Regional Information Report No. 5J13-10

An Evaluation of the Wally Noerenberg Salmon Hatchery for Consistency with Statewide Policies and Prescribed Management Practices

by

Mark Stopha

November 2013

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

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Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

Mathematics, statistics

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

REGIONAL INFORMATION REPORT NO. 5J13-10

AN EVALUATION OF THE WNH FOR CONSISTENCY WITH STATEWIDE POLICIES AND PRESCRIBED MANAGEMENT PRACTICES

by
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November 2013

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ABSTRACT

The salmon hatchery program in Alaska is governed by policies, plans, and regulations that emphasize protection of wild salmon stocks. A rotational series of hatchery evaluations will examine 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 Wally Noerenberg Hatchery located on Esther Island in Prince William Sound about 20 miles east of Whittier, Alaska. The hatchery is operated by the Prince William Sound Aquaculture Corporation. The facility is permitted to produce pink *Oncorhynchus gorbuscha*, chum *O. keta*, coho *O. kisutch*, and Chinook salmon *O. tshawytscha*. The original pink, chum and coho salmon donor stocks were from Prince William Sound region wild stocks. Chinook salmon donor stocks were from wild Cook Inlet stocks, as there are no significant native Chinook salmon stocks in Prince William Sound. From 2003 to 2012, adult runs to the hatchery averaged about 7.2 million pink, 3.1 million chum, and 71,000 coho salmon. The Chinook salmon program recently restarted and there have been no returns to date. From 2002 to 2012, pink, chum and sockeye salmon escapement goals or escapement targets in creeks and rivers near the hatchery (the Coghill District commercial fishing district of Prince William Sound) were met or exceeded in most years, albeit with an unknown number of hatchery-produced fish in the escapement. The basic management plan for the hatchery should be updated with a description of current permit conditions and operations.

Key words: WNH, hatchery evaluation, pink salmon, chum salmon, coho salmon, Chinook salmon, hatchery, PWS 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 wild stock 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 restoration efforts came in response to statewide annual commercial salmon harvests of under 32 million fish from 1972 to 1975, among the lowest catches since 1900 (Figure 1,

ADF&G 2012). 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 non-utilized 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 juvenile salmon growth (FRED 1975). A combination of favorable environmental conditions, limited fishing effort, abundance-based harvest management, habitat improvement, and hatchery production gradually boosted salmon catches, and recent commercial salmon harvests (2002–2012) have averaged 170 million fish (Vercessi 2013).

In Alaska, the purpose of salmon hatcheries is to supplement wild stock production for public benefit. Hatcheries are efficient in improving survival from the egg to fry or smolt stage. In natural production, survival of eggs to fry or smolt is highly variable. Estimates of egg to fry survival 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 80% or higher.

Alaska hatcheries do not grow fish to adulthood, but incubate fertilized eggs and release resulting progeny. 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 characteristics. 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 salmon is not legal in Alaska; it is prohibited under 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 smolt 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.

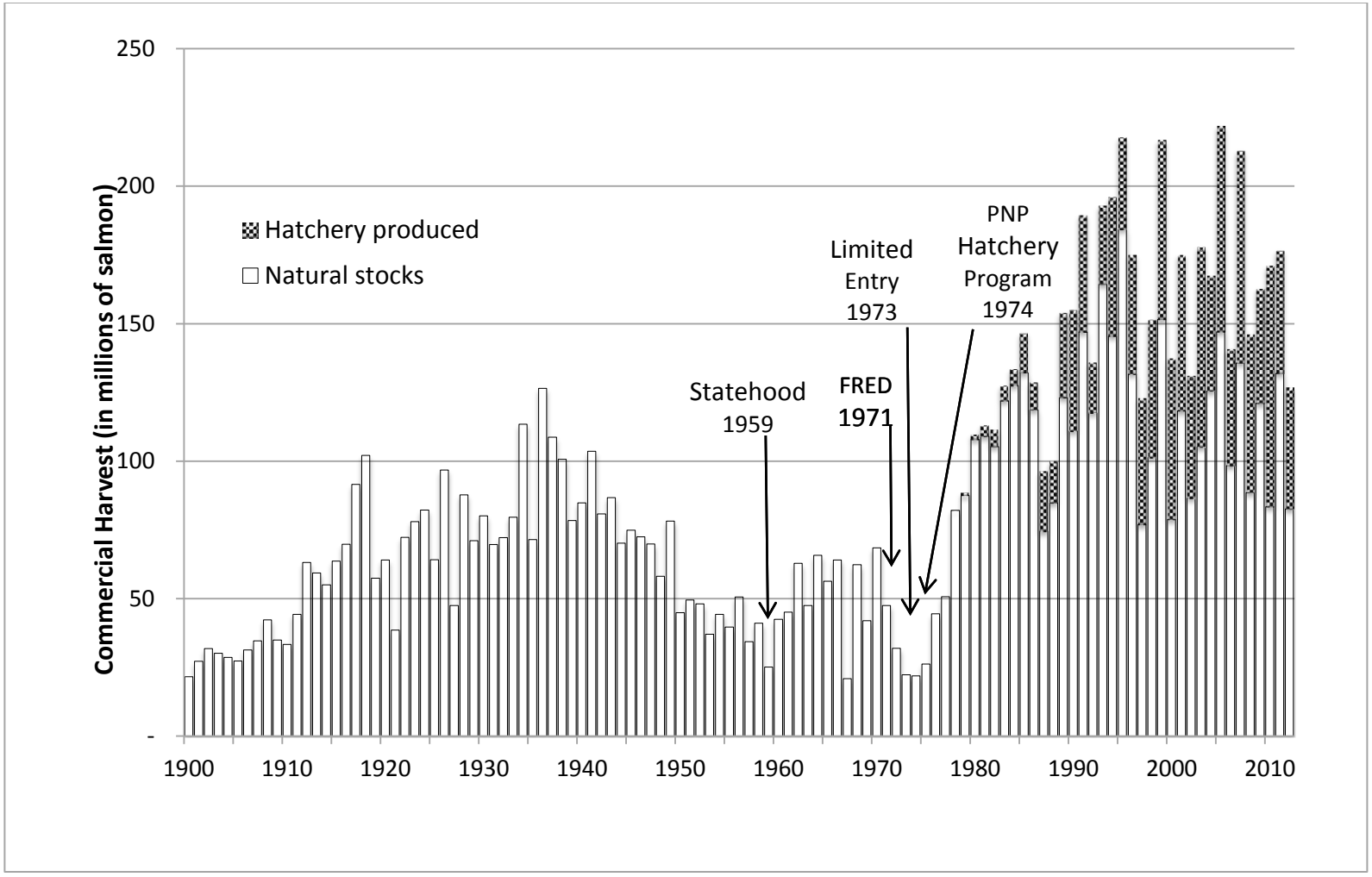

Figure 1.–Commercial salmon harvest in Alaska, 1900–2012.

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 2002 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 2012, 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 farmed salmon flooded the marketplace in the U.S., Europe, and Japan. Alaska responded to the competition by improving fish quality at harvest and implementing intensive marketing efforts to differentiate Alaska salmon from farmed salmon. By 2004, these efforts paid off through increasing demand and prices (ADF&G 2012).

Today, Alaska typically accounts for just 12% to 15% of the global supply (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 despite large fluctuations in harvest volume (ADF&G 2012). The exvessel value[1] of hatchery harvest increased from $59 million in 2003 to $104 million in 2012, with a peak 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 of $509 million in 2010. Pink and chum salmon, on average, accounted for over 75% of the annual hatchery exvessel and first wholesale values from 2003 to 2012.

From 2002 to 2012, hatcheries contributed an average 35% of the total Alaska salmon harvest, in numbers of fish (Farrington 2003, 2004; White 2005–2011, Vercessi 2012, 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. 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.

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[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 2012, 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.

Part of the reason for the rise in price of Alaska salmon was a message of 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 (FAO)-based Responsible Fisheries Management criteria in 2011 (Global Trust Certification Ltd 2011). The hatchery evaluations started under the MSC certification continue under the new FAO-based certification 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, 2013e) completed reviews of the Trail Lakes, Port Graham and Eklutna hatcheries in Cook Inlet and for the Cannery Creek, Solomon Gulch, Gulkana and Main Bay hatcheries in Prince William Sound (PWS). This report is for the Wally Noerenberg Hatchery (WNH) in PWS. Following completion of reviews of hatcheries in PWS, reviews of hatcheries in 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 the *Genetic Policy* (Davis et al. 1985), *Regulation Changes, Policies, and Guidelines for Fish and Shellfish Health and Disease Control* (Meyers 2010), and various fisheries management policies, such as the Sustainable Salmon Fisheries Policy (5 AAC 39.222). 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 (Table 1). Policy guidelines include banning importation of salmonids from outside the state for enhancement (except U.S./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 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 discusses 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 of, 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 those stocks.

Salmon fishery enhancement efforts are guided by comprehensive salmon plans for each region. 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 (Table 2). The policy and associated guidelines are discussed in *Regulation Changes, Policies, and Guidelines for Fish and Shellfish Health and Disease Control* (Meyers 2010), which 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 and geneticists 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.

In addition, although several *Genetic Policy* guidelines relate to hatchery stock effects on significant wild stocks, to date, significant stocks have only been designated in the Cook Inlet Region (Cook Inlet RPT 2007). The absence of significant stock designations elsewhere in the state adds uncertainty to the enhancement review process in applying standards set out in the *Genetic Policy*.

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. Independent PNP corporations, not affiliated with an RAA, also operate hatcheries in several areas of the state. RAAs (but not independent PNP corporations) 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. Both the RAAs and independent PNP hatchery organizations may harvest salmon returning to their hatcheries or release sites (cost-recovery harvest) 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. Hearings are held before a hatchery is permitted for operation. RPTs hold public meetings to define desired production goals by species, area, and time 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): (1) hatchery permit with basic management plan (BMP), (2) annual management plan (AMP), (3) fish transport permit (FTP), and (4) 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. Permits remain in effect unless revoked or withdrawn by the ADF&G commissioner.

Hatchery permits/BMPs may be amended through a permit alteration request (PAR). In PWS, the Phase 3 Comprehensive Salmon Plan guides the review of PARs by the RPT through a Criteria Check List that describes project intent and goals. The Criteria Check List includes objectives that provide for reduced congestion and conflict in the fishery; minimized impact on wild stocks; promotion of the highest possible fish quality; maximization of production; minimization of impacts to historic and traditional fisheries; support of subsistence, sport and personal use needs; encouragement and support of research; and recognition of healthy competition in the fishery.

PARs 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 by 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. 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 required or in place (described below), and fish culture techniques. The AMP must be consistent with the hatchery permit and BMP.

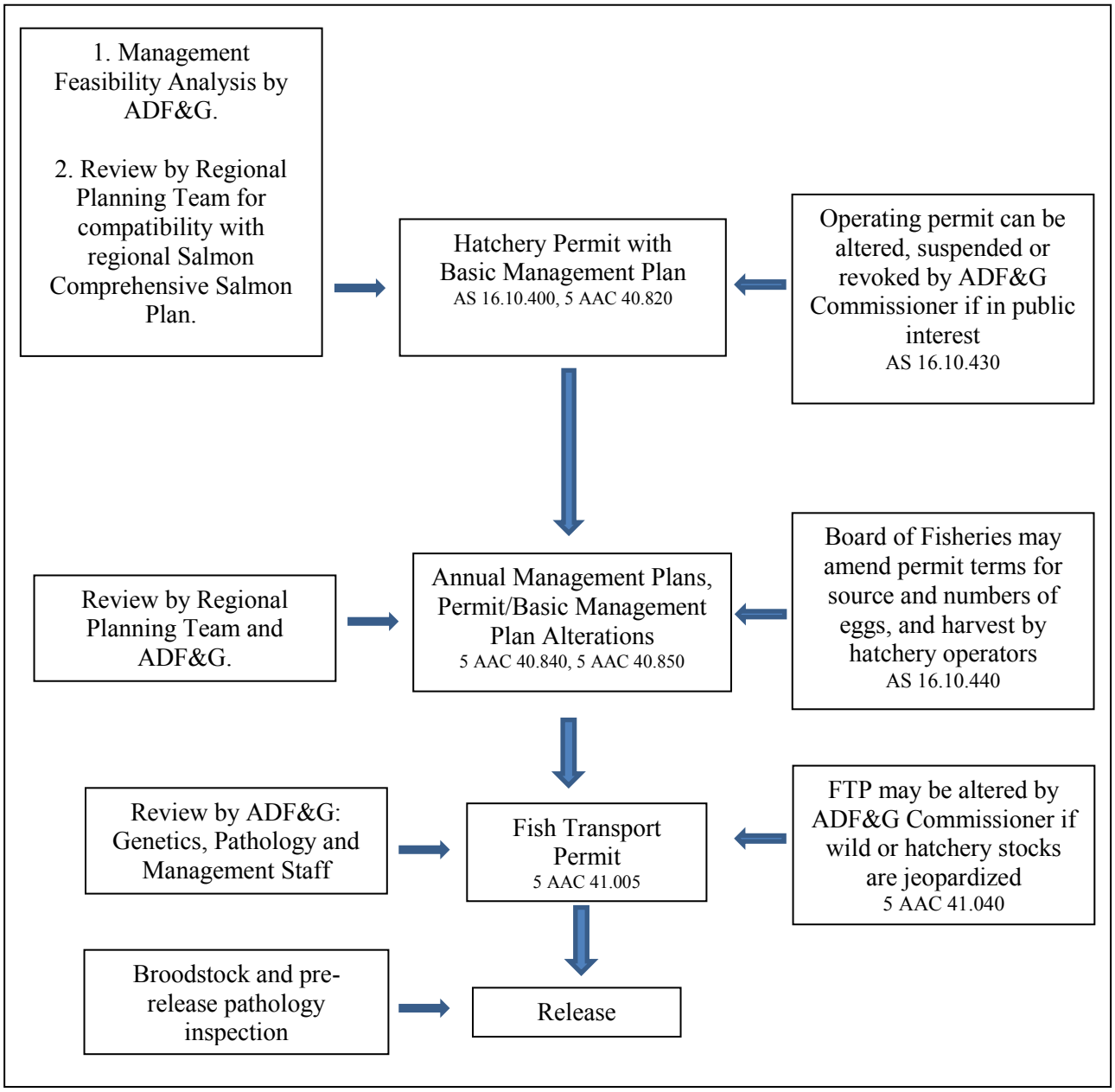

Figure 2.–Diagram of Alaska hatchery permitting process.

