointed by the regional aquaculture association Board of Directors (5 AAC 40.310). According to McGee (2004), "Regional comprehensive planning in Alaska progresses in stages. Phase I sets the long-term goals, objectives and strategies for the region. Phase II identifies potential projects and establishes criteria for evaluating the enhancement and rehabilitation potentials for the salmon resources in the region. In some regions, a Phase III in

planning has been instituted to incorporate Alaska Board of Fisheries approved allocation and fisheries management plans with hatchery production plans."

The *Alaska Fish Health and Disease Control Policy* (5 AAC 41.080) is designed to protect fish health and prevent spread of infectious disease in fish and shellfish. The policy and associated guidelines are discussed in *Regulation Changes, Policies, and Guidelines for Fish and Shellfish Health and Disease Control* (Meyers 2010). It includes regulations and guidelines for 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 ADF&G fish pathologists to review hatchery plans and permits.

The *Alaska Policy for the Management of Sustainable Salmon Fisheries* (5 AAC 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* (5 AAC 39.220), the *Salmon Escapement Goal Policy* (5 AAC 39.223), and local fishery management plans (5 AAC 39.200). These regulations require biologists to consider the interactions of wild and hatchery salmon stocks when reviewing hatchery management plans and permits.

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 iodine solution on salmon eggs transported between watersheds—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 or mandating how to assess those effects. These less specific policies provide principles and priorities, but not specific direction, for decision making.

The initial rotation of these evaluation reports will assess the consistency of individual hatcheries with state policies 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. Future reports may assess regional effects of hatcheries on wild stocks and fishery management.

OVERVIEW OF HATCHERY PERMITS AND PLANS

The FRED Division built and operated several hatcheries across the state in the 1970s and gradually transferred operations of most facilities to PNP corporations. Regional aquaculture associations (RAAs), comprised primarily of commercial salmon fishing permit holders, operate most of the PNP hatcheries in Kodiak, Cook Inlet, PWS, and Southeast Alaska. Each RAA's board of directors establish goals for enhanced production, oversee business operations of the hatcheries, and work with ADF&G staff to comply with state permitting and planning regulations. RAAs may vote to impose a salmon enhancement tax on sale of salmon by permit holders in their region to finance hatchery operations and enhancement and rehabilitation activities. Independent PNP corporations, not affiliated with an RAA, also operate hatcheries in several areas of the state. Both the RAAs and independent PNP hatchery organizations may harvest salmon returning to their hatcheries or release sites to pay for operations. Several organizations have tourist and educational programs that contribute to the financial support of their programs, as well.

Public participation is an integral part of the PNP hatchery system, and hearings are held before a hatchery is permitted for operation. RPTs comprised of ADF&G and RAA personnel hold public meetings to define desired production goals by species, area, and time, and document these goals in comprehensive salmon plans (5 AAC 40.300). RPTs review applications for new hatcheries to determine compatibility with the comprehensive salmon plan, and also make recommendations to the ADF&G commissioner regarding changes to existing hatchery operations, new hatchery production, and new hatchery facilities. Municipal, commercial, sport, and subsistence fishing representatives commonly hold seats on both RAA and independent PNP hatchery organization boards, providing broad public oversight of operations.

Alaska PNP hatcheries operate under four documents required in regulation (5 AAC 40.110–990 and 5 AAC 41.005–100) and statute (AS 16.05.092): hatchery permit with basic management plan (BMP), annual management plan (AMP), fish transport permit (FTP), and annual report (Figure 2).

The hatchery permit authorizes operation of the hatchery, specifies the maximum number of eggs of each species that a facility can incubate, specifies the authorized release locations, and may identify stocks allowed for broodstock. The BMP is an addendum to the hatchery permit and outlines the general operations of the hatchery. The BMP may describe the facility design, operational protocols, hatchery practices, broodstock development schedule, donor stocks, harvest management, release sites, and consideration of wild stock management. The BMP functions as part of the hatchery permit and the two documents should be revised together if the permit is altered. The permit and BMP are not transferrable. Hatchery permits remain in effect unless relinquished by the permit holder or revoked by the ADF&G commissioner.

Hatchery permits/BMPs may be amended through a permit alteration request (PAR). Requested changes are reviewed by the RPT and ADF&G staff and a recommendation is sent to the ADF&G commissioner for consideration. If no agreement is reached through the RPT, the PAR is sent to the commissioner without a recommendation. If approved by the commissioner, the permit is amended to include the alteration. Reference to a *permit* or *hatchery permit* in this document also includes approved PARs to the hatchery permit unless otherwise noted.

The AMP outlines operations for the current year and is in effect until superseded by the following year's AMP. 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). Typically, AMPs include the upcoming year's egg-take goals, fry or smolt releases, expected adult returns, harvest management plans, FTPs (described below) required or in place, and fish culture techniques. The AMP must be consistent with the hatchery permit and BMP.

An FTP is required for egg collections, transports, and releases (5 AAC 41.001–41.100). The FTP authorizes specific activities described in the hatchery permit and management plans, including broodstock sources, gamete collections, and release sites. All FTP applications are currently reviewed by the ADF&G fish pathologist, fish geneticist, regional resource development biologist, and other ADF&G staff as delegated by the ADF&G commissioner. Reviewers may suggest conditions for the FTP. Final consideration of the application is made by the ADF&G commissioner or commissioner's delegate. 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.

Each hatchery is required to submit an annual report documenting egg collections, juvenile releases, current year run sizes, contributions to fisheries, and projected run sizes for the

following year. Information for all hatcheries is compiled into an annual ADF&G report (e.g., Vercessi 2013) to the Alaska Legislature (AS 16.05.092).

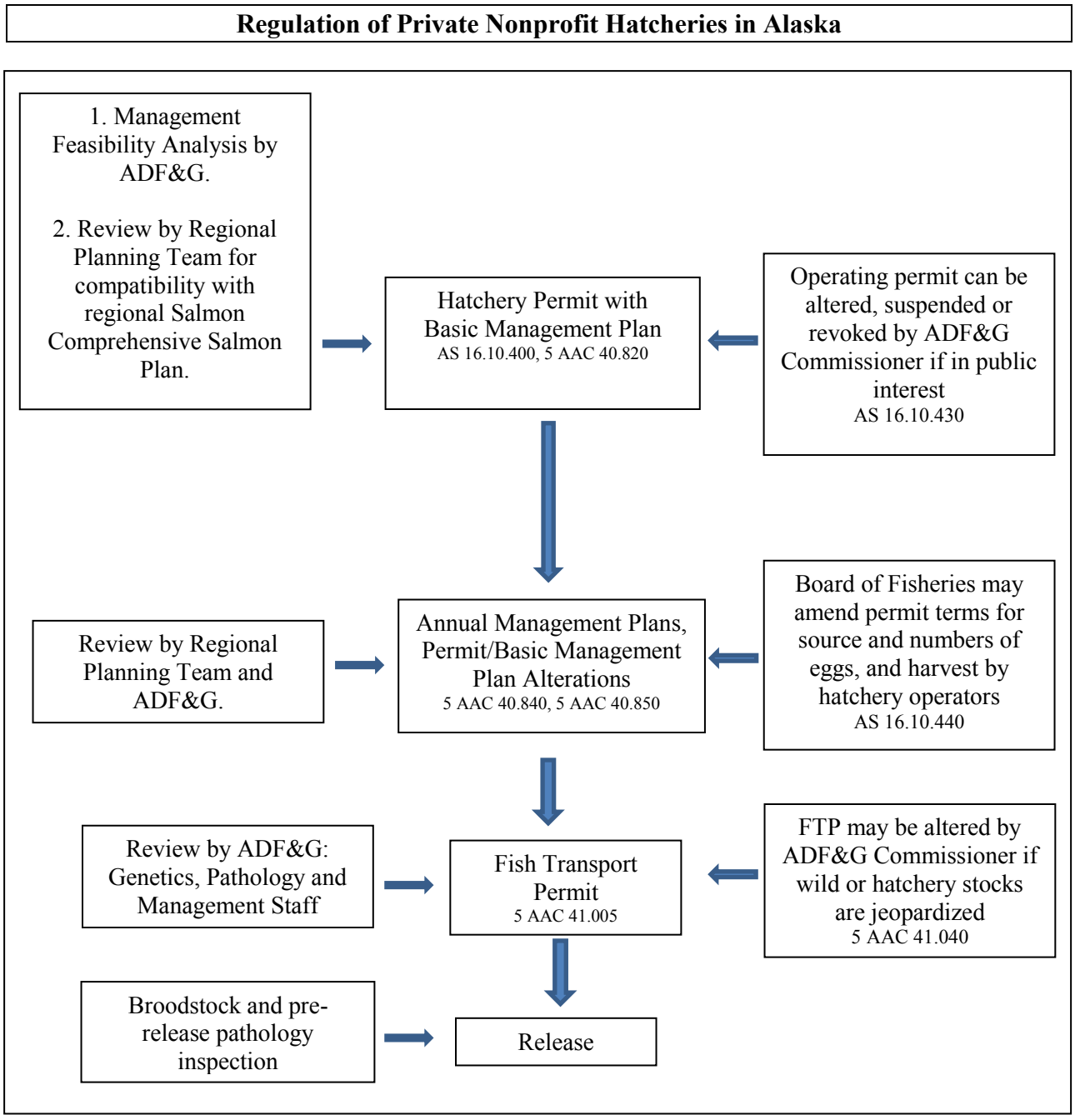

Figure 2.–Diagram of Alaska hatchery permitting process.

The administration of hatchery permitting, planning, and reporting requires regular and direct communication between ADF&G staff and hatchery operators. The serial documentation from hatchery permit/BMP to AMP to FTP to annual report spans generations of hatchery and

ADF&G personnel, providing an important history of each hatchery's species cultured, stock lineages, releases, returns, and pathology.

MAIN BAY HATCHERY OVERVIEW

Much of this overview is summarized from the Main Bay BMP[3] because of its historical significance and depth of description. Main Bay Hatchery (MBH) is located at the head of Main Bay in the Eshamy fishing district in western Prince William Sound (PWS), approximately 40 miles southeast of Whittier, Alaska (Figure 3). Main Lake is the water source for MBH. The facility was constructed in 1982 by ADF&G and operated by ADF&G until operations were transferred to PWSAC in 1992.

The PWSAC Board of Directors has 45 members. Twenty-seven board members are PWS salmon permit holders, elected by PWS salmon permit holders. The remaining 18 seats are appointed by the board and are designated representatives from municipalities, Native organizations, processors, sport fisheries, personal use fisheries, and subsistence fisheries.[4]

Prior to the development of MBH, Eshamy district was open sporadically to commercial fishing. ADF&G initially intended to enhance the Eshamy Lake sockeye salmon stock for the Eshamy District gillnet fishery by producing fry for stocking in Eshamy Lake. The small size of Eshamy Lake, however, did not have the potential to produce large numbers of adults. At the time, rearing of sockeye salmon to the smolt stage was largely unsuccessful because of problems with infectious hematopoietic necrosis virus (IHNV), so successfully establishing a return directly to the hatchery was uncertain. As a result, the hatchery concept for MBH was changed to production of early-run chum salmon.

Broodstock collection began in 1982 using wild chum salmon from the Wells River, a PWS watershed (Appendices B and C). Development of the hatchery stock proceeded quickly, and the hatchery reached full production capacity in 1986. Concurrent with the development of MBH, but one year behind, PWSAC (working with ADF&G) released chum salmon fry reared at MBH at the present site of the Wally Noerenberg Hatchery (WNH). WNH reached its annual production goal of about 100 million eggs in 1988. A total annual return of approximately 4 million chum salmon was expected from releases at both hatcheries. =

Pink salmon were also incubated and released at MBH from 1983 to 1989 (Appendices E and F). The original broodstock for MBH was from Armin F. Koernig Hatchery (AFKH). AFKH pink salmon fry were transferred to MBH and released to develop broodstock at MBH. AFKH stock was later replaced with Cannery Creek Hatchery (CCH) stock. This was done because it was easier to collect eggs at MBH than at CCH, so MBH returns were intended to be used as broodstock for both MBH and CCH.

