Regional Information Report No. 5J15-07

An Evaluation of the Sheldon Jackson Salmon Hatchery for Consistency with Statewide Policies and Prescribed Management Practices

by

Mark Stopha

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

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Weights and measures (metric)	
centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm
Weights and measures (English)	
cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd
Time and temperature	
day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s
Physics and chemistry	
all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

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

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

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AN EVALUATION OF THE SHELDON JACKSON SALMON HATCHERY FOR CONSISTENCY WITH STATEWIDE POLICIES AND PRESCRIBED MANAGEMENT PRACTICES

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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. This report reviews the Sheldon Jackson salmon hatchery located in Sitka, Alaska, for consistency with those policies and prescribed management practices. The hatchery was constructed in 1975 and permitted to Sheldon Jackson College, where it served primarily as an education component of the college. In 2010, Sitka Sound Science Center was permitted to operate the facility after Sheldon Jackson College closed. The hatchery continues to serve primarily as an education and research facility.

The facility produces pink, coho and chum salmon. The even-year pink salmon ancestral stock is from the Indian River, as is the ancestral coho stock. The odd-year pink salmon stock originated from nearby Starrigavin River. The chum salmon ancestral stock is comprised of several donor stocks from rivers in Sitka Sound. These stocks have been produced at the hatchery since the late 1970s and have intermingled with Indian River stocks for about 3 decades.

A portion of the coho salmon releases are marked with coded wire tags and adipose finclip. All pink and chum salmon are thermal otolith marked. Coho salmon are sampled in the commercial fisheries to assess contribution. Three area streams are monitored for straying.

The basic management plan for the hatchery should be updated to reflect current hatchery operations. Egg take procedures should be reviewed to ensure egg-take numbers do not exceed permitted capacity. The need for sampling the Indian River escapement for hatchery strays should be reviewed in light of the integration of the hatchery and Indian River stocks since the 1970s.

Key words: Sheldon Jackson Hatchery, Indian River, salmon hatchery, hatchery evaluation, hatchery, coho salmon, chum salmon, pink 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. Logjams were removed in streams to enable returning adults to reach spawning areas. 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. Chinook, sockeye, and coho salmon 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.

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[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.

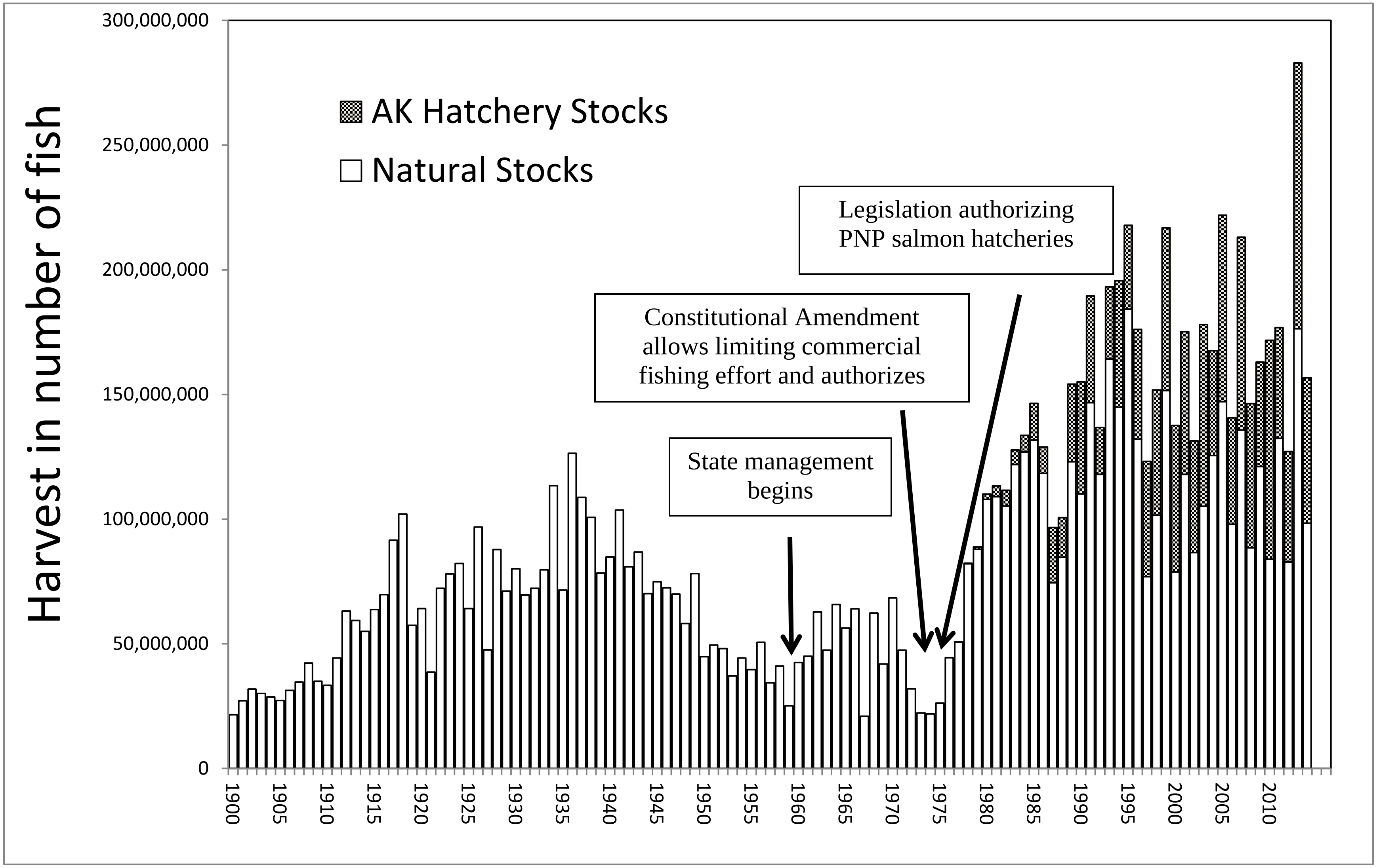

Figure 1.–Commercial salmon harvest in Alaska, 1900–2014.

Source: 1900–1976 from Byerly et al. (1999). 1977–2014 from Vercessi (2015).

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 fresh, high quality 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 $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 a 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 recovery of 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 alone 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 a message of the state's sustainable fisheries management to a growing audience of discriminating buyers. The Alaska Seafood Marketing Institute applied to the Marine Stewardship Council (MSC) for certification as a sustainably managed fishery. In 2000, the MSC certified the salmon fisheries managed by ADF&G as sustainably managed, and the state's salmon fisheries remained the only MSC certified salmon fishery in the world for nearly a decade. Salmon fisheries elsewhere (Annette Islands Indian Reserve salmon; British Columbia pink and sockeye salmon; and Iturup Island, Russia, pink and chum salmon) were later certified for much smaller geographic areas, and in some cases, only for specific salmon species (MSC 2012). Alaska's certification was MSC's broadest and most complex, covering all 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) 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, 2013b, 2013c, 2013d, 2013e, 2013f, 2013g, 2013h, 2014a, 2014b, 2014c, Stopha 2015a, 2015b, 2015c) completed reviews of the remainder of the Cook Inlet and Prince William Sound hatcheries, and a portion of the hatcheries in northern Southeast Alaska. This report is for the Sheldon Jackson Hatchery located in Sitka, Alaska. Following completion of reviews of hatcheries in the northern Southeast Alaska region, reviews of 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 U.S./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 nonsensitive 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, and (2) a watershed with a significant stock can only be stocked with progeny from the indigenous stocks.[5] 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*,

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[5] Fish releases from remote release sites or in landlocked lakes where no interaction with significant or unique stock will occur need not be restricted by genetic concerns, according to *Genetic Policy*.

which identifies criteria to be used for evaluating the significance of a wild stock under the *Genetic Policy*.

