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An Evaluation of the Sheep Creek Salmon Hatchery for Consistency with Statewide Policies and Prescribed Management Practices

by

Mark Stopha

December 2014

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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AN EVALUATION OF THE SHEEP CREEK SALMON HATCHERY FOR CONSISTENCY WITH STATEWIDE POLICIES AND PRESCRIBED MANAGEMENT PRACTICES

by
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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.

This report reviews the Sheep Creek Salmon Hatchery (SCH) operated by the Douglas Island Pink and Chum Incorporated (DIPAC), a private nonprofit corporation. The facility is located in Gastineau Channel on the Juneau waterfront in Southeast Alaska. SCH was constructed by DIPAC in 1980 and is currently permitted to rear coho salmon *Oncorhynchus kisutch,* and pink salmon *Oncorhynchus gorbusha*.

The original broodstock for chum, pink, and coho salmon were from several area stocks. Juvenile salmon hatched at SCH were released from the hatchery and several release sites near Juneau. Chinook salmon smolts incubated and reared at other Southeast Alaska hatcheries were released from SCH saltwater netpens.

Hatchery operations were largely discontinued beginning in 1997. There is no egg incubation at the site today, but chum salmon incubated at Macaulay Salmon Hatchery (MSH) are reared and released from saltwater netpens at Sheep Creek. Chum salmon capacity at SCH was transferred to MSH in 2001. The current capacity for coho salmon at SCH is 150,000 eggs. The permitted capacity for pink salmon is uncertain from review of hatchery permitting documents. The basic management plan for SCH should be updated to reflect the current status of the hatchery and to clarify the current permitted pink salmon egg capacity.

Key words: Sheep Creek Salmon Hatchery, DIPAC, hatchery evaluation, hatchery, Douglas Island Pink and Chum, Incorporated, chum salmon hatchery, coho salmon hatchery, pink salmon hatchery

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

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

Salmon fishery restoration efforts came in response to statewide annual salmon harvests of 30 million fish, among the lowest catches since 1900 (Figure 1; ADF&G 2014). The FRED Division and PNPs engaged in a variety of activities to increase salmon production. New hatcheries were built to raise salmon, fish ladders were constructed to provide adult salmon access to previously non-utilized spawning and rearing areas, lakes with waterfall outlets too high for adult salmon to ascend were stocked with salmon fry, log jams were removed in streams to enable returning adults to reach spawning areas, and nursery lakes were fertilized to increase the available feed for juvenile salmon (FRED 1975). A combination of favorable environmental conditions, limited fishing effort, abundance-based harvest management, habitat improvement, and hatchery production gradually boosted salmon catches, with recent commercial salmon harvests (2004–2013) averaging 180 million fish.[1]

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

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

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

Pink salmon have the shortest life cycle of Pacific salmon (two years), provide a quick return on investment, and provide the bulk of Alaska hatchery production. From 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%; Farrington 2003, 2004; White 2005–2011; Vercessi 2012–2014).

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

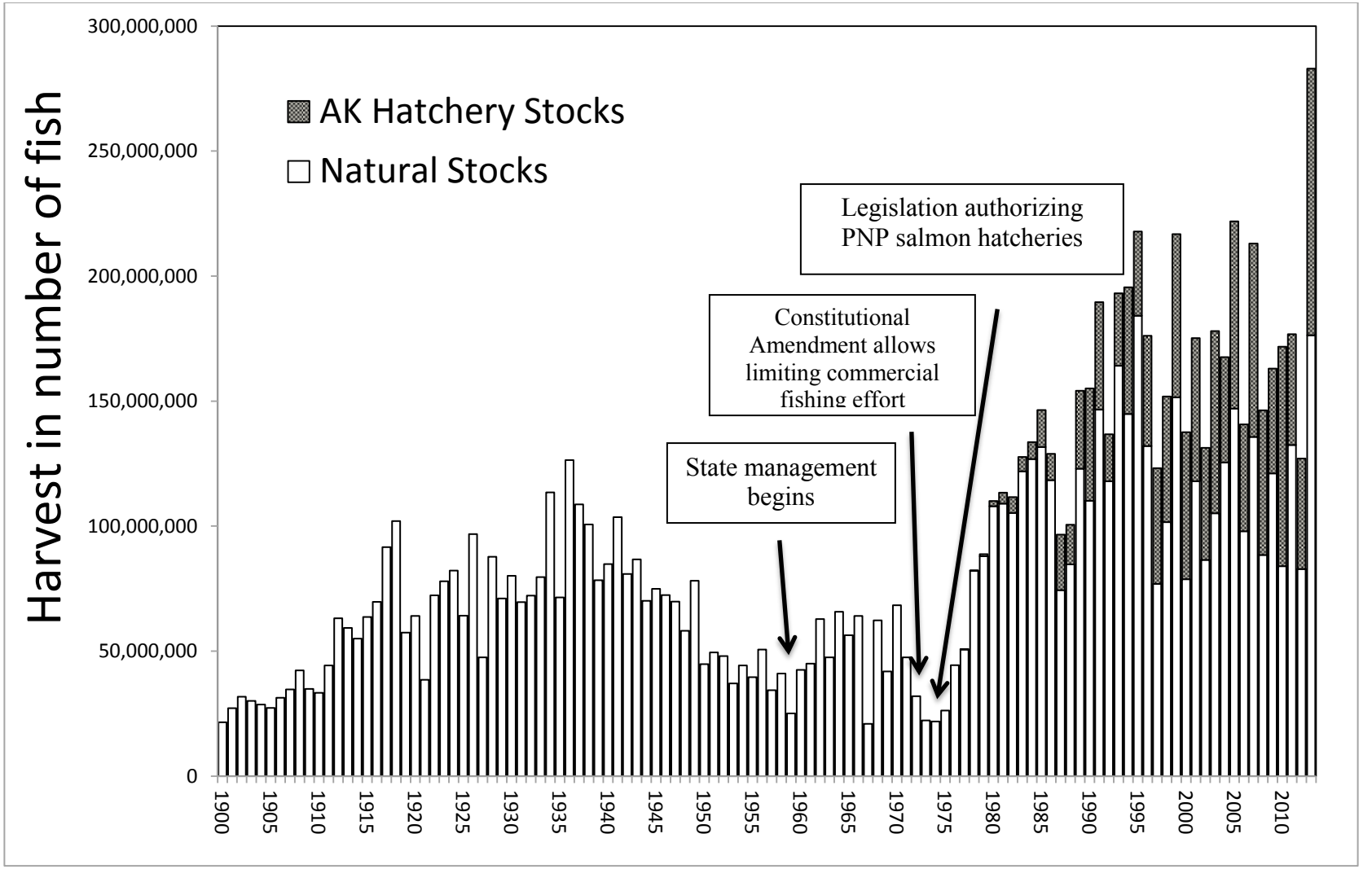

Figure 1.–Commercial salmon harvest in Alaska, 1900–2012. Source: 1900-1976 from Byerly et al. (1999).

Source: 1977–2013 from Vercessi (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 (Stopha 2013a).

Exvessel value[2] 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[3] 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 a third of the total Alaska salmon harvest, in numbers of fish (Farrington 2003, 2004; 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 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

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

[3] 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.

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, Figure 1) in history. The 2013 season was the first year the hatchery harvest alone exceeded 100 million fish, which was greater than the total statewide commercial salmon harvest in 1987 and every year prior to 1980 except for six 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 five salmon species harvested by all fishing gear types in all parts of the state. Achievement of statewide certification was a reflection of the state's commitment to abundance-based fisheries management and constitutional mandate to sustain wild salmon populations.

MSC-certified fisheries are reviewed every five years. When Alaska salmon fisheries were recertified in 2007 (Chaffee et al. 2007), a condition of certification was to "Establish and implement a mechanism for periodic formal evaluations of each hatchery program for consistency with statewide policies and prescribed management practices. This would include a specific evaluation of each program relative to related policies and management practices." (Knapman et al. 2009).

The Alaska Seafood Marketing Institute changed to a new sustainable fishery certification under the Food and Agriculture Organization in 2011 (Global Trust Certification Ltd. 2011). The hatchery evaluations started under the MSC certification program continued as an important systematic assessment of Alaska salmon fishery enhancement and its relation to wild stock production at a time of heightened interest for increased hatchery production and potential impacts on wild salmon production. ADF&G established a rotational schedule to review PNP hatchery programs. Musslewhite (2011a, 2011b) completed hatchery reviews for the Kodiak region in 2011, Stopha and Musslewhite (2012) completed the hatchery review for Tutka Bay Lagoon Hatchery in Cook Inlet, and Stopha (2012a, 2012b, 2013b, 2013c, 2013d, 2013e, 2013f, 2013g, 2013h, 2014) completed reviews of the Trail Lakes, Port Graham and Eklutna hatcheries in Cook Inlet and the Solomon Gulch, Gulkana, Main Bay, Cannery Creek, Wally Noerenberg and Armin F. Koernig hatcheries in Prince William Sound, and the Macaulay Salmon Hatchery (MSH) in Southeast Alaska. This report is for the Sheep Creek Hatchery (SCH) in Juneau in the Northern Southeast Alaska region. 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), *Regulation Changes, Policies, and Guidelines for Fish and Shellfish Health and Disease Control* (Meyers 2010), and fisheries management policies, such as the Sustainable Salmon Fisheries Policy (5 AAC 39.222). These policies are used by ADF&G staff to assess hatchery operations for genetic, health, and fishery management issues in the permitting process.

The State of Alaska ADF&G *Genetic Policy* (Davis et al. 1985; Davis and Burkett 1989) sets out restrictions and guidelines for stock transport, protection of wild stocks, and maintenance of genetic variance. Policy guidelines include banning importation of salmonids from outside the state (except 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.

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

These stock designations are interrelated with other restrictions of the *Genetic Policy*, including (1) hatchery stocks cannot be introduced to sites where the introduced stock may have interaction or impact on significant or unique wild stocks; (2) a watershed with a significant stock can only be stocked with progeny from the indigenous stocks; and (3) fish releases at sites where no interaction with, or impact on, significant or unique stock will occur, and which are not for the purposes of developing, rehabilitation, or enhancement of a stock (e.g., releases for terminal harvest or in landlocked lakes) will not produce a detrimental genetic effect. Davis and Burkett (1989) suggest that regional planning teams (RPTs) are an appropriate body to designate significant and unique wild stocks and wild stock sanctuaries. To date, only the Cook Inlet RPT has established significant stocks and wild stock sanctuaries. In Southeast Alaska, enhancement activities are generally prohibited in drainages on Forest Service lands, which make up the majority of land mass in the region. In this respect, the drainages represent de facto wild stock

sanctuaries (Duckett et al. 2010). 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, each of which is composed of six members: three from ADF&G and three appointed by the regional aquaculture association Board of Directors (5 AAC 40.310). According to McGee (2004), "Regional comprehensive planning in Alaska progresses in stages. Phase I sets the long-term goals, objectives and strategies for the region. Phase II identifies potential projects and establishes criteria for evaluating the enhancement and rehabilitation potentials for the salmon resources in the region. In some regions, a Phase III in planning has been instituted to incorporate Alaska Board of Fisheries approved allocation and fisheries management plans with hatchery production plans."

The *Alaska Fish Health and Disease Control Policy* (5 AAC 41.080) is designed to protect fish health and prevent spread of infectious disease in fish and shellfish. The policy and associated guidelines are discussed in *Regulation Changes, Policies, and Guidelines for Fish and Shellfish Health and Disease Control* (Meyers 2010). It includes regulations and guidelines for fish transports, broodstock screening, disease histories, and transfers between hatcheries. The *Alaska Sockeye Salmon Culture Manual* (McDaniel et al. 1994) also specifies practices and guidelines specific to the culture of sockeye salmon. As with the *Genetic Policy*, these regulations and guidelines are used by ADF&G fish pathologists to review hatchery plans and permits.

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

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

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

OVERVIEW OF HATCHERY PERMITS AND PLANS

The FRED Division built and operated several hatcheries across the state in the 1970s and gradually transferred operations of most facilities to PNP corporations. Regional aquaculture

associations (RAAs), comprised primarily of commercial salmon fishing permit holders, operate most of the PNP hatcheries in Kodiak, Cook Inlet, 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. RAAs may vote to impose a salmon enhancement tax on sale of salmon by permit holders in their region to finance hatchery operations and enhancement and rehabilitation activities. Independent PNP corporations, not affiliated with an RAA, also operate hatcheries in several areas of the state. Both the RAAs and independent PNP hatchery organizations may harvest salmon returning to their hatcheries or release sites to pay for operations. Several organizations have tourist and educational programs that contribute to the financial support of their programs, as well.

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

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

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

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

The AMP outlines operations for the current year and is in effect until superseded by the following year's AMP. It should "organize and guide the hatchery's operations, for each calendar year, regarding production goals, broodstock development, and harvest management of hatchery returns" (5 AAC 40.840). Typically, AMPs include the upcoming year's egg-take goals, fry or smolt releases, expected adult returns, harvest management plans, FTPs (described

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

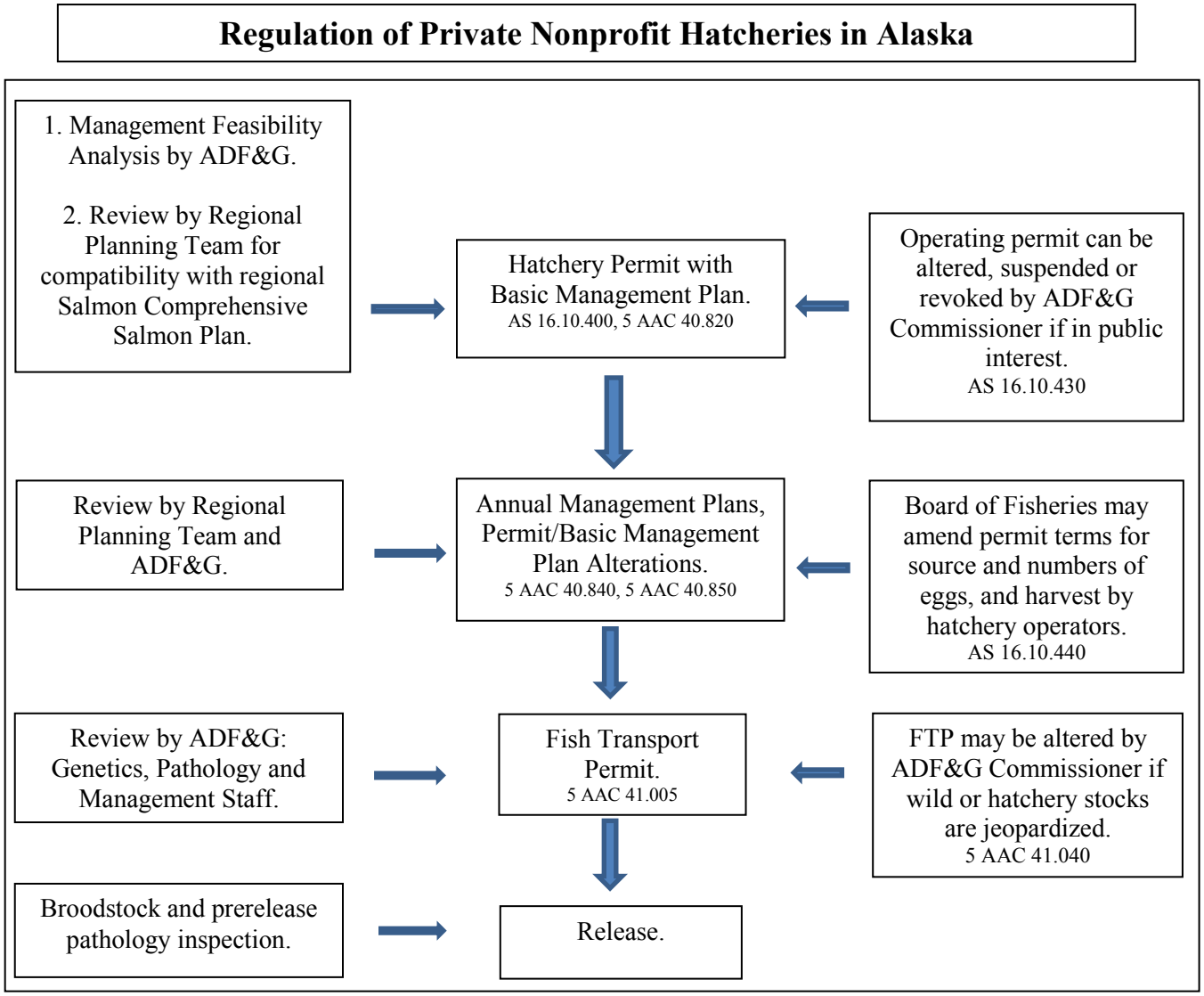

Figure 2.–Diagram of Alaska hatchery permitting process.

