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An Evaluation of the Klawock River Salmon Hatchery for Consistency with Statewide Policies and Prescribed Management Practices

by

Mark Stopha

June 2016

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

Symbols and Abbreviations

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Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

Mathematics, statistics

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

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

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ABSTRACT

The salmon hatchery program in Alaska is governed by policies, plans, and regulations that emphasize protection of wild salmon stocks. A rotational series of hatchery evaluations will examine 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.

The Klawock River salmon hatchery in Klawock, Alaska, is one of the few hatcheries in Alaska located on a major salmon spawning river. The hatchery was constructed in 1977 and operated by ADF&G from 1978 to 1992. In 1996, the Prince of Wales Hatchery Association, a private nonprofit aquaculture association, took over operations. The hatchery currently rears coho salmon *Oncorhynchus kisutch* that contribute to commercial, sport, and subsistence fisheries. Eggs are collected from returns of hatchery-spawned and naturally spawned fish, and incubated and reared in the hatchery.

Some fry are reared to smolt in saltwater net pens at the river mouth, some fry are released from the hatchery into Klawock Lake in mid-May, and the remainder are reared in net pens in the lake and released into the lake in June. Fish will also be released from Port Asumcion on Baker Island. A portion of all releases are marked with coded wire tags and adipose finclip, and all releases are otolith thermal marked. Coho salmon are sampled in the commercial fisheries to assess hatchery contribution.

The basic management plan for the hatchery should be updated to reflect changes to the program since the BMP was issued in 1996.

Key words: Klawock River salmon hatchery, hatchery evaluation, hatchery, coho salmon

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

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

in the state and under a policy of management which allows reasonable segregation of returning hatchery-reared salmon from naturally occurring stocks."[1]

Salmon fishery restoration efforts came in response to statewide annual salmon harvests of just 22 million fish in 1973 and 1974, among the lowest catches since 1900 (Figure 1). The FRED Division and PNPs engaged in a variety of activities to increase salmon production. New hatcheries were built to raise salmon, fish ladders were constructed to provide adult salmon access to previously nonutilized spawning and rearing areas, lakes with waterfall outlets too high for adult salmon to ascend were stocked with salmon fry, log jams were removed in streams to enable returning adults to reach spawning areas, and nursery lakes were fertilized to increase the available feed for juvenile salmon (FRED 1975). A combination of favorable environmental conditions, limited fishing effort, abundance-based harvest management, habitat improvement and protection, and hatchery production gradually boosted salmon catches, with recent commercial salmon harvests (2004–2013) averaging 180 million fish.[2]

In Alaska, the purpose of salmon hatcheries is to supplement natural stock production for public benefit. Hatcheries are efficient in improving survival from the egg-to-fry or -smolt stage. In natural production, estimates for pink salmon *Oncorhynchus gorbuscha* egg-to-fry survival in 2 Southeast Alaska creeks ranged from less than 1% to 22%, with average survivals from 4% to 9% (Groot and Margolis 1991). Under hatchery conditions, egg-to-fry survival is usually 90% or higher.

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

Hatchery production is limited by freshwater capacity and freshwater rearing space. Soon after emergence, all pink and chum salmon *O. keta* fry can be transferred from fresh water to salt water. Most Chinook *O. tshawytscha*, sockeye *O. nerka*, and coho salmon *O. kisutch* must spend a year or more in fresh water before fry develop to the smolt stage and can tolerate salt water. These 3 species require a higher volume of fresh water for rearing. 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.

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

[2] Data from http://www.adfg.alaska.gov/index.cfm?adfg=CommercialByFisherySalmon.exvesselquery (Accessed 08/12/14).

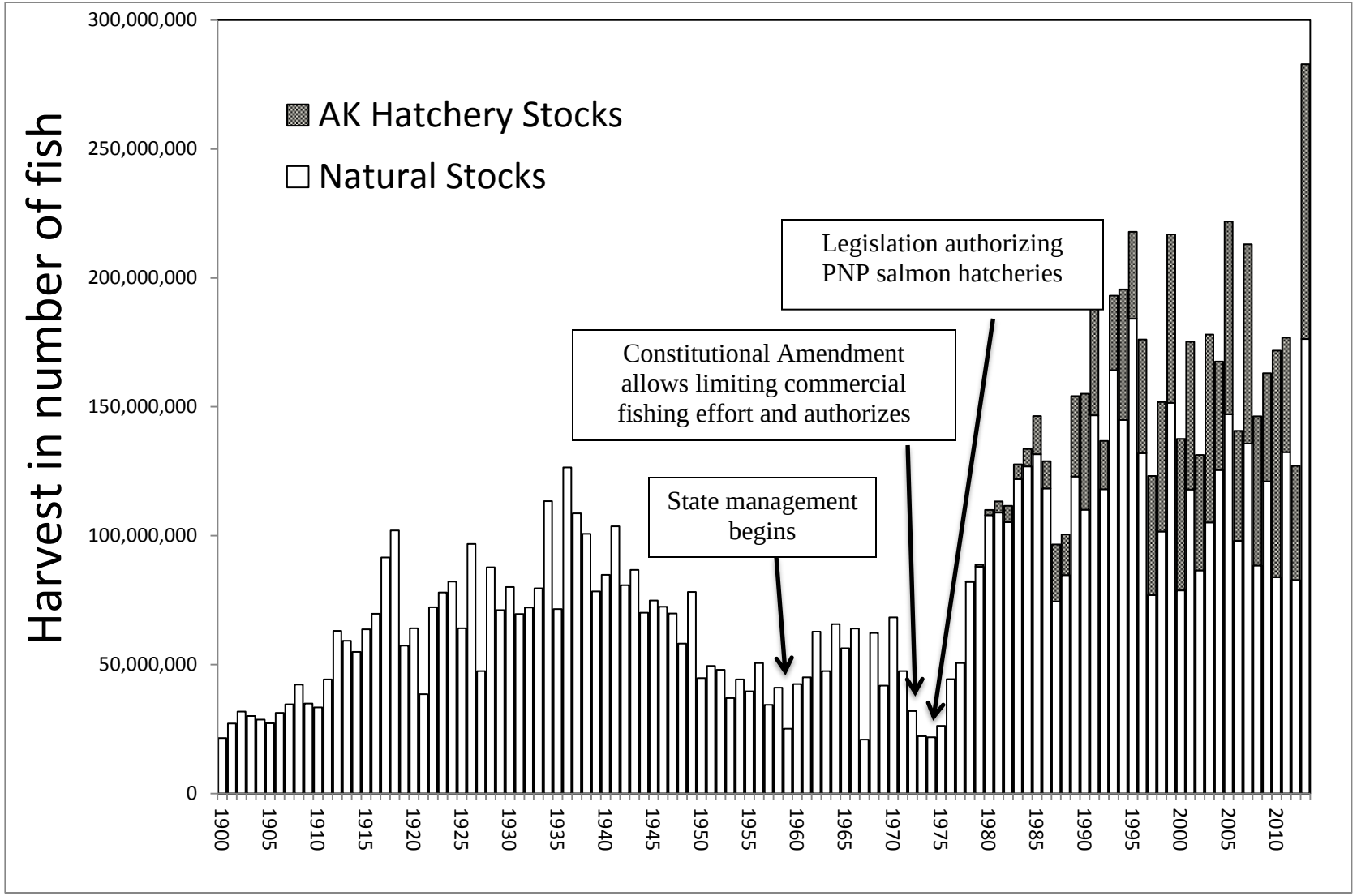

Figure 1.–Commercial salmon harvest in Alaska, 1900–2012.

Source: 1900-1976 from Byerly et al. (1999). 1977–2013 from Vercessi (2014).

Pink salmon have the shortest life cycle of Pacific salmon (2 years), provide a quick return on investment, and provide the bulk of Alaska hatchery production. From 2004 to 2013, pink salmon accounted for an average 74% of Alaska hatchery salmon returns by number, followed by chum (20%), sockeye (4%), coho (2%) and Chinook salmon (<1%; White 2005–2011; Vercessi 2012–2014).

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

The Alaska fishing industry responded to the competition by improving fish quality and implementing intensive marketing efforts to differentiate Alaska salmon from farmed salmon. By 2004, these efforts paid off through increasing demand and prices.

Today, Alaska typically accounts for just 12% to 15% of the global supply of salmon (Alaska Seafood Marketing Institute 2011). Alaska's diminished influence on world salmon production means that Alaska's harvest volume has little effect on world salmon prices. Prices paid to fishermen have generally increased over the past decade (2004–2013) despite large fluctuations in harvest volume (ADF&G 2014; Stopha 2013a).