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 *Policies and Guidelines for Alaska Fish and Shellfish Health and Disease Control* (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. 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 fishery managers 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 is comprised of 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. Commercial salmon fishing permit holders 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* fisheries, which are fisheries open to all commercial fishing permit holders, subsistence users and sport harvesters. 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. Acquisition of a hatchery permit is an extensive process (5 AAC 40.110–40.230). A hatchery 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. The hatchery 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 (5AAC 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 affecting management of wild stocks, and not requiring significant alterations of traditional fisheries; (2) the operation of the hatchery makes the best use of the site's potential to benefit the common property fishery; (3). the harvest area size at the hatchery is sufficient in size to provide a segregated harvest of hatchery fish of acceptable quality for sale; (4) proposed donor sources can meet broodstock needs for the hatchery for the first cycle; (5) water sources for the hatchery are secured by permit and are of appropriate quality and quantity; and (6) the hatchery has a reasonable level of operational feasibility and an acceptable degree of potential success.

Public participation is an integral part of the PNP hatchery system. 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. 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 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).

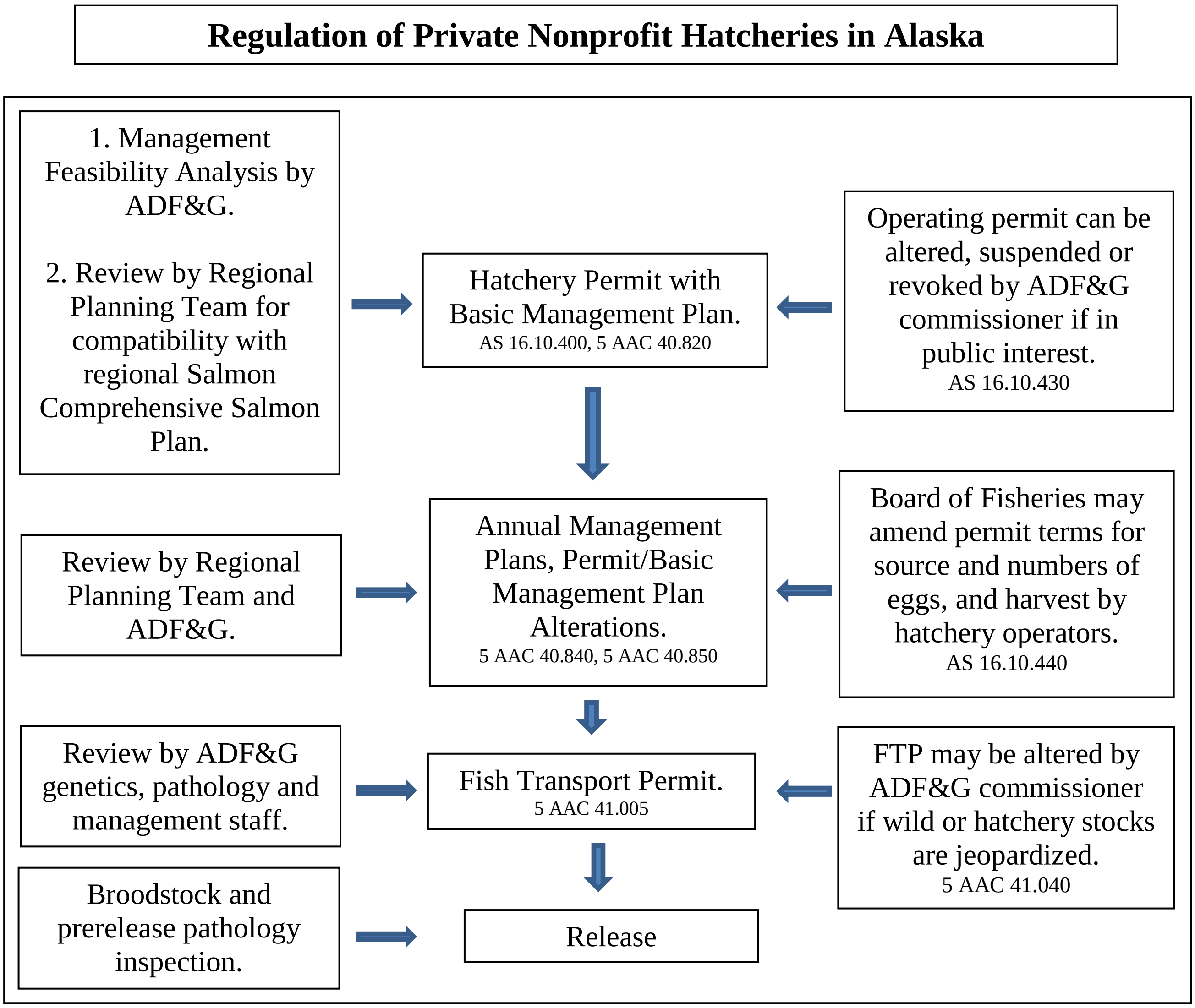

Figure 2.–Diagram of Alaska hatchery permitting process.

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 amended. 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 are reviewed by the RPT and ADF&G staff and their recommendations are sent to the ADF&G commissioner. If approved by the commissioner, the permit is amended to include the PAR. 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 ADF&G.

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 2015) 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.

SHELDON JACKSON HATCHERY OVERVIEW

The Sheldon Jackson Hatchery is located in Sitka, Alaska. The facility was originally permitted to Sheldon Jackson College in 1975, and served primarily as an education facility for the college.

Sitka Sound Science Center (SSSC), a nonprofit education and research organization, took over management of the hatchery in 2007 after Sheldon Jackson College closed. At that time, Sheldon Jackson Hatchery was permitted to Sheldon Jackson College for 1 million pink salmon (*Oncorhynchus gorbuscha*) eggs, 10 million chum salmon (*O. keta*) eggs, 150,000 coho salmon (*O. kisutch*) eggs, and 100,000 Chinook salmon (*O. tshawytscha*) eggs (Appendices A–D).

In the summer of 2010, SSSC submitted a PNP hatchery application to permit the facility under their organization. Chum salmon production would remain unchanged. SSSC requested an increase in pink salmon production from 1 million to 3 million eggs to increase cost recovery income to fund the facility. SSSC requested an increase in coho salmon production from 150,000 eggs to 200,000 eggs, and removal of Chinook salmon production because Chinook salmon returns to the hatchery had been poor and coho salmon returns more successful.

SSSC intended to continue to provide the hatchery as a research and education facility to other institutions, such as the University of Alaska Ketchikan, University of Alaska Sitka, and secondary schools, as well as provide salmon to common property fisheries of Sitka Sound and Southeast Alaska.

The Sheldon Jackson College Board of Trustees submitted a letter to ADF&G supporting the acquisition of the Sheldon Jackson Hatchery permit by SSSC and requested that the original PNP hatchery permit No. 3 be revoked and SSSC's new hatchery permit approved.

Water for the facility is from Indian River. Water rights for the facility were held by Sheldon Jackson College and would transfer to SSSC with transfer of the hatchery and land.[6]

The ADF&G management feasibility analysis (MFA) for the permit application indicated that it would not likely be necessary to alter fisheries management in the area for the hatchery, except for a small area in front of the hatchery that may, at times, be closed to sport fishing to protect broodstock.