An FTP is required for egg collections, transports, and releases (5 AAC 41.001–41.100). The FTP authorizes specific activities described in the hatchery permit and management plans, including broodstock sources, gamete collections, and release sites. All 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 staff.

Each hatchery is required to submit an annual report documenting egg collections, juvenile releases, current year run sizes, contributions to fisheries, and projected run sizes for the following year. Information for all hatcheries is compiled into an annual ADF&G report (e.g., Vercessi 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 cultured, stock lineages, releases, returns, and pathology.

SHEEP CREEK SALMON HATCHERY OVERVIEW

Douglas Island Pink and Chum Incorporated (DIPAC) was incorporated as a nonprofit corporation in 1976 to "contribute, by artificial means, to the rehabilitation of the state's depleted and depressed salmon fishery, to further studies on fisheries research, and to build a self-perpetuating run of pinks and or chums in fresh water streams."

DIPAC started SCH in 1980 with construction of a dam, pipeline, holding pond and hatchery building.[4] Additional facilities for coho production were added in 1986.[5] DIPAC also operated Kowee Creek Hatchery (KCH) from 1976 to 1989, Snettisham Hatchery from 1996 to present, and MSH from 1990 to present (Figure 3). DIPAC is unique in Alaska in that it operates multiple hatcheries as an independent PNP hatchery corporation, rather than an RAA.

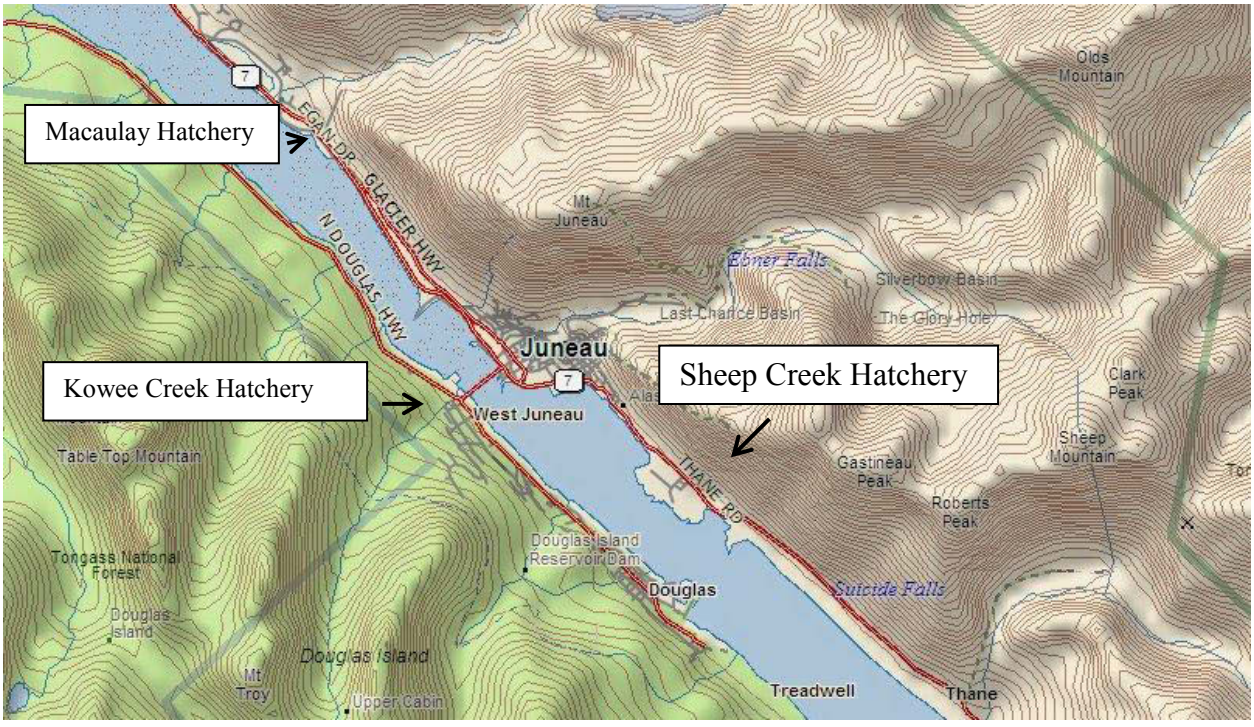

Figure 3.– Sheep Creek Salmon Hatchery and other area hatchery sites (Macaulay and Kowee).

[4] 1980 Annual Report for Sheep Creek Hatchery submitted by Ladd Macaulay, president, DIPAC. February 27, 1981 to ADF&G. Unpublished document acquired from Sam Rabung, ADF&G PNP Hatchery Coordinator, Juneau.

[5] Information from DIPAC website at http://dipac.net/facil.htm accessed on December 30, 2013.

DIPAC began the application process for a PNP hatchery permit at Sheep Creek in 1977. The preliminary application was for a hatchery capacity of 125,000 chum and 125,000 pink salmon eggs for release of fry at the hatchery. The water source for the hatchery was Sheep Creek. Suggested stock sources included Fish, Salmon, and Sheep creeks, Young Bay, and the Chilkat River.

ADF&G staff commented on the preliminary hatchery application. ADF&G Division of Sport Fish staff recommendations included maintaining sport fishing access for Dolly Varden at the Sheep Creek site and limiting the hatchery special harvest area (SHA)[6] to no further south than the Dupont Dock (about a mile south of the hatchery) to avoid impacts to Taku River Chinook salmon. Division of Sport Fish staff recommended sourcing chum salmon from the existing run at Sheep Creek. Division of Sport Fish staff recommended against using Fish and Salmon creek chum salmon sources, but gave no reason for the recommendation. Auke Creek was recommended as a suitable pink salmon source.[7]

ADF&G FRED Division staff comments included concerns for adequate water volume that would be able to supply water for egg incubation, short-term fry rearing, and natural spawning in Sheep Creek.[8]

ADF&G Division of Commercial Fisheries staff indicated that returns to the hatchery would likely contribute to area gillnet and troll fisheries. Staff also indicated that segregation of natural and hatchery stocks was probably adequate near the hatchery for terminal harvest and broodstock collection, but also noted net gear was not legal at the time in the proposed SHA. Staff noted that small natural runs in the area, including those to Kowee, Salmon, Sheep, Nevada and Ready Bullion creeks would be considered expendable if the hatchery was established. Staff indicated that Salmon and Fish creeks[9] stocks were adequate donor streams within 10 miles of the hatchery, but that these stocks would probably not provide many fish because the stocks were depressed. Admiralty Creek was noted as the closest major system that could supply sufficient donor stock.[10]

The final application was submitted in December 1977.[11] The application requested a hatchery capacity of 20 million pink and/or chum salmon fry at full capacity. The National Marine Fisheries Service comments on the final application for SCH included concern for the possible genetic impacts to the existing wild stocks at Sheep Creek, which included pink and chum salmon. The ADF&G commissioner responded that using the small populations at Sheep Creek for broodstock would take an inordinate amount of time to reach the broodstock levels required to operate the hatchery at a desired capacity, and the genetic effects would be weighed against the time to develop the hatchery broodstock:

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[6] A designated body of water where hatchery returns are harvested by the hatchery operator and the common property fishery.

[7] Memorandum dated June 6, 1977 from Richard Marriott, area management biologist, ADF&G Division of Sport Fish to Rita Miller, Division of Commercial Fisheries. Unpublished document acquired from Sam Rabung, ADF&G PNP Hatchery Coordinator, Juneau.

[8] Memorandum dated May 16, 1977 from Ken Leon, acting regional supervisor, ADF&G FRED Division to Carl Rosier, director of the ADF&G Division of Commercial Fisheries. Unpublished document acquired from Sam Rabung, ADF&G PNP Hatchery Coordinator, Juneau.

[9] There are 2 Fish Creek streams near Juneau. One is on Douglas Island and the other is a tributary of the Taku River.

[10] Questionnaire for the Sheep Creek Hatchery preliminary application from the ADF&G Division of Commercial Fisheries, dated May 16, 1977. Unpublished document obtained from Sam Rabung, ADF&G PNP Hatchery Coordinator, Juneau.

[11] Final hatchery application for Sheep Creek hatchery submitted by DIPAC to ADF&G dated December 16, 1977. Unpublished document obtained from Sam Rabung, ADF&G PNP Hatchery Coordinator, Juneau.

> "A comparison must be made, in this circumstance, between increased time for brood development using Sheep Creek stock only, versus the risk encountered by utilizing 2 or 3 stocks for brood development. ADF&G personnel have concluded that the stocks in question are not so dissimilar that genetic variation of detrimental magnitude would be incurred if used in brood development. In our analysis, "detrimental" was, of course, weighed against the increased time for brood development if only a single stock were utilized. Implicitly, then, the tradeoff between utilizing one or several stocks and the "genetic risk" involved was made against the time required for brood development using one or several stocks. The judgment was made that the genetic risk did not offset the benefits derived from shortening the broodstock development time by using 2-3 stocks. Our reasoning predicated in part, in that the biological and ecological requirements of these stocks appear close."[12]

SCH salmon would return at the same time as returns to KCH and the proposed hatchery at Salmon Creek (site of the present day MSH). The three facilities were located on Gastineau Channel in the city of Juneau.[13] DIPAC owned KCH, and the Salmon Creek facility was owned by a PNP operated through the Southeast Gillnet Federation. All three facilities proposed to raise pink and chum salmon. Managing these stocks for return to their respective facilities would be complex and may have been the reason the public hearing for SCH did not occur until June 1979 due to extensive discussions among the users and ADF&G regarding hatchery return management.

Multiple concerns were raised on the final application by ADF&G staff and those attending the public hearing regarding harvest of hatchery returns in Gastineau channel. What gear would be permitted? How would hatcheries discreetly harvest their own fish when fish from all hatcheries returned en masse to Gastineau Channel? How would the sport fishery in the channel be impacted by harvest of hatchery fish? Where would broodstock be contained until ripe? [14] DIPAC staff anticipated harvesting fish by beach seine at the mouth of Sheep Creek.[15] Representatives of the hatchery facilities proposed an agreement to allow chartered gillnet vessels to harvest cost recovery fish for the hatcheries under a cooperative agreement that would be developed and approved through the Board of Fisheries.[16]

Alaska PNP Salmon Hatchery Permit number 11 was issued to DIPAC for SCH in September 1979. The hatchery was permitted for 5 million pink and chum salmon eggs combined. The permit listed Kowee, Sheep and Fish creeks, all which flow into Gastineau Channel, as primary pink and chum salmon broodstock sources. Admiralty Creek on Admiralty Island was listed as an alternate stock source.

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[12] Letter from Don W. Collinsworth, ADF&G Deputy Commissioner to Harry L. Reitze, Director, Alaska Region, National Marine Fisheries Service, dated July16, 1979. Unpublished document obtained from Sam Rabung, ADF&G PNP Hatchery Coordinator, Juneau.

[13] Letter from Don W. Collinsworth, ADF&G Deputy Commissioner to Joe Davis, ADF&G Acting Salmon Enhancement Coordinator and Barbara Norris, ADF&G fishery biologist, F.R.E.D. Division dated February 14, 1979. Unpublished document obtained from Sam Rabung, ADF&G PNP Hatchery Coordinator, Juneau.

[14] Memorandum from Ladd Macaulay, DIPAC to Ronald Skoog, ADF&G commissioner dated May 18, 1978. Unpublished document obtained from Sam Rabung, ADF&G PNP Hatchery Coordinator, Juneau.

[15] Memorandum from Ladd Macaulay, DIPAC to Ronald Skoog, ADF&G commissioner dated May 18, 1978. Unpublished document obtained from Sam Rabung, ADF&G PNP Hatchery Coordinator, Juneau.

[16] Memorandum from Bob Wilbur, ADF&G regional supplemental production coordinator to Mike Kaill ADF&G salmon rehabilitation, enhancement coordinator dated May 2, 1978. Unpublished document obtained from Sam Rabung, ADF&G PNP Hatchery Coordinator, Juneau.

The BMP for SCH indicated a future production goal of 20 million pink and chum eggs, but with a cautionary note that this would depend largely on developing a workable harvest of hatchery returns. The initial egg take for 1980 was limited to 300,000 pink and chum salmon eggs. A combined limit of pink and chum salmon eggs provided flexibility should hatchery pink salmon production unduly complicate wild stock pink salmon purse seine fisheries in Icy and Chatham straits. The BMP also indicated a future goal to produce coho and Chinook salmon for Juneau area sport fisheries.

Several amendments have been added to the SCH hatchery permit and BMP since the hatchery permit was issued (Appendix A). The current permitted capacity for SCH is 150,000 coho salmon eggs, but the capacity for pink salmon is uncertain. In 1984, the SCH permit was amended for a permitted capacity of 40 million pink and chum salmon eggs combined. In 2000, chum salmon capacity was limited to 10 million eggs, but the 40 million total egg capacity for chum and pink salmon was not changed. A year later, a permit amendment transferred the remaining 10 million chum salmon egg capacity to MSH, but the amendment did not specify the remaining capacity at SCH.

ADF&G issues annual reports on the Alaska Salmon Enhancement program (e.g., Vercessi 2014). In reviewing the annual enhancement reports, the first time a table appears listing permitted hatchery capacities is the 2001 report (McNair 2002). From 2001 to 2006, the hatchery capacity table showed Sheep Creek with a permitted capacity of 10 million pink and 150,000 coho salmon eggs. In 2007, the permitted capacity went to just 150,000 coho salmon eggs and the pink salmon capacity was no longer listed. It is unclear where this 10 million egg capacity figure came from, if it was an error, or why the number was deleted after 2007.