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 proposed FTPs 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, before final consideration by the ADF&G commissioner. 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 to the Alaska Legislature as required by AS 16.05.092 (e.g., Vercessi 2012).

The administration of hatchery permitting, planning, and reporting requires regular communication between ADF&G staff and hatchery operators. The serial documentation from hatchery permit/BMP to AMP to FTP to annual report necessarily spans generations of hatchery and ADF&G personnel, providing an important history of each hatchery's species cultured, stock lineages, releases, returns, and pathology.

WALLY NOERENBERG HATCHERY

OVERVIEW

Wally Noerenberg Hatchery (WNH) is located on Esther Island in PWS about 20 miles east of Whittier, Alaska (Figure 3). Water for hatchery operations is supplied by Esther Lake. The facility was constructed in 1985 by the PWS Aquaculture Corporation (PWSAC), the RAA for the PWS region. The PWSAC Board of Directors has 45 members. Twenty-seven board members are PWS salmon permit holders and elected by PWS salmon permit holders. The remaining 18 seats are designated representatives from municipalities, Alaska Native organizations, processors, sport fisheries, personal use fisheries, and subsistence users, and appointed by the Board of Directors.[3] The current (2013) permitted green egg[4] capacity at WNH is 148 million pink, 131 million chum, 4 million coho, and 4 million Chinook salmon.

PWSAC submitted a pre-application for the hatchery facility on Esther River in 1976. The pre-application requested rearing of pink, chum, coho and sockeye salmon. At the time, regulations, policies and procedures for PNP hatcheries were still being developed by ADF&G, as the Alaska Legislature had just authorized PNP hatchery operations in 1974. ADF&G FRED division staff was concerned about attempting sockeye salmon production until methods for dealing with infectious hematopoietic necrosis virus (IHNV) were developed.[5] Additional concerns were expressed for coho salmon broodstock availability because coho salmon stock status was not well known in PWS.[6]

The final application was submitted in 1983 to produce pink, chum, Chinook, and coho salmon. The long time period between the pre-application and the final application was due to land planning issues stemming from the early days of the Alaska Native Claims Settlement Act and Alaska National Interest Lands Conservation Act legislation.[7] Pink and chum salmon production was intended to provide additional harvest opportunity for gillnet and purse seine commercial fisheries. Chinook and coho salmon production was intended to contribute to the sport fishery in Whittier.

Minutes of the public testimony showed unanimous support for the hatchery. The comments included the hope that the hatchery would stabilize production, provide adequate competition with foreign salmon sales, and encourage the processing sector to invest in a more predictable return. One fisherman cautioned that using Esther Lake as source water for the facility could later preclude rearing sockeye salmon juveniles in the lake due to IHNV issues.

ADF&G issued PNP salmon hatchery permit number 20 to PWSAC in 1983 for a permitted capacity of 211 million pink salmon eggs, 111 million chum salmon eggs, 1 million coho salmon eggs and 1 million Chinook salmon eggs. At the time, the facility was called the Esther Island Hatchery, and the name was changed in about 1990 to WNH. WNH salmon releases receive thermal otolith marks, beginning with pink salmon in 1995, chum salmon in 1996, coho salmon

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

[4] Green eggs refer to salmon eggs immediately after fertilization that are placed in the hatchery.

[5] Richard Nickerson, ADF&G fishery biologist, to Sandra Lindstrom, ADF&G; December 23, 1976 memorandum. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

[6] Stan Kubik, ADF&G Division of Sport Fish to Sandra Lindstrom, ADF&G; November 12, 1976 memorandum. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

[7] Armin Koernig, PWSAC board of directors president; May 28, 1983 minutes of the Esther Lake Hatchery public meeting, Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

in 1999, and Chinook salmon in 2010. The marks are used for fisheries management to differentiate hatchery-reared salmon in the harvest and escapement.

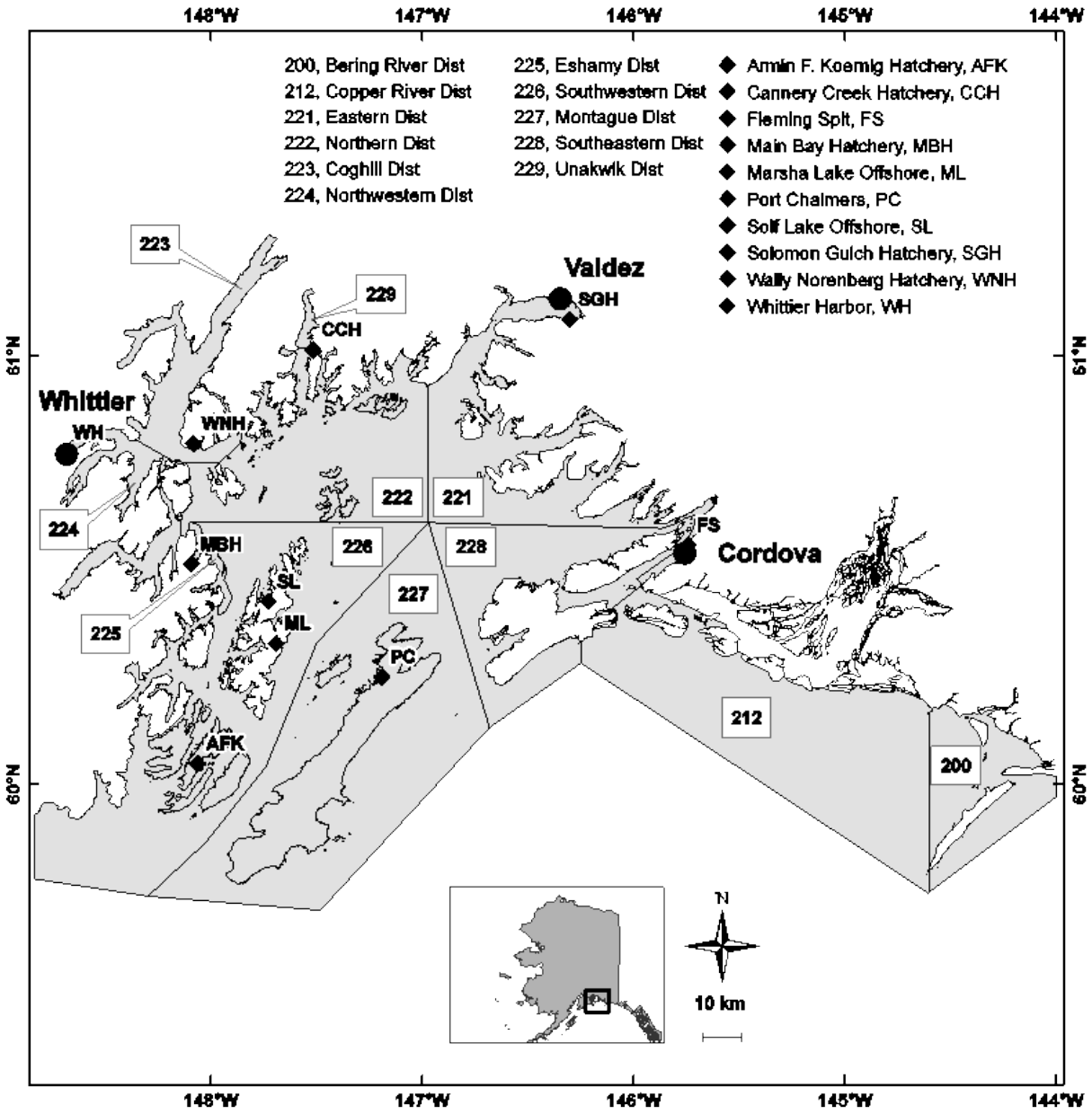

Figure 3.– Prince William Sound hatcheries and fishing districts.

Pink salmon fry are reared in net pets for an average of 6 weeks prior to release, and chum salmon fry are fed for 12 weeks prior to release. Chinook and coho salmon fry are reared in freshwater raceways to the smolt stage from June until the following spring, when they are transferred into saltwater net pens for a few weeks of further feeding and released.[8]

[8] 2012 Annual Management Plan for the WNH. Unpublished document obtained from Sam Rabung, ADF&G PNP Hatchery Coordinator, Juneau.

The pink salmon donor broodstock at WNH is from Armin F. Koernig Hatchery (AFKH), a PWS hatchery which used donor stocks from PWS systems (Larsen, Ewan and Galena creeks). Pink salmon eggs from Beartrap Creek[9] and from Main Bay (MBH) and Cannery Creek (CCH) hatcheries (both located in PWS[10]) were incubated at WNH, but the fry were released elsewhere and not incorporated into the WNH brood line.[11]

The chum salmon program began with cooperative programs with MBH and AFKH. Summer-run (aka early-run) chum salmon eggs were collected at Wells River (Kohler 1984). Eggs were incubated at MBH, and half of the resulting fry were released at MBH and half at WNH[12]. Beartrap Creek chum salmon were also used for brood stock.[13] The fall-run (aka late-run) chum salmon program used eggs received from the AFKH chum salmon stock, as well as gametes collected directly from Fidalgo Bay chum salmon, which was the original donor stock for AFKH. By 1988, WNH was able to acquire all summer-run chum salmon gametes from WNH returns. Fall-run returns performed poorly, and the program was discontinued in 1992.

Coho salmon donor stocks included Mile 18 Creek (a Copper River tributary), Power Creek (an Eyak Lake tributary), and Solomon Gulch Hatchery (SGH), which used Corbin Creek in Valdez Arm as its donor stock. Chinook salmon broodstock were from Cook Inlet stocks (Deshka River, Ship Creek and Deception Creek). Although there are Chinook salmon stocks in the Copper River, there are no substantial native Chinook salmon stocks in PWS. Copper River Chinook salmon stocks were considered as the first stock at WNH, but were rejected because of small population size, disease history, and logistics problems.[14]

The sockeye salmon program, which operated from 1986 to 1990, used broodstock from the Coghill River and Eshamy Lake, both located in PWS.

PERMIT ALTERATIONS

Numerous permit alterations occurred over the years (Appendix A). Sockeye salmon capacity (31 million eggs) was added in 1986, and later removed from the permit in 1997. Coho and Chinook salmon egg capacities were increased from 1 million each to 4 million each in 1988.

A PAR was approved in 1994 establishing Port Chalmers as a remote release site for WNH chum salmon (Figure 3). The project moved a portion of the chum salmon releases from the WNH release site in the Coghill District to Port Chalmers in the Montague District (Figure 3). The project was intended to create a new common property fishery opportunity that would disperse and diversify fleet effort, and reduce the harvest rate on Coghill Lake sockeye salmon.[15] The first accurate assessment of the Port Chalmers return occurred in 2012, when most returning hatchery chum salmon from the WNH and Port Chalmers releases had discreet otolith markings. In that year, most (83%) of the Port Chalmers-origin common property commercial chum salmon

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[9] 1986 Annual Report submitted by PWSAC for WNH. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

[10] 1985 Annual Report submitted by PWSAC for WNH. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

[11] Dave Reggiani, PWSAC Executive Director, personal communication.

