Norton Sound-Bering Strait Regional Comprehensive Salmon Plan: Phase II

Developed by the Norton Sound-Bering Strait Regional Planning Team

July 2015

THE STATE of ALASKA
GOVERNOR BILL WALKER

Department of Fish and Game

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July 31, 2015

Mr. Sam Rabung, Chairman
Norton Sound/Bering Strait Regional Planning Team
ADF&G, Division of Commercial Fisheries
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Dear Mr. Rabung:

This letter is to inform you and members of the Norton Sound/Bering Strait Regional Planning Team (RPT) of my approval of the *Norton Sound/Bering Strait Regional Comprehensive Salmon Plan: Phase II (CSP).*

I understand that RPT members Oscar Takak, Charlie Lean, Tom Gray, John Linderman, Brendan Scanlon, Ron Josephson, Roy Ashenfelter, Wes Jones, Rose Fosdick, and Sam Rabung, worked diligently to solicit public input for the second phase of the CSP. In compliance with AS.10.375, over the past three years, the CSP Phase II development has been on the agenda of all public meetings held by the RPT. To provide additional opportunity for public involvement, the RPT created a public survey questionnaire which was distributed throughout the region. The RPT also facilitated two rounds of public meetings in the affected communities of the region and held seven public RPT meetings to guide the development of the plan. The plan was provided to ADF&G staff to perform a technical review and was made available to any interested party for review and comment. The public review draft was distributed to every governmental and tribal office in all the communities of the region, was publicly noticed in the newspaper and posted on the ADF&G website, and the RPT offered a final public hearing and completed its final review of the draft and consideration of public comments at its June 30, 2015, meeting in Nome.

This plan satisfies the regional planning process requirements for developing guidance for the permitting of fishery enhancement activities while ensuring the continued sustainability of salmon stocks in the region. This plan also provides a compilation of useful information pertaining to area fisheries and resources, and the statutes, regulations and policies that guide fishery enhancement activities in Alaska. I find that this is a useful and responsive planning document for salmon fishery enhancement efforts in the region. I appreciate the efforts of the RPT and all those involved in producing the *Norton Sound/Bering Strait Regional Comprehensive Salmon Plan: Phase II* and I offer my congratulations.

Sincerely,

Sam Cotten
Commissioner

Table of Contents

7-24-2015

Page

Table of Contents (Continued)

Table of Contents (Continued)

List of Tables

List of Figures

EXECUTIVE SUMMARY

In 1996, the *Norton Sound/Bering Strait Comprehensive Salmon Plan* (NS/BSRPT 1996), at times referred to as Phase I, was adopted by the commissioner of Alaska Department of Fish and Game (ADF&G). Since 1996, many changes have occurred in the region and the comprehensive salmon plan (CSP) is being updated to reflect these changes.

> 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 established criteria for evaluating the enhancement and rehabilitation potentials for the salmon resources in the region (McGee 2004).

In some regions, a Phase III plan has been written to update information, add new scientific research projects and reports, and incorporate Alaska Board of Fisheries decisions on allocation of hatchery-produced salmon and fisheries management plans concerning hatchery production.

The revised and updated *Norton Sound/Bering Strait Comprehensive Salmon Plan* will be a combination of a Phase I and Phase II planning process, describing goals, objectives, and strategies while maintaining the same overall mission statement:

> To promote, through sound biological practices, activities to increase salmon production in the Norton Sound/Bering Strait region for the maximal social and economic benefits of the users consistent with the public interest.

This plan explains the authority of the State of Alaska over salmon fishery enhancement programs and provides a brief history of the salmon fishery enhancement program in the state. It also provides updated information regarding the changes within the fisheries and landscape over the last 19 years; outlines new goals and strategies; summarizes comments from regional community meetings and a public survey; describes planning, permitting, and reporting regulations and policies; and lists current and possible future project descriptions.

This document is the culmination of a collaborative process involving local residents and the ADF&G. The Northern Bering Sea Regional Aquaculture Association (NoBSRAA) formed a board composed of representatives of various user groups and subregional residents. The drafting process of the plan included 2 rounds of community meetings to gather input from the communities and to mine the local ecological knowledge of residents. Additionally, many of the board members of the NoBSRAA are members of Fish and Game Advisory Committees where local issues are discussed and the department is consulted. The discussions help to balance traditional ecological knowledge (TEK) and biology. This allows subsistence use to be emphasized more so than in the previous CSP, as it is the priority use under state law. Readers of the plan should be aware that although several local residents are cited as the source of statements regarding TEK, this information is widely accepted and they are likely not the sole source of the information. The plan was drafted to provide the basis for proposed actions and extensive listings of supporting documentation of the statements were omitted in the interest of providing a readable document.

CHAPTER 1: INTRODUCTION TO ALASKA'S FISHERY ENHANCEMENT PROGRAM

1.1 Overview: Authority, Purpose, and Historical Perspective

Comprehensive salmon planning represents an ongoing process of identifying fisheries restoration, rehabilitation, enhancement, research, and management priorities for the salmon resources in the Norton Sound/Bering Strait region. This section provides the legislative authority and background for the salmon fisheries enhancement program in the State of Alaska.

1.1.1 Salmon Fishery Enhancement Program

The intent of the salmon fishery enhancement program in Alaska is to benefit the public by providing additional harvest opportunities to regional salmon fisheries without adversely affecting natural stocks. The methods, means, and constraints for providing these fish are addressed in Alaska statutes (AS) and in the regulations, management regimes, and policies of the Alaska Department of Fish and Game (ADF&G). The regional planning team (RPT) plays a pivotal, coordinating role in the realization of this program by (1) developing regional plans that establish production/project goals, objectives, and guidelines; and (2) assuming responsibility for insuring that proposed projects are consistent with the regional plan and that they optimize public benefits without jeopardizing natural stocks.

1.1.2 Constitution of the State of Alaska

The framework for management and protection of natural resources is enshrined in the Constitution of the State of Alaska in Article VIII - Natural Resources. These built in protections for sustained yield of fishery resources is a fundamental principle of the Alaska hatchery program. They are listed below:

§ 2. General Authority – The legislature shall provide for the utilization, development, and conservation of all natural resources belonging to the state, including land, and waters, for the maximum benefit of the people.

§ 3. Common Use – Whenever occurring in their natural state, fish, wildlife, and waters are reserved for the people for common use.

§ 4. Sustained Yield – Fish and all other renewable resources belonging to the State shall be utilized, developed, and maintained on the sustained yield principle, subject to preferences among beneficial uses.

§15. No Exclusive Right of Fishery [as amended in 1972 to allow limited entry and aquaculture] – No exclusive right or special privilege 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.

With the adoption of the Alaska State Constitution, Ordinance No. 3 – Abolition of Fish Traps also was voted on by the convention members and passed, having the following language become effective on the adoption date of the constitution:

> As a matter of immediate public necessity, to relieve economic distress among individual fishermen and those dependent upon them for a livelihood, to conserve the rapidly dwindling supply of salmon in Alaska, to insure fair competition among those engaged in commercial fishing, and to make manifest the will of the people of Alaska, the use of fish traps for the taking of salmon for commercial purposes is hereby prohibited in all the coastal water of the State.

In 1960, ADF&G assumed management authority over the fisheries from the federal government with the strong constitutional mandate to conserve wild stocks. This was further strengthened by the Legislature recognizing the importance of fish and game to the fledgling state, by designating ADF&G as a cabinet level department run by a commissioner, who answers directly to the Governor. The Legislature again emphasized the directives of the constitution by including as part of AS 16.05.020 the functions of the commissioner. The commissioner shall

> (2) manage, protect, maintain, improve, and extend the fish, game and aquatic plant resources of the state in the interest of the economy and general well-being of the state.

While ADF&G was given the responsibility to manage fisheries to maintain sustained yield, the Board of Fisheries was given the responsibility for allocating that yield to the users of the resource. The clear separation of conservation authority from allocation authority is one of the strengths of Alaska's fishery management system (Meacham and Clark 1994).

1.1.3 Alaska Department of Fish and Game

ADF&G is responsible for salmon resource management in the State of Alaska. The overall mission of ADF&G is

> To protect, maintain, and improve the fish, game, and aquatic plant resources of the state, and manage their use and development in the best interest of the economy and the well-being of the people of the state, consistent with the sustained yield principle.[1]

Responsibility for maintenance and management of salmon resources in the state is shared by several divisions within ADF&G.

The Division of Commercial Fisheries provides the services of stock management and assessment; laboratory services in genetics, pathology, and marking/tagging; aquaculture permitting, evaluation and oversight; and maintains programs for dissemination of information and public participation. The mission of the Division of Commercial Fisheries is

[1]ADF&G website commissioner's office overview link to mission statement http://www.adfg.alaska.gov/index.cfm?adfg=about.mission (Accessed January 2014)

> To manage subsistence, commercial and personal use fisheries in the interest of the general well-being of the people and economy of the state, consistent with the sustained yield principal, and subject to allocations through public regulatory processes.[2]

Formerly, the Fisheries Rehabilitation, Enhancement and Development (FRED) Division was responsible for developing and maintaining a comprehensive, long-range plan for salmon fisheries enhancement and rehabilitation efforts. In 1992, FRED was absorbed into the Division of Commercial Fisheries. Today a small section within that division, called Fishery Monitoring, Permitting, and Development, has the lead role for salmon fishery enhancement activities and permitting with ADF&G. Four regional resource development biologist positions assist Fishery Monitoring, Permitting, and Development by coordinating efforts with regional ADF&G offices (ADF&G 2010).

The mission of the Division of Subsistence is

> to scientifically gather, quantify, evaluate, and report information about customary and traditional uses of Alaska's fish and wildlife resources.[3]

Management of subsistence fisheries is conducted by the Division of Commercial Fisheries.

The Division of Sport Fish Strategic Plan 2010–2014 (ADF&G 2010) states the Division of Sport Fish vision is

> Excellence in fisheries management and research for the benefit of recreational anglers, the state's economy, and future generations of Alaskans.

and the mission is

> To protect and improve the state's recreational fisheries resources.

The core functions of the Division of Sport Fish include fisheries management, research, enhancement, angler access, and information and educational services with the priority to manage recreational fisheries for sustained yield and recreational angler satisfaction.

The Division of Habitat provides oversight for protection of salmon spawning and rearing areas. Their mission statement is

> To protect Alaska's valuable fish and wildlife resources and their habitats as Alaska's population and economy continue to expand.[4]

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[2] ADF&G Website Commercial Fisheries, Division Overview, Mission and Core Functions http://www.adfg.alaska.gov/index.cfm?adfg=divisions.cfmission (Accessed January 2014)

[3] ADF&G Website Subsistence, Division Overview, Mission and Core Functions http://www.adfg.alaska.gov/index.cfm?adfg=divisions.subsmission (Accessed January 2015)

[4] ADF&G website Sport Fish, Division Overview, Mission and Core Functions http://www.adfg.alaska.gov/index.cfm?adfg=divisions.sfmission (Accessed January 2014)

1.1.4 Authority for Salmon Planning

The commissioner has the duty under AS 16.10.375–480 to designate regions of the state for the purpose of salmon production and have developed and amend as necessary a comprehensive salmon plan for each region. The commissioner also has the authority to establish RPTs within each designated region (5 AAC 40.300–370). The primary purpose of the RPT is to develop a comprehensive salmon plan for the region. Each regional planning team consists of 6 members. Three are department personnel appointed by the commissioner and 3 are appointed by the board of directors of the authorized Regional Aquaculture Association (RAA).

1.1.5 Regional Aquaculture Associations

RAAs are formed under the commissioner's authority for the purpose of enhancing salmon production and are developed in accordance to criteria set out in AS 16.10.380: (1) comprised of representatives of commercial fishermen in the region; (2) includes representatives of other user groups interested in fisheries within the region who wish to belong; and (3) possesses a board of directors that includes but is not limited to, commercial fishermen, sport fishermen, subsistence fishermen, processors and representatives of local communities. Appendix B provides a table of steps necessary to form a RAA. Each RAA has a board of directors weighted toward the commercial fishing interests that initially incorporated them.

1.1.5.1 Northern Bering Strait Regional Aquaculture Association

On August 21, 1996, the Norton Sound/Bering Strait (NS/BS) RAA was formed at a meeting organized by Kawerak, Inc. with a group of commercial and subsistence fishermen. The bylaws were adopted on August 26, 1996 and on July 8, 1997, the commissioner recognized NS/BSRAA as the qualified regional association for the region. The first official annual meeting was held August 22, 1997, during which bylaws were reviewed (amendments were adopted December 5, 1997), a Board of Directors was duly elected, and the RAA became fully operational. The NS/BSRAA nonprofit corporation risked dissolution in 2004 and 2010 because of inactivity, and this created confusion over the local entity for RPT associated planning. To avoid confusion and facilitate future business operations, the RAA nonprofit corporation registered under a new name, Northern Bering Sea Regional Aquaculture Association (NoBSRAA) on January 23, 2012, and on April 20, 2012, ADF&G Commissioner Campbell issued a statement accepting the name change and recognizing that NoBSRAA (formerly NS/BSRAA as chaired by Oscar Takak) remained the sole recognized RAA for the Norton Sound/Bering Strait region. According to the bylaws adopted by NoBSRAA, the board shall consist of 6 members who represent districts in the region and 6 members who represent specific user groups. The current Articles of Incorporation state

> Six (6) directors shall represent communities in the Region, one from each of the following districts:
>
> Island District, including the communities of Gambell and Savoonga;
>
> Bering Strait District, including Diomede, Wales, Brevig Mission, and Teller;
>
> Nome District, including Nome, King Island Native Community, Nome Eskimo Community, Solomon Traditional Council, and Council Traditional Council;
>
> Northeast Norton Sound District, including White Mountain, Golovin, Elim, and Koyuk;
>
> Eastern Norton Sound District, including Shaktoolik and Unalakleet; and

Southern Norton Sound District, including St. Michael and Stebbins;

One (1) director shall represent holders of Norton Sound or Port Clarence limited entry salmon permits;

One (1) director shall represent Kawerak, Inc., or its successor;

One (1) director shall represent Norton Sound Economic Development Corporation, or its successor;

One (1) director shall represent sport fishermen resident in the Region;

One (1) director shall represent salmon processors with shore-side offices in the Region; and

One (1) director shall represent subsistence fishermen resident in the region.

No director shall represent more than one user group, or District thereof. All directors terms of office are three (3) years, and these terms are staggered so that no more than five (5) director's terms expire in any one year.

1.1.6 Regional Planning Teams

The commissioner establishes the RPT. Each RPT consists of 6 members; 3 appointed by the commissioner and 3 appointed by the board of directors of the RAA. Additionally, nonvoting ex-officio members may be appointed by the commissioner or by the RPT as deemed necessary. Each RPT elects a chairman, who may or may not be a member of the RPT, and whose responsibilities are defined in regulation 5 AAC 40.310 Chairman of Regional Planning Team.

Alaska Statutes (16.10.375–16.10.480) and regulations (5 AAC 40.300–40.370) define the duties of the RPT as comprehensive plan development and amendment; review of hatchery permit applications, permit alteration requests, and recommendations to the commissioner; and review of and comment on proposed hatchery permit suspensions or revocations to the commissioner.

The users of the resource within each region determine what fishery enhancement is desirable and ADF&G determines what is appropriate within their mandate to protect natural production. The mechanism for this cooperative effort is the RAA working with ADF&G within the RPT process.

1.1.6.1 Norton Sound Regional Planning Team

In 1989, the first meetings to consider a regional organization that would operate a hatchery at Elim Hot Springs took place. Although the hatchery never got to the design stage, Norton Sound Economic Development Corporation (NSEDC) also had its origins at these same meetings. The region's first aquaculture organization, the Norton Sound Aquaculture Association was established March 3, 1992; it operated for 2 years and was dissolved in 1994. That same year, the Norton Sound /Bering Strait Regional Planning Team (NS/BSRPT) was established with NSEDC acting in the role of an RAA in order to appoint the local representatives to the planning team until the RAA was approved in 1997. The NS/BS RPT has operated with the same charge and membership seats since 1997 with the RAA and ADF&G each seating 3 members. The RPT Chairman has been elected from both entities over the years.

1.1.7 Regulatory Background

The current state hatchery program was developed in response to depressed salmon fisheries in the 1970s and was predicated on the concept of supplementing fisheries, not replacing wild stocks. The policies and laws implemented in Alaska were carefully considered to meet the state's constitutional mandate for sustained yield. There was a concerted effort by all parties involved to collectively support fisheries and minimize negative impacts to wild stocks to the greatest extent possible.

In 1971 the Alaska Legislature in AS 16.05.092 created the FRED division to oversee and develop salmon fishery enhancement programs. FRED division had 4 main responsibilities: (1) develop and maintain a state plan for long-range fishery rehabilitation, (2) encourage private investment in the development and use of Alaska's fishery resources, (3) assure the perpetuation of Alaska's fish resource, and (4) make an annual report to the legislature.

In 1974, the Private Non-profit Hatchery Act statutes (AS 16.10.375–16.10.620) authorized the issuance of hatchery permits to qualified private nonprofit (PNP) corporations. This was the method and means for establishing PNP salmon hatcheries in Alaska. The legislative intent of this act was

> "...to authorize private ownership of salmon hatcheries by qualified non-profit corporations for the purpose of contributing, by artificial means, to the rehabilitation of the state's depleted and depressed salmon fisheries. The program shall be operated without adversely affecting natural stocks of fish in the state and under a policy which allows reasonable segregation of returning hatchery-reared salmon from naturally occurring stocks." [5]

The regulatory background provides for checks and balances by giving the commissioner the authority to alter the conditions of the hatchery permit or revoke the permit. The Board of Fisheries may alter the terms of the hatchery permit relating to the source and number of eggs, the harvest of fish by the hatchery operator, and the location of the special harvest area (SHA). Fish are considered available for common use until they return to a SHA.

Some pertinent statutes and regulations affecting enhanced fish are included below.

AS 16.10.440 Regulations relating to released fish.
(a) Fish released into the natural waters of the state by a hatchery operated under AS 16.10.400–16.10.470 are available to the people for common use and are subject to regulation under applicable law in the same way as fish occurring in the their natural state until they return to the specific location designated by the department for harvest by the hatchery operator. (b) The Board of Fisheries may, after the issuance of a permit by the commissioner, amend by regulation adopted in accordance with AS 44.62 (Administrative Procedure Act), the terms of the permit relating to the source and number of salmon eggs, the harvest of fish by hatchery operators, and the specific locations designated by the department for harvest. The Board of Fisheries may not

[5] Section 1 Chapter 111 Session Laws of Alaska

adopt any regulations or take any action regarding the issuance or denial of any permits required in AS 16.10.400–16.10.470.

AS 16.10.445 Egg Sources.
(a) The department shall approve the source and number of eggs taken under AS 16.10.400–16.10.470. (b) Where feasible, salmon eggs utilized by a hatchery operator shall first be taken from stocks native to the area in which the hatchery is located, and then, upon department approval, from other areas, as necessary.

AS 16.10.450 Sale of salmon and salmon eggs: use of proceeds; quality and price.
(a) Except as otherwise provided in a contract for the operation of a hatchery under AS 16.10.480, a hatchery operator who sells salmon returning from the natural waters of the state, or sells salmon eggs to another hatchery operating under AS 16.10.400–16.10.470, after utilizing the funds for reasonable operating costs, including debt retirement, expanding its facilities, salmon rehabilitation projects, fisheries research, or costs of operating the qualified regional association for the area in which the hatchery is located, shall expend the remaining funds on other fisheries activities of the qualified regional association. (b) Fish returning to hatcheries and sold for human consumption shall be of comparable quality to fish harvested by commercial fisheries in the area and shall be sold at prices commensurate with the current market.

AS 16.10.375 Regional Salmon Plans.
The commissioner shall designate regions of the state for the purpose of salmon production and have developed and amend, as necessary, a comprehensive salmon plan for each region, including provisions for both public and private nonprofit hatchery systems. Subject to plan approval by the commissioner, comprehensive salmon plans shall be developed by regional planning teams consisting of department personnel and representatives of the appropriate qualified regional associations formed under AS 16.10.380.

5AAC 40.170 Regional Planning Team Review.
(a) The appropriate regional planning team, as established under 5 AAC 40.300, shall review each application to determine if the proposed hatchery is compatible with the appropriate regional comprehensive salmon plan. The regional planning team shall use the following application review criteria:

The contribution the proposed hatchery would make to the common property fishery;

The provisions for protection of the naturally occurring stocks from any adverse effects which may originate from the proposed hatchery;

The compatibility of the proposed hatchery with the goals and objectives of the comprehensive plan for the region; and

Whether the proposed hatchery would make the best use of the site's potential to benefit the common property fishery.

(b) An applicant may review the regional planning team determination and comment on it by letter to the commissioner.

5AAC 39.222 Policy for the Management of Sustainable Salmon Fisheries.
(a) The Board of Fisheries (board) and Department of Fish and Game (department) recognize that

(1) while, in the aggregate, Alaska's salmon fisheries are healthy and sustainable largely because of abundant pristine habitat and the application of sound, precautionary, conservation management practices, there is a need for a comprehensive policy for the regulation and management of sustainable salmon fisheries;

(2) in formulating fishery management plans designed to achieve maximum or optimum salmon production, the board and department must consider factors including environmental change, habitat loss or degradation, data uncertainty, limited funding for research and management programs, existing harvest patterns, and new fisheries or expanding fisheries;

(3) to effectively assure sustained yield and habitat protection for wild salmon stocks, fishery management plans and programs require specific guiding principles and criteria, and the framework for their application contained in this policy.

(b) The goal of the policy under this section is to ensure the conservation of salmon and salmon's required marine and aquatic habitats, protection of customary and traditional subsistence uses and other uses, and the sustained economic health of Alaska's fishing communities.

For the full policy as written see Appendix G. The policy is a good reference for common definitions regarding salmon.

For further discussion about additional regulations, policies, and permitting affecting enhancement planning and enhanced stocks see chapter 4.

CHAPTER 2: NORTON SOUND/BERING STRAIT REGIONAL COMPREHENSIVE SALMON PLAN 1996–2010

2.1 Background of the NS/BS Regional Comprehensive Salmon Plan 1996–2010

Development of the original (Phase 1) CSP for the Norton Sound/Bering Strait region (NS/BSRPT 1996) was initiated by NSEDC and ADF&G in the spring of 1994 with the organizational meeting of the RPT. This process was initiated in compliance with the commissioner's statutory mandate for salmon planning and in response to interests expressed by NSEDC.

Desires and objectives of the area fishermen, as expressed by the RPT, indicated an emphasis on restoring habitat of previously productive salmon systems damaged through mining/dredging activities; reestablishing historic runs of chum salmon through instream incubators, central incubation facilities, and/or fry planting techniques; and practicing better management. There was very little support or desire for large-scale hatchery production of pink and chum salmon stocks, such as that proposed in other regions. There was also strong recognition of the need to protect genetic integrity of local stocks, and a desire to promote a more comprehensive understanding of local watersheds and their potential for increased production of chum, sockeye, and coho salmon.

Specific actions promoted by the Phase 1 plan included the following:

> Improve management of existing regional salmon fisheries by (1) increasing monitoring of chum and coho escapements in the region and (2) encouraging knowledge of stock identity of salmon harvested in the region.
>
> Improve projections of salmon production in regional waters by (1) conducting comprehensive surveys of Norton Sound systems and (2) encouraging studies of nearshore and marine environments and their capacity to support salmon populations.
>
> Investigate rehabilitation and enhancement opportunities by (1) evaluating results of fry-stocking, instream incubators, or other rehabilitation or enhancement potentials and (2) assessing area watersheds for removal of barriers to fish migration or repair of damaged spawning/rearing habitat.
>
> Develop central incubation facilities by (1) establishing recirculating incubators in each community and (2) pursuing placement and operation of stream-side incubators in locations identified in the studies outlined above.

The RPT set preliminary target common property fishery harvest goals that were intended to result from existing natural production and any rehabilitation or enhancement work conducted under this plan. These goals, intended to be achieved by the year 2010, are listed below by species for the entire regional salmon fishery; the 1981 to 1995 average commercial harvest by species is also included (Table 2.1).

Table 2.1.–Average harvest 1981–1995 and target for 2010.

Species	Average Annual Commercial Harvest (1981–1995)	Annual Target Goal (2010)
Chinook	7,865	20,000
Sockeye	242	10,000
Coho	54,872	90,000
Pink	133,971	1,250,000
Chum	113,643	200,000
Total	310,593	1,570,000

The goals of the of the Phase 1 plan, shown above, were found to be too broad and not very useful. They failed to account for market shortfalls which significantly reduced the harvest of salmon during the past 20 years. It is arguable that the goals of the pink, coho, and sockeye salmon harvestable surpluses were often available and the goals were attainable except for market reasons. Lifestyle changes and/or local economies also changed, further affecting harvest practices. Many of the original directed projects were attempted and there have been some success stories. Section 5.2 reviews the projects of the past 20 years.

2.2 Historical Fishery Use

Archeological evidence dating back 2,000 years indicates fishing has been a part of life for Norton Sound residents for many centuries (Bockstoce 1979). The largest precontact settlements on the Bering Strait Islands and the western Seward Peninsula were located where marine mammals were the primary subsistence resource. The rest of the region's population lived in small groups scattered along the coast, often moving seasonally to access fish and wildlife resources. During summer months, residents would usually disperse in groups comprised of 1 or 2 families, and set up camps near the mouths of streams. Harvest levels of fish on any one stream were relatively small because of low concentrations of people who caught only what their families and 1 or 2 dogs needed through the winter (Thomas 1982).