In 1987, when the MSH permit was issued, the BMP for MSH stated that DIPAC had a combined maximum permitted capacity of 50 million pink salmon eggs among DIPAC's three hatcheries operating at the time (Kowee, Macaulay and Sheep Creek hatcheries).[17] Therefore, a total production limit of 50 million pink salmon is clearly in place for DIPAC facilities. The uncertainty lies in the current permitted level of production allowed at SCH.

At hatchery startup, DIPAC requested use of chum and pink salmon stocks from Salmon Creek, the site of the present day MSH. The ADF&G deputy commissioner denied this request because of the presence of Bacterial Kidney Disease (BKD) in the Salmon Creek stocks, per ADF&G policy not to introduce potentially diseased fish into a hatchery that had never experienced a problem with BKD.[18]

Chum salmon broodstock at SCH originated from a conglomeration of stock origins, including Fish, Salmon, Kowee and Sawmill creeks near Juneau, and the Klehini River near Haines. These donor stocks represent the donor stocks to the Kowee, Sheep Creek, Salmon Creek and Macaulay Salmon hatcheries. The hatchery sites are near each other in Gastineau Channel and although broodstock was not permitted to be obtained directly from Salmon Creek as stated above, all stocks, including Salmon Creek, were likely included in the broodstock of SCH. Hidden Falls Hatchery-origin chum salmon, comprised of three Chatham Strait stocks

[17] Section 1.1 of salmon hatchery permit number 25 and Basic Management Plan issued for MSH, June 3, 1987. Unpublished document obtained from Sam Rabung, ADF&G PNP Hatchery Coordinator, Juneau.

[18] Letter from Steven Pennoyer, ADF&G Deputy Commissioner to Ladd Macaulay, DIPAC, dated July 25, 1984. Unpublished document obtained from Sam Rabung, ADF&G PNP Hatchery Coordinator, Juneau.

(Kadashan, Seal Bay Cove and Clear River), were also reared at SCH and likely a part of the SCH chum salmon lineage.

SCH pink salmon stock ancestry is from Fish Creek (Douglas Island).

According to SCH annual reports, coho salmon ancestry included broodstock taken from Montana Creek in 1985 and 1987, and from Steep Creek in 1986. Both streams are tributaries of the Mendenhall River watershed in Juneau.

Pink salmon egg collections and subsequent releases peaked from 1983 to 1986 (Appendices B and C). Pink salmon returns peaked in 1987, but because pink salmon releases from SCH were not marked, contributions to the fisheries were gross estimates based on applying an estimated harvest rate in the commercial fishery to the estimated number of fish that reached the hatchery[19] and/or an assumed survival rate of released fry[20] (Appendix D).

Chum salmon egg takes peaked at 31.9 million from 1988 (Appendix E) and fry releases at over 30 million the following year (Appendix F). Chum salmon were marked initially with coded-wire tags and later (ca. 1993) by otolith thermal marking. Prior to 1996, estimates of SCH contributions to the fisheries were made based on increases from earlier historic-average harvests.[21] Beginning in 1996, recovery of otoliths from the commercial fishery provided additional information for estimating SCH contribution to the harvest.[22] During several years, SCH chum salmon eggs were collected and transferred to MSH, where they were incubated and otolith marked together with MSH eggs. The resulting SCH and MSH fry were released together at Limestone Inlet, Amalga Harbor, Boat Harbor and MSH. Releases and returns to these release sites were all allocated to MSH stock fish. Therefore, fry releases and return values of SCH stock chum salmon (Appendix G) reported in the annual reports are considered minimum estimates.

Coho salmon egg takes ranged from about 38,000 in 1987 to 1.4 million in 1998 (Appendix H). Peak releases of over 500,000 smolt occurred in 1990 to 1991 (Appendix I). Coho salmon broodstock taken at the hatchery were recorded in five years from 1988 to 2001, but no estimates of SCH harvest in the fisheries were reported (Appendix J).

Chinook salmon eggs and fry were not reared at SCH. Chinook salmon smolt incubated and reared at other facilities smolt were released from SCH saltwater net pens from 1986 to 1991. Small returns were recorded in 1988 and from 1993 to 1995.

In 1997, DIPAC demobilized the Sheep Creek saltwater rearing and release site, and all chum salmon production at SCH was moved to MSH.[23] Broodstock and harvest operations continued at SCH through 2001. SCH was renovated to provide overwinter fresh water rearing space for a portion of MSH coho production to improve smolt quality and increase ocean survival by decreasing rearing densities at MSH.[24] Coho salmon eggs are incubated at MSH, reared at SCH,

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[19] Memo from Jerry Madden, ADF&G to Ladd Macaulay dated February 8, 1988. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

[20] Ron Josephson, ADF&G, personal communication.

[21] 1992 Sheep Creek Annual Report submitted to ADF&G. Unpublished document obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.

[22] 1996 DIPA Annual Report.

[23] 1997 Sheep Creek Hatchery annual report submitted by DIPAC. Unpublished document obtained from Sam Rabung, ADF&G PNP Hatchery Coordinator, Juneau.

[24] 1998 Annual Management Plan for Gastineau, Sheep Creek and Kowee Creek Hatcheries. Unpublished document obtained from Sam Rabung, ADF&G PNP Hatchery Coordinator, Juneau.

and returned to MSH to saltwater net pens for imprinting and released. In addition, SCH provides coho salmon research space for University of Alaska staff. Beginning in 2002, DIPAC resumed rearing and releasing MSH chum salmon at the SCH saltwater net pen site.[25]

PROGRAM EVALUATIONS

Hatchery permits, BMP, AMP, and FTP documents (Appendices K, L, and M) for MSH 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.

In comparing the levels permitted in the hatchery permit, AMP and FTP with the reported egg collection or release in the annual report, few discrepancies were found for pink salmon. For brood years 1983 and 1985, egg collections and releases significantly exceeded the level permitted in the FTP (Appendix N).

For chum salmon, beginning in 1993, eggs from SCH were incubated at MSH, and fry from both MSH and SCH stocks were reared together and released at various release sites. These are hereafter denoted as MSH(SCH) stock. SCH was the donor stock for MSH and utilized up through brood year 2001. Although the FTPs for releases were for either SCH or MSH stocks, by 1993, these were essentially the same stock and therefore considered valid under the FTP guidelines. Were the two facilities not in such close proximity to each other, the mixing and release of mixed stocks without a specific FTP authorizing the release might be considered an action contrary to the intent of the FTP process (Appendix O).

For coho salmon, in 1987, Montana Creek stock coho salmon fry were released from MSH. The only FTP found for release of Montana stock coho salmon was FTP 85J-1078, which permitted release at SCH, rather than MSH (Appendix P).

COMPREHENSIVE SALMON ENHANCEMENT PLAN

RPTs in Southeast Alaska have developed three phases of Comprehensive Salmon Plans (CSP) to date. Phase I was issued in 1981, and established the philosophy and goals for Southeast Alaska. The mission statement of the plan was "To promote, through sound biological practices, activities to increase salmon production in Southeast Alaska for the maximum social and economic benefit of the users consistent with public interest." Harvest objectives were established in the Phase I CSP, and methods for bridging the gap between the harvest goal and the natural and enhanced production at the time were developed.

Chum salmon comprised most of SCH's production. According to the Phase I CSP (Joint Southeast Alaska Regional Planning Teams 1981), the highest Southeast Alaska chum salmon harvest in at the time of the issuance of the Phase I CSP in 1981 was 9,350,000 fish in 1918. The highest average consecutive 30-year harvest of 5,200,000 chum salmon occurred between 1915 and 1944. After 1954, chum salmon runs declined sharply, with the regionwide harvest falling

[25] 2002 Annual Management Plan for Gastineau, Sheep Creek and Kowee Creek Hatcheries. Unpublished document obtained from Sam Rabung, ADF&G PNP Hatchery Coordinator, Juneau.

below one million chum salmon in the late 1970s. The Northern Southeast Alaska chum salmon harvest showed a similar dynamic to the regionwide harvest (Figure 4).

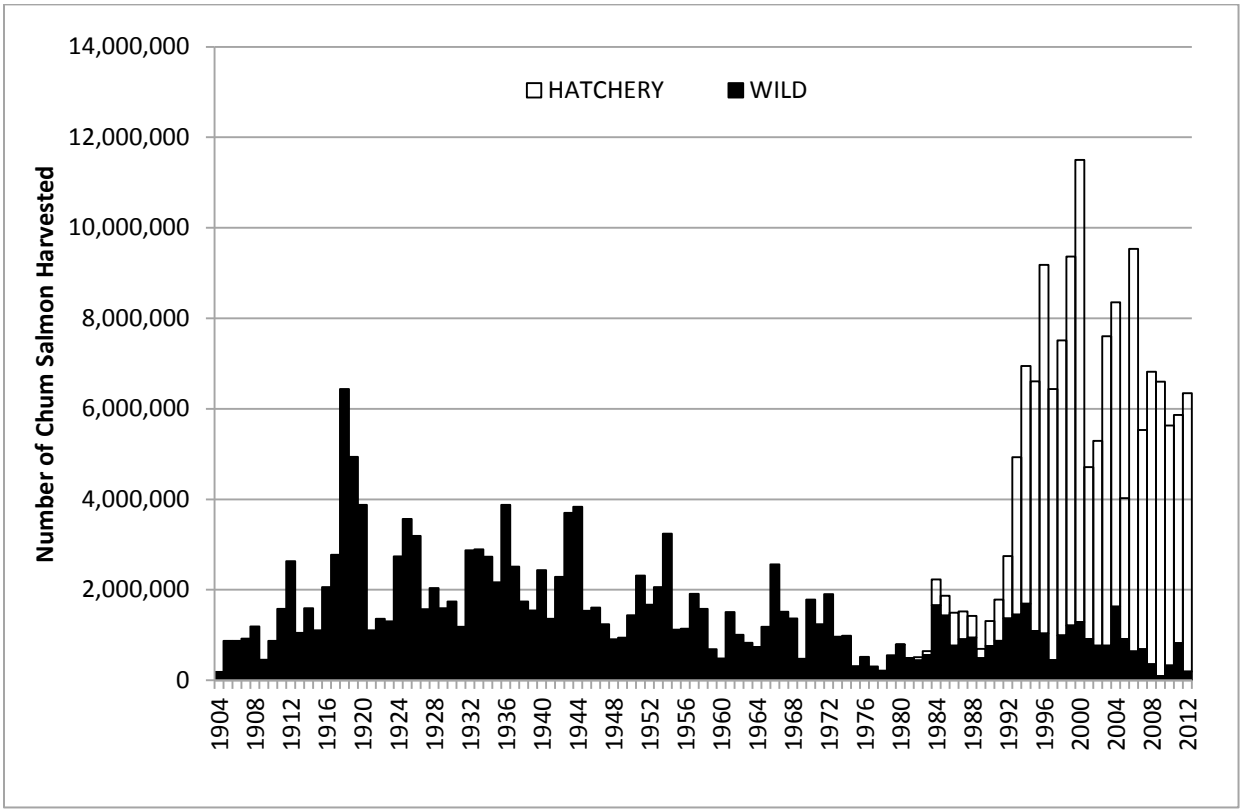

Figure 4.–Chum salmon commercial harvest, including hatchery cost recovery, in Northern Southeast Alaska, 1904–2012. Hatchery component includes contributions from all hatcheries.

Source: 1985–2012 ADF&G ZEPHYR database and hatchery database accessed 12/04/2013 by Lorraine Vercessi, ADF&G PNP Assistant Coordinator, Juneau. 1904–1984 data from Byerly et al. 1999.

The Phase I CSP indicated a 15-year average chum salmon harvest of 1.7 million was the achievable long-term wild stock production for this species. Some of the salient points of the Phase I document with regard to SCH production included the NSRAA objectives to (1) increase Chinook and coho salmon for hand troll and sport fishing in the Juneau area; (2) produce summer chum salmon for gillnet in areas with little or no current fishing pressure, especially in the Lynn Canal, Lower Stephens Passage and Gastineau Channel; (3) produce fall chum salmon in the Chilkat River area and Lower Stephens Passage gillnet harvest areas; and (4) produce chum salmon for seine harvest in lower Stephens Passage.

Salmon processors indicated an increasing demand for chum and pink salmon as an inexpensive frozen fish. Processors preferred chum salmon to pink and sockeye salmon because its relatively large size was ideal for processing salmon steaks. A special demand was expressed for fall chum salmon to fill a volume gap after the coho season waned. Chum salmon was the most preferred species for major hatchery production with respect to management because they were less likely to disrupt management precision. Summer chum salmon would enter existing fisheries managed

for sockeye and pink salmon, and fall chum salmon could generally be discretely managed and discretely harvested in most areas of Southeast Alaska, except where significant fall chum salmon stocks occur naturally.

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.

For Phase II CSP planning, the RPTs for northern and southern Southeast Alaska developed separate plans. SCH is located in northern Southeast Alaska. The northern Southeast Alaska CSP Phase II was issued in 1982 (NSERPT 1982). The purpose of the Phase II CSP was to identify and prioritize enhancement opportunities within five defined geographical units of northern Southeast Alaska: Outer Coastal Unit, Icy Strait/Chatham Strait Unit, Frederick Sound Unit, Stephens Passage Unit, and Lynn Canal Unit. SCH and SCH release sites are located within the Lynn Canal and Stephens Passage units, and SCH returns were harvested in these two units, as well as in the Chatham Strait/Icy Strait, Outer Coastal and Frederick Sound units (Figure 5). The Phase II CSP was to provide direction to the efforts of the many government agencies and private groups involved with salmon (e.g., ADF&G, U.S. Forest Service, National Marine Fisheries Service, RAAs and independent hatchery PNP operators), and to prevent and resolve conflicts over the use and development of the region's salmon resources. Beginning in 1986, the Phase II plan was updated annually through 1996. SCH chum, pink, and coho salmon production during this period supported the Phase II plan goals.

The Phase II CSP identified gaps between the harvest objectives and current harvests for Lynn Canal and Stephens Passage. For the Lynn Canal unit, the harvest gap included 5,000 Chinook, 100,000 sockeye, 50,000 coho, 500,000 pink and 700,000 chum salmon. For Stephens Passage unit, the gap included 0 Chinook, 160,000 sockeye, 25,000 coho, 500,000 pink and 100,000 chum salmon. These targets were to "provide an equitable distribution of production to serve user needs, while considering the limitations imposed by the availability of opportunities and requirements for effective management of wild and enhanced stocks. It is the accepted principle throughout this plan that mixed stock harvests will be managed on the basis of wild run strength, and the unit targets will direct enhancement to areas where it is believed that enhanced stocks can be harvested without ill effects on wild stocks or their management." Recommended hatchery enhancement activities during the five years of this first Phase II plan included investigation of stocking sockeye salmon in Canadian lakes in the Taku River drainage (part of the Stephens Passage Unit), expansion of existing hatcheries (including SCH) in the Stephens Passage, development of chum salmon release sites in the Lynn Canal Unit, and production of pink salmon at SCH.