[3] Main Bay Hatchery Basic Management Plan, 2001, unpublished document. Obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

[4] website: http://pwsac.com/about/board-directors/ (Accessed 10/24/2012), and Dave Reggiani, PWSAC General Manager, personal communication)

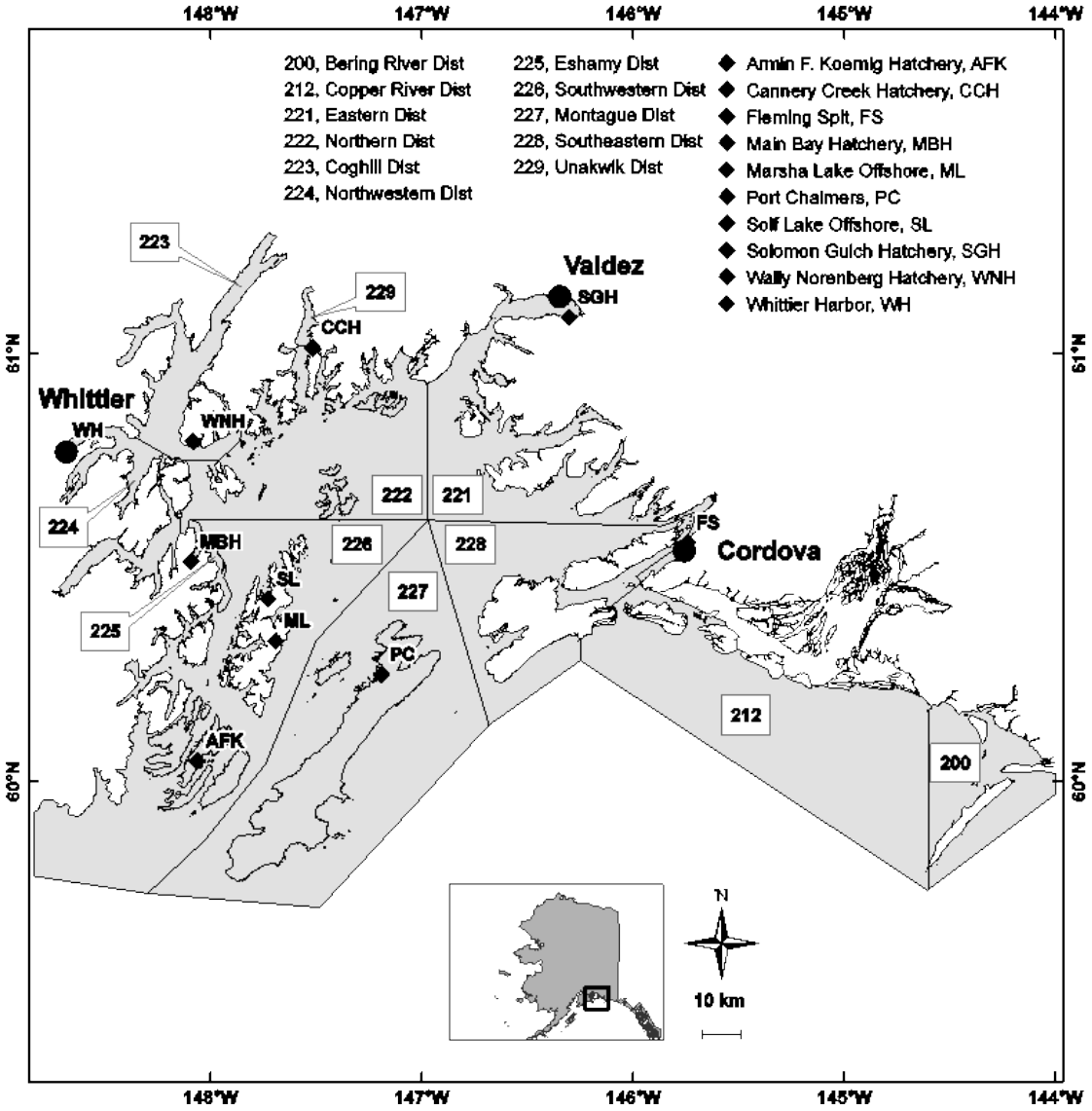

Figure 3.–Fishing districts and hatchery locations in PWS.

Coded wire tag recovery data collected during the 1986 fishing season indicated that many of the adult chum salmon returning to MBH were captured by the drift gillnet fleet in the Coghill District, where WNH is located[5]. The natural run of sockeye salmon returning to Coghill Lake passed through the Coghill District at the same time that these MBH chum salmon were present, and the incidental harvest of Coghill Lake sockeye salmon concerned fisheries managers trying to manage several very large hatchery stocks and a smaller, but valuable, natural stock in the same time and area. Several enhancement program alternatives were examined to alleviate this problem. The alternative adopted was to discontinue the chum salmon program and replace it with an early-run sockeye salmon stock beginning in 1987.

[5] Main Bay Hatchery Basic Management Plan, 2001 unpublished document. Obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

The goal of the MBH sockeye salmon program was to produce a significant run of adult sockeye salmon for the drift and set gillnet fisheries in the Eshamy District before the annual opening of the seine fishery in PWS (historically July 18). A secondary goal was to produce fry for various lake stocking projects in western PWS.[6]

Coghill Lake sockeye salmon was chosen as the initial broodstock. This stock was large enough at the time to provide sufficient broodstock for the hatchery while still meeting escapement requirements, and was a relatively early-run stock that was expected to pass through the traditional seine districts before fishing began for seine gear on July 18.

MBH had adequate water supply, raceway rearing area for fry, and saltwater net pen rearing area for smolts, and therefore was not limited to producing only fry for lake stocking. The new hatchery operation plan included collection of 10 million sockeye salmon eggs at Coghill Lake, and rearing of 5 million fry to the smolt stage in the spring of 1989 through 1993. Any remaining fry were to be stocked into appropriate lakes in PWS. After 1991, it was anticipated that enough broodstock would return for collection of 15 to 20 million sockeye salmon eggs annually at MBH, resulting in anticipated returns of about 3 million to 4 million adults.

Broodstock was obtained from Coghill Lake in the fall of 1986. Eggs were incubated and hatched at WNH. Fry were transferred to Trail Lakes Hatchery[7] for rearing, and pre-smolt were transferred to MBH in September of 1987. Following the successful production and release of approximately 330,000 sockeye salmon smolts in the spring of 1988, ADF&G planned to expand the program to include other stocks of sockeye salmon. Two additional projects were considered: enhancement of the Eshamy Lake sockeye salmon run, and development of an earlier sockeye salmon run to the hatchery using a small stock of sockeye salmon from the middle arm of Eyak Lake near Cordova.

Eshamy Lake sockeye salmon production at MBH focused on two primary objectives: rehabilitation of the Eshamy Lake stock and developing a late-run sockeye salmon run to MBH. Several approaches to rehabilitation of the Eshamy Lake system were considered, including fry and presmolt stocking, and imprinting and release of full-term smolts at the lake outlet.

The Eyak Lake sockeye salmon project was intended to establish an early run to MBH. The approximate return timing of this stock (May 15–June 15) coincided with the early and most intense segment of the Copper River drift gillnet fishery, and would provide additional fishing opportunity during that time period. Under optimal environmental conditions, progeny from the Eyak Lake stock were capable of migrating and adapting to the ocean as age-zero smolts. If an age-zero program could be established, it would reduce freshwater residence time at MBH by nearly a year. Such a program would reduce operational costs and maximize production.

At full production under the three-stock concept, MBH would produce approximately 20 million smolts and an expected adult run of approximately 4 million fish. To distribute the fishing effort, hatchery produced sockeye salmon smolts would be imprinted and released at three primary sites: MBH, Eshamy Lagoon, and the mouth of Coghill River. The three-stock concept was implemented in 1989 with the transfer from WNH of 2.6 million Eshamy Lake stock sockeye

---

[6] Briefing paper, Main Bay Hatchery Production and Expansion Plans, attachment to FP 90A-0008, unpublished document. Obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

[7] Main Bay Hatchery Basic Management Plan, 2001, Table 2, unpublished document. Obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

salmon eyed eggs of Eshamy Lake origin to MBH. The first remote egg take at Eyak Lake occurred in June 1990.

ADF&G began the process of transferring operation of the hatchery to PWSAC in 1990. A public hearing for the transfer was held by the ADF&G commissioner in Cordova in 1991. Public testimony was unanimous in support of transfer of the hatchery.[8] On July 1, 1991, PWSAC assumed full operation of MBH and continued the development plan.

In 1992, ADF&G staff expressed concern regarding the effect of the proposed MBH expansion plan on wild stock escapements in PWS. This led to several years of debate within the Prince William Sound/Copper River Regional Planning Team (PWSCR RPT) regarding acceptable production levels for the MBH expansion plan. The PWSCR RPT reached consensus at its March 1995 meeting, recommending a production level of 10.2 million green sockeye salmon eggs for "all stocks combined."

In 1994, ADF&G and PWSAC jointly decided to cease releases of sockeye salmon smolt at the mouth of the Coghill River and the Eshamy Lagoon because the returning adults did not home properly into the lake systems.[9]

On January 17, 1996, the MBH main water supply pipeline separated and cut off water to the incubators and raceways. This resulted in the loss of all brood year 1995 MBH/Eyak stock and MBH/Coghill stock sockeye salmon alevins, and 95% of brood year 1994 MBH/Eshamy stock sockeye salmon fry. Additionally, the pipeline break forced an unplanned release of 100% of brood year 1994 MBH/Coghill stock sockeye salmon fry. This catastrophic event led to another evaluation of the MBH sockeye salmon program.

Operational hurdles required by the ADF&G *Sockeye Salmon Culture Manual* protocol became apparent as the number of different sockeye salmon stocks placed in the hatchery increased. Modifications to the hatchery completed in 1996 helped, but did not solve all of the problems of rearing multiple sockeye salmon stocks. In 1996, PWSAC decided to reduce the program to only two stocks, and production would be split between the Eyak Lake stock and the Eshamy Lake stock.

By 1997, it was apparent that the survivals of the early timed MBH/Eyak sockeye salmon were considerably less than expected. It was also apparent that the run timing of the later MBH/Eshamy sockeye salmon would pose a considerable conflict with migrating pink salmon. PWSAC decided to return to rearing only the Coghill Lake stock based on past hatchery performance, marine survivals, and run timing. This one-stock program was implemented in 1998 and remains the current plan.

Based on the number of Coghill Lake stock released in earlier years, PWSAC did not anticipate that there would not be enough returning adult Coghill Lake stock to meet the permitted egg capacity in 2000 and 2001. PWSAC supplemented the MBH Coghill Lake stock egg take in 2000 with eggs from Coghill Lake. In 2001, PWSAC took all eggs for the hatchery from a final brood year of MBH/Eshamy stock sockeye salmon returns. From 2002 forward, MBH/Coghill stock sockeye salmon has been the sole broodstock for MBH.

---

[8] Memorandum from J.P. Koenings, Director, Division of FRED to Carl Rosier, ADF&G Commissioner, June 2, 1991, unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator.

[9] Email from Mark Willette, PWSCR RPT Chairman to several ADF&G staff dated Friday, August 12, 1994. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator.

HATCHERY PERMIT

After operating MBH for a decade, PNP hatchery permit number 31 and MBH BMP were issued to PWSAC in 2001 for a permitted capacity of 10.2 million sockeye salmon eggs (Appendix A). The goal of the program stated in the BMP was to provide an annual average run of 800,000 adult sockeye salmon.

Fishing near the hatchery is managed according to the Main Bay Special Harvest Management Plan (5 AAC 24.367). Otolith marking of all releases began in 1999. Lake stocking of Coghill and Eshamy Lakes was also part of the BMP. The wild stock escapement goal for Coghill Lake was 25,000 sockeye salmon at that time. If the escapement to the lake was less than 15,000 sockeye salmon for two consecutive years, then consideration would be given to stocking the lake from MBH. For Eshamy Lake, no stocking would be considered without a continuing limnology program, which was not funded at the time. As mentioned earlier, the Eshamy and Eyak stock programs at MBH were dropped, and since 2002, only Coghill Lake stock is used.

Three PARs have been approved since PWSAC was issued the MBH permit. The first PAR was approved in 2004, when a release of 1.2 million sockeye salmon fry was permitted in Marsha Lake as a means of using excess fry when egg to fry survival was higher than average and exceeded the rearing capacity at MBH. Provisions of the permit alteration included otolith sampling of adults returning to the release area to monitor the harvest of wild stock sockeye salmon.

A second PAR was approved in May 2005 to increase permitted egg capacity from 10.2 million to 11.0 million eggs for a five-year period. PWSAC intended to evaluate advanced technology rearing units that could allow increased smolt production. The increased production from the additional 800,000 eggs was to be released at MBH. A provision of the permit was for PWSAC to evaluate and report on the increased sockeye salmon production. In May 2010, the approved permit alteration expired and permitted capacity returned to 10.2 million eggs.

A third PAR was approved in June 2010 for an increase in the permitted egg number from 10.2 million to 12.4 million eggs. A provision of the permit alteration was that release groups would be differentially marked, and that Marsha Lake releases would have additional identifying marks. The request for an increase in permitted capacity was based on the desire to increase the number of fish available for common property harvest. Successful trials of increased fry and smolt densities from 2005 to 2010 in MBH raceways demonstrated feasibility.

HATCHERY PRODUCTION

Chum salmon egg takes occurred from 1982 to 1986 (Appendix B), and juvenile releases from 1983 to 1987 (Appendix C). Chum salmon releases peaked at over 76 million fry in 1986. The peak chum salmon run of 321,000 fish was in 1990 (Appendix D).

Pink salmon egg takes occurred from 1982 to 1985, 1986, and 1987 (Appendix E). Pink salmon releases peaked at nearly 42 million fry in 1984 (Appendix F). The pink salmon return peaked at over 600,000 fish in 1984 (Appendix G).

The first sockeye salmon egg takes were from Coghill Lake sockeye salmon broodstock in 1986 (Appendix H). From 1987 to 2012, sockeye salmon releases peaked at 11 million fry in 2012 (Appendix I). MBH sockeye salmon runs exceeded 1 million fish in 1997, 2003, 2006, 2007, and from 2010 to 2012 (Appendix J).

The PWS sockeye salmon common property commercial harvest roughly tripled from an average 721,000 fish per year in the decade prior to statehood (1959) to an average 2.1 million sockeye salmon per year from 2000 to 2009. From 2000 to 2009, the average annual hatchery contribution of the Gulkana Hatchery and MBH combined (820,000 fish) comprised about 38% of the total average annual commercial harvest of 2,152,000 fish (Table 1).

Table 1.–Average of yearly total sockeye salmon common property commercial harvests and hatchery harvests by decade in PWS, 1950–2009.

		Common Property Commercial Hatchery Harvest		
Decade	PWS Sockeye Salmon Average Common Property Commercial Harvest	Gulkana Hatchery	MBH	Total Hatchery Contribution
1950s	721,000	0	0	0
1960s	749,000	0	0	0
1970s	755,000	0	0	0
1980s	1,201,000	40,000	0	40,000
1990s	2,016,000	270,000	294,000	564,000
2000s	2,152,000	153,000	667,000	820,000

Source: Botz et al. (2012).
Note: Numbers rounded.

PROGRAM EVALUATIONS

Hatchery permit/BMP, AMP, and FTP documents for MBH were reviewed (Appendices K to GG) 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 hatchery permit and BMP do not expire. The BMP should be updated when any permit amendments are approved through PARs.