Exvessel value[3] of the commercial hatchery harvest increased from $45 million in 2004 to $191 million in 2013, with a peak value for the decade of $204 million in 2010. First wholesale value[4] also showed an increasing trend, with the value of hatchery fish increasing from $138 million in 2004 to a decadal high value of $532 million in 2013. Pink and chum salmon combined accounted for about 80% of both the exvessel value and the first wholesale value of the hatchery harvest from 2004 to 2013.

From 2004 to 2013, hatcheries contributed about one-third of the total Alaska salmon harvest, in numbers of fish (White 2005–2011; Vercessi 2012–2014). 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 by ensuring adequate numbers of adults spawn, and the wild harvest is arguably at its maximum, given fluctuations due to environmental variability and imperfect management precision. Unlike Pacific Northwest systems, such as the Columbia River, where habitat loss, dam construction, and urbanization led to the decline of salmon stocks to the point of endangered species listings, Alaska's salmon habitat is largely intact. ADF&G, with the assistance and sacrifice of commercial, sport, personal

[3] 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 02/04/2014), multiplied by the hatchery percent of the commercial harvest in Farrington 2003, 2004; White 2005–2011, and Vercessi 2013.

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

use, and subsistence users, has been successful in recovering several populations identified as *stocks of concern* through restricted fishing and intensive spawning assessment projects. 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.

Alaska's salmon fisheries are among the healthiest in the world. The 2013 season was a record harvest overall, with the 283 million fish commercial harvest comprised of the second highest catch for wild stocks (176 million fish) and the highest catch for hatchery stocks (107 million fish) in Alaska's history (Figure 1). The 2013 season was the first year the hatchery harvest alone exceeded 100 million fish. The 2013 hatchery harvest was greater than the entire statewide commercial salmon harvest in 1987 and every year prior to 1980 except for 6 years (1918, 1934, 1936, 1937, 1938, and 1941; Figure 1).

Part of the reason for the rise in price of Alaska salmon was the message of the state's sustainable fisheries management to a growing audience of discriminating buyers. The Alaska Seafood Marketing Institute applied to the Marine Stewardship Council (MSC) for certification as a sustainably managed fishery. In 2000, the MSC certified the salmon fisheries managed by ADF&G as sustainably managed, and the state's salmon fisheries remained the only MSC certified salmon fishery in the world for nearly a decade. Salmon fisheries elsewhere (Annette Islands Indian Reserve salmon; British Columbia pink and sockeye salmon; and Iturup Island, Russia, pink and chum salmon) were later certified for much smaller geographic areas, and in some cases, only for specific salmon species (MSC 2012). Alaska's certification was MSC's broadest and most complex, covering all 5 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 5 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 first of these evaluations was published by ADF&G in 2011 (Musslewhite 2011a).

The Alaska Seafood Marketing Institute changed to a new sustainable fishery certification under the Food and Agriculture Organization in 2011 (Global Trust Certification Ltd. 2011). The hatchery evaluations started under the MSC certification program continued as an important systematic assessment of Alaska salmon fishery enhancement and its relation to wild stock production at a time of heightened interest for increased hatchery production and potential impacts on wild salmon production. ADF&G established a rotational schedule to review PNP hatchery programs. Musslewhite (2011a, 2011b), Stopha and Musslewhite (2012) and Stopha (2012a, 2012b, 2013a, 2013b, 2013c, 2013d, 2013e, 2013f, 2013g, 2013h, 2014a, 2014b, 2015) completed hatchery reviews for the Kodiak, Cook Inlet, and Prince William Sound region PNP hatcheries, and for the Macaulay, Sheep Creek, Snettisham, and Haines Projects hatcheries in northern Southeast Alaska. This report is for the Klawock River Hatchery located on Prince of Wales Island in Klawock, Alaska. Following completion of review of Klawock River Hatchery, reviews of the remainder of the PNP hatcheries in southern Southeast Alaska will follow.

OVERVIEW OF POLICIES

Numerous Alaska mandates and policies for hatchery operations were specifically developed to minimize potential adverse effects to wild stocks. The design and development of the hatchery program is described in detail in McGee (2004): "The success of the hatchery program in having minimal impact on wild stocks can be attributed to the development of state statutes, policies, procedures, and plans that require hatcheries to be located away from significant wild stocks, and constant vigilance on the part of ADF&G and hatchery operators to improve the program through ongoing analysis of hatchery performance." Through a comprehensive permitting and planning process, hatchery operations are subject to continual review by a number of ADF&G fishery managers, geneticists, pathologists, and the ADF&G commissioner.

A variety of policies guide the permitting of salmon fishery enhancement projects. They include *Genetic Policy* (Davis et al. 1985), *Policies and Guidelines for Alaska Fish and Shellfish Health and Disease Control* (Meyers 2014), and fisheries management policies, such as the Sustainable Salmon Fisheries Policy (5 AAC 39.222). These policies are used by ADF&G staff to assess hatchery operations for genetic, health, and fishery management issues in the permitting process.

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

Genetic Policy also recommends 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, *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 significant interaction or impact on significant or unique wild stocks; (2) a watershed with a significant stock can only be stocked with progeny from the indigenous stocks; and (3) fish releases at sites where no interaction with, or impact on, significant or unique stock will occur, and which are not for the purposes of developing, rehabilitation, or enhancement of a stock (e.g., releases for terminal harvest or releases in landlocked lakes) will not produce a detrimental genetic effect. Davis and Burkett (1989) suggest that regional planning teams (RPTs) are an appropriate body to designate significant and unique wild stocks and wild stock sanctuaries. To date, only the Cook Inlet RPT has established significant stocks and wild stock sanctuaries. In addition, the Phase III Comprehensive Salmon Plan (described in the next paragraph) for Southeast Alaska includes a *stock appraisal tool*, which identifies criteria to be used for evaluating the significance of a wild stock that may potentially interact with hatchery releases.

Salmon fishery enhancement efforts are guided by comprehensive salmon plans for each region. These plans are developed by the RPTs, which are composed of 6 members: 3 from ADF&G and 3 appointed by the regional aquaculture association Board of Directors (5 AAC 40.310). According to McGee (2004), "Regional comprehensive planning in Alaska progresses in stages. Phase I sets the long-term goals, objectives and strategies for the region. Phase II identifies potential projects and establishes criteria for evaluating the enhancement and rehabilitation potentials for the salmon resources in the region. In some regions, a Phase III in planning has been instituted to incorporate Alaska Board of Fisheries approved allocation and fisheries management plans with hatchery production plans."

The Alaska Fish Health and Disease Control Policy (5 AAC 41.080) is designed to protect fish health and prevent spread of infectious disease in fish and shellfish. The policy and associated guidelines are discussed in Meyers (2014). It includes regulations and guidelines for fish transports, broodstock screening, disease histories, and transfers between hatcheries. The *Alaska Sockeye Salmon Culture Manual* (McDaniel et al. 1994) also specifies practices and guidelines specific to the culture of sockeye salmon. As with the genetic policy, these regulations and guidelines are used by ADF&G fish pathologists to review hatchery plans and permits.

The Alaska Policy for the Management of Sustainable Salmon Fisheries (5 AAC 39.222) mandates protection of wild salmon stocks in the management of salmon fisheries. Other applicable policies include the Policy for the Management of Mixed-Stock Salmon Fisheries (5 AAC 39.220), the Salmon Escapement Goal Policy (5 AAC 39.223), and local fishery management plans (5 AAC 39.200). These regulations require biologists to consider the interactions of wild and hatchery salmon stocks when reviewing hatchery management plans and permits.

The guidance provided by these policies is sometimes very specific, and sometimes less so. For example, the Alaska Fish Health and Disease Control Policy (5 AAC 41.080) mandates the use of an iodine solution on salmon eggs transported between watersheds—a prescribed practice that requires little interpretation. In contrast, several policies prioritize the protection of wild stocks from the potential effects of fisheries enhancement projects without specifying or mandating how to assess those effects. These less specific policies provide principles and priorities, but not specific direction, for decision making.

The initial rotation of these evaluation reports will assess the consistency of individual hatcheries with state policies by (1) confirming that permits have been properly reviewed using applicable policies, and (2) identifying information relevant to each program's consistency with state policies. Future reports may assess regional effects of hatcheries on wild stocks and fishery management.