Drift gillnet and hook and line (troll) are legal gears in Lynn Canal and Stephens Passage Units. Purse seining is allowed for common property and cost recovery harvest in the MSH SHA at Amalga Harbor, and for cost recovery only in Gastineau Channel. A substantial salmon sport fishery occurs in the Lynn Canal and Stephens Passage units.

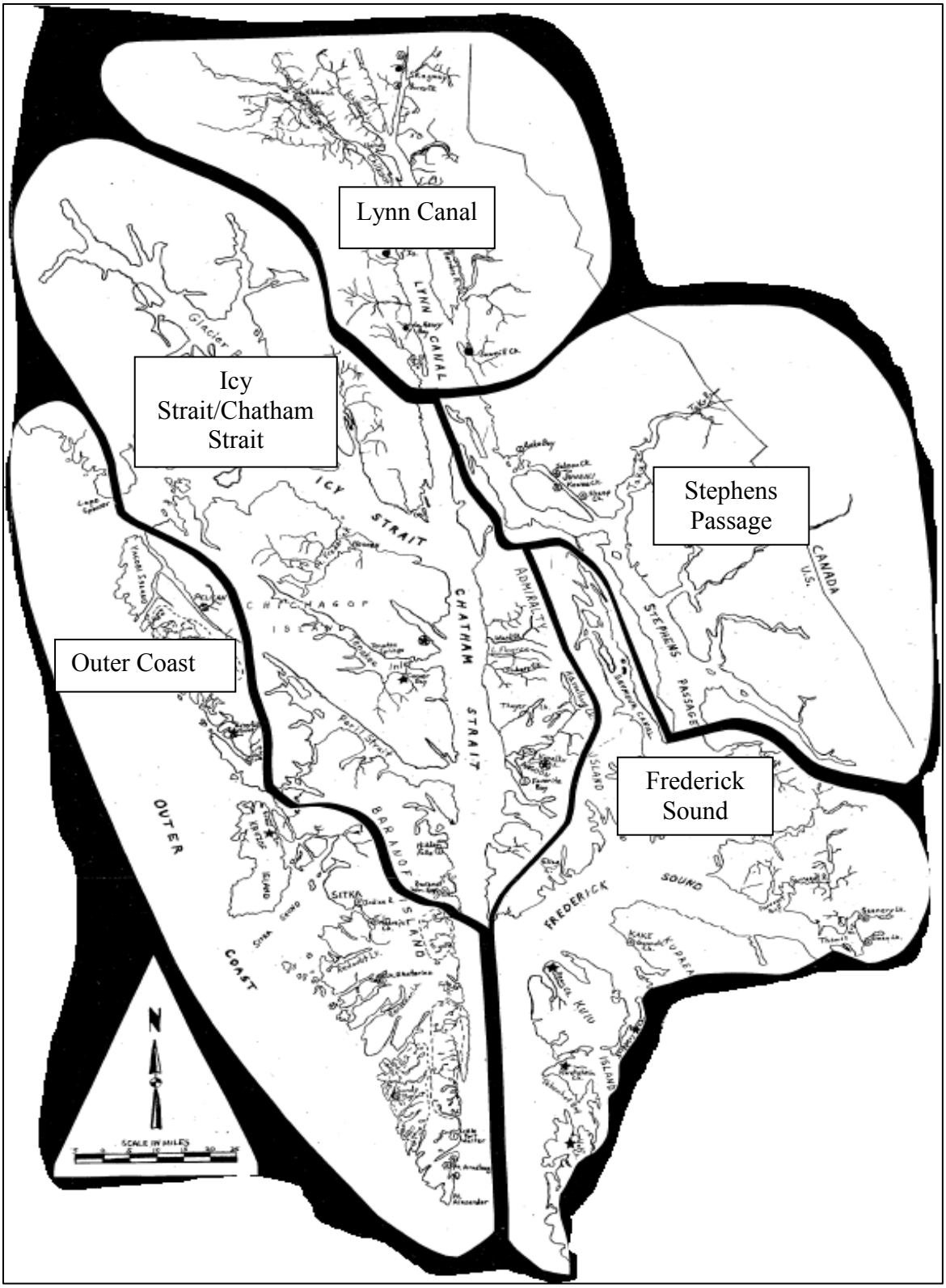

Figure 5.–Commercial fishing units for northern Southeast Alaska as described in the Phase II CSP.

Source: Northern Southeast Regional Planning Team (1982).

The gillnet fishery in northern Southeast Alaska is directed primarily toward runs of sockeye and chum salmon to the Taku, Chilkat, and Chilkoot systems. In Lynn Canal and Stephens Passage, early-summer sockeye, mid-summer pink salmon, and fall chum salmon are the predominant wild stocks. Summer chum salmon was the only species recommended for hatchery production for the gillnet fishery in the first Phase II plan because returning chum salmon would have temporal separation from important wild Chinook, sockeye, coho, and fall chum salmon runs. Production of summer chum salmon would also extend the gillnet fishery season by providing returns during the slow summer period between sockeye and fall chum salmon runs. The Phase II CSP also recommended assessment and development of release site techniques.

Sockeye production was also important in the Phase II plan. At the time, technology was not fully developed for sockeye hatchery production to the smolt stage for release because of infectious hematopoietic necrosis virus (IHNV) disease. Sockeye enhancement involved collecting eggs from wild broodstock, incubating and hatching the eggs in the hatchery, and returning the fry to the natal system of their parents. By the mid 1990s, hatchery techniques for rearing sockeye salmon to the smolt stage had been refined at Snettisham Hatchery, with a total return in 1995 of about 486,000 fish (ADF&G 1996).

In 1985, significant changes in hatchery production occurred in Southeast Alaska due to the U.S./Canada Pacific Salmon Treaty. From 1986 to 1992, $20 million of funding was made available for fishery enhancement projects to mitigate the harvest restrictions imposed on Southeast Alaska fishers by the treaty agreement. Enhancement from Pacific Salmon Treaty mitigation funds initially focused on hatchery production of Chinook salmon (NSERPT 1986). Sockeye, coho and chum salmon program funding was added in subsequent years. As a result, production goals for Southeast Alaska in the U.S./Canada Pacific Salmon Treaty Mitigation program of 100,000 Chinook, 20,000 sockeye and 1 million chum salmon were part of the 1988 Phase II update as well (NSERPT 1989).

The Phase III CSP (Duckett et al. 2010) was issued in 2004 and 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) release site has an adequate freshwater supply for adequate 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. The Phase III CSP also provides an extensive history of Southeast Alaska fisheries and salmon enhancement.

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 the *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 five stock characteristics of consideration: wildness, uniqueness, isolation, population size, population trend and the stock's economic and/or cultural significance (fishery support).

The Phase III plan 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."

CONSISTENCY WITH POLICY

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

Table 1.–Key elements of the ADF&G *Genetic Policy*.

I. Stock Transport	
Use of appropriate local stocks	This element addresses Section I of the *Genetic Policy*, covering stock 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.
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.
Interaction with or impact on significant wild stocks	Priority is given to protection of significant wild stocks from harmful interactions with introduced stocks. Stocks cannot be introduced to sites where they may impact significant or unique wild stocks.
Use of indigenous stocks in watersheds with significant wild stocks	A watershed with a significant wild stock can only be stocked with progeny from the indigenous stocks. The policy also specifies that no more than one generation of separation from the donor system to stocking of the progeny will be allowed.
Establishment of wild stock sanctuaries	Wild stock sanctuaries should be established on a regional and species basis. No enhancement activities would be allowed, but gamete removal would be permitted. The guidelines and justifications describe the proposed sanctuaries as gene banks of wild type variability.
Straying impacts	Prevention of detrimental effects of gene flow from hatchery fish straying and interbreeding with wild fish.
III. Maintenance of genetic variance	
Maximum of three hatchery stocks from a single donor stock	A maximum of three hatchery stocks can be derived from a single donor stock. Offsite releases, such as for terminal harvest, should not be restricted by this policy if the release sites are selected so that they do not impact significant wild stocks, wild stock sanctuaries, or other hatchery stocks.
Minimum effective population size	The policy recommends a minimum effective population size of 400. It also recognizes that small population sizes may be unavoidable with Chinook salmon and steelhead.
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.

Table 2.–Key elements of Alaska policies and regulations pertaining to fish health and disease.

Fish Health and Disease Policy (5 AAC 41.080)	
Egg disinfection	Within 48 hours of taking and fertilizing live fish eggs or transporting live fish eggs between watersheds, all eggs must be treated with an iodine solution. This requirement may be waived for large scale pink and chum salmon facilities where such disinfection is not effective or practical.
Hatchery inspections	According to AS 16.10.460, inspection of the hatchery facility by department inspectors shall be permitted by the permit holder at any time the hatchery is operating.
Disease reporting	The occurrence of fish diseases or pathogens listed in 5 AAC 41.080(d) must be immediately reported to the ADF&G Fish Pathology Section.
Pathology requirements for Fish Transport Permits (FTPs) (5 AAC 41.005 – 41.060)	
Disease history	Applications for FTPs require either a complete disease history of the stock or a broodstock inspection and certification if the disease history is not available.
Isolation measures	Applications must list the isolation measures to be used during transport, including a description of containers, water source, depuration measures, and plans for disinfection.
Pathology review of FTPs	Each application is reviewed by the pathologist, who then makes a recommendation to either approve or deny it. The pathologist may also recommend to the commissioner terms or conditions to the permit to protect fish health. Transports of fish between regions are discouraged.

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

Sustainable Salmon Fishery Policy (5 AAC 39.222)	
I. Management principles and criteria	
Assessment of wild stock interaction and impacts	As a management principle, the effects and interactions of introduced or enhanced salmon stocks on wild stocks should be assessed. Wild stocks should be protected from adverse impacts from artificial propagation and enhancement efforts.
Use of precautionary approach	Managers should use a conservative approach, taking into account any inherent uncertainty and risks.
Salmon Escapement Goal Policy (5 AAC 39.223)	
Establishment of escapement goals	Management of fisheries is based on scientifically based escapement goals that result in sustainable harvests.
Mixed Stock Salmon Fishery Policy (5 AAC 39.220)	
Wild stock conservation priority	The conservation of wild stocks consistent with sustained yield is the highest priority in management of mixed stock fisheries.
Fisheries management review of FTPs (5 AAC 41.010 – 41.050)	
Review by management staff	All proposed FTPs are reviewed by the regional supervisors for the Divisions of Commercial Fisheries and Sport Fish, the deputy director of Commercial Fisheries, and the local Regional Resource Development Biologist before consideration by the commissioner of ADF&G. Department staff may recommend approval or denial of the permit, and recommend permit conditions.

Genetics

The chum salmon broodstock at SCH originated from a conglomeration of stock origins, including Fish, Salmon, Kowee and Sawmill creeks near Juneau, Klehini River near Haines, and Hidden Falls Hatchery-origin chum salmon, comprised of three Chatham Strait stocks (Kadashan, Seal Bay Cove and Clear River). These donor stocks represent the donor stocks to the Kowee, Sheep Creek, Salmon Creek and Macaulay Salmon hatcheries. The hatchery sites are near each other in Gastineau Channel, and therefore all of these stocks were likely included in the broodstock of SCH due to intermingling of returning adults. Initially, Kowee Creek Hatchery donated broodstock to SCH. SCH later donated broodstock to MSH through 2001.

Pink salmon broodstock originated from the Kowee Creek Hatchery, whose donor stock was from Fish Creek on Douglas Island.

The initial coho salmon broodstocks originated from Montana and Steep creeks near Juneau. Several FTP applications for use of other stocks of coho salmon were denied based on genetic concerns (Appendix M).

None of the stocks used at SCH were used simultaneously at more than three hatchery facilities.

Table 4.–The Sheep Creek Salmon Hatchery fishery enhancement program and its consistency with elements of the ADF&G *Genetic Policy* (see Table 1).

I. Stock Transport	
Use of appropriate local stocks	SCH used broodstock from within the northern Southeast Alaska region.
II. Protection of wild stocks	
Identification of significant or unique wild stocks	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 the *Genetic Policy*. Presumably these appraisal tools would be applied for any new SCH projects.
Establishment of wild stock sanctuaries	No wild stock sanctuaries are designated for northern Southeast Alaska by the Regional Planning Team. Many streams in Southeast Alaska are on Forest Service land where enhancement activities are generally prohibited. This creates de facto wild stock sanctuaries (Duckett et al. 2010, p. 51)
Straying Impacts	Straying studies were conducted for chum salmon from 2008 to 2010. Studies are underway to examine hatchery–wild stock interactions.
Review by geneticist	The ADF&G geneticist reviewed the FTPs for the SCH programs.

Fish Health and Disease

FTPs for the SCH program were approved by the pathologist (Table 5). Pathology records showed no inconsistencies with fish health and disease policies. Appropriate salmon culture techniques were used and disease reporting and broodstock screening occurred as required (Appendix N).

The hatchery was inspected regularly from 1982 to 1999, and no major chronic health issues were identified.

Table 5.–The Sheep Creek Hatchery salmon fishery enhancement program and its consistency with elements of the Alaska policies on fish health and disease (see Table 2).

Fish Health and Disease Policy (5 AAC 41.080; amended by Meyers 2010)	
Egg disinfection	Only coho salmon eggs were disinfected until 1988, when all eggs were disinfected on the advice of the fishery pathologist during the 1987 inspection.
Hatchery inspections	Hatchery inspections were conducted regularly from at least 1982 through 1999.
Disease reporting	There was no chronic disease issues at the hatchery.
Pathology requirements for FTPs (5 AAC 41.010)	
Disease history	Samples were submitted as requested by the fish pathologist for disease history.
Isolation measures	Isolation procedures were indicated on the FTP.
Pathology review of FTPs	FTPs were reviewed by the pathologist.

Fisheries Management

Escapement goals or management targets were established through ADF&G and the Pacific Salmon Treaty process for sockeye, coho, Chinook, and chum salmon in systems near Juneau (District 11) and Haines (District 15). Chum salmon management targets in place during the period of SCH production (1985–2001) were based on *professional judgment* and later dropped in about 2004 because of a lack of quality escapement counts with which to make data-based goals (Geiger and McPherson 2004).

The District 11 Taku/Snettisham and District 15 Lynn Canal drift gillnet fisheries harvested the majority of SCH chum salmon. Purse seine and troll gear also harvested SCH chum salmon in mixed-stock fisheries along the migration routes in Icy Strait and Chatham Strait.

The District 11 drift gillnet fishery was managed based on returns to the Taku River of Chinook salmon from May to mid-June, sockeye salmon from mid-June to mid-August, and coho salmon from mid-August through September. Taku River pink and chum salmon stocks were harvested incidentally to the other three salmon species. SCH chum salmon transited through the District 11 drift gillnet fishery, and like the Taku River pink and chum salmon stocks, were harvested incidentally to Chinook, sockeye, and coho salmon.

The District 15 drift gillnet fishery was managed to meet sockeye salmon escapement goals to the Chilkat and Chilkoot river systems in June and July, and to provide for sufficient spawning escapement for chum, coho and pink salmon stocks to the Chilkat River, Chilkoot River, Berners River and other Lynn Canal systems in August and September.