A large-scale fur trade was developed by the Russians in the late 1800s and continued after the American purchase of Alaska (Magdanz and Punguk 1981). These activities and support for hundreds of commercial whalers and trading ships caused trading to increase in the region around 1848 (Ray 1975). Increased competition for walrus, caribou, and other species from outsiders may have increased the importance of salmon to area residents (Magdanz and Punguk 1981). In the late 1890s, gold was discovered on the Seward Peninsula and boomtowns sprang up with thousands of new immigrants flocking to the region. Commerce and the establishment of missions drew people to central year-round communities.

Mining impacted fish populations significantly. Nearly every stream on the Seward Peninsula has had some sort of mining operation, ranging from simple gold panning to sluice boxes to hydraulic giants to bucket line dredges. One example of extensive impact is the Solomon River, which is only 30 miles long but had 13 dredges working at one time. Another obvious impact was the large number of people who came to live in the region between 1900 and 1930. Communities like Nome, which had a population of 30,000, and Council, which had 10,000 residents, did not exist before gold was discovered (Thomas 1982).

In the late nineteenth century the size of dog teams increased from 2 or 3 to as many as 10 to 20. At about the same time, wooden boats began to replace kayaks. Consequently, the demand for dried fish to feed the dog teams increased with the development of better means to harvest fish. Winter transportation throughout the region was hired dog teams and drivers who carried mail or freight along the coast and across the state to the ice-free port at Seward. Dried fish, primarily chum and pink salmon, became a major barter item in response to the increased demand for dog food (Thomas 1982).

Local residents spent most of their summers catching and drying large amounts of salmon, some of which they kept for themselves and the rest they bartered or sold to mining camps, roadhouses, and trading posts or stores. For example, the Haycock mining camp on the Koyuk River bought about 2 tons of dried fish each year. Roadhouses were located at Cape Nome, Solomon, Bluff, Golovin, Portage, Moses Point, Isaac's Point, Ungalik, Rabbittvale, Foothills (south of Shaktoolik), Egavik, Unalakleet, St. Michaels, and other locations. The livery stable in Nome was a significant consumer of dried fish as well. Dried fish was bought in units of bundles (50 dried fish tied together) at a typical price of $0.10 per pound from the fishermen. One elder in the area thought even more fish were retained for their own use, which may have averaged 5 to 10 bundles per household, compared to the amount sold (Thomas 1982).

After the gold rush and the gold deposits were depleted, the number of people gradually decreased. The number of dog teams diminished by the mid-1930s when mail planes and mechanical tractors were introduced and the last dog team mail contract ended in 1962 at Savoonga. Yet, local stores continued to trade and barter in dry fish at Shaktoolik, St. Michael, Unalakleet, and Golovin. An example of quantity was the 8×20×40 foot cache at the Shaktoolik store filled to the top with dry fish. One elder said the stores would buy the fish for $0.06 a pound and then sell them for $0.10 a pound or their equivalent in groceries and supplies (Thomas 1982). By the early 1960s, commercial salmon fishing developed into a source of summer cash and snow machines were replacing the need for dog teams. The use of dry fish to feed dogs decreased and cash became more available for exchange at stores.

2.2.1 Subsistence Fisheries

Subsistence harvest is an integral part of the way of life of most residents of the communities of the Norton Sound/Bering Strait region. Most residents of the region participate in a mixed subsistence-cash economy, and depend on wild foods for cultural and nutritional sustenance (Fall et al. 2012). While the primary reason for this mixed economy is to supply food for sustenance, the subsistence harvests does help to offset food costs by minimizing the purchase of commercial groceries. More opportunities for wage work exist in Nome itself, but subsistence activities are still an important facet of life to many of its inhabitants.

> Norton Sound and Bering Strait region residents have long depended on the resources of the land and water to sustain their traditional subsistence lifestyle. Because of their long-term, multi-generational observations and understandings of the region, local residents are familiar with changes in salmon harvest opportunities, escapement,

colonization, climate and environmental changes and other related topics. (Raymond-Yakoubian and Raymond-Yakoubian *In prep*)

The average annual unemployment rate in the Norton Sound Bering Strait area (i.e., Nome Census area) was 12% from 2008 to 2012.[6] In summer, subsistence and commercial fishermen harvest salmon with gillnets or seines in the main Seward Peninsula rivers and coastal marine waters. Subsistence fishermen also use beach seines near the spawning grounds to harvest schooling or spawning salmon and other species of fish. A major portion of subsistence fish taken during the summer months is air dried or smoked for later consumption by residents. Chum and pink salmon are the most abundant salmon species district wide; Chinook and coho salmon are present throughout the area, but are more common in eastern and southern Norton Sound. Sockeye salmon are found in a few Seward Peninsula streams.

2.2.2 Commercial Fisheries

Commercial salmon fishing in Norton Sound District began in Shaktoolik and Unalakleet Subdistricts in 1961. Most early interest involved Chinook and coho salmon flown in dressed condition to Anchorage for further processing. A single U.S. freezer ship purchased and processed chum and pink salmon during 1961. In 1962, 2 floating cannery ships operated in the district and commercial fishing was extended into Norton Bay, Moses Point, and Golovin. The peak in salmon canning operations occurred in 1963. Since then, markets have been sporadic and some subdistricts have often been unable to attract buyers for entire seasons. A joint venture between KEG (Koyuk-Elim-Golovin) Fisheries and NPL Alaska, Inc. operated from 1984 until midseason in 1988. Two Japanese freezer ships were permitted to buy directly from domestic fishermen limited to salmon caught in the internal waters of Golovnin and Norton Bays. The most consistent markets were at Shaktoolik and Unalakleet and onshore processing occurred at Unalakleet (Lean et al 1993).

2.2.3 Sport Fisheries

Nine rivers, accessible from the road system near Nome, sustain some level of sport fishing effort for salmon (Figure 2.1). The Nome River has accounted for about 11% of all the sport fishing effort in the entire NW/NSMA during 2008 to 2012. Trends in effort have generally coincided with the abundance of pink salmon available to anglers; however, recent fluctuations in summer employment in the Nome area associated with mining have possibly contributed to the recent effort variation as well. The alternate-year strong pink salmon run in Norton Sound has a major influence on salmon harvests in sport fisheries on road-accessible streams. This relationship has been strongest in the Nome River because of its proximity to Nome and the ease of access to visitors and residents alike. All data tables are in Appendix I.

Chum salmon escapements had been increasing in the Nome River in recent years since the collapse in 1990 and had reached up to 7,034 fish in 2007, but in 2009 these numbers had dropped again to 1,565 fish. In 2013, the chum salmon escapement into the Nome River was

[6]Alaska Dept of Labor and Workforce Development. http://live.laborstats.alaska.gov/labforce/labdata.cfm?s=19&a=0 accessed 06/19/2013.

4,811 fish. The pink salmon escapement dropped from over 1.1 million fish in 2008 to just 16,490 fish in 2009; however, due to the alternating strong (even-year) and weak (odd-year) run life cycle of pink salmon, this drop was not unexpected. The 2007 parent year escapement for the 2009 return was 24,395 fish. The pink salmon escapement in 2013 was 10,257 fish, a reduction of 29% from parent year 2011; however, this level of escapement is considered sufficient to provide for subsistence and sport harvests.

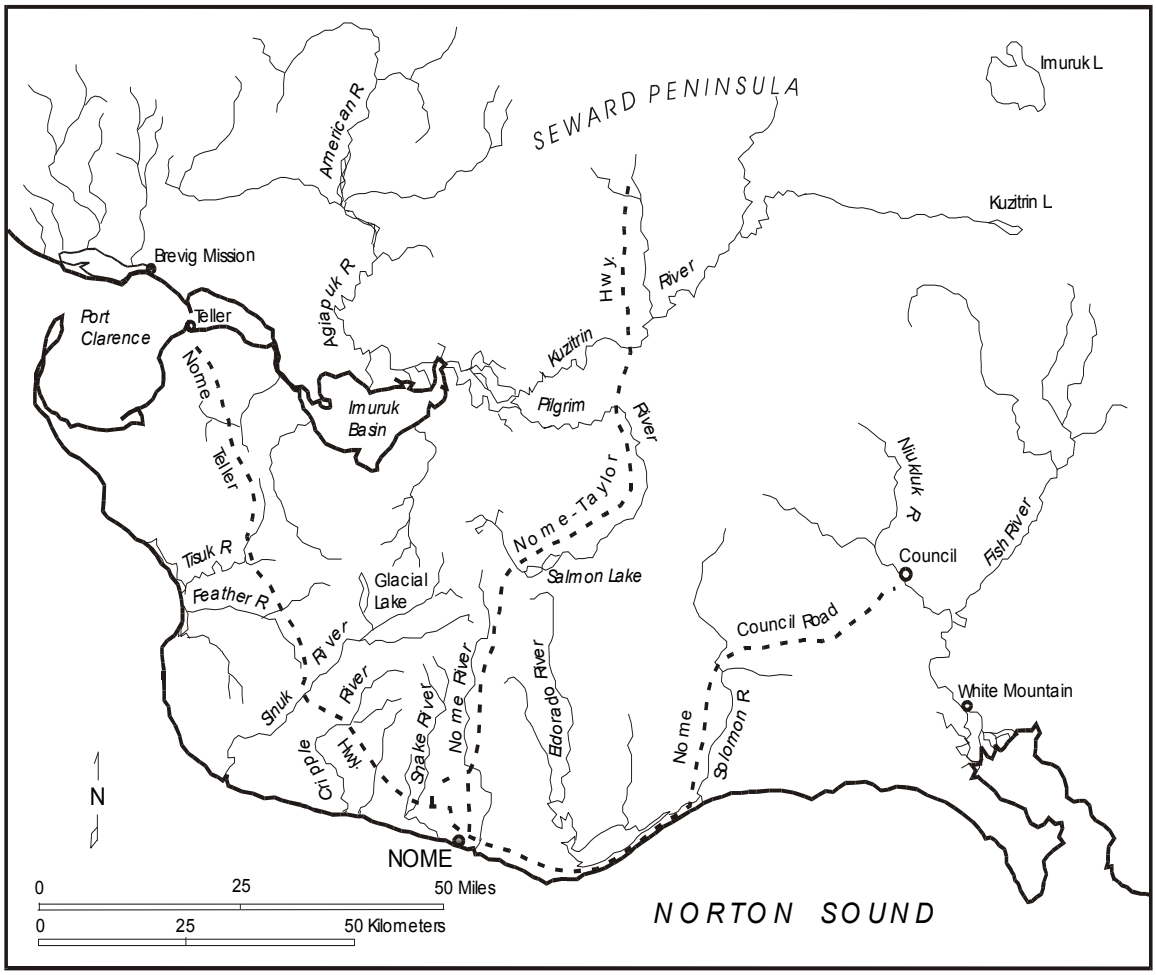

Figure 2.1.–Northern Seward Peninsula with road-accessible waters.

The Niukluk and Fish Rivers are also popular sport fishing locations for salmon. Two guiding operations are located on the Niukluk River, and another uses helicopters to transport clients to the upper reaches of these rivers to fish primarily for Arctic grayling, but also coho salmon and Dolly Varden. Many Nome residents have summer cabins on the Niukluk River or fish camps along the river. Residents of White Mountain also travel upriver to the Niukluk for recreation and because the river has several good spots to beach seine for salmon. Since the construction of the bridge over Safety Sound in 1980, as well as improvements to the road, access to the Niukluk and Fish Rivers has improved and this area has become a desirable destination for the road-bound angler. Pink, chum, and coho salmon fishing is popular in the Fish River drainage but the

majority of the harvest is of coho salmon. Since 2005, the lower bound of the escapement goal range for coho salmon (2,400–6,100) has been met every year through 2011, averaging over 7,000 coho salmon a year during this time. The 2012 count of 1,729 is considered incomplete, because the counting tower was inoperable after August 16 due to high water, well before the historical coho salmon escapement midpoint date of August 21. Historically, Chinook salmon have not been found in large numbers in the Niukluk River, and escapement of Chinook salmon into the Niukluk River has been less than 200 fish.

The Pilgrim River, with its headwaters at Salmon Lake, has historically been less popular for salmon fishing. Some of the sport fishing effort in the Pilgrim River drainages is directed toward other species, because the Pilgrim (and the nearby Kuzitrin River) provides anglers with access to the best northern pike fishing on the Nome road system. There is a Bureau of Land Management campground at the outlet of Salmon Lake, and from there, the river can be floated for about 25 river miles to the bridge at mile 65 of the Kougarok Road. Riverboats can be launched at the bridge for access to downstream locations. The Pilgrim River is also open to subsistence fishing with gillnets, beach seines, and dip nets, so it is likely that local residents who desire sockeye salmon from the Pilgrim River would use this gear under a subsistence fishing permit rather than by sport fishing with hook and line. This may explain, in part, the lower sport fishing effort and salmon harvest on the Pilgrim River, when compared to those systems with larger runs of coho and pink salmon—species that are more easily caught by sport fishing gear (such as Nome and Niukluk Rivers). Until 2013, the Fish/Niukluk and the Pilgrim Rivers were the only road-accessible rivers where sport fishing for chum salmon was allowed.

Large sockeye salmon escapements during 2003 to 2008 drew additional subsistence effort to this drainage. All 5 species of Pacific salmon occur in the Pilgrim River. Sockeye salmon spawn in Salmon Lake, and runs initially appeared to respond positively to lake fertilization conducted by Norton Sound Economic Development Corporation (NSEDC), as well as favorable marine conditions (C. Lean, biologist, NSEDC, Nome, personal communication). However, recent escapements have decreased, and the efficacy of fertilization to enhance smolt condition or adult returns remains unclear (Hamazaki et al. 2012). Escapement of sockeye salmon past the weir in the Pilgrim River for the years 2004 to 2008 ranged from 20,448 to 85,520 fish, dropped to 953 fish in 2009, and was back up to 12,428 fish in 2013. These compare to an average escapement of 5,400 for 3 years of enumeration between 2000 and 2002.

The mouth of the Snake River is in downtown Nome. This small stream can be accessed from a bridge at about mile 8 of the Teller Road and from the nearby Glacier Creek Road, and is a popular location to fish for pink and coho salmon as well as Arctic grayling and Dolly Varden. Other popular road-accessible waters include the Solomon and Sinuk Rivers, though sport harvest in these streams is low and consists primarily of pink salmon.

The Unalakleet River supports substantial runs of Chinook, chum, coho, and pink salmon. Most of the angling effort on the Unalakleet River is directed toward Chinook and coho salmon, but other species of salmon, Arctic grayling, and Dolly Varden are also targeted. The Chinook salmon run usually begins in mid-June, peaks during the first week of July, and continues through late July. Anglers access the river by boat from the village of Unalakleet and are composed of a mix of local residents, visitors who rent boats or fish with friends, and visitors who stay at 1 of the 2 sport fishing guide operations on the river. Most sport fishing effort occurs in the lower 15 miles of the Unalakleet River and in the lower 5 miles of the North River, a tributary that enters the Unalakleet River about 7 miles upstream from its confluence with the

Bering Sea. Sport fishing for Chinook salmon in the Unalakleet River is popular with both local residents and guided and nonresident anglers. Generally, about 20% of the Chinook salmon harvested from the river each year are taken by guided anglers.

There are 2 private lodges on the Unalakleet River, upstream of the North River, which provide guided fishing trips for salmon, Dolly Varden, and Arctic grayling. The U.S. Air Force operated a sport fishing recreational camp on the Unalakleet River, 8 miles upstream of the village, during the 1960s. A commercial sport fishing lodge was constructed there in the late 1960s, and the Unalakleet Native Corporation owned the lodge for several years and contracted operations. This lodge is currently in private ownership and can accommodate up to 15 clients at a time. The other, smaller operation generally has 2 to 6 clients at a time and focuses primarily on fishing for coho salmon in August. While the majority of angling on the Unalakleet River used to be by unguided anglers, the proportion of guided anglers has increased in the last 20 years. An unpublished survey by the Division of Sport Fish in the 1990s estimated that only about 8.5% of salmon anglers on the Unalakleet River were guided. Based on estimated effort levels from the Statewide Harvest Survey and known effort by the guiding businesses via the guide logbook program, it is likely that guiding currently accounts for about 15% of the total angling effort on the Unalakleet River.

CHAPTER 3: AREA OF COVERAGE

3.1 Description and Maps

The area encompassed by the *Norton Sound/Bering Strait Comprehensive Salmon Plan* (NS/BSRPT 1996) includes the Port Clarence and Norton Sound salmon districts (5 AAC 04.200; Figure 3.1). Subdistrict boundaries within each district were established to facilitate management of individual salmon stocks, and each subdistrict contains at least 1 major salmon-producing stream.

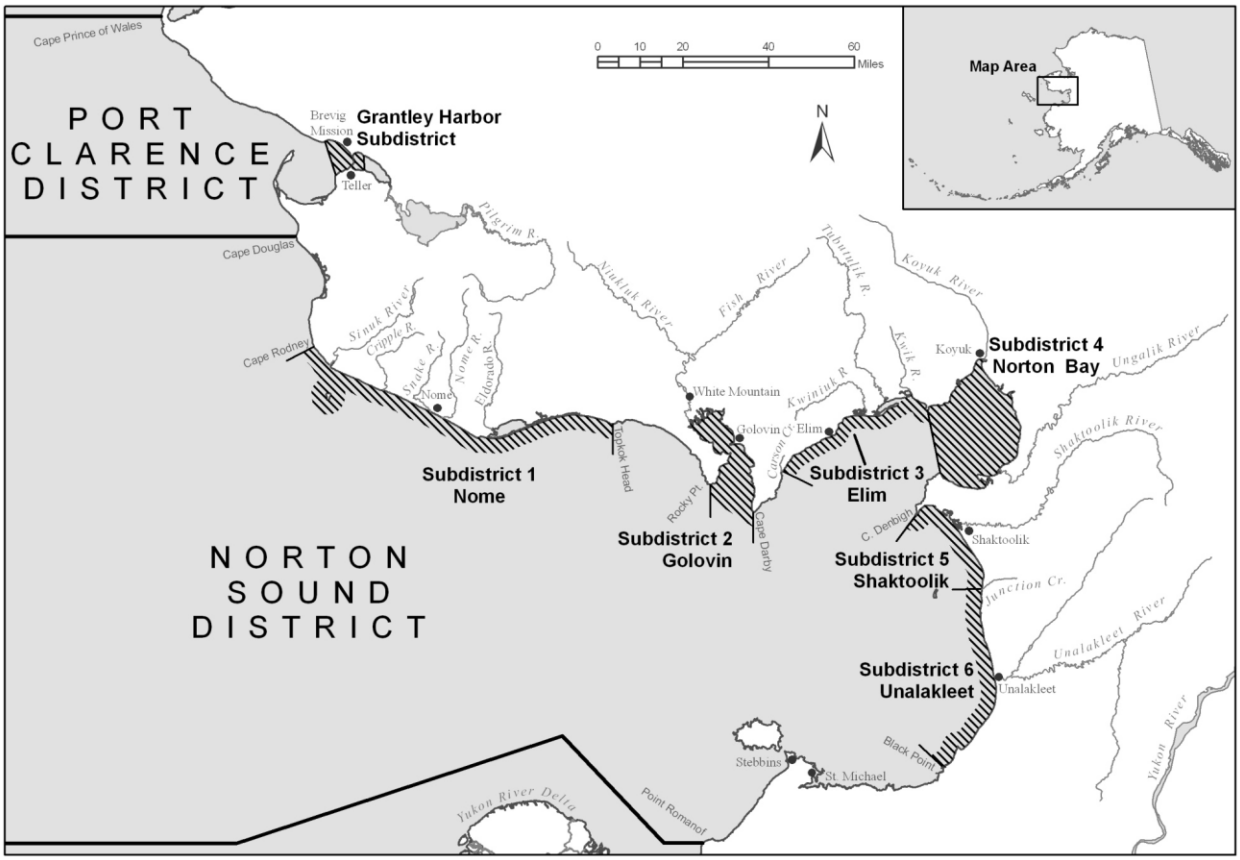

Figure 3.1.–Norton Sound District and Port Clarence District.

The Port Clarence District consists of waters between Cape Prince of Wales and Cape Douglas. The district is divided into 2 subdistricts: (1) The Grantley Harbor Subdistrict, which includes waters inside ADF&G regulatory markers located at the western tip of Cape Riley to the entrance of Brevig Lagoon and from Four Mile Point across Grantley Harbor to the mouth of Sunset Creek; and (2) the Outer Subdistrict, which includes the remainder of the Port Clarence District (Figure 3.2).

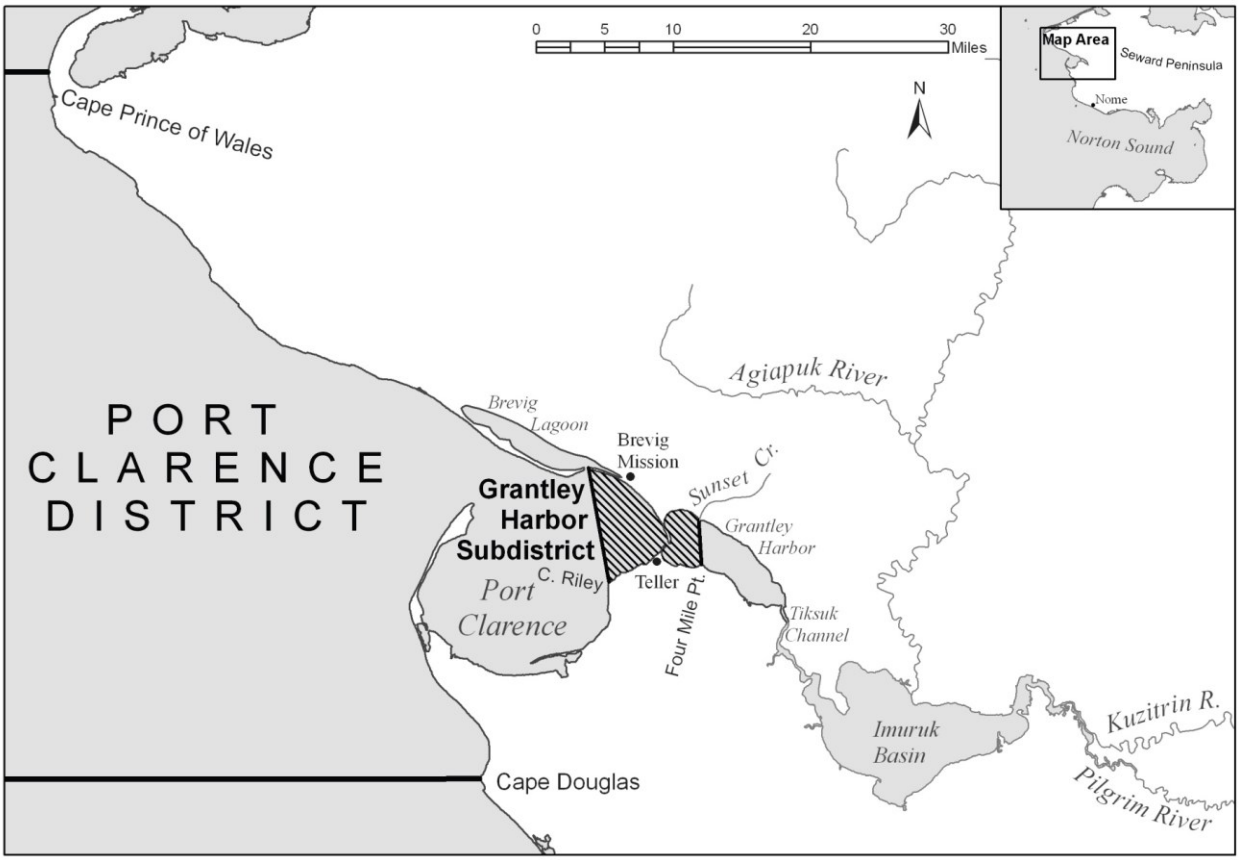

Figure 3.2.–Port Clarence District.

Note: Cross-hatched area on map shows location where commercial salmon fishing may be opened.

The Norton Sound Salmon District consists of all waters between Cape Douglas in the north and Point Romanof in the south. The district is divided into 6 subdistricts: Subdistrict 1, Nome (Cape Rodney to Topkok Head); Subdistrict 2, Golovin (Rocky Point to Cape Darby); Subdistrict 3, Elim (Carson Creek to Bald Head); Subdistrict 4, Norton Bay (Bald Head to Point Dexter); Subdistrict 5, Shaktoolik (Cape Denbigh to Junction Creek); and Subdistrict 6, Unalakleet (Junction Creek to Black Point; Figure 3.3).