OVERVIEW OF HATCHERY PERMITS AND PLANS

The FRED Division built and operated several hatcheries across the state in the 1970s and gradually transferred operations of most facilities to PNP corporations. Regional aquaculture associations (RAAs), whose membership comprises the commercial salmon fishing permit holders and representatives of other user groups interested in fisheries within the region, operate most of the PNP hatcheries in Kodiak, Cook Inlet, Prince William Sound, 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. RAA members may vote to impose a salmon enhancement tax on sale of

salmon in their region to finance hatchery operations and enhancement and rehabilitation activities. Independent PNP corporations, not affiliated with an RAA, also operate hatcheries in several areas of the state. Both the RAAs and independent PNP hatchery organizations may harvest salmon returning to their release sites to pay for operations. Such harvests by hatchery operators are called *cost-recovery* fisheries, and are in contrast to *common property* commercial fisheries, which are fisheries open to all commercial fishing permit holders. Several organizations have tourist and educational programs that contribute to the financial support of their programs, as well.

RAAs do not receive a blanket permit for their hatcheries. Each hatchery is permitted separately. Application for a hatchery permit is an extensive process (5 AAC 40.110–40.230). An application consists of the goals of the hatchery, production goals and hatchery site information, water flow and chemistry data, land ownership and water rights, hatchery design, initial proposed broodstock for the hatchery, and a financial plan. ADF&G staff review the application with the applicant, address any deficiencies, and draft a fishery management feasibility analysis for the proposed hatchery. The RPT reviews the hatchery plan to determine if the hatchery operation is compatible with the regional comprehensive salmon plan. A public hearing is then held where the applicant describes the proposed hatchery plan. ADF&G staff present the basic management plan for the hatchery, including fish culture aspects of the proposed hatchery and management of the hatchery return. Public testimony and questions follow the presentations. ADF&G must respond in writing to any specific objections.

Following review by the RPT and the public hearing, the application is sent to the ADF&G commissioner for final consideration. By regulation (5 AAC 40.220) the commissioner's decision is based on consideration of (1) the suitability of the site for making a reasonable contribution to the common property fishery, not adversely affect management of wild stocks, and not requiring significant alterations of traditional fisheries; (2) the hatchery making the best use of the site's potential to benefit the common property fishery; (3) the harvest area size at the hatchery being sufficient in size to provide a segregated harvest of hatchery fish of acceptable quality for sale; (4) proposed donor sources meeting broodstock needs for the hatchery for the first cycle; (5) water sources for the hatchery being secured by permit and are of appropriate quality and quantity; and (6) the hatchery having a reasonable level of operational feasibility and an acceptable degree of potential success.

Public participation is an integral part of the PNP hatchery system. 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. Hearings are held before a hatchery is permitted for operation. RPTs comprised of ADF&G and RAA representatives hold public meetings to define desired production goals by species, area, and time, and document these goals in comprehensive salmon plans (5 AAC 40.300). RPTs hold public meetings to review applications for new hatcheries and to make recommendations to the ADF&G commissioner regarding changes to existing hatchery operations, new hatchery production, and new hatchery facilities.

Alaska PNP hatcheries operate under 4 documents required in regulation: hatchery permit with basic management plan (BMP), annual management plan (AMP), fish transport permit (FTP), and annual report (Figure 2).

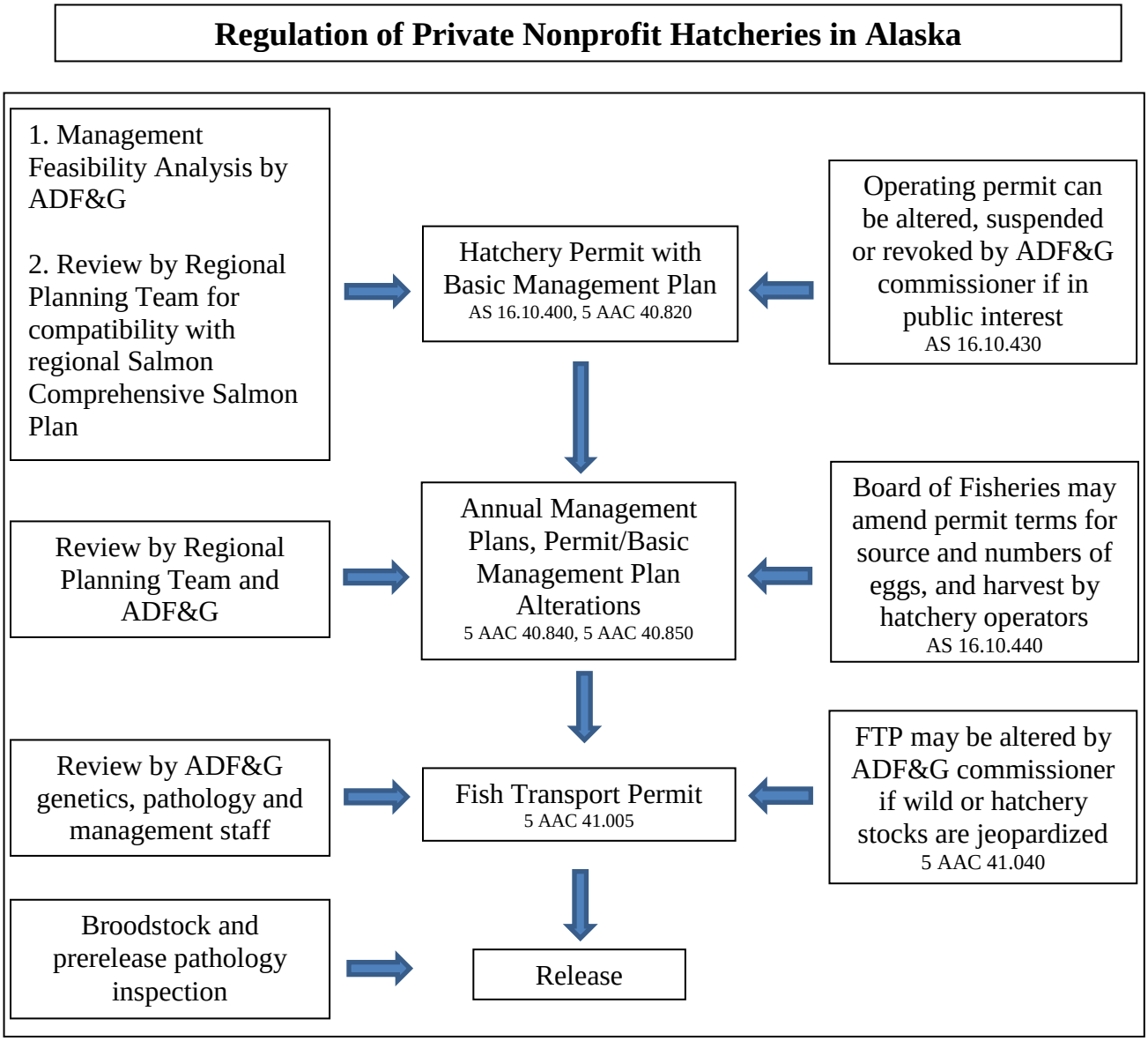

Figure 2.–Diagram of Alaska hatchery permitting process.

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 2 documents should be revised together if the permit is altered. The permit and BMP are not transferrable. Hatchery permits remain in effect unless relinquished by the permit holder or revoked by the ADF&G commissioner.

Hatchery permits/BMPs may be amended by the permit holder through a permit alteration request (PAR). Requested changes may be reviewed by the RPT and ADF&G staff, and a recommendation is sent to the ADF&G commissioner for consideration. 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 current year's egg-take goals, fry or smolt releases, expected adult returns, harvest management plans, FTPs (described below) required or in place, and fish culture techniques. The AMP must be consistent with the hatchery permit and BMP.

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

Each hatchery is required by law 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 (AS 16.10.470). Information for all hatcheries is compiled into an annual ADF&G report (e.g., Vercessi 2014) to the Alaska Legislature (AS 16.05.092).

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

KLAWOCK RIVER HATCHERY OVERVIEW

The Klawock River Hatchery (Klawock Hatchery) is located on the Klawock River in Klawock, Alaska (Figure 3). The hatchery was constructed by the State of Alaska in 1977 and 1978, and the hatchery remains under state ownership. The hatchery was initially built to produce chum and coho salmon from natal stocks from the Klawock River, with the first eggs taken in 1978.[5] In 1980, sockeye salmon and steelhead trout production was added to the hatchery plan using natal stocks from the river. Pink salmon production was added in the 1982 AMP but pink salmon were never produced at the hatchery. The water source for the hatchery is the Klawock River. A history of enhancement activities and fishing history of the Klawock River through 2000 can be found in Lewis and Zadina (2001).