[12] Ibid 8.

[13] Ibid 9.

[14] Bob Davis, Principal Genetist, FRED Division, comments on application for FTP 86A-1018 dated 05/29/1986. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

[15] Steve McGee, PNP Hatchery Program fishery biologist, Division of Commercial Fisheries, Management and Development Division, to Carl Rosier, ADF&G Commissioner; February 18, 1994 memorandum. Unpublished document btained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

harvest[16] was taken in the Montague District and about 7% in the Coghill District. From 2006-2011, an annual average of over 570,000 chum salmon was harvested at the Port Chalmers release site in common property commercial fisheries (Botz et al. 2013). Sockeye salmon escapement to the Coghill River was 98,000 fish in 2011 (Appendix M) and 72,000 fish in 2012.[17] These escapements exceeded the upper escapement goal limit of 40,000 fish, and were two of the highest escapements to the Coghill River in the past 25 years (Appendix M). These results indicate that the Port Chalmers release site is meeting the intended purposes of the project, at least in the short term.

In 1999, a PAR was approved to reduce the pink salmon permitted egg take to the number of eggs the hatchery actually used.[18] This reduced permitted pink salmon capacity from 211 million eggs to 150 million eggs. In 2003, a permit alteration changed permitted levels for pink and chum salmon to address harvest allocation plan goals between drift gillnet fishermen, who targeted chum salmon, and purse seine fishermen, who targeted pink salmon. This resulted in an increase of permitted capacity for chum salmon from 111 million eggs to 148 million eggs, and a decrease in permitted capacity for pink salmon from 150 million eggs to 120 million eggs.

In 2005, a PAR for a chum salmon remote release site at Nelson Bay was denied because of concern that the WNH chum salmon stock that would be released was not similar to the native Rude River chum salmon stock in Nelson Bay. A second PAR submitted in 2005 to increase chum salmon capacity from 148 million to 165 million eggs and decrease pink salmon capacity from 120 million to 93 million eggs was approved. This request was to "increase a greater return on its investment given current and projected fish prices."[19]

In 2007, a PAR was approved to reduce chum salmon capacity from 165 million eggs to 131 million eggs and increase pink salmon capacity from 93 million eggs to 148 million eggs. Prior to 2007, chum salmon eggs taken at WNH were marked with three unique otolith marks—one for release at AFKH, one for release at Port Chalmers, and one for release at WNH. Inclement spring weather sometimes prevented transfer of fry marked for AFKH or Port Chalmers release sites from WNH to the release sites. Out of necessity, these fry were placed in net pens at WNH and released at WNH because the fry would imprint to WNH once placed in the saltwater net pens. A portion of the fry hatching later bearing the otolith mark intended for WNH were transferred to AFKH and Port Chalmers for release in place of those placed in net pens at WNH due to earlier inclement weather. Therefore, although all chum salmon were otolith marked and would be known to have been incubated at WNH, they could not be distinguished by release site. To improve operational logistics and evaluation, this permit alteration changed the life-stage at which chum salmon would be transferred from WNH to AFKH from fry to egg so that the eggs could be otolith-marked at AFKH for release there and inclement weather would no longer prevent spring fry transports from WNH to AFKH. A PAR was approved for AFKH at the same time to increased chum salmon capacity by the number of eggs (17 million) transferred from WNH. The PWSAC board of directors decided to further reduce the WNH chum salmon capacity by an additional 17 million eggs, and replace this capacity with an increase of 55

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[16] Common property commercial harvest refers to a fish harvested in a public fishery open to the commercial salmon fleet, as opposed to a cost recovery harvest, which is fishery implemented by a PNP hatchery, with the proceeds used to fund hatchery operations.

[17] Jeremy Botz, ADF&G Area Salmon Management Biologist, Cordova. personal communication.

[18] PAR dated 2/12/2003 by Dave Reggiani, Executive Director of PWSAC. Unpublished document obtained from Sam Rabung, ADF&G PNP Hatchery Coordinator, Juneau

[19] PAR dated 2/12/2003 by Dave Reggiani, Executive Director of PWSAC. Unpublished document obtained from Sam Rabung, ADF&G PNP Hatchery Coordinator, Juneau

million pink salmon eggs because pink salmon were more economically advantageous given the survival rates and market conditions for pink and chum salmon at the time.

In 2010, a PAR was approved to increase the number of eggs transferred from WNH for incubation and release at AFKH from 17 million to 34 million. Several issues were brought forward regarding the PAR. Few sizeable chum salmon runs exist near AFKH and all chum salmon releases in PWS are otolith marked. When sampling for straying showed chum salmon straying to systems 50 km from release sites, the AFKH releases could no longer be assumed to be "safer" due to the release location being in an area of few wild chum salmon returns. Another issue was that in the hatchery allocation regulatory scheme between purse seine and gillnet operators, the gillnet fleet was behind in their target allocation of hatchery fish, with the purse seine fleet ahead. Since the AFKH return would primarily benefit the seine fleet, additional returns could further exacerbate the imbalance. A third issue was a steady increase in the harvest of sockeye salmon of unknown origin in the three years prior to the PAR (2007–2010) during purse seine fisheries targeting hatchery chum salmon near the AFKH. ADF&G believed increases to chum salmon returning to AFKH could increase the sockeye salmon harvest as well.

PWSAC RPT members voted to recommend approval of the PAR, and ADF&G staff voted against recommending the PAR. The PWSAC representatives believed the allocation issues could be negotiated; releases at AFKH posed a low straying risk of adult returns because the Southwest District, where AFKH is located, did not have significant numbers of wild stock chum salmon; and the potential economic value was worth the risks articulated by ADF&G.[20] The commissioner reviewed the recommendations and approved the PAR.

PARs submitted in 2010 and 2011 to increase pink salmon production were denied. ADF&G biologists were concerned that increasing pink salmon returns to WNH could bias wild stock assessment due to hatchery straying, and that it was prudent to wait for further information from new research projects (described in the Genetics and Discussion sections of this document) to assess interactions between hatchery and wild stocks.

PRODUCTION SUMMARY

Pink salmon egg takes averaged about 152 million and fry releases about 132 million per year from 1986 to 2012. Average annual adult pink salmon returns were about 7 million fish from 1987 to 2012 (Appendix B).

Chum salmon egg takes averaged about 118 million and fry releases about 96 million from 1986 to 2012. Average annual adult chum salmon runs to all permitted release sites of the WNH permit were about 2.4 million fish from 1990 to 2012 (Appendix C).

Coho salmon egg takes averaged about 1.9 million and fry releases about 1.5 million per year from 1986 to 2012. Average annual adult coho salmon returns from 1987 to 2012 were about 64,000 fish (Appendix D).

Chinook salmon releases occurred from 1986 through 1996. Initial releases were from Deshka River stock eggs transferred from the Fort Richardson State Hatchery in Anchorage, with eggs taken from broodstock returning to the hatchery from 1988 to 1996. About 1,300 to 3,000 fish

[20] Ron Josephson, Section Chief, ADF&G Fisheries Monitoring, Permitting and Development, Division of Commercial Fisheries, to Denby Lloyd, ADF&G Commissioner; July 9, 2010 memorandum. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

per year returned to release sites at WNH, Cordova and Whittier from 1991 to 2000 (Appendix E). The program restarted in 2010 with Ship Creek stock (Cook Inlet) eggs transferred from the Fort Richardson State Fish Hatchery, and continued in 2011 with Deception Creek stock (Cook Inlet) eggs transferred from the William Jack Hernandez Sport Fish Hatchery, which replaced the Fort Richardson facility.

The sockeye salmon program at WNH was initially planned to incubate eggs at the hatchery from a local brood source and then plant fry into PWS lakes. No fry were to be released from the hatchery.[21] Eggs were collected in 1986 from wild stocks at Coghill and Eshamy lakes in PWS. In 1987, MBH converted from chum salmon production to sockeye salmon production, and used the Coghill Lake sockeye salmon stock as broodstock. Consequently, the Coghill Lake stock was dropped from the WNH program, and the Coghill Lake fry hatched at WNH were transported to Trail Lakes Hatchery for interim holding prior to final transfer to MBH for release.[22] From 1986 to 1989, eggs were also collected from adult sockeye salmon returning to Eshamy Lake, and from 1987 to 1990, resultant fed fry were stocked in Eshamy Lake. WNH converted from sockeye salmon production to pink salmon production in 1990, and transferred the Eshamy Lake sockeye salmon stocking program to MBH[23] (Appendix F).

PROGRAM EVALUATIONS

Hatchery permit/BMP, AMP, and FTP documents for WNH were reviewed to determine that they met the following guidelines:

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

The hatchery permit and BMP do not expire. The BMP should be updated when any permit amendments are approved through PARs.

The current WNH program FTPs were reviewed and approved by numerous ADF&G personnel. FTPs were issued for egg collections from wild brood stocks, but no FTPs were found authorizing egg takes and releases at the hatchery for any species prior to 1996. This may have been due to uncertainty during the initial years of the PNP program as to whether FTPs were required for taking eggs from hatchery returns and releasing resultant progeny from the hatchery[24] (Appendix G).

The 2012 AMP provides thorough documentation of expected operations for the season, including egg take and release goals, a listing of current FTPs, expected returns, hatchery return management, plans for otolith marking, and evaluation plans. The AMP is consistent with the permit and PARs, but not the BMP. The BMP does not include all PARs approved since the hatchery permit was issued.

Egg-takes and fry releases reported in the annual report were generally within permitted levels in the hatchery permit, FTPs and AMPs for all species, except for chum salmon from 2009 to 2012

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[21] Notice of Permit Alteration, Esther Lake Hatchery, 1986. Unpublished document obtained from Sam Rabung, ADF&G Coordinator, Juneau.

[22] 1987 Esther Sockeye Hatchery Annual Report. Unpublished document obtained from Lorraine Vercessi, ADF&G PNP Assistant Coordinator, Juneau.

[23] 1987–1990 Annual Reports, Esther Sockeye Hatchery. Unpublished documents received from Sam Rabung, ADF&G PNP Coordinator, Juneau.

[24] Ron Josephson, ADF&G Hatchery and Mariculture Section Chief, personal communication.

(Appendices H through L). Chum salmon egg take numbers can be more difficult to estimate than pink salmon because there are four age classes returning, with varying size of eggs.[25] At WNH, the number of green eggs taken is estimated by volume, and the egg take ends when the permitted level is estimated to be achieved. The egg number is estimated again at the eyed-egg stage, when dead eggs are removed. From 2009 to 2012, the number of eggs estimated at the eyed-egg stage was higher than the number of eggs estimated at the egg take, and exceeded the permitted level. Eyed eggs in excess of the permitted level were discarded. Permitted egg capacity is based on the number of green eggs placed in the hatchery. If the egg number at the eyed-egg stage continues to exceed permitted capacity, the methodology for estimating the number of eggs at the egg take should be refined so that the number of eggs taken stays within the permitted capacity.

COMPREHENSIVE SALMON ENHANCEMENT PLAN

The PWS Comprehensive Salmon Enhancement Plan (CSEP) Phase I was issued in 1983, and served to assemble relevant information regarding the development and protection of salmon resources in the area (PWS 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. WNH was not yet constructed at the time of the publication, but anticipated in the near future. The Phase I CSEP indicated the design capacity for the hatchery would be for 200 million pink salmon eggs, 100 million chum salmon eggs, 10 million sockeye salmon eggs and 1 million each Chinook and coho salmon eggs.

The RPT also implemented a survey as part the Phase I CSEP to ask the fishing community about their desires for enhancement. Drift gillnet and purse seine are the commercial fishing gears permitted in the Coghill District where most WNH fish are harvested. The Coghill District ranked third among purse seine respondents as a preferred district for new enhancement projects, with pink salmon as the preferred species. For drift gillnet respondents, the Coghill District ranked second as a preferred district for new enhancement projects, with sockeye salmon as the preferred species.

The CSEP Phase II was issued in 1986 (PWS 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. For WNH, the Phase II plan recommended completion of the hatchery, brood stock development, and providing the region's commercial, sport, commercial and subsistence fishermen with a harvest of 7.5 million pink, 2.2 million chum, 33,000 coho, and 107,000 Chinook salmon annually.

The Phase III CSEP was issued in 1994. 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." For WNH, the plan recommended starting an early pink salmon program of 252 million eggs, increasing hatchery capacity for late pink salmon from 188 million eggs to 211 million eggs, increasing chum salmon production from the 111 million eggs to 302 million eggs, and maintaining current levels of coho and Chinook salmon production. These recommendations were made contingent upon levels of production

[25] Dave Reggiani, PWSAC General Manager, personal communication.

that were compatible with fishery management issues, genetic guidelines and stock interactions (PWS-Copper River Regional Planning Team 1994).