From 1987 to 1995, FTPs were only issued for off-site egg takes and releases, but not egg takes and releases at MBH. Beginning in 1996, FTPs were also issued for egg takes and releases at MBH (Appendix K). MBH operated under the AMP from 1991 until 2001, when the hatchery permit and BMP were issued.

It appears that the 2001 release of MBH/Coghill Lake stock fry to Solf Lake (FTP 98A-0055; Appendix V), the 1994 and 2000 releases of Coghill Lake stock sockeye salmon fry to Coghill Lake (FTP 87A-1054, Appendix L), and the 2002 release of Coghill Lake stock sockeye salmon fry at MBH (FTP 91A-0038, Appendix M) occurred when the FTPs for these activities had expired.

Egg-takes and fry releases reported in the annual reports submitted by PWSAC were reviewed for consistency among the hatchery permit, FTPs and AMPs. Coghill stock egg takes in 1993 and from 2003 to 2012 were within permitted levels as determined by the egg collection estimate method prescribed in the AMP.

The number of eggs collected in the annual reports may appear to exceed permitted levels (Appendices P and CC), but this is because the estimated number of eggs collected is not calculated based on sampling. Fecundity sampling is not practical for sockeye salmon during the egg take due to concern of IHNV cross contamination. Instead, the egg-take number is estimated based on an assumed fecundity according to the AMP approved by ADF&G, and the egg take ends when the permitted level is reached.

At the eyed-egg stage, the number of eggs collected is measured by a weight and volume sample estimate. PWSAC reported the sampled egg count on the annual report, but conducted the egg take based on the procedures outlined in the AMP using the specified assumed fecundity.[10]

Any deviation of the actual fecundity to the assumed fecundity will yield more or less eggs. The deviation can be dramatic in some years depending on the age composition of the broodstock that is produced from the differences in the marine survival of the two age classes (age-4 and age-5 returning adults).[11] If egg numbers are in excess to permitted capacity as estimated at the eyed-egg stage, excess eggs are discarded to bring the facility into compliance with the egg collection number allowed on its permit.

PWSAC has followed the egg-take procedure according to the AMP, discarded eggs that were excess to permitted capacity, and provided a detailed description of their egg take estimate on their annual reports.

COMPREHENSIVE SALMON ENHANCEMENT PLAN

The PWSCR RPT has developed three Comprehensive Salmon Plans (CSP) to date. Phase I was issued in 1983, and served to assemble relevant information regarding the development and protection of salmon resources in the area (Prince William Sound Regional Planning Team 1983). The document assessed the region's commercial, sport, and subsistence fisheries resource needs, identified areas for enhancement and rehabilitation to meet those needs, and set 20-year goals for each fishery. The Phase I plan projected that average wild sockeye salmon catches in the commercial fisheries would be about 810,000 fish, which was average annual catch between 1960 and 1981.

The PWS management area is divided into 11 districts. MBH is located in the Eshamy District (Figure 3). Drift gillnet gear is permitted in six PWS districts, including the Eshamy District. Set gillnet commercial fishing gear is permitted only in the Eshamy District. The RPT conducted a survey as part the Phase I CSP to ask the fishing community about their desires for enhancement. Drift gillnet respondents ranked Eshamy District fourth, and set gill net respondents ranked it first, as a preferred district for new enhancement projects. Sockeye salmon was the preferred species for both gear groups.

The CSP Phase II was issued in 1986 (Prince William Sound Regional Planning Team 1986). The purpose of the Phase II plan was to recommended 5-year goals to achieve the 20-year goals in the Phase I plan. At the time, MBH was producing pink and chum salmon. For MBH, the Phase II plan recommended (1) an increase in eyed-egg capacity to 100 million chum salmon and 25 million pink salmon eggs, (2) providing 25 million eyed pink salmon eggs for incubation and release at CCH (3) increasing the short-term rearing capacity for emergent fry, and (4)

[10] Dave Reggiani, PWSAC General Manager, personal communication.
[11] Ibid.

providing runs of about 1.2 million pink salmon and 1.6 million chum salmon to the region's fisheries.

The Phase III CSP was issued in 1994. By this time, the hatchery had converted from pink and chum salmon production to sockeye salmon production. The purpose of the Phase III plan was to "achieve optimum production of wild and enhanced salmon stocks on a sustained yield basis through an integrated program of research, management, and application of salmon enhancement technology, for the benefit of all user groups." The plan stated two recommendations intended to minimize increases in the exploitation rate on wild stocks migrating through the Eshamy District: 1) shift emphasis in sockeye salmon to an earlier run timing (i.e., the Eyak Lake stock); and 2) remote release any increase in sockeye salmon production in the middle run timing (Coghill stock) to minimize the exploitation rate on wild stocks migrating through the Eshamy District.

Enhancement production goals over the next decade called for increasing the early-run Eyak stock permitted egg capacity at MBH from 100,000 to 10.64 million, increasing the middle run Coghill stock permitted egg capacity at MBH from 5.10 million to 7.97 million, and increasing the late run Eshamy stock permitted egg capacity at MBH from 2.10 million to 4.26 million. This would have the effect of increasing the hatchery capacity permitted for sockeye salmon from a total of 7.3 million eggs to 22.87 million eggs (Prince William Sound-Copper River Regional Planning Team 1994). As mentioned earlier, in 1998, MBH sockeye salmon production was reduced from three stocks to one stock, and the current permitted egg take is 12.4 million Coghill stock eggs.

The Phase III plan also recommended five biological and economic criteria as the hatchery program in PWS was developed. Two recommendations—that growth rates of juvenile salmon during the early marine period should be density independent over the long term, and that abundance of juvenile salmon predators should be independent of juvenile salmon abundance over the long term—are not addressed here because these parameters would likely be affected by more than one hatchery. These issues may be addressed in future enhancement evaluations that address issues on a regional scale. Two recommendations—that straying remain below 2% of the wild-stock escapement over the long term and that wild stock escapement goals must be achieved over the long term—can be assigned to an individual hatchery and are addressed in this document.

The fifth recommendation of the Phase II plan was that the long-term average cost of hatchery operation, management, and evaluation must remain 50% of the value of hatchery production and that the RPT will determine how to calculate costs and values of the hatchery program and establish more definitive decision criteria regarding economic benefits. The RPT has not defined these values and costs.

The RPT developed a Project Criteria Checklist in the Phase III plan to evaluate new project applications. The check list evaluates projections on their contribution to achieving objectives of the comprehensive plan. The evaluation is based on project feasibility, land use, management, biology, allocation, and cost/benefit analyses. The RPT encouraged applicants to use the checklist to develop the information for discussion by the RPT so that hatchery operators would have a better understanding of their role in fisheries regional development.

In addition, the revised charter for the RPT under Phase III Plan states that the RPT will update the CSP at least once a year, and will provide an updated plan to the commissioner each year. Annual reports have not occurred since issuance of the Phase III Plan.

CONSISTENCY WITH POLICY

Policies governing Alaska hatcheries were divided into three categories for this review: genetics, fish health, and fisheries management. Key elements in each of the policy categories are summarized in Tables 2–4. These templates identifying the key elements of state policies were used to assess compliance of the MBH salmon program with each policy element in Tables 5–7.

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	
Identification of significant or unique wild stocks	Significant or unique wild stocks must be identified for each region and species as stocks most important to that region. The Regional Planning Teams should establish criteria for determining significant stocks and recommend such stock designations.
Interaction with or impact on significant wild stocks	Priority is given to protection of significant wild stocks from harmful interactions with introduced stocks. Stocks cannot be introduced to sites where they may impact significant or unique wild stocks.
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.
Straying Impacts	Prevention of detrimental effects of gene flow from hatchery fish straying and interbreeding with wild fish.
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 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 broodstock.
Genetics review of Fishery Transport Permits (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 the application. 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;	
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	According to AS 16.10.460, inspection of the hatchery facility by department inspectors shall be permitted by the permit holder at any time the hatchery is operating.
Disease reporting	The occurrence of fish diseases or pathogens listed in 5 AAC 41.080(d) must be immediately reported to the ADF&G Fish Pathology Section.
Pathology requirements for Fish Transport Permits (FTPs) (5 AAC 41.005–41.060)	
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 list the isolation measures to be used during transport, including a description of containers, water source, depuration measures, and plans for disinfection.
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 recommend to the commissioner terms or conditions to the permit to protect fish health. Transports of fish between regions are discouraged.

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

Sustainable Salmon Fishery Policy (5 AAC 39.222)	
I. Management principles and criteria	
Assessment of wild stock interaction and impacts	As a management principle, the effects and interactions of introduced or enhanced salmon stocks on wild stocks should be assessed. Wild stocks should be protected from adverse impacts from artificial propagation and enhancement efforts.
Use of precautionary approach	Managers should use a conservative approach, taking into account any inherent uncertainty and risks.
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 consideration by the commissioner of ADF&G. Department staff may recommend approval or denial of the permit, and recommend permit conditions.

Genetics

Donor stocks at MBH were from PWS sockeye salmon watersheds (Eyak, Coghill and Eshamy lakes; Table 5). The ADF&G geneticist specified that only the progeny from wild fish from the respective lakes should be used for stocking Coghill Lake and Eshamy Lake, per the *Genetic Policy*.[12] The geneticist also expressed concerns that the smolt production techniques at MBH had resulted in a year-class shift in returning adults, i.e., hatchery adults were returning at different ages than the broodstock from where their ancestral stock was derived.

Although the geneticist did not agree with development of the Eshamy Lake stock for release from MBH due to concerns that temporal separation would not be able to be maintained over time as hatchery operations might change the timing of the runs through hatchery management practices, the geneticist was apparently unaware of the planning process and briefing papers that occurred over the course of the previous 12 months.[13] Comments later in the application direct the geneticist to these documents.[14] The FRED regional program manager also provided information about the project and indicated that peak timing for the Eshamy Lake and Coghill Lake stocks was 45 days apart, and therefore, adequate temporal separation should exist for selective broodstock collection.[15] The FRED director's opinion was that there was no genetic issue and "selection pressure can be applied toward the heritable trait of adult run timing in an effort to maintain early run timing separation."[16]

The chief of technology and development for the FRED Division, who was the same biologist who served as the state genetics reviewer on the Eshamy Lake project, disagreed with the FTP application to develop the Eyak Lake stock at MBH for similar concerns as for the Eshamy Lake stock. The Eyak Lake stock returned earlier than the Coghill Lake stock. The application was part of the hatchery plan to develop three temporally separated sockeye salmon stocks that would provide an extended fishing season in the Eshamy District. The geneticist gave similar reasons of disagreement as for the Eshamy FTP application—that it was unlikely that the stocks could be kept separate when returning to the hatchery.[17] The FRED regional supervisor, who was the same person listed as the FRED regional program manager for the Eshamy Lake release above, and the FRED director gave similar comments as for the Eshamy Lake release mentioned earlier. Both the Eshamy and Eyak lakes releases were approved by the ADF&G commissioner. The Eshamy and Eyak lake stocks were eventually dropped from the program, and the Coghill Lake stock is the only stock used today.

Brenner et al. (2012) assessed straying of sockeye salmon at the Coghill and Eshamy Lake systems. Eshamy Lake is the nearest major sockeye salmon system to MBH, whereas Coghill Lake is the ancestral stock for MBH. In the Eshamy River, MBH fish comprised less than 2% of samples taken in four of five years (2006, 2008–2010), with 33% MBH fish in samples taken

[12] James Seeb, ADF&G geneticist, comments on FTP 91A-0038 application, unpublished document. Obtained from Sam Rabung, ADF&G PNP Hatchery coordinator, Juneau.

[13] Rob Burkett, ADF&G geneticist, comments on FTP 90A-0008 application to develop Eshamy Lake stock sockeye salmon at MBH. Obtained from Sam Rabung, ADF&G PNP Hatchery coordinator, Juneau.

[14] Dennis Haanpaa, ADF&G Commercial Fisheries Regional Supervisor designee, comments on comments on FTP 90A-0008 application to develop Eshamy Lake stock sockeye salmon at MBH. Obtained from Sam Rabung, ADF&G PNP Hatchery coordinator, Juneau.

[15] Tim McDaniel, FRED Regional Hatchery Manager, to FTP reviewers; April 18, 1990, memorandum regarding Eshamy Sockeye FTP #90A0008. Obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

[16] Brian Allee, FRED Director, comments on FTP 90A-0008 application to develop Eshamy Lake stock sockeye salmon at MBH. Obtained from Sam Rabung, ADF&G PNP Hatchery coordinator, Juneau.

[17] Rob Burkett, ADF&G Chief of Technology and Development, FRED Division, comments on FTP 90A-0023 application to develop Eshamy Lake stock sockeye salmon at MBH. Obtained from Sam Rabung, ADF&G PNP Hatchery coordinator, Juneau.

during one year (2007). Hatchery fish comprised less than 1% of samples taken in seven years (2004–2010) in the Coghill River.

Table 5.–The current MBH salmon fishery enhancement program and its consistency with elements of the ADF&G *Genetic Policy* (see Table 2).