[5] 1979 AMP for Klawock Hatchery. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

During the summer, a weir spans the Klawock River and directs adult salmon to the hatchery fish ladder and into raceways, where broodstock and cost-recovery fish are collected. Fish not needed are passed through to the river above the weir or passed through a gate in the weir itself.

Klawock Hatchery coho salmon are significant contributors to regional commercial fisheries and the local sport and subsistence fisheries.

HATCHERY PERMIT AND BMP

From 1993 to 1995, hatchery operations were contracted by ADF&G to a PNP corporation formed by the City of Klawock. In June 1995, the City of Klawock ended their involvement with the hatchery because city officials determined that the City of Klawock could be liable to repay hatchery loans taken out by the PNP hatchery corporation, which was an unacceptable risk. The City of Craig and the Craig Chamber of Commerce took over as an interim operator.[6]

Citizens from several Prince of Wales Island communities and the City of Craig formed a PNP corporation, the Prince of Wales Hatchery Association (POWHA), in a fashion that did not financially encumber the City of Craig for hatchery loans, and applied for a permit to operate the Klawock Hatchery in October 1995. The application requested a start-up hatchery capacity of 2.9 million sockeye salmon, 5.0 million coho salmon and 50,000 steelhead trout eggs. Water usage from the Klawock River system for the hatchery was conveyed to the State of Alaska, who retained ownership of the hatchery. Water from the City of Klawock water supply was also authorized.[7]

ADF&G staff from the Divisions of Commercial Fisheries, Sport Fish and Habitat supported continued operation of the hatchery. ADF&G staff expressed concern for steelhead trout and pink and chum salmon bound for other areas that could be caught during cost-recovery harvest. ADF&G Division of Sport Fish staff were concerned for continued funding of the steelhead trout program.[8]

The Southern Southeast Regional Planning Team (SSERPT) reviewed the permit application and unanimously recommended issuance of the permit to the ADF&G commissioner.[9]

The public hearing for the hatchery was held in Craig in January 1996. All testimony was in favor of the hatchery.[10]

The ADF&G deputy commissioner approved the permit application and issued ADF&G PNP Salmon Hatchery permit number 38 to POWHA in February 1996 (Appendix A). The facility was permitted for 5 million sockeye salmon, 5 million coho salmon, and 50,000 steelhead trout eggs. The hatchery received water from either Klawock Lake or Half Mile Creek, a tributary to

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[6] 1996 AMP for Klawock River Facility. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

[7] Copy of water rights certificate ADL 79921-C and City of Klawock resolution for water sale found in the hatchery application permit submitted by POWHA. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

[8] Printed email from S. Hoffman, ADF&G biologist, ADF&G to S. McGee, ADF&G biologist. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

[9] Ibid.

[10] Memo from S. McGee, ADF&G biologist, to R. Bosworth, ADF&G deputy commissioner. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

Klawock Lake and a pathogen-free water source. Later, the hatchery added an ozone depuration unit to depurate Klawock Lake water as a pathogen-free water source.[11]

All donor stocks of fish are from the Klawock River. The BMP allowed that sockeye salmon broodstock could be taken before the Klawock River escapement goal was met, but that cost-recovery fishing for sockeye salmon could not occur until the river escapement goal was met.

A portion of the coho and sockeye salmon released from the hatchery each year would be coded wire tagged and adipose finclipped. All steelhead trout released from the hatchery were to be adipose finclipped but not necessarily coded wire tagged.

Wild Klawock River chum salmon stock, which had similar river entry timing to the coho salmon return, were protected in the BMP, with a requirement that 30,000 to 40,000 chum salmon had to pass through the terminal harvest area on their way to the river before a terminal common property net fishery was allowed.

ADF&G hatcheries rarely conducted cost-recovery fisheries, as hatchery operations were funded by the state. When POWHA took over hatchery operations, they needed to fund the hatchery with cost recovery and other funding sources. Cost recovery initially occurred at the Klawock River weir, and coho salmon quality was reported as good.[12] The weir provided simple separation of coho salmon and the wild Klawock River pink and chum salmon, which overlapped in timing with the coho. A saltwater Special Harvest Area was added for additional area for cost-recovery harvest (Figure 3).

A cost-recovery harvest at the mouth of the river in Klawock Inlet, however, was uncertain due to the likely presence of other wild stocks transiting the area. The BMP indicated that the first 2 years of cost recovery would be done on a trial basis to determine if returning hatchery coho salmon could be harvested by seine gear without adversely impacting chum and pink salmon. An observer could be required aboard fishing vessels. Pink and chum salmon retention would not be allowed as practical, and if mortality rates of these species during cost-recovery harvest were not acceptable, then money from the sale of any chum or pink salmon could be used to pay ADF&G expenses for monitoring cost recovery or Klawock River escapement.

[11] 1999 Klawock Hatchery Inspection Report, p. 3. J. Follett, ADF&G. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

[12] P. Doherty, ADF&G biologist, to S. Marshall, ADF&G regional supervisor. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

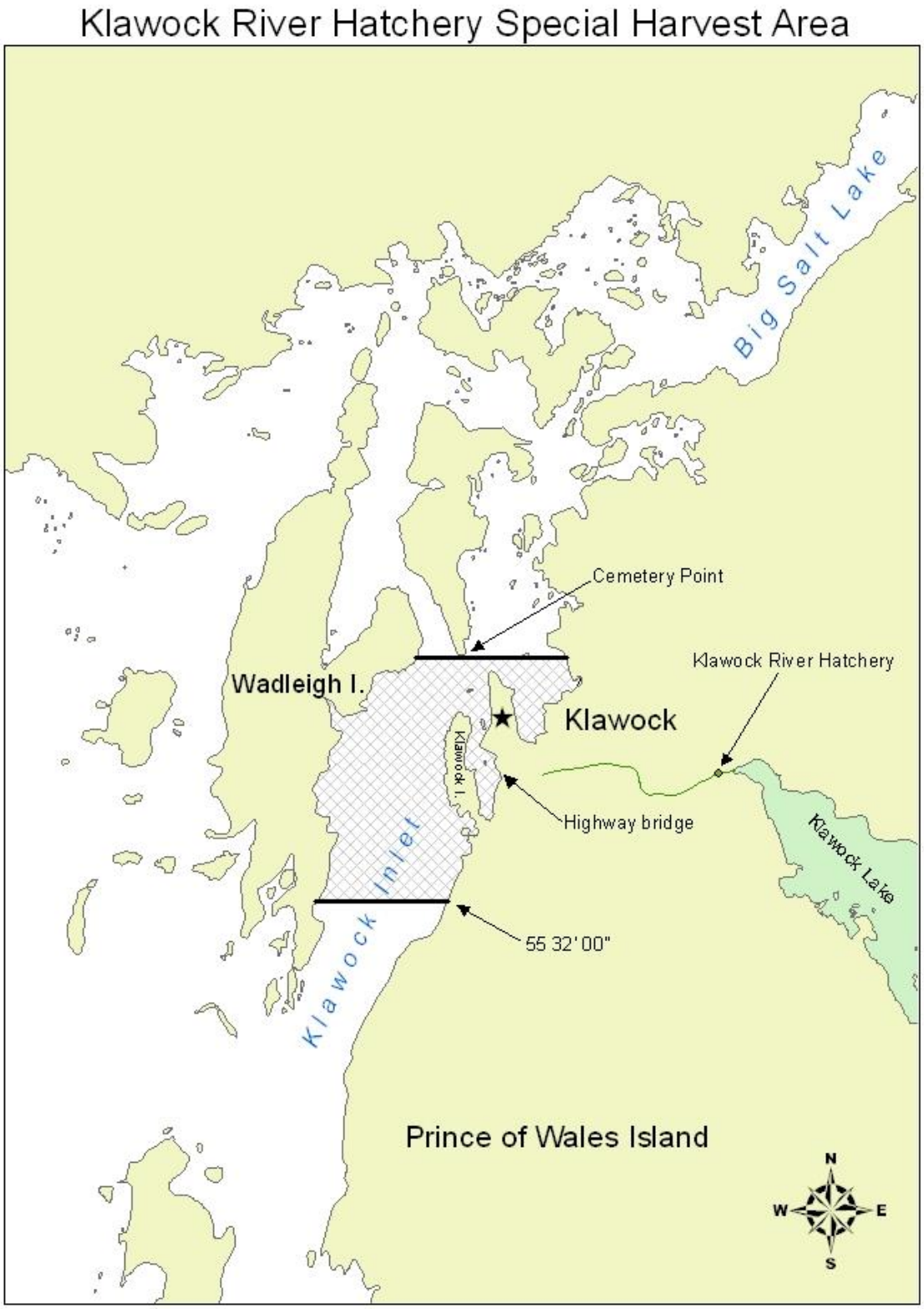

Figure 3.–Klawock River Hatchery and Special Harvest Area.