The MFA noted that the ancestral stocks for coho and pink salmon were from the Indian River. Although straying into the river was apparent, no formal studies had been conducted in Indian River over the years, despite the long history of salmon production at the hatchery. ADF&G records showed 2 coho salmon escapement surveys of Indian River showing significant numbers of adipose-clipped coho salmon observed.[7] The MFA noted that in 1986, 33 of 126 coho salmon counted had clipped adipose fins. In 1989, 96 of 603 coho salmon counted had clipped adipose fins. Straying levels were likely to increase with the proposed increased production for pink and coho salmon. It was likely that some level of hatchery strays had previously spawned with naturally produced returns to the river. The MFA indicated that monitoring of stray rates may be warranted with the increased production request. If excessive straying rates were encountered, hatchery production could be curtailed or release strategies reevaluated.

The MFA also stated a concern for competition for resources with local salmon stocks and other marine species during the early marine phase of salmon production and growth, as juvenile salmon releases from hatcheries in Sitka Sound had risen to nearly 60 million fish by 2010.

The public hearing for the permit was held in Sitka in March 2011. Only 1 person, a representative of the Northern Southeast Regional Aquaculture Association (NSRAA), testified and spoke in favor of approving the hatchery permit. Written testimony from the City and Borough of Sitka, a local seafood processor, and the Sitka Economic Development Council were in favor of the permit. Written testimony from the National Park Service indicated support for a requirement in the BMP to monitor the Indian River for stray pink and coho salmon. The National Park Service also recommended actions by SSSC to help direct returning hatchery-produced salmon to the hatchery, such as the addition of natural or artificial attractants to the rearing and attractant waters.[8]

In late 2010, the Northern Southeast Regional Planning Team reviewed and unanimously recommended approval of the hatchery application to the ADF&G commissioner. The ADF&G

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[6] Appendix 7 of Sheldon Jackson Hatchery permit application by SSSC. Unpublished document obtained from Sam Rabung, ADF&G PNP coordinator, Juneau.

[7] A portion of all coho salmon released from Southeast Alaska hatcheries are adipose finclipped.

[8] Letter from R. Larson, Superintendent, National Park Service, Sitka dated March 24, 2011 to Sam Rabung, ADF&G. Unpublished document obtained from Sam Rabung, ADF&G PNP coordinator, Juneau.

commissioner approved and issued PNP Hatchery Permit number 45 to SSSC in 2011. The hatchery was permitted for 3 million pink salmon eggs, 250,000 coho salmon eggs and 10 million chum salmon eggs. A requirement for monitoring hatchery strays to Indian River was outlined in the BMP and specific protocols are detailed in the AMP.

SHELDON JACKSON HATCHERY STOCKS

The pink salmon stocks originated primarily from Indian River (even years) and Starrigavin River (odd years; Appendix A; Figure 3).

The coho salmon stock originated from Indian River (Appendix B).

The chum salmon stock is Medvejie Creek Hatchery stock, which is comprised of Sitka Sound ancestral stocks from Nakwasina River, Medvejie Creek, and Salmon Lake (Figure 3).[9] In addition, the Sheldon Jackson Hatchery donor stocks that included Nakwasina River, Katlian River and Sandy Cove are also likely part of the genetic makeup of the broodstock (Figure 3; Appendix C).

SHELDON JACKSON HATCHERY OPERATION OVERVIEW

Pink salmon eggs are collected from returns, incubated, reared and released on site (FTP 11J-1007; Appendix E). Pink salmon from the Indian River serve as a backup brood source (FTP 11J-1013). All pink salmon releases are otolith marked. Fishery contributions are based on assumed survival and harvest rates.

Coho salmon eggs are collected from returns, incubated, reared and released on site (FTP 11J-1014). Coho salmon from the Indian River serve as a backup brood source (FTP 11J-1015). A portion of the releases are coded wire tagged and adipose finclipped. A regionwide sampling program for coho salmon is used to estimate hatchery contribution to the fisheries and hatchery broodstock.

The Sheldon Jackson Hatchery was initially permitted for up to 10 million chum salmon eggs, with an additional 2 million eggs added later by permit amendment (see next section). All chum salmon releases are otolith marked. Fishery contributions are based on assumed survival and harvest rates. Some of the production occurs at Sheldon Jackson Hatchery and the remainder at Medvejie Creek Hatchery.

Up to 3 million eggs are collected from returns, incubated and released onsite at Sheldon Jackson Hatchery (FTP 11J-1008). Medvejie Creek Hatchery chum salmon returns serve as a backup egg source (FTP 11J-1010).

Up to 9 million chum salmon eggs are collected at Medvejie Creek Hatchery. The eggs are incubated and reared at Medvejie Creek Hatchery (FTP 11J-1011), then transferred to Deep Inlet for imprinting and release (FTP 11J-1009). Sheldon Jackson Hatchery returns serve as backup egg source and Sheldon Jackson Hatchery as backup facility for this production (FTP 11J-1012 and FTP 11J-1016). NSRAA, who also releases chum salmon in Deep Inlet under the Medvejie

[9] Appendix 7 of Sheldon Jackson Hatchery permit application by SSSC. Unpublished document obtained from Sam Rabung, ADF&G PNP coordinator, Juneau.

Hatchery permit, shares cost-recovery revenue from the returns with SSSC to support Sheldon Jackson Hatchery.[10]

PERMIT ALTERATIONS

In 2013, SSSC submitted the only PAR to date under its permit to increase chum salmon capacity from 10 million to 12 million eggs. The additional 2 million eggs were for incubation and release at the hatchery to enable SSSC to fully utilize hatchery incubation potential and saltwater rearing capacity. The increased release would provide more chum salmon broodstock and additional cost recovery income.

ADF&G genetic and pathology staff reviewed the PAR and recommended approval.[11] The RPT voted to recommend the measure to the ADF&G commissioner by a 4 to 2 vote. One of the voters opposing the PAR indicated that there should be a pause in production increases until results came back from an ongoing straying study. This person was also concerned about possible fleet behavior changes and its effects on wild stock systems. No information was stated for the other vote in opposition.[12]

The deputy directors of the Divisions of Commercial Fisheries and Sport Fish approved the PAR. The FTP for the program (11J-1008) was subsequently amended for the increase.

The current permitted capacity of the Sheldon Jackson Hatchery permit is 12 million chum, 3 million pink, and 250,000 coho salmon eggs, of which 9 million chum salmon eggs are collected, reared, and released offsite through Medvejie Creek Hatchery.

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[10] Nothing could be found in regulation or statute preventing one hatchery from conducting a program fully within its facility for another hatchery. NSRAA assisted Sheldon Jackson Hatchery over the years to keep it operational during economic hardship. In 2002, when the hatchery permit was assigned to Sheldon Jackson College, a PAR was approved for Sheldon Jackson Hatchery to incubate chum salmon eggs at the hatchery and release up to 4 million chum salmon fry at Deep Inlet. Under the permit amendment, NSRAA, who also released chum salmon at Deep Inlet from Medvejie hatchery, would share cost recovery revenue with Sheldon Jackson Hatchery. In 2005, a PAR for the Sheldon Jackson Hatchery was approved to increase chum salmon production at Deep Inlet from 4 million to 9 million eggs. At the time, Sheldon Jackson Hatchery was under repair, and NSRAA staff indicated to the RPT during the PAR review that the eggs for Deep Inlet could be incubated at Medvejie Creek Hatchery and resultant fry released at Deep Inlet until Sheldon Jackson Hatchery repairs were complete and the hatchery could accommodate the increased production. When Sheldon Jackson Hatchery changed hands from Sheldon Jackson College to SSSC in 2011, the new BMP prescribed the previous arrangement whereby NSRAA would collect up to 9 million eggs for incubation at Medvejie Creek Hatchery for rearing and release at Deep Inlet. In exchange, NSRAA would provide the SSSC with a “steady revenue stream.” An FTP specific to this arrangement was issued under the new Sheldon Jackson Hatchery permit to SSSC (FTP 11J-1009).