SCH chum salmon are primarily caught in the fisheries from late June through mid-August, and therefore primarily overlap in timing during management for sockeye salmon. Escapement goals for sockeye salmon are established at several systems in Districts 111 and 115. During the years of significant SCH returns (1990–2001), the lower escapement goal was met for Chilkat Lake sockeye salmon in District 115 and the Taku River and Speel Lake systems in District 111 in all years. The lower Chilkoot Lake sockeye escapement goal was met in 6 of 12 years (Appendix Q). Taku River sockeye salmon escapement goals were established in 1986 (Munro and Volk

2013), and met in every year of SCH chum salmon returns (about 1990–2001). Sockeye salmon escapement goals were met at Speel Lake in Port Snettisham as well (Appendix R).

Two purse seine cost-recovery fisheries targeting chum salmon also occurred in District 11—one that targeted hatchery returns to the Amalga Harbor release site, and the other in Gastineau Channel that targeted hatchery fish returning to the SCH and MSH release sites.

SCH coho salmon were targeted in sport fisheries near Juneau, Skagway and Haines. According to Skannes et al. (2013), escapement goals to Juneau area systems were met in years of SCH returns.

National Oceanic and Atmospheric Administration and DIPAC staff assessed wild and hatchery juvenile chum salmon interaction in the rearing waters of SCH juvenile chum salmon. Orsi et al. (2004) concluded that interactions between hatchery and wild stocks of juvenile chum salmon occurred in Icy Strait, that the prey resources for juvenile chum salmon were large relative to the consumption demands of the combined hatchery and wild juvenile chum salmon numbers present, and that under their modeling assumptions, the current levels of hatchery production in southeastern Alaska did not represent a significant impact on the prey resource available in the Icy Strait study area.

Reese et al. (2009) concluded MSH and wild chum salmon were present at the same period in Taku Inlet, near the MSH and Limestone Inlet release sites, but direct indications of competitive effects on wild fry, such as poor condition or reduced growth rates, were not observed.

Sturdevant et al. (2011) indicated that DIPAC hatchery release strategies for MSH chum salmon released in the Taku Inlet area promoted early spatial segregation and prey partitioning between hatchery and wild fish, limiting the probability of competition between the two stocks.

Table 6.–The Sheep Creek Hatchery salmon fishery enhancement program and its consistency with elements of Alaska fisheries management policies and regulations (see Table 3).

Sustainable Salmon Fishery Policy (5 AAC 39.222)	
I. Management principles and criteria	
Assessment of wild stock interaction and impacts	National Oceanic and Atmospheric Administration and DIPAC have conducted several studies on the interaction between MSH and wild chum salmon juveniles after SCH ceased chum salmon production.
Use of precautionary approach	ADF&G manages the salmon fishery to meet escapement goals.
Salmon Escapement Goal Policy (5 AAC 39.223)	
Establishment of escapement goals	During the period of SCH production, escapement goals or targets were established for Chilkat, Klehini, and Taku rivers, Sawmill Creek and West Lynn Canal chum salmon; Chilkat and Chilkoot Lake, Taku and Speel River sockeye salmon; Taku and Chilkat River Chinook salmon, and for Chilkat River, Auke Creek, Berners River, Montana Creek and Petersen Creek coho salmon. In 2004, all the chum salmon escapement goals, which were based on professional judgment, were discarded because quality escapement data was not yet available to establish science-based escapement goals for these systems (Geiger and McPherson 2004).
Mixed Stock Salmon Fishery Policy (5 AAC 39.220)	
Wild stock conservation priority	The Taku/Snettisham commercial gillnet salmon fishery was managed to meet escapement goals for Chinook, sockeye and coho salmon returning to the Taku River, and managed to meet sockeye salmon escapement targets in Port Snettisham systems. For chum salmon, the Lynn Canal commercial gillnet salmon fishery is managed to maximize the harvest of hatchery chum salmon while conserving wild summer chum salmon stocks and meeting escapement goals for sockeye salmon in Lynn Canal through time and area closures as necessary (Davidson et al. 2013).
Fisheries management review of FTPs (5 AAC 41.010 – 41.050)	
Review by management staff	The FTPs for the SCH program were reviewed by fisheries 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 completed report is due on December 15 and the SCH annual reports were received for all years except for 2002, which was a year of no production or returns.

RECOMMENDATIONS

The BMP for SCH should be updated to reflect the current hatchery status. The BMP should clarify the current permitted pink salmon egg capacity at SCH.

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APPENDIX

Appendix A.–History of Sheep Creek Hatchery permit and permit alterations, 1979–2013.

Date	Description	Permitted Capacity in millions of eggs			
		Pink and Chum Salmon Combined	Pink Salmon	Chum Salmon	Coho Salmon
09/18/1979	Permit number 11 issued to DIPAC for the Sheep Creek Hatchery. Permitted for 5 million pink and chum salmon eggs combined.	5			
06/17/1980	PAR approved to allow production limits for pink and chum salmon eggs combined to increase from 5 million in 1980 to 10.5 million in 1981 and 1982 to 11.25 million in 1983. Approved pink salmon stocks were from Kowee Creek, Sheep Creek and Fish Creek. Approved chum salmon stocks were from Kowee Creek, Sheep Creek, Fish Creek, Admiralty Creek, Neka Creek and Sawmill Creek.	11.25			
06/30/1982	PAR approved to increase permitted capacity from 11.25 million pink and chum salmon eggs combined to 25 million pink and 5 million chum salmon eggs.		25	5	
09/09/1983	PAR denied to take an additional 5 million pink salmon eggs, apparently for shipment outside the state for fish farming/ranching research. ADF&G commissioner indicated he did want to support industries elsewhere competing with Alaska's salmon fishery.		25	5	
12/07/1983	PAR temporarily allowed incubation of an additional 10 million eggs that were taken in excess of permitted capacity. The amendment expired June 30, 1984.		25	5	
04/18/1984	PAR approved to increase permitted capacity from 25 million pink and 5 million chum salmon eggs to 40 million pink and chum salmon eggs combined.	40			
03/20/1985	PAR approved to allow rearing and release of pink and chum salmon fingerlings from SCH net pens.	40			
10/04/1985	PAR approved to add 56,000 coho salmon eggs to the SCH permitted capacity.	40			0.056
04/29/1986	PAR to allow marine rearing and release of up to 100,000 coho and 100,000 Chinook salmon smolts.	This PAR application was found on file but does not appear that it was approved.			
07/05/1988	PAR approved to allow Sheep Creek incubate, for one year only, up to 500,000 coho salmon eggs and transfer the resulting fry to Macaulay Salmon Hatchery and to release up to 2,000 coho salmon smolt annually into Twin Lakes.	40			0.500

-continued-

Date	Description	Permitted Capacity in millions of eggs: Pink and Chum Salmon Combined	Pink Salmon	Chum Salmon	Coho Salmon
12/01/1988	PAR approved to increase coho salmon egg incubation from 500,000 to 1 million for one year only. This amendment superseded the 07/05/1988 amendment.	40			1.0
05/06/1992	PAR approved to incubate up to 150,000 coho salmon eggs systems at Sheep Creek for fry stocking at unspecified remote sites. Requirement to install water depuration at hatchery to prevent BKD infection from resident fish in Sheep Creek.	40			0.150
12/27/2000	PAR approved to reduce chum salmon capacity from 40 million to 10 million eggs.	10	40		0.150
06/21/2001	PAR approved to transfer permitted capacity of 10 million chum salmon eggs from the Sheep Creek Hatchery permit to the Macaulay Salmon Hatchery permit.	0	40[a]		0.150

[a] The current permitted level for pink salmon at Sheep Creek is uncertain.

Appendix B.–Sheep Creek Salmon Hatchery pink salmon egg takes, 1980–1993.

Year	Eggs	Stock
1980	822,000 [a]	Kowee Creek Hatchery
1981	6,059,000 [a]	Kowee Creek Hatchery
	3,221,000 [a]	Fish Creek
1981 Total	9,280,00 [a]	
1982	8,938,000 [a]	Fish Creek
	2,009,000 [a]	Sheep Creek Hatchery
	4,885,000 [a]	Kowee Creek Hatchery
1982 Total	15,832,000 [a]	
1983	32,967,000 [a]	Sheep Creek Hatchery
	431,000 [a]	Kowee Creek Hatchery
	814,000 [a]	Fish Creek
1983 Total	34,213,000 [a]	
1984	15,840,643	Sheep Creek Hatchery
1985	31,579,200	Sheep Creek Hatchery
	701,760	Kowee Creek Hatchery
1985 Total	32,280,960	
1986	1,534,260	Sheep Creek Hatchery
1987	19,650,518	Sheep Creek Hatchery
1988	[b]	Sheep Creek Hatchery
1989	17,726,863 [c]	Sheep Creek Hatchery
1990	0	
1991	[d]	Sheep Creek Hatchery
1992	0	
1993	[e]	Sheep Creek Hatchery

Source: SCH annual reports (unpublished documents obtained from Sam Rabung, ADF&G PNP coordinator, Juneau) and ADF&G PNP Hatchery database (not publicly available).

[a] From 1984 SCH AMP.

[b] In 1988, 9,306,355 SCH green eggs collected and all transferred to Macaulay Salmon Hatchery.

[c] In 1989, collected 19,067,666 SCH eggs and then transferred 1,340,803 eyed eggs to Macaulay Salmon Hatchery.

[d] In 1991, 18,768,157 SCH green eggs collected and all transferred to Macaulay Salmon Hatchery.

[e] In 1993, 315,208 SCH green eggs collected and all transferred to Macaulay Salmon Hatchery.

Appendix C.–Sheep Creek Salmon Hatchery pink salmon fry releases.

Year	Fry	Stock
1981[a]	786,480	
1982	5,387,882	Kowee Creek Hatchery
	3,029,060	Fish Creek
1982 Total	8,416,942	
1983[a]	14,486,000	Sheep and Kowee Creek Hatcheries and Fish Creek
1984	30,847,735	Sheep Creek Hatchery
	403,472	Kowee Creek Hatchery
	762,115	Fish Creek
1984 Total	32,013,322	
1985	14,931,240	Sheep Creek Hatchery
1986	29,806,940	Sheep Creek Hatchery
	663,529	Kowee Creek Hatchery
1986 Total	30,470,469	
1987	1,258,800	Sheep Creek Hatchery
1988	15,034,137	Sheep Creek Hatchery
	4,665,580	Sheep Creek Hatchery[b]
1988 Total	19,699,717	
1990	17,962,133	Sheep Creek Hatchery

Source: SCH annual reports (unpublished documents obtained from Sam Rabung, ADF&G PNP coordinator, Juneau) and ADF&G PNP Hatchery database (not publicly available).

[a] From 1984 Sheep Creek AMP.

[b] Released at Macaulay Salmon Hatchery saltwater netpen release site

Appendix D.–Sheep Creek Salmon Hatchery pink salmon returns.

Year	Return	
1982	9,613	[a]
1983	72,355	[a]
1984	64,862	[a]
1985	669,767	[a]
1986	23,352	[a]
1987	1,083,700	[a]
1988	28,642	[a]
1989	108,851	
1990	5,907	[b]
1991	259,697	
1992	10,340	
1993	1,469	[b]
1994	34,128	[b]
1995	144	[c]

Source: SCH annual reports (unpublished documents obtained from Sam Rabung, ADF&G PNP coordinator, Juneau) and ADF&G PNP Hatchery database (not publicly available).

[a] No sport harvest estimate – commercial harvest, broodstock, escapement and cost recovery only.

[b] no commercial harvest estimate – sport harvest, broodstock, escapement and cost recovery only

[c] no harvest estimate; no fish used for broodstock or cost recovery – escapement only.

Appendix E.–Sheep Creek Salmon Hatchery chum salmon egg takes.

Year	Eggs	Stock
1981	50,000	Kowee Creek Hatchery
	56,000	Fish Creek
	4,000	Sheep Creek
1981 Total	110,000	
1982	825,076	Fish Creek
	48,664	Sheep Creek
1982 Total	873,740	
1983	229,490	Sheep Creek Hatchery
	255,470	Kowee Creek Hatchery
	502,280	Fish Creek
1983 Total	987,240	
1984	2,907,078	Fish Creek
	1,620,111	Kowee Creek Hatchery
	55,524	Sheep Creek Hatchery
1984 Total	4,582,713	
1985	3,696,676	Fish Creek
	658,772	Kowee Creek Hatchery
	117,488	Sheep Creek Hatchery
	2,873,494	Salmon Creek Hatchery
1985 Total	7,346,430	
1986	10,433,925	Salmon Creek Hatchery
	7,076,000	Hidden Falls Hatchery
	237,000	Fish Creek
	1,773,550	Sheep Creek Hatchery
1986 Total	19,520,475	
1987	1,394,350	Sheep Creek Hatchery
	18,355,650	Salmon Creek Hatchery
1987 Total	19,750,000	
1988	26,449,110[a]	Sheep Creek Hatchery
	5,413,861	Salmon Creek Hatchery
1988 Total	31,862,971	

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Year	Eggs	Stock
1989	162,337 [b]	Sheep Creek Hatchery
	18,000 [c]	Salmon Creek Hatchery
1989 Total	180,337	
1990	29,234,432 [d]	Sheep Creek Hatchery
1991	27,517,050 [e]	Sheep Creek Hatchery
	440,710 [f]	Salmon Creek Hatchery
1991 Total	27,957,760	
1992	27,867,761 [g]	Sheep Creek Hatchery
1993	21,162,447 [h]	Sheep Creek Hatchery
	205,938	Transferred to SCH from MSH
1993 Total	21,368,385	
1994	29,641,425 [i]	Sheep Creek Hatchery
1995	25,849,935 [j]	Sheep Creek Hatchery
1996	27,073,865 [k]	Sheep Creek Hatchery
1997	[l]	Sheep Creek Hatchery

Source: SCH annual reports (unpublished documents obtained from Sam Rabung, ADF&G PNP coordinator, Juneau) and ADF&G PNP Hatchery database (not publicly available).

[a] Transferred and additional 202,126 eggs to Kowee Creek Hatchery.

[b] An additional 597,939 green eggs and 17,612,724 eyed eggs transferred to Macaulay Salmon Hatchery.

[c] 18,000 green eggs transferred in from Macaulay Salmon Hatchery and then transferred back to MSH as eyed eggs.

[d] An additional 48,966,036 green eggs and 15,297,027 eyed eggs transferred to MSH.

[e] An additional 46,924,918 green eggs and 13,101,955 eyed eggs transferred to MSH.

[f] An additional 625,760 eyed eggs transferred to MSH.

[g] An additional 49,298,108 green eggs and 9,649,745 eyed eggs transferred to MSH.

[h] An additional 16,452,004 green eggs and 11,427,842 eyed eggs transferred to MSH.

[i] An additional 11,307,261 green eggs and 10,353,095 eyed eggs transferred to MSH.

[j] An additional 25,837,804 green eggs and 9,896,423 eyed eggs transferred to MSH.