I. Stock Transport	
Use of appropriate local stocks	MBH used broodstock originating from PWS pink, chum and sockeye salmon wild stocks. Pink and chum salmon stocks were also transferred to MBH from CCH and AFKH. The stocks from these two hatcheries also originated from PWS wild stocks.
II. Protection of wild stocks	
Identification of significant or unique wild stocks	No PWS stocks have been identified as significant stocks or unique wild stocks in PWS by the PWS RPT.
Establishment of wild stock sanctuaries	No wild stock salmon sanctuaries are designated for PWS.
Straying Impacts	Straying of MBH hatchery pink and chum salmon was not studied during the production years for these species. Most of streams consistently sampled by Brenner et al. (2012) showed low (<2%) levels of hatchery fish in samples at wild sockeye salmon spawning systems in most years. Restricted fishing effort in 2007 to provide for wild stock escapement may have led to higher MBH straying at the Eshamy weir that year (Brenner et al. 2012). The Coghill District showed less than 1% of hatchery fish in all years sampled (Brenner et al. 2012). Brenner et al. (2012) also sampled small numbers of carcasses from four other systems known to have sockeye salmon spawning populations, and only one of the four streams sampled in more than one year between 2004 and 2010. These streams showed sampled percentages of hatchery fish of 0, 5.5, 62.5 and 93.3%. Streams without documented wild sockeye salmon spawning populations were also sampled between 2004 and 2010, with 44 out of 69 of the carcasses sampled (69%) of hatchery origin.
III. Maintenance of genetic variance	
Maximum of three hatchery stocks from a single donor stock	MBH stock pink salmon were used at AFKH and WNH. MBH used Wells River (a PWS system) chum salmon, and provided broodstock for the WNH chum salmon program. Sockeye salmon broodstocks were from PWS stocks at Coghill, Eshamy and Eyak lakes.
Minimum effective population size of 400	The AMP for MBH requires about 9,000 adult sockeye salmon broodstock to meet egg-take goals.
Use of no more than 90% of any run segment of donor stock so all segments of donor stock run can spawn	Donor stocks were collected based on assessment that adequate escapement would be met for each system, and likely did not incur any long lasting effect on timing of the donor stock.
Genetics review of FTPs (5 AAC 41.010 – 41.050)	
Review by geneticist	The geneticist reviewed FTPs issued for MBH programs. The geneticist recommendations against approval of Eshamy and Eyak lake release FTPs due to concerns about maintaining stock separation with run timing overlap were based on a lack of background information regarding the planning and research into these projects that were later provided by ADF&G staff familiar with the projects.

Fish Health and Disease

FTPs for the MBH programs were approved by the pathologist (Table 6). Pathology records showed no inconsistencies with fish health and disease policies. Appropriate salmon culture techniques are being used, and disease reporting and broodstock screening have occurred as required. ADF&G pathology staff has regularly inspected MBH since ADF&G transferred operations to PWSAC in 1990 (Appendix GG).

Table 6.–The current MBH salmon fishery enhancement program and its consistency with elements of the 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	Eggs disinfected with 100 ppm iodophore for 1 hour.
Hatchery inspections	Hatchery inspections were conducted regularly from at least 2001 through 2012.
Disease reporting	Periodic episodes of IHVN have been reported by hatchery staff.
Pathology requirements for FTPs (5 AAC 41.010)	
Disease history	The disease histories are completed as needed.
Isolation measures	No physical transport occurs for onsite release, according to the FTP.
Pathology review of FTPs	The FTPs were reviewed and approved by the pathologist.

Fisheries Management

Sockeye salmon at MBH are otolith marked for stock identification and escapement goals are in place for Coghill Lake and Eshamy Lake wild stock returns (Table 7). During the early years of sockeye salmon production, ADF&G staff were concerned that Coghill and Eshamy lakes wild sockeye salmon stocks could be overharvested during the harvest of hatchery runs. In Cook Inlet, returning hatchery-reared sockeye salmon released in lower Cook Inlet followed wild stocks well north or their release site before returning south again to their release location. If such extended intermingling occurred during MBH runs, ADF&G staff was concerned that wild sockeye salmon could be caught in the hatchery harvest area before they separated from the hatchery fish and migrated to their natal streams. [18]

Eshamy Lake is located near MBH. Coghill Lake sockeye salmon also migrate through the Eshamy District, so wild fish from both systems can be harvested during fisheries targeting MBH hatchery runs. The first significant run of sockeye salmon to the hatchery occurred in 1990 (Appendix J). From 1990 to 2011, the lower bound of the escapement goal to Eshamy Lake was met in 14 of 21 years (the Eshamy Lake weir was not operated in 1998). Prior to hatchery returns, from 1967 to 1989, the lower bound of the escapement goal was met in 10 of 22 years (the weir was not operated in 1987; Appendix HH).

From 1980 to 1987, annual escapements to Coghill Lake exceeded the upper range of the escapement goal in every year except 1983. The progeny of these runs appear to have significantly depleted zooplankton stocks in Coghill Lake, resulting in poor survival of sockeye salmon offspring (Edmundson et al. 1992). Subsequent low adult returns from the large

[18] Ken Florey, ADF&G Commercial Fisheries, Management and Development regional supervisor, comments on FTP 87A1054 application, unpublished document. Obtained from Sam Rabung, ADF&G PNP Hatchery coordinator, Juneau.

escapements and incidental harvest in the commercial fisheries led to escapements below the lower bound of the escapement goal in all but one year from 1990 to 1994 (Appendix HH).

In 1991, the state geneticist made several comments on an FTP application to use Coghill Lake stock sockeye salmon returning to Davis Lake for broodstock for MBH because poor returns to Coghill Lake were anticipated to continue and would preclude collecting broodstock at Coghill Lake. The state geneticist recommended that the overharvest of Coghill Lake sockeye salmon during WNH hatchery fisheries and the collapse in primary productivity in Coghill Lake due to low numbers of sockeye salmon carcasses be addressed in developing a plan for enhancing the Coghill Lake system with release of smolt.[19]

The FTP was approved with the stipulation that a Coghill Lake analysis and management plan be developed. From 1991 to 1995, juvenile Coghill Lake stock sockeye salmon incubated and reared at MBH were released into the Coghill Lake system (Appendix I). In 1993, a nutrient enrichment plan was implemented at Coghill Lake to increase lake productivity (Edmundson et al. 1995). In addition, ADF&G assessed sockeye salmon stock composition through coded wire tag recoveries and scale pattern analysis to improve understanding of migration routes of sockeye salmon destined for Coghill Lake and to assess interception of Coghill Lake sockeye salmon in the MBH sockeye and WNH chum salmon fisheries (Donaldson et al. 1995a). In 1994, management strategies were adopted by the Alaska Board of Fisheries to reduce the interception of Coghill Lake sockeye salmon in the PWS commercial fisheries to ensure escapement into Coghill Lake. Escapement to Coghill Lake improved, and the lower bound of the escapement goal has been met annually since 1995 (Appendix HH).

Table 7.–The current MBH 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 interaction and impacts	Adult runs are sampled for presence of hatchery otolith markings to estimate contributions to the fisheries. Straying studies are ongoing in Prince William Sound.
Use of precautionary approach	ADF&G manages the salmon fishery to meet wild stock escapement.
Salmon Escapement Goal Policy (5 AAC 39.223)	
Establishment of escapement goals	Escapement goals are established for the Eshamy Lake and Coghill Lake sockeye salmon systems.
Mixed Stock Salmon Fishery Policy (5 AAC 39.220)	
Wild stock conservation priority	A management plans is in place for the MBH sockeye salmon return. Terminal harvest areas for sockeye salmon returning to the hatchery allows their targeted harvest and minimizes incidental catch of other stocks when necessary.
Fisheries management review of FTPs (5 AAC 41.010 – 41.050)	
Review by management staff	The FTP for the MBH program was reviewed by fisheries management staff.

[19] James Seeb, ADF&G geneticist, comments on FTP 91A-0115 application, unpublished document. Obtained from Sam Rabung, ADF&G PNP Hatchery coordinator, Juneau.

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; broodstock 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 and the MBH annual reports have been received for all years.

Alaska hatcheries are required to document the disposal of the carcasses of salmon used for broodstock (5 AAC 93.350). If the carcasses are disposed, the hatchery must record the number of males and females disposed each day, and whether gametes 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 utilizing the carcass; the proceeds from any excess must be surrendered to ADF&G. MBH carcass logs appear to be complete and timely.

RECOMMENDATIONS

The BMP should be updated to reflect current permitted levels and operations.

DISCUSSION

Alaska hatchery and fisheries enhancement programs are governed by a comprehensive permitting system designed to protect wild stocks and provide increased harvest opportunities. The success of enhancement efforts depends on implementing that system and ensuring policies are followed.

ADF&G built MBH in 1982 in response to poor salmon runs to PWS and most of Alaska during the 1970s. Advancement of sockeye salmon hatchery practices allowed MBH to successfully rear sockeye salmon to the smolt stage for onsite release. The advent of otolith marking, and additions to the time series of harvest, escapement, migration and timing data have added to management precision of the MBH runs and to meeting escapement goals to the Eshamy Lake and Coghill Lake systems. MBH is providing a significant contribution to the PWS fisheries and local sockeye salmon populations appear healthy.

Defining permitted hatchery egg capacity should be examined for sockeye, coho, and Chinook salmon because egg take procedures for these species preclude estimating fecundity at the egg take stage due to concerns for disease prevention. When assumed fecundities are used, operators may exceed green egg permitted capacity even though they are following procedure according to guidelines approved by ADF&G in the AMP. Flexibility may exist in the current regulations to consider permit alterations that define permitted egg capacity at the eyed-egg stage.

ADF&G recognizes the importance of PWSAC within the PWS region and strongly supports the effective and continued operation of PWSAC hatcheries. ADF&G determines PWSAC to be in full compliance with its hatchery permit, annual management plans and other agreements with the department, and recently renewed the operations contract with PWSAC for MBH (Jeff Regnart, ADF&G Director of Commercial Fisheries, personal communication).

ACKNOWLEDGEMENTS

ADF&G staff Bert Lewis, Steve Moffitt, Tommy Sheridan, Sam Rabung, Ron Josephson and Lorraine Vercessi and PWSAC staff Dave Reggiani reviewed this document.

REFERENCES CITED

ADF&G. 2013. Information by fishery. Commercial salmon catch, effort & value. http://www.adfg.alaska.gov/index.cfm?adfg=commercialbyfisherysalmon.salmoncatch (Accessed May 2013).

Alaska Legislature 1974. An Act authorizing the operation of private nonprofit salmon hatcheries. Section 1, Chapter 111, SLA 1974, in the Temporary and Special Acts.

Alaska Seafood Marketing Institute. 2011. May 2011 Seafood Market Bulletin. Alaska Seafood Marketing Institute. Juneau. www.alaskaseafood.org (Accessed October 2012).

Botz, J., G. Hollowell, T. Sheridan, R. Brenner and S. Moffitt. 2012. 2010 Prince William Sound area finfish management report. Alaska Department of Fish and Game, Fishery Management Report No. 12-06, Anchorage.

Botz, J., G. Hollowell, T. Sheridan, R. Brenner and S. Moffitt. 2013. 2011 Prince William Sound area finfish management report. Alaska Department of Fish and Game, Fishery Management Report No. 13-11, Anchorage.

Brenner R. E., S. D. Moffitt, and W. S. Grant. 2012. Straying of hatchery salmon in Prince William Sound, Alaska. Environmental Biology of Fishes 94:179–195. doi:10.1007/s10641-012-9975-7.

Bue, B. G., J. J. Hasbrouck and M. J. Evenson. 2002. Escapement goal review of Copper River and Bering Rivers, and Prince William Sound Pacific salmon stocks. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A02-35 Anchorage.

Chaffee, C., G. Ruggerone, R. Beamesderfer, and L. W. Botsford. 2007. The commercial Alaska salmon fisheries managed by the Alaska Department of Fish and Game, a 5-year re-assessment based on the Marine Stewardship Council program. Final draft assessment report, October 30, 2007 (IHP-05-069), Emeryville, CA. Prepared by Scientific Certification Systems, Inc., for the Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau.

Davis, B., B. Allee, D. Amend, B. Bachen, B. Davidson, T. Gharrett, S. Marshall, and A. Wertheimer. 1985. Genetic policy. Alaska Department of Fish and Game, Division of Fisheries Rehabilitation, Enhancement and Development, Juneau.

Davis, B., and B. Burkett. 1989. Background of the genetic policy of the Alaska Department of Fish and Game. FRED Report No. 95. Alaska Department of Fish and Game, Division of Fisheries Rehabilitation, Enhancement and Development, Juneau.

Donaldson, W., S. Morstad, E. Simpson and E. Biggs. 1992. Prince William Sound management area 1991 annual finfish management report. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A92-09, Anchorage.

Donaldson, W., S. Morstad, E. Simpson, J. Wilcock and E. Biggs. 1993. Prince William Sound management area 1992 annual finfish management report. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A93-12, Anchorage

Donaldson, W., S. Morstad, D. Sharp, J. Wilcock and S. Sharr. 1995a. Prince William Sound management area 1993 annual finfish management report. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 2A95-20, Anchorage.

Donaldson, W., S. Morstad, D. Sharp, J. Wilcock and S. Sharr. 1995b. Prince William Sound management area 1994 annual finfish management report. Alaska Department of Fish and Game, Commercial Fisheries nagement and Development Division, Regional Information Report 2A95-47, Anchorage.

Edmundson, J. A., G. B. Kyle and M. Willette. 1992 Limnological and fisheries assessment of Coghill Lake relative to sockeye salmon (Oncorhynchus nerka) production and lake fertilization. Alaska Department of Fish and Game, Division of Fisheries Rehabilitation, Enhancement and Development Report 118 (available from: Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau).

Edmundson, J. A., G. B. Kyle, and S. R. Carlson. 1995. Restoration of Coghill Lake sockeye salmon: 1994 annual report on nutrient enrichment. Alaska Department of Fish and Game, Division of Commercial Fisheries, Management and Development, Regional Information Report 5J95-16, Juneau.

REFERENCES CITED (Continued)

Evenson, M. J., J. J. Hasbrouck, S. D. Moffitt, and L. Fair. 2008. Escapement goal review for Copper River, Bering River, and Prince William Sound salmon stocks. Alaska Department of Fish and Game, Fishery Manuscript No. 08-01, Anchorage.

FRED (Division of Fisheries Rehabilitation, Enhancement and Development). 1975. Report to the 1975 Legislature. Alaska Department of Fish and Game, Juneau.

FRED (Division of Fisheries Rehabilitation, Enhancement and Development). 1976. Report to the 1976 Legislature. Alaska Department of Fish and Game, Juneau.