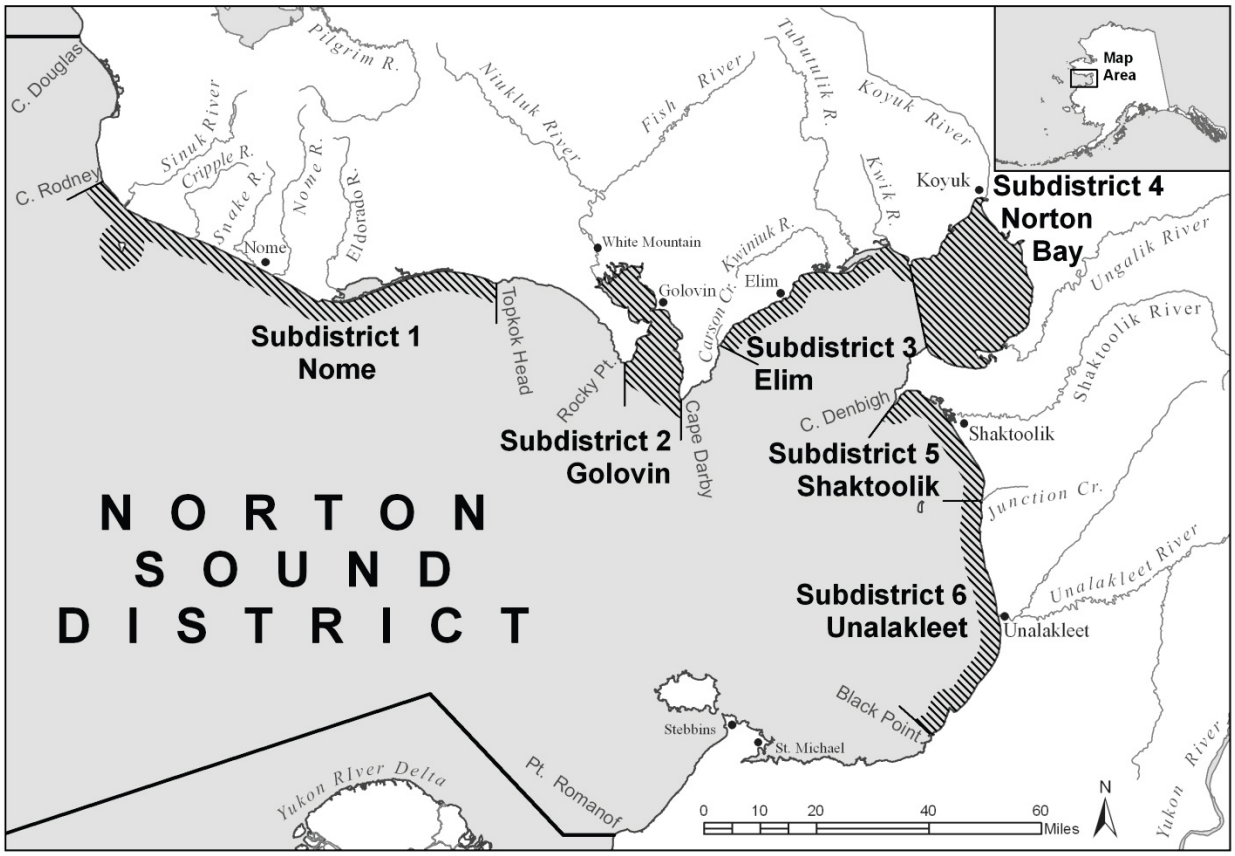

Figure 3.3.–Norton Sound commercial salmon fishing subdistricts.

3.2 Major Fishery Systems

3.2.1 Port Clarence

The coast from Cape Prince of Wales to Lost River has no known salmon streams. This stretch of coast is highly mineralized limestone cliffs. The streams are shallow and tend to freeze down.

The larger streams flowing into Brevig Lagoon, to the west, are known to have runs of pink and coho salmon. A modest harvest of these fish occurs at the entrance of the Lagoon.

In the Grantley Harbor/Tuksuk Channel watersheds most of the larger streams have modest amounts of salmon, primarily pink, chum, and coho. The subsistence fishing is focused on the migratory sockeye and chum salmon running in the center of the channel to the large rivers of Imuruk Basin. Small amounts of sockeye salmon mill at stream mouths along the shore of Windy Cove and a few may spawn on the alluvial fans at each stream. The Cobblestone River supports a few sockeye salmon. The Pilgrim River with Salmon Lake at its head is the main producer of sockeye salmon. The Pilgrim River also supports chum, pink, coho and an occasional Chinook salmon. The Kuzitrin River is primarily a whitefish producing stream, but supports a few chum and pink salmon. The Agiapuk River on the northern shore of Imuruk Basin has strong runs of chum salmon and Dolly Varden of salmon size in the fall. These various salmon stocks, in combination, provide a nearly continuous run of salmon each summer through Tuksuk Channel providing for a

consistent subsistence opportunity. Road access to the Pilgrim River is utilized by the residents of Nome to harvest sockeye salmon. Agiapuk River stocks of chum salmon and Dolly Varden are strong, but harvested in greater numbers when fuel costs were less and the communities on the Lower Pilgrim were inhabited.

3.2.2 Subdistrict 1 (Nome)

Historically, Nome Subdistrict salmon runs were predominantly chum with the possible exception of the Sinuk River sockeye run. The Sinuk River was heavily impacted by the fishery conducted to feed the military in WWII, and then by greatly improved road access in the early 1970s. Pink salmon runs built beginning in the late 1970s and established a strong even-year cycle from 1984 to present. Beaver colonized the subdistrict by 1990 and with the numerous beaver ponds, coho salmon found much improved juvenile overwintering habitat (Nemeth et al. 2004). Pink and coho salmon have coincidental cyclic returns (even and odd year) and both have prospered in the last 3 decades. In contrast, chum salmon have generally declined through the 1990s. Chum salmon abundance has stabilized in the last decade at a level below pre-1980 levels (Appendix I).

A commercial fishery for chum and coho salmon operated from the mid-1970s to the mid-1980s; however, after the mid-1980s runs were no longer adequate to support both subsistence and the commercial fishery. Managers of the fisheries recognized salmon bound for further north were likely being harvested when marine harvest opportunities were allowed within the subdistrict. A policy of directing harvest to local salmon stocks was enforced starting in 1990 and severe harvest restrictions and closures occurred in both the fresh and marine water fisheries. Those years of closures and small harvests combined with increased availability of refrigeration has caused a decline in the use of seasonal fish camps. Today, commercial fishing is very limited in this subdistrict. Chum salmon are now second to pink salmon in the number of those being utilized for subsistence. Coho salmon are predominantly caught on the less traditional hook and line gear and preserved with refrigeration. Nome residents invest less in fixed summer fish camps and now focus on boats and trailers which provide mobility to harvest a more diverse suite of stocks in the Pt. Clarence, Nome, and Golovin Bay Subdistricts and associated drainages.

The Sinuk River is a shallow braided river with coarse substrate. There are several springs that support winter flow levels, but extensive portions of the river may freeze in years of low snow cover or cold temperatures. The Sinuk River currently supports runs of sockeye, coho, pink, and chum salmon and abundance varies from year to year. There has been increased enforcement of fishing regulations near the Teller Highway bridge in the last decade and returns appear to have increased. During the 1980s, local residents were aware of a small stock of Chinook salmon that spawned a few miles below the Teller Highway in the Sinuk River. At the time there was fishing on this stock, but it now no longer exists.

Glacial Lake was evaluated in 1995 in a comparison study with Salmon Lake to investigate nutrient levels for rearing sockeye salmon. Glacial Lake was determined to be spawning area limited—in contrast to Salmon Lake which was found to be nutrient limited (Todd and Kyle 1997). Enumeration projects over the years at Glacial Lake indicate the sockeye stock has grown since the 1970s.

The Cripple and Penny Rivers are accessible for much of their length. Historically they supported modest subsistence salmon harvests. Some local residents have expressed concern that tourist mining operations have impacted habitat and escapement on the Cripple and Penny Rivers in the

last 20 years, and salmon runs no longer support much local harvest with the possible exception of coho salmon fishing during peak migration times. Coho salmon appear to benefit from beaver colonization induced habitat alterations (Nemeth et al. 2004).[7] The Penny River chum stock abundance has declined so dramatically that it potentially may become extirpated.

The Snake River has sustained a heavy harvest for the past 100 years, likely because it runs through the city of Nome. The stream is historically a chum salmon-producing stream, and in more recent years it supports a good number of coho salmon. Pink salmon runs occur in modest numbers which may be attributed to the relatively coarse gravel in the vicinity of year-round springs. Salmon stocks are no longer observed spawning in several small tributaries that run through the developed parts of the watershed where residents state it formerly occurred.

The Nome River historically supported chum and pink salmon in good numbers (NS/BSRPT, 1996). In the mid-1950s, large quantities of river gravel were mined for road construction from the mouth of Banner Creek to its headwaters. This changed the character of the stream by reducing the extent of river braiding and increased the coarseness of the gravel (Woodward-Clyde 1980). Chum salmon typically prefer braided streams and pink salmon require finer substrate. This habitat shift appears to favors coho salmon.

The Eldorado and Flambeau Rivers support strong chum runs, often accounting for more than half of the chum salmon returning to the Nome Subdistrict (Appendix I). These rivers support modest returns of pink and coho salmon. Safety Sound, located east of Cape Nome, is a shared estuary for these streams, and research indicates that the juvenile chum salmon leaving these systems have an alternate exit strategy to the standard mid-June migration to sea. A significant proportion of the chum salmon from these streams migrate to sea in August after apparently spending time in the estuary (Nemeth et al. 2006). This may account in part for a better survival for these stocks compared to stocks immediately to the west with very small estuaries.

The Bonanza and Solomon Rivers drain into the Bonanza Channel, the eastern extension of Safety Sound. The Solomon River is the most heavily impacted stream in the region with regard to gold mining. These streams have a mix of water sources with relatively deep springs that run a constant 4°C and others that run at more variable temperatures. These streams support populations of coho, pink, chum and a few sockeye salmon. Coho salmon spawning activity is focused on inriver springs as the summer flow dries up. The remaining salmon species spawn short distance from the springs when there are several months of relatively warm ground water. Significant reaches of these rivers freeze to the bottom during the winter which limits the amount of viable spawning beds (Charlie Lean, personal communication).

Escapement goals and management strategies for Subdistrict 1

In Subdistrict 1, chum salmon run abundance is first projected and then monitored to achieve the optimal escapement goals (OEGs) listed in regulation for the Nome, Snake, and Eldorado River chum salmon. These OEGs are the recognized primary escapement indices for achieving a

[7] Williams, B. C., M. J. Nemeth, R. C. Bocking, C. Lean, and S. Kinneen. 2009. Abundance and marine survival of coho salmon smolts from the Nome River, Alaska, 2006-2008. Unpublished report prepared for the AYKSSI by LGL Alaska Research Associates, Inc. and NSEDC.

subdistrictwide biological escapement goal (BEG) range of 23,000 to 35,000 chum salmon and an amount necessary for subsistence range of 3,430 to 5,716 chum salmon. A Tier II fishery can be implemented should the abundance fall short of these requirements. There has not been a Tier II fishery implemented since 2005, and Tier II subsistence fishing restrictions were rescinded early during the 2004 and 2005 seasons.

The Subdistrict 1 BEG of 23,000 to 35,000 chum salmon has been achieved 4 of the last 5 years. However, achievement of the goal may be a result of better productivity of chum salmon east of Cape Nome disproportionately contributing to the BEG. Even though both the Nome and Snake Rivers have achieved escapement goals 8 out of the last 10 years, the Eldorado and Bonanza are bigger rivers with large escapements. The chum salmon escapement goal range for the Eldorado River, which is east of Cape Nome, is double the combined escapement goal range of the Nome and Snake Rivers, both of which are west of Cape Nome, highlighting the disparity in river productivity within the subdistrict. In the last 5 years, the Eldorado River has exceeded the chum salmon escapement goal range in 4 years, and the Nome and Snake Rivers have met or exceeded their escapement goal ranges in 3 years (Appendix I). In recognition of the possibility that only some of the index streams within Subdistrict 1 may have adequate escapement of chum salmon, regulation changes made at the 2013 Alaska Board of Fisheries meeting allowed for subsistence gillnet fishing for chum salmon to be managed separately in the western and the eastern half of Subdistrict 1.

Although chum salmon runs are greater east of Cape Nome, for pink salmon the run strength is much greater west of Cape Nome. Both the Nome and Sinuk Rivers have much larger runs of pink salmon, particularly in even-numbered years, compared to rivers east of Cape Nome. Nome River has the only pink salmon escapement goal in Subdistrict 1 with an odd-year goal of 3,200 and an even-year goal of 13,000 pink salmon. Beach seining and species specific openings are allowed to take advantage of strong returns of pink salmon in several rivers or sockeye salmon on the Sinuk River.

No coho salmon escapement goals have been established in Subdistrict 1.

3.2.3 Subdistrict 2 (Golovin)

Inner Golovnin Bay is a shallow estuary with significant coverage of eel grass. The second largest salmon-producing stream in Norton Sound flows into this estuary, the Fish River. Prior to 1985, this was the largest producer of chum salmon in the district. Today the chum returns are much smaller (Appendix I). Besides the Fish River, the Klockerblock (Kutche-block) River and the Kachavik River also drain into the estuary. The Kachavik River is heavily utilized by Golovin residents as their primary subsistence fishing site. The Fish River system has several tributaries of note. The Niukluk River, which is roughly 1/3 of the system, is primarily a chum and coho salmon stream. There is a small pocket of sockeye salmon that spawn on the lower Casadepaga River near No Name Creek. Several tributaries of the upper Fish River, Boston Creek, and the Etchepuk and Arathlatulik Rivers are all important contributors to salmon production of the Fish River drainage. Boston Creek has a well-documented Chinook salmon run of 200 to 600 fish.

Outer Golovnin Bay has 2 streams that produce salmon: Chenik Creek and McKinley Creek. Chenik Creek is close to the mouth of inner Golovnin Bay and pink and coho salmon are the primary salmon in that stream. McKinley Creek is several miles further out on the Darby Peninsula,

has a steep gradient with coarse substrate, and residents report it only supports a coho salmon population.

Escapement goals and management strategies for Subdistrict 2

The Subdistrict 2 regulatory salmon management plan limits commercial harvest to a maximum of 15,000 chum salmon before mid-July in an attempt to protect chum salmon stocks and allow for some harvest while flesh quality is at its best. By mid-July, the chum salmon run can be assessed and fishing time adjusted accordingly. The counting tower project on the Niukluk River was used to evaluate escapement in the Golovin Subdistrict from 1995 to 2012, but the project was eliminated in 2013. In 2014, a new tower project was placed on the Fish River, a few miles below the mouth of the Niukluk River. It was sited just below the alluvial fans of the Fox River and Niukluk River where the bulk of the chum salmon spawn in the Fish River. This new project is expected to provide a more complete count of salmon to the drainage and therefore a better index of salmon escapement for the subdistrict. Like all new projects it will take a few years to establish comparative data.

There was no commercial chum salmon fishing in Golovin Subdistrict from 2002 to 2007, largely because escapements in most of those years had fallen short of the lower bound sustainable escapement goal (SEG) for the Niukluk River (Appendix I). Consequently, ADF&G has implemented a conservative approach to determine when commercial fishing may occur.

3.2.4 Subdistrict 3 (Elim/Moses Point)

The western portion of the subdistrict from Carson Creek to Iron Creek has no salmon-producing streams; however, pink salmon may stray into Walla Walla Creek during years of high abundance. Iron Creek was a chum producing stream with a few subsistence camps at its mouth until the road was built in the late 1960s with a perched culvert that restricted salmon passage (Oscar Takak, personal communication). This culvert was replaced with a less perched culvert in 1984. Today, Iron Creek is known for its extensive terraced beaver pond complex and a strong coho salmon run.

The Kwiniuk River has a history of changing its mouth location periodically, utilizing different channels; the word Kwiniuk translates loosely to *new river*. Several old channels are visible from the air. In the last few years the channel from Caches or Kwiniuk Lagoon (known locally as the bypass channel) has been blocked by beach retreat when storm surge pushes sand into the channel, and this has appeared to coincide with lower chum salmon counts at the Kwiniuk counting tower. The Kwiniuk and Tubutulik Rivers are important chum salmon streams. Coho appear to be increasingly utilizing Subdistrict 3 rivers whereas Chinook salmon stocks appear to be experiencing a regionwide decline.

On the Kwik River, Jepson Ponds provide a spawning habitat for a small run of late-spawning chum salmon that is important to some in Elim. Similar small runs of chum also existed on the opposite side of the Kwik River valley 2 decades ago, prior to recent beaver colonization of the area. The beaver dams create impasses where salmon must wait for water levels to rise in order to transit the dams. While concentrated here, the salmon may fall prey to bear and other predators. Coho salmon are utilizing the upper Kwik River for spawning (Oscar Takak, personal communication).

Escapement goals and management strategies for Subdistrict 3

The Subdistrict 3 management plan directs ADF&G to project that the chum salmon OEG for the Kwiniuk River will be reached, and that ensure harvestable surpluses will be in excess of subsistence needs before directed chum or pink salmon commercial fishing is allowed. Further,

in times of low chum salmon abundance, directed pink salmon commercial fishing may not occur before July 7 in the subdistrict. By this date, historical data indicate that the bulk of the chum salmon run is in Kwiniuk River and commercial pink salmon fishing would be expected to have little impact on chum salmon escapement or subsistence needs.

3.2.5 Subdistrict 4 (Norton Bay)

Regulatory boundaries of the Norton Bay Subdistrict have gradually been expanded to the west in an effort to increase commercial product quality by harvesting brighter salmon prior to entering freshwater spawning tributaries. The same 3 salmon-producing rivers, the Koyuk, the Inglutalik, and the Ungalik, have been within the subdistrict since it was established, but today all of Norton Bay is the regulatory commercial fishing subdistrict. Although the Koyuk River, draining into Norton Bay from the north, is the largest drainage in Norton Sound, it produces relatively few salmon. The East Fork of the Koyuk River flows from the Nulato Hills and support a small chum salmon spawning population. Tests of these fish indicate they are genetically similar to the later running Kotzebue chum salmon (Olson et al. 2006). A small subsistence camp is located at the confluence of the East Fork and Koyuk Rivers.

The Inglutalik River is located near the town of Koyuk and supports some subsistence effort and some commercial chum salmon fishing as well. Based on Norton Bay tributary assessment programs, the Inglutalik River may support the largest Chinook salmon run (approximately 900–1,600 fish) in the subdistrict.

According to residents of the area, there was a separate village at the Ungalik River up to WWII, and the beach near the Ungalik River supported a seasonal commercial fishing camp of 7 to 9 permits for 2 decades until the mid-1980s. In recent years, several commercial fishermen target coho salmon near the same beach. The Ungalik River today supports chum, pink, and coho salmon runs.

Norton Bay salmon returns have been some of the most consistent in the Norton Sound area during the last 50 years. Norton Bay provides a large mixing zone, similar to an estuary. The sea ice is constantly shore fast, helping to ensure a thick freshwater lens in early summer that may benefit juvenile salmon as they emigrate to sea, and the bottom of the bay has good coverage of vegetation that hosts spawning herring and provides cover for juvenile fish (Charlie Lean, personal communication).

Escapement goals and management strategies for Subdistrict 4

Historically, Norton Bay Subdistrict has had difficulty attracting a buyer due to its long distance from a port and its reputation for watermarked fish. Until recently, Norton Bay Subdistrict was typically managed based on Shaktoolik and Unalakleet Subdistricts salmon run assessments due to a lack of ground-based escapement projects in Norton Bay. However, in 2011, an enumeration tower project was initiated by NSEDC on the Inglutalik River to provide an index of salmon escapement to Norton Bay. Currently, the Inglutalik River escapement counts are considered ancillary to comparative catch statistics for inseason management until a longer time series of escapement data become established.

In 2008, a small-scale commercial salmon fishery occurred in Norton Bay Subdistrict for the first time since 1997, and 4 permit holders participated. ADF&G again opened the commercial salmon fishery in 2009 and 7 permits holders participated. In 2010, there were 5 permit holders participating in the fishery, which was limited due to a combination of inadequate tendering

capacity in early July, mechanical breakdowns on tender vessels in August, and reduced fishery participation likely due to concurrent fisheries prosecuted in the Elim and Shaktoolik Subdistricts (Permit data on file with ADF&G, Division of Commercial Fisheries, Nome).

In 2011 effort nearly doubled to 12 permit holders and in 2012 there were 18 permit holders fishing in Norton Bay Subdistrict and a record 49,970 pink salmon were harvested. In 2013 there was a record catch of 36,021 chum and 5,485 coho salmon by 18 permit holders.

3.2.6 Subdistrict 5 (Shaktoolik)

The Shaktoolik River has a long history of providing salmon for multiple villages that have existed near its mouth. Tagoomenik River, a tributary of the Shaktoolik River, has borne a disproportionate share of these communities' fishing effort. Today the Tagoomenik River serves as the boat harbor and water source for the town of Shaktoolik and coho salmon are still harvested there. The combination of human activity and colonization of the area by beavers is believed by some to have caused significant changes in salmon habitat in the Tagoomenik River, particularly for chum salmon and possibly for Chinook salmon.

The Shaktoolik River can be considered in 2 parts; the lower river which transits the broad coastal plain and the upper river that runs through the Nulato Hills. The lower portion, which is far shorter than the upriver portion, contains much of the salmon spawning and juvenile rearing habitat. This portion of the river consists of a meandering deep channel with eroded wooded banks that provide cover and excellent interstitial ground flow. There are numerous oxbow lakes which can provide good juvenile salmon habitat. The upper river has much sparser use by salmon. Chinook, coho, chum, and pink salmon stocks are all present in the main river (Charlie Lean, personal communication).

Escapement goals and management strategies for Subdistrict 5 and 6

Both Subdistricts 5 and 6 consistently attract commercial markets due to larger volumes of fish and consistent transportation services. Management actions typically encompass both subdistricts because salmon tend to intermingle and harvest in one subdistrict, which can affect the movement of fish in the adjacent subdistrict (Gaudet and Schaefer 1982). Results from ADF&G's test net in Unalakleet River (Kent 2010), North River tower counts, and subsistence fishermen interviews in Unalakleet were used to set early fishing periods in both subdistricts. However, the test net project was discontinued in 2013. In 2013, ADF&G used the North River tower counts to assess run strength along with commercial and subsistence catches and, later in the run, counts from the Unalakleet River weir which is much farther upstream. Radio telemetry projects in the Unalakleet River drainage have shown a large percentage of the Chinook salmon run spawns in the North River compared to chum and coho salmon (Estensen et al. 2005; Estensen and Hamazaki 2007; Joy et al. 2005; Joy and Reed 2006 and 2007; Wuttig 1998 and 1999). Aerial surveys are only useful for late season escapement assessment because of the long travel time between the fishing and spawning grounds.

In Subdistricts 5 and 6, directed commercial Chinook salmon fishing has only occurred in 2 of the previous 11 years. Restrictive action was taken in the subsistence and sport fisheries from 2003 to 2004 and from 2006 to 2013. A weak run of Chinook salmon to Shaktoolik and Unalakleet Subdistricts in 2013 precluded commercial fisheries directed on Chinook salmon but also led to a significant amount of foregone chum salmon harvest. As a consequence of the poor Chinook salmon run, directed chum salmon fishing was delayed until July 1 per the Shaktoolik

and Unalakleet Subdistricts management plan. This early season closure to commercial fishing is likely to continue for the foreseeable future.

3.2.7 Subdistrict 6 (Unalakleet)

The Unalakleet River is the primary salmon-producing stream in the subdistrict, but both the Egavik and Golsovia Rivers also produce salmon. The Golsovia River is unique in Norton Sound with its steep gradient and large boulder bottom, which appears more suitable to Chinook salmon since relatively few chum or coho salmon are present. A camp at the mouth of the Golsovia River is used for subsistence salmon fishing activity, guided sport fishing, and herring commercial fishing. Black Point, less than 1 mile from the mouth of the Golsovia River, is used for both commercial Chinook and coho salmon fishing.

Both the Unalakleet and Egavik Rivers drain from the Nulato Hills. Their gradient, substrate, and fish communities are very similar. These streams have a long history of subsistence fishing activity. All 5 pacific salmon species exist in these watersheds. Sockeye salmon are not numerous, but there is a slough on the south side of the Unalakleet River that supports a consistent spawning aggregation of sockeye salmon each year. Chinook salmon run abundance has been in decline for the past decade. The South River, a small tributary, no longer has Chinook spawning there although locals state that it once did. Other salmon species have had much more consistent returns in eastern Norton Sound.

A tagging study conducted in 1978 found that multiple species and stocks of salmon in eastern Norton Sound comingled in a gyre bounded by Cape Denbigh Peninsula, Besboro Island, and the Unalakleet River plume (Gaudet and Schaefer 1982). The discovery of this behavior has resulted in salmon management that recognizes the harvest may contain stocks bound for other subdistricts, and considers Subdistricts 5 and 6 as a unit with their respective salmon harvest coming from both the Shaktoolik and Unalakleet River populations. This adult behavior is an indicator that salmon from these rivers may face similar marine conditions (Charlie Lean, personal communication).

Escapement goals and management strategies for Subdistrict 5 and 6
Subdistricts 5 and 6 are managed together and are described in Section 3.2.6 above.

3.2.8 Other

3.2.8.1 St. Lawrence Island

The St. Lawrence Island communities of Gambell and Savoonga were able to list a number of streams with small salmon returns. They also indicated there a number of capes and headlands that consistently yielded harvests of specific salmon. Some of these fish were likely late-stage juvenile Chinook salmon about 1 year from spawning.