[k] An additional 17,084,574 green eggs transferred to MSH.

[l] 55,494,322 eggs collected at SCH and all incubated at MSH.

Appendix F.–Sheep Creek Salmon Hatchery chum salmon fry releases.
Key: SCH=Sheep Creek Hatchery, MSH=Macaulay Salmon Hatchery, KCH=Kowee Creek Hatchery

Year	Fry	Stock	Release Site
1982	3,880	Sheep Creek	SCH
	48,460	Kowee Creek	Kowee Creek
	52,060	Fish Creek	Fish Creek
1982 Total	104,400		
1983	45,258	Sheep Creek	SCH
	767,321	Fish Creek	Fish Creek
1983 Total	1,219,779		
1984	475,157	SCH	SCH
	241,675	Kowee Creek	SCH
	217,098	SCH	SCH
1984 Total	933,930		
1985	2,722,731	Fish Creek	SCH
	1,517,449	Kowee Creek	SCH
	51,472	SCH	SCH
1985 Total	4,291,652		
1986	3,522,933	Fish Creek	SCH
	628,215	Kowee Creek	SCH
	112,090	SCH	SCH
	2,738,440	Salmon Creek	SCH
1986 Total	7,001,678		
1987	6,927,159	Hidden Falls Hatchery	SCH
	368,345	Kowee Creek Hatchery	SCH
	222,126	Fish Creek	SCH
	9,778,600	Salmon Creek	SCH
	1,675,050	SCH	
1987 Total	18,971,280		
1988	709,004	SCH	SCH
	9,413,831	SCH	SCH
1988 Total:	10,122,835		

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Year	Fry	Stock	Release Site
1989	22,158,676	SCH	SCH
	4,538,524	Salmon Creek	SCH
1989 Total	26,697,200		
1990	2,922,554[a]	Salmon Creek and SCH	SCH
	150,984	SCH	SCH
1990 Total	3,073,538		
1991	27,949,864	SCH	SCH
1992	26,585,790	SCH	SCH
	425,795	MSH	SCH
1992 Total	27,011,585		
1993	27,002,939	SCH	SCH
1994	14,635,458[b]	SCH	SCH
1995	28,970,413		
1996	21,670,244	SCH	SCH
	2,934,744	SCH	Amalga Harbor
1996 Total	24,604,988		
1997	25,938,500	SCH	SCH

[a] Fry transferred from MSH and released at SCH.

[b] Eyed eggs transferred to MSH during 1993 flood event, combined with MSH stock, and released at SCH.

Appendix G.–Sheep Creek Salmon Hatchery chum salmon returns to the SCH hatchery.

Year	Return	
1983	250	
1984	50	
1985	208	
1986	2,549	
1987	4,100	
1988	62,720	[a]
1989	33,592	[b]
1990	180,783	[b]
1991	201,469	
1992	283,918	[c]
1993	63,278	[b]
1994	284,087	
1995	104,993	[b]
1996	493,083	[b]
1997	173,270	[c]
1998	201,198	[c]
1999	291,210	[c]
2000	450,861	[c]
2001	55,301	[c]

Source: SCH annual reports (unpublished documents obtained from Sam Rabung, ADF&G PNP coordinator, Juneau) and ADF&G PNP Hatchery database (not publicly available).

[a] No sport harvest estimate – commercial harvest, broodstock, escapement and cost recovery only.

[b] No commercial harvest estimate – sport harvest, broodstock, escapement and cost recovery only

[c] No commercial harvest estimate for purse seine or troll gear – commercial gillnet harvest, sport harvest, broodstock, escapement and cost recovery only

Appendix H.–Sheep Creek Salmon Hatchery coho salmon egg takes, 1985–1993.

Year	Eggs	Stock
1985	65,761	Montana Creek
1986	76,725	Steep Creek
1987	37,874	Montana Creek
1988	1,393,626[a]	Sheep Creek Hatchery
1989	No egg takes.	
1990	No egg takes.	
1991	No egg takes.	
1992	50,000	Fish Creek (Taku River tributary)
1993	149,157	Fish Creek (Taku River tributary)

Source: SCH annual reports (unpublished documents obtained from Sam Rabung, ADF&G PNP coordinator, Juneau) and ADF&G PNP Hatchery database (not publicly available).

[a] Of the 1,393,626 green eggs collected, 80,000 eyed eggs transferred to Pullen and Burro Creek.

Appendix I.–Sheep Creek Hatchery coho salmon smolt releases from Sheep Creek Hatchery.

Year	Fry	Stock	Release Site
1987	61,342	Montana Creek	SCH
1988	18,896 [a]	Steep Creek	Auke Creek
1989	[b]	Sheep Creek Hatchery	SCH
	[c]	Montana Creek	SCH
1994	126,265 [d]	Fish Creek (Taku River tributary)	Davidson Creek
1995	9,874 [e]	Pavlof River	SCH
1996	7,229 [e]	Pavlof River	SCH
2000	91,025	Mixed (UAF release)	SCH

Source: SCH annual reports (unpublished documents obtained from Sam Rabung, ADF&G PNP coordinator, Juneau) and ADF&G PNP Hatchery database (not publicly available).

[a] Released from Auke Bay Recreation Area net pens.

[b] Of 1,288,941 fry from the 1988 egg take, 16,000 transferred to Burro Creek and 1,274,710 transferred to Macaulay Salmon Hatchery for release. None released at SCH.

[c] 36,893 fry from the 1987 egg take were transferred to Macaulay Salmon Hatchery, reared, 36,850 smolt released at MSH.

[d] Smolt released into Davidson Creek.

[e] Fry transferred from Auke Creek Hatchery in May, reared to smolt and released from SCH about a month later.

Appendix J.–Sheep Creek Salmon Hatchery coho salmon returns.

Year	Return	
1988	1,401	
1994	25	[a]
1995	295	
1997	215	
2000	2,301	[b]
2001	2,363	[b]

Source: SCH annual reports (unpublished documents obtained from Sam Rabung, ADF&G PNP coordinator, Juneau) and ADF&G PNP Hatchery database (not publicly available).

[a] No harvest estimate—broodstock only.

[b] Does not include broodstock taken separately by UAF under a Fishery Resource Permit.

Appendix K.–Summary of Fish Transport Permits for Sheep Creek Salmon Hatchery chum salmon.

FTP No.	Issued	Expiration	FTP summary and reviewer comments
80-101	1980	1980	Collect up to 1 million chum salmon eggs from Neka River for incubation and release at SCH.
81-0170	1981	1999	Collect up to 0.5 million chum salmon eggs from Sheep Creek for incubation and release from SCH. In 1982, permit amended that increased permitted egg take level from 0.5 million to 5.0 million and permit expiry date extended from 1981 to 1990. In 1988, permitted egg take level increased from 5.0 million to 40 million and expiry extended from 1990 to 1999.
81-162	1981	1987	Collect up to 0.5 million chum salmon eggs from Fish Creek on Douglas Island for incubation and release from SCH. In 1982, permit amended that increased permitted egg take level from 0.5 million to 5 million and permit expiry date extended from 1982 to 1987.
82J-1059	1982	1990	Collect up to 5 million chum salmon eggs from KCH for incubation and release at SCH.
82J-1062	1982	1998	Collect up to 5 million chum salmon eggs from Sawmill Creek, incubate and release at SCH.
82J-1064	1982	1990	Collect up to 6 million chum salmon eggs from SCH for incubation, rearing and release at KCH.
84J-1050	DENIED		Collect up to 40 million chum salmon eggs from MSH for incubation, rearing and release at SCH. Denied due to concerns that BKD could be passed from MSH to SCH
85J-1030	1985	1988	Collect up to 6 million chum salmon eggs from Limestone Creek broodstock for incubation, rearing and release at SCH.
85J-1031	1985	1988	Collect up to 6 million chum salmon eggs from Limestone Creek broodstock for incubation at KCH and rearing and release at SCH.
85J-1032	1985	1988	Collect up to 6 million chum salmon eggs from Snettisham Hatchery broodstock for incubation at KCH and rearing and release at SCH.
85J-1033	1985	1988	Collect up to 6 million chum salmon eggs from Snettisham Hatchery broodstock for incubation at KCH and rearing and release at SCH.
85J-1034	1985	1988	Collect up to 6 million eggs from Neka R. chum salmon for incubation at KCH and rearing and release at SCH.
85J-1035	1985	1988	Collect up to 6 million chum salmon eggs from Neka River broodstock for incubation, rearing and release at SCH.
85J-1037	1985	1988	Collect up to 6 million chum salmon eggs from Montana Creek broodstock for incubation at KCH and rearing and release at SCH.
85J-1038	1985	1988	Collect up to 6 million chum salmon eggs from MSH broodstock for incubation at KCH and rearing and release at SCH.
85J-1039	1985	1990	Collect up to 6 million chum salmon eggs from MSH broodstock for incubation, rearing and release at SCH. In 1988, permitted egg take increased from 6 million to 40 million and expiry date extended from 1988 to 1999.

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FTP No.	Issued	Expiration	FTP summary and reviewer comments
86J-1051	1986	1990	Collect up to 20 million chum salmon eggs from Hidden Falls Hatchery broodstock for incubation, rearing and release at SCH.
88J-1037	1988	1988	Transfer 9 million chum salmon fry from SCH to MSH saltwater net pens for release.
88J-1049	1988	1998	Collect up to 111 million chum salmon eggs from King Salmon River broodstock for incubation and rearing at MSH and release from SCH saltwater net pens.
88J-1055	1988	1998	Collect up to 50 million chum salmon eggs from MSH/Salmon Creek broodstock for incubation and rearing at MSH and release at SCH saltwater net pens.
88J-1058	1988	1998	Collect up to 50 million chum salmon eggs from Neka River broodstock for incubation and rearing at MSH and release from saltwater net pens at SCH.
88J-1073	1988	1999	Collect up to 3 million chum salmon eggs from Kadashan River for incubation and rearing at SCH and release at MSH. Appears FTP issued to MSH.
88J-1088	1988	1998	Collect up to 11 million eggs from MSH/Salmon Creek, incubate and rear at SCH, and release at MSH. Permit appears issued to SCH.
88J-1089	1988	1998	Collect up to 11 million eggs from SCH, incubate at SCH, and release at MSH. Permit appears issued to SCH.
88J-1118	1988	1998	Collect up to 40 million eggs from SCH, incubate at MSH, and release at Peterson Creek (Amalga Harbor). Permit appears issued to SCH.
89J-1027	1988	1999	Transport up to 9 million chum salmon fry incubated at MSH from Hidden Falls/Kadashan River stock chum salmon eggs transferred from Hidden Falls hatchery to MSH to Boat Harbor for release. Permit amended in 1994 to extend expiration date from 1993 to 1999. Apparently this permit also provides both for the transfer of up to 9 million eggs from Hidden Falls to MSH, and for transfer of the resulting fry from MSH to Boat Harbor.
90J-1041	1990	1999	Collect up to 10 million chum salmon eggs from MSH for incubation and rearing at KCH and release at SCH.
90J-1043	1990	1999	Collect up to 10 million chum salmon eggs from SCH for incubation and rearing at KCH and release at MSH.
90J-1044	1990	1999	Collect up to 10 million chum salmon eggs from SCH for incubation and rearing at KCH and release at SCH.
90J-1049	1990	1999	Collect up to 40 million chum salmon eggs at SCH for incubation at MSH and release at SCH.
90J-1071	1991	1999	Transfer up to 15 million chum salmon fry from MSH to Limestone Inlet for release. This FTP included for SCH because SCH and MSH eggs were incubated together and released as MSH stock at Limestone Inlet.
98J-1012	1998	2002	Release of up to 9 million chum salmon fry from the Aurora Basin saltwater net pen site near MSH, which replaced the SCH net pens, releasing MSH and SCH stock chum salmon.

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FTP No.	Issued	Expiration	FTP summary and reviewer comments
99J-1002	1999	2021	Updated and replaced FTP 88J-1053. Collect up to 111 million chum salmon eggs from MSH and Sheep Creek broodstock for incubation, rearing and release at MSH and remote release sites and release up to 27 million fry at MSH. FTP had incorrect permit number (number 8 instead of the correct number 25). FTP amended in 2001 to increase egg take from 111 million to 121 million and increase release at MSH from 27 million to 36 million, which was requested when Sheep Creek Hatchery and MSH consolidated operations. Permit amended in 2003 to extend expiration date from 2003 to 2013. In 2011, the permit was amended to increase the egg collection number from 121 million to 125 million, and to extend the expiration date from 2013 to 2021.
00J-1011	2000	2019	Updated and replaced FTP 89J-1027. FTP had incorrect hatchery permit number (number 8 instead of the correct number 25). Permit allowed the rearing and release of up to 9 million MSH Stock chum salmon fry from the Boat Harbor release site. In 2001, the permit was amended to increase the release number from 9 million to 15 million fry. In 2004, permit extended until 2009 and increase number from 15 million to 24 million fry. In 2009, permit extended to 2019. In 2013, a technical amendment was added for clarity, only.
02J-1001	2002	2023	Permit allowed the rearing and release of up to 24 million MSH chum salmon fry from Gastineau Channel/Sheep Creek Delta saltwater net pens. Permit was amended in 2007 to extend expiration date from 2007 to 2017.

Appendix L.–Summary of Fish Transport Permits for Sheep Creek Salmon Hatchery pink salmon. Key: SCH= Sheep Creek Hatchery, MSH=Macaulay (Gastineau) Salmon Hatchery, KCH=Kowee Creek Hatchery.

FTP No.	Issued	Expiration	FTP summary and reviewer comments
81-0171	1981	1990	Collect up to 10 million pink salmon eggs from SCH for incubation and release from SCH. In 1982, permit amended that increased permitted egg take level from 10 million to 25 million and permit expiry date extended from 1981 to 1990.
81-160	1981	1987	Collect up to 10 million pink salmon eggs from Fish Creek on Douglas Island for incubation and release from SCH. In 1982, permit amended that increased permitted egg take level from 10 million to 25 million and permit expiry date extended from 1982 to 1987.
82J-1060	1982	1999	Collect up to 25 million pink salmon eggs from KCH hatchery for incubation and release at SCH. In 1988, permit amended to reduce egg take number from 25 million to 10 million and extend expiry date to 1999.
82J-1063	1982	1983	Collect up to 25 million pink salmon eggs from Admiralty Creek, incubate and release at SCH.
82J-1064	1982	1990	Collect up to 6 million pink salmon eggs from SCH for incubation, rearing and release at KCH.
84J-1049	DENIED		Collect up to 40 million pink salmon eggs from MSH for incubation, rearing and release at SCH. Permit application denied because sufficient broodstock anticipated to be available at SCH, and because of danger of transfer of BKD from MSH to SCH.
85J-1010	1985	1995	Incubate up to 10 million SCH pink salmon fry at KCH, transfer to SCH saltwater net pens for imprinting and release.
87J-1052	1988	1998	Collect up to 15 million even-year pink salmon eggs from pink salmon returns to SCH for incubation at SCH and MSH, with and release at MSH or SCH. In 1988, the FTP was amended to increase the egg take from 15 million to 40 million eggs.
88J-1076	1988	1989	Collect up to 20 million even-year pink salmon eggs from Kadashan River for incubation and rearing at MSH and release at SCH.
88J-1077	1988	1989	Collect up to 20 million even-year pink salmon eggs from Kadashan River for incubation, rearing and release at SCH.
88J-1079	1988	1989	Collect up to 20 million even-year pink salmon eggs from Kadashan River for incubation and rearing at SCH and release at MSH.
90J-1039	1990	1999	Collect up to 10 million pink salmon eggs from Sheep Creek for incubation and rearing at Kowee Creek and release at MSH.
90J-1040	1990	1999	Collect up to 10 million pink salmon eggs from MSH for incubation and rearing at Kowee Creek and release at Sheep Creek.
90J-1045	1990	1999	Collect up to 10 million pink salmon eggs from MSH for incubation and rearing at Sheep Creek Hatchery and release at MSH.
90J-1046	1990	1999	Collect up to 40 million pink salmon eggs from MSH for incubation, rearing and release at Sheep Creek Hatchery.
90J-1047	1990	2004	Collect and incubate up to 40 million pink salmon eggs from MSH for release at Sheep Creek Hatchery. FTP expiration date extended in 1999 to 2004.