Fried, S. M. 1994. Pacific salmon spawning escapement goals for the Prince William Sound, Cook Inlet, and Bristol Bay areas of Alaska. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Special Publication No. 8, Juneau.

Farrington, C. 2003. Alaska salmon enhancement program 2002 annual report. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 5J03-05, Juneau.

Farrington, C. 2004. Alaska salmon enhancement program 2003 annual report. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 5J04-02, Juneau.

Groot, C., and L. Margolis, editors. 1991. Pacific Salmon Life Histories. UBC Press, Vancouver, BC Canada.

Global Trust Certification Ltd. 2011. FAO-based responsible fishery management certification full assessment and certification report for the US Alaska Commercial Salmon Fisheries. AK/Sal/001/2011. Global Trust Certification Ltd., Dundalk, Co. Louth, Ireland. http://sustainability.alaskaseafood.org/wp-content/uploads/2010/05/AlaskaSalmonFAOGTCCertificationSummary.pdf

Hansen, J. A. 1985. FRED 1984 annual report to the Alaska State Legislature. Alaska Department of Fish and Game, Fisheries Rehabilitation, Enhancement, and Development Division Report 42 (available from: Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau).

Hansen, J. A., editor. 1986. FRED 1985 annual report to the Alaska State Legislature. Alaska Department of Fish and Game, Fisheries Rehabilitation, Enhancement, and Development Division Report 59 (available from: Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau).

Hansen, J. A., editor. 1987. FRED 1986 annual report to the Alaska State Legislature. Alaska Department of Fish and Game, Fisheries Rehabilitation, Enhancement, and Development Division Report 70 (available from: Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau).

Holland, J. S., editor. 1988. FRED 1987 annual report to the Alaska State Legislature. Alaska Department of Fish and Game, Fisheries Rehabilitation, Enhancement, and Development Division Report 81 (available from: Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau).

Holland, J. S., editor. 1989. FRED 1988 annual report to the Alaska State Legislature. Alaska Department of Fish and Game, Fisheries Rehabilitation, Enhancement, and Development Division Report 89 (available from: Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau).

Holland, J. S., editor. 1990. FRED 1989 annual report to the Alaska State Legislature. Alaska Department of Fish and Game, Fisheries Rehabilitation, Enhancement, and Development Division Report 101 (available from: Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau).

Industry Working Group, 2010. Open Letter to Alaska Hatcheries, April 16, 2010. Industry Working Group (Trident Seafoods, Pacific Seafood Processors Association, Icicle Seafoods, Ocean Beauty Seafoods LLC, and Alaska General Seafoods, PSPA member companies with salmon processing operations).

Knapman, P. G. Ruggerone, J. Brady, and A. Hough. 2009. Alaska salmon fisheries: first annual surveillance report 2007/08. February 2009 (MML-F-017), Houston, TX. Prepared by Moody Marine Ltd., for the Alaska Department of Fish and Game.

REFERENCES CITED (Continued)

Knapp, G., K. Roheim, and J. Anderson. 2007. The great salmon run: Competition between wild and farmed salmon. TRAFFIC North America, World Wildlife Fund, 1250 24th Street NW, Washington, D.C.

MSC (Marine Steward Ship Council). 2012. www.msc.org (Accessed February 6, 2012).

McDaniel T. R., K. M. Pratt., T. R. Meyers, T. D. Ellison, J. E. Follett, and J. A. Burke. 1994. Alaska sockeye salmon culture manual. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Special Publication No. 6, Juneau.

McGee, S. G. 2004. Salmon hatcheries in Alaska – plans, permits, and policies designed to provide protection for wild stocks. Pages 317-331 [*In*] M. Nickum, P. Mazik, J. Nickum, and D. MacKinlay, editors. Symposium 44: Propagated fish in resource management. American Fisheries Society, Bethesda, MD.

McKean, M., editor. 1991. FRED 1990 annual report to the Alaska State Legislature. Alaska Department of Fish and Game, Fisheries Rehabilitation, Enhancement, and Development Division Report 109 (available from: Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau).

McMullen, J. C. and J. A. Hansen. 1984. FRED 1983 annual report to the Alaska State Legislature. Alaska Department of Fish and Game, Fisheries Rehabilitation, Enhancement, and Development Division Report 22 (available from: Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau).

McMullen, J. C., J. A. Hansen and M. W. Kissel. 1983. FRED 1982 annual report to the Alaska State Legislature. Alaska Department of Fish and Game, Fisheries Rehabilitation, Enhancement, and Development Division Report 02 (available from: Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau).

Meyers, T. 2010. Regulation changes, policies, and guidelines for Alaska fish and shellfish health and disease control. Alaska Department of Fish and Game, Regional Information Report 5J10-01, Anchorage.

Musslewhite, J. 2011a. An evaluation of the Kitoi Bay salmon hatchery for consistency with statewide policies and prescribed management practices. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 5J11-01, Anchorage.

Musslewhite, J. 2011b. An evaluation of the Pillar Creek salmon hatchery for consistency with statewide policies and prescribed management practices. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 5J11-02, Anchorage.

Prince William Sound Regional Planning Team. 1983. Prince William Sound-Copper River Comprehensive Salmon Plan. Phase I- 20 Year Plan (1983-2002). ADF&G. Juneau.

Prince William Sound Regional Planning Team. 1986. Prince William Sound-Copper River Comprehensive Salmon Plan. Phase II 5-Year Plan (1986-1991). ADF&G, Juneau.

Prince William Sound-Copper River Regional Planning Team. 1994. Prince William Sound-Copper River Phase 3 Comprehensive Salmon Plan. ADF&G, Juneau.

Randall, R., P. Fridgen, M. McCurdy, and K. Roberson. 1984. Prince William Sound area, annual finfish management report, 1983. Alaska Department of Fish and Game, Division of Commercial Fisheries, Annual Management Report, Anchorage.

Randall, R., P. Fridgen, J. Brady, M. McCurdy, and K. Roberson. 1985. Prince William Sound area, annual finfish management report, 1984. Alaska Department of Fish and Game, Annual Management Report, Anchorage.

Randall, R., P. Fridgen, J. Brady, M. McCurdy, K. Roberson and S. Sharr. 1986. Prince William Sound area, annual finfish management report, 1985. Alaska Department of Fish and Game, Annual Management Report, Anchorage.

Stopha, M. and J. Musslewhite. 2012. An evaluation of the Tutka Bay Lagoon salmon hatchery for consistency with statewide policies and prescribed management practices. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 5J12-05, Anchorage.

REFERENCES CITED (Continued)

Stopha, M. 2012a. An evaluation of the Trail Lakes salmon hatchery for consistency with statewide policies and prescribed management practices. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 5J12-21, Anchorage.

Stopha, M. 2012b. An evaluation of the Port Graham salmon hatchery for consistency with statewide policies and prescribed management practices. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 5J12-28, Anchorage.

Stopha, M. 2013a. An evaluation of the Eklutna salmon hatchery for consistency with statewide policies and prescribed management practices. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 5J13-02, Anchorage.

Stopha, M. 2013b. An evaluation of the Solomon Gulch salmon hatchery for consistency with statewide policies and prescribed management practices. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 5J13-04, Anchorage.

Stopha, M. 2013c. An evaluation of the Gulkana salmon hatchery for consistency with statewide policies and prescribed management practices. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 5J13-05, Anchorage.

Stopha, M. 2013d. An evaluation of the Cannery Creek salmon hatchery for consistency with statewide policies and prescribed management practices. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 5J13-06, Anchorage.

Vercessi, L. 2013. Alaska salmon enhancement program 2012 annual report. Alaska Department of Fish and Game, Fishery Management Report No. 13-05, Anchorage.

White, B. 2005. Alaska salmon enhancement program 2004 annual report. Alaska Department of Fish and Game, Fishery Management Report No. 05-09, Anchorage.

White, B. 2006. Alaska salmon enhancement program 2005 annual report. Alaska Department of Fish and Game, Fishery Management Report No. 06-19, Anchorage.

White, B. 2007. Alaska salmon enhancement program 2006 annual report. Alaska Department of Fish and Game, Fishery Management Report No. 07-04, Anchorage.

White, B. 2008. Alaska salmon enhancement program 2007 annual report. Alaska Department of Fish and Game, Fishery Management Report No. 08-03, Anchorage.

White, B. 2009. Alaska salmon enhancement program 2008 annual report. Alaska Department of Fish and Game, Fishery Management Report No. 09-08 Anchorage.

White, B. 2010. Alaska salmon enhancement program 2009 annual report. Alaska Department of Fish and Game, Fishery Management Report No. 10-05, Anchorage.

White, B. 2011. Alaska salmon enhancement program 2010 annual report. Alaska Department of Fish and Game, Fishery Management Report No. 11-04, Anchorage.

APPENDIX

Appendix A.–History of MBH PNP hatchery permit and permit alterations, 2001–2012.

Date	Description	Permitted Capacity in millions of eggs Sockeye Salmon
04/17/2001	PNP hatchery permit number 31 issued to PWSAC to operate the MBH Hatchery. Hatchery permitted for 10.2 million sockeye salmon eggs. Broodstock already developed at the hatchery prior to issuance of the permit included the MBH Early-Run Eyak Lake origin stock, the MBH Middle-Run Coghill Lake origin stock, and the MBH Late-Run Eshamy origin stock.	10.2
05/17/2004	Approved permit alteration to allow release of up to 1.2 million sockeye salmon fry from Marsha Lake. The permitted capacity remained at 10.2 million eggs.	10.2
05/18/2005	Approved permit alteration to increase permitted capacity from 10.2 to 11.0 million sockeye salmon eggs. Increased production of 0.8 million eggs valid for 5 years. PWSAC was to evaluate and report on the increased sockeye salmon production.	11.0
05/18/2010	2005 permit alteration expired, reducing permitted capacity from 11.0 to 10.2 million sockeye salmon eggs.	10.2
06/22/2010	Approved permit alteration to increase permitted capacity from 10.2 to 12.4 million sockeye salmon eggs.	12.4

Appendix B.–Chum salmon egg takes at Main Bay Hatchery (MBH), 1982–1986.

Year	Species	Stock Source		Egg Take
1982	Chum	Wells River		9,860,000
1983	Chum	Wells River		21,600,000
1984	Chum	Wells River		34,900,000
1985	Chum	MBH		1,260,000
	Chum	Wells River		10,700,000
			1985 Total:	11,960,000
1986	Chum	Wells River		84,600,000

Source: MBH BMP 2001, unpublished document. Obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

Appendix C. –Chum salmon releases at Main Bay Hatchery (MBH), 1983–1987.

Year	Stock	Release	Release Site
1983	Wells R	8,644,179	MBH
1984	Wells R	7,490,291	MBH
		7,355,000	Lake Bay
	1984 Total:	**14,845,291**	
1985	Wells R	11,033,065	MBH
		12,559,082	Lake Bay
	1985 Total:	**23,592,147**	
1986	Wells R	5,258,175	MBH
	MBH	4,251,497	Lake Bay
	1986 Total:	**9,509,672**	
1987	MBH	76,646,750	MBH

Source: MBH BMP 2001, unpublished document. Obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

Appendix D.–Chum salmon adults returning to Main Bay Hatchery (MBH), 1985–1991.

Year	Adults Returning
1985	2,233
1986	103,400
1987	128,000
1988	200,000
1989	130,000
1990	321,000
1991	137,000

Source: Hansen 1985–1987; Holland 1988–1990; McKean 1991; 1991 Annual Reports submitted by PWSAC, unpublished, obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

Appendix E.–Pink salmon egg takes at Main Bay Hatchery (MBH), 1981–1988.

Year	Egg Source	Egg Take
1981	AFKH	35,288,000 [a]
1982	AFKH	31,685,000 [b]
1983	MBH returns	55,000,000
1984	Cannery Creek	30,000,000 [c]
1985	Cannery Creek	34,100,000 [c]
1985	MBH returns	2,900,000
1986	AFKH	12,500,000
1987	MBH returns	3,020,000
1988	AFKH	14,560,000

Source: MBH BMP 2001, unpublished document. Obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.
[a] Eyed eggs transferred from AFKH.
[b] Eyed eggs transferred from AFKH and incubated at Cannery Creek and later released at MBH.
[c] Eyed eggs transferred from Cannery Creek.

Appendix F.–Pink salmon releases at Main Bay Hatchery (MBH), 1981–1989.

Year	Stock	Release	
1981	AFKH	2,752,000	[a]
1982	AFKH	33,700,561	[b]
1983	AFKH	25,751,531	
1984	MBH	41,945,403	
1985	Cannery Creek Hatchery (CCH)	29,286,498	
1986	CCH	32,728,663	
1987	MBH	2,660,000	
1988		No Releases	
1989	AFKH	10,200,000	

Source: MBH BMP 2001, unpublished document. Obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

[a] Fry from AFKH transferred to MBH in April 1981 and released at MBH; ADF&G, 1982, Main Bay Annual Facility Management Plan, 1982, unpublished document. Obtained from Sam Rabung, ADF&G PNP Hatchery Coordinator, Juneau.

[b] Fry of AFKH origin that were incubated at CCH, transferred to MBH in April 1982 and released at MBH; ADF&G, 1983, Main Bay Annual Facility Management Plan, unpublished document. Obtained from Sam Rabung, ADF&G PNP Hatchery Coordinator, Juneau.

Appendix G.–Pink salmon adults returning to Main Bay Hatchery (MBH), 1983–1990.

Year	Adults Returning
1983	496,850
1984	606,000
1985	383,300
1986	232,000
1987	328,000
1988	100,000
1989	No Returns
1990	500,000[a]

Source: McMullen et al. 1983; McMullen and Hansen 1984; Hansen 1985–1987; Holland 1988–1989.

[a] No return data reported from the 1989 release. An unsigned document found in a file obtained from Sam Rabung, ADF&G PNP Hatchery Coordinator, indicated the return could have been about 500,000 fish.