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 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.

A fifth recommendation was that the long-term average cost of hatchery operations, management, and evaluation must remain below 50% of the value of hatchery production. The Phase III plan requires that "An assessment of the benefits of enhanced salmon production must include costs associated with managing mixed stocks of wild and hatchery fish, because management precision must be increased to achieve wild-stock escapement. Similarly, costs associated with evaluation programs must be part of the equation, because the effect of enhanced salmon production on wild salmon must be determined and quantified to insure sustained yield of wild salmon." "Calculation of the value of enhanced salmon production must include ex-vessel value, and non-commercial and secondary economic benefits to communities in the region." The Phase III plan also indicates that the RPT will determine how to calculate costs and values of the hatchery program and establish more definitive decision criteria regarding economic benefits. In addition, the revised charter for the RPT under Phase III Plan states that the RPT will update the Comprehensive Salmon Plan at least once a year, and will provide an updated plan to the commissioner each year. The RPT has not yet defined how costs and production values are calculated nor issued annual updates since the Phase III Plan was completed.

CONSISTENCY WITH POLICY

The policies governing Alaska hatcheries were divided into three categories for this review: genetics, fish health, and fisheries management. The key elements of the policies in each of those categories are summarized in Tables 1–3. These templates identifying the key elements of state policies were used to assess compliance of the WNH salmon program with each policy element in Tables 4–6.

Table 1.–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 transport. 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 basis so as to define sensitive and non-sensitive areas for movement of stocks. 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.
Stock rehabilitation and enhancement	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 sanctuaries would serve as gene banks of wild type variability.
Straying impacts	Gene flow from hatchery fish straying and interbreeding with wild stocks may have significant detrimental effects on wild stocks. Stocks cannot be introduced to sites where the introduced stock may have significant interaction or impact on significant or unique wild stocks.
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 (i.e., broodstock) size of 400 fish. It also recognizes that small population sizes may be unavoidable with Chinook salmon and steelhead.
Genetics review of Fishery Transport Permits (5 AAC 41.05 – 41.060)	
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 recommend terms or conditions to protect wild or hatchery stocks. The commissioner may prescribe such terms or conditions on an FTP.

Table 2.–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.
Sockeye Salmon Culture Policy	
Alaska Sockeye Salmon Culture Manual	The Sockeye Salmon Culture Policy is designed to control the occurrence of infectious hematopoietic necrosis virus (IHNV) in Alaska. The policy specifies the use of a virus-free water supply; rigorous disinfection procedures; compartmentalization of eggs and fry; and immediate destruction of infected fish, followed by disinfection. The *Alaska Sockeye Salmon Culture Manual* prescribes procedures and fish culture practices developed to control IHNV.

Table 3.–Key elements of Alaska fisheries management policies and regulations relevant to salmon hatcheries and enhancement.

Sustainable Salmon Fishery Policy (5 AAC 39.222)	
I. Management principles and criteria	
Assessment of wild stock 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

The WNH donor stocks of pink, chum, sockeye and coho salmon were from the PWS region and reviewed by the ADF&G geneticist through the FTP process. Although there are Chinook salmon stocks in the Copper River, there are no substantial native Chinook salmon stocks in PWS. Copper River Chinook salmon stocks were considered as the first stock at WNH, but were rejected because of small population size, disease history, and logistics problems. The Deshka River Chinook salmon stock from Cook Inlet was then chosen because the return timing of this stock fit management needs of the hatchery, the returning fish were expected to be in good condition when returning to the hatchery, and there were indications the stock had advanced early development and could potentially be released from the hatchery in their first year.[26] Cook Inlet stocks from Deception Creek and Ship Creek were also approved by the geneticist beginning in 2010 for releases at Crab Bay near the community of Chenega Bay.

Straying of hatchery chum and pink salmon into PWS wild systems has been documented. Brenner et al. (2012) indicated that streams closest to release facilities generally contained the highest proportions of hatchery pink salmon strays, which is similar to findings for chum salmon hatchery straying in Southeast Alaska (Piston and Heinel 2012). Brenner et al. (2012) found that

[26] Bob Davis, ADF&G geneticist, comments on application for FTP 86A-1018. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Junea-

hatchery chum salmon straying, however, did not follow this pattern. Hatchery fish were present in higher proportions in samples taken from streams more distant from hatcheries than in streams closer to the hatcheries. Straying by release site could not be assessed for chum salmon because releases were not uniquely marked by release site.

The Phase III Comprehensive Salmon Plan recommended that wild stock escapement goals be achieved over the long term, and that the proportion of hatchery salmon straying into wild stock escapements remain below 2% over the long term. The proportion of hatchery pink salmon sampled in three streams in the Coghill District from 2008 to 2010 showed an average annual percentage ranging from about 1% to 2% (Brenner et al. 2012). During this three year period, the commercial harvest of pink salmon in the Coghill District ranged from 1.3 million to 14.2 million, and had an annual hatchery contribution rate ranging from 92% to 95% of the harvest (Botz et al. 2012, Botz et al. 2010, Bell et al. 2010).

The proportion of hatchery chum salmon sampled in two Coghill District streams from 2004 to 2010 showed an average annual hatchery percentage of about 2.5% and 3.5% (Brenner et al. 2012). During the same period, the commercial harvest of chum salmon in the Coghill District ranged from 0.2 million to 2.5 million fish, with an annual hatchery contribution rate ranging from about 96% to 99% of the harvest (Ashe et al. 2005, Hollowell et al. 2007, Botz et al. 2008, Lewis et al. 2008, Bell et al. 2010, Botz et al. 2010, Botz et al. 2012).

The proportion of otolith-marked pink and chum salmon in streams elsewhere in PWS were higher; however, and some of the strays in those systems were releases from WNH (Brenner et al. 2012; Joyce and Evans 1999). According to the Phase III Comprehensive Salmon Plan, if the proportion of hatchery salmon straying into wild stock escapements in PWS is significantly greater than 2%, the PWS-Copper River RPT is to "determine whether and to what extent the hatchery program in PWS should be monitored to reduce the rate of straying." The RPT recognized at the time that the 2% threshold of hatchery straying was not well supported in the scientific literature, and that further study was needed to improve understanding of acceptable straying rates (PWS-Copper River Regional Planning Team 1994). Studies initiated in 2012 will assess straying of hatchery-reared chum and pink salmon, the genetic stock structure of pink and chum salmon, and the effects on fitness of wild pink and chum salmon stocks due to straying of hatchery-reared pink and chum salmon.[27]

In 2010, two FTPs were issued for wild stock chum salmon egg takes at WNH when it appeared that adults returning to the hatchery might not meet broodstock needs. The two stocks—Wells River and Beartrap Creek—were both original donor stocks to the facility. However, the ADF&G geneticist recommended against issuance of the Beartrap FTP, citing recent genetic research that Wells River and Beartrap Creek were genetically different such that the use of Beartrap Creek at WNH "would represent a hybrid broodstock and this is discouraged by department genetics policy. It is noted, however, that Beartrap Creek fish were used once in 1986 as WNH broodstock. The new genetic results did not find evidence for a strong effect of Beartrap Creek genes in the present WNH broodstock."

[27] PWS Science Center (PWSSC) http://www.adfg.alaska.gov/index.cfm?adfg=fishingHatcheriesResearch.current_research, (Accessed 11/17/2012).

Table 4.–The current WNH salmon fisheries enhancement program and its consistency with elements of the ADF&G *Genetic Policy* (see Table 1).

I. Stock transport	
Use of appropriate local stocks	WNH pink and chum salmon brood stocks are from PWS. The Chinook salmon donor stock is from the Deshka River in Cook Inlet, as there are no Chinook salmon stocks in PWS and Copper River stocks could not be used due to small wild stock population, disease and logistic issues. Coho salmon broodstocks are from within the PWS/Copper River region, including stocks from a Copper River tributary (Mile 18 Creek), an Eyak Lake tributary, and the SGH, which are Corbin Creek (Valdez Arm) stock.
II. Protection of wild stocks	
Identification of significant or unique wild stocks	No stocks were identified as significant stocks or unique wild stocks to date in PWS by the RPT.
Establishment of wild stock sanctuaries	No wild stock salmon sanctuaries are designated for the PWS area.
III. Maintenance of genetic variance	
Maximum of three hatchery stocks from a single donor stock	The pink salmon broodstock was from AFKH. The MBH stock was also originally from AFKH, so the AFKH stock was used at AFKH, MBH and WNH. The chum salmon donor stocks included Wells River, Beartrap Creek, and Fidalgo Bay. The WNH coho salmon donor stock was from Mile 18 Creek stock (a Copper River tributary), which is also approved for, but not used at, CCH for lake stocking. Chinook salmon were from Cook Inlet stocks (Deshka River, Ship Creek and Deception Creek), and these stocks are only used at the Fort Richardson/William Jack Hernandez Hatchery in Anchorage.
Minimum effective population size of 400	The AMP for WNH requires about 283,000 adult pink salmon, 216,000 adult chum salmon, and 2,700 adult coho salmon brood stock to meet egg-take goals. About 16 Chinook salmon broodstock are used to meet egg take goals.
Genetics review of FTPs (5 AAC 41.010 – 41.050)	
Review by geneticist	The geneticist reviewed the FTPs for the WNH programs.

Fish Health and Disease

The FTPs for the WNH program were approved by the pathologist (Table 5). Pathology records showed no inconsistencies with fish health and disease policies. Appropriate salmon culture techniques are implemented, and disease reporting and broodstock screening occur as required.

The hatchery was been inspected regularly since at least 1986, and no major health issues were reported. Fish showing signs of illness were forwarded to the state pathology lab for diagnoses. In their 2012 report, inspectors commented that the "facility follows fish culture guidelines that promote good fish health. Foot baths are large and placed throughout the facility. Separate utensils are used for different groups of fish. Proper disinfection and clean up procedures are

exercised. Apart from the occasional gas bubble disease, fish from this facility have had relatively few health problems."[28]

Table 5.–The current WNH salmon fisheries enhancement program and its consistency with elements of the Alaska policies on fish health and disease (see Table 2).

Fish Health and Disease Policy (5 AAC 41.080; amended by Meyers 2010)	
Egg disinfection	Eggs are treated for fungus initially and then up to three times per week.
Hatchery inspections	Hatchery inspections were conducted regularly from at least 1986 through 2012.
Disease reporting	Reports from the ADF&G pathology lab indicate that diseased fish have been sent to the state lab as necessary for diagnoses.
Pathology requirements for FTPs (5 AAC 41.010)	
Disease history	Samples have been sent to the pathology lab as necessary for disease history.
Isolation measures	Isolation measures to control for disease during transport are listed as necessary in approved FTPs.
Pathology review of FTPs	FTPs were reviewed and approved by the pathologist.

Fisheries Management

All WNH releases are otolith-marked. Hatchery contribution to commercial fisheries is estimated inseason from otoliths sampled from the fisheries. ADF&G manages area fisheries based on meeting wild stock escapements and broodstock requirements at the hatchery under the Wally Noerenberg Salmon Hatchery Management Plan (5 AAC 24.368). Fishery managers close areas of the district as necessary to provide escapement for sockeye, chum and pink salmon systems (e.g., Brady et. al 1991a, 1991b; Botz et al. 2012).

Allocation of hatchery-produced fish is based on the PWS Management and Salmon Enhancement Allocation Plan (5 AAC 24.370). Because WNH fish return intermixed with other stocks, management of the return is based on a variety of factors. Poor escapement may require closures in mixed-stock fishing areas and shift harvest to the terminal areas near the hatchery to target individual hatchery-produced stocks. During strong wild stock runs and liberalized fishing periods, returning hatchery fish may be intercepted in other fishing districts and result in insufficient runs to meet broodstock and cost-recovery goals, requiring selected fishing closures near the hatchery to provide broodstock and cost recovery.

Escapement goals are in place for the Coghill District for sockeye, pink and chum salmon stocks. The first escapement goals for pink and chum salmon in the Coghill District were reported by Pirtle (1978) and may have been in place since at least 1960 (Fried 1994). Escapement goals were reviewed and updated in 1994 (Fried 1994), 2002 (Bue et al. 2002), 2005 (Evenson et al. 2008), and 2011 (Fair et al. 2011). Using the escapement observed each year in relation to the

[28] Jayde Ferguson and Collette Bentz, Hatchery Inspection Report, 2012. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau

escapement goal in place during that year, pink salmon escapement goals to the Coghill District were achieved in 16 of 36 years from 1977 to 2012. Chum salmon escapement goals were met in 10 of the same 36-year period. Sockeye salmon escapement goals were met most years (Appendix M).