[11] Memo from L. Vercessi, ADF&G, to S. Aspelund and T. Brookover, ADF&G, subject *Sheldon Jackson Hatchery alteration*, dated May 7, 2013. Unpublished document obtained from Sam Rabung, ADF&G PNP coordinator, Juneau.

[12] Memo from F. Pryor, ADF&G, to C. Campbell, ADF&G commissioner, subject *Joint, Northern and Southern Southeast regional planning teams spring 2013 meeting* dated April 26, 2013. Unpublished document obtained from Sam Rabung, ADF&G PNP coordinator, Juneau.

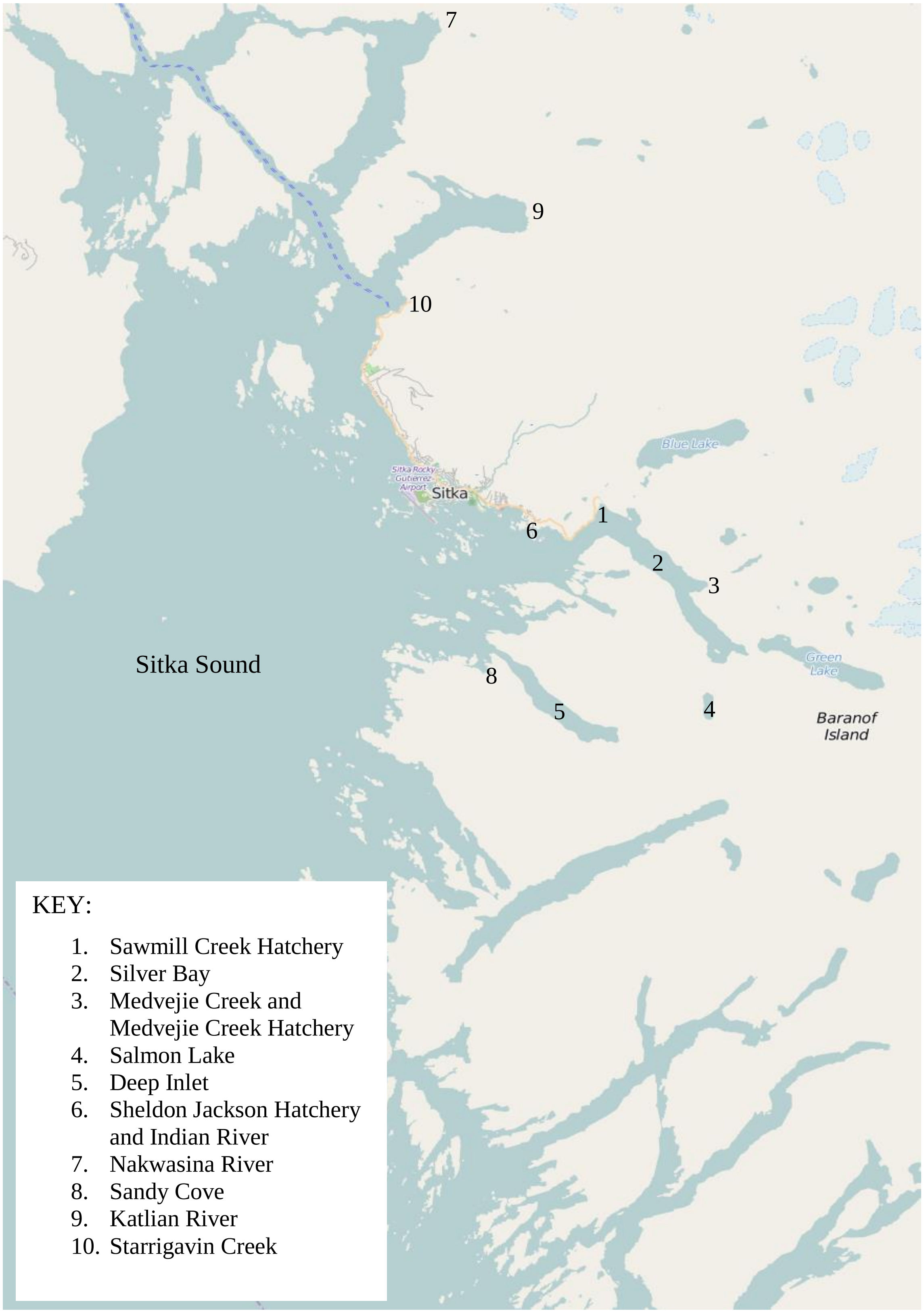

Figure 3.–Location of Sheldon Jackson Hatchery, area hatcheries, and ancestral hatchery broodstock systems.

COMPREHENSIVE SALMON ENHANCEMENT PLAN

Three phases of Comprehensive Salmon Plans (CSP) have been developed to date in Southeast Alaska. Phase I and Phase II CSPs provided planning focused on increasing salmon production with specific harvest targets for each salmon species.[13] The Phase III CSP provided planning to support salmon fishery enhancement while minimizing impacts on wild stocks (Duckett et al. 2010), and is the CSP under which the Sheldon Jackson Hatchery was permitted to SSSC.

Phase III 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: (A) the release site has an adequate freshwater supply for imprinting and is not in close proximity to significant wild stocks, (B) fish are adequately imprinted to the release site, (C) releases are marked and contribute to the harvest without jeopardizing the sustainability of wild stocks, and (D) 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 also provided a stock appraisal tool for assessing the *significance* of stocks referenced 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 5 stock characteristics of consideration: wildness, uniqueness, isolation, population size, population trend and the stock's economic and/or cultural significance.

The Phase III CSP 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

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

Northern Southeast Regional Planning Team. 1982. Comprehensive Salmon Plan, Phase II: Northern Southeast Alaska. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

evaluation agreements between the hatchery corporation or agency and the department, including any agreements for funding evaluation activities."

The Sheldon Jackson Hatchery program was one of the first hatcheries to be permitted under the Phase III CSP. The review and assessment of the hatchery program by ADF&G, the RPT and the public during the permitting process and development of the BMP demonstrated application of the policies and guidelines outlined above in the Phase III CSP.

PROGRAM EVALUATION

CONSISTENCY WITH POLICY

The policies governing Alaska hatcheries were divided into 3 categories for this review: genetics, fish health, and fisheries management. The key elements of the policies in each of those categories are used to assess compliance of the Sheldon Jackson Hatchery salmon program with the policy elements.

Genetics

Sheldon Jackson Hatchery even-year pink salmon stock was obtained primarily from the Indian River and the odd-year stock obtained primarily from Starrigavin Creek (Table 1; Appendix A; Figure 3). The ancestral coho salmon stock is from Indian River (Appendix B).

Chum salmon were indigenous to the Indian River and listed in the original hatchery permit issued to Sheldon Jackson College as an approved donor source. However, the stock size was not sufficient to provide adequate broodstock to establish a hatchery return. Additional donor sources were added from several stocks from the Sitka Sound area, as well as the Medvejie Creek Hatchery stock, which was comprised of ancestral donors from Sitka Sound systems (Appendix C).