Appendix H.–Sockeye salmon egg takes at Main Bay Hatchery (MBH), 1986–2012.

Year	Stock Source	Egg Take[a]
1986	Coghill Lake	441,000
1987	Coghill Lake	10,541,000
1988	Coghill Lake	7,150,000
1989	Coghill Lake	2,980,000
1990	MBH Coghill Lake	1,520,000
	Coghill Lake	1,113,000
	Eshamy Lake	3,012,000
	Eyak Lake	70,000
	1990 Total:	**5,715,000**
1991	MBH Coghill Lake	4,871,201
	Davis Lake (Coghill Lake stock)	1,658,000
	Eshamy Lake	2,505,000
	Eyak Lake	113,874
	1991 Total:	**9,148,075**
1992	MBH Coghill Lake	3,180,773
	Coghill Lake	1,032,165
	Eshamy Lake	2,148,427
	Eyak Lake	117,347
	Davis Lake (Coghill Stock)	1,510,971
	1992 Total:	**7,989,683**
1993	MBH Coghill Lake	5,905,093
	Coghill Lake	448,584
	MBH Eshamy Lake	1,148,742
	Eshamy	1,089,000
	Eyak Lake	111,486
	1993 Total:	**8,756,905**
1994	MBH Coghill Lake	4,672,901
	Coghill Lake	1,301,525
	MBH Eshamy Lake	1,292,836
	Eshamy	1,336,088
	MBH Eyak Lake	159,976
	1994 Total:	**8,763,326**
1995	MBH Coghill Lake	3,096,961
	MBH Eshamy Lake	2,132,614
	MBH Eyak Lake	2,651,472
	1995 Total:	**7,881,047**
1996	MBH Eshamy Lake	2,819,639
	MBH Eyak Lake	92,962
	Eyak Lake	300,578
	1996 Total:	**3,213,179**
1997	MBH Eshamy Lake	6,464,400
	MBH Eyak Lake	4,118,859
	Eyak Lake	93,134
	1997 Total:	**10,676,393**

-continued-

Year	Stock Source		Egg Take[a]
1998	MBH Coghill Lake		9,249,583
1999	MBH Coghill Lake		9,838,623
2000	MBH Coghill Lake		10,793,044
	Coghill Lake		724,488
		2000 Total:	**11,517,532**
2001	MBH Eshamy Lake		9,943,700
2002	MBH Coghill Lake		9,906,932
2003	MBH Coghill Lake		11,470,097
2004	MBH Coghill Lake		11,388,672
2005	MBH Coghill Lake		11,384,543
2006	MBH Coghill Lake		11,534,979
2007	MBH Coghill Lake		13,100,000
2008	MBH Coghill Lake		11,200,000
2009	MBH Coghill Lake		12,500,000
2010	MBH Coghill Lake		13,700,000
2011	MBH Coghill Lake		13,700,000
2012	MBH Coghill Lake		12,900,000

Source: McMullen et al. 1983; McMullen and Hansen 1984; Hansen 1985–1987; Holland 1988–1990; McKean 1991; 1991–2012, annual reports submitted by PWSAC, unpublished, obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

[a] Some numbers listed in the table may not match source data because they were updated to the ADF&G PNP hatchery database verbally from MBH personnel (Lorraine Vercessi, ADF&G PNP Assistant Coordinator, personal communication).

Appendix I.–Main Bay Hatchery (MBH) sockeye salmon juvenile releases, 1988–2012.

Year	Stock Source		Release Number[a]	Release Site
1988	Coghill Lake		330,025	MBH
			657,287	Davis Lake
			153,031	Esther Pass Lake
			594,210	Pass Lake
		1988 Total:	**1,734,553**	
1989	Coghill Lake		3,925,026	MBH
	Coghill Lake		154,644	Esther Pass Lake
	Coghill Lake		603,219	Pass Lake
		1989 Total:	**4,682,889**	
1990	Coghill Lake		2,619,305	MBH
	Eshamy Lake		25,169	Esther Pass Lake
			100,121	Pass Lake
		1990 Total:	**2,744,595**	
1991	Coghill Lake		1,517,774	MBH
			443,000	Coghill River
	Eshamy Lake		406,983	Eshamy Lake
			872,492	Eshamy River
			845,563	MBH
	Eyak Lake		47,609	MBH
		1991 Total:	**4,133,421**	
1992	MBH Coghill Lake		826,054	MBH
			691,405	Marsha Lake
	Coghill Lake		720,875	Coghill River
	Eshamy Lake		1,043,350	Eshamy River
			1,025,051	MBH
	Eyak Lake		63,822	MBH
		1992 Total:	**4,370,557**	
1993	MBH Coghill Lake		2,597,284	MBH
	Eshamy Lake		966,750	Eshamy River
	Davis Lake/Coghill Stock		806,218	Coghill River
		1993 Total:	**4,370,252**	
1994	MBH Coghill Lake		2,400,666	MBH
	Coghill Lake		1,219,454	Coghill Lake
	Eshamy Lake		761,797	MBH
			691,633	Eshamy River
	MBH Eyak Lake		90,358	MBH
		1994 Total:	**5,163,908**	
1995	MBH Coghill Lake		3,719,567	MBH
	Coghill Lake		865,020	Coghill Lake
	MBH Coghill Lake		215,944	Marsha Lake
	MBH Eshamy Lake		769,575	MBH
	MBH Eyak Lake		82,514	MBH
		1995 Total:	**6,429,056**	

-continued-

Year	Stock Source	Release Number[a]	Release Site
1996	MBH Eshamy Lake	178,216	MBH
	MBH Coghill Lake	3,113,210	MBH
	Eshamy Lake	114,475	MBH
	1996 Total:	**3,405,901**	
1997	MBH Eyak Lake	131,503	MBH
	MBH Coghill Mid	239,023	MBH
	MBH Eshamy Lake	845,190	MBH
	1997 Total:	**1,215,716**	
1998	MBH Early Eyak	109,827	Solf Lake
	Early Eyak	180,940	MBH
	MBH Eshamy Lake	2,485,204	MBH
	1998 Total:	**2,775,971**	
1999	MBH Coghill Lake	103,142	Solf Lake
	MBH Eyak Lake	2,803,660	MBH
	MBH Eshamy Lake	4,165,786	MBH
	1999 Total:	**7,072,588**	
2000	MBH Coghill Lake	116,473	Solf Lake
	MBH Coghill Lake	8,181,502	MBH
	2000 Total:	**8,297,975**	
2001	MBH Coghill Lake	116,144	Solf Lake
	MBH Coghill Lake	7,379,733	MBH
	2001 Total:	**7,495,877**	
2002	MBH Coghill Lake	7,162,722	MBH
	Coghill Lake	695,468	MBH
	2002 Total:	**7,858,190**	
2003	MBH Eshamy Lake	6,320,515	MBH
	Coghill Lake	256,020	Solf Lake
	2003 Total:	**6,576,535**	
2004	MBH/Coghill	7,607,383	MBH
	MBH/Coghill	248,090	Solf Lake
	MBH/Coghill	946,336	Marsha Lake
	2004 Total:	**8,801,809**	
2005	MBH Coghill Lake	7,641,728	MBH
	MBH Coghill Lake	260,971	Solf Lake
	MBH Coghill Lake	419,336	Marsha Lake
	2005 Total:	**8,322,035**	
2006	MBH Coghill Lake	8,302,760	MBH
	MBH Coghill Lake	126,002	Solf Lake
	2006 Total:	**8,428,762**	

-continued-

Year	Stock Source		Release Number[a]	Release Site
2007	MBH Coghill Lake		9,150,000	MBH
	MBH Coghill Lake		117,000	Solf Lake
		2007 Total:	**9,267,000**	
2008	MBH Coghill Lake		9,147,000	MBH
	MBH Coghill Lake		120,000	Solf Lake
		2008 Total:	**9,267,000**	
2009	MBH Coghill Lake		8,340,000	MBH
	MBH Coghill Lake		332,000	Marsha Lake
		2009 Total:	**8,672,000**	
2010	MBH Coghill Lake		8,160,000	MBH
2011	MBH Coghill Lake		8,680,000	MBH
2012	MBH Coghill Lake		11,040,000	MBH

Source: Holland 1989–1990; McKean 1991; 1991–2012, annual reports submitted by PWSAC, unpublished, obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

[a] Some numbers listed in the table may not match source data because they were updated to the ADF&G PNP hatchery database verbally from MBH personnel (Lorraine Vercessi, ADF&G PNP Assistant Coordinator, personal communication).

Appendix J.–Sockeye salmon adults returning to Main Bay Hatchery (MBH), 1989–2012.

Year	Adults Returning
1989	3,000
1990	9,000
1991	484,900
1992	533,505
1993	314,323
1994	372,583
1995	208,708
1996	497,509
1997	1,098,400
1998	257,062
1999	157,765
2000	347,291
2001	835,750
2002	954,651
2003	1,424,779
2004	653,738
2005	467,109
2006	1,035,876
2007	1,161,359
2008	851,400
2009	898,998
2010	1,323,815
2011	1,304,858
2012	1,303,909

Source: 1989–2010 data, Botz 2012. 2011 and 2012 data, 2011 and 2010 PWSAC annual reports for MBH, unpublished, obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

Appendix K.–Summary of Fish Transport Permits for Main Bay Hatchery.

FTP No.	Issued	Expiration	Summary and reviewer comments
None	1979	None	Allowed transfer of 100,000 chum salmon from MBH to AFKH for rearing, and then transfer of fry back to MBH for release at MBH.
82A-0007	1981	1982	Allowed transport of 2 million pink fry from AFKH to MBH for release to initiate broodstock program.
84A-1004	1984	1985	Allowed 7.3 million chum salmon fry in 1984 and 15 million chum salmon fry in 1985 of Wells River stock to be transferred from MBH for release at WNH to initiate a broodstock program at WNH.
84A-1031	1984	1985	Allowed transport of 25 million pink salmon fry from MBH to WNH to establish broodstock program at WNH. This was part of a plan to remove this stock from MBH and replace with CCH pink salmon stocks. MBH was then to be a central egg collection site for both MBH and CCH.
84A-1036	1984	1985	Allowed collection of up to 50 million pink salmon eggs at MBH from AFKH broodstock to be transported to AFKH for incubation, rearing and release.
85A-1019	1986	1994	Allowed transport of 50,000 Mile 18 Creek, Cordova stock coho salmon smolt and fry from Fort Richardson Hatchery to MBH for rearing and release to establish a broodstock program at MBH.
86A-1008	1986	1986	Allowed transport of 2,000 chum salmon fry from MBH to Seward for experimental study.
86A-1019	1986	None	Allowed collection of up to 25 million CCH stock pink salmon eggs at MBH to be transported to CCH for incubation, rearing and release.
87A-1036	1987	1987	PWSAC had 400,000 brood year 1986 Coghill Lake sockeye salmon fry at WNH. These fish were to be transferred to Trail Lakes Hatchery, reared until about September 1987, then transferred to MBH for rearing and release in May 1988.
87A-1054	1987	1993	Allowed collection of 10 million sockeye salmon eggs at Coghill Lake, incubation and rearing at MBH, and release of 5 million smolt at MBH and 5 million fry at lakes in western PWS. FTP amended in 1993 to change egg number from 10 million eggs to 2.6 million eggs.
88A-1015	1988	1998	Allowed transport and release of 2 million Coghill Lake stock sockeye salmon fry into Davis Lake, a barriered PWS lake with no anadromous fish production.
88A-1016	1988	1998	Allowed transport and release of 700,000 Coghill Lake stock sockeye salmon fry into Pass Lake, a barriered PWS lake with no anadromous fish production.
88A-1017	1988	1998	Allowed transport and release of 200,000 Coghill Lake stock sockeye salmon fry into Esther Pass Lake, a barriered PWS lake with no anadromous fish production.
90A-0008	1990	Unreadable	Allowed transfer of 3 million Eshamy Lake stock sockeye salmon fry from WNH, rearing to smolt at MBH, and releasing the smolt at MBH. This would establish a late-run sockeye program at MBH.
90A-0023	1990	1994	Allowed collection of 100,000 eggs or 33 females from Eyak Lake sockeye salmon for incubation, rearing and release at MBH to establish an early-run return to MBH.

-continued-

FTP No.	Issued	Expiration	Summary and reviewer comments
90A-0085	1990	1994	This FTP replaced FTP 88A-1016. Allowed transport and release of 800,000 Eshamy Lake stock MBH sockeye salmon pre-smolt into Pass Lake, a barriered PWS lake with no anadromous fish production. FTP 88A-1016 used Coghill stock fish and stocked fry. Since it is a barriered system, there was not a genetic concern switching stocks.
90A-0086	1990	1994	This FTP replaced FT 88A-1017. Allowed transport and release of 200,000 Eshamy Lake stock MBH sockeye salmon pre-molt into Esther Pass Lake, a barriered PWS lake with no anadromous fish production. FTP 88A-1017 used Coghill stock fish and stocked fry. Since it is a barriered system, there was not a genetic concern switching stocks.
91A-0037	1991	2001	Allowed transport and release of 850,000 Eshamy Lake wild stock sockeye salmon smolt into Eshamy Lagoon. Geneticist indicated only smolts from eggs collected from wild stock Eshamy Lake broodstock should be used for releases to the Eshamy Lagoon. Release number increased to 1.0 million in 1992.
91A-0038	1991	2001	Allowed transport and release of 600,000 Coghill Lake wild stock sockeye salmon smolt into the mouth of the Coghill River. Geneticist indicated only smolts from eggs collected from wild stock Coghill Lake broodstock should be used for releases to the Coghill River mouth. FTP Amended in 1992 to increase release number from 600,000 to 800,000.
91A-0115	1991	1996	Allowed collection of 3.0 million sockeye salmon eggs from Davis River broodstock, which are of Coghill Lake origin, for incubation and rearing at MBH, and release of smolts to Coghill Estuary.
91A-0141	1991	1991	Allowed transport and release of 600,000 Eshamy Lake wild stock sockeye salmon pre-smolt into Eshamy Lake. Geneticist indicated only pre-smolts from eggs collected from wild stock Eshamy Lake broodstock should be used for releases to the Eshamy Lagoon.
95A-0088	1995	1995	Allowed stocking of Marsha Bay Lake with 200,000 MBH Coghill Lake stock sockeye salmon fry.
96A-0042[a]	1995	2016	Allowed egg take of 0 Coghill stock MBH sockeye salmon eggs and release of 8.5 million smolt at MBH. The FTP was changed from 10.2 to 0 when it was seen that the project was not in the AMP, and later amended back to 10.2 million. This FTP put the MBH in compliance with regulation in requiring an FTP for egg takes and releases on site at a hatchery. In 1998, FTP amended to increase egg take from 0 to 10.2 million eggs. In 2005, FTP amended to increase egg take from 10.2 to 11.0 million eggs. Permit amended in 2006 to extend FTP from 2006 to 2011. Permit amended in 2010 to extend FTP from 2011 to 2014 and increase egg number from 11.0 to 12.4 million eggs. In 2011, FTP extended until 2016.
96A-0043[a]	1995	2006	Allowed the eggtake, incubation, rearing and release of 10.2 million Eshamy stock sockeye salmon eggs at MBH.
96A-0044[a]	1995	2006	Allowed the eggtake, incubation, rearing and release of 10.2 million Eyak stock sockeye salmon eggs at MBH.