The cost of fuel for boating was seen as a limiting factor for subsistence activity, thus the subsistence closest to the 2 communities were favored over some of the historic summer camp locations that were established at the site of stronger fish populations. Gambell favored the coast line due south from that community, particularly the headlands, for set gillnets. The small lagoon just to the east of Gambell is also said to support a run of Chinook salmon. Savoonga listed the area around Northeast Cape as particularly productive for salmon. Reportedly Koozata Lagoon and River were historically areas that supported salmon fishing, but with the price of fuel they are increasingly hard to get to.

3.2.8.2 Wooley Lagoon

The Wooley Lagoon region lies just north of the Nome Subdistrict. It was excluded from the Nome Subdistrict because it contained no salmon streams sufficient to attract fishing effort in the early 1960s. Today there is a seasonal camp near the entrance to Wooley Lagoon. Occasionally set gill nets are deployed and small catches of salmon result. Most of these are thought to be fish that stray during their migration and are not part of a perpetuating return. Aerial surveys find very small numbers of pink and chum salmon in the Feather and Tisuk Rivers and occasionally Pelluk Creek. These streams are thought to be limited in their production because they freeze during the winter.

3.2.8.3 The Southern Coast of the Norton Sound District (beyond Subdistrict 6)

The communities of St. Michaels and Stebbins have no commercial fishery for salmon, but have a long history of subsistence fishing at various headlands and in 3 local rivers. The St. Michael Canal has multiple channels and 2 mouths. Its largest tributary is the Nunvulnuk River which once supported a small village near a lake at the edge of the coastal plain. This lake has both chum salmon and sheefish. Occasionally other salmon species can be caught in the canal. The Kogak or Nunakogak River is a small stream that supported a couple summer fish camps that historically fished for chum salmon. Locals note that beavers began colonizing the area in the late 1980s, and since then it has been observed that coho salmon have expanded while chum salmon have decreased their former spawning range on this stream. The Kogak River supports a few pink salmon and a run of cisco that likely are utilized as prey by juvenile coho salmon. The Pikmiktalik River once supported a small community for hundreds of years. Three old village sites are visible from the air. This river has runs of coho, chum, and pink salmon that are harvested by local residents, along with a few Chinook salmon every year as well. The river sees fewer visitors now as increased fuel costs discourage travel.

3.3 Current Status of Fisheries (1996–2013)

3.3.1 Subsistence Fishery

Subsistence fisheries in the Norton Sound area are currently in a state of flux. For example, increasing coho salmon abundance during the last 3 decades has affected harvest by local residents. Other climate change effects, as well as economic considerations such as the cost of fuel and limited commercial fishing income, may also be driving change in subsistence harvest patterns. Families have extended their fishing season in some years as Chinook salmon became less available and they shift some effort to coho salmon harvest later in the season. The need for multiple fishing strategies targeting additional species requires more mobility. Boats and nets have become a greater priority and camps in areas with declining harvest opportunity have been abandoned or poorly maintained. In many peoples' minds this shift to fish processing in town has resulted in less family time. Concern has been expressed by individuals that important opportunities to pass down traditional knowledge no longer exist. Elders have been particularly affected due to limited ability to follow the harvest, physical limitations, and shortened family contact.

A recent study examining traditional knowledge and subsistence salmon fishing in the region described its findings as

> There was an uptick in concerns about fish health compared to the past. Overall participants noted a decrease in salmon populations. Harvests are down overall. A number of environmental changes were noted, such as more rain, less snow, more

> unpredictable weather, warmer winters, warmer water temperatures, widespread erosion, thinner winter ice, later freezeups, and more variable breakups. Concerns were noted about the effects on salmon populations of predator fish (especially trout), commercial harvests, and dramatic increases in beaver populations. Environmental changes, management practices, and large-scale commercial fishing activities are seen as the three biggest threats and sources of harm to fisheries, fish environments, and abilities for local harvest. Significant concern was expressed by participants for the health of fisheries and natural resources in general. A complex picture also emerged of the importance of salmon to communities, coupling decreased harvest activities with continued importance in cultural, nutritional, and economic terms. Numerous recommendations were made by participants which have relevance for management, policy makers, researchers, and study region residents and entities. (Raymond-Yakoubian and Raymond-Yakoubian *In prep*)

Subsistence users have become more responsive to short-term abundance or availability. Traditional dry fish preservation is declining and with it the harvest of chum salmon in particular. Chum salmon require at least a week to dry well and pink salmon can be dried in just a few days and are far more abundant. In areas and rivers that can support a harvest of Chinook salmon they are preferred and recent closures of the traditional Chinook salmon fisheries in Subdistricts 5 and 6 are of great concern to local residents. Nome and Pt. Clarence residents greatly value sockeye salmon, particularly the Salmon Lake stock, with demand often exceeding supply. In the last 20-plus years, harvest and participation in this fishery has increased. Coho salmon in Northern Norton Sound can be harvested for subsistence using hook and line which is the preferred method. Daily limits for all hook and line fisheries in this area are the same and small in comparison to limits for net fisheries. Coho salmon are an important component of the subsistence harvest (Appendix I).

Subsistence salmon fishermen in Port Clarence District, Cape Woolley region, and Subdistricts 1–3 are required to possess a subsistence salmon fishing permit for each household that fished in these locations. Households may obtain and fish permits for multiple areas. Return rates for these permits have been close to 100% in most years.

In southern Norton Sound, postseason household surveys are conducted in the villages of Koyuk, Shaktoolik, and Unalakleet, and attempts are made to contact 100% of the households. In many years, the villages of Stebbins and St. Michael are surveyed in the same manner as the communities in Subdistricts 5 and 6.

Within Norton Sound District, there are limits on subsistence salmon harvests in Subdistrict 1 (Nome) that have been in place since 1985. Also, subsistence fishermen using hook and line must follow sport fish bag and possession limits in all subdistricts except in the Subdistrict 1 subsistence zones, where they can catch the subsistence limit. From 1991 through 2005, Subdistrict 1 was closed to subsistence salmon fishing in mid-June in order for ADF&G to determine the run strength of chum salmon before allowing fishing. Tier II regulations have not been in effect since 2006 because the chum salmon run was projected to achieve escapement goals and exceed the amount necessary for subsistence (Menard et al 2015).

In Port Clarence District subsistence permits are required. A separate permit is required for Pilgrim River and for Salmon Lake. Harvest limits exist on the Kuzitrin and Pilgrim Rivers and Salmon Lake; otherwise there are no salmon harvest limits in Port Clarence District.

Beginning in 2007, regulations allowed for cash sales of up to $200 worth of subsistence taken finfish per household, per year, in the Norton Sound-Port Clarence Area only. In 2013 the amount allowed was raised to $500. Increased efforts to remind residents about the permit requirement when selling subsistence caught finfish resulted in 18 permits issued and cash sales of almost $2,000.

3.3.2 Commercial Fishery (Menard et al. 2012)

Commercial fisheries are influenced by limited markets and marginal runs of many salmon stocks in the Norton Sound Region. Commercial fishing is allowed if a market is available *and* if the commercial fishery is not expected to jeopardize escapement or reasonable opportunity for subsistence fishing (Menard 2013). The eastern subdistricts (Norton Bay, Shaktoolik, and Unalakleet) have fairly healthy salmon stocks, but Chinook salmon runs have been poor in the recent decade resulting in little-to-no Chinook salmon-directed commercial fishing.

The commercial salmon fishing season usually opens by emergency order between June 8 and July 1, but depends on run timing within each subdistrict. The season closes by regulation on August 31 in Subdistricts 1, 2, and 3, and on September 7 in Subdistricts 4, 5, and 6, but processors had often terminated their operations before regulatory closure dates. However, during recent years Norton Sound Seafood Products has remained operational until the regulatory fishing season closure. Commercial fishing periods are set by emergency order.

Commercial fishing gear is restricted to gillnets. A maximum aggregate length of 100 fathoms is allowed for each fisherman and there are no depth restrictions. However, fishery timing and gear specifications (e.g., mesh size, net length) are often restricted in an attempt to direct harvest toward a specific species of salmon. Fishing periods restricted to gillnets with 6.0 in and smaller stretched mesh are used to target chum and coho salmon and most gillnets fished are approximately 5.875 in stretched mesh. In Subdistricts 5 and 6, 8.25 in stretched mesh gillnets are commonly used to target Chinook salmon in June through early July. During years when large pink salmon runs occur and there is a buyer, ADF&G establishes fishing periods allowing only 4.5 in mesh or less to target pink salmon while reducing harvest of larger sized salmon species.

No commercial salmon fishing periods occurred in Subdistrict 1 from 1996 to 2013. The subdistrict had depressed chum salmon stocks that, until the mid-2000s, required closure or severe restrictions of the subsistence fishery. Although salmon runs have improved greatly in recent years with record runs of pink and coho salmon and the best chum salmon runs since the 1980s, the subdistrict has been unable to attract a buyer for pink and coho salmon. The subdistrict was closed to commercial chum salmon fishing by regulation until runs sizes proved adequate to provide for subsistence harvest for a full chum salmon life cycle. In response to improved chum salmon run abundance, the regulation changed in early 2013 allowing commercial fishing by emergency order if escapement goals are projected to be met.

The Norton Bay Subdistrict often has healthy stocks of chum, coho and pink salmon, but the remote area has been unattractive to buyers. In 2008, improved market conditions allowed

Norton Sound Seafood Products to bring tenders to the subdistrict to buy salmon and commercial fishing resumed in the subdistrict.

Commercial fisheries in Golovin and Elim Subdistricts target chum and pink salmon during June and July and coho salmon in late July and August. Commercial chum salmon harvests have dropped dramatically since the mid-1980s. Poor chum salmon runs resulted in restrictive management actions during the late 1990s and early 2000s, and in the mid-2000s there was little market interest even as runs began to rebound. However, continued improvement of chum salmon runs in the late 2000s in Norton Sound have sparked renewed buyer interest in the northern subdistricts.

In the Port Clarence District, commercial fishing has only opened in 2 seasons since 1967 due to relatively small runs in this area, and the state's subsistence priority which precludes commercial harvests unless subsistence needs are being met. Large increases in sockeye salmon runs in the mid-2000s and positive results from an ADF&G test fishery in 2006 led to the opening of commercial fisheries in 2007 and 2008 (Menard et al. 2010). The commercial fishery has not reopened since 2008 due to low runs of sockeye salmon.

3.3.2 Sport Fishery

Sport fishing for salmon takes place throughout the Norton Sound/Bering Strait region. However, the vast majority of salmon fishing occurs in the Seward Peninsula/Norton Sound subarea, with concentrated effort near Unalakleet and in waters accessible from the Nome area road system. Angling opportunities for salmon, especially chum, pink, and coho salmon, can be excellent. During the recent 5 years (2008–2012), harvests have averaged 6,617 coho, 3,213 pink, 327 chum, and 199 Chinook salmon (Appendix I) In 2013, harvests were 7,067 coho, 1,806 pink, 2,267 chum, and 0 Chinook salmon. Sockeye salmon are not typically targeted by sport fishermen, and annual harvests average approximately 50 fish per year regionwide.

The Unalakleet River, due to its excellent fishing opportunities, large population center, and 2 sport fish guiding operations, sustains the highest sport fishing effort of any single river in the Norton Sound/Bering Strait region and supports the largest directed Chinook salmon fishery in the area (Scanlon 2014). The sport fishery primarily harvests coho salmon, with small numbers of pink, Chinook, and chum salmon harvested as well. Currently there is an SEG for Chinook salmon using an expansion of the tower counts on the North River (a large Unalakleet River tributary) of 1,200 to 2,600 fish. After a historic high of 4,185 fish in 1997, tower counts have declined steadily, and the counts have failed to reach the lower end of the SEG for 7 out of the last 11 years recorded (2003–2013; Scanlon 2014). Consequently, the sport fishery for Chinook salmon has been closed early in the season by emergency Order in 7 of the last 8 years. Uncertainty regarding the reasons for declines in escapement, coupled with continued pressure from multiple user groups, makes the Unalakleet River Chinook salmon stock a primary concern for fisheries managers in northwestern Alaska.

Outside of the Unalakleet River, most sport fishing for salmon in the Norton Sound/Bering Strait region occurs on streams along the Nome road system. The Nome, Fish-Niukluk, and Snake Rivers, and to a lesser degree the Pilgrim, Sinuk, and Solomon Rivers, are all easily accessible and provide good opportunity for coho, pink, and chum salmon. Trends in sport fishing effort have generally coincided with the abundance of pink salmon available to anglers; however, recent fluctuations in summer employment in the Nome area associated with mining may be

contributing to the recent variation in effort. While pink salmon are the most prevalent salmon found in Norton Sound roadside streams, with over 1 million fish returning to some streams in even years, estimated sport harvest of pink salmon averaged only about 1,900 fish for the years 2008 to 2012 and comprised just 46% of the total salmon harvest. Although they are less abundant, coho salmon are a more targeted sport fish. Estimated sport harvest of coho salmon in roadside fisheries around Nome for the years 2008 to 2012 averaged 2,158 fish per year and comprised 53% of the total salmon harvest (Appendix I). Prior to 2013, chum salmon fishing was closed for many years because of depressed stocks. A total of 139 fish were harvested from Nome River in 2013, the first harvest since all Nome Subdistrict streams were closed to chum salmon fishing in 1992. Both runs and harvests of sockeye and Chinook salmon in the Nome area are negligible. Although sockeye salmon have recently returned in large numbers to the Pilgrim River, they are typically targeted with gillnets and seines within the subsistence fishery rather than the sport fishery.

CHAPTER 4: NORTON SOUND/BERING STRAIT REGIONAL COMPREHESIVE SALMON PLAN – PHASE II

4.1 Overview

In this document, the RPT has reexamined and revised the assumptions and goals of the Phase 1 document. The new goals are intended to be more community directed and should help to better align projects to specific needs. Although specific numeric goals were not forthcoming, there were some common themes expressed such as the importance and priority of subsistence harvesting; concern about environmental changes, due to both climate change and human activities, and the effects on habitats and fish; and the recognition that things are interrelated and so any change may affect others.

4.2 Mission, Goals, and Strategies

The mission of the CSP, the goals described in it, and the strategies to achieve the goals, have been crafted with the input of salmon users of the region and are intended to assist project planners to design projects that will better understand and meet the needs of the affected communities.

4.2.1 Mission Statement

The mission of the comprehensive salmon plan is

> To promote, through sound biological practices, activities to increase salmon production in the Norton Sound/Bering Strait region for the maximal social and economic benefits of the users consistent with the public interest.

In accordance with this mission the RPT will recommend restoration, rehabilitation, and enhancement activities in the region that will be consistent with the protection of the existing wild salmon stocks and the habitats upon which they depend. Artificial propagation shall not be used as a substitute for effective fishery regulation, stock conservation, and habitat management or protection. The priorities for implementing restoration and enhancement projects shall be in this order: (1) restoring habitat and wild stocks, (2) enhancing habitat, (3) rehabilitating wild stocks, and (4) creating new common property fisheries through enhancement.

Careful planning is necessary before undertaking restoration, rehabilitation, or enhancement projects that might impact wild stocks. Projects shall be evaluated by the RPT in accordance with a regional comprehensive salmon plan. Careful assessment and inventory of wild stocks and their health, habitat, and life history must be an integral part of restoration, rehabilitation, and enhancement planning. Alaska fish genetics and fish disease policies will be applied to all salmon restoration, rehabilitation, and enhancement projects. When appropriate, the RPT will solicit an evaluation of the ecological and genetic risks and socioeconomic impacts of proposed restoration, rehabilitation, and enhancement activities and will attempt to identify alternative or additional actions, including but not restricted to fishery management actions, to achieve the goals. To the extent practicable, the RPT will endeavor to establish production levels for restored stocks consistent with natural or enhanced habitat capacity.

4.2.1.1 Assumptions

For the purposes of this plan, it is assumed that the following conditions will exist. If some of these conditions change or are inaccurate, then added difficulty will be encountered in implementing this plan.

1. The RPT will take a conservative approach to the project planning process to ensure perpetuation of natural stock production.
2. Projects will be designed to restore or supplement wild stock production and harvest opportunities with minimal impacts on wild stocks and the priority for wild stock management.
3. Benefits to all user groups will be considered and equity within the constraints of Alaska statutes and regulations will be a primary consideration as part of the long-term planning process.
4. The flexibility to adapt to changes in the fishery will be incorporated into the updating process of the comprehensive salmon plan.
5. The establishment of significantly increased runs or production of hatchery stocks will need to have a plan for full utilization.
6. This comprehensive salmon plan will use the best data available.
7. It will be biologically feasible to bring about a sustained increase in harvestable surplus of salmon, if appropriate technology and management practices are utilized.
8. The technology exists or will be developed to meet production objectives.
9. Research programs will be implemented to obtain information needed for optimizing salmon production, using the strategies of habitat and fishery restoration/protection, management, enhancement, and rehabilitation.
10. Marine and freshwater habitats will be safeguarded to remain favorable for salmon survival.
11. Support will continue and sufficient funding will be provided to achieve the goals.
12. The goals and objectives of this plan will be periodically reviewed and revised as needs, knowledge, and resources change.

4.2.2 Phase II Goals

4.2.2.1 Research, Management, and Planning Goals

Although fisheries management goals are aimed at maintaining and improving salmon runs by achieving proper escapement for each stock and full utilization of fish surplus to escapement needs, the precision of management policies is sometimes limited by insufficient knowledge of run size, stock composition, timing, optimal escapement rates and levels, and behavioral characteristics of both juvenile and adult salmon, which represent essential information needed for optimal natural and supplemental fish production. There are many necessary and associated research studies not directly expressed in production or harvest numbers that may directly or indirectly result in more fish. Such studies will contribute to a stronger harvester/manager/resource relationship that, in turn, will contribute to increased production and harvests.

The following goals will be pursued: (1) protect wild stocks and increase their production; (2) improve accuracy of salmon forecasts; (3) improve accuracy of escapement enumeration and refine estimates of optimal escapement levels for all species; (4) assess spatial and temporal distribution and migration paths of salmon in the region as well as age, size at return, and location of return; (5) assess stock composition of the harvest; (6) inventory and catalog spawning and rearing habitat in conjunction with habitat protection, stream clearance and improvement activities, carrying capacity

and productivity assessments, limnological investigations, and stocking assessments; and (7) periodically review and reevaluate needs of subsistence, sport, and commercial users in the regional fisheries.

The progressive decline of Chinook salmon stocks in western Alaska and the long-term depression of Seward Peninsula chum salmon have resulted in these stocks being declared *stocks of concern*. These 2 stock designations are of the highest priority to local resident stakeholders. In the short term, fishermen are utilizing alternative salmon stocks when returns allow. The alternating even/odd pink salmon return is utilized by subsistence fishermen, particularly during the strong even year returns. Coho salmon, which have increased significantly during the last twenty years, are now the bread and butter of the commercial fishery (Appendix I). Still, the weak returns of the 2 traditionally strongest species are of great concern and the focus of research and fish culture projects. In the case of chum salmon, the general goal is to bring the returns back to historic levels in order to avoid conservation restrictions which impact fishing opportunity on similarly timed salmon. The Chinook salmon stakeholders are concerned that any recovery will take so long they may not have even a modest harvest opportunity in the next 20 years. The desire for Chinook salmon is to turn the decline around and have both commercial and subsistence harvests at the levels seen in the 1990s.

The salmon subdistricts of the Norton Sound District were established to provide separate stock terminal fisheries and individual management of stock groupings of similar character and environmental influences. The communities of the region have developed with an awareness of the spawning streams production and each significant salmon stream had a terminal subsistence fishery. Within a few years of statehood terminal commercial fisheries were established in regulation. Not all subdistricts depend to the same extent on any one species of salmon. Specific goals for the production of salmon by species and by location should be established for fully utilized stocks. Other stocks may only rarely have harvest levels that trigger management actions related to conservation. Production goals for stocks that have limited utilization present marketing challenges, but do not warrant the rigorous biologic program that fully utilized stocks require.

4.2.2.2 Production and Harvest Goals

Community meetings, public input at RPT meetings, and a survey of salmon users were utilized by the RPT in an attempt to gain an understanding of the desired production and harvest goals by subregion or community. While specific numeric goals of new production or harvest were not determined, more general community concerns and desires were communicated and are reproduced below. A list of all public meetings held and summaries of the community meetings and the survey responses are included in Appendix H.

The St Lawrence Island Subregion

This area is a largely unregulated subsistence harvesting area. Subsistence fishing primarily occurs at capes on the western end of the island and in sheltered bays and lagoons at various locations around the island. The cost of fuel limits travel to sites remote from the communities. Little research has been done on the origins of the salmon caught on the capes; it is likely some are bound for distant locations both in Alaska and Asia. There are no commercial salmon fisheries and no documented sport fisheries in these waters. Limited interest was expressed in selling Chinook salmon. In community meetings there was some confusion about the names of various salmon species, no doubt complicated by the bright condition of marine-caught salmon. Both communities firmly stated they were not interested in commercial salmon fisheries. They valued their subsistence way of life and questioned if the limited runs of salmon could support

additional harvest a commercial fishery would bring. There is a strong cultural memory of the commercialization of sea mammals and the food shortages associated with that.

The Port Clarence District

This district extends from Cape Prince of Wales to Cape Douglas. The community of Wales has a very limited subsistence harvest of salmon with much of it caught in the Kotzebue district north of the cape. Very limited tagging data (Gaudet and Schaeffer 1982) and traditional knowledge indicate adult salmon passing the community are primarily bound for the Kotzebue district. The communities of Brevig Mission and Teller, on the other hand, fish for salmon near their communities or in the migratory path of the salmon returning to spawning locations. A small commercial fishery exists in regulation to target sockeye salmon returns as they transit Grantley Harbor. The salmon stocks that are managed for and are targeted in subsistence fisheries are Salmon Lake sockeye; Pilgrim River chum; and Agiapuk River chum, coho, and pink salmon. Sport fishing is limited in the district and is often directed at nonsalmon fish, but some salmon are caught on sport tackle.

Community meetings in Brevig Mission and Teller expressed the reliance on sockeye salmon and chum salmon. A Teller resident recommended focusing management on Pilgrim River sockeye and on Agiapuk River chum salmon. Fuel costs are limiting subsistence activities in traditional spots far from town, but these stocks transit the waters at the communities themselves. There was little support for a commercial fishery. Comments on the decline of Chinook salmon and the increase in predatory fish coincident with beaver colonization were repeated. Concerns about industrial port activities on salmon were expressed, as were the plankton blooms in Imuruk Basin. The need for baseline data was recognized.

The Norton Sound District from Cape Douglas to Cape Rodney

This area consists of some small drainages flowing into Wooley Lagoon. A subsistence camp at the eastern entrance of the lagoon serves as the base for a small subsistence harvest of sockeye, chum, and coho salmon migrating north in marine waters, and chum and pink salmon in the local streams. No commercial or sport fishery occurs in this location.

Subdistrict 1 (Nome)

This area extends from Cape Rodney to Topkok Head. From 1974 to 1984 a commercial chum salmon fishery occurred with a harvest of approximately 10,000 per year. Prior to and since that commercial fishery, the bulk of the harvest has been from subsistence. No commercial salmon fishing periods occurred in the Nome Subdistrict from 1997 to 2012 because of regulatory restrictions on chum salmon, lack of buyer interest, or weak runs. In 2013, limited commercial fishing occurred for chum and pink salmon. There is, and has been, a small but consistent sport harvest in this subdistrict. Community testimony emphasized the need for more consistent coho, chum, and pink salmon opportunity on the Nome, Snake, and Solomon River drainages. Sockeye salmon harvests in the Pilgrim and Sinuk Rivers were also stocks of great interest. Salmon management focuses on stocks that tend to track together and support fisheries in discrete geographic clusters.

Production levels for the various stocks discussed in the community meetings were not agreed upon due to differing visions of harvest. There are individuals in Nome who wish to maximize returns to provide a large harvestable surplus. The practical considerations of cost and utilization will require a more deliberate approach—first rehabilitation of the runs, and then enhancement—if there is support or demand for increased production.

Sinuk River management considers sockeye salmon primarily in July and coho salmon in August. The Cripple and Penny Rivers once supported small subsistence camps that targeted chum salmon. Shortly after statehood these stocks began to decline and there has been concern about extirpation over the last 2 decades; however, the large tourist mining camp near these streams still makes use of these pink and coho salmon runs. The Nome and Snake Rivers, located in and near Nome, often track similarly with regard to chum and coho salmon returns. Escapement projects on these rivers serve as an index to manage the western subdistrict. Both the Nome and Snake Rivers support relatively high harvest rates of chum and coho salmon due to their proximity to Nome. Public testimony supports small rehabilitative projects to increase chum and odd-year pink salmon returns in the immediate vicinity of Nome, as well as larger scale enhancement projects.

The Safety Sound streams, Eldorado, Flambeau, Solomon, and Bonanza Rivers, east of Cape Nome, are also managed as a block. Subsistence effort is concentrated at the camps at Nuuk to focus on Eldorado and Flambeau River chum salmon. Chum salmon stocks to the east of Cape Nome have increased in numbers more than those to the west. Regulations have been recently amended to direct harvest to either the east or west of Cape Nome. Public testimony favored more opportunity for chum salmon harvest on the Solomon River.

Subdistrict 2 (Golovin)

This subdistrict produced more than half the Norton Sound chum salmon commercial catch for the first 2 decades of statehood. Chum salmon returns have declined over the southern Seward Peninsula since then. Today, the pink and coho salmon runs support the bulk of the commercial harvest and a significant subsistence fishery. Sport fishing for coho salmon and Arctic grayling are also important in this subdistrict.