Anecdotal observations indicate that the Indian River and Sheldon Jackson Hatchery pink and coho salmon stocks (and likely the chum salmon stocks, too) have intermingled since the first hatchery returns in the mid-1970s. The Indian River had most of its spawning gravel removed in the years after World War II and was classified as a *depleted system* with annual fall runs of pink salmon averaging less than 200 fish from the mid-1960s to mid-1970s. The Sheldon Jackson College aquaculture program was committed to "assuring escapement of a minimum of 2000 fish [14] annually to Indian River to maintain the maximum possible natural run and continue a reservoir of genetically unselected fish for insurance against hatchery inbreeding or brood year failure."[15] Returning marked pink salmon adults from a 1975 Sheldon Jackson Hatchery release were observed in the Indian River escapement, at the hatchery, and in the seine harvest. Marked hatchery pink salmon returns were noted again in the escapements to the Indian River in 1977.[16]

In early management plans for the hatchery, ADF&G required Sheldon Jackson Hatchery to "allow 25 percent of the total hatchery and natural seeding requirements (in number of fish) to

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[14] Fish referenced are pink salmon.

[15] Draft Sheldon Jackson Hatchery document written about 1978. Unpublished document obtained from Sam Rabung, ADF&G PNP coordinator, Juneau.

[16] Letter from D. Lund, Sheldon Jackson College to H. Heinkel, ADF&G dated June 25, 1979. Unpublished document obtained from Sam Rabung, ADF&G PNP coordinator, Juneau.

pass by the weir" for Indian River escapement needs.[17] Pink salmon and chum salmon were also transported from the hatchery to the river to spawn. [18]

A portion of Sheldon Jackson Hatchery-produced coho salmon are coded-wire-tagged and adipose finclipped. In the past, Indian River escapement surveys[19] have noted adipose-clipped coho salmon or "hatchery fish" (Schmidt 1986), but coded wire tags were not recovered. In review of annual reports of the hatchery, coho salmon were regularly taken from the river as broodstock, and excess broodstock at the hatchery regularly released into the river[20]. No attempt was recorded or mandated to prevent hatchery fish from joining the spawning escapement, nor prevent naturally spawned fish from being used as broodstock.

Assessment of the interaction of hatchery and naturally spawning coho and pink salmon is a requirement of the hatchery permit for Sheldon Jackson Hatchery. Sampling results for pink salmon, which are all otolith marked, indicate that more naturally spawned fish than hatchery returns are used for broodstock at the hatchery. Sampling of pink salmon in the Indian River escapement indicates a range of 2% to 24% of hatchery fish in the samples (Table 2).

For coho salmon, fish were sampled in the Indian River escapement and at the Sheldon Jackson Hatchery rack in 2013 and 2014. Fish with adipose fins missing were examined for coded wire tags. If tags were detected, they were read to determine the tag ratio. A first order estimate of the contribution of Sheldon Jackson Hatchery origin coho salmon contribution to the escapement based on tagging ratio was 47% in 2013 and 63% in 2014. At the hatchery, the first order estimate of Sheldon Jackson Hatchery origin coho salmon contribution to the broodstock was 80% in 2013 and 89% in 2014 (Table 2).[21]

Chum salmon were otolith marked beginning in 2005. No records were found of sampling for hatchery chum salmon in the escapement or at the hatchery.[22]

The use of broodstock at the hatchery from other sources and the mixing of hatchery-spawned and naturally spawned salmon both in Indian River and in the hatchery have likely had a significant influence on pink, chum, and coho salmon spawning in Indian River. It is unclear to the author why there is concern for hatchery strays to the spawning population in the Indian River when the river and hatchery populations have been managed as a single stock since the 1970s. The interaction between hatchery stock and wild populations will be important if the RPT considers the status of Indian River salmon as a significant stock under the tool defined in the Phase III CSP.

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[17] Letter from J. Brooks, ADF&G commissioner, to D. Lund, Sheldon Jackson Aquaculture Program, dated July 6, 1977. Unpublished document obtained from Sam Rabung, ADF&G PNP coordinator, Juneau.

[18] Sheldon Jackson College Aquaculture Program. Unpublished document obtained from Sam Rabung, ADF&G PNP coordinator, Juneau.

Letter from D. Lund, Sheldon Jackson College, to H. Heinkel, ADF&G, dated June 25, 1979. Unpublished document obtained from Sam Rabung, ADF&G PNP coordinator, Juneau.

Notice to Sitka Area Seiners. Received May 15, 1980. Letter from D. Lund, Sheldon Jackson College, to H. Heinkel, ADF&G, dated June 25, 1979. Unpublished document obtained from Sam Rabung, ADF&G PNP coordinator, Juneau.

[19] Escapement data sampling information for 1983, 1985, 1986, 1989 and 2010 from ADF&G Alexander Database. 2008 from Troy Tydingco, ADF&G fishery biologist, Sitka.

[20] For example, 1980–1984 annual reports.

[21] Statistical error around coho salmon estimates is considerably larger than for pink salmon, especially for smaller sample sizes, because not all coho salmon are marked.

[22] The 2005–2010 AMPs indicated that the escapement would be sampled for strays, but no record of this occurring was found.

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 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. Local stocks were used for broodstock at Sheldon Jackson Hatchery.
II. Protection of wild stocks	
Identification of significant or unique wild stocks	Significant or unique wild stocks must be identified for each region and species as stocks most important to that region. Regional Planning Teams should establish criteria for determining significant stocks and recommend such stock designations. In Southeast Alaska, no significant stocks have been identified by the RPT. The Phase III CSP provided a stock appraisal tool for use as a guideline by the RPT and ADF&G biologists when charged with evaluating the biological significance of naturally occurring stocks near a proposed release site.
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. The Phase III CSP denotes guidelines for significant stock determination. No significant stocks have been recommended in Southeast Alaska by the RPT.
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. Assessment of the interaction of hatchery and naturally spawning coho and pink salmon is a requirement of the hatchery permit for Sheldon Jackson Hatchery. Chum salmon are not assessed.

Table 1.–Page 2 of 2.

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.
	Only the Medvejie Creek Hatchery stock used at Sheldon Jackson is used at another hatchery (Medvejie Creek Hatchery).
Minimum effective population size	The policy recommends a minimum effective population size of 400. It also recognizes that small population sizes may be unavoidable with Chinook and steelhead.
	The pink and chum salmon programs require well over the 400 fish broodstock. The coho program does not because of the relatively small number of eggs collected.
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 add terms or conditions to the permit to protect wild or enhanced stocks.
	The FTPs for Sheldon Jackson Hatchery were reviewed by the geneticist.

Table 2.–Estimated number of hatchery fish (H) out of the total number of fish examined (T) at Sheldon Jackson Hatchery and in the Indian River spawning escapement.

Return Year	Pink Salmon[a]		Coho Salmon[b]	
	Hatchery[c] H / T	Escapement H / T	Hatchery[d] H / T	Escapement H / T
2011	8/94	2/81		
2012	17/94	7/144		
2013	22/95	21/185	110/138	37/78
2014	[e]	22/200	262/295	124/196

[a] From 2014 Sheldon Jackson Hatchery AMP.

[b] Data from the ADF&G Mark, Tag and Age Lab database. http://mtalab.adfg.alaska.gov/CWT/reports/default.asp

[c] The estimated number of hatchery pink salmon was the number of pink salmon with hatchery otolith marks seen in the total number of pink salmon examined.