-continued-

FTP No.	Issued	Expiration	Summary and reviewer comments
97A-0046	1997	2002	Allowed the eggtake, incubation, rearing and release of up to 1.0 million Eshamy stock sockeye salmon fry at Eshamy Lake.
97A-0047	1995	2002	Allowed the eggtake of 125,000 MBH/Eyak stock sockeye salmon eggs, incubation at MBH, transport and release of 100,000 fry into Solf Lake.
98A-0055	1998	2010	Allowed egg take of 125,000 Coghill stock MBH sockeye salmon eggs and release of 100,000 fry into Solf Lake. Permit amended in 2000 to extend FTP from 1999 to 2000 and change fry stocking number from 100,000 to resulting progeny of the 125,000 egg take. This FTP appeared to expire in 2000, and was renewed in 2003 to extend FTP to 2005 and increase release from 125,000 to 250,000 fry. Permit amended in 2006 to extend FTP from to 2010 and reduced release from 250,000 to 100,000 fry.
04A-0047	2004	2014	Allowed transport and release of 1.2 million Coghill Lake MBH stock sockeye salmon fry into Marsha Lake, a barriered lake on Knight Island. Project was to provide a place to stock pre-smolt that were excess to the MBH rearing capacity.

[a] Approved and issued in 1996, but with a 1995 transport date on application.

Appendix L.–Comparison of egg take levels, in millions, permitted for Coghill Lake sockeye salmon by the hatchery annual management plan, fish transport permit, and the number of eggs taken as reported in the hatchery annual report.

	Permitted Egg Take				Egg Take
Year	Permit[a]	AMP[b]	FTP	FTP No	Annual Report[c]
1987			10	87A-1054	10.5
1988			10	87A-1054	7.15
1989			10	87A-1054	2.98
1990			10	87A-1054	1.52
1991			10	87A-1054	None
1992		2.6	10	87A-1054	1.032
1993		2.6	2.6	87A-1054	0.449
1994		2.7		No FTP issued	1.301
1995		1.09			
1996					
1997					
1998					
1999					
2000		10.323		No FTP issued	0.724

[a] Hatchery permit issued in 2002.
[b] First AMP for MBH issued for PWSAC in 1991.
[c] Annual reports for MBH started in 1991. Reported values in Holland (1988–1990) substituted for annual report data from 1987–1990.

Appendix M.–Comparison of juvenile release levels permitted, in millions, for Coghill Lake sockeye salmon released at Main Bay Hatchery by the hatchery annual management plan, fish transport permit, and the number of juveniles released as reported in the hatchery annual report.

	Permitted Fry Release				No. Fry Released
Year	Permit[a]	AMP[b]	FTP	FTP No	Annual Report[c]
1987					
1988			5	87A-1054	0.330
1989			5	87A-1054	3.925
1990			5	87A-1054	2.619
1991		0.600			
1992		0.797	0.800	91A-0038	0.721
1993					
1994		0.800	0.800	91A-0038	1.219
1995		0.900	0.800	91A-0038	0.865
2002		Not Listed		91A-0038 Expired	0.695

[a] Hatchery permit issued in 2002.
[b] First AMP for MBH issued for PWSAC in 1991.
[c] Annual reports for MBH started in 1991. Reported values in Holland (1988–1990) substituted for annual report data from 1987–1990.

Appendix N.–Comparison of juvenile release levels permitted, in millions, for Coghill Lake sockeye salmon released at Coghill Lake by the hatchery annual management plan, fish transport permit, and the number of juveniles released as reported in the hatchery annual report.

	Permitted Fry Release			No. Fry Released
Year	AMP[a]	FTP	FTP No	Annual Report
1992	0.797	0.800	91A-0038	0.721
1993				
1994	0.800	0.800	91A-0038	1.219
1995	0.900	0.800	91A-0038	0.865

[a] First AMP for MBH issued for PWSAC in 1991.

Appendix O.–Comparison of sockeye salmon egg take and juvenile release levels permitted for Davis Lake/Coghill Lake stock eggs, incubated and reared at Main Bay Hatchery (MBH) and released at Coghill Bay, by fish transport permit, and the number of juveniles released taken as reported in the hatchery annual report. No annual management plan or hatchery permit were in effect during the release years.

Year	Life Stage	FTP	FTP No	Annual Report
1991	Egg Take	3,000,000	91A-1015	1.658
1993	Fry Release	3,000,000	91A-1015	0.806

Appendix P.–Comparison of egg take levels, in millions, permitted for Main Bay Hatchery/Coghill Lake stock sockeye salmon by hatchery permit, annual management plan, fish transport permit, and the number of eggs taken as reported in the hatchery annual report.

	Egg Take Level				Egg Take
Year	Permit[a]	AMP	FTP	FTP No	Annual Report
1991		5.3		No FTP issued	4.871
1992		5.1		No FTP issued	3.181
1993		5.1		No FTP issued	5.905
1994		5.4		No FTP issued	4.673
1995		3.3		No FTP issued	3.097
1996			10.2	96A-0042	
1997			10.2	96A-0042	
1998		10.325	10.2	96A-0042	9.25
1999		9.525	10.2	96A-0042	9.939
2000		9.525	10.2	96A-0042	10.793
2001			10.2	96A-0042	
2002	10.2	10.2	10.2	96A-0042	9.907
2003	10.2	10.2	10.2	96A-0042	11.47
2004	10.2	10.2	10.2	96A-0042	11.389
2005	11	11	11	96A-0042	11.385
2006	11	11	11	96A-0042	11.535
2007	11	11	11	96A-0042	13.1
2008	11	10.6	11	96A-0042	11.2
2009	11	10.2	11	96A-0042	12.5
2010	12.4	12.4	12.4	96A-0042	13.7
2011	12.4	12.4	12.4	96A-0042	13.7
2012	12.4	12.4	12.4	96A-0042	12.9

[a] Hatchery permit issued in 2002.

Appendix Q.–Comparison of sockeye salmon juvenile release levels, in millions, permitted for Main Bay Hatchery (MBH)/Coghill Lake stock released at MBH by annual management plan, fish transport permit, and the number of juveniles released taken as reported in the hatchery annual report. The hatchery permit for MBH is in terms of egg number, only, with no permitted level of juvenile releases listed.

	Juvenile Release Level			No. Juveniles Released
Year	AMP	FTP	FTP No.	Annual Report
1991	1.4		No FTP Issued	1.518
1992	0.917			0.826
1993	2.85			2.597
1994	2.4			2.401
1995	3.7			3.720
1996	3.2	10.2	96A-0042	3.113
1997	0.241	10.2	96A-0042	0.239
1998		10.2	96A-0042	
1999		10.2	96A-0042	
2000	8.2	10.2	96A-0042	8.182
2001		10.2	96A-0042	7.380
2002	7.9	10.2	96A-0042	7.163
2003		10.2	96A-0042	
2004	7.7	10.2	96A-0042	7.607
2005	8	11	96A-0042	7.642
2006	8.35	11	96A-0042	8.303
2007	9	11	96A-0042	9.150
2008	9	11	96A-0042	9.147
2009	8.2	11	96A-0042	8.340
2010	8.4	12.4	96A-0042	8.160
2011	9.53	12.4	96A-0042	8.680
2012	11.1	12.4	96A-0042	11.040

Appendix R.–Comparison of sockeye salmon juvenile release levels permitted for Main Bay Hatchery (MBH)/Coghill Lake stock released at Esther Pass Lake by annual management plan, fish transport permit, and the number of juveniles released taken as reported in the hatchery annual report. The hatchery permit for MBH is in terms of egg number, only, with no permitted level of juvenile releases listed. No annual management plan or hatchery permit was in effect during the release years.

	Juvenile Release Level		No. Juveniles Released
Year	FTP	FTP No	Annual Report[a]
1988	200,000	88A-1017	153,000
1989	200,000	88A-1017	155,000

[a] Annual reports for MBH started in 1991. Reported values in Holland (1988–1990) substituted for annual report data from 1987–1990.

Appendix S.–Comparison of sockeye salmon juvenile release levels permitted for Main Bay Hatchery (MBH)/Coghill Lake stock released at Pass Lake by fish transport permit, and the number of juveniles released taken as reported in the hatchery annual report. The hatchery permit for MBH is in terms of egg number, only, with no permitted level of juvenile releases listed. No annual management plan or hatchery permit were in effect during the release years.

	Juvenile Release Level		No. Juveniles Released
Year	FTP	FTP No	Annual Report[a]
1988	700,000	88A-1016	594,000
1989	700,000	88A-1016	603,000

[a] Annual reports for MBH started in 1991. Reported values in Holland (1988–1990) substituted for annual report data from 1987–1990.

Appendix T.–Comparison of sockeye salmon juvenile release levels permitted for Main Bay Hatchery (MBH)/Coghill Lake stock released at Davis Lake by fish transport permit, and the number of juveniles released taken as reported in the hatchery annual report. The hatchery permit for MBH is in terms of egg number, only, with no permitted level of juvenile releases listed. No annual management plan or hatchery permit were in effect during the release years.

	Juvenile Release Level		No. Juveniles Released
Year	FTP	FTP No	Annual Report[a]
1988	2,000,000	88A-1015	657,000

[a] Annual reports for MBH started in 1991. Reported values in Holland (1988–1990) substituted for annual report data from 1987–1990.

Appendix U.–Comparison of sockeye salmon juvenile release levels permitted for Main Bay Hatchery (MBH)/Coghill Lake stock released at Marsha Lake by fish transport permit, and the number of juveniles released taken as reported in the hatchery annual report. The hatchery permit for MBH is in terms of egg number, only, with no permitted level of juvenile releases listed.

	Juvenile Release Level			No. Juveniles Released
Year	AMP	FTP	FTP No	Annual Report[a]
1992	715,000	750,000	92A-0146	691,000
2004	1,200,000	1,200,000	04A-0047	946,000
2005	1,200,000	1,200,000	04A-0047	419,000
2009	1,200,000	1,200,000	04A-0047	332,000

[a] Annual reports for MBH started in 1991. Reported values in Holland (1988–1990) substituted for annual report data from 1987–1990.

Appendix V.–Comparison of sockeye salmon juvenile release levels permitted for Main Bay Hatchery (MBH)/Coghill Lake stock released at Solf Lake by fish transport permit, and the number of juveniles released taken as reported in the hatchery annual report. The hatchery permit for MBH is in terms of egg number, only, with no permitted level of juvenile releases listed.

	Juvenile Release Level			No. Juveniles Released
Year	AMP	FTP	FTP No	Annual Report
1998	100,000	100,000	98A-0055	110,000
1999	100,000	100,000	98A-0055	103,000
2000	100,000	100,000	98A-055	116,000
2001	100,000	100,000	98A-0055 (expired)	116,000
2003	250,000	250,000	98A-0055	256,000
2004	250,000	250,000	98A-0055	248,000
2005	250,000	250,000	98A-0055	261,000
2006	250,000	100,000	98A-0055	126,000
2007	150,000	100,000	98A-0055	117,000
2008	150,000	100,000	98A-0055	120,000

Appendix W.–Comparison of egg take levels permitted, in millions, from Eshamy Lake sockeye salmon, for the hatchery annual management plan, fish transport permit, and the number of juveniles released as reported in the hatchery annual report.

	Permitted Egg Take			Egg Take
Year	AMP[a]	FTP	FTP No	Annual Report
1991	2.1		None	2.505
1992	2.1		None	2.148
1993	1.05	1.0	91A-0037	1.149
1994	1.09	1.0	91A-0037	1.336

[a] First AMP for MBH issued for PWSAC in 1991.

Appendix X.–Comparison of juvenile releases, in millions, for Eshamy Lake sockeye salmon broodstock with eggs incubated at Main Bay Hatchery and progeny released at Eshamy Lagoon, for the hatchery annual management plan, fish transport permit, and the number of juveniles released as reported in the hatchery annual report.

	Permitted Fry Release			No. Fry Released
Year	AMP[a]	FTP	FTP No	Annual Report
1991	600,000	850,0000	91A-0037	872,000
1993	1,050,000	1,000,000	91A-0037	967,000
1994	750,000	1,000,000	91A-0037	692,000

[a] First AMP for MBH issued for PWSAC in 1991.

Appendix Y.–Comparison of juvenile releases, in millions, for Eshamy Lake sockeye salmon broodstock with eggs incubated at Main Bay Hatchery and progeny released at Eshamy Lake, for the hatchery annual management plan, fish transport permit, and the number of juveniles released as reported in the hatchery annual report.