Public testimony focused on the many demands placed on the salmon in this subdistrict. Road access from Nome brings with it additional sport and subsistence fishing pressure. Both vehicle and boat traffic have increased in the last 2 decades. Pollution in the form of hydrocarbons from engine products and the disturbance of gravel beds by boats and fording vehicles were of concern. Residents of both White Mountain and Golovin expressed a desire for more timely and inclusive escapement indices for salmon. Concerns over the proposed road to Fairbanks and the increasing number of vessels seeking a harbor in the inner Golovin Bay were voiced. The vessels sometimes tear up the eel grass beds at the mouth of the Fish River. White Mountain is collecting baseline data to address inland development, but would like to see more work in the estuarine areas. The commenters generally expressed concern that chum and coho salmon numbers could not meet all the demands of the combined fisheries. Residents at White Mountain indicated that if the current Chinook stock enhancement research project on the Niukluk River is successful it should be considered for coho salmon as well.

Subdistrict 3 (Elim/Moses Point)

Salmon abundance is currently far below the harvest levels once supported. Chinook and chum salmon returns are below historic averages. The blockage of Agsuraq Slough appears to have directed salmon away from the Kwiniuk River and to the Tubutulik River. Coho salmon returns are generally strong. The subdistrict supports a number of fish camps: Moses Point, Caches, and Iron Creek. Commercial fishing is supported by a buying station during most years. Sport fishing is minimal. Historically, this subdistrict supported a significant commercial chum salmon fishery. Residents hosted a meeting as early as 1993 to support a hatchery to provide employment and fish for commercial harvest. There is strong support for a hatchery and also for

smaller projects like the instream incubation box at Corral Creek. Concerns ranged from providing more opportunity for abundant pink salmon returns, to opening Agsuraq Slough, to addressing salmon interceptions from southern Bering Sea fisheries. Salmon abundance is below historic levels and the local fisheries are being impacted as a result.

Subdistrict 4 (Norton Bay)
This area has seen an inconsistent commercial buying effort and as a result has just recently re-established a commercial salmon fishery. The Inglutalik and Koyuk Rivers support Chinook and chum salmon commercial fisheries and subsistence fisheries. The Ungalik River supports the bulk of the commercial coho salmon fishery.

Public comment expressed the importance of subsistence salmon use to the local community. Although there have been few declines in salmon in the subdistrict, the Mukluktoolik River and Kwik River in the adjacent subdistrict are said to have so many beaver that even coho salmon have trouble spawning. The community would appreciate more communication on escapement counts and the abundance of fish that are salmon predators. They would like to see some inventory work of spawning and rearing habitats, particularly on the upper Koyuk River for Chinook salmon.

Subdistrict 5 (Shaktoolik)
This area supports a consistent commercial salmon fishery. The recent Chinook salmon decline has dramatically affected opportunity and the conservation efforts directed at Chinook salmon have reduced opportunity on chum salmon as well due to a temporal overlap in run timing. Commercial fishing in both the Unalakleet and Shaktoolik Subdistricts harvest a mix of salmon that could be bound for any of the streams in either subdistrict or adjacent river systems. Marine management, either commercial or subsistence, can be affected by conservation concerns on all these watersheds. Subsistence fishing is practiced by nearly all residents of the community and is considered important, but commercial fishing affects the local economy significantly as well. Sport fishing has occurred at times on the Shaktoolik River depending on local guide or outfitter availability.

Public testimony spoke to observed habitat changes over the years as an explanation of declining Chinook salmon numbers. The Tagoomenik River has been choked with debris and beaver dams. This tributary has just a few salmon near the town now. It has potential for a salmon planting project. Another idea was to reduce boat traffic in salmon spawning sloughs to improve survival.

Subdistrict 6 (Unalakleet)
This subdistrict has the Unalakleet River as the primary salmon-producing watershed. The subdistrict includes the Egavik River which also supports populations of Chinook, coho, chum, and pink salmon. The Golsovia River on the far southern reach of the subdistrict is primarily a Chinook and coho salmon stream. Commercial fishing in both the Unalakleet and Shaktoolik Subdistricts harvests a mix of salmon that could be bound for any of the streams in either subdistrict or adjacent river systems outside of Subdistricts 5 and 6. Marine management, either commercial or subsistence, can be affected by conservation concerns on all these watersheds. Inriver subsistence fishing or sport fishing in the Unalakleet or Golsovia Rivers are managed primarily by system.

Unalakleet residents pointed out that both beaver and Dolly Varden were once harvested in far greater numbers than they are now. This may account for their perceived high numbers and contribute to the coincident decline in some salmon species. A habitat project that was suggested

was adding another culvert to the road crossing the Kwekok Slough east of the airport. The slough has become stagnant and it is thought to have reduced smolt rearing area. Local residents felt strongly that restraint by all users was warranted for the speedy recovery of Chinook salmon. Catch and release mortality needs to be considered as does fishing for extended family members. Residents felt that subsistence rights were not being given proper deference. Residents also indicated that fish culture and habitat improvement projects should be developed that involve the youth in order to instill respect for the resource and the program.

Norton Sound District South of Black Point to Point Romanof

This area includes only 3 small salmon streams, the Nunvulnuk, Pikmiktalik and the Kogak Rivers. There are no commercial salmon fisheries in this area. However, there are a few Yukon River commercial fishing permits owned by residents of Stebbins and St. Michaels. Subsistence harvest areas include sites where migrating salmon can be intercepted, and locations where watermarked fish near their spawning grounds. Very little sport fishing occurs here. Local residents pointed out pink salmon as an underutilized resource.

4.2.2.3 Management Goals

ADF&G manages salmon fisheries to ensure adequate annual escapements that provide for sustained yield. Salmon in excess of escapement needs represent a harvestable surplus that can be utilized by various fisheries. Subsistence maintains priority use over other fisheries, with harvestable surpluses in excess of subsistence available to commercial and recreational fisheries. To accomplish these management goals, various salmon assessment and research programs are operated by ADF&G throughout the region, many of which are operated collaboratively with local organizations and funding partners. NSEDC also funds and provides staffing for salmon assessment and research in the region, with several programs operated collaboratively with ADF&G (Menard 2013). Fishery managers use estimates of run strength from salmon escapement counting projects, test fishing, aerial surveys, and harvest indices (CPUE) to manage salmon fisheries. Weirs on the Unalakleet, Pilgrim, Eldorado, Nome, Solomon, and Snake Rivers and Glacial Lake, streamside towers on the Kwiniuk, Inglutalik, and North Rivers, and a video camera and weir on the Sinuk River are used for counting salmon spawning escapement (Menard 2013). Smolt studies on the Pilgrim and Nome Rivers have been used to estimate abundance and timing of smolt outmigration.[8,9] Catch sampling on the Unalakleet River is used to determine age-sex-length (ASL) composition of the harvest (Kent 2010). Additional salmon assessment and research projects operated periodically include but are not limited to mark–recapture abundance estimation, fresh water and marine juvenile ecology studies, migratory tagging studies, genetic stock composition and stock biology assessment, and propagative research programs. Table 4.1 lists salmon projects operated within the Norton Sound and Port Clarence Districts in 2014. Past counting tower projects no longer in operation include the Chiroskey River (Cunningham 1976; Kuhlmann 1977), Tubutulik

[8] Williams, B. C., M. J. Nemeth, R. C. Bocking, C. Lean, and S. Kinneen. 2009. Abundance and marine survival of coho salmon smolts from the Nome River, Alaska, 2006-2008. Unpublished report prepared for the AYKSSI by LGL Alaska Research Associates, Inc. and NSEDC.

[9] Keith, K. 2014. Pilgrim River Sockeye Salmon Smolt Project 2014. Unpublished report for Fish Resource Permit No. SF2014-090. Obtained from Norton Sound Economic Development Corporation, Nome.

River (Schaefer 1980), Boston Creek,[10] Pikmiktalik River (Menard et al. 2010) and Niukluk River (Menard et al. 2013).

Salmon management has changed significantly since the mid-1990s, when there were limited markets for commercial harvest and marginal returns of several salmon stocks. Salmon returns and markets rebounded in the mid-2000s, resulting in renewed buyer interest. There were buyers for pink salmon from 2000 to 2006, but in 2007, there was renewed buyer interest in Golovin and Elim Subdistricts, and in 2008, buyer interest in Norton Bay Subdistrict. In 2007 and 2008, large sockeye salmon escapements to Salmon Lake allowed the first commercial fisheries in the district since 1966.

Table 4.1.–Salmon projects conducted within Norton Sound and Port Clarence Districts, 2014.

Weir	Counting towers	Juvenile Indices
Unalakleet River	North River	Salmon Lake Sockeye smolt
Eldorado River	Shaktoolik River (sonar)	
Solomon River	Inglutalik River	
Nome River	Kwiniuk River	
Snake River	Fish River	
Glacial Lake (video)		
Pilgrim River		

The principal regulation that governs commercial salmon harvest in the Norton Sound District is the scheduled weekly fishing periods. Commercial salmon fishing regulations allow for variable fishing periods per week during the open season depending on area and season differences. ADF&G attempts to distribute fishing effort throughout the entire return to avoid harvesting only particular segments of the run. Occasionally, fishing time is increased or decreased by emergency order. Managers issue these orders depending upon fishing conditions and strength of runs or spawning escapements, as determined by evaluation of available run timing and abundance indicators, as well as the capacity of the buyers to process the harvest. Weekly fishery reports with fishery status and schedules are broadcast during the fishing season over local radio stations and published in regional newspapers.

Subsistence fishing is conducted in fresh and marine waters with gear that includes set gillnets, beach seines, and rod and reel. Commercial salmon fishing is conducted using set gillnets in marine waters, usually concentrated near river mouths. Subsistence and commercial fishing typically begin in June and target Chinook salmon. Emphasis switches to chum and pink salmon in July and coho salmon in late July thru September. Pink salmon are more abundant in even-numbered year returns primarily in July.

[10] Kretsinger, C. F., R. Brown, and R. Jandt, 1992. Norton Sound coho salmon project update Boston Creek 1992. Unpublished draft obtained from Carl Kretsinger, Bureau of Land Management, Fairbanks.

Subdistricts 1, 2, and 3 (Nome, Golovin, and Elim) are monitored intensively for subsistence use with permits, including Tier II regulations within Subdistrict 1. Closed waters, setting fishing period length, limiting gear, and harvest limits are all tools that can be employed throughout the season to provide for escapement needs and to maximize subsistence opportunity in all subdistricts.

4.2.2.3 Research Goals

A project beginning in summer 2015 will use acoustic telemetry to study the migration path of chum salmon within the Nome Subdistrict. This study will re-examine conclusions from a 1978 study (Gaudet and Schaffer 1982) to determine what stocks migrate through the subdistrict and are there points where migrating stocks diverge within the subdistrict.

Current research is focused on the region's most desirable salmon species for harvest: Chinook salmon. With their recent decline, they are of particular concern. Research will be focused on juvenile Chinook salmon, and topics will include assessing juvenile survival and competition in southeastern Norton Sound Chinook salmon populations. Recent studies of Yukon River juvenile salmon in marine waters have a high potential for describing marine life cycles for Norton Sound salmon.

Sockeye salmon are also in the public eye in the region. Once numerous and then very scarce from 1962 to 1996, they have been rediscovered in the past 10 years. A study conducted in the mid-1990s determined Salmon Lake juveniles were nutrient limited (Todd and Kyle 1997). Results were inconclusive whether fertilization of Salmon Lake has increased production of sockeye salmon (Hamazaki et al. 2012). However, that work has provided the impetus to study other drivers of sockeye salmon production.

Propagative salmon research in the Norton Sound region began in the late 1970s with migration studies and the feasibility study for the location of what became the Sikusuliaq Hatchery on the Noatak River within the Kotzebue Sound area. Earlier work was mostly inventory of the various salmon runs and classification of potential commercial fishery opportunities which began in the mid-1950s (Raleigh 1957).

Incubation box technology, in both instream and streamside applications, has been used in the region since the 1990s to research the feasibility of rehabilitating salmon stocks on a small localized scale. The research was permitted through Fish Resource Permits issued by ADF&G. The technology demonstrated limited success in most locations due to the challenging winter environment. In order to protect streamside incubation boxes from freezing, a small building was constructed by ADF&G and the RAA to house the incubators at Hobson Creek in the late 1990s. This site was tested off and on until 2007 and proved successful at protecting the incubators from freezing and demonstrated that the technology could be used to produce pink, chum and coho salmon fry in the region where there is adequate year-round water flow.

Beginning in 2005, Fish Resource Permits have also been issued for several mist incubation/eyed egg planting propagative research feasibility projects conducted by NSEDC. Like the instream incubation projects conducted by ADF&G in the 1990s to 2000s, these projects are intended to demonstrate the feasibility of small-scale rehabilitation of depressed stocks using this method.

It is a goal of the RPT that propagative research projects continue to be used to test technology and sites to determine the feasibility of different approaches that may be used to restore, rehabilitate, or enhance salmon stocks in the region.

4.2.3 Strategies to achieve production goals

There are many techniques or tools that can be used to achieve salmon production goals. The choice of which technique is appropriate to use in each case is dependent upon what the goal is, what is limiting the production that needs to be remedied, and the location and the species desired. Restoration entails restoring altered or decimated habitat, or severely depleted or extirpated fish stocks, to a previous level of natural production. Rehabilitation entails rehabilitating altered or impacted habitat, or depressed fish stocks, to a previous level of natural production. Enhancement entails creating new or artificially improved habitat, or producing runs of fish where they do not naturally occur or above what could be naturally produced there, in order to create fish that are available specifically for harvest. Fish runs produced by enhancement projects would not exist otherwise and will no longer exist if that project is discontinued, whereas fish runs produced by restoration or rehabilitation projects were previously in existence naturally and will continue as natural production once the project is completed.

4.2.3.1 Habitat Restoration, Rehabilitation and Enhancement

Salmon habitat improvement is usually specific to a particular life stage and for that reason may benefit a specific salmon species. Chum and pink salmon benefit primarily from spawning habitat improvements and the removal of barriers to migration. Salmon with freshwater juvenile rearing requirements such as Chinook, sockeye and coho salmon also benefit from improved summer and winter rearing habitats and increased feeding opportunities. The following methods are suggested for this region.

Stream Clearance and/or Modification of Barriers

The clearance of periodic blockages (e.g., debris-choked culvert, instream debris, beaver dams etc.) of portions of streams can facilitate the passage of salmon into spawning and rearing areas that otherwise would lose production potential for some species of salmon. Many of these blockages occur on an intermittent basis and are of a size that removal could be accomplished by designated personnel. Authority to remove these stream blockages requires approval by Habitat Division, Department of Natural Resources, or the Corp. of Engineers on a case-by-case basis.

Rearing Ponds

Rearing ponds may benefit salmon with freshwater juvenile rearing requirements, primarily Chinook and coho salmon, by providing new habitat for these species. These projects have been associated with road maintenance projects locally, in part due to the formation of these ponds by gravel extraction practices. The creation of a pond of sufficient depth to avoid freeze down is the primary size determinant. It is important to have an upwelling area where ground water will provide oxygenated water during the ice covered portion of the year. This can be arranged by placing the pond below the winter water table in riparian corridor. Another important character is to incorporate a source of nutrients in the pond to support macroinvertebrates over the year. This can be accomplished by encouraging beavers to colonize the pond or to mimic that situation by placing organic matter like tundra sod in the water. The most successful ponds have both a littoral shelf and a deep portion to the pond to help warm the water during the summer and to provide for some vegetative growth for cover and water quality.

Habitat Rehabilitation (stream channel)

These projects address stream bed conditions that have been impacted by natural factors or human activities. Migration corridors or spawning conditions can often be improved with a one-

time project which makes these projects attractive even when the cost can be high. The most common of these projects is spawning channel substrate cleaning.

Nutrient Enrichment
This strategy is only useful for salmon which are resident in the river/lake system as rearing juveniles. The best local example is the fertilization of Salmon Lake. At that project, commercial grade fertilizer is mixed into the lake water to enhance the production of algae, which in turn is consumed by zooplankton, a favorite food of juvenile sockeye salmon. These projects require ongoing operation and production monitoring. The fertilization rate is tuned over time to the specific site and stock. Adjustments can be made on an annual basis to stabilize production and minimize costs.

4.2.3.2 Stock Restoration and Rehabilitation
Salmon stock restoration and/or rehabilitation generally entails strategies designed to restore depleted or depressed populations to prior levels of production. Various fish culture methods can be employed to achieve restoration and rehabilitation goals. Fish culture methods range from artificial manipulation of salmon egg fertilization and incubation to rearing of juvenile salmon from emergence through various juvenile life stages. Many communities in Norton Sound would like to see their harvest opportunities stabilized at production levels that provide for sufficient subsistence opportunities. Only a few communities expressed interest in increasing production to afford greater economic opportunity in sport or commercial fisheries. The following are fish culture methods that have been considered for restoration or rehabilitation of Norton Sound stocks.

Eyed-Egg Planting
This is one of the methods used to stock river systems with juvenile salmon. Salmon eggs are collected, fertilized, and incubated to a point of development approaching hatch. The eggs are then planted into suitable substrate for rearing following hatch as alevins. Advantages to this method, versus planting as fry, are reduced financial and water needs. In both cases, the fry can be marked prior to hatch for evaluation. Disadvantages include low survival to adult return, limited planting sites, and the logistics of planting eggs during the coldest part of the year.

Instream or stream-side incubation boxes
This method of stocking was used with mixed success during the 1990s in the Norton Sound District. The method has the disadvantage of very limited methods of marking fish produced to allow for subsequent evaluation. The ability to mark fish production to evaluate the efficacy and effects of the project and justify costs is important. In this northern climate, periodic site checks are needed to ensure operation of the incubator boxes in cold temperatures. Freezing at the incubator outlet was a common problem which created a cascade of system failures if left uncorrected.

4.2.3.3 Fishery Enhancement
Salmon fishery enhancement generally entails strategies designed to increase salmon production beyond natural levels for the specific purpose of harvest.

Central Incubation Facility
The central incubation facility is a hatchery type that is most often constructed where there is available water and infrastructure, but fish are not necessarily released or returning there. Multiple stocks of salmon from a variety of locations can be incubated in a central incubation facility. Stocks in a central incubation facility are kept discreet and remain separated out of

concern for potential genetic and pathologic effects on stocks where they are to be released. Measures to disinfect both the facility effluent as well as the source water are often required. Generally, the complexity of these facilities requires a fully developed hatchery program with remote stocking, egg takes, and water treatment. Central incubation facilities are not necessarily production facilities, although they can support production programs, smaller restoration programs, and/or small scale programs producing fish for public use.

Production Hatchery
Production hatcheries are intended to produce salmon returns on a large enough scale to support directed fisheries. Typically these hatcheries produce 1 or 2 stocks of salmon to be released in a location that has no natural runs of salmon. A cost-recovery fishery is often associated with the hatchery release site if an area has been designated as a special harvest area (SHA) for it. Broodstock for future production and a cost-recovery harvest for supporting the facility through sales of fish are allowed at these locations. In some instances other release sites, designated as terminal harvest areas (THA), are allowed where the entire return to that location is managed as a common property fishery. The genetic makeup of these type of production hatchery releases are not necessarily restricted to 1 specific genetic line. Sometimes the initial broodstock may be derived from multiple natural runs of the same species in the general vicinity of the release site. Because the entire return is harvested in these situations, there is less concern for affecting the natural-run genetic lines.

4.3 Public Participation

The salmon fishery enhancement program is stakeholder driven in Alaska. The state, through laws passed by the legislature, created a framework of guidance that includes public participation that the program is to operate within. This legal framework and the organizations established by it are discussed in more detail in Chapter 1.

Public participation and input was sought throughout the 2.5-year process of updating this CSP. The Northern Bering Strait Regional Aquaculture Association codrafted this CSP with guidance from board members representative of salmon users from throughout the region. ADF&G codrafted this CSP in partnership with the RAA through participation on the RPT. The RPT held numerous public meetings and utilized a survey to solicit input from salmon users during the drafting process. And the RPT hosted a final public meeting, following a formal public comment period, to solicit additional input prior to finalizing and submitting this CSP to the commissioner of ADF&G for approval (Appendix H).

If there is a salmon hatchery permit application received for a project in the region, it must be reviewed by the RPT at a public meeting, and the RPT must forward a recommendation to approve or deny it to the commissioner as part of the hatchery permitting process. The RPT will utilize public participation and the CSP to help determine the appropriateness of the proposed hatchery project in regards to the desires of the effected salmon users in the region.

Once salmon are produced and returning, they are available for harvest. The harvest of salmon is guided by regulations approved by the Alaska Board of Fisheries. Public participation in development and approval of fisheries regulations is achieved through local advisory committees, through public regulation proposals, and through providing testimony to the Board of Fisheries regarding regulation proposals. Additional information about the Alaska Board of Fisheries and regulations can be found on the ADF&G website.

CHAPTER 5: PLANNING, PERMITTING, AND REPORTING REGULATIONS, POLICIES AND PUBLIC BENEFITS

This chapter is intended to provide enough information to understand the permitting process, regulations and policies, and how they interact with each other. This chapter is also intended to provide information that an aquaculture association should consider during the development of a project and the RPT should consider when reviewing a project for the commissioner.

5.1 Fishery Enhancement

5.1.1 Overview of the PNP Permitting Regulations

Hatcheries are heavily regulated. The PNP Hatchery permits are authorized under AS 16.10.400-16.10.480 and AS 16.43.410–16.43.440 and under regulations in 5AAC Part 1 Commercial and Subsistence Fishing and Private Non-Profit Salmon Hatcheries, Chapters 40 and 41. These regulations and statutes require 4 main documents for operation: hatchery permit with basic management plan (BMP), annual management plan (AMP), fish transport permit (FTP), and annual report.

The following figure (Figure 5.1) shows a flow chart of the regulation of PNP hatcheries in Alaska and how the progression of permits results in the release of fish. Appendix C has a more detailed roadmap which includes considerations to be made by an aquaculture association when planning a project, such as information needs, permits and department requirements.

5.1.1.1 Hatchery Permit and Basic Management Plan

The hatchery permit authorizes the operation of the hatchery, specifies the maximum number of eggs of each species that a facility can incubate, authorizes release locations and numbers, and identifies the broodstock to be used for each species. The basic management plan (BMP) is a part of the hatchery permit (an addendum) and outlines the general operation 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 hatchery permit and BMP are nontransferable and remain in effect until relinquished by the permit holder or revoked by the commissioner of ADF&G.

The hatchery permit and BMP may be amended through a permit alteration request (PAR). The hatchery's permitted capacity, broodstock source, or approved release sites must be changed through the use of a PAR. ADF&G and the RPT review the PAR and provide a recommendation to the commissioner of ADF&G for consideration and final decision. If the RPT is unable to reach an agreement on a recommendation the PAR is sent to the commissioner without a recommendation (but generally with a summary of the discussion).

A management feasibility analysis (MFA) is required before a hatchery permit application is submitted. The analysis is conducted by ADF&G is based on information provided by the applicant. The following information is required: (1) location of the facility, (2) species desired for hatchery production, (3) run timing by species, (4) incubation and rearing levels desired during the first reproductive cycle by species, and (5) incubation and rearing levels desired at full capacity by species. After submittal of a request for a MFA, ADF&G will, within 90 days (business), complete the MFA which includes as a minimum, the following information: (1) an estimate of potential contributions to the common property fishery, (2) potential size and location

of a special harvest area, (3) special management considerations or the need for additional studies, (4) potential broodstock sources, (5) an assessment of production potentials for each species, and (6) additional factors considered by ADF&G to be relevant to the proposed hatchery operation. Regulations regarding the MFA are located at 5 AAC 40.130.