Hatchery Permit Amendments

The first PAR occurred in 1999 (Appendix A).POWHA requested adding to their hatchery permit Chinook salmon egg incubation and freshwater rearing at Klawock Hatchery, with transfer to saltwater net pens located at Coffman Cove for rearing and release. The SSERPT unanimously recommended approval of the PAR to the ADF&G commissioner.

The ADF&G geneticist recommended a strong and consistent source of freshwater for imprinting the Chinook salmon smolt and that returning adults not be blocked from entering freshwater at the release site because if blocked, they would likely stray to other systems. The geneticist also recommended that a portion of the release be marked and a recovery program initiated to document straying. In addition, he recommended that if Unuk River stock Chinook salmon was selected as the brood source, then the hatchery could not switch to another stock later.[13]

The fish pathologist required that the eggs for initial startup be family tracked for disease, stressed the importance of preventing infectious hematropoietic necrosis virus (IHNV) transmission from sockeye salmon at the hatchery to the Chinook salmon, and required establishing a disease history of fish in the freshwater rearing sources at Coffman Cove.

The ADF&G deputy commissioner approved the PAR to add 250,000 Chinook salmon eggs to the Klawock Hatchery permit for release at Coffman Cove.

In 2006, the Chinook salmon capacity was removed from the hatchery permit by amendment when the Port St. Nicholas Hatchery, also operated by POWHA, took over the Chinook salmon program from Klawock Hatchery. No Chinook salmon production ever occurred at Klawock Hatchery under the 1999 permit amendment.

In 2010, POWHA submitted a PAR to increase coho salmon capacity from 5.0 million eggs to 6.0 million eggs to supply increasing demand in the common property harvest and to increase cost-recovery revenue in order to implement strategies recommended by a regional hatchery advisory panel. At the RPT hearing for the PAR, ADF&G staff indicated they would like to see the effects of previously recommended fish culture changes before increasing permitted capacity. The SSERPT recommended against approval of the PAR by the ADF&G commissioner by a vote of 2 in favor and 4 opposed.[14] The ADF&G deputy commissioner denied the PAR.

In 2014, POWHA submitted a PAR to add Port Asumcion on Baker Island (west of Prince of Wales Island) as a remote release site for 2 million coho salmon smolt. The purpose of the PAR was to move a portion of the Klawock Hatchery coho salmon production away from the Klawock River. In conjunction with this PAR, POWHA had submitted another PAR for its Port St. Nicholas Hatchery to also release chum salmon at Port Asumcion. The purpose of the projects was primarily for POWHA cost recovery of fish not harvested in common property commercial and sport fisheries.

ADF&G staff recommended a release of 250,000 coho salmon smolt in order to evaluate the program at Port Asumcion, including monitoring the harvest of wild stock fish in the cost-recovery fishery. ADF&G genetics and fish pathology staff had no concerns with the PAR. The

[13] Email comments on PAR from D. Moore, ADF&G geneticist, to S. McGee, dated October 6, 1998. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

[14] Memo from F. Pryor, ADF&G biologist, to D. Lloyd, ADF&G commissioner, dated April 28, 2010. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

SSERPT reviewed the original request for release of up to 2 million smolt. By a vote of 4 in favor, 1 opposed and 1 abstained, the SSERPT voted to amend the PAR to reduce the release to 250,000 smolt, and the SSERPT then unanimously recommended approval of the amended PAR to the ADF&G commissioner. The ADF&G directors of the Divisions of Sport Fish and Commercial Fisheries[15] subsequently approved the amendment.

HATCHERY PRODUCTION

Steelhead Trout

Steelhead trout eggs were collected at the hatchery, reared to smolt in pathogen-free water, and stocked into the Klawock River (FTP 97J-1006). Juvenile steelhead were also released into One Duck Lake, a land locked system, on Prince of Wales Island for an annual kids fishing day event (FTP 97J- 1005). Eggs were taken during 4 years from 1996 to 2001, after which the program was discontinued when funding for the program by the US Forest Service ended (Table 1).[16] Fish were not tagged so there are no return estimates based on sampling.

Table 1.–Steelhead trout production at Klawock Hatchery under POWHA operation. Egg takes and releases from annual reports submitted by POWHA.

Brood Year	Eggs	AR Release
1996	23,000	3,000
1997	0	0
1998	5,500	1,975
1999	17,462	8,715
2000	0	0
2001	6,700	5,644

Sockeye Salmon

POWHA collected eggs for the sockeye salmon program from 1996 through 2004 for release into Klawock Lake (FTP 97J-1007; Table 2). Broodstock were collected from the Klawock River system, eggs incubated in the hatchery in pathogen-free water and isolated from other species in the hatchery, and fry released into Klawock Lake. There was no cost recovery of sockeye salmon. When financial support from other sources (e.g., grants and donations) to cover the sockeye salmon program declined, the program was discontinued after release of progeny from the 2004 egg take.[17] Fish were marked in several years but not sampled in the harvest so there are no harvest contribution estimates based on sampling.

[15] The directors were delegated authority to approve hatchery permit alterations by the ADF&G commissioner.

[16] 2002 Klawock River Hatchery AMP, page 7. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

[17] 2005 Klawock River Hatchery AMP, page 5. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

Table 2.–Sockeye salmon production under POWHA operation. Egg takes and releases from annual reports submitted by POWHA.

Brood Year	Egg Take	Number of Smolt
1996	1,328,175	244,720
1997	1,476,000	581,047
1998	1,037,323	868,025
1999	707,895	359,431
2000	374,000	254,227
2001	630,487	510,140
2002	739,769	364,587
2003	977,490	706,031
2004	587,281	402,099

Coho Salmon

Coho salmon eggs are collected from Klawock River system broodstock. Beginning in 1997, a total of 3.25 million eggs were permitted for collection under FTPs (Appendix B). Up to 750,000 of the resulting progeny were permitted for release as smolts into the river (FTP 97J-1004), and the remaining progeny—up to 2.5 million—were permitted for transfer to net pens in Klawock Lake for rearing and release as smolt (FTP 97J-1003).

When the coho salmon FTP was renewed in 2007 (FTP 07J-1003), the permitted egg take was increased to the full 5 million eggs allowed under POWHA's hatchery permit. Smolt were reared and released from net pens in Klawock Lake. In 2010, FTP 10J-1020 was issued to allow rearing and release of part or all of the progeny from saltwater net pens at the mouth of the Klawock River.

Since brood year 2005, about 5 million eggs have been collected per year. Annual smolt releases from brood year 1997 to 2013 ranged from about 436,000 to 4.6 million fish (Table 3).

Table 3.–Coho salmon production under POWHA operation. Egg takes and releases from annual reports submitted by POWHA.

Brood Year	Egg Take	AR Release
1997	3,476,364	2,420,000
1998	704,809	435,742
1999	2,331,000	1,596,381
2000	2,567,424	2,065,306
2001	3,515,790	2,908,348
2002	5,108,535	4,247,837
2003	3,312,687	2,247,310
2004	1,585,796	1,301,877
2005	4,943,737	3,728,278
2006	4,772,269	3,579,202
2007	4,943,737	3,731,278
2008	4,882,185	3,935,232
2009	5,004,800	4,551,657
2010	5,004,982	4,537,106
2011	4,637,341	3,894,603
2012	5,280,126	4,282,242
2013	4,761,397	3,720,457
2014	5,682,774[18]	
2015	5,048,400	

[18] POWHA reported in 2015 that 615,059 eggs were culled from this number to be in compliance with their permitted number.

Hatchery contribution to the commercial fisheries and the marine sport fishery were estimated from sampling the catch for coded wire tags (Table 4). Cost recovery and subsistence harvests were not sampled and the harvest figures for these fisheries likely contain a mix of hatchery and naturally-spawned returns. There is also a substantial freshwater sport fishery in the Klawock River that is not sampled and not reflected in the sport harvest numbers in the table.

Table 4.–Klawock Hatchery coho salmon returns, 1996–2014.