Several caveats to escapement goals in the Coghill District bear mention. Early escapement goals for pink and chum salmon reported by Pirtle (1978) appear to have been based on professional judgment "thought to produce high, if not maximum, sustained yield" (Fried 1994). As decades of escapement data were compiled following the statehood mandate for sustainable fisheries management, escapement goals were developed that were based on empirical data. The first pink salmon escapement goals based on historical aerial survey data were adopted for pink salmon in 1990 (Fried 1994) and for chum salmon in 2002 (Bue et al. 2002). Escapement goal reviews continued in 2005 (Evenson et al. 2008). From 2003 to 2011, PWS pink salmon escapement goals were changed from fishing district-level goals to a PWS area-wide goal, with fishing district escapement "target" ranges within the area-wide goal (Bue et al. 2002). Beginning in 2012, escapement goals were again established for each fishing district (Fair et al. 2011).

From the first year of significant returns to WNH in 1977, pink salmon escapement goals (1977–2002 and 2012) or escapement targets (2003–2011) were met in 16 out the 36 years (Appendix D). The escapement goals for the Coghill District were changed "target" escapement ranges as part of the area-wide escapement goal established in Bue et al. (2002) to district-specific escapement goal ranges in 2012. The district escapement goals were lowered from the 2003-2011 district target goals because the long time series of escapement data and their general stationary or increasing characteristics through time suggested that the management targets established in Bue et al. (2002) were set too high relative to the existing sustainable fishery (Fair et al. 2011).

For chum salmon, the chum salmon escapement goal range was lowered from 29,600–37,050 fish to 8,000–25,000 fish in 2003 as recommended by Bue et al. (2002), based on accumulated escapement indices. The current minimum sustainable escapement goal of 8,000 fish, with a long-term average escapement of 18,750 fish, was implemented in 2005 according to recommendations in Evenson et al. (2008), based on accumulated escapement indices and risk of management error from Bernard et al. (2009).

In retrospect, the current minimum sustainable escapement goals of 8,000 fish for chum salmon and 60,000 fish for pink salmon for the Coghill District were met in most years since 1971. The validity of applying the current escapement goals to escapement levels decades earlier, however, is uncertain, given possible changes in productivity and migratory patterns, continued geologic effects of the 1964 earthquake, possible influence from hatchery-reared fish straying and spawning in wild systems, and changes in fishing patterns targeting hatchery runs. Although pink and chum salmon escapements to monitored systems in the Coghill District appear sustainable and healthy, recent assessments show hatchery-reared fish make up an unknown portion of escapements throughout PWS (Brenner et al. 2012).

For sockeye salmon, a weir has been installed in Coghill Lake since 1974 (Fried 1994), providing accurate annual escapement estimates. The first escapement goal for the weir of 25,000 fish was adopted in the 1970s. That goal was adopted again in 1992, with a range of 20,000 to 30,000 fish. The escapement goal was reviewed again during the same periods mentioned earlier for chum and pink salmon. Through escapement monitoring and closure of

areas as necessary to protect the sockeye salmon run to Coghill Lake, ADF&G area management biologists have achieved escapement goals to Coghill Lake nearly every year since 1977, despite a significant overlap in harvest timing with the much larger WNH chum salmon run in late May and early June that began in the late 1980s (e.g., Botz et al. 2012).

Table 6.–The current WNH salmon fisheries enhancement program and its consistency with elements of Alaska fisheries management policies and regulations (see Table 3).

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 marks to estimate contributions to fisheries. Straying studies are ongoing in PWS.
Use of precautionary approach	ADF&G manages the salmon fisheries to meet escapement goals, recognizing that an unknown percentage of the fish in streams are hatchery fish.
Salmon Escapement Goal Policy (5 AAC 39.223)	
Establishment of escapement goals	Escapement goals are established for Coghill District pink, chum and sockeye salmon systems.
Mixed Stock Salmon Fishery Policy (5 AAC 39.220)	
Wild stock conservation priority	A management plan is in place for the WNH run. Special harvest areas for pink and chum 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 FTPs for the WNH program were reviewed by fisheries management staff.

OTHER REQUIREMENTS

ANNUAL HATCHERY PRODUCTION REPORTS

All hatcheries are required to submit an annual report to ADF&G that summarizes their production and activities for the year (AS 16.10.470). The annual report must include "information pertaining to species; brood stock source; number, age, weight, and length of spawners; number of eggs taken and fry fingerling produced; and the number, age, weight, and length of adult returns attributable to hatchery releases, on a form to be provided by the department." Much of the data in the annual reports may be gross estimates, and averages may be from a few samples taken opportunistically, rather than a statistically derived estimate. WNH annual reports have been received for all years of operation.

CARCASS LOGS

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 each day, and whether they were fertilized, unused, or used for roe sales. A maximum of 10% of the total number of females can be used for roe sales without using the carcass; the proceeds from any sales in excess of the 10% maximum must be surrendered to ADF&G. The WNH carcass logs appear to be complete and timely.

RECOMMENDATIONS

1) 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.

PWSAC began the permitting process for WNH in 1976[29] in response to poor salmon returns to PWS and most of Alaska during the 1970s. Today, the combination of favorable environmental conditions, sustainable management of wild stock systems, and hatchery production supports economically healthy salmon fisheries in PWS.

With full utilization of virtually the entire hatchery run and strong demand for salmon, there is heightened interest in increasing Alaska hatchery production. The processing industry has expanded infrastructure and markets for abundant salmon returns. The advent of otolith marking and additions to the time series of harvest, escapement, migration, and timing data have added to management precision for harvesting the WNH run and providing for adequate spawning escapement to most wild stock systems.

Straying of WNH pink salmon have been documented for over two decades (Sharr et al. 1995, Joyce and Evans 2000, Brenner et al. 2012). Hatchery-released salmon strays were included in aerial survey spawning escapement counts and have likely been interbreeding. Current stocks spawning in wild systems are likely a mix of hatchery and naturally spawned stocks. Because hatchery broodstocks are derived from local wild stocks, with large numbers of broodstock used and no selective breeding allowed, it is unknown if there are any effects on fitness from this mixing on the spawning grounds. Garforth et al. (2012), in the first surveillance report for certification of Alaska's salmon fisheries under the FAO-based responsible fisheries management certification, indicated the need for hatchery and wild stock interaction study: "To evaluate whether or not fitness of natural-origin (wild) versus stray hatchery-origin salmon differ when spawning in the wild, survival of both types of fish and their relative spawning success needs to be documented."

A science panel composed of current and retired scientists from ADF&G, University of Alaska, aquaculture associations, and National Marine Fisheries Service with broad experience in salmon enhancement, management, and wild and hatchery interactions designed a long-term research project to potentially answer some of these questions. The four-year study entitled *Interactions of Wild and Hatchery Pink and Chum Salmon in Prince William Sound and Southeast Alaska* currently underway is funded by the state of Alaska and administered by ADF&G, with field work conducted by the Prince William Sound Science Center. The study will improve understanding of hatchery and wild stock interactions and provide Alaska-specific scientific guidance for assessing Alaska's hatchery program, including recommendations for escapement goals, fisheries management, hatchery production levels, and hatchery practices at WNH and other hatcheries in the state.

[29] PWSAC Pre-application for hatchery permit. Unpublished file from Sam Rabung, ADF&G PNP Coordinator, Juneau.

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.[30]

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[30] Jeff Regnart, ADF&G Director of Commercial Fisheries, personal communication.

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APPENDIX

Appendix A.–History of WNH permit and permit alterations, 1983 through 2012.

Date	Description	Permitted Capacity in millions of eggs				
		Pink Salmon	Chum Salmon	Coho Salmon	Chinook Salmon	Sockeye Salmon
06/17/1983	PNP hatchery permit number 20 issued to PWSAC to operate the WNH. Hatchery permitted for 211 million pink salmon, 111 million chum salmon, 1 million coho salmon, and 1 million Chinook salmon eggs. Pink salmon source stocks included Koppen Creek, Wells River, Coghill River, Shrode Creek and Port San Juan Hatchery, with Beartrap, Olsen and Indian creeks as alternates. Chum salmon source stocks included Koppen Creek, and Wells, Coghill and Sunny rivers. Alternate sites were the same as for pink salmon. Coho salmon source stocks were Corbin Creek or Copper River. Chinook salmon source stocks were Crooked Creek Hatchery stock or the Copper River. According to the BMP, pink and chum salmon fry were to be released on site, with coho and Chinook salmon released at lake stocking sites, and at Quillian Bay to establish a return for brood stock and a sport fishery. A coded-wire tagging program was to be submitted to ADF&G before the first egg take.	211	111	1	1	0
04/29/1986	Permit amended to add 31 million sockeye salmon eggs. Shoestring and Solf lakes were approved brood stock sources. All sockeye salmon fry releases were to be in PWS lakes, and none were to be released from the hatchery.	211	111	1	1	31
05/29/1988	Permit amended to increase coho and Chinook salmon egg takes to 4 million each.	211	111	4	4	31
08/28/1989	Permit amended to increase pink salmon egg take from 211 to 261 million eggs to offset a lack of chum salmon eggs due to a lack of chum salmon broodstock. Pink salmon increase was for one year only.	261	111	4	4	31
04/17/1990	Permit amended to allow release of up to 20,000 Chinook salmon smolt from Fleming Spit in Cordova.	211	111	4	4	31
09/17/1990	Permit amended to increase pink salmon egg take from 211 to 241 million to offset a lack of chum salmon eggs due to a lack of chum salmon broodstock. Pink salmon increase was for one year only.	241	111	4	4	31
04/7/1991	Permit amended to allow release of 100,000 Chinook salmon smolt and coho salmon smolt each at Fleming Point, and Whittier, and 200,000 Chinook salmon smolt at Port Valdez. In addition, 10 million pink salmon fry were to be released at MBH for one year (1991) only.	211	111	4	4	31

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Date	Description	Permitted Capacity in millions of eggs				
		Pink Salmon	Chum Salmon	Coho Salmon	Chinook Salmon	Sockeye Salmon
03/17/1994	Permit amended to allow release of up to 24 million chum salmon fry at Port Chalmers on Montague Island. PWSAC was required to develop and fund an evaluation program for the project to estimate the inseason contribution of hatchery-produced fish to common property fisheries in PWS.	211	111	4	4	31
04/21/1994	Permit amended to allow release of up to 50,000 Chinook salmon smolt at Crab Bay near Chenega.	211	111	4	4	31
05/21/1996	Permit amended to transfer up to 300,000 coho salmon fry to MBH for rearing and release.	211	111	4	4	31
06/09/1997	Permit amended to incubate an additional 18 million pink and 11 million chum salmon eggs only for transport at the eyed-egg stage to the Armin F. Koernig Hatchery at Port San Juan. Removed sockeye salmon from the permit.	229	122	4	4	0
02/08/1999	Permit amended to decrease pink salmon capacity from 211 million to 150 million eggs. Remove entire 31 million sockeye salmon egg capacity.	150	122	4	4	0
04/22/1999	Permit amended to allow release of up to 50,000 coho salmon smolt at Crab Bay near Chenega. This PAR substituted coho salmon for the Chinook salmon PAR approved 4/21/1994.	150	122	4	4	0
05/21/2003	Permit amended to decrease pink salmon capacity to 120 million eggs and increase chum salmon capacity to 148 million eggs. Amendment allowed an additional 16.8 million chum salmon fry to be released at Port Chalmers, for a total release of up to 40.8 million fry at Port Chalmers. Port San Juan was increased by 15.6 million fry, for a total release of up to 34 million fry at Port San Juan. PWSAC was to establish sampling program to assess the origin of any sockeye salmon harvested incidentally in the terminal fisheries for chum salmon at Port San Juan.	120	148	4	4	0
03/15/2005	Permit amendment request denied to add a remote release site at Nelson Bay for WNH chum salmon because it conflicted with the state's Fish Genetics Policy.	120	148	4	4	0

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Date	Description	Permitted Capacity in millions of eggs				
		Pink Salmon	Chum Salmon	Coho Salmon	Chinook Salmon	Sockeye Salmon
05/18/2005	Permit amended to increase chum salmon capacity to 165 million eggs and reduce pink salmon capacity to 93 million eggs. Permit valid for 5 years, after which PWSAC was to evaluate and report on the increased chum salmon production. PWSAC was to establish a chum salmon catch sampling program. The increased chum salmon production was to be released at the hatchery.	93	165	4	4	0
06/15/2007	Permit amended to increase pink salmon capacity from 93 million to 148 million eggs and reduce chum salmon capacity from 165 million to 131 million eggs. Also allowed an additional 17 million chum salmon eggs to be taken for AFKH. These eggs were in addition to the permitted capacity of 131 million chum salmon eggs.	148	131	4	4	0
07/10/2010	Permit amended to increase the number of chum salmon eggs taken at WNH for transport to AFKH from 17 million to 34 million eggs.	148	131	4	4	0
09/10/2010	Permit amendment request denied for increasing pink salmon capacity from 148 million eggs to 188 million eggs.	148	131	4	4	0
08/23/2011	Permit amendment request denied for increasing pink salmon capacity from 148 million eggs to 188 million eggs.	148	131	4	4	0

Appendix B.–WNH pink salmon egg takes, fry releases and adult returns.