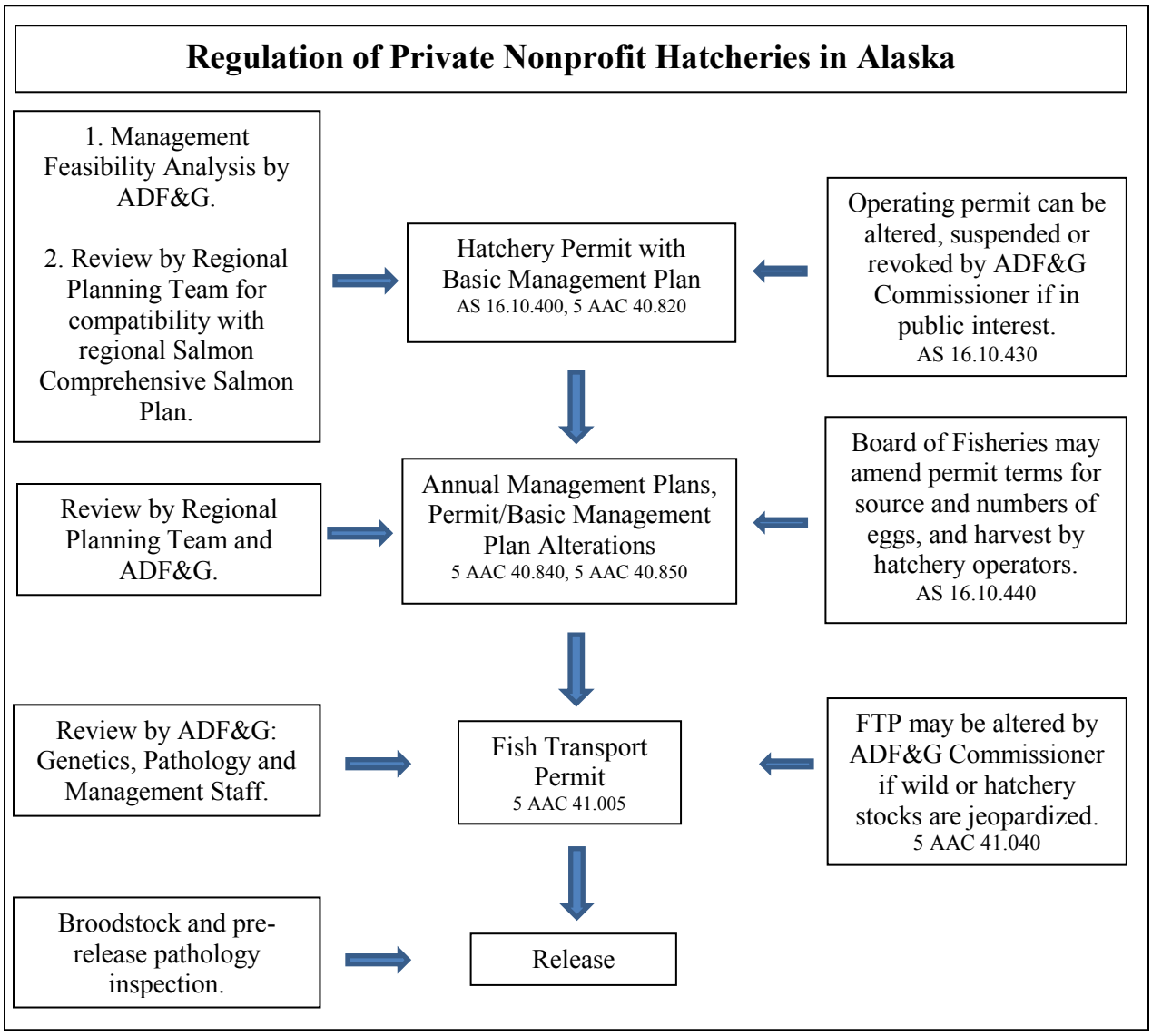

Figure 5.1–Regulation of private nonprofit hatcheries in Alaska (Stopha 2013).

5.1.1.2 Annual Management Plan

The AMP outlines the year's operations regarding production goals, broodstock development, and harvest management of hatchery returns on an annual basis (5 AAC 40.840). The AMP is in effect until superseded by the following year's AMP. The AMP must be consistent with the hatchery permit and BMP. The AMP generally contains the upcoming year's egg-take goals, fry or smolt releases, expected adult returns, harvest management plans, FTPs required or in place

and fish culture techniques. The RPT may review the AMP and provide a recommendation to approve or deny to the commissioner.

5.1.1.3 Fish Transport Permit

FTPs are required to transport, possess, export from the state, or release into the waters of the state, any live fish or eggs (5 AAC 41.001–41.100). Permits are subject to a department review that takes approximately 45 days. Department review includes pathology, genetics, area management staff, a regional resource development biologist, and possibly other staff if appropriate. Reviewers may make recommendations as to whether the permit should be issued or suggest conditions to be imposed with the permit. FTPs are valid for a fixed term identified in the permit.

Additional information on FTPs, Fish Resource Permits, and Salmon Incubation (classroom projects) can be found on the ADF&G website[11].

5.1.1.4 Annual Report

The annual report is due by December 15 of each year and includes, but is not limited to, information on species, brood stock source, number of egg collected, juvenile releases, current year run sizes, contributions to fisheries, and run projections for the following year (AS 16.10.470). ADF&G takes information from all the submitted annual reports and prepares a summary annual report which is provided to the Alaska State Legislature.

5.1.2 Regulation of Broodstock

AS 16.10.445 states

> (a) The department shall approve the source and number of salmon eggs taken under AS 16.10.400–16.10.470. (b) Where feasible, salmon eggs utilized by a hatchery operator shall first be taken from stocks native to the area in which the hatchery is located, and then, upon department approval, from other areas, as necessary.

Broodstock are examined for disease prior to use in a hatchery. The sale of salmon and salmon eggs by hatchery operators is addressed in AS 16.10.450. After a PNP hatchery operator uses funds from these sales for reasonable operating costs, including debt service, facilities expansion, and salmon rehabilitation or research projects, remaining funds must be expended on other fisheries activities of the qualified regional associations for the area in which the hatchery is located. In accordance with AS 16.05.730, the Board of Fisheries may direct ADF&G to manage fisheries to achieve an adequate return of fish from enhanced stocks to enhancement projects for broodstock in a manner consistent with sustained yield of wild fish stocks.

5.1.3 Regulation of Harvest of Enhanced Fish

Fish released by a hatchery are available for common use in the same manner as natural stocks until they return to the SHA established by ADF&G (AS 16.10.440). The harvest of fish by the PNP Hatchery Permit holder within the SHA falls under the authority of AS 16.43.400–

[11] http://www.adfg.alaska.gov/index.cfm?adfg=otherlicense.aquatic_overview (accessed January 2015).

16.43.440, and regulations specific to the SHA promulgated by the Board of Fisheries. Additionally, AS 16.05.730 requires fisheries to be managed in a manner consistent with that of sustained yield of wild salmon stocks, and the conservation of wild stocks is given the highest priority among competing uses.

5.1.3.1 Special Harvest Area

A definition of a SHA is provided in statute AS 16.10.455(g)(2), and in regulation 5 AAC 40.990 (12) *special harvest area* means an area designated by the commissioner or the Board of Fisheries, where hatchery returns are to be harvested by the hatchery operators, and in some situations, by the common property fishery.

5.1.3.2 Terminal Harvest Area

A definition of a THA is provided in 5 AAC 40.990 (13) and means an area designated by the commissioner, Board of Fisheries regulation, or department emergency order where hatchery returns have achieved a reasonable degree of segregation from naturally occurring stocks and may be harvested by the common property fishery without adverse effects.

A hatchery operator should be prepared for ADF&G to require the cleanup of a SHA/THA if the common property fishery or cost-recovery fishery is allowing aggregations of hatchery-produced salmon to accumulate, in order to minimize the risk of straying. This may be a condition written in the BMP, the AMP, or the FTP, or just a directive from ADF&G. In order to facilitate cleanup if necessary, all possible gear types such as purse seine, hand purse seine, beach seine, fyke net, drift gillnet, set gillnet, dip net, and troll should be listed for flexibility purposes as allowable gear types in a SHA and the THA. However, gear restrictions may occur due to wild stock interception concerns. Fishermen may wish to approach the Board of Fisheries and ask for gear modifications within a THA to more effectively harvest returning fish produced by an enhancement program.

5.1.4 Performance Review of Hatcheries

ADF&G has the right to inspect a hatchery facility or perform a consistency review at any time while the facility is operating under AS 16.10.460. The goal is to inspect each facility at least every other year or as needed.

5 AAC 40.860 Performance Review

(a) Based upon a department internal review, the PNP coordinator will notify the commissioner if a hatchery operator's performance is inadequate, according to the conditions under which the permit was granted.

(b) The commissioner will, in his or her discretion, consider a permit alteration, suspension, or revocation in accordance with AS 16.10.430. If the commissioner decides to consider a permit alteration, suspension, or revocation, the coordinator will notify the appropriate regional planning team. The regional planning team may make a written recommendation to the commissioner on the proposed alteration, suspension, or revocation. The regional planning team shall use the following performance standards in their review, evaluation and recommendation to the commissioner, including whether:

(1) survivals in the hatchery are more than the minimum standards described in (c) of this section for a period of greater than four years;

(2) the transport of broodstock from wild sources does not continue for longer than one cycle of the particular species without reevaluation of hatchery operations;

(3) the hatchery contributes to the common property fishery;

(4) the hatchery does not significantly impact wild stocks in a negative manner;

(5) the hatchery fulfills the production objectives described in the terms of the hatchery permit; and

(6) are there any mitigating circumstances which were beyond the control of the hatchery operator.

(c) Minimum hatchery survival standards are as follows:

	Survival for this Stage	Cumulative Survival
For captured brood stock to egg take	70%	
Green egg to eyed egg	80%	80%
Eyed egg to emergent fry	85%	68%
Emergent to fed fry[1]	90%	61%
Fed fry to fingerling[2]	90%	55%
Fingerling to smolt	75%	41%

[1] Fry achieving up to 25% weight gain from swim up.
[2] Fry achieving substantially more than 25% weight gain from swim up.

Internal consistency reviews check to see that the hatchery is operating according to its permits and that the permits are current and consistent with each other, and that they provide an accurate description of current hatchery practices. The operations are compared to the goals and expectations of the regional comprehensive plan. The review also compares for consistency with the policies governing Alaska hatcheries that can be summarized by the categories of genetics, fish health, and fisheries management (Stopha 2013).

5.1.5 Public Benefit and Hatchery Funding

5.1.5.1 Public Benefit

Public benefits are generally measured by the number of hatchery-produced fish harvested in common property fisheries. Contribution to common property fisheries is a criteria used by both the commissioner and the RPT when reviewing hatchery permit applications. Furthermore, contribution to common property fisheries is a criteria used to evaluate state loans to PNP hatchery programs. It is understood that PNP hatchery programs will need to harvest a certain percentage of the returning hatchery-produced fish to cover the cost of operation, commonly referred to as cost recovery. A PNP hatchery program has to balance between the needs of the business (cost recovery) and providing public benefit by contributing hatchery-produced fish to common property fisheries.

5.1.5.2 Hatchery Funding Overview

Hatchery facilities and programs are expensive to start and operate. In regions of the state with developed aquaculture programs, both RAAs and nonregional PNP corporations sought public funding to provide initial capital and operating expenses, but it was the intent of the legislators who designed the program that funding for enhancement of the state's fisheries would come

from those who benefitted from that production; that is, a user-pays fiscal policy (Burke 2002). The legislature granted fishermen the right to assess themselves the salmon enhancement tax (SET). Further details can be found in Section 5.1.5.4. The intent of this tax was to provide organizational funds, collateral for loans and operating expenses. Hatchery operators were also given the right to conduct cost-recovery harvest of a portion of the returning fish to the SHA. Further details can be found in Section 5.1.5.5. Many associations have been successful in finding grant sources for specific projects and some associations have developed tourist attractions and gift shops to earn additional funds. In the Norton Sound region, it is probable that any hatchery program will need to have some additional source of funding as the traditional forms of revenue generation (SET and cost recovery) will likely not be adequate to meet the financial needs of the operation by themselves.

5.1.5.3 Fisheries Enhancement Revolving Loan Fund

The Alaska State Legislature created the Fisheries Enhancement Loan program as a way to promote the enhancement of the state's fisheries through long-term, low-interest loans for hatchery planning, construction, and operation as well as for implementing other enhancement and rehabilitation activities such as lake fertilization and habitat improvement. This loan program is established under AS 16.10.500–16.10.560.

5.1.5.4 Salmon Enhancement Tax

In 1980 the legislature adopted the Salmon Enhancement Act. This legislation established statutes (AS 43.76.001–43.76.040) authorizing either a SET upon a 51% affirmative vote of all commercial salmon permit holders within the region. The SET is levied on the exvessel value of salmon harvested in the region. Department of Revenue is responsible for the collection of the SET. The tax revenues are then deposited in the general fund, and appropriated yearly by the Legislature to the RAA for the region. Only RAAs are legally allowed to receive SETs, nonregional associations must rely on cost recovery to fund operations, or grants/donations on collaborative projects with the RAA. The price of fish, along with the volume of commercial harvest, greatly influences the amount of funds generated.

5.1.5.5 Cost Recovery

The intent of the legislation (AS 16.10.440) authorizing PNP hatcheries to harvest a portion of the hatchery-produced fish returning to the SHA is to develop a *user pay* approach so that hatcheries can have a self-supporting income necessary to support programs and operate salmon fishery enhancement facilities. AS 16.10.455 Cost Recovery Fisheries specifies how a hatchery permit holder is allowed to conduct a cost-recovery fishery. A hatchery permit holder may conduct cost-recovery harvest of hatchery returns within a SHA, or cost-recovery funds can be collected from an assessment tax on a commercial common property fishery in a THA.

Legislation authorizing SHA entry permits and conditions of use can be found in AS 16.43.400–16.43.440. A PNP hatchery permit holder may be issued a SHA entry permit that is valid for 1 year and applies to an SHA designated by ADF&G. Authorized gear for cost-recovery fishing in the SHA is designated by the Board of Fisheries.

Effective in 2006, the legislature amended AS 16.10.455 to allow an assessment tax on common property harvest in a THA to be used for cost-recovery funding. The assessment is levied on the value of salmon that the fishermen takes in the THA and sells to a licensed buyer. The Alaska Department of Revenue sets the rate of the assessment levied on salmon taken in the THA in consultation with the Alaska Department of Commerce, Community, and Economic Development; the permit holder; and representatives of affected commercial fishermen.

Considerations when setting the assessment include the estimated return and harvest of salmon in the THA, the projected price to be paid for the salmon, the amount of the existing reserve held by the hatchery permit holder, and the amount by which the assessment collected the previous years exceeded or fell short of the amount anticipated to be collected. The total rate of the assessment may not exceed 50% of the value of the salmon.

Alaska Statute clearly outlines the uses of cost-recovery funds in AS 16.10.450 Sale of salmon and salmon eggs: use of proceeds; quality and price.

> (a) Except as otherwise provided in a contract for the operation of a hatchery under AS 16.10.480, a hatchery operator who sells salmon returning from the natural waters of the state, or sells salmon eggs to another hatchery operating under AS 16.10.400–16.10.470, after utilizing the funds for reasonable operating costs, including debt retirement, expanding its facilities, salmon rehabilitation projects, fisheries research, or costs of operating the qualified regional association for the area in which the hatchery is located, shall expend the remaining funds on other fisheries activities of the qualified regional association.

Management of traditional wild stock fisheries are not to be restricted by cost-recovery needs (economic escapement) of hatcheries. This concept is embodied in AS 16.05.730. There is not envisioned any circumstance where a traditional wild stock fishery should be interrupted to assure a cost-recovery harvest.

5.2 Habitat Enhancement and Rehabilitation

Habitat enhancement and rehabilitation is another potential tool for restoring, rehabilitating, or enhancing salmon fisheries. There are several types of habitat restoration, including lake and stream restoration and fish passage improvement. Whether improving existing habitats or returning degraded habitats to their natural condition, these attempts to benefit fish populations through protection of healthy habitats and rehabilitation of impacted habitats is an important aspect of fishery restoration, enhancement, and development. Work on impacted and healthy habitats to restore riparian habitat, restore fish passage, enhance fish habitat, and provide educational opportunities on these subjects is desirable.

5.2.1 Habitat Permit (AS 16.05.871)

Alaska's fish habitat protection statutes were adopted shortly after statehood and remain unchanged to this day. This reflects the longstanding Alaska ideal that fishery resources and habitats are assets that improve our quality of life and merit protection from unnecessary human disturbance. Land and Water use permits from ADF&G are issued through the Division of Habitat. ADF&G has the statutory responsibility for protecting freshwater anadromous fish habitat and providing free passage for anadromous and resident fish in fresh water bodies (AS 16.05.841–16.05.871). Any activity or project that is conducted below the ordinary high water mark of an anadromous stream requires a Fish Habitat Permit. A Fish Habitat Permit is required before any action is taken to construct a hydraulic project; use, divert, obstruct, pollute, or

change the natural flow or bed of a specified river, lake, or stream; or use wheeled, tracked, or excavating equipment or log-dragging equipment in the bed of a specified river, lake, or stream.[12]

5.3 Fishery Research and Education

Projects that have a research and/or educational objective rather than a fishery enhancement objective may still provide a benefit to salmon populations and fisheries. Most public and commercial uses of Alaska's fish resources are closely regulated by the Alaska Board of Fisheries. However, people may wish to use fish or their eggs in other ways too. Researchers sometimes collect or kill fish for reference specimens. Organizations or individuals sometimes need to move fish or their eggs between points within Alaska. When done properly, the capture, collection, holding, or propagation of fish can also have considerable educational value. ADF&G authorizes, monitors, and evaluates potential effects of these uses by issuing different types of fish resource permits for qualifying projects by individuals and organizations.

5.3.1 Fish Resource Permit

Fish resource permits are only issued to applicants that meet requirements in department policy, and who are engaged in legitimate scientific, educational, propagative, or exhibition activities. The fish resource permit policies and requirements govern permits needed for collecting, holding, and propagating fish, shellfish, or aquatic plants for research or educational purposes. Additional permits are required for anyone who wants to transport, possess, export from the state, or release into the waters of the state, any live fish (the broad legal definition) or their eggs. Violating the terms of a fish resource permit or associated regulations may be found to be a Class A misdemeanor or more serious offense under Alaska law.[13]

5.3.1.1 Pertinent ADF&G Policies

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 (Stopha 2013). For example, estimates of pink salmon *Oncorhynchus gorbuscha* survival in the wild ranged from less than 1% to 22% with average survivals from 4% to 9% (Groot and Margolis 1991) while hatchery survivals are usually 90% or higher. Policies were developed to guide the hatchery program while protecting wild stocks.

> 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

[12] ADF&G Website Lands & Waters, Fish Habitat Permits http://www.adfg.alaska.gov/index.cfm?adfg=uselicense.main (Accessed January 2015).

[13] ADF&G Website Licenses & Permits, Fish Resource Permits http://www.adfg.alaska.gov/index.cfm?adfg=otherlicense.aquatic_resource (Accessed January 2015).

> 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 (AS 16.40.210). (Stopha 2013)

A variety of policies guide the permitting of salmon fishery enhancement projects: ADF&G's *Genetic Policy* (Davis et al. 1985); *Regulation Changes, Policies, and Guidelines for Fish and Shellfish Health and Disease Control* (Meyers 2014); and fisheries management policies such as the 5 AAC 39.222 Policy for the management of sustainable salmon fisheries. The policies are used by ADF&G staff to assess hatchery operations for genetic, health, and fishery management issues in the permitting process (Stopha 2013).

5.3.2 Genetic Policy

The State of Alaska developed a provisional genetic policy in 1975 to protect wild stocks from enhancement activities. The genetic policy was revised in 1978 and again in 1985, to provide guidelines for Alaska's aquaculture program while maintaining protections of wild stocks as the principle objective. ADF&G's genetic policy is the policy in effect today. The intent of this policy is to meet the goal of greater fish production through enhancement while maintaining healthy wild stocks. Additional information regarding background and intent of the policy can be found in *Background of the Genetic Policy of the Alaska Department of Fish and Game* (Davis and Burkett 1989). Both of these publications are in Appendix F.

The genetic policy statement is broken down into 3 parts: stock transport, protection of wild stocks, and maintenance of genetic variance. Guidelines and justifications are presented to further explain policy statement. Stock transport is broken down into 3 categories: interstate, inter-regional, and regional transports.

Interstate
Transfer of salmonids, including gametes, will not be imported from outside the state, with the exception of some transboundary river projects.

Inter-regional
Stocks will not be transported between major geographic areas: Southeast, Kodiak Island, Prince William Sound, Cook Inlet, Bristol Bay, Artic-Yukon-Kuskokwim, and Interior.

Regional
Transports are acceptable within regions as long as (a) the phenotypic characteristics of the donor stock is appropriate for the region and the transfer meets the goals set in the regional comprehensive management plan; and (b) noting that transplants occurring over greater distances may have a higher rate of straying and reduce the likelihood of a successful project, the distance of the proposed transport does not have a high probability of failure.

It should be noted that regions mentioned in the genetic policy do not correlate with regions identified by the commissioner for enhancement. Furthermore, the guidelines and justifications section of the genetic policy note that the environment can vary greatly from one region to another in a state as large as Alaska; therefore, considerations may be given to regional border areas, especially when no suitable donor stock is available within the region.

5.4.1.1 Significant or Unique Stocks (genetic policy)

The genetic policy also recommends the identification and protection of *significant and unique* wild stocks:

> Significant or unique wild stocks must be identified on a regional and species basis so as to define sensitive and non-sensitive areas for movement of stocks.

In addition, it 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 recommendations 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 RPTs are an appropriate body to designate significant and unique wild stocks and wild stock sanctuaries.

The genetic policy recommends the regional designation of significant and unique wild stocks. This designation of criteria for runs of fish that are considered significant would greatly expedite the evaluation process. However, *significance* must be defined not only by the magnitude of the run, but also in the context of local importance and utilization. A small sockeye salmon stock near a village in southeast Alaska may be *significant*, whereas the same size population may be too small to be considered a manageable entity in Bristol Bay. Because local utilization is an important concern, a regional planning group such as the RPTs, should consider what criteria will be used to determine significant stocks within a region and recommend such stock designations.

Different regions of the state have approached this issue in different ways in their comprehensive plans. *The Cook Inlet Regional Salmon Enhancement Planning Phase II 2006-2025* (CIRPT 2007) further defined the terms *significant* and *unique* and then as they reviewed each system, determined if it was *significant*. They stated, *significant stocks* are being identified by size, and that size varies by species. For purposes of planning the Cook Inlet Regional Planning Team (CIRPT) has set the following minimum size criteria for *significant* stocks in Cook Inlet: Chinook salmon, 400 fish; coho salmon and chum salmon 800 fish; sockeye salmon, 2,000 fish; and pink salmon, 5,000 fish.[14] CIRPT, for their planning purposes defined a *unique stock* as an

[14] Supplementary notes: This definition was developed and adopted by the CIRPT in the absence of any other suggested definition. Stocks that are designated *significant* must be of a sufficient size to maintain themselves. In this case what is being identified is a stock that can continue to be the optimum level of what the habitat could probably support. This definition should not be construed to devalue the collective importance of the many smaller or *nonsignificant* stocks. Applying this designation amounts to identifying the major discrete components of the total salmon resource of the planning unit being considered.

atypical stock that can be identified by exhibiting gross characteristics that are noticeably different from the prevailing regional patterns for that species.[15] Using this definition, CIRPT reached the conclusion there were no stocks it could designate as unique, and therefore discussion of unique stocks does not occur in each individual unit chapter (CIRPT 2007, 3–12, 3–16).

In the *Comprehensive Salmon Enhancement Plan for Southeast Alaska: Phase III*,[16] the RPT developed a *stock appraisal tool* that looks at 4 stock characteristics: wildness, uniqueness, isolation, and viability. The Joint Northern/Southern Southeast RPT stock appraisal tool splits the viability into population size and population trend and adds a criterion that addresses the human use pattern. In the Southeast *stock appraisal tool* each of the 6 characteristics has a nonnumerical gradient ranging from the quality that would indicate less significance (left side of scale) to the quality that would indicate more significance (right side of scale). The combined assessments of the 6 characteristics provide a qualitative estimate of significance. While they admit this is not a perfect method it does provide a consistent framework upon which to make professional judgments about the significance of wild stocks in the neighborhood of a proposed project. When this assessment is documented, it provides a record as part of the project development process.[17]

The *Kodiak Comprehensive Salmon Plan Phase III, 2010-2030* (KRPT 2011) did not address the genetic policy issue of significant or unique but did develop a *New Project Opportunities Form* located as Appendix F of their comprehensive plan.

The *Prince William Sound–Copper River Phase 3 Comprehensive Salmon Plan*, (PWSRPT 1994) also did not define any significant or unique stocks but did develop a checklist for new project evaluations, but they have not been consistently using the form (Stopha 2013).

The *Norton Sound/Bering Strait Regional Comprehensive Salmon Plan* (NS/BSRPT 1996) did not address significant or unique stocks. In this updated version, considerations for fishery enhancement planning and a stock appraisal tool was included for use by the RPT to determine significant or unique stocks when evaluating a project. This combined form was modeled after other RPTs stock appraisal tools and project criteria and is located in Appendix C.

The stock appraisal tool portion identifies some key factors for determining whether a stock impacted by an enhancement project should be considered *significant or unique* under the

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[15] Supplementary notes: This definition was developed and adopted by CIRPT in the absence of any other suggested definition. The term *unique stocks*, as it seems to be most commonly used, implies an undefined level of discrimination among stocks and varying degrees of positive connotation associated with the word *unique*. In the most absolute sense each individual fish is *unique*, but this level of discrimination is beyond practical ability to recognize or act on the *uniqueness*. In addition, the level of *uniqueness* is regularly and continuously subjected to alteration through such natural phenomena as were discussed in the concept of genetic integrity. For the purposes of this type of planning and for day-to-day management such a use of the *uniqueness* concept is not functional. The degree to which such a difference or *uniqueness* has a particular value (positive or negative) must be judged on a case-by-case basis.

[16] Joint Northern/Southern Southeast Regional Planning Team. 2004. Comprehensive salmon enhancement plan for Southeast Alaska: Phase III. Unpublished document obtained from Sam Rabung, ADF&G PNP Hatchery Program Coordinator, Juneau.

[17] Ibid.

ADF&G genetic policy. It is meant to be an objective and consistent framework for use by ADF&G biologists, hatchery associations, and the RPT when planning a project and evaluating permit applications. It will look at the 5 characteristics—population trend, supplementation, isolation, uniqueness, and human use pattern of the stock—using a nonnumerical gradient ranging from the least significance on the left hand side of the scale to the right hand side of the scale indicating more significance. Combining the assessments of these 5 characteristics will provide a qualitative estimate of significance or uniqueness that can be used in the development and evaluation of a project.