Year	Drift Gillnet	Seine	Troll	Marine Sport	Cost Recovery	State Subsistence	Federal Subsistence	Total
1996		2,588	9,924	2,798	740	59		19,777
1997		310	1,994	1,317	2,938	2		68,203
1998			107	-	-	128		235
1999		1,626	9,574	2,524	4,992	50		11,679
2000	197	4,272	29,181	7,610	17,936	31		35,732
2001	30	6,564	13,592	3,782	13,943	60		26,372
2002	44	2,356	9,645	2,505	23,630	29	327	58,073
2003	44	8,939	27,665	5,769	21,093	10	142	45,920
2004		4,001	11,721	2,806	9,172	53	73	25,678
2005		11,427	45,447	10,706	38,884	49	73	72,860
2006		395	13,500	2,230	7,128	76	29	19,504
2007		6,861	23,771	5,941	10,875	31	34	37,242
2008	476	10,674	26,829	10,194	20,840	108	215	79,376
2009	56	2,745	5,686	1,868	10,437	104	44	42,920
2010		972	2,488	166	6,409	382	346	107,224
2011	329	29,547	63,636	43,705	2,238	34	244	99,868
2012	83	8,771	36,870	11,378	13,275	146	115	60,597
2013	185	34,463	196,746	47,159	68,188	476	371	196,289
2014	91	26,750	98,949	16,971	61,393	299	330	302,581
Total	1,536	163,262	627,326	179,427	334,111	2,127	2,343	1,310,133

Source: All drift gillnet, seine, and troll harvest and 1996–2005 sport harvest from http://mtalab.adfg.alaska.gov database (accessed 4/1/2015). Sport harvest from 2006 to 2014 is the number from http://mtalab.adfg.alaska.gov database multiplied by 5 because no expansion factor for the sampling fraction was contained in the database for those years. The expansion factor 5 was based on the approximate average expansion factor used in 2004 and 2005. State subsistence harvest from ADF&G Southeast region Alexander database (accessed 4/1/2015). Federal subsistence harvest data received from J. Reeves, USFS, Craig Ranger District. Data on annual reports did not appear to be based on tag recoveries or other credible basis for the estimates given in the reports.

COMPREHENSIVE SALMON ENHANCEMENT PLAN

Three phases of Comprehensive Salmon Plans (CSP) have been developed to date in Southeast Alaska. Phase I[19] set goals for salmon production in Southeast Alaska. The Phase II CSP[20] provided planning to achieve the goals of the Phase I CSP. The Phase III CSP (Duckett et al. 2010) focused on integrating hatchery production increases with natural production to sustainably manage fisheries.

[19] Comprehensive salmon enhancement plan for Southeast Alaska: Phase I, by the Joint Southeast Alaska Regional Planning Teams, 1981. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

[20] Comprehensive Salmon Plan, Phase II: Southern Southeast Alaska, by the SSERPT. September 1983. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

The long-range (year 2000) harvest objectives for the Phase I CSP were to increase the harvest in Southeast Alaska by 537,000 Chinook, 2.1 million sockeye, 2.65 million coho, 30.0 million pink salmon and 9.7 million chum salmon. Gaps at the time between the increases available by better management and the current hatchery capacity were 134,000 Chinook, 1.4 million sockeye, 1.1 million coho, 14 million pink, and 4.6 million chum salmon. Klawock Hatchery operated in support of filling these gaps.

Phase II CSP planning identified projects and plans to meet the Phase I harvest objectives, and the RPTs for northern and southern Southeast Alaska developed separate plans. The southern Southeast Alaska CSP Phase II was issued in 1983.[21] Subsequent Phase II CSP plan updates were issued yearly through 1995.

When POWHA took over Klawock Hatchery in 1996, the last Phase II CSP update in 1995 indicated that the 5-year average harvest (1991–1995) for coho salmon (3.9 million fish) and sockeye salmon (2.4 million fish) was meeting harvest objectives for Southeast Alaska established in the Phase I CSP (2.1 million sockeye and 2.65 million coho salmon). Klawock Hatchery production supported continuing to meet these harvest goals.

With the maturation of the salmon enhancement program, the harvest target objectives and programs in the Phase I and Phase II CSPs were replaced with objectives in the Phase III CSP[22] that supported an overriding goal to enhance the salmon fishery while minimizing the impact of enhancement on wild stocks. These new objectives included (1) minimizing the impact of hatchery stocks on wild stocks, (2) maintaining existing production potential for wild and enhanced stocks, (3) assuring that increases in hatchery production are consistent with region-wide goals and allocation plans, and (4) updating the RPT process periodically to provide status reports and recommendations in a timely manner.

The Phase III CSP provided "best practice" guidelines for enhancement planning to provide a systematic approach to project formulation and the decision-making process. Guidelines were developed for fishery supplementation, wild stock supplementation, and colonization. Four standards are to be documented in developing a fishery supplementation project: (1) the release site has an adequate freshwater supply for imprinting and is not in close proximity to significant wild stocks, (2) fish are adequately imprinted to the release site, (3) releases are marked and contribute to the harvest without jeopardizing the sustainability of wild stocks, and (4) the terminal area enables harvest or containment of all returning adults. These standards were to meet the Policy for the Management of Sustainable Salmon Fisheries (5 AAC 39.222) developed by the Alaska Board of Fisheries and ADF&G.

The Phase III CSP provided a stock appraisal tool for assessing the "significance" of stocks for assessment of projects with regard to the significant stock references in *Genetic Policy*. The Phase III CSP states that significance is more complex than a simple production number because some of the region's most viable fisheries depend on aggregates of wild stocks, each of which is not very large. Diversity among wild stocks is a key factor in maintaining production capacity and the potential to maximize harvest opportunities over time. The tool identified 6 stock characteristics of consideration: wildness, uniqueness, isolation, population size, population trend, and the stock's economic and/or cultural significance.

[21] Ibid.

[22] Phase III CSP was issued in 2004, but not published online until 2010.

The Phase III CSP also provided a framework for assessment of new projects: "All projects will have an approved evaluation plan to assess impacts and measure success. This plan will describe how the project benefits will be measured and include a method for detecting negative or unintended impacts. An evaluation plan includes (A) fish identification (marking) method to be used; (B) mark–recovery plan for common property and terminal site harvests; (C) identification of potential ecological and genetic impacts that might warrant evaluation, a strategy to detect them, and criteria to determine when measured impacts would warrant project modification; (D) a description of how impacts to fishery management will be evaluated; and (E) a plan for dispersing information about the project. Proposals for new projects should document all evaluation agreements between the hatchery corporation or agency and the department, including any agreements for funding evaluation activities."

The Klawock Hatchery was permitted to POWHA in 1996 under the Phase II CSP. The Port Asumcion coho salmon project was the only new project at Klawock issued under the Phase III CSP. Development and assessment of the Port Asumcion project reflected the Phase III CSP program assessment, policies, and guidelines during the permitting process.

PROGRAM EVALUATIONS

CONSISTENCY WITH POLICY

The policies governing Alaska hatcheries were divided into 3 categories for this review: genetics, fish health, and fisheries management.

Genetics

All releases from the Klawock Hatchery are from broodstock originating from the Klawock River, and Klawock River stocks are not used at any other hatchery (Table 5).

The coho salmon program at Klawock Hatchery has been in operation since 1978. In 2007, an ADF&G geneticist commented in his review of an FTP renewal for the program that the project had been in place for a long time and that "any genetic damage that can be done by the program has probably already occurred. In addition, the program appears to be producing additional fish for harvest. Therefore, in this case, these benefits outweigh the risks of additional genetic damage to the wild stocks. If this were a new project, I would object to this FTP."

From the beginning of the coho salmon program, broodstock were collected without regard to hatchery or wild stock origin. Therefore, with over 3 decades of hatchery operations at the hatchery, the Klawock River coho salmon stock is an integrated stock with both natural and hatchery spawning components. This interaction will be an important consideration if the RPT considers the status of Klawock River coho salmon as a significant stock under the tool defined in the Phase III CSP.

For coho salmon, a portion of hatchery releases are coded wire tagged and adipose finclipped. Beginning in brood year 2010, all coho salmon releases were thermal marked as well. Escapement and broodstock sampling through collection of otoliths in 2013 and 2014[23] indicated that most (90% or more) of the fish were of hatchery origin. In the other years where the

[23] Data from F. Pryor, ADF&G, by email. Data was not yet published.

hatchery contribution from coded wire tag recoveries was noted, it ranged from 22% in 2004 to 64% in 2006[24] to 90% in 1991 and 1992 (Lewis and Zadina 2001).

Table 5.–Key elements of the ADF&G *Genetic Policy*.