	Permitted Fry Release			No. Fry Released
Year	AMP	FTP	FTP No	Annual Report
1991	850,000	600,000	91A-0141	407,000

Appendix Z.–Comparison of juvenile releases, in millions, for Eshamy Lake sockeye salmon broodstock with eggs incubated at Main Bay Hatchery and progeny released at Pass Lake, for the hatchery annual management plan, fish transport permit, and the number of juveniles released as reported in the hatchery annual report.

	Permitted Fry Release			No. Fry Released
Year	AMP[a]	FTP	FTP No	Annual Report
1990		800,000	90A-0085	100,000

[a] First AMP for MBH issued for PWSAC in 1991.

Appendix AA.–Comparison of juvenile releases, in millions, for Eshamy Lake sockeye salmon broodstock with eggs incubated at Main Bay Hatchery and progeny released at Esther Pass Lake, for the hatchery annual management plan, fish transport permit, and the number of juveniles released as reported in the hatchery annual report.

	Permitted Fry Release			No. Fry Released
Year	AMP[a]	FTP	FTP No	Annual Report
1990		200,000	90A-0086	25,000

[a] First AMP for MBH issued for PWSAC in 1991.

Appendix BB.–Comparison of juvenile releases, in millions, for Eshamy Lake sockeye salmon broodstock with eggs incubated at Main Bay Hatchery and progeny released at Eshamy Lake, for the hatchery annual management plan, fish transport permit, and the number of juveniles released as reported in the hatchery annual report.

	Permitted Fry Release			No. Fry Released
Year	AMP	FTP	FTP No	Annual Report
1991	600,000	850,000	91A-0037	407,000
1994	750,000	1,000,000	91A-0037	692,000

Appendix CC.–Comparison of egg take levels permitted, in millions, from Main Bay Hatchery/Eshamy Lake stock sockeye salmon, for the hatchery annual management plan, fish transport permit, and the number of juveniles released as reported in the *hatchery* annual report.

		Permitted Egg Take			Egg Take
Year	Permit[a]	AMP	FTP	FTP No	Annual Report
1993		2.1		None	1.14
1994		2.18		None	1.29
1995		2.18		None	2.13
1996		2.0	10.2	96A-0043	2.82
1997		6.2	10.2	96A-0043	6.46
2001	10.2	10.2	10.2	96A-0043	9.94

[a] Main Bay Hatchery permit not issued until 2001.

Appendix DD.–Comparison of egg take levels permitted from Eyak Lake stock sockeye salmon, for the hatchery annual management plan, fish transport permit, and the number of juveniles released as reported in the hatchery annual report.

	Permitted Egg Take			Egg Take
Year	AMP	FTP	FTP No	Annual Report
1991	100,000	100,000	90A-0023	114,000
1992	100,000	100,000	90A-0023	117,000
1993	100,000	100,000	90A-0023	111,000
1994	106,000[a]	100,000	90A-0023	160,000
1996	270,000	270,000	95A-0067	301,000
1997	270,000	270,000	95A-0067	93,000

[a] FTP allowed eggs from both Eyak Lake and Eyak Lake stock returns to Main Bay Hatchery.

Appendix EE.–Comparison of egg take levels permitted from Main Bay Hatchery/Eyak Lake stock sockeye salmon, in millions, for the hatchery annual management plan, fish transport permit, and the number of juveniles released as reported in the hatchery annual report.

	Permitted Egg Take			Egg Take
Year	AMP	FTP	FTP No	Annual Report
1995	1.9	10.2	96A-0044	2.65
1996	10.2	10.2	96A-0044	0.09
1997	4.0	10.2	96A-0044	4.1

Appendix FF.–Comparison of sockeye salmon juvenile release levels permitted for Main Bay Hatchery (MBH)/Eyak Lake stock released at Solf Lake by fish transport permit, and the number of juveniles released taken as reported in the hatchery annual report. The hatchery permit for MBH is in terms of egg number, only, with no permitted level of juvenile releases listed.

	Juvenile Release Level			No. Juveniles Released
Year	AMP	FTP	FTP No	Annual Report
1998	None	0.125	97A-0047	110,000

Appendix GG.–Summary of ADF&G pathology inspections at MBH after transfer of operations from ADF&G to PWSAC in 1990.

Year	Inspection Notes
1991	First inspection after hatchery operations transferred from ADF&G to PWSAC. Sockeye salmon the only species under culture. Most stocks showed signs of exposure to supersaturation events and two stocks showed GBD related pathology. Recommendations include installing nozzles in each incurrent water line for gas stabilization; replace open cell foam with closed cell foam.
1992	Some gas bubble and BKD noted. Recommended replacing open cell foam with closed cell foam and discontinue illegal use of malachite green.
1993	Clubbed gills in Davis Lake (Coghill Stock) sockeye salmon. Gill fungus and aneruysms in Eshamy Lake sockeye salmon. Myxobacterial infection in 1991 MBH/Coghill Lake stock. Yeast infection in 1992 MBH/Coghill Lake stock. Major improvements in start tank cleanliness since last inspection. Recommendations included discontinue illegal use of malachite green; use iodophore for egg takes; move net pens so they do not touch the bottom; rear the three stocks in different net pen complexes; remove open cell foam in contact with fish or water and replace with closed cell foam; write down egg-take procedures in a manual; put footbaths at all entrances; move protective clothing storage area outside of footbath entrance; disinfect floors daily; depurate hatchery effluent to prevent IHNV transmission to net pens.
1994	Mild anemia, ichthyobodiasis in MBH/midstock. Previously IHNV, internal air bubbles and bad gills in 1992 Eshamy Lake sockeye salmon. Unexplained emergence mortality, gill hyperplasia and bacteria in gill wet mounts for 1993 Eshamy Lake sockeye salmon. Gill capillary bubbles in 1993 Eyak Lake sockeye salmon. 1993 MBH midstock sockeye salmon had some loss in early start-up from unidentified cause. 1993 MBH late unexplained eyed to emergence mortality. Hatchery never looked cleaner and fish containers looked the best ever. Previous recommendations partially implemented. Malachite green still in use for fungus control. Recommended addressing periodic gas supersaturation casuing gas bubble disease; survey fish and freshwater clams in water supply to determine source of periodic ichthyobodiasis; discontinue use of malachite green.
1995	Osmoregulatory problems in netpens of MBH/Mid-stock. GBD possibly complicated by Ichthyobodiasis in MBH/Early-stock. Ichthyobodo (Costia) outbreak in March 1995 caused mortality in 6 incubators of MBH/Mid-stock. Fungal infections of fry a recurring problem. Recommendations: discontinue use of malachite green; group start tanks by stock and use visqueen separation if tanks are too close to each other; evaluate seawater challenge and feeding protocols to reduce losses due to osmoregulation problems.

Year	Inspection Notes
1997	Pseudomonas infection in fry of MBH/Coghill Lake and MBH/Eyak Lake fry. Ichthyobodo infestation on MBH/Eshamy Lake alevins. Bacterial coldwater disease on MBH/Eyak caused mortality in 2 incubators. Separation between units excellent. Personnel careful to disinfect gloves between units and raingear and gloves between stocks. Procedure manual has been developed and disinfection procedures discussed at bimonthly meetings. Floors disinfected weekly. Staff conscientious about examining fish and sending samples in when alevins appear unhealthy. Overall, hatchery clean and well organized. Recommended separating stocks of fish in downstairs raceways; consider use of hydrogen peroxide for fungal control as necessary; Eshamy fish that are to be released at hatchery should be kept different from those being released at the lake; locate net pens as afar as possible from outfall so effluent will not be taken near the net pens to potentially spread IHNV.
1999	High loss in start-up due to holding fish back for 1997 MBH/Eyak stock sockeye salmon. Two startup tanks of 1997 MBH/Eshamy stock sockeye salmon lost due to IHNV. High losses in net pens due to Chaetoceros. Staff doing excellent job of maintaining separation in start tanks. Start tanks and incubation room immaculate. Recommended covering the headbox to reduce chance of disease transmission.
2001	Inspectors noted that great care taken in broodstock selection. No fish with any abnormality such as a snag mark or mechanical damage were used. Hatchery personnel strictly adhere to guidelines concerning IHNV prevention. Recommended sending in samples of moribund fish to state lab to confirm on-site diagnosis.
2003	Some IHNV infected fish destroyed. Hatchery not visited by inspectors due to budgetary constraints.
2004	Hatchery well organized and scrupulously clean and carefully managed. *Pseudomonas septicemia* a significant health problem in newly ponded fry, and likely endemic to the water supply. Hatchery considering disinfecting influent water if economically feasible.
2006	Facility continues to operate using exemplary protocols for sockeye salmon culture. *Pseudomonas septicemia* continues as a significant health problem in newly ponded fry, and likely endemic to the hatchery piping system.
2008	Facility organized and clean. Facility continues to be a good example of exceptional sockeye culture. Experiments with freshwater lensing bag for rearing sockeye salmon shows promise. Some problem with acute gas bubble disease were noted, and regular gas monitoring was recommended.
2010	Facility continues to operate using exemplary protocols for sockeye salmon culture. *Pseudomonas septicemia* continues as a significant health problem in newly ponded fry, and likely endemic to the hatchery piping system. Recommend flushing and disinfecting of influent water pipes.
2012	Facility continues to operate using exemplary protocols for sockeye salmon culture. *Pseudomonas septicemia* continues as a significant health problem in newly ponded fry, and likely endemic to the hatchery piping system. Recommended UV treatment system in start tank to prevent or reduce *Pseudomonas* infections if time and funds permit.

Appendix II.–Total sockeye salmon return to MBH, sockeye salmon escapement through the Eshamy Lake weir and Coghill Lake weir, and escapement goals for these systems. Escapement numbers in italics denote escapement was below the escapement goal or lower escapement goal if an escapement goal range is listed.

Year	MBH Total Return	Eshamy Lake Escapement	Eshamy Lake Escapement Goal	Coghill Lake Escapement	Coghill Lake Escapement Goal
1967		*10,821*	20,000–30,000		
1968		68,048	20,000–30,000		
1969		61,196	20,000–30,000		
1970		*11,460*	20,000–30,000		
1971		*954*	20,000–30,000	15,000	
1972		28,683	20,000–30,000	51,000	
1973		*10,202*	20,000–30,000	55,000	
1974		*633*	20,000–30,000	*22,333*	25,000
1975		*1,724*	20,000–30,000	34,855	25,000
1976		19,367	20,000–30,000	*9,056*	25,000
1977		*11,746*	20,000–30,000	31,562	25,000
1978		*12,580*	20,000–30,000	42,284	25,000
1979		*12,169*	20,000–30,000	48,281	25,000
1980		44,263	20,000–30,000	142,253	45,000
1981		23,048	20,000–30,000	156,112	45,000
1982		*6,782*	20,000–30,000	180,314	50,000
1983		*10,348*	20,000–30,000	*38,783*	50,000
1984		36,121	20,000–30,000	63,622	40,000–50,000
1985		26,178	20,000–30,000	163,311	40,000–50,000
1986		*6,949*	30,000–40,000	71,095	50,000
1987		Not Operated	30,000–40,000	187,263	40,000–60,000
1988		31,747	30,000–40,000	72,052	55,000
1989	3,000	57,232	30,000–40,000	*37,751*	50,000–60,000
1990	243,200	*14,477*	30,000–40,000	*8,949*	55,000
1991	484,900	46,229	30,000–40,000	*9,752*	50,000
1992	533,505	36,237	30,000–40,000	29,642	20,000–30,000
1993	315,237	42,893	30,000–40,000	*9,232*	20,000–30,000
1994	366,613	64,660	30,000–40,000	*7,264*	20,000–30,000
1995	211,304	*21,701*	30,000–40,000	30,382	20,000–30,000
1996	501,391	*5,271*	30,000–40,000	38,693	20,000–30,000
1997	1,098,400	39,015	30,000–40,000	35,517	20,000–30,000
1998	251,771	Not Operated	30,000–40,000	28,923	20,000–30,000
1999	157,765	*27,057*	30,000–40,000	59,311	20,000–30,000
2000	347,291	*22,653*	30,000–40,000	28,446	20,000–30,000
2001	835,750	55,187	30,000–40,000	38,558	20,000–30,000

-continued-

Year	MBH Total Return	Eshamy Lake Escapement	Eshamy Lake Escapement Goal	Coghill Lake Escapement	Coghill Lake Escapement Goal
2002	954,651	40,478	20,000–40,000	28,323	20,000–30,000
2003	1,424,779	39,845	20,000–40,000	75,427	20,000–40,000
2004	635,738	*13,443*	20,000–40,000	30,569	20,000–40,000
2005	395,109	23,523	20,000–40,000	30,313	20,000–40,000
2006	1,035,876	41,823	20,000–40,000	23,479	20,000–40,000
2007	1,161,124	*16,646*	20,000–40,000	70,001	20,000–40,000
2008	851,600	18,494	13,000–28,000	29,298	20,000–40,000
2009	901,057	24,025	13,000–28,000	23,186	20,000–40,000
2010	1,323,815	16,291	13,000–28,000	24,312	20,000–40,000
2011	1,304,858	24,129	13,000–28,000	102,359	20,000–40,000

Source: Total MBH return from annual reports submitted to ADF&G by PWSAC. Eshamy Lake weir and Coghill Lake weir escapement counts from Botz et al. 2013. Escapement goals for Coghill Lake and Eshamy Lake, 1974–1979 from Fried 1994; 1980–1992 from the annual management report for each year (Randall et al. 1984–1986; Brady et al. 1987, 1988, 1990, 1991a, b; Donaldson et al. 1992, 1993, 1995a, 1995b); 1994–2002 from Fried 1994; 2003–2008 from Bue et al. 2002; 2009–2011 from Evenson et al. 2008.