[d] The estimated number of hatchery coho salmon was the sum of tag ratios from the tags recovered in the total number of coho salmon examined.

[e] 2014 pink salmon results were not yet available.

Fish Health and Disease

FTPs for all operations of the Sheldon Jackson Hatchery are reviewed and approved by an ADF&G fish pathologist (Table 3). All eggs are disinfected. Disease histories and disease occurrence were submitted as required. ADF&G fish pathology staff conduct regular inspections of the facility and provide recommendations.

When SSSC took over the hatchery permit, the hatchery was in an aged condition. The hatchery experienced chronic problems with water supply. Salmon carcasses in the Indian River water source caused fungus, bacteria and parasite problems in the hatchery. Fungal infiltration historically caused mortality of eggs and fry as high as 100%. Flood events cause turbidity problems. The SSSC is currently renovating the facility as funding allows.

The most recent inspection reported progress in many areas.[23] The facility was noted in good order overall. The 2014 AMP indicated that work continues in developing and acquiring improved water quality, fish culture and adult harvesting equipment.

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

Fish Health and Disease Policy (5 AAC 41.080)	
Egg disinfection	Within 48 hours of taking and fertilizing live fish eggs or transporting live fish eggs between watersheds, all eggs must be treated with an iodine solution. This requirement may be waived for large scale pink and chum salmon facilities where such disinfection is not effective or practical. All eggs are disinfected
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 has been regularly inspected.
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. Disease issues have been reported as necessary.
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. Disease histories have been provided as necessary.
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 have been listed as necessary.
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 pathologist reviewed the FTP applications.

[23] Hatchery inspection report for Sheldon Jackson Hatchery, dated 7/16/2014. Unpublished document obtained from Theodore Meyers, ADF&G fish pathologist, Juneau.

Fisheries Management

Impacts to fisheries management from the Sheldon Jackson Hatchery alone are small because of the small return to Sheldon Jackson Hatchery relative to hatchery and naturally spawning stocks in Sitka Sound. Sheldon Jackson Hatchery returns are harvested in common property purse seine, drift gillnet and troll fisheries. Fish returning to the special harvest area are usually needed entirely for cost recovery and broodstock, and according to the 2014 AMP, common property openings in the hatchery terminal area are unlikely.

No formal escapement goals are in place for coho, pink, or chum salmon in the Indian River (Table 4). If hatchery returns do not meet broodstock needs for pink or coho salmon, broodstock can be taken from the Indian River escapement on approval of ADF&G staff. The hatchery chum salmon backup brood source is Medvejie Creek Hatchery.

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

Sustainable Salmon Fishery Policy (5 AAC 39.222)	
I. Management principles and criteria	
Assessment of wild stock interaction and impacts	As a management principle, the effects and interactions of introduced or enhanced salmon stocks on wild stocks should be assessed. Wild stocks should be protected from adverse impacts from artificial propagation and enhancement efforts.
	The Indian River stocks of pink, chum and coho salmon have largely been treated as an integrated stock since the hatchery began operation in the 1970s.
Use of precautionary approach	Managers should use a conservative approach, taking into account any inherent uncertainty and risks.
	The Indian River stocks of pink, chum and coho salmon have largely been treated as an integrated stock since the hatchery began operation in the 1970s.
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.
	No formal escapement goals are in place for coho, pink, or chum salmon in the Indian River.
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.
	No formal escapement goals are in place for coho, pink or chum salmon in the Indian River. Area watersheds with escapement goals have been met in most years.
Fisheries management review of Fishery Transport Permits (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.
	Fishery managers reviewed the FTPs.

Pink salmon returns to Indian River increased by orders of magnitude following the first returns to the hatchery in 1977 (Table 5). The increases are likely attributable to both natural production and production from the hatchery. In the decade prior to the first hatchery returns in 1977, peak escapement counts for pink salmon in the river did not exceed 500 fish in any year. In the years after hatchery production, peak returns exceeded 125,000 in several years. Escapements in other Sitka Sound pink salmon escapement index streams (of which Indian River is not included) ballooned as well (Table 6). It is not known if there were any hatchery fish that strayed to these index streams, but hatchery fish alone could not attribute to the large increase in escapements in Sitka Sound since 1977. For example, in 2004, only 36,000 brood year 2003 fry were released from the hatchery (Appendix A), and the escapement to Indian River in 2005 was over 375,000 fish, the highest recorded escapement since 1962. Escapement surveys to the Indian River for other species have occurred opportunistically (Table 5).

Table 5.–Peak escapement counts in Indian River, water source for Sheldon Jackson Hatchery.

Year	Pink	Coho	Chum	Chinook	Sockeye
1962	500				
1963	300	30			
1964	300				
1965	500				
1966	300				
1967	150				
1969	500				
1971	300				
1972	200				
1973	500				
1974					
1975					
1976					
1977	17,500				
1978	2,000				
1979	5,991	96			
1980	2,893	110	125		
1981	16,000	32	4		1
1982	12,000	125			
1983	21,000	55			
1984	6,000	175			
1985	11,000	86			
1986	10,000	93	286		
1987	3,000	53	1,372		
1988	1,651		556		
1989		603			
1990	1,750	20	500		
1993	800				
1994	55,000				
1995	14,000				
1996	185,000		500		
1997	260,000				
1998	66,000				
1999	160,000		500		
2000	85,000		2,210	50	
2001	90,000		1,000		
2002	68,000		152		
2003	270,000				
2004	73,000		2,215		
2005	376,200		300		
2006	46,000	583	360		
2007	75,600		690		
2008	75,000				
2009	87,400		300		
2010	91,000	105			
2011	127,000				
2012	165,000	80			
2013	295,000				
2014	95,000				

Source: ADF&G Alexander database.

Table 6.–Peak escapement counts in Indian River, water source for Sheldon Jackson Hatchery, and peak escapement estimate for Sitka Sound Pink salmon index streams. The Indian River is not part of the cluster of streams comprising the Sitka Sound index.

Year	Indian River Peak Escapement	Sitka Sound Index Escapement
1962	500	23,885
1963	300	196,095
1964	300	13,735
1965	500	96,037
1966	300	15,732
1967	150	63,554
1969	500	4,470
1971	300	115,306
1972	200	10,275
1973	500	75,957
1974		17,850
1975		175,003
1976		56,334
1977	17,500	210,546
1978	2,000	68,611
1979	5,991	732,689
1980	2,893	82,941
1981	16,000	511,672
1982	12,000	45,039
1983	21,000	464,800
1984	6,000	161,929
1985	11,000	344,000
1986	10,000	315,946
1987	3,000	542,925
1988	1,651	117,217
1989		132,737
1990	1,750	40,121
1993	800	47,064
1994	55,000	49,448
1995	14,000	101,747
1996	185,000	77,393
1997	260,000	33,240
1998	66,000	336,154
1999	160,000	292,979
2000	85,000	587,275
2001	90,000	1,045,375
2002	68,000	1,061,978
2003	270,000	1,624,076
2004	73,000	514,558
2005	376,200	639,470
2006	46,000	882,403
2007	75,600	1,447,610
2008	75,000	847,000
2009	87,400	1,474,000
2010	91,000	693,000
2011	127,000	929,467
2012	165,000	732,000
2013	295,000	1,413,000
2014	95,000	747,000

Source: ADF&G Alexander database.

CONSISTENCY IN PERMITTING

Hatchery permit/BMP, AMP, and FTP documents for Sheldon Jackson 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 should cover all egg takes and releases, and transfer of eggs, juveniles, or adults to other sites.