Appendix M.–Summary of Fish Transport Permits related to Sheep Creek Salmon Hatchery coho salmon.

FTP No.	Issued	Expiration	FTP summary and reviewer comments
85J-1072	DENIED		FTP application requested collection of up to MSH for incubation, rearing and release at SCH. Denied due to concerns for transmitting BKD from MSH to SCH.
85J-1078	1985	1987	FTP allowed collection of up to 56,000 coho salmon eggs from Montana Creek for incubation at KCH in 1985, then SCH hereafter, for rearing and release in all years at SCH.
86J-1072	1986	1989	FTP allowed collection of up to 60,000 coho salmon eggs from Steep Creek broodstock for incubation, rearing and release at SCH.
87J-1063	DENIED		FTP application requested collection of up to 56,000 coho salmon eggs from KCH for incubation at SCH and release at Peterson Creek. Denied due to genetic concerns at Peterson Creek, which had an indigenous stock, and escapement of returning adults from the proposed release, which were from ancestral Montana and Steep Creek stock.
87J-1064	1988	1998	FTP allowed collection of up to 56,000 coho salmon eggs from KCH for incubation at SCH and release at MSH.
87J-1065	1988	1998	FTP allowed collection of up to 56,000 coho salmon eggs from KCH for incubation at SCH and release at SCH.
87J-1068	DENIED		FTP application requested collection of up to 1 million coho salmon eggs at Sashin Creek, Little Port Walter for incubation at MSH and release at SCH. Denied due to genetic concerns that proposed stock was from a substantial distance from the incubation and release site and due to pathology concerns.
87J-1071	1988	1998	FTP allowed collection of up to 1 million coho salmon eggs at SCH for incubation, rearing and release at MSH.
87J-1072	1988	1998	FTP allowed collection of up to 1 million coho salmon eggs at SCH for incubation and rearing at MSH and release at SCH.
87J-1073	DENIED		FTP application requested collection of up to 1 million coho salmon eggs at SCH for incubation and rearing at MSH and release at Peterson Creek. Denied due to genetic concerns because Peterson Creek had an indigenous stock and returning adults from the proposed release would be from ancestral Montana and Steep Creek stocks.
88J-1016	1988	1999	FTP allowed the transfer of 100,000 Speel River/Snettisham Hatchery stock coho salmon smolt to Sheep Creek Hatchery salt water net pens for short term rearing for imprinting and release.
88J-1038	1988	1988	Transfer 50,000 Steep Creek stock coho pre-smolts from SCH to MSH saltwater net pens for release.

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FTP No.	Issued	Expiration	FTP summary and reviewer comments
88J-1044	1988	1998	Allows collection of up to 300,000 coho salmon eggs from Montana Creek broodstock for incubation and rearing at MSH, then transfer to saltwater netpens at SCH for release.
88J-1050	1988	1998	Allows collection of up to 56,000 coho salmon eggs from SCH for incubation and rearing at SCH and release from MSH saltwater net pens.
88J-1051	1988	1998	Allows collection of up to 56,000 coho salmon eggs from SCH for incubation and rearing at SCH and release from Peterson Creek saltwater net pens.
88J-1052	DENIED		Allows collection of up to 56,000 coho salmon eggs from SCH for incubation and rearing at SCH and release from SCH saltwater net pens.
88J-1061	1988	1995	Allows release of 20,000 Steep Creek stock coho presmolts to saltwater netpen at Auke Village Recreation Area for rearing and release.
89J-1063	1989	1989	Allows transport of 100,000 coho pre-smolts incubated at SCH, reared at MSH, for release at Dredge Lake to reduce over-crowding in MSH raceways. According to a memo from region ADF&G staff to ADF&G PNP Coordinator, DIPAC was taking more eggs than they were permitted, and this was resulting in overcrowding of resulting fry. Memo encouraged PNP Coordinator to remind DIPAC staff of their permitted capacity levels.
92J-1031	1992	1995	Allowed release of 150,000 Fish Creek (Taku River) coho salmon eggs to be incubated at SCH and stocked in Davidson Creek to initiate a coho salmon return to the formerly barriered stream. Expiration dates were extended by one year in 1993 and 1994.
95J-1025	1995	1995	Allowed release of 50,000 Auke Creek Hatchery/Pavlof River stock coho salmon smolt from SCH net pens.
95J-1026	1995	1997	Allowed collection of up to 50,000 eggs from coho salmon in the Pavlof river, transfer to SCH for incubation, rearing and release.
05J-1018	1995	1997	Allowed release of 100,000 coho salmon smolt from SCH. University of Alaska project.

Appendix N.–Summary of ADF&G pathology inspections at Sheep Creek Hatchery.

Year	Inspection Notes
1982	Hatchery orderly and clean. Formalin treatments for egg fungus prophylaxis are weekly. Chum and pink salmon egg incubated together – they should be separate.
1984	Facility clean. Foot bath in use at main entrance. Improved formalin dispensing holder in use. No lack of compliance.
1985	Good culture techniques minimize ability of disease to spread.
1986	Common sense, cleanliness and good management are obvious at SCH.
1987	Recommend disinfect all eggs coming into hatchery and screen for BKD and *A. salmonicida* on 1987 pink and chum salmon returns.
1988	Overall hatchery well managed, clean efficient and provide a good example of properly maintained fish culture facility.
1990	Facility orderly and well run as in past years.
1991	Recommend rigorous disinfection of the ponds holding Chinook salmon followed by thorough drying.
1993	Hatchery clean and well maintained as usual. If a disease problem should develop in the coho the wood structures should be replaced.
1995	Disinfectant foot baths in use and plywood covering drains and trenches had been replaced with fiberglass grating. As usual, hatchery very clean and well organized.
1997	No recommendations.
1999	No recommendations.

Appendix O.–Comparison of permitted and reported pink salmon egg takes in hatchery permit, annual management plan, fish transport permits and annual reports for Sheep Creek Hatchery, 1979–2012. Numbers are in millions and rounded. Egg take numbers on annual reports do not specify egg take by release site, only the total number of eggs taken by each stock and egg take location.
Key: KCH=Kowee Creek Hatchery; SCH=Sheep Creek Hatchery; MSH=Macaulay Salmon Hatchery; FC=Fish Creek.

Brood Year	Hatchery Permit Egg Take	AMP	FTP for Egg Take	Egg Source	Incubation Location	FTP Expiration Year	FTP Permitted Egg Level	Egg Take from Annual Report or AMP	Release Site	FTP for Release	FTP Expiration Date	FTP Permitted Fry/Smolt Release Level	Release Number from Annual Report
1979	5[a]												
1980	11.25[a]	4.5	82J-1060	KCH	SCH	1999	25	0.822	SCH	82J-1060	1999	25	0.786[b]
			81-160	FC	SCH	1982	10	0.325	SCH	81-160	1982	10	
1981	11.25[a]	10.5	82J-1060	KCH	SCH	1999	25	6.059	SCH	82J-1060	1999	25	5.388
			81-160	FC	SCH	1982	10	3.221	SCH	81-160	1982	10	3.029
1982	25	25	82J-1060	KCH	SCH	1999	25	4.885	SCH	82J-1060	1999	25	14.486[b,c]
			81-160	FC	SCH	1982	10	8.938	SCH	81-160	1982	10	
			81-0171	SCH	SCH	1990	25	2.009	SCH	81-0171	1990	25	
1983	25	25	81-0171	SCH	SCH	1990	25	32.967	SCH	81-0171	1990	25	30.848
			82J-1060	KCH	SCH	1999	25	0.431	SCH	82J-1060	1999	25	0.403
			81-160	FC	SCH	1987	25	0.814	SCH	81-160	1987	25	0.762
1984	40[a]	40[a]	81-0171	SCH	SCH	1990	25	15.841	SCH	81-0171	1990	25	14.936
1985	40[a]	40[a]	81-0171	SCH	SCH	1990	25	31.582	SCH	81-0171	1990	25	29.807
			82J-1060	KCH	SCH	1999	25	0.702	SCH	82J-1060	1999	25	0.664
1986	40[a]	40[a]	81-0171	SCH	SCH	1990	25	1.534	SCH	81-0171	1990	25	1.259
1987	40[a]	40[a]	81-0171	SCH	SCH	1990	25	19.651	SCH	81-0171	1990	25	15.034[b,c]
				SCH	SCH				MSH	87J-1052	1998	15	4.666[b,c]
1988	40[d]	None		No egg takes.					No Releases.				
1989	40[d]	40[d]	81-0171	SCH	SCH	1990	25	17.727	SCH	81-0171	1990	25	17.962[e]
1990	40[d]	40[d]		No egg takes.					No Releases.				
1991	40[d]	40[d]	87J-1052	SCH	MSH	1998	40	18.768	SCH	87J-1052	1998	40	11.315
				SCH	MSH				MSH	87J-1052	1998	40	5.515
1992	40[d]	40[d]						0					
1993	40[d]	40[d]		SCH	MSH			0.315		94J-1002[f]			

[a] Permitted egg level for chum and pink salmon eggs combined.
[b] fry release number is the sum of all stocks released.
[c] Fry and eggs estimates measured by different methods and hence higher fry count than egg count. Source. 1988 SCH annual report (unpublished documents obtained from Sam Rabung, ADF&G PNP coordinator, Juneau).
[d] Permitted number was for a combined total of 40 million pink and chum salmon.
[e] Fry and eggs measured by different methods and hence higher fry count than egg count. Source. 1990 SCH annual report (unpublished documents obtained from Sam Rabung, ADF&G PNP coordinator, Juneau).
[f] The 0.315 million SCH stock eggs collected were transferred to MSH and released with MSH stock fry at MSH and Burro Creek Hatchery

Appendix P.–Comparison of permitted and reported chum salmon egg takes in hatchery permit, annual management plan, fish transport permits and annual reports for Sheep Creek Hatchery, 1984-2012. Numbers are in millions and rounded. Egg take numbers on annual reports do not specify egg take by release site, only the total number of eggs taken by each stock and egg take location.
Key: KCH=Kowee Creek Hatchery, SCH=Sheep Creek Hatchery, FC=Fish Creek, MSH= Macaulay Salmon Hatchery (also called Salmon Creek), HFH=Hidden Falls Hatchery, AH=Amalga Harbor, NR=Neka River, MSH (SCH) = are combined releases of SCH and MSH fry from MSH. In some years, eggs were taken for multiple release sites. In these cases, the number of eggs taken is listed by stock and incubation location, and then FTPs permitting the egg take are listed by release site.

Brood Year	Hatchery Permit Egg Take	AMP	FTP for Egg Take	Egg Source/ Stock	Incubation Location	FTP Exp. Year	FTP Egg Level	Egg Take from Annual Report	Release Site	FTP for Release	FTP Exp. Date	FTP Release Level	Release Number from Annual Report
1979	5[a]												
1980	5[a]	0.5	80-101	NR	SCH	1980	1						
1981	10.5	5.0	81-0170	SCH	SCH	1990	5	0.004	SCH	81-070	1990	5	0.004
			81-162	FC	SCH	1987	5	0.056	SCH	81-162	1987	5	0.052
			82J-1059	KCH	SCH	1990	5	0.050	SCH	82J-1059	1990	5	0.048
1982	5	5.0	81-0170	SCH	SCH	1990	5	0.049	SCH	81-070	1990	5	0.045
			81-162	FC	SCH	1987	5	0.825	FC	81-162	1987	5	0.767
1983	5	5.0	81-0170	SCH	SCH	1990	5	0.229	SCH	81-070	1990	5	0.217
			81-162	FC	SCH	1987	5	0.502	FC	81-162	1987	5	0.475
			82J-1059	KCH	SCH	1990	5	0.255	KCH	82J-1059	1990	5	0.242
1984	40[a]	40[a]	81-0170	SCH	SCH	1990	5	0.056	SCH	81-070	1990	5	0.051
			81-162	FC	SCH	1987	5	2.907	SCH	81-162	1987	5	2.723
			82J-1059	KCH	SCH	1990	5	1.620	SCH	82J-1059	1990	5	1.517
1985	40[a]	40[a]	81-0170	SCH	SCH	1990	5	0.117	SCH	81-070	1990	5	0.112
			81-162	FC	SCH	1987	5	3.697	SCH	81-162	1987	5	3.523
			82J-1059	KCH	SCH	1990	5	0.659	SCH	82J-1059	1990	5	0.628
			85J-1039	MSH	SCH	1988	6	2.873	SCH	85J-1039	1988	6	2.738
1986	40[a]	40[a]	81-0170	SCH	SCH	1990	5	1.774	SCH	81-070	1990	5	1.675
			81-162	FC	SCH	1987	5	0.237	SCH	81-162	1987	5	0.222
			85J-1039	MSH	SCH	1988	6	10.434	SCH	85J-1039	1988	6	9.779
			86J-1051	HFH	SCH	1990	20	7.076	SCH	86J-1051	1990	20	6.927
1987	40[a]	40[a]	81-0170	SCH	SCH	1990	5	1.394	SCH	81-070	1990	5	0.709
				SCH	SCH		None		MSH	88J-1037			0.587
			85J-1039	MSH	SCH	1988	6	18.356	SCH	85J-1039	1988	6	9.414
				MSH	SCH		None		MSH	None			7.640