Year	Eggs		Fry Released	Total Adult Return
1985	53,593,141	[a]		
1986	78,909,893	[b]	34,437,214	
1987	227,152,267	[c]	75,932,715	2,321,312
1988	180,262,515	[d]	195,321,335	3,866,618
1989	269,624,688		159,920,124	7,130,475
1990	240,097,347		233,258,252	15,089,718
1991	180,470,137		214,963,378	13,700,566
1992	184,752,082		163,591,233	2,079,068
1993	180,559,831		172,078,972	1,509,324
1994	188,110,652		162,386,766	6,094,141
1995	188,506,249		168,864,536	2,449,301
1996	176,216,859		169,508,993	7,504,880
1997	229,372,959		106,440,456	6,194,964
1998	130,197,003		103,675,208	8,542,600
1999	130,003,972		123,869,678	9,466,850
2000	132,447,650		116,069,339	8,695,768
2001	119,081,166		127,650,249	7,181,077
2002	132,655,040	[e]	106,229,524	5,617,122
2003	125,700,223		119,553,743	17,847,316
2004	94,862,542		109,640,296	2,704,727
2005	96,333,418		84,060,920	9,164,154
2006	91,771,186		84,795,328	4,065,035
2007	148,000,000		77,200,000	7,540,222
2008	148,000,000		136,000,000	8,737,521
2009	149,300,000	[f]	128,000,000	3,237,364
2010	148,000,000		136,000,000	17,243,401
2011	149,000,000		136,000,000	6,647,471
2012	148,000,000		137,000,000	5,687,710

Source: Alaska hatchery annual reports database. Version 3. Juneau, AK: Alaska Department of Fish and Game, Division of Commercial Fisheries. 1964–present (Accessed 08/19/2013). [URL not publically available.]

[a] Includes 3,015,639 green eggs taken at MBH and 50,577,502 green eggs taken at AFKH, transferred as eyed eggs to WNH and released. Eggs taken at MBH and eyed eggs transferred to WNH and released. About 86,000 eggs, not included in the 1986 total, were sent to WNH for research purposes and never intended for release (Lorraine Vercessi, ADF&G Assistant PNP Hatchery Coordinator, personal communication).

[b] Eggs from AFKH.

[c] Includes 19,198,504 green eggs transferred from AFKH.

[d] Includes 28,561,947 green eggs taken at AFKH transferred to WNH.

[e] Includes 13,610,005 eggs transferred from AFKH.

[f] Includes an additional 33.3 million eggs transferred to WNH from AFKH.

Appendix C.–WNH chum salmon egg takes, fry releases and adult returns.

Year	Eggs		Fry Released	Total Adult Return
1985	22,720,530	[a]		
1986	40,213,074	[b]	15,172,261	49
1987	82,637,512	[c]	36,478,818	54,968
1988	101,500,873		68,388,803	299,749
1989	53,359,960	[d]	79,845,649	241,988
1990	85,298,403	[e]	46,981,584	372,896
1991	113,196,810	[f]	76,842,328	241,713
1992	112,427,380		97,953,492	416,250
1993	111,200,784		107,992,433	1,198,549
1994	109,164,712		100,108,254	969,422
1995	111,319,900		96,466,004	795,516
1996	110,336,444	[g]	102,314,523	1,875,834
1997	117,342,493	[h]	87,236,047	1,788,700
1998	111,129,724		99,944,727	1,181,410
1999	111,010,849		99,294,184	2,826,995
2000	81,922,013		100,351,928	4,364,073
2001	116,408,182		76,116,325	2,450,968
2002	115,637,488		101,255,366	6,268,938
2003	151,526,806		98,649,705	3,524,315
2004	148,755,546		131,172,881	1,954,561
2005	169,862,314		126,985,991	2,200,373
2006	169,740,042		146,015,891	2,230,319
2007	131,600,000	[i]	129,100,000	3,731,120
2008	130,600,000	[j]	115,800,000	4,893,155
2009	143,400,000	[k]	110,000,000	3,135,625
2010	138,000,000	[l]	117,300,000	4,254,078
2011	148,400,000	[m]	109,000,000	1,818,159
2012	142,200,000	[n]	110,900,000	3,572,443

Source: Annual reports submitted by PWSAC. *Source*: Alaska hatchery annual reports database. Version 3. Juneau, AK: Alaska Department of Fish and Game, Division of Commercial Fisheries. 1964–present (Accessed 08/19/2013). [URL not publically available.]

[a] Includes 10,653,600 eggs incubated to emergence at MBH (WNH received 50% of the emergent fry), 2,320,051 green eggs (shipped as eyed eggs) from AFKH, and 9,746,879 green eggs collected from Port Fidalgo for WNH.
[b] Includes 14,070,749 green eggs (transferred as eyed eggs) from AFKH.
[c] Includes 67,467,095 eggs from MBH and 2,011,208 green eggs from AFKH.
[d] An additional 846,220 green eggs were taken and sent to SGH as eyed eggs.
[e] An additional 782,938 green eggs were taken and sent to SGH as eyed eggs.
[f] An additional 297,951 green eggs were taken and sent to SGH as eyed eggs.
[g] An additional 11,763,730 sent to AFKH as eyed eggs.
[h] An additional 11,060,010 sent to AFKH as eyed eggs.
[i] A total of 148 million eggs were collected at WNH in 2007, of which 16.4 million were transferred to AFKH as eyed eggs.
[j] A total of 148 million eggs were collected at WNH in 2008, of which 17.4 million were transferred to AFKH.
[k] A total of 162 million eggs were collected at WNH in 2009, of which 18.6 million were transferred to AFKH.
[l] A total of 177 million eggs were collected at WNH in 2010, of which 39 million were transferred to AFKH.
[m] A total of 186 million eggs were collected at WNH in 2011, of which 37.6 million were transferred to AFKH hatchery.
[n] A total of 180 million eggs were collected at WNH in 2012, of which 37.8 million were transferred to AFKH hatchery.

Appendix D.–WNH coho salmon egg takes, fry releases and adult returns.

Year	Eggs		Fry Released		Total Adult Return
1985	273,218	[a]			
1986	992,010	[b]	98,788	[c]	
1987	2,692,060		376,385	[d]	16,377
1988	2,786,864		871,469		56,824
1989	2,595,391		2,499,106		120,050
1990	3,043,831		2,389,771		171,779
1991	2,669,069		2,223,282		92,756
1992	2,493,000		1,831,198		164,421
1993	2,683,531		1,303,077		42,171
1994	2,736,523		1,484,936		104,262
1995	636,688		2,064,056		44,796
1996	644,829		275,406		87,561
1997	1,601,534		203,651		19,615
1998	541,427		407,715		9,292
1999	366,900		1,068,338		6,971
2000	1,288,630		375,670		152,878
2001	1,400,436		221,967		12,565
2002	1,197,181		485,834		28,302
2003	1,423,932		920,858		24,005
2004	1,270,363	[e]	989,383		14,663
2005	2,548,377		1,057,922		87,399
2006	3,806,000		1,052,897		177,501
2007	255,000		1,850,000		124,038
2008	4,000,000		1,930,000		140,049
2009	4,000,000		226,000		26,973
2010	945,000	[f]	3,490,000		22,099
2011	4,000,000		3,480,000		150,520
2012	981,000		1,018,000		12,064

Source: Alaska hatchery annual reports database. Version 3. Juneau, AK: Alaska Department of Fish and Game, Division of Commercial Fisheries. 1964–present (Accessed 08/19/2013). [URL not publically available.]

[a] Received brood year 1985 eyed eggs from Fort Richardson Hatchery in 1986.

[b] Brood year 1986 Corbin Creek stock received as eyed eggs.

[c] Release of brood year 1984 smolt received from Fort Richardson Hatchery.

[d] Includes 125,000 brood year 1985 fry, received in 1986 from Fort Richardson Hatchery.

[e] Includes 52,807 green eggs from Mile 18, Copper River and 1,217,556 from SGH, Corbin Creek stock.

[f] Actual green egg count was 1,170,000 after inventoried at eyed egg stage.

Appendix E.–WNH Chinook salmon egg takes, smolt releases and adult returns.

Year	Eggs		Smolt Released		Total Adult Return
1986	248,892	[a]	57,544	[b]	
1987	217,784	[a]			
1988	274,020	[c]	44,787		308
1989	1,116,895	[d]	144,934		466
1990	835,504		138,609		608
1991	1,072,059		598,901		1,947
1992	1,267,483		574,147		2,482
1993	1,251,832		671,128		3,071
1994	462,854		1,1010,010	[e]	1,567
1995	249,956		637,132		1,274
1996	478,612		86,415		2,112
1997			95,844		2,505
1998			79,038		2,808
1999					1,383
2000					1,730
2001					860
2002					278
2003					
2004					
2005					
2006					
2007					
2008					
2009					
2010	50,000	[f]			
2011	50,000	[f]			
2012	28,000		49,700		

Source: Alaska hatchery annual reports database. Version 3. Juneau, AK: Alaska Department of Fish and Game, Division of Commercial Fisheries. 1964–present (Accessed 08/19/2013). [URL not publically available.]

[a] Eyed eggs of Deshka Stock origin transferred from Fort Richardson Hatchery to WNH.

[b] Deshka stock fry transferred from Fort Richardson Hatchery to WHN.

[c] Includes 90,325 eggs of Deshka Stock origin taken at Fort Richardson Hatchery.

[d] Includes 726,210 eggs of Deshka Stock origin taken at Fort Richardson Hatchery.

[e] Approximately 367,450 BY93 fry were released into Lake Bay early due to lack of rearing space.

[f] Eggs of Ship Creek stock origin transferred from Fort Richardson/William Jack Hernandez Hatchery to WNH.

Appendix F.–WNH sockeye salmon egg takes, fry releases and adult returns.

Year	Eggs		Fry/Smolt Released		Total Adult Return
1986	888,100	[a]			
1987	1,167,000	[b]	716,683	[c]	
1988	3,427,200	[b]	764,472	[d]	
1989	2,985,984	[b,e]	2,054,849	[d]	

Source: Alaska hatchery annual reports database. Version 3. Juneau, AK: Alaska Department of Fish and Game, Division of Commercial Fisheries. 1964–present (Accessed 08/19/2013). [URL not publically available.]

[a] Approximately 447,000 eggs collected from Eshamy Lake and 441,100 eggs from Coghill River broodstock.

[b] Eggs collected from Eshamy Lake broodstock.

[c] Transferred 320,650 Coghill Lake stock to Trail Lakes. 396,033 fry Eshamy Lake stock released to Eshamy Lake.

[d] Fry released to Eshamy Lake.

[e] Resultant 2,192,162 fed fry transferred to Main Bay Hatchery.

Appendix G.–Summary of Fish Transport Permits for WNH.