Considerations for the fishery enhancement portion identify and provide supplemental information to the hatchery permit application. The project checklist focuses questions for consideration in 5 categories: project feasibility, land use, management, cost, and stock identification. An aquaculture association should be evaluating and considering these items during the development of a project. The information should be passed on to the RPT for their consideration during the review of the hatchery permit application.

It is the intent that these tools can be updated and adjusted by the RPT as appropriate over time without having to update or amend the whole comprehensive plan.

5.3.3 Pathology (fish health)

The regulation designed to protect fish health and prevent spread of infectious disease in fish and shellfish is 5 AAC 41.080 Reporting and control of fish diseases at egg-take sites, hatcheries, and rearing facilities. Additional information can be found in Meyers 2014. The *Alaska Sockeye Salmon Culture Manual* (McDaniel et al. 1994) provides practices and guidelines specific to the culture of sockeye salmon. These regulations and policies are used by ADF&G fish pathologists to review hatchery plans and permits. The pathology procedures seek to ensure that pathogens are not introduced into watersheds where they don't naturally occur.

With respect to fish diseases, Alaska's geographic isolation and colder water temperatures minimize the amount of pathogens that occur; however, it has within its boundaries large areas of separated watersheds supporting wild stocks that have never been examined for disease. Therefore, there is a risk of unknowingly transporting diseases from 1 major geographic area to another that may not be detected at the 5% level per 60 adult fish examined prior to transport (60 fish is the state's required disease screening sample size for any fish transports). To minimize this risk, ADF&G discourages the transplant of wild fish stocks between major geographic zones: Southeast, Kodiak Island, Prince William Sound, Cook Inlet, Bristol Bay, Alaska Yukon/Kuskokwim, and the Interior. To maintain consistency with the ADF&G genetic policy, this policy includes hatchery stocks as well, although exceptions may be considered on a case-by-case basis under stringent constraints. Proposals to do so must have adequate justification for using a nonlocal stock and be for gametes only (Meyers 2014).

5.3.4 Salmon Escapement Goal Policy

ADF&G and the Board of Fisheries developed and implemented 5 AAC 39.223 Policy for statewide salmon escapement goals. The purpose of this policy is to establish the concepts, criteria, and procedures for establishing and modifying salmon escapement goals and to establish a process that facilitates public review of allocative issues associated with escapement goals. The establishment of salmon escapement goals is the joint responsibility of ADF&G and the Board of Fisheries working collaboratively in order to meet the charge of managing the Alaska salmon

fisheries on the sustained yield principal. Escapement goals for the Norton Sound region are discussed in Section 3.4.

5.3.5 Sustainable Salmon Fishery Policy

What is commonly referred to as the *Sustainable Salmon Fishery Policy* can be found in regulation 5 AAC 39.222 Policy for the management of sustainable salmon fisheries (Appendix F). In this section, we will highlight sections of the policy specific to enhancement planning.

Section (c)(1)(D) – ". . . effects and interactions of introduced or enhanced stocks on wild salmon stocks should be assessed; wild salmon stocks and fisheries on those stocks should be protected from adverse impacts from artificial propagation and enhancement efforts."

Section (c)(3)(J) – ". . . proposals for salmon fisheries development or expansion and artificial propagation and enhancement should include assessments required for sustainable management of existing salmon fisheries and wild salmon stocks."

Section (c)(3)(K) – ". . . plans and proposals for development or expansion of salmon fisheries and enhancement programs should effectively document resource assessments, potential impacts, and other information needed to assure sustainable management of wild salmon stocks."

The main points of Section (c)(5)(A) are: "(i) consideration of the needs of future generations and avoidance of potentially irreversible changes;

(ii) prior identification of undesirable outcomes and of measures that will avoid undesirable outcomes or correct them promptly;

(iii) initiation of any necessary corrective measure without delay and prompt achievement of the measure's purpose . . .;

(iv) that where the impact of the resource use is uncertain, but likely presents a measurable risk to sustained yield, priority should be given to conserving the productive capacity of the resource;

(v) appropriate placement of the burden of proof . . ."

Section (f)(34) defines *salmon stocks* as a locally interbreeding group of salmon that is distinguished by a distinct combination of genetic, phenotypic, life history, and habitat characteristics or an aggregation of 2 or more interbreeding groups which occur within the same geographic area and is managed as a unit.

The *burden of proof* concept mentioned above in the SSFP is further discussed in the *Comprehensive Salmon Enhancement Plan for Southeast Alaska: Phase III* (Ducket et al. 2010), referencing the Food and Agriculture Organization of the United Nations (FAO 1996). The FAO states that the precautionary approach does not imply a prohibition against fishing (or by inference, enhancement or other activities affecting the fish resource)

> until all potential impacts have been assessed and found to be negligible. Waiting for a complete analysis of all potential impacts would constitute a reversal of the burden of proof, where an action is assumed to be harmful unless proven otherwise. Conversely, it should not be assumed that potential impacts are negligible until proven otherwise.

The FAO also states the standard for proof of impacts

> should be commensurate with the potential risk to the resource, while also taking into account the expected benefits of the activities . . .

This shows the importance of the concept of burden of proof while also being careful that it not be misused.

CHAPTER 6: FISHERY RESTORATION, REHABILITATION, AND ENHANCEMENT PROJECTS

6.1 Potential Systems for Projects

Several rivers, streams, and lakes throughout the region were identified in the 1996 CSP (NS/BSRPT 1996) as systems where production of salmon may be increased through implementation of various restoration, rehabilitation, or enhancement techniques to benefit regional fishermen with increased harvests. This section provides an update to that list. In the 1996 CSP the RPT selected habitat restoration/improvement and recirculating and/or instream incubation techniques as the most practical and cost-effective strategies to investigate in the region. The current RPT recognizes that without all of the project information available it is not possible to determine the most practical or cost-effective strategy in advance; therefore they will review project proposals on a case by case basis as they proceed through the permitting process. The 1996 CSP further stated that before beginning any projects it will be necessary to learn as much as possible about the physical, chemical, and biological characteristics of selected systems, identify the appropriate strategy, and determine the feasibility of proposed projects.

Systems selected for investigation were based on information received from fishermen, RPT members, ADF&G staff, and public comments received during the village information meetings. The criteria used to determine systems that would initially be investigated included (1) importance to community, (2) size of system, (3) proximity to communities, (4) potential for increased salmon production based on historical escapement and harvest information, and (5) status of land surrounding the system.

The *ADF&G Anadromous Water Catalog*[18] can be used to determine if a system has been formally identified as being used by salmon or other anadromous species.

6.1.1 Port Clarence District

Tuqsuk Channel and Imuruk Basin (Freshwater Lake)

Imuruk Basin is connected to Grantley Harbor by Tuksuk Channel, a 6-mile-long tidal canal with strong currents that reverse periodically. Brevig Mission and Teller are located on Port Clarence near the entrance to Grantley Harbor, 14 miles from the Bering Sea. In the eyes of local residents these areas are riverine rather than estuarine and salmon behave as if they were in a river or lake during their migration through these waters. The salinity levels are very low in the spring, summer and fall, and a salt water lens only develops in the ice-covered months. Grantley Harbor is the furthest upstream that salt water intrudes during the ice-free months. These waters are the terminus of several large salmon streams, yet little is known about how salmon utilize these waters. Adult salmon may spawn along the south shore of Imuruk Basin and juvenile salmon may spend time rearing in the upper basin among the vegetation covering the shallows. The active exploration of a

[18] www.adfg.alaska.gov/sf/SARR/AWC/

large graphite deposit just a short distance from Windy Cove, on the south side of Imuruk Basin, adds urgency to the need for investigation of salmon utilization in this locale.

Agiapuk River
The watershed system for the Agiapuk River consists of the main river and 2 major tributaries, the American River and Igloo Creek, with several smaller tributaries such as Boulder, Arctic, and Flat Creeks. The mouth is located approximately 21 miles east-southeast of Teller and about 25 miles from Brevig Mission. The river originates in the Black Mountains and flows approximately 60 miles southeast to the Imuruk Basin. The American River is approximately 35 miles in length, entering the Agiapuk about 18 miles from its mouth. Igloo Creek flows approximately 28 miles to the American River, 1 mile north of its junction with the Agiapuk. Pink, chum, and coho salmon are present and are targeted by subsistence fishermen. Residents of Teller have indicated that Chinook salmon are also present in the Agiapuk River. The Agiapuk is considered an important salmon system to local residents, who have indicated there are ice-free areas on the Agiapuk and American Rivers as well as on Igloo Creek during the winter. It is a primary system for subsistence chum salmon in that area. The fish run from July through September, and the late-run chum salmon are considered to be fat when they enter Port Clarence Bay.

Sunset Creek
The headwaters of this system lie southwest of Eva Mountain. Sunset Creek flows approximately 6 miles before entering Grantley Harbor, 4 miles northeast of Teller. Pinks are the only known salmon to spawn in Sunset Creek and are utilized by the subsistence fishermen who camp at the creek's mouth.

Bluestone River
The headwaters of Bluestone River are at the junction of Gold Run and Right Fork; the river flows northeast approximately 13 miles to Tuksuk Channel, 12 miles southeast of Teller. Pink and chum salmon are present in the Bluestone River but numbers are few. Subsistence fishermen are the primary user group of these salmon stocks and the system is important because of its proximity to Teller.

Cobblestone River
Cobblestone River headwaters are located in the Kigluaik Mountains. This river flows northeast approximately 20 miles to Imuruk Basin, about 28 miles southeast of Teller. Chum, sockeye, and pink salmon are the only known salmon species to inhabit this system. No data are available concerning what user groups, if any, target this system.

Kuzitrin River
Kuzitrin Lake is the headwaters of the Kuzitrin River, a body of water approximately 3 miles long and located within the Bering Land Bridge National Preserve. The Kuzitrin River flows west approximately 95 miles to Imuruk Basin, passing through the Kuzitrin Flats. Pink, chum, coho, Chinook, and sockeye salmon are present in this system. The Noxapaga River is a major tributary that supports populations of pink and chum salmon. Belt Creek, a small tributary, also has spawning populations of chum and coho salmon. Subsistence fishermen target primarily pink, chum, and coho salmon in the Kuzitrin system.

Salmon Lake
Salmon Lake (the Eskimo name is *Nahwazuk*, meaning salmon) is approximately 35 miles north of Nome. Salmon Lake is 4 miles long, is accessible via the Nome-Taylor Highway, and is considered one of the most northerly lakes in Alaska supporting a sockeye salmon population. Historically, the

sockeye population was much higher and supported a small commercial fishery in 1996, 2007, and 2008. Limnology studies began in 1994 to determine potential productivity levels, and a lake fertilization project has taken place over the past decade. The population appears to be stabilizing following record escapements in the mid-2000s (Kevin Keith, NSEDC, personal communication). Residents of Brevig Mission and Teller indicate sockeye salmon are their most desired subsistence species.

Pilgrim River
The Pilgrim River (the Eskimo name is *Kruzgamepa*) begins at the outlet of Salmon Lake southeast of the Kigluaik Mountains and flows northeast and then west approximately 55 miles to Kuzitrin River before entering Imuruk Basin. Pink, chum, coho, Chinook, and sockeye salmon are present in the river. Pink, chum, and sockeye salmon are primarily harvested for subsistence use by residents of the villages of Teller and Brevig Mission. Coho and Chinook salmon are targeted by sport fishermen, and additional sockeye salmon harvest occurs by subsistence fishermen from Nome. Residents of Teller have indicated there are areas on the Pilgrim River that remain ice free and open during winter.

6.1.2 Subdistrict 1 (Nome)

Glacial Lake
Glacial Lake is located approximately 25 miles northwest of Nome and drains into the Sinuk River. It is also one of the most northerly lakes in Alaska supporting a sockeye salmon population. Glacial Lake is approximately 3.7 miles in length, has a mean depth of 20 feet, a maximum depth of 72 feet, and a surface area of 986 acres. Limnology studies were conducted in the 1990s to determine the lake's productivity and a weir has been operational on Glacial Lake since 2000.

Sinuk River
The Sinuk River is located approximately 25 miles northwest of Nome, and is accessible via the Blodgett Memorial Highway and by a trail along the beach. The Sinuk River is about 48 miles long, drains Glacial Lake, and empties into Norton Sound. An Eskimo village and mission were once sited at the mouth of this system. The Sinuk River currently has runs of pink, chum, coho, and sockeye salmon, and is reported to have formerly had a Chinook salmon run as well. Subsistence fishermen are the primary user group of pink and chum, while sport fishermen target coho and sockeye salmon.

Cripple River
Cripple River is located approximately 12 miles northwest of Nome and is accessible from the Blodgett Memorial Highway and a trail along the beach. The Cripple River is approximately 25 miles in length and empties into Norton Sound. Pink, chum, and coho salmon are present in this system. Several tributaries of the Cripple River provide rearing habitat for juvenile coho salmon. Sport and subsistence hook and line fishermen are the primary user groups of these fish. Up until the early 1980s, a small seasonal subsistence fishing camp existed at the mouths of the Cripple and Penny Rivers. A tourist mining camp has been established at the mouth of the Cripple River, and the subsistence camps are no longer used. Subsistence fishing for chum salmon has been closed here since 2001.

Penny River
The Penny River is located approximately 10 miles west of Nome and is accessible via the Blodgett Memorial Highway and a trail along the beach. The river is approximately 13 miles in length and

supports pink, chum, and coho salmon runs. Sport and subsistence hook and line fishermen are the primary user groups. The pink salmon run appears stable, while the coho run is more variable. The chum salmon stock is depressed and subsistence fishing for chum salmon has been closed here since 2001.

Snake River

The Snake River, named in 1898 because of its serpentine-like course by the persons who discovered gold in the area, is formed by junction of Goldbottom Creek and North Fork Snake River. The river flows southwest 15 miles, then southeast 5 miles to Norton Sound near the west end of the city of Nome. The Glacial Creek Road follows the river. The Snake River drainage was the site of the first major gold discovery in Nome during the late nineteenth century. The area was heavily impacted from mining activities, which played a significant role in damaging salmon spawning and rearing habitat as well as impacting the runs of the different species of salmon. The Snake River's many tributaries are still occasionally mined today.

In 1995, Kawerak Native Corporation, in cooperation with ADF&G, began operating a salmon counting tower on the Snake River in an effort to better assess salmon escapements. The project switched over to a weir in 2002. In 2008, NSEDC, in cooperation with ADF&G, began operating the weir. Escapement for pink, chum and coho salmon are generally considered adequate to meet spawning requirements. There is also a small run of sockeye salmon that has fluctuated greatly. The primary user group of this system is subsistence fishermen who harvest pink, chum, and coho salmon. Sport fishermen predominately seek coho salmon from this system. NSEDC, in cooperation with ADF&G, has utilized the Snake River for chum and coho salmon restoration research in recent years. Small tributaries offer opportunities to increase chum salmon populations using instream incubation boxes because they are relatively ice-free in the winter. Several abandoned mining pits constructed by mining companies offer potential for development into rearing habitat for juvenile coho salmon.

Nome River

The Nome River is located approximately 3 miles east of Nome; it is about 40 miles long and flows in a southerly direction before draining into Norton Sound. The Nome-Taylor Highway follows the Nome River nearly its entire length. Prior mining activities on the Nome River and its tributaries as well as road construction have adversely impacted salmon populations over the years. Pink, chum, and coho salmon are the predominant species, with occasional recordings of sockeye and Chinook salmon. Since 1993, ADF&G has operated a salmon enumeration project on the Nome River in an effort to better assess escapements. Escapement has varied for chum salmon. Pink salmon escapement goals haves been met in most years and an escapement goal has not been established for coho salmon. A seasonal subsistence camp (Fort Davis) and the lower Nome River below the highway bridge have been the focus of subsistence salmon harvests in this watershed. In years of large pink runs much of the reported salmon subsistence harvest in the Nome Subdistrict in the last decade has been from the Nome River.

Flambeau River

The Flambeau River is located approximately 10 miles east of Nome and about 15 miles southwest of Solomon; it flows in a southeasterly direction approximately 23 miles before entering Safety Sound. The Flambeau River supports a pink, chum, and coho salmon populations, and previously it was believed to have been a major producer of chum salmon harvested in the Subdistrict 1 commercial fishery (Charlie Lean, personal communication). Today, the primary harvest of salmon

in Subdistrict 1 is by subsistence fishermen. Seasonal subsistence fishing camps are located along Safety Sound.

Eldorado River
The Eldorado River is located approximately 10 miles east of Nome and about 15 miles southwest of Solomon. The river flows southeast approximately 30 miles and enters the Flambeau River about 4 miles north of Safety Sound. Pink, chum, Chinook, and coho salmon are present in the Eldorado River. A tower initiated by Sitnasuak Native Corporation in 1995 was converted to a weir in 2002. For most years Kawerak Inc. operated the project, and since 2008 NSEDC has operated the project with assistance from ADF&G. The primary user group is subsistence fishermen who predominately target the chum and coho salmon stocks. Seasonal subsistence fishing camps are located along Safety Sound. The chum salmon escapement goal has been reached in all but 3 years in the 2000s and has ranged from nearly 3,300 in 2004 to over 40,000 in 2006 and 2010. Escapement goals have not been established for pink or coho salmon, but coho salmon escapement tends to be small.

Bonanza River
The Bonanza River flows southeast approximately 25 miles before entering Bonanza Channel, an extension of Safety Sound. Seasonal subsistence fishing camps are located along Safety Sound. Pink, chum, sockeye, and coho salmon are present in the system. Escapement goals have not been established for coho, sockeye, and pink salmon, but runs are generally considered adequate to meet spawning requirements.

Solomon River
The Solomon River flows west-southwest approximately 22 miles before entering Norton Sound. The main stem of the Solomon River parallels the Nome-Council Highway for about 10 miles. The village of Solomon is located on the west bank of the river, about 1 mile from Norton Sound. Early mining activity was substantial; at least 13 dredges operated on the Solomon River and its tributaries. Considerable damage was done to some sections of the river as a result of these activities. Additionally, road construction has resulted in redirection of portions of the river that may require stream channelization work for a complete recovery. Major tributaries that support spawning or rearing areas include the East Fork, Big Hurrah, and Shovel Creek. Pink salmon are currently the primary species targeted by subsistence fishermen here. NSEDC has conducted chum salmon restoration research work on this system.

6.1.3 Subdistrict 2 (Golovin)

Fish River
The Fish River is an important salmon system located in the White Mountain/Golovin area. It begins in the Bendeleben Mountains and flows approximately 47 miles south to Golovin Lagoon. There are several tributaries (e.g., Fox, Niukluk, Klokerblok, Etchepuk, Paragon, and Rathlatulik Rivers; and Boston Creek) that form the Fish River system. The Niukluk River and Boston Creek are the 2 most important salmon tributaries. The village of White Mountain is located about 15 miles from the mouth. Historically, the Fish River was once the largest single chum and pink salmon producer in Norton Sound. Subsistence and sport fishermen harvest pink, chum, and coho salmon inriver and there are commercial chum and coho salmon fisheries within the subdistrict marine waters. Many local residents have subsistence fishing camps along the river. Escapement goals for chum salmon have been achieved intermittently. Because the subsistence fishery has highest priority, there has been only a limited commercial fishery for chum salmon. Coho salmon

have contributed to a popular and significant sport fishery there, and small numbers of Chinook salmon are also present in this system.

Niukluk River
The Niukluk River is a major tributary of the Fish River. The river's headwaters begin about 5 miles northwest of Mount Bendeleben; the river flows southwest approximately 8 miles, then southeast 52 miles, passing the village of Council, before entering the Fish River. The tributaries (Ophir Creek, Bear Creek, and Casadepaga River), all contribute salmon to the Niukluk River. Pink, chum, and coho salmon are present in this system. In 1995, ADF&G established a salmon counting tower approximately 10 miles downstream of Council and in 2007 moved the project down river to near the confluence with the Fish River, where it was operated through 2012. Subsistence fishermen from White Mountain and Nome are the primary harvesters of salmon. The escapement goal for chum salmon has been met in most years in the 2000s.

Boston Creek. Boston Creek, a tributary of the Fish River, has its headwaters in the Bendeleben Mountains. It flows approximately 38 miles southeast to the Fish River. Pink, chum, coho, and Chinook salmon are present in this system. The primary user group is subsistence fishermen. Boston Creek is also home to the bulk of the Chinook salmon returning to the Fish River system, although Chinook escapements have recently shown a decline region wide.

Paragon River. The Paragon River is a tributary of the Fish River. The headwaters are in the Bendeleben Mountains with the river flowing in a southeasterly direction approximately 32 miles before entering the Fish River. Populations of pink, chum, coho, and Chinook salmon are present.

Ophir Creek. Ophir Creek flows approximately 19 miles southwest before entering the Niukluk River and is located about 2 miles northwest of Council. Pink, chum and coho salmon have been reported to inhabit Ophir Creek.

6.1.3.1 Golovin Bay systems

Kachauvik River. Kachauvik River is situated north of Golovin and is utilized by many residents of the community for subsistence salmon harvests. Coho, chum and pink salmon are all present.

Chenik Creek
Chenik Creek flows into the Golovin Bay at the village of Golovin. This stream produces small numbers of coho, chum and pink salmon and supports limited fishing. The community of Golovin also draws water from this stream.

Mckinley Creek and Peter's Creek
These streams flow off the west side of the Cape Darby Peninsula and produce primarily coho salmon with a few pink salmon. Both support limited subsistence harvests.

6.1.4 Subdistrict 3 (Elim/Moses Point)

Kwiniuk River
The Kwiniuk River flows northeast approximately 43 miles and then south 8 miles to its mouth at Moses Point on Norton Bay. Moses Point is about 10 miles northeast of Elim. Pink, chum, coho, and Chinook salmon are present in the Kwiniuk River system. Chum salmon escapement goals have been achieved in most years, and Chinook salmon escapement goals have been achieved in about half of the years, since 2000. Escapements of pink and coho salmon are generally considered adequate to meet spawning requirements. There is commercial fishing for chum and coho salmon in the marine waters of the subdistrict and there is limited market interest in pink salmon. Agsuruq

Slough connects the Kwiniuk River to Caches Lagoon and is believed to provide another migration corridor into and out of Kwiniuk River via Kwiniuk Inlet. In recent years storm debris has closed the channel completely at times.

Tubutulik River
The Tubutulik River flows southeast approximately 25 miles to Kwiniuk Inlet at the northwest end of Norton Bay, approximately 15 miles northeast of Elim and 25 miles southwest of Koyuk. A large Eskimo village was once located at the mouth of the Tubutulik River. Today a seasonal subsistence camp at Caches Lagoon is situated on the barrier spit near the river to take advantage of the returning salmon. Runs of Chinook, chum, pink and coho occur in the Tubutulik River. The chum salmon escapement is calculated from aerial survey and has been met in recent years.

Kwik River
The Kwik River flows southeast approximately 20 miles before entering Norton Bay. This system is approximately 20 miles northeast of Elim and 15 miles southwest of Koyuk and supports a late-run chum salmon stock that spawns in a spring-fed lake about 10 miles from the mouth of the river. A large Eskimo village was once located at the mouth of the Kwik River. Horseshoe Creek drains Jepson Ponds, which supports a small stock of late-run chum salmon. The stock was believed by locals to have been larger prior to beaver colonization and it supported a subsistence harvest 40 years ago but no longer does.

Quiktalik Creek
Investigations conducted by ADF&G in 1991 indicated that Quiktalik Creek, located about 2 miles west of Elim, had the biological and physical characteristics necessary for successful implementation of a salmon restoration project there. The system currently supports a small run of chum salmon (Charlie Lean, personal communication).

6.1.5 Subdistrict 4 (Norton Bay)

Koyuk River
The Koyuk River flows southeast approximately 115 miles where it enters Koyuk Inlet, about 30 miles northwest of Christmas Mountain-Nulato Hills area. The village of Koyuk is located on the west bank of the river, about 3 miles upriver from Norton Bay. Pink, chum, coho, and Chinook salmon are present in the system. The primary salmon-producing tributary is the East Fork Koyuk River.

East Fork Koyuk River
The East Fork Koyuk River flows southwest approximately 33 miles to the Koyuk River and is located 8 miles southeast of Haycock and about 20 miles northeast of Koyuk. This river once (i.e., 1910–1930) supplied Dime Landing's dog food needs with chum salmon (Charlie Lean, personal communication). Pink, chum, and coho salmon are present in the system and are targeted primarily by subsistence fishermen from the village of Koyuk.

Inglutalik River
The term *Inglutalik* means “like a house” and was named after an adjacent hump-like landmark that in profile looks like a house. The Inglutalik River starts at Traverse Peak and flows southwest approximately 80 miles to Norton Bay. The mouth is located 10 miles southeast of Koyuk. Pink, chum, coho, and Chinook salmon are present in the system and targeted primarily by subsistence fishermen. A salmon escapement counting tower project was initiated here by NSEDC in 2011.