Pink salmon egg takes exceeded the permitted capacity of 3 million green eggs every year since the hatchery permit was issued in 2011 (Appendix A). Coho salmon egg collections significantly exceeded the 250,000 permitted egg number in 2011 and 2014 (Appendix B).

FTPs are current and accurate for hatchery operations (Appendix E). The AMP, FTPs, and hatchery permit are consistent with each other, except that the BMP was not updated for the 2013 permit amendment increasing chum salmon production.

RECOMMENDATIONS

1. Egg take procedures should be reviewed so that the egg take does not exceed permitted capacity.
2. The BMP should be updated to reflect the 2013 permit amendment that increased chum salmon capacity.
3. Due to the small size of the coho salmon program, otolith marking of coho salmon, in addition to coded wire tagging, should be considered to provide more precise assessment of the contribution of hatchery fish to hatchery broodstock and the stream spawning population.
4. The current management plan for the hatchery requires sampling of the escapement to note the extent of straying to Indian River. ADF&G historically considered the Indian River and Sheldon Jackson Hatcher pink[24] and coho[25] salmon as 1 stock. Past observations and management, as well as recent sampling results, indicate that pink and coho salmon have intermingled in the hatchery broodstock and river escapement for over 30 years. If further sampling confirms this, and after assessment by the ADF&G genetics staff, the coho and pink salmon stocks should be managed as single stocks since it would serve no benefit in isolating portions of the same stock.

ACKNOWLEDGEMENTS

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[24] Harvest management plans for Sheldon Jackson returns for 1978 approved by ADF&G commissioner R. Skoog. Unpublished document obtained from Sam Rabung, ADF&G PNP coordinator, Juneau.

[25] FTP 82-20. Unpublished document obtained from Sam Rabung, ADF&G PNP coordinator, Juneau.

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APPENDIX

Appendix A.–Pink salmon hatchery production history at Sheldon Jackson Hatchery (SJH). The hatchery was permitted to Sheldon Jackson College from 1975 to 2010, and to Sitka Sound Science Center from 2011 to present.

Brood Year	Egg Source	Egg Take	Fry Release
1975	Indian river 91% Katlian River 9%	1,747,935	1,653,666
1976	Starrigavin 97% Indian River 3%	1,949,664	1,593,184
1977	SJH	10,226,500	7,147,974
1978	SJH	2,477,472	2,376,944
1979	SJH	9,551,000	7,883,250
1980	SJH	2,248,968	2,062,139
1981	SJH	13,697,711	10,689,600
1982	SJH	14,814,740	9,996,783
1983	SJH	15,637,021	14,536,624
1984	SJH	12,248,695	11,070,423
1985	SJH	11,340,010	10,050,822
1986	SJH	15,015,110	14,200,000
1987	SJH	14,783,715	14,250,000
1988	SJH	3,264,000	2,957,500
1989	SJH	5,846,122	5,400,000
1990	SJH	2,940,000	2,500,000
1991	SJH	9,517,109	9,040,000
1992	SJH	7,236,522	6,790,000
1993	SJH	916,619	347,868
1994	SJH	10,800,604	7,130,000
1995	SJH	8,911,063	7,900,000
1996	SJH	12,518,798	6,700,000
1997	SJH	5,651,192	4,500,000
1998	SJH	10,182,193	3,779,737
1999	SJH	6,778,092	1,650,092
2000	SJH	5,888,519	5,327,708
2001	SJH	900,000	861,422
2002	SJH	3,248,952	796,000
2003	SJH	803,200	36,399
2004	SJH	1,891,790	1,036,476
2005	SJH	1,526,081	1,154,284
2006	SJH	1,171,848	1,092,918
2007	SJH	1,064,909	1,016,500
2008	SJH	1,131,859	1,079,283
2009	SJH	1,040,102	985,000
2010	SJH	1,075,427	701,431
2011	SJH	3,239,267	2,627,965
2012	SJH	3,238,858	2,600,008
2013	SJH	3,431,387	2,971,630
2014	SJH	3,399,893	

Source: Sheldon Jackson Hatchery annual reports. Unpublished documents obtained from Sam Rabung, ADF&G PNP coordinator, Juneau.

Appendix B.–Coho salmon egg take, release, and return data for Sheldon Jackson Hatchery, 1975–2014. Ancestral stock was Indian River. The hatchery was permitted to Sheldon Jackson College from 1975 to 2010, and to Sitka Sound Science Center from 2011 to present.

Brood Year	Eggs	Release	Brood Year	Eggs	Release
1975	12,622	11,102[a]	1995	181,764	74,000
1976	24,150	0	1996	163,836	28,034
1977	10,500	2,723	1997	2,856	19,690
1978	33,430	12,196	1998	109,694	84,000
1979	3,703	2,523	1999	74,653	43,540
1980	32,983	8,769	2000	108,000	560
1981	687,529	2,930	2001[b]	0	0
1982	72,935	54,695	2002	120,144	940
1983	19,338	6,623	2003[c]	77,043	67,329
1984	103,519	86,366	2004[c]	52,141	69,569
1985	176,165	111,213	2005[c]	94,096	121,222
1986	183,921	97,942	2006	189,000	141,460
1987	146,679	81,248	2007	175,637	147,502
1988	171,000	43,863	2008	263,727	126,707
1989	121,000	49,787	2009	104,000	0
1990	120,000	70,669	2010	33,000	19,560
1991	127,649	31,071	2011	343,679	245,907
1992	142,499	96,134	2012[d]	2,785	1,320
1993	125,548	70,398	2013	90,119	
1994	92,607	46,468	2014	276,000	

Source: Sheldon Jackson Hatchery annual reports except for 1975–1979 data, which is from Sheldon Jackson Hatchery 2014 annual management plan. Unpublished documents obtained from Sam Rabung, ADF&G PNP coordinator, Juneau.

[a] Approximately 8,000 released in 1976 as fry, remainder released in 1977 as smolt.

[b] No eggs taken. Not enough broodstock available.

[c] Egg take at Medvejie Creek Hatchery. Not enough broodstock available at SJH.

[d] Minimal broodstock available.

Appendix C.–Chum salmon hatchery production history at Sheldon Jackson Hatchery (SJH). The hatchery was permitted to Sheldon Jackson College from 1975 to 2010, and to Sitka Sound Science Center from 2011 to present.