I. Stock Transport	
Use of appropriate local stocks	This element addresses Section I of *Genetic Policy*, covering stock transports. The policy prohibits interstate or interregional stock transports, and uses transport distance and appropriate phenotypic characteristics as criteria for judging the acceptability of donor stocks. The Klawock Hatchery has only used coho salmon from the Klawock River drainage.
II. Protection of wild stocks	
Identification of significant or unique wild stocks	Significant or unique wild stocks can be identified for each region and species as stocks most important to that region. Regional Planning Teams should establish criteria for determining significant stocks and recommend such stock designations. The Klawock River stock has not been identified by the RPT as a significant stock.
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 significantly impact significant or unique wild stocks. The Phase III CSP denotes guidelines for significant stock determination. No introduced stocks have been used at the Klawock River hatchery.
Establishment of wild stock sanctuaries	Wild stock sanctuaries should be established on a regional and species basis. No enhancement activities would be allowed, but gamete removal would be permitted. The guidelines and justifications describe the proposed sanctuaries as gene banks of wild type variability. No wild stock sanctuaries have been established in Southeast Alaska.
Straying impacts	Prevention of detrimental effects of gene flow from hatchery fish straying and interbreeding with wild fish. Coho salmon have been produced by the Klawock Hatchery since 1978 and all coho salmon in the watershed now likely have a similar genetic makeup.
III. Maintenance of genetic variance	
Maximum of three hatchery stocks from a single donor stock	A maximum of three hatchery stocks should 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. The Klawock River coho salmon stock is not used for any other hatchery stock.
Minimum effective population size	The policy recommends a minimum effective population size of 400. About 3,000 broodstock coho salmon are required to meet egg-take goals at Klawock Hatchery.
Genetics review of Fish Transport Permits (5 AAC 41.010–41.050)	
Review by geneticist	Each application is reviewed by the geneticist, who then makes a recommendation to either approve or deny the application. The geneticist may also recommend terms or conditions to the permit to protect wild or enhanced stocks. The ADF&G geneticist reviewed the FTPs.

[24] 2004 and 2005 data from 2004 and 2005 AMPs, form C-1. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

Fish Health and Disease

FTPs are approved for all operations, were reviewed and approved by an ADF&G fish pathologist, and included isolation measures. All eggs are disinfected (Table 6). Disease histories and disease occurrence were submitted as required. ADF&G fish pathology staff last inspected the facility in 2014. The inspection reported noted that there had been a complete overhaul of fish culture practices since the last inspection in 1999 and that the hatchery had significantly improved. Silt in the water supply remained a problem, and POWHA had applied for a grant to install a drum filter. Fish health issues were minimal and had improved vastly from the past. [25]

Table 6.–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.
	This practice was occurring at Klawock Hatchery, according to the most recent (2014) hatchery inspection.
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.
	The hatchery was inspected in 2014.
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.
	The facility appears to have complied with this requirement.
Pathology requirements for Fish Transport Permits (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.
	These were provided by Klawock Hatchery staff when required.
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.
	Isolation measures were listed when required.
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.
	The fish pathologist reviewed FTP applications.

[25] Hatchery Inspection Report dated 8/29/13 by J. Ferguson, ADF&G. Unpublished document received from T. Meyers, ADF&G fish pathologist.

Fisheries Management

There was concern over the years about possible predation of sockeye salmon fry by Klawock Hatchery coho salmon released into Klawock Lake (Lewis and Zadina 1981), but no research has been done. The transfer of the release site for most Klawock Hatchery coho production from Klawock Lake to saltwater should alleviate those concerns.

Sockeye salmon escapements were monitored by weir and mark–recapture from 2001 to 2009. Sockeye salmon escapement to the river in recent times appears well below escapement before statehood (Bednarski 2010). However, the cause for the decline in the stock is largely unknown and could be due to many things such as changes in fishing, habitat alteration from logging, interaction with hatchery-produced coho salmon, or changing ocean conditions compared to pre-statehood days.

When POWHA took over the hatchery, they needed cost-recovery income to fund the hatchery. The hatchery manager at the time harvested most of the cost-recovery fish during the early part of the return, when the fish were bright and worth the most money.

Beginning in the early 2000s, there was considerable discussion among ADF&G and POWHA staff regarding apportioning the escapement goal weekly over time to maintain the historic timing of the wild return to the river. In 2002, ADF&G required in the AMP that an overall goal and weekly goals for escapement be met to maintain the run timing of the wild stock. This requirement was apparently in response to the Policy for the Management of Sustainable Salmon Fisheries (5 AAC 39.222) adopted into regulation by the Alaska Board of Fisheries legislature in 2002, which states in part that salmon escapement should be managed "in a manner to maintain genetic and phenotypic characteristics of the stock by assuring appropriate geographic and temporal distribution of spawners."

ADF&G staff insisted that they had a statutory responsibility to protect the wild Klawock River run, and cited parts of 5 AAC 39.222 that related to salmon stock management in their defense.[26] However, as the hatchery and wild stock had been integrated for over 2 decades, it was difficult to classify the Klawock River stock as a *wild salmon stock*, which is defined as a "stock of salmon that originates in a specific location under natural conditions." The stock could arguably be classified rather as an *enhanced salmon stock*, which is defined as "a stock of salmon that is undergoing specific manipulation, such as hatchery augmentation or lake fertilization, to enhance its productivity above the level that would naturally occur; "enhanced salmon stock" includes an introduced stock, where no wild salmon stock had occurred before, or a *wild salmon stock undergoing manipulation, but does not include a salmon stock undergoing rehabilitation*,[27] which is intended to restore a salmon stock's productivity to a higher natural level."[28]

Despite the provision in the 2002 AMP for weekly escapement targets, POWHA and ADF&G were at odds for many years over POWHA's escapement practice. When weekly escapement targets and reporting were not followed despite regular direction by ADF&G staff to do so, ADF&G instituted a requirement in 2009 that POWHA had to report fish escapement and collection numbers weekly to ADF&G. Failure to do so would result in ADF&G closing cost-

[26] Letter from R. Holmes, ADF&G, to C. Farrington and F. Pryor. 2006. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

[27] Italics added by the author.

[28] Wild salmon stock defined 5 AAC 39.222 (6)(f)(43) and enhanced salmon stock defined 5 AAC 39.222 (6)(f)(9).

recovery harvest for the following week by emergency order. Since 2009, POWHA has satisfactorily met escapement targets and reporting requirements.

Common property fishery management for Klawock River coho salmon stocks has not presented significant management challenges. Most Klawock Hatchery coho salmon are harvested in the troll fishery, a mixed stock fishery occurring throughout Southeast Alaska. Coho salmon escapements in indicator streams in Southeast Alaska have been met in nearly every year since 1993 (Skannes et al. 2015).

Fisheries management in the SHA does present challenges because other wild stocks of salmon are likely to be present during cost recovery for coho salmon, and the harvest must be closely monitored for wild stock harvest. Most cost recovery harvest continues to occur at the hatchery, where separation of fish species is simple.

Table 7.–Key elements of Alaska fisheries management policies and regulations relevant to salmon hatcheries and fishery enhancement.

Sustainable Salmon Fishery Policy (5 AAC 39.222)	
I. Management principles and criteria	
Assessment of wild stock interaction and impacts	As a management principle, the effects and interactions of introduced or enhanced salmon stocks on wild stocks should be assessed. Wild stocks should be protected from adverse impacts from artificial propagation and enhancement efforts.
	The Klawock Hatchery and Klawock River have been used as an integrated broodstock for 35 years and therefore there are not likely separate wild and hatchery stocks in the system.
Use of precautionary approach	Managers should use a conservative approach, taking into account any inherent uncertainty and risks.
	The cost recovery harvest plan at the river mouth includes monitoring for wild stocks. Regionwide coho salmon escapement monitoring shows no direct negative impact from the Klawock Hatchery coho salmon releases.
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.
	An escapement goal is established for Klawock River (Der Hovanisian 2013).
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.
	There is not likely a significant wild stock component for Klawock River coho salmon.
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 the Division 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.
	FTPs were reviewed by management staff.