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Brood Year	Hatchery Permit Egg Take	AMP	FTP for Egg Take	Egg Source/ Stock	Incubation Location	FTP Exp. Year	FTP Egg Level	Egg Take from Annual Report	Release Site	FTP for Release	FTP Exp. Date	FTP Release Level	Release Number from Annual Report
1988	40[a]	40[a]	81-0170	SCH	SCH	1999	40	26.449	SCH	81-070	1999	40	22.159
				SCH	SCH				MSH	88J-1037	1988	9	3.332
			85J-1039	MSH	SCH	1988	6	5.414	SCH	85J-1039	1988	6	4.539
			88J-1088	MSH	SCH	1998	11		MSH	88J-1088	1998	11	0.683
1989	40[a]	40 [a]	81-0170	SCH	SCH	1999	40	0.162	SCH	81-070	1999	40	0.151
			None	SCH	MSH			18.229	MSH	None			8.223
			None	SCH	MSH				SCH	None			2.922
				SCH	MSH				BH	00J-1011			2.257
			88J-1053	MSH	MSH	1998	111		MSH	88J-1053	1998	111	0.323
				MSH(SCH)	MSH				BH	None			0.089
1990	40[a]	40[a]	81-0170	SCH	SCH	1999	40	29.234	SCH	81-070	1999	40	27.950
				SCH	MSH			64.263					
			None	SCH	MSH				MSH	None			7.782
			90J-1049	SCH	MSH	1999	40		SCH	90J-1049	1999	40	9.928
			88J-1118	SCH	MSH	1999	40		AH	88J-1118	1998	40	31.578
				MSH(SCH)	MSH				BH	None			2.825
1991	40[a]	40[a]	81-0170	SCH	SCH	1999	40	27.517	SCH	81-070	1999	40	26.586
				MSH(SCH)	MSH			1.729[b]					
				MSH(SCH)	MSH				MSH	88J-1088	1998	11	0.251
			88J-1118	SCH	MSH	1998	40		AH	88J-1118	1998	40	0.756
				MSH(SCH)	MSH				LI	90J-1071	1999	15	0.179
			85J-1039	MSH	SCH	1999	40	0.441	SCH	85J-1039	1999	40	0.426
				SCH	MSH			60.027					
				SCH	MSH				MSH	None			11.708
			88J-1118	SCH	MSH	1998	40		AH	88J-1118	1998	40	35.165
			90J-1071	SCH	MSH	1999	15		LI	90J-1071	1999	15	8.322
1992	40[a]	40[a]	81-070	SCH	SCH	1999	40	27.868	SCH	81-070	1999	40	27.003
				SCH	MSH			49.298[c]					
				SCH	MSH				MSH	None			11.495
			88J-1118	SCH	MSH	1998	40		AH	88J-1118	1998	40	34.944
			90J-1071	SCH	MSH	1999	15		LI	90J-1071	1999	15	9.683

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Brood Year	Hatchery Permit Egg Take	AMP	FTP for Egg Take	Egg Source/ Stock	Incubation Location	FTP Exp. Year	FTP Egg Level	Egg Take from Annual Report	Release Site	FTP for Release	FTP Exp. Date	FTP Release Level	Release Number from Annual Report
1993	40[a]	40[a]		MSH(SCH)	MSH	1999	40	63.065[d]					
			88J-1053	MSH(SCH)	MSH	1998	111		MSH	88J-1053	1998	111	5.870
			88J-1118	MSH(SCH)	MSH	1998	40		AH	88J-1118	1998	40	31.912
				MSH(SCH)	MSH				LI	90J-1071	1999	15	5.833
			90J-1049	MSH(SCH)	MSH	1999	40		SCH	90J-1049	1999	40	14.635
1994	40[a]	40	81-070	SCH	SCH	1999	40	29.641	SCH	81-070	1999	40	28.970
				MSH(SCH)	MSH			88.108[b]					
			88J-1118	MSH(SCH)	MSH	1998	40		AH	88J-1118	1998	40	34.472
			90J-1071	MSH(SCH)	MSH				LI	90J-1071	1999	15	11.411
			90J-1049	MSH(SCH)	MSH		40		SCH	90J-1049	1999	40	15.703
				MSH(SCH)	MSH				BH	None			8.931
1995	40[a]	29	81-070	SCH	SCH	1999	40	25.850	SCH	81-070	1999	40	21.670
				SCH	SCH				AH	88J-1118			2.935
				MSH(SCH)	MSH			98.899[c]					
			88J-1118	MSH(SCH)	MSH	1998	40		AH	88J-1118	1998	40	34.980
			90J-1071	MSH(SCH)	MSH				LI	90J-1071	1999	15	15.421
			90J-1049	MSH(SCH)	MSH	1999	40		SCH	90J-1049	1999	40	19.570
				MSH(SCH)	MSH				BH	None			8.537
			88J-1053	MSH(SCH)	MSH	1998	111		MSH	88J-1053	1998	111	11.474
1996	40[a]	27	81-070	SCH	SCH	1999	40	27.074	SCH	81-070	1999	40	25.939
				MSH(SCH)	MSH			98.401[d]					
			88J-1118	MSH(SCH)	MSH		40		AH	88J-1118	1998	40	34.536
				MSH(SCH)	MSH				LI	90J-1071	1999	15	12.983
			90J-1049	MSH(SCH)	MSH		40		SCH	90J-1049	1999	40	13.340
				MSH(SCH)	MSH				BH	None			7.759
			88J-1053	MSH(SCH)	MSH		111		MSH	88J-1053	1998	111	12.166
1997	40[a]	[f]		MSH(SCH)	MSH			116.741[e]					
			88J-1118	MSH(SCH)	MSH	1998	40		AH	88J-1118	1998	40	49.155
				MSH(SCH)	MSH	1999			LI	90J-1071	1999	15	13.994
				MSH(SCH)	MSH				BH	None			7.212
			88J-1053	MSH(SCH)	MSH	1998	111		MSH	88J-1053	1998	111	24.247

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Brood Year	Hatchery Permit Egg Take	AMP	FTP for Egg Take	Egg Source/ Stock	Incubation Location	FTP Exp. Year	FTP Egg Level	Egg Take from Annual Report	Release Site	FTP for Release	FTP Exp. Date	FTP Release Level	Release Number from Annual Report
1998	40[a]	[f]		MSH(SCH)	MSH			108.131[b]					
			88J-1118	MSH(SCH)	MSH				AH	88J-1118	1998	40.0	50.738
				MSH(SCH)	MSH				LI	90J-1071	1999	15.0	14.474
				MSH(SCH)	MSH				BH	None			9.263
			88J-1053	MSH(SCH)	MSH				MSH	88J-1053	1998	111	21.992
1999	40[a]	[f]		MSH(SCH)	MSH			111.048[c]					
			88J-1118	MSH(SCH)	MSH				AH	88J-1118	1998	40.0	53.219
				MSH(SCH)	MSH				LI	90J-1071	1999	15.0	15.100
				MSH(SCH)	MSH				BH	None			9.010
			88J-1053	MSH(SCH)	MSH				MSH	99J-1002	2003	111	27.879
2000	40[a]	[f]		MSH(SCH)	MSH			111.244[d]					
			88J-1118	MSH(SCH)	MSH				AH	88J-1118	1998	40.0	46.028
				MSH(SCH)	MSH				LI	90J-1071	1999	15.0	15.144
				MSH(SCH)	MSH				BH	00J-1011			14.884
			88J-1053	MSH(SCH)	MSH				MSH	99J-1002	2003	111	27.859
2001	40[a]	[f]		MSH(SCH)	MSH			121.065[e]					
			88J-1118	MSH(SCH)	MSH				AH	88J-1118	1998	40.0	17.453
				MSH(SCH)	MSH				LI	90J-1071	1999	15.0	14.617
				MSH(SCH)	MSH				BH	00J-1011			11.263
			88J-1053	MSH(SCH)	MSH				MSH	99J-1002	2003	111	28.142

[a] Hatchery permitted capacity was for the combined total of pink and chum salmon eggs.

[b] Includes 42.094 million SCH eggs and 66.037 million MSH eggs for a total of 108.131 million eggs that were incubated at MSH and released as "Gastineau Stock" fry to the release sites listed.

[c] Includes 38.189 million SCH eggs and 72.860 million MSH eggs for a total of 111.048 million eggs that were incubated at MSH and released as "Gastineau Stock" fry to the release sites listed.

[d] Includes 33.935 million SCH eggs and 77.309 million MSH eggs for a total of 111.244 million eggs that were incubated at MSH and released as "Gastineau Stock" fry to the release sites listed.

[e] Includes 31.139 million SCH eggs and 89.926 million MSH eggs for a total of 121.065 million eggs that were incubated at MSH and released as "Gastineau Stock" fry to the release sites listed.

[f] Chum salmon egg take goal for SCH in 1997 AMP was to supplement the MSH egg take, as needed.

Appendix Q.–Comparison of permitted and reported coho salmon egg takes in hatchery permit, annual management plan, fish transport permits and annual reports for Sheep Creek Hatchery, 1984–2012. Numbers are in millions and rounded. Egg take numbers on annual reports do not specify egg take by release site, only the total number of eggs taken by each stock and egg take location. FTPs were not found issued until 1988. Key: ACH=Auke Creek Hatchery, AV=Auke Village, BC= Burro Creek, DC=Davidson Creek, FC(TR)=Fish Creek (Taku River tributary), MC=Montana Creek, MSH=Macaulay Salmon Hatchery, PR=Pavlof River, SC=Steep Creek, SCH=Sheep Creek Hatchery.

Brood Year	Hatchery Permit Egg Take	AMP	FTP for Egg Take	Egg Source	Incubation Location	FTP Expiration Year	FTP Permitted Egg Level	Egg Take from Annual Report	Release Site	FTP for Release	FTP Expiration Date	FTP Permitted Fry/Smolt Release Level	Release Number from Annual Report
1985	0.056		85J-1078	MC	SCH	1987	0.056	0.066	SCH	85J-1078	1987	0.056	0.061
1986		0.056	86J-1072	SC	SCH	1989	0.065	0.077	AV	88J-1061	1995	0.020	0.019
				SC	SCH				MSH	88J-1038	1998	0.050	0.050
				SL/SH	SH				SCH	88J-1016	1999	0.100	0.100
				SL/SH	SH				SCH	88J-1016	1999	0.100	0.042[b]
1987	0.056	0.056	85J-1078	MC	SCH	1987	0.056	0.038	MSH	None[a]			0.037[c]
1988	1.0	0.556		SCH	SCH			1.394	BC				0.080[d]
									BC				0.002
				MC	MSH	1988			SCH	88J-1044		0.300	0.533
1989	1.0	0.056		MSH	MSH				SCH				0.505
1992	0.150	0.150	92J-1031	FC(TR)	SCH	1993	0.150	0.050	DC	92J-1031	1993	0.150	0.049
1993	0.150	0.150	92J-1031	FC(TR)	SCH	1994	0.150	0.149	DC	92J-1031	1994	0.150	0.126
				PR	ACH				SCH	95J-1025	1995	0.050	0.010
1994	0.150	0.150		PR	ACH				SCH	95J-1025	1995	0.050	0.007

[a] In 1987, Montana Creek stock coho salmon fry were released from MSH. The only FTP found for release was for MC stock coho salmon was FTP 85J-1078, which permitted release at SCH, rather than MSH.
[b] 1988 release.
[c] 1989 release.
[d] 80,000 eyed eggs shipped to BC.

Appendix R.–Spawning escapements and escapement goals for Chilkat Lake sockeye and chum salmon, Chilkoot Lake sockeye salmon and Peterson Creek coho salmon, 1990–2001.

Year	Chilkat Lake Sockeye Escapement	Chilkat Lake Sockeye Salmon Escapement Goal Range	Chilkoot Lake Sockeye Escapement Weir Count	Chilkoot Lake Sockeye Salmon Escapement Goal Range	Taku River Sockeye Salmon Escapement	Taku River Sockeye Salmon Escapement Goal Range	Speel Lake Sockeye Salmon Escapement	Speel Lake Sockeye Salmon Escapement Goal Range
1990	60,231	52,000-106,000	73,324	50,500-91,500	96,099	71,000-80,000	34,463	10,000
1991	52,889	52,000-106,000	90,638	50,500-91,500	129,493	71,000-80,000	359	10,000
1992	97,740	52,000-106,000	67,071	50,500-91,500	137,514	71,000-80,000	15,623	5,000
1993	209,730	52,000-106,000	51,827	50,500-91,500	108,625	71,000-80,000	34,823	5,000
1994	153,540	52,000-106,000	37,416	50,500-91,500	102,579	71,000-80,000	3,834	5,000
1995	184,541	52,000-106,000	7,209	50,500-91,500	113,739	71,000-80,000	7,668	5,000
1996	262,852	52,000-106,000	50,739	50,500-91,500	92,626	71,000-80,000	16,215	5,000
1997	238,803	52,000-106,000	44,254	50,500-91,500	71,086	71,000-80,000	6,906	5,000
1998	211,114	52,000-106,000	12,335	50,500-91,500	74,451	71,000-80,000	26,155	5,000
1999	236,374	52,000-106,000	19,284	50,500-91,500	98,241	71,000-80,000	22,115	5,000
2000	131,322	52,000-106,000	43,455	50,500-91,500	75,498	71,000-80,000	9,426	5,000
2001	131,687	52,000-106,000	76,283	50,500-91,500	144,286	71,000-80,000	12,735	5,000

Source: Chilkat Lake sockeye salmon escapement data are weir counts for 1990–1993, mark-recapture estimates for 1994–2007, and DIDSON counts for 2008–2012. Chilkat Lake sockeye salmon escapement goals: biological escapement goal 52,000–160,000 (1990–2001). Chilkoot Lake sockeye salmon escapement goal: biological escapement goal 50,500–91,500 (1990–2001). Sockeye salmon escapement goals for Chilkoot and Chilkat systems from McPherson (1990). Sockeye salmon escapement numbers for Chilkoot River and Chilkat River 1990-2001 from Geiger et al. (2004). Speel Lake escapement goal from Riffe and Clark (2003). Speel Lake weir escapement counts from Geiger et al (2004). Taku River escapement goal and escapement counts from Munro and Volk (2013).

Appendix S.–Speel Lake and Taku River sockeye salmon escapement during years of returns to Sheep Creek Hatchery, 1990–2001.

Year	Speel Lake Sockeye Salmon Escapement	Speel Lake Sockeye Salmon Escapement Goal	Taku River Sockeye Salmon Escapement	Taku River Sockeye Salmon Escapement Goal
1990	34,463	10,000	96,099	71,000–80,000
1991	359	10,000	129,493	71,000–80,000
1992	15,623	5,000	137,514	71,000–80,000
1993	34,823	5,000	108,625	71,000–80,000
1994	3,834	5,000	102,579	71,000–80,000
1995	7,668	5,000	113,739	71,000–80,000
1996	16,215	5,000	92,626	71,000–80,000
1997	6,906	5,000	71,086	71,000–80,000
1998	26,155	5,000	74,451	71,000–80,000
1999	22,115	5,000	98,241	71,000–80,000
2000	9,426	5,000	75,498	71,000–80,000
2001	12,735	5,000	144,286	71,000–80,000
2002	5,016	5,000	109,337	71,000–80,000
2003	7,014	5,000	160,366	71,000–80,000
2004	7,813	4,000–13,000	106,688	71,000–80,000

Sources: Speel Lake escapement goal from Riffe and Clark (2003). Taku River escapement goal from Munro and Volk (2013). Weir escapement counts 1983–2002 from Geiger et al (2004). 2003 escapement from Munro and Volk (2012) and 2004-2012 escapements from Munro and Volk (2013). Total MSH chum salmon return to Limestone Inlet from annual reports submitted by DIPAC, unpublished documents obtained from Sam Rabung, ADF&G PNP Coordinator, Juneau.