			Fry Release by Release Site	
Brood Year	Stock	Number Eggs	SJH	Deep Inlet
1975	Katlian River	75,185	70,000	
1976	Nakwasina River	206,821	176,887	
1977	No egg take			
1978	Nakwasina River	691,340	646,852	
1979	Sandy Cove	56,127	53,174	
1980	Nakwasina River and Hatchery combined	118,018	84,072	
1981	SJH	50,761	34,671	
	Sandy Cove	83,107	50,299	
	1981 Total	133,868	84,970	
1982	SJH	80,236	69,144	
	Sandy Cove	118,000	75,070	
	Nakwasina River	1,054,000	791,403	
	1982 Total	1,252,236	935,617	
1983	SJH	155,147	114,551	
	Sandy Cove	31,246	27,315	
	Nakwasina River	587,427	486,854	
	1983 Total	773,820	628,720	
1984	SJH	274,455	244,867	
	Sandy Cove	1,542,332	1,386,657	
	Nakwasina River	1,008,037	683,089	
	1984 Total	2,824,824	2,314,613	
1985	SJH	363,011	301,708	
	Sandy Cove	1,930,468	1,610,002	
	Deep Inlet	466,923	332,845	
	1985 Total	2,767,352	2,244,553	
1986	SJH	1,884,662	1,600,000	
1987	SJH	691,840	450,000	
1988	SJH	939,517	827,000	
1989	SJH	386,000	270,000	
1990	SJH	348,000	280,000	
1991	SJH	4,985	4,000	
1992	SJH	95,064	88,000	
1993	SJH	402,427	201,000	
1994	SJH	217,672	182,000	
1995	SJH	86,268	3,620,000	
	Medvejie Creek Hatchery	3,542,655		
	1995 Total	3,628,923	3,620,000	
1996	SJH	20,794	3,400,000	
	Medvejie Creek Hatchery	3,434,455		
	1996 Total	3,455,249	3,400,000	

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Brood Year	Stock	Number Eggs	Fry Release by Release Site SJH	Deep Inlet
1997	SJH	263,521	1,670,00	
	Medvejie Creek Hatchery	1,460,875		
	1997 Total	1,724,396	1,670,000	
1998	SJH	295,488	1,337,504	
	Medvejie Creek Hatchery	1,090,000		
	1998 Total	1,385,488	1,337,504	
1999	SJH	6,287,555	3,379,480	
	Medvejie Creek Hatchery	1,706,000		
	1999 Total	7,993,555	3,379,480	
2000	SJH	4,292,727	3,861,739	
2001	SJH	719,769	954,387	
	Medvejie Creek Hatchery	3,230,000		
	2001 Total	3,949,769	954,387	
2002	SJH	427,500	182,225	
2003	SJH	23,783	19,995	
	Medvejie Creek Hatchery	4,640,000	999,658	3,257,000
	2003 Total	5,123,783	1,015,653	3,257,000
2004	SJH	1,232,409	1,081,718	3,249,000
	Medvejie Creek Hatchery	3,590,000		
	2004 Total	4,822,409	1,081,718	3,249,000
2005	SJH	1,206,402	1,066,200	
	Medvejie Creek Hatchery	5,475,875		5,098,000
	2005 Total	6,682,277	1,066,200	5,098,000
2006	SJH	1,349,498	1,095,094	
	Medvejie Creek Hatchery	9,126,429		8,818,000
	2006 Total	10,475,927	1,095,094	8,818,000
2007	SJH	986,069	939,800	
	Medvejie Creek Hatchery	8,443,311		8,083,000
	2007 Total	9,429,380	939,800	8,083,000
2008	SJH	1,143,049	1,075,190	
	Medvejie Creek Hatchery	7,806,786		7,393,000
	2008 Total	8,949,835		7,393,000
2009	SJH	1,184,400	1,080,000	
	Medvejie Creek Hatchery	8,703,999		8,358,000
	2009 Total	9,888,399	1,080,000	8,358,000
2010	SJH	1,148,670	724,312	
	Medvejie Creek Hatchery	8,992,203		8,536,000
	2010 Total	10,140,873	728,489	8,536,000

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Appendix C.–Page 3 of 3.

Brood Year	Stock	Number Eggs	Fry Release by Release Site SJH	Fry Release by Release Site Deep Inlet
2011	SJH	542,571	430,436	
	Medvejie Creek Hatchery	8,254,667		7,630,000
	2011 Total	8,797,238	430,436	7,630,000
2012	SJH	1,191,264	809,816	8,516,000
	Medvejie Creek Hatchery	9,043,896		
	2012 Total	10,235,160	809,816	8,516,000
2013	SJH	3,285,138	2,946,059	
	Medvejie Creek Hatchery	9,295,799		8,765,000
	2013 Total	12,580,937	2,946,059	8,765,000
2014	SJH	915,329		
	Medvejie Creek Hatchery	11,140,768		
	2014 Total	12,056,097		

Source: 2014 Sheldon Jackson Hatchery Annual Management Plan except for 2013 and 2014 data, which is from Sheldon Jackson Hatchery 2014 annual report. Unpublished documents obtained from Sam Rabung, ADF&G PNP coordinator, Juneau.

Appendix D.–Chinook salmon hatchery production history at Sheldon Jackson Hatchery. The hatchery was permitted to Sheldon Jackson College from 1975 to 2010, and to Sitka Sound Science Center from 2011 to present.

Key: CCH=Crystal Creek Hatchery, SJH=Sheldon Jackson Hatchery, MCH=Medvejie Creek Hatchery.

Brood Year	Stock	Number Eggs	Smolt Released
1984	CCH	72,472	54,164
1985	CCH	52,712	46,649
1986	CCH	48,753	32,278
1987	CCH	115,129	96,692
1988	CCH	125,254	100,482
1989	SJH	58,000[a]	50,596
1990	SJH	155,255	94,092
1991	SJH	129,696	89,443
1992	SJH	130,917	103,391
1993	SJH	146,681	78,358
1994	SJH	121,044	57,792
1995	SJH	127,659	79,070
1996	SJH	150,644	41,323
1997	SJH	52,658	11,376
1998	SJH	241,254	88,124
1999	SJH	135,618	53,170
2000	SJH	38,987	28,320
2001	SJH	42,300	
2002	SJH	70,500	
2003	MCH		7,545[b]
2004	MCH		8,875[b]
2005	MCH	74,181	37,288
2006	MCH	71,193	45,427
2007	MCH	103,603	45,938
2008	MCH	140,184	90,926
2009	SJH and MCH	174,056	8,257
2010	SJH	115,269	87,200

Source: Sheldon Jackson Hatchery annual reports.

[a] Includes 9,000 eyed eggs from Crystal Lake Hatchery.

[b] From Medvejie Creek Hatchery, short-term reared at Crescent Bay and released.

Appendix E.–Sheldon Jackson Hatchery (SJH) Fish Transport Permits (FTP).

Key: MCH=Medvejie Creek Hatchery.

FTP Number	Issued	Expiration	FTP Summary
11J-1007	2011	2021	Permits collection of up to 3 million pink salmon eggs from SJH returns for incubation, rearing and release from SJH.
11J-1008	2011	2021	Permits collection of up to 1 million chum salmon eggs from SJH returns for incubation, rearing and release from SJH. In 2013, the permit was amended to increase the egg number from 1 million to 3 million eggs.
11J-1009	2011	2021	Permits transfer of the resultant fry of up to 9 million chum salmon eggs from MCH to Deep Inlet for release.
11J-1010	2011	2021	Permits collection of up to 1 million chum salmon eggs from MCH returns, transport of eggs to SJC for incubation, rearing and release from SJH. In 2013, the permit was amended to increase the egg number from 1 million to 3 million eggs.
11J-1011	2011	2021	Permits collection of up to 9 million chum salmon eggs from MCH returns. Fry release is permitted under FTP 11J-1009.
11J-1012	2011	2021	Permits collection of up to 9 million chum salmon eggs from SJH returns, incubation at SJH, and release at Deep Inlet.
11J-1013	2011	2021	Permits collection of up to 3 million pink salmon eggs from the Indian River for incubation, rearing and release from SJH.
11J-1014	2011	2021	Permits collection of up to 250,000 coho salmon eggs from SJH returns for incubation, rearing and release from SJH.
11J-1015	2011	2021	Permits collection of up to 250,000 coho salmon eggs from Indian River for incubation, rearing and release from SJH.
11J-1016	2011	2021	Permits collection of up to 9 million chum salmon eggs from SJH returns, transfer to and incubation at MCH, and release at Deep Inlet.