OTHER REQUIREMENTS

ANNUAL REPORTING AND CARCASS LOGS

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

Annual reports were received for all years of operation from POWHA. The 2009 annual report was received over a month late and was incomplete and inaccurate. At the time, this was at least the 6th consecutive year of late reporting, and led to a letter of noncompliance from ADF&G in 2010. [29]

Hatchery carcass reporting began in 2008, when PNP hatcheries were required to document the disposal of salmon broodstock carcasses (5 AAC 93.350). If hatchery carcasses are not utilized and disposed of, the hatchery must record the number of males and females used each day, and whether eggs were fertilized, unused, or used for roe sales. A maximum of 10% of the total number of females that are not utilized and disposed of can be used for roe sales; the proceeds from any sales in excess of the 10% maximum must be surrendered to ADF&G. Logs submissions are not necessary if all carcasses are fully utilized. Carcass logs were submitted by POWHA for Klawock Hatchery from 2009 to 2011. POWHA was issued a letter of noncompliance in 2010 for carcass logs that were incomplete and not consistent with annual report numbers in 2009.[30]

CONSISTENCY IN PERMITTING

Hatchery permit/BMP, AMP, and FTP documents for Klawock Hatchery operations 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. FTPs for all egg takes and transfers are in place and current for Klawock Hatchery.

The BMP does not reflect permit amendments approved since the BMP was issued in 1996.

The 1997 FTPs permitted a total of 3.25 million coho salmon eggs to be collected for the coho salmon program. However, the AMPs issued during the period indicated the permitted total was 5 million eggs (the hatchery permit total), and thus POWHA took well above the number of eggs permitted under the FTP in 6 of 10 years between 1997 and 2006 (about 436,000 to 4.6 million fish (Table 3).

[29] Letter of Noncompliance from S. Rabung, ADF&G, to F. Burns, POWHA, dated June 21, 2010. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

[30] Ibid.

Table 3). No record was found of any concern by ADF&G staff for this, so it appears that the error went unnoticed and was unintentional.

When the FTP was renewed and updated in 2007, the permitted level in the FTP was increased to 5.0 million eggs, and the hatchery did not significantly exceed 5.0 million from 2007 to 2014.

POWHA was issued a letter of noncompliance with its hatchery permit conditions in 2010 because POWHA staff reported during the 2009 season that they had taken 5.5 million eggs. However, the annual report submitted by POWHA for the 2009 egg take indicated that just over 5 million eggs were taken. It is unclear if surplus eggs were discarded or the number reported inseason was in error.

RECOMMENDATIONS

The BMP should be updated to add the Port Asumcion coho salmon program.

DISCUSSION

Klawock Hatchery is one of the few hatcheries in Alaska located on a river with major anadromous salmon runs. This practice was discouraged in statute for PNP hatcheries (AS 16.10.400 (f)) at about the same time (1978) as the hatchery was constructed, although state hatcheries were not subject to the regulation.

The hatchery location illustrates valuable lessons learned from salmon production elsewhere in the Pacific Northwest and illustrates why the state did permit subsequent PNP hatcheries on major spawning systems. Maintaining a wild return in the presence of a hatchery on an anadromous system, especially when hatchery production dwarfs natural production, is virtually impossible without marking 100% of releases, using only hatchery returns as broodstock, and preventing hatchery returns from spawning in the river.

ADF&G staff working during the period when ADF&G operated the hatchery recalled that when the hatchery was constructed, it was the last to be built on an anadromous river, and that construction occurred about the same time as state statute was adopted by the legislature discouraging PNP hatchery construction on anadromous streams. In addition, ADF&G genetics staff and FRED Division staff discussed the issue of Klawock Hatchery practices in the 1990s, and concluded that due to the interaction between hatchery production and natural production in the Klawock River since the late 1970s, ADF&G could not say for sure there were any wild coho salmon in the drainage. However, as a significant contributor to the fisheries, it made sense to continue enhancing production from the Klawock River watershed, treating fish spawned in the hatchery and those that naturally spawned in the river as an integrated broodstock.[31]

When POWHA took over operations in 1996, they needed to fund the hatchery with cost-recovery funds. The early fish in the run were desirable for 2 reasons. First, they would be more valuable when they were bright fish just entering the river. Second, they could be harvested before most of the broodstock was collected so hatchery staff did not have to juggle cost-recovery harvest and broodstock collection at the same time.

[31] Email from C. Denton, former ADF&G regional resource biologist, to F. Pryor, ADF&G regional resource biologist, 2008. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

Taking cost-recovery fish from the early part of the run, however, could alter the historical run timing in the river. Although most of the run now comprises hatchery returns,[32] those that spawn naturally in the system may be considered to be producing wild fish each year under the regulatory definition. As a result, weekly escapement goals were required to maintain the historic timing of the run.

Klawock hatchery produces a significant number of fish in some years, primarily for the salmon troll fishery. In 2013, trollers harvested a record 136,000 Klawock Hatchery origin coho salmon (Table 4). In addition, the Klawock Hatchery is the only facility in Alaska that directly supports both state and federal subsistence fisheries. Despite the fishery and management challenges, the Klawock Hatchery continues as a significant contributor to the local and regional fisheries.

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ADF&G staff Garold Pryor, Craig Schwanke, Judy Lum, Jeff Lundberg, Sam Rabung, Ron Josephson and Lorraine Vercessi reviewed this document.

[32] The coho salmon return was sampled weekly during the run in 2013 and 2014. In 2013, 99% of the fish sampled were hatchery origin, and in 2014, 94% of the fish sampled were hatchery origin.

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APPENDIX

Appendix A.–Klawock Hatchery permit and permit alterations, 1996–2014. Numbers in millions of eggs.

Date	Description	Coho	Sockeye	Steelhead	Chinook
02/14/1996	PNP hatchery permit number 38 and BMP issued to POWHA for Klawock Hatchery in Klawock. Hatchery permitted for 5 million each coho and sockeye salmon eggs and 50,000 steelhead trout eggs. Donor stocks for all species from Klawock River.	5.0	5.0	0.05	
04/22/1999	PAR approved to add 250,000 Chinook salmon eggs to the hatchery permit for release at Coffman Cove.	5.0	5.0	0.05	0.25
06/9/2006	PAR approved to remove Chinook salmon from the hatchery permit when program transferred to Port St. Nicholas Hatchery.	5.0	5.0	0.05	
5/11/2010	PAR submitted to increase the coho salmon capacity from 5.0 million eggs to 6.0 million eggs. ADF&G staff indicated they would like to see the effects of the recommended fish culture changes before increasing permitted capacity. The SSERPT recommended against approval of the PAR by the ADF&G commissioner by a vote of 2 in favor and 4 opposed. ADF&G deputy commissioner denied the PAR.	5.0	5.0	0.05	
6/2/2014	PAR approved to release up to 250,000 coho smolt from Port Asumcion. Coho salmon capacity remained at 5 million eggs.	5.0	5.0	0.05	

Appendix B.–Summary of fish transport permits (FTP) for Klawock Hatchery.

FTP Number	Issued	Expiration	FTP summary
97J-1003	1997	2007	Collect up to 2.5 million Klawock River stock coho salmon eggs from the Klawock River, incubate and rear at Klawock Hatchery, the transfer resultant progeny to net pens at Klawock Lake for rearing and release of smolts into the lake.
97J-1004	1997	2007	Collect up to 750,000 Klawock River stock coho salmon eggs from the Klawock River, incubate and rear at Klawock Hatchery, and release smolts into the river.
97J-1005	1997	2007	Collect up to 4,000 eggs from Klawock River stock steelhead trout for incubation and rearing at Klawock Hatchery for release to One Duck Lake for "Kid's Fishing Day".
97J-1006	1997	2007	Collect up to 46,000 eggs from Klawock River stock steelhead trout for incubation and rearing at Klawock Hatchery and release to Klawock R.
97J-1007	1997	2007	Collect up to 5.0 million eggs from Klawock River stock sockeye salmon trout for incubation and rearing at Klawock Hatchery and release to Klawock Lake.
07J-1003	2007	2017	Collect up to 5.0 million Klawock River stock coho salmon eggs from the Klawock River, incubate and rear at Klawock Hatchery, then transfer resultant progeny to net pens at Klawock Lake for rearing and release of smolts into the lake. In 2010, FTP amended to allow for an earlier release date of 400,000 of the total release to assess if survival was improved by an earlier release. In February 2013, FTP amended to increase early release from 400,000 to 800,000 smolt due to fungus issues with fish held in the net pens. In December 2013, the FTP was amended to increase the release level again from 800,000 to 1.2 million to save on the cost of fish feed.
10J-1020	2010	2025	Transport progeny from up to 5.0 million Klawock River stock coho salmon eggs collected under 07J-1003 to saltwater net pens at the mouth of the Klawock River for imprinting and release. FTP amended in 2015 to extend expiration date from 2015 to 2025.