FTP Number	Issued	Expiration	Summary and reviewer comments
Coho Salmon			
85A-1054	1985	1999	Allows the egg take of 1 million eggs from Eyak Lake coho salmon and release of resultant smolt from WNH.
86A-1047	1986	1986	Allows the incubation to eyed-egg stage at the City of Cordova water treatment plan of up to 1 million eggs from Eyak Lake coho salmon. Further incubation and release covered under 85A-1054. Permit amended to change the incubation site to the City of Cordova pump station in 1987. No record of expiration date being amended past 1986.
86A-1049	1986	1987	Allows the transfer of up to 1 million eyed coho salmon eggs from SGH for incubation, rearing, and release at WNH.
91A-0041	1991	1991	Allows transport from WNH and release of 40,000 Corbin Creek stock coho salmon smolt at Fleming Point near Cordova.
91A-0042	1991	2001	Allows transport from WNH and release of 100,000 Corbin Creek stock coho salmon smolt at Shakespeare Creek near Whittier.
92A-0038	1992	2007	Allows transport and release of 100,000 Mile 18 Copper River Delta stock coho salmon smolt at Fleming Spit, Cordova.
92A-0039	1992	2007	Allows the egg take of 2.5 million eggs from Mile 18 Copper River Delta stock coho salmon and release of resultant smolt from WNH.
92A-0143	1992	1992	Allows 2.5 million egg Eyak Lake coho salmon egg take for incubation and release at WNH.
92A-0144	1992	Withdrawn	Allows 2.5 million egg Little Marten Lake coho salmon egg take for incubation and release at WNH.
96A-0047	1996	2006	Allows egg take of 4 million coho salmon at WNH and release at WNH.
96A-0055	1996	1997	Allows transport, rearing and release of 300,000 WNH stock coho salmon smolt at MBH.
97A-0031	1997	2006	Allows transport and release of 50,000 Power Creek stock coho salmon smolt at Fleming Spit, Cordova.
97A-0032	1997	2006	Allows transport and release of 50,000 Power Creek stock coho salmon smolt at Smitty's Cove, Whittier.
97A-0060	1997	2017	Allows egg take and release of 1.18 million Mile 18 Copper River Delta stock coho salmon eggs at WNH.
98A-0053	1998	2019	Allows transport and release of 100,000 Mile 18 Copper River Delta stock coho salmon smolt at Smitty's Cove, Whittier. In 2009, effective date extended through 2019.
99A-0049	1999	2020	Allows transport and release of 50,000 Mile 18 Copper River Delta stock coho salmon smolt at Chenega Bay, Chenega.
99A-0073	1999	2020	Allows the egg take at Fleming Spit and egg transport to WNH of up to 1.18 million Mile 18 Creek, Copper River Delta stock coho salmon eggs.
04A-0048	2004	2004	Allows transport of 1.2 million SGH/Corbin Creek stock coho salmon eggs for incubation and release at WNH hatchery.
08A-0042	2008	2018	Allows the egg take, incubation, and rearing of 4.0 million Mile 18, Copper River Delta stock coho salmon eggs at WNH.
08A-0043	2008	2018	Allows the release of 1.75 million coho salmon smolt at WNH.

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FTP Number	Issued	Expiration	Summary and reviewer comments
Pink Salmon			
84A-1031	1985	1986	Allows transport of 25 million MBH stock pink salmon fry from MBH and released to Lake Bay, Esther Island for proposed Esther Island Hatchery (i.e., WNH) broodstock.
86A-1022	1986	1987	Allows collection of 10 million Koppen Creek pink salmon eggs for incubation and release at WNH. Stock chosen because run timing provided segregation from early chum salmon stocks.
86A-1023	1986	1987	Allows collection of 10 million Indian Creek pink salmon eggs for incubation and release at WNH. Stock chosen because run timing provided segregation from early-run chum salmon stocks.
86A-1024	1986	1987	Allows collection of 10 million Olsen Creek pink salmon eggs for incubation and release at WNH. Stock chosen because run timing provided segregation from early-run chum salmon stocks.
86A-1025	1986	1987	Allows collection of 10 million Beartrap Creek pink salmon eggs for incubation and release at WNH. Stock chosen because run timing provided segregation from early-run chum salmon stocks.
86A-1026	1986	1987	If surplus pink salmon broodstock available at MBH, up to 20 million green pink salmon eggs transferred to WNH for subsequent incubation and release. Stock chosen because run timing provided segregation from early-run chum salmon stocks.
86A-1035	1986	1987	Transfer 50,000 pink salmon eggs from Valdez Fisheries Development Association to WNH to study water quality at WNH. Stock chosen because it would allow various experimental studies to be completed prior to the arrival of the majority of pink salmon eggs later in the season.
86A-1038	1986	1988	If surplus pink salmon broodstock available at CCH, up to 20 million green pink salmon eggs transferred to WNH for subsequent incubation and release. Stock chosen because run timing provided segregation from early-run chum salmon stocks.
86A-1039	1986	1995	Allows transport of 36 million Larsen Creek stock pink salmon eggs from AFKH to WNH for incubation and release of resultant fry.
96A-0048	1996	2021	Issued in 1996 for egg take and release of 188 million Larsen, Ewan, and Galena creek stocks pink salmon at WHN to expire in 2006. Amended in 2003 to reduce egg take from 188 million to 120 million. Amended in 2005 to reduce egg take from 120 million to 93 million. Amended in 2006 to extend FTP until 2011. Amended in 2007 to increase eggtake from 93 million to 148 million. Amended in 2011 to extend FTP until 2021.
97A-0033	1997	2007	Allows transport and release of 60 million WNH pink salmon eggs at AFKH. Amended in 1997 to increase number of eggs from 60 million to 118 million.
Chum Salmon			
84A-1004	1984	1985	Allows transport and release of 7.3 million chum salmon fry to at WNH that were incubated and reared at MBH. FTP amended in 1985 to increase release number to 15 million chum salmon fry.
86A-1027	1986	1989	Allows collection of 10 million Olsen Creek chum salmon eggs for incubation and release at WNH.

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FTP Number	Issued	Expiration	Summary and reviewer comments
86A-1028	1986	1989	If surplus Wells River chum salmon broodstock available at MBH, up to 20 million green chum salmon eggs transferred to WNH for subsequent incubation and release. Amended to increase egg take from 20 million to 80 million in 1987, only, and then back to 20 million 1988 and 1989.
86A-1029	1986	1989	Allows collection of 10 million Koppen Creek chum salmon eggs for incubation and release at WNH.
86A-1030	1986	1989	Allows collection of 10 million Bear Trap Creek chum salmon eggs for incubation and release at WNH. FTP amended to allow a take of 20 million eggs in 1986, only, and then 10 million from 1987 to 1989.
86A-1031	1986	1989	Allows collection of 10 million Indian Creek chum salmon eggs for incubation and release at WNH.
86A-1032	1986	1989	Allows collection of 10 million Mill Creek chum salmon eggs for incubation and release at WNH.
86A-1040	1985	1988	Allows transfer of 22 million eyed chum salmon eggs from AFKH for incubation and release at WNH.
87A-1003	1987	2000	Allows transport of 500,000 Sunny River stock chum salmon fry for release at Chalmers River.
87A-1008	1987	2000	Allows transport of 500,000 Sunny River stock chum salmon fry for release at Swamp Creek.
94A-0006	1994	2015	Allows transport of 24 million WNH/Wells River/Beartrap stocks chum salmon fry to Port Chalmers for release. In 2000, FTP amended to extend effective date until 2010. In 2003, FTP amended to increase release from 24 million to 41 million and effective date reduced to 2006. In 2006, FTP effective period extended until 2008 pending straying study. The project operated without a valid FTP in 2008. In 2009, the FTP was renewed for one year until 2010. In 2010, permit effective date extended until 2015.
95A-0084	1995	1995	Allows transfer or 100,000 eyed eggs from WNH to AFKH to study the feasibility of incubating chum salmon eggs at AFKH.
96A-0046	1996	2016	Allows egg take of 111 million Wells River stock and release of 85 million fry at WNH. In 2003, permit amended release number of fry from 111 million to 148 million. In 2005, FTP amended to increase egg take from 148 million to 165 million. In 2006, FTP extended through 2011. In 2011, permit extended through 2016.
97A-0030	1996	2001	Allows transfer of 11.1 million chum salmon eggs from WNH for incubation and release at AFKH.
03A-0041	2003	2003	Allows transport of 15.6 million WNH/Wells River chum salmon eggs for incubation and release at AFKH.
04A-0046	2004	2015	Allows transfer of 15.6 million chum salmon fry from WNH for rearing and release at AFKH. In 2007, FTP amended stating maximum egg take at 16.4 million. In 2008, FTP amended to allow common property fishery if cost recovery harvests have not occurred for a period of more than five consecutive days after July 1. In 2009, FTP amended to extend effective period from 2009 until 2010. In 2010, permit amended to increase eggtake from 16.4 to 34 million eggs and extend effective period until 2015.
11A-0063	2011	2012	Allows remote egg take of up to 10 million chum salmon eggs at Beartrap Creek (WNH original donor stock) if brood stock requirements are not available at the hatchery.

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FTP Number	Issued	Expiration	Summary and reviewer comments
11A-0064	2011	2012	Allows remote egg take of up to 10 million chum salmon eggs at Wells River (WNH original donor stock) if brood stock requirements are not available at the hatchery.
Chinook Salmon			
86A-1018	1986	1990	Allows remote egg take of up to 1.0 million Chinook salmon eggs at Deshka River for incubation, rearing and release from WNH.
88A-1002	1988	1992	Allows transfer of 1 million eyed Chinook salmon eggs from the Crooked Creek Hatchery for incubation, rearing and release from WNH.
90A-0018	1990	1995	Allows transport from WNH and release of 100,000 WNH/Deshka stock Chinook salmon smolt at Fleming Spit, Cordova.
91A-0014	1991	1991	Allows transport and release of 200,000 Deshka River stock Chinook salmon smolt from WNH to Valdez.
91A-0040	1991	1991	Allows transport from WNH and release of 100,000 Deshka River stock Chinook salmon smolt at Shakespeare Creek near Whittier.
91A-0159	1991	2001	Allows transport and release of 200,000 Deshka River stock Chinook salmon smolt from WNH to 6.5 Mile Creek, Valdez for release.
91A-0160	1992	2001	Allows transport and release of 100,000 Deshka River stock Chinook salmon at Shakespeare Creek near Whittier.
94A-0025	1994	1998	Allows transport and release of 50,000 Deshka River stock Chinook salmon smolt from WNH to Crab Bay, Chenega Village.
96A-0045	1996	2006	Allows egg take of 4 million Deshka River stock Chinook salmon and release of smolts at WNH.
97A-0029	1997	1998	Allows transport and release of 50,000 Deshka River stock Chinook salmon smolt at Fleming Spit, Cordova.
10A-0158	2010	2020	Allows transport of 50,000 Fort Richardson/Deception Creek stock Chinook salmon eyed eggs for incubation and freshwater rearing to the smolt stage at WNH and then release in Crab Bay near Chenega.
10A-0162	2010	2020	Allows transport of 50,000 Fort Richardson/Ship Creek stock Chinook salmon eyed eggs for incubation and freshwater rearing to the smolt stage at WNH and then release in Chenega Bay, Chenega.
11A-0061	2011	2021	Allows transport of 50,000 William Jack Hernandez Sport Fish Hatchery/Ship Creek stock Chinook salmon eyed eggs for incubation and freshwater rearing at the smolt stage at WNH and then release in Chenega Bay, Chenega.
86A-1033	1986	1990	Allows collection of up to 800,000 sockeye salmon eggs at Coghill Lake, and transfer of eggs to WNH for incubation. Of resulting fry, approximately 700,000 fry to be stocked in Shoestring Bay Lake and up to 5,000 fry in Falls Lake 505A and up to 5,000 fry in Falls Lake 505B.
86A-1034	1986	1990	Cover page indicates allowing collection of up to 1.2 million sockeye salmon eggs at Eshamy Lake, and transfer of eggs to WNH for incubation. Of resulting fry, approximately 1 million fry to be stocked in Solf Lake and up to 10,000 fry in Ewan Lake. Page 12 of FTP 86A-1034, however, allows a 2.3 million egg take and stocking levels are not specified.
86A-1036	1987	1987	Allows 400,000 Coghill Lake brood sockeye salmon at WNH to be transferred to the Trail Lakes Hatchery, reared until the early fall, and then transferred to MBH for rearing until May 1988 and released.

Appendix H.–Comparison of permitted and reported egg takes in hatchery permit, basic management plan, annual management plan, fish transport permits and annual reports for WNH pink salmon. Numbers are in millions and rounded.

Year	Permit	AMP	FTP Number	FTP Permitted Level	Annual Report
1985					54[a]
1986	211	98.5	86A-1025	10	0.086
			86A-1039	36	79
1987	211	210	86A-1039	36	19
					208[b]
1988	211	194	86A-1039	36	29
					152[b]
1989	261	200			270[b]
1990	241	200			240[b]
1991	211	170			180[b]
1992	211	188			185[b]
1993	211	188			181[b]
1994	211	188			188[b]
1995	211	188			189[b]
1996	211	176	96A-0048	188	176
					60[c]
1997	229	228	96A-0048	188	110
			97A-0033	118[d]	119
1998	229	130	96A-0048	188	130
1999	150	130	96A-0048	188	130
2000	150	130	96A-0048	188	132
2001	150	130	96A-0048	188	119
2002	150	150	96A-0048	188	133
2003	120	120	96A-0048	120	126
2004	120	120	96A-0048	120	95
2005	93	93	96A-0048	93	96
2006	93	93	96A-0048	93	92
2007	148	148	96A-0048	148	148
2008	148	148	96A-0048	148	148
2009	148	148	96A-0048	148	116
			09A-0071[e]	33	33
2010	148	148	96A-0048	148	148
2011	148	188[f]	96A-0048	148	149
2012	148	148	96A-0048	148	148

[a] Eggs from MBH and AFKH.
[b] These eggs collected from hatchery returns. No FTP was issued for egg takes from hatchery returns until from 1988 to 1995.
[c] Eggs transferred to AFKH but FTP for transfer not issued until following year.
[d] Egg take at WNH and transferred to AFKH for incubation and release.
[e] This FTP allowed transfer of up to 35 million eyed eggs from AFKH to WNH in 2009.
[f] 188 million was pending a PAR which was denied.

Appendix I.–Comparison of permitted and reported egg takes in hatchery permit, basic management plan, annual management plan, fishery transport permits and annual reports for WNH chum salmon. Numbers are in millions and rounded.

Year	Permit	AMP	FTP Number	FTP Permitted Level	Annual Report
1985					23.0
1986	111	108.1	86A-1028	20	5.7
			86A-1030	20	20.4
			86A-1040	22	14.1
					0.32[a]
1987	111	55	86A-1028	80	67.5
			86A-1040	22	2.0
					13.2[a]
1988	111	100			101.5[a]
1989	111	110			53.4[a]
1990	111	110			85.3[a]
1991	111	113			113.2[a]
1992	111	111			112.4[a]
1993	111	111			111.2[a]
1994	111	111			109.2[a]
1995	111	111			111.3[a]
1996	111	122	96A-0046	111	110.3
1997	122	122	96A-0046	111	117.3
1998	122	111	96A-0046	111	111.1
1999	122	111	96A-0046	111	111.0
2000	122	111	96A-0046	111	81.9
2001	122	111	96A-0046	111	116.4
2002	122	111	96A-0046	111	115.6
2003	148	147.4	96A-0046	148	151.5
2004	148	147.4	96A-0046	148	148.8
2005	165	165	96A-0046	165	169.8
2006	165	165	96A-0046	165	169.7
2007	131	148[b]	96A-0046	165	131.6
2008	131	148[b]	96A-0046	165	130.6
2009	131	148[b]	96A-0046	165	143.4
2010	131	148[b]	96A-0046	165	138.0
2011	131	165[c]	96A-0046	165	148.4
2012	131	165[c]	96A-0046	165	142.2

[a] These eggs collected from hatchery returns. No FTP was issued for egg takes from hatchery returns issued from 1988 to 1995.
[b] Includes 131 million permitted for WNH and 17 million permitted for AFKH.
[c] Includes 131 million permitted for WNH and 34 million permitted for AFKH.

Appendix J.–Comparison of permitted and reported egg takes in hatchery permit, basic management plan, annual management plan, fishery transport permits and annual reports for WNH coho salmon. Numbers are in millions and rounded.

Year	Permit	AMP	FTP Number	FTP Permitted Level	Annual Report
1986	1	1	85A-1054	1	0.354
			86A-1049	1	1.0[a]
1987	1	1			2.7[b]
1988	4	2			2.8[b]
1989	4	2.5			2.6[b]
1990	4	2.5			3.0[b]
1991	4	2.5			2.7[b]
1992	4	2.5	92A-1043	2.5	2.5[c]
1993	4	2.5			2.7[b]
1994	4	2.5			2.7[b]
1995	4	0.265			0.637[b]
1996	4	1.725	96A-0047	4	0.645
1997	4	1.7	96A-0047	4	1.6
1998	4	1.6	96A-0047	4	0.541
1999	4	1.18	96A-0047	4	0.242
			99A-0073	1.18	0.125
2000	4	1.18	96A-0047	4	1.3
2001	4	1.18	96A-0047	4	1.4
2002	4	1.18	96A-0047	4	1.2
2003	4	1.18	96A-0047	4	1.4
2004	4	1.18	97A-0060	1.18	0.053
			04A-0048	1.2	1.2
2005	4	1.5	92A-0039	2.5	2.5
2006	4	2.3	96A-0047	4	3.8
2007	4	1.18	97A-0060	1.18	0.255
2008	4	4	08A-0042	4	4.0
2009	4	4	08A-0042	4	4.0
2010	4	4	08A-0042	4	0.945
2011	4	4	08A-0042	4	4.0
2012	4	4	08A-0042	4	0.981

[a] About 1 million eggs transferred from SGH to WNH.
[b] These eggs collected from hatchery returns. No FTP was issued for egg takes from hatchery returns until 1996.
[c] These eggs collected from Power Creek/Eyak Lake coho salmon under FTP 92A-1043.

Appendix K.–Comparison of permitted and reported egg takes in hatchery permit, basic management plan, annual management plan, fishery transport permits and annual reports for WNH Chinook salmon. Numbers are in millions and rounded.

Year	Permit	AMP	FTP Number	FTP Permitted Level	Annual Report
1986	1	1	86A-1018	0.5	0.249[b]
1987	1	1			0.218 [b]
1988	4	1			0.274
1989	4	10			0.391[a]
					0.726[b]
1990	4	2			0.836[a]
1991	4	1			1.1[a]
1992	4	1			1.3[a]
1993	4	1			1.3[a]
1994	4	0.820			0.462[a]
1995	4	0.095			0.250[a]
1996	4	0.400	96A-0045	4.0	0.479
2010	4	0.050	10A-0162	0.050	0.050[c]
2011	4	0.050	10A-0162	0.050	0.050[c]
2012	4	0.050	10A-0162	0.050	0.028[c]

[a] These eggs collected from hatchery returns. No FTP was issued for egg takes from hatchery returns until 1996.
[b] Eggs transferred from ADF&G Fort Richardson Hatchery. No FTP for this transfer was found.
[c] Eyed eggs transferred to WNH from Fort Richardson/William Jack Hernandez hatcheries.

Appendix L.–Comparison of permitted and reported egg takes in hatchery permit, basic management plan, annual management plan, fish transport permits and annual reports for WNH sockeye salmon. Numbers are in millions and rounded.

Year	Permit	AMP	FTP Number	FTP Permitted Level	Annual Report
1986	31		86A-1033	0.800	0.441
			86A-1034	2.3	0.447
1987	31	1.24	86A-1034	2.3	1.2
1988	31	[a]	86A-1034	2.3	3.4
1989	31	3.0	86A-1034	2.3	3.0

[a] Annual management plan not found for 1988. Author believes one may have been written but it was not found in the paper files.

Appendix M.–Total WNH pink and chum salmon returns, pink and chum salmon escapement in the Coghill District, and escapement goals for the Coghill fishing district, Prince William Sound. Pink and chum salmon goals were first reported in Pirtle (1978), and updated in Fried (1994), Bue et al. (2002), Evenson et al. (2008) and Fair et al. (2011). Numbers in bold indicate years in which lower bound of escapement goal was not reached.

Year	Coghill District Pink Salmon Escapement[a]	Coghill District Pink Salmon Escapement Goal[b]	Total WNH Pink Salmon Return[c]	Coghill District Chum Salmon Escapement[a]	Coghill District Chum Salmon Escapement Goal[b]	Total WNH Chum Salmon Run[c]	Coghill River Sockeye Salmon Escapement	Coghill River Sockeye Salmon Escapement Goal
1977	**211,400**	262,500–315,000		43,940	29,600–37,050		31,562	
1978	**217,750**	262,500–315,000		**18,160**	29,600–37,050		42,284	
1979	**195,000**	262,500–315,000		**6,330**	29,600–37,050		48,281	
1980	374,190	262,500–315,000		**23,340**	29,600–37,050		142,253	
1981	**157,660**	262,500–315,000		**2,050**	29,600–37,050		156,112	
1982	542,670	262,500–315,000		**22,130**	29,600–37,050		180,314	
1983	506,960	262,500–315,000		61,140	29,600–37,050		38,783	
1984	881,820	262,500–315,000		**19,960**	29,600–37,050		63,622	
1985	496,160	262,500–315,000		**22,140**	29,600–37,050		163,311	
1986	**183,090**	262,500–315,000		**13,140**	29,600–37,050		71,095	
1987	222,450	262,500–315,000	2,321,312	**24,510**	29,600–37,050	54,968	187,263	
1988	**110,850**	262,500–315,000	3,866,618	39,240	29,600–37,050	299,749	72,052	
1989	**114,050**	262,500–315,000	7,130,475	**22,680**	29,600–37,050	241,988	37,751	
1990	**49,110**	129,000–158,000	15,089,718	**26,020**	29,600–37,050	372,896	8,949	
1991	**98,580**	160,000–196,000	12,094,645	**6,070**	29,600–37,050	241,713	9,752	
1992	**23,611**	129,000–158,000	2,079,068	**10,003**	29,600–37,050	416,250	29,642	20,000–30,000
1993	**41,387**	160,000–196,000	1,509,324	**8,430**	29,600–37,050	1,198,549	**9,232**	20,000–30,000
1994	**65,648**	129,000–158,000	6,094,141	**14,176**	29,600–37,050	969,422	**7,264**	20,000–30,000
1995	**46,029**	160,000–196,000	2,449,301	**11,596**	29,600–37,050	795,516	30,382	20,000–30,000
1996	**104,781**	129,000–158,000	7,221,681	**19,669**	29,600–37,050	1,875,834	38,693	20,000–30,000
1997	**52,961**	160,000–196,000	6,194,964	**3,101**	29,600–37,050	1,788,700	35,517	20,000–30,000
1998	**85,968**	129,000–158,000	8,542,600	**22,764**	29,600–37,050	1,181,410	28,293	20,000–30,000
1999	168,816	160,000–196,000	9,466,850	**5,507**	29,600–37,050	2,826,995	59,311	20,000–30,000
2000	223,646	129,000–158,000	8,695,768	**20,488**	29,600–37,050	4,364,073	28,446	20,000–30,000

-continued-

Year	Coghill District Pink Salmon Escapement[a]	Coghill District Pink Salmon Escapement Goal[b]	Total WNH Pink Salmon Return[c]	Coghill District Chum Salmon Escapement[a]	Coghill District Chum Salmon Escapement Goal[b]	Total WNH Chum Salmon Run[c]	Coghill River Sockeye Salmon Escapement	Coghill River Sockeye Salmon Escapement Goal
2001	**148,665**	160,000–196,000	7,181,077	**13,388**	29,600–37,050	2,450,968	38,558	20,000–30,000
2002	**54,882**	129,000–158,000	5,617,122	**7,430**	29,600–37,050	6,268,938	28,323	20,000–30,000
2003	375,147	125,000–175,000	17,847,316	19,729	8,000–25,000	3,524,315	75,427	20,000–40,000
2004	**79,010**	115,000–250,000	2,704,727	9,685	8,000–25,000	1,954,561	30,569	20,000–40,000
2005	528,264	125,000–175,000	9,164,154	11,979	8,000	2,200,373	30,313	20,000–40,000
2006	145,511	115,000–250,000	4,065,035	15,900	8,000	2,230,319	23,479	20,000–40,000
2007	197,405	125,000–175,000	7,540,222	14,052	8,000	3,731,120	70,001	20,000–40,000
2008	145,177	115,000–250,000	8,737,521	39,660	8,000	4,893,155	29,298	20,000–40,000
2009	125,907	125,000–175,000	3,237,364	**6,150**	8,000	3,135,625	23,186	20,000–40,000
2010	335,108	115,000–250,000	17,243,401	51,589	8,000	4,254,078	24,312	20,000–40,000
2011	257,020	125,000–175,000	6,647,471	20,777	8,000	1,820,250	98,000	20,000–40,000
2012[d]	172,611	60,000–150,000	5,428,811	10,281	8,000	3,430,976	72,678	20,000-60,000

[a] Escapement data: 1977–2005 from Hollowell et al. (2007). The escapement counts in the table from 1977 to 1990 are the sum of the Coghill and Northwestern Districts (per Fried 1994). Escapement counts 1990–2011 are for the Coghill District only; 2005–2010 from Botz et al. (2012); 2011 from Jeremy Botz, PWS ADF&G management biologist, personal communication and ADF&G News Release at http://www.adfg.alaska.gov/static/fishing/PDFs/commercial/pws_salmon_summary_11.pdf

[b] Escapement goals: 1980–1994 Fried (1994); 2002–2005 Bue et al. (2002); 2005–2011 Evenson et al. (2008); 2012 Fair et al. (2011). For chum salmon, although separate goals were apparently in place for the Coghill and Northwestern Districts, they were reported together in the annual management report for PWS by Pirtle 1978 (Fried 1994). Escapement goals from 1977 to 1990 were for the Coghill and Northwestern Districts combined to match the escapement goals from Pirtle (1978). Fair et al. (2011) recommended that each fishing district be managed for the current long-term median value of escapement for pink salmon.

[c] Alaska hatchery annual reports database. Version 3. Juneau, AK: Alaska Department of Fish and Game, Division of Commercial Fisheries. 1964–present (Accessed 08/19/2013). [URL not publically available.]

d Unpublished data provided by Steve Moffitt, ADF&G Fishery Biologist, Cordova.