Ungalik River

The Ungalik River starts at Traverse Peak and flows southwest 90 miles to Norton Bay. This river has a long history of subsistence use by Athabascans and Inupiaqs. In the early 1900s, active mining sites were located approximately 1 mile and 10 miles from the mouth. Pink, chum, coho, and Chinook salmon are present in the river. In the 1970s and 1980s, Norton Bay fishermen conducted their commercial fishing effort at the mouth of this system; however, since 1988, salmon species have been harvested primarily by subsistence users. Commercial salmon fishing returned in 2008 after 10 years of no fishing. Escapement goals have not been established. During a village informational meeting in January 1995, residents of Koyuk indicated concerns over increased beaver activity in some rivers and the interception by trawling fleets in the North Pacific as possible reasons for the decline in salmon in Norton Bay drainages. Koyuk residents have also expressed interest in the use of instream incubation boxes as a means to increase local salmon populations.

6.1.6 Subdistrict 5 (Shaktoolik)

Shaktoolik River

The Shaktoolik River flows southwest approximately 95 miles to Shaktoolik Bay; its mouth is located about 22 miles southwest of Christmas Mountain. It is a shallow, fast-running river that has a long history of subsistence use. Historically, there was an Inupiaq village located approximately 5 miles up the river near Rabbit Vale. In the 1930s a few cabins were built along the banks by prospectors and reindeer herders. Currently, fish camps are located from the mouth to 10 miles upriver. Pink, chum, coho, and Chinook salmon are present in the river. Chinook and pink salmon are harvested primarily by subsistence users, while chum and coho salmon contribute to a significant commercial fishery. There is a small amount of sport use in the upper stretches of the system. The fish mill between Shaktoolik and Unalakleet Rivers, and fishermen in the 2 communities are able to harvest fish bound for either river.

Tagoomenik River

The Tagoomenik River joins the Shaktoolik less than a mile from the sea and at the present site of the community. There are several old village sites on the banks of the Tagoomenik River. Community member state that in the 1970s beaver colonized the area and have progressively slowed the flow of the river and impeded salmon migration, so much so that even boat use is limited today. During village informational meetings, residents of Shaktoolik expressed concern for habitat degradation due to some human activities (i.e., tree cutting along riverbanks), predation of salmon and salmon eggs from bears and trout, jet-boat use and its effects on salmon eggs, and beaver emigration as problems contributing to declines in the number of returning salmon. Local residents have expressed an interest in chum salmon restoration, beaver control, and predator control.

6.1.7 Subdistrict 6 (Unalakleet)

Egavik Creek

Egavik Creek flows southwest approximately 29 miles to Norton Sound; its mouth is located 38 miles southwest of Christmas Mountain and 25 miles southeast of Shaktoolik. During the 1930s a reindeer processing plant was located at the outlet of the creek, and some of its structures are still in use today. Pink, chum, coho, and Chinook salmon are present in the creek. Only a few Chinook salmon return each year and pink salmon are harvested primarily by subsistence users. Salmon stocks from this river also contribute harvests in the marine waters within the vicinity of the Shaktoolik and Unalakleet Rivers.

Unalakleet River

The headwaters of the Unalakleet River drainage are in the Kaltag Mountains. The river flows west approximately 90 miles to its outlet at Norton Sound, just south of Unalakleet. The Unalakleet river drainage system has a long history of subsistence use by upriver Athabascans and coastal Inupiaqs and Yupiks; currently, subsistence fishing is an important activity that occurs at the mouth of the river and in nearshore marine waters. All 5 species of Pacific salmon occur in the river. Chinook and pink salmon are harvested primarily by subsistence users while chum and coho salmon primarily contribute to the commercial fisheries.

A weir was established in 2010 on the Unalakleet River at approximately river mile 15 and is operated cooperatively by ADF&G, NSEDC, Bureau of Land Management, and the Native Village of Unalakleet IRA. Aerial survey escapement goals for Chinook and chum salmon have been established for a combined escapement for the Unalakleet and Old Woman River. In order to achieve Chinook salmon escapement goals, subsistence, commercial, and sport fishing have been restricted or closed some years. Sockeye salmon are occasionally harvested in those fisheries. There is 1 sport fishing lodge located on the river, and 1 or 2 outfitters utilizing the river are based in the village of Unalakleet. Local residents also maintain cabins on the lower portion of the river. There are several major tributaries of the Unalakleet River, including the South and North Rivers, Chirosky River, North Fork Unalakleet River, and Old Woman River. Above the mouth of the Chirosky River, the Unalakleet River is designated a National Wild River by the Bureau of Land Management and is closed to Chinook salmon harvest.

South River

The South River is about 40 miles long and enters the Unalakleet River from the south about 5 miles upstream from the outlet of the Unalakleet River. It is primarily a chum salmon system and fish congregate about a mile from its outlet where a spring is located. The lower section of the South River is more like a slough with a muddy bottom and slow current.

North River

The North (50 miles long) River is about 50 miles long and enters the Unalakleet River from the northeast about 5 miles upstream from the outlet of the Unalakleet River. A salmon counting tower was reestablished on the North River in 1996 and monitors escapements for pink, chum, coho and Chinook salmon.

Chirosky River

The Chirosky River flows approximately 50 miles northeast into the Unalakleet River about 15 miles from its outlet. Pink, chum, and coho salmon are present along with small numbers of Chinook salmon.

North Fork Unalakleet River

The North Fork Unalakleet River is approximately 30 miles long; it enters the Unalakleet River about 25 miles from its outlet. Pink, chum, coho, and Chinook salmon are present in low numbers.

Old Woman River

The Old Woman River is 48 miles long, entering the Unalakleet River from the north, about 37 miles from its outlet. Historically, Athabascans inhabited the area. There is 1 cabin, which is used as a shelter on the Iditarod Trail route, built along the river. Pink, chum, coho, and Chinook salmon are present in this river.

Golsovia River
The Golsovia River has a steep gradient with much of the river in a deep canyon with very coarse substrate covered in white water. These conditions limit the salmon species to only Chinook and coho salmon. It is generally believed to receive less use than the rivers nearer communities. At times a guided sport fishing operation is active on the Golsovia River.

6.1.8 Other

6.1.8.1 St. Lawrence Island

Ikalooksik River/Niyrakpad Lagoon
The headwaters of the Ikalooksik River, located on the north side of St. Lawrence Island, is on the north slope of Poovookpuk Mountains; this river flows north approximately 10 miles into Niyrakpak Lagoon, which is about 16 miles southeast of Gambell. There have been 4 active fish camps around the lagoon. Pink, chum, coho, sockeye, and Chinook salmon are present in the system and subsistence fishing is the traditional use for these fish.

Aghnaghak Lagoon
Aghnaghak (pronounced "Akhnakhak") Lagoon, which refers to 2 Eskimo women who lost their lives there, is located on the north side of St. Lawrence Island and extends 5 miles from the mouth of Kangik River, 10 miles southeast of Gambell. In addition to the Kangik River, the Aghnuk River also flows north about 10 miles into the lagoon. Residents of Savoonga report that pink, chum, coho, sockeye, and Chinook salmon are found in this system. Subsistence fishing has been the traditional use of the resource.

Moghoweyik River
The Moghoweyik River flows approximately 12 miles to the Bering Sea, 22 miles south of Gambell. Residents of Savoonga report that pink, chum, Chinook, and Dolly Varden are present. Subsistence fishing has been the traditional use of the resource.

Boxer River
Located on the south side of St. Lawrence Island, the Boxer River flows south approximately 7 miles to Boxer Bay, named in 1926 for the vessel *USMS Boxer* which took shelter there during a storm. Residents of Savoonga report that pink salmon are present in the system and that subsistence fishing is the traditional use for these fish.

Koozata River and Lagoon
The river drains the south side of the Kookooligit Mountains and has a number of small forks. The lagoon is about 40 miles in length with an entrance on the southeastern end, 25 miles from the river mouth. Historically, the lagoon and river were important subsistence camp locations with year-round family dwellings located at prime locations. The eastern fork of the Koozata River is a known spawning location for chum, pink, and coho salmon.

6.1.8.2 Wooley Lagoon

Tisuk River
The Tisuk River is located approximately 40 miles northwest of Nome. The river system is accessible via the Blodgett Memorial Highway. It is approximately 22 miles in length and flows west into Wooley Lagoon before reaching the Bering Sea. Chum salmon migrate into Wooley Lagoon on their way to the Tisuk River. This system supports small chum and pink salmon runs that are targeted mainly by subsistence fishermen.

Feather River
The Feather River is located approximately 38 miles northwest of Nome. The river is accessible from the Blodgett Memorial Highway. This system is approximately 17 miles in length, flowing west into Wooley Lagoon before reaching the Bering Sea. The river has runs of chum, coho, and pink salmon.

6.1.8.3 Southern Coast of Norton Sound (beyond Subdistrict 6)

Kogok River
The Kogok River flows northwest approximately 35 miles to Norton Sound, and its outlet is about 22 miles southwest of St. Michael. Pink, chum, coho, and Chinook salmon are present in this system. The villages of St. Michael and Stebbins primarily target these fish for subsistence use. Residents report that beaver dams have prevented salmon access to much of the river, and now salmon inhabit only the lower 10 miles of the system below Nunakogok Fork. There is 1 permanent subsistence camp on the lower river.

Pikmiktalik River
The Pikmiktalik River flows north approximately 45 miles to Norton Sound; it is located about 22 miles southwest of St. Michael. Pink, chum, coho, and Chinook salmon are present in the system, and residents of St. Michael and Stebbins primarily target these fish for subsistence use. There are roughly 10 permanent fish camps on the lower river owned primarily by families from Stebbins and St. Michael, although 1 cabin is owned by a family from Kotlik. A salmon counting tower was operated for 5 years by Kawerak Inc. beginning in 2003.

Nunavulnuk River
The Nunavulnuk River (descriptive Eskimo name meaning river which widens to form a lake) flows northwest approximately 30 miles to Big St. Michael Canal, about 11 miles southeast of St. Michael. The *ADF&G Anadromous Water Catalog* indicates the presence of both pink and chum salmon in the system, although the numbers appear to be very low. A 1.5-mile-long lake is located approximately 8 miles from the mouth of the river. Local residents indicate there is a small population of red salmon there and that the salmon spawn above the lake in areas that remain ice free in winter. There is an abandoned village and fish camp at the outlet of the lake; there is also a smaller abandoned fish camp at the confluence of the river and canal.

6.2 Past and Current Project Descriptions

6.2.1 Port Clarence

Imuruk Basin surveys and baseline data collection
A more complete understanding of salmon use and water quality conditions is needed to adequately manage this district's salmon. The active exploration of a large graphite deposit near the Cobblestone River, which drains into Imuruk Basin, adds urgency to collecting this data. Baseline hydrographic data and an inventory of fishes in the basin will be attempted during 2015. Several previous attempts have met with limited success (Charlie Lean, NSEDC, personal communication).

Salmon and Glacial Lakes limnology investigations
The Salmon and Glacial Lakes limnology investigations project was described as follows: Over a 2-year period, it will be necessary to acquire data and knowledge relative to the productive potential of Salmon and Glacial Lakes. Limnology sampling would entail taking a suite of physical measurements (for light penetration, salinity, temperature, oxygen concentration, and water depth), water samples (for analysis of nutrient concentrations and phytoplankton abundance), zooplankton

samples (to determine food availability for salmon fry), and fry samples (to determine growth patterns and diet). Limnology sampling on each lake must be conducted an average 5 times per year (May through October) for 2 years to assess seasonal and annual fluctuations. Further accumulation of biological and limnological data on shallow lakes will provide necessary information to assess and model carrying capacities of such lakes. Limnological studies of physical, chemical, and biological attributes of regional lakes will assess their respective potential feasibility for fertilization or application of other enhancement or rehabilitation techniques for increased production of sockeye and, perhaps, coho salmon.

The fisheries aspects of the investigations have been initiated to determine the nature and extent of juvenile sockeye fry utilization of the 2 lakes. This is accomplished by enumerating emigrating sockeye fry in the lakes using fyke nets or mark–recapture techniques to determine abundance and timing of the migration. Adult fish returning to these systems will also be enumerated. Additionally, smolt enumeration and sampling will determine the production of smolts from each system and establish an index for abundance, size, and age data sufficiently accurate to be used in forecasting as well as monitoring conditions of the rearing environments.

These types of limnological and biological studies have been initiated at Salmon and Glacial Lakes as a result of a cooperative agreement between Bering Sea Fishermen's Association, U.S. Bureau of Land Management, and ADF&G (No. 1422L953-A5-0013) as well as a cooperative agreement between ADF&G and NSEDC (COOP 96-003). Comprehensive limnology work has not previously occurred in the region because of its remoteness, commensurate high costs of transportation, and other difficult logistical constraints. These studies are necessary, however, not only to provide a foundation for future restoration and enhancement work, but to provide a basic understanding of sockeye production in western Alaska. Anecdotal evidence suggests that sockeye populations in these lakes were historically far more abundant than at present. Preliminary data suggest potential for annual returns of 200,000 or more adults. Sockeye salmon are highly valued for subsistence and commercial harvests; however, there has been no commercial fishing on these stocks since 1967, and subsistence harvests are believed to have been only about 1,000 fish annually. These projects will attempt to rebuild these populations to levels limited by the carrying capacity of the freshwater environment. Initial work will focus on identifying these limits and methods to fully utilize available habitat. Research has been ongoing for most years since 1996. Reports are available from NSEDC (Charlie Lean, NSEDC, personal communication).

Salmon Lake Fertilization

The fertilization of Salmon Lake began in 1997 with the goal of increasing returns of sockeye salmon to the Pilgrim River. Among salmon species, sockeye salmon are uniquely dependent on lake environments as part of their life cycle. After hatching in the fall, young sockeyes spend 1 or 2 summers feeding on plankton and growing in a lake environment. In the spring, they leave the lake as smolt. In systems where the limiting factor in sockeye salmon production is food for fry, increasing the nitrogen and/or phosphorous level in the lake may increase the amount of plankton, which, in turn, should increase the number and/or the size of smolt. Larger smolt may have higher ocean survival and produce larger adult returns.

The fertilizer used has always been a 20-05-00 liquid blend of phosphorous and nitrogen. The amount of fertilizer added each year has been variable (Table 6.1). The methods are detailed in annual reports and are available from NSEDC.

Table 6.1.–Amount of fertilizer added to Salmon Lake by year

Year	Escapement[a]	Tons of Fertilizer
1997	13,000-20,000	40
1998	9,000-15,000	40
1999	42,000-80,000	40
2000	16,000-26,000	40
2001	12,000-20,000	40
2002	4,000-7,000	0
2003	42,729	0
2004	85,417	27
2005	55,951	0
2006	52,323	0
2007	43,432	16
2008	20,448	8
2009	953	28
2010	1,654	19
2011	8,423	11
2012	7,272	10
2013	12,405	11
2014	9,719	20

Note: Escapement is not related to the tons of fertilizer applied in the same year.
[a] The escapement estimates for 1997 to 2002 are based on aerial surveys. After 2002, the escapements are weir counts.

Salmon Lake sockeye salmon smolt
A project to index smolt outmigration and health is being conducted by NSEDC in concert with the lake fertilization project. Emigrating smolt are enumerated and measured to provide an estimate of abundance and relative condition. Annual reports are submitted to fulfill the requirements of Fish Resource Permits and are available from NSEDC or from ADF&G permit coordinators.

6.2.2 Subdistrict 1 (Nome)

Nome area streams salmon eyed egg planting
This is a project conducted by NSEDC. The project's primary purpose is to assess the efficacy of producing an increase in viable outmigrating wild salmon fry and smolt. This is achieved through capturing donor stocks, manually fertilizing eggs, incubating eggs to the eyed stage of development in a facility, effecting an otolith mark for assessment, and replanting eggs back into natural spawning beds. It is intended to demonstrate and assess a minimalist human intervention with appreciable increases in viable swim-up fry in a cost-effective manner.

Secondary objectives include providing an educational opportunity and demonstrating a collaborative model for local citizens, students, and governmental agencies to work together in projects to benefit wild salmon. The planting locations are sites of chum or coho salmon run depletion or extirpation along the Snake and Solomon River systems. These activities are an attempt to bolster or restart the salmon cycle in these systems. The project investigates the viability of applying a suite of developed technologies and operations designed to effectively utilize full fecundity of wild salmon, and assessing these stewardship efforts. The project

attempts to demonstrate how stock rehabilitation can be effectively practiced in small rural situations with relatively inexpensive apparatus.

Methods entailing salmon brood stock collection, manual fertilization (spawning), incubation either to the resilient eyed stage of development or to fry in varying types of incubators in a facility, and returning (hydraulically replanting or releasing) eggs/fry back into the natural watershed(s) should effect an increase in emergent fry and/or fry survival. Creating an otolith mark during the incubation process provides the opportunity for assessing survival of emergent fry and returning adults.

Recent mining activity has created an oportunity for seeding mitigated habitats on both the Snake and Solomon watersheds. These habitats have not been available to salmon for nearly a century. This project is an opportunity to further test the technology that has been pioneered in earlier phases of this study. The coho salmon project on the Snake River system is utilizing vacant rearing habitats as a way of rehabilitation of the larger river stock. NSEDC has a cooperative agreement with ADF&G to conduct this research. Reports are available from NSEDC and the ADF&G Permit Coordinator.

Instream incubation boxes

Little is known regarding historical numbers of chum salmon in the Nome area, but returns to other systems within the region suggest their abundance may have been much higher. The Kwiniuk and Fish Rivers, for example, have had annual escapement estimates of 25,000 (Kwiniuk, based on counting tower assessments) and 17,000 (Fish, based on aerial surveys) since the mid-1970s. In contrast, aerial survey escapement estimates of the Nome, Solomon, and Snake Rivers have averaged only 1,500 (Nome), 300 (Solomon), and 3,100 (Snake) chum salmon, during the same period. These differences are probably related to the widespread habitat degradation of rivers in the Nome area and subsequent exploitation of those stocks.

In 1991 ADF&G introduced the use of instream incubation technology as a relatively low-cost method of rebuilding depressed salmon stocks in the Norton Sound region. It is generally assumed that in nature the normal survival for fertilized salmon eggs to fry typically is from 5% to 10%, while the survival rate for fertilized salmon eggs to fry in an instream incubator may be as high as 80% (Sam Rabung, Division of Commercial Fisheries, ADF&G, Juneau; personal communication). The incubators protect salmon eggs by providing them with near-optimal conditions as they develop through the winter, dramatically increasing their chances for survival.

Since 1991, incubators have been placed in several locations including the Nome (Hobson Creek), Snake (Boulder Creek, Anvil Creek), and Solomon River drainages. Investigations to locate additional suitable incubation sites continued. A cooperative agreement (No. 95-065) between the Bering Sea Fishermen's Association and the Commercial Fisheries Management and Development Division of ADF&G was signed in March 1995. This agreement allowed ADF&G personnel to conduct late-winter aerial surveys to locate potential instream incubation sites throughout the region. Location of these sites is difficult because of the remoteness and inaccessibility of the region as well as the rigorous site-specific requirements. Aerial surveys are a practical and accurate method of locating potential sites that—at a minimum—must remain ice free during the winter. Beginning on March 17, 1995, 5 aerial surveys were conducted; flying time totaled 12 hours. Part of the surveys were flown near the villages of White Mountain, Golovin, Elim, and Koyuk, and potential ice-free instream incubation sites were located in the following systems: Mukluktulik River (Koyuk); Aggie Creek (White Mountain); and Walla Walla, Clear, Quiktalik, and Miniatulik Creeks

(Elim). Aerial surveys were also conducted to the west of Nome, including the Snake, Penny, Sinuk, and Feather Rivers. Aside from the incubation sites already in operation on Boulder Creek (tributary to Snake River), the only other system with apparent potential is a spring located on the Sinuk River, approximately 3 miles north of the Sinuk River Bridge. Boxes were set up on Quiktalik and Miniatulik Creeks. This project was discontinued due to the inability of the project to document success. It was thought by ADF&G staff to have been successful at Boulder Creek and Hobson Creek based on the observation that eggs had hatched and fry had exited the incubators. It was thought to have failed at Shovel Creek, Next (or Quiktalik) Creek (near Elim) and Eldorado River. Inconclusive attempts were made at Anvil Creek, Kwiniuk River, and Salmon Lake. No instream or streamside incubator projects have incubated eggs in the region since 2007. The Sinuk River incubation project never incubated eggs, but is still fully assembled and had water flowing in the fall of 2014 (Charlie Lean, personal communication).

Anvil Creek Spawning Bed Washing
This project was an offshoot of the coho salmon egg planting research. The egg pumps were utilized to loosen gravel in some likely looking stream channels. The site was chosen for its proximity to a beaver pond, which indicated a year-round water supply and the fact it was above mining effluent. Coho salmon were observed spawning later in the year (Charlie Lean, personal communication).

6.2.3 Subdistrict 2 (Golovin)

Residents of both White Mountain and Golovin expressed a desire for more timely and inclusive escapement indices for salmon. This was addressed in part by the counting tower project which was initiated by NSEDC in 2014.

Fish River salmon restoration research project
Similar to the Nome area eyed-egg planting projects discussed in Section 6.2.2, the Native Village of White Mountain has conducted a project involving salmon brood stock collection, manual fertilization (spawning), incubation either to the resilient eyed stage of development or to fry in varying types of incubators in a facility, and returning (hydraulically replanting or releasing) eggs/fry back into the natural watershed(s). This should effect an increase in emergent fry and/or fry survival. Creating an otolith mark during the incubation process provides the opportunity for assessing survival of emergent fry and returning adults. This project has focused on collecting eggs from Chinook salmon at Boston Creek (a tributary of the Fish River) for planting into unutilized habitat on the Niukluk River (a tributary of the Fish River), and from coho salmon at the Niukluk River for planting into unutilized habitat on Ophir Creek (a tributary of the Niukluk River). The Native Village of White Mountain has a cooperative agreement with ADF&G to conduct this research.

6.2.4 Subdistrict 3 (Elim/Moses Point)

Kwik River Fall Chum Migration Barrier Removal
This small and declining stock of very late fall chum have historic and cultural significance in that they provided an emergency late-season harvest opportunity during times of famine. Recent beaver activity has impounded the fish, allowing heavy predation by bear in the fall. The project would remove or breach beaver dams to allow unimpeded salmon migration to spawning locations.

Corral Creek Instream Incubation Box
This was the longest operating instream incubation project in Norton Sound and was operated for several years in the 1990s. The project was attempted again in 2013 but installation was not successful. The project requires local support in the form of maintenance and egg collection. Egg marking for evaluation is problematic with this type of project. Additional discussion of Norton Sound instream incubation box projects is in section 6.2.2.

Agsuruq Slough Reroute
This slough was closed and opened by several storms in recent years. Permitting is under way to allow a new channel to be opened further back from the retreating beach. The slough has been shown to be important to migrating salmon and facilitates small boat traffic during times of rough weather.

6.2.5 Subdistrict 4 (Norton Bay)

No projects have been attempted.

6.2.6 Subdistrict 5 (Shaktoolik)

No projects have been attempted.

6.2.7 Subdistrict 6 (Unalakleet)

Unalakleet River Chinook salmon restoration research
Similar to the Nome area and Fish River eyed-egg planting projects discussed in Section 6.2.2 and 6.2.3, NSEDC has conducted a project involving salmon brood stock collection, manual fertilization (spawning), incubation either to the resilient eyed stage of development or to fry in varying types of incubators in a facility, and returning (hydraulically replanting or releasing) eggs/fry back into the natural watershed(s). This should effect an increase in emergent fry and/or fry survival. Creating an otolith mark during the incubation process provides the opportunity for assessing survival of emergent fry and returning adults. This project has focused on collecting eggs from Chinook salmon at Old Woman (a tributary of the Unalakleet River) for planting into unutilized habitat on the South River (a tributary of the Unalakleet River). NSEDC has a cooperative agreement with ADF&G to conduct this research. Annual reports are available from NSEDC and ADF&G Permit Coordinator.

6.2.8 Other

6.2.8.1 St. Lawrence Island
No projects have been attempted.

6.2.8.2 Woolley Lagoon
No projects have been attempted.

6.2.8.3 Southern Coast of Norton Sound (beyond Subdistrict 6)
No projects have been attempted.

6.3 Potential Future Projects

As of the date of publication, the following projects have been identified as contributing to the goals of this plan.

6.3.1 Port Clarence

The Port Clarence District may see large industrial changes in the next 15 years from development of a major graphite mine and the potential for a deep water arctic port to be developed within the Port Clarence area. A more complete understanding of salmon use and water quality conditions is needed to adequately manage this district's salmon. The active exploration of a large graphite deposit near the Cobblestone River, which drains into Imuruk Basin, adds urgency to collecting this data. Baseline hydrographic data and an inventory of fishes in the basin will be attempted during 2015. Several previous attempts have met with limited success (Charlie Lean, NSEDC, personal communication).

The USGS investigation of water temperatures from Port Clarence to Salmon Lake with associated adult salmon energetics measurements is one such idea. Another idea is to take more temperatures along the south side of Imuruk Basin to collect baseline data to assess for mining impacts on likely temperature refugia for both adult and juvenile salmon.

6.3.2 Subdistrict 1 (Nome)

Overwintering Pond Construction (Sinuk River)
A number of these projects were approved to facilitate gravel use on road maintenance in Nome area highways. All were eventually created except the Site at the Sinuk River Bridge.

Big Hurrah Creek Channel Reconstruction
When the Rock Creek mine was preparing to mine Uncle Sam Mountain this design was created as a remediation project. Only a blue print exists today.

Spawning Channels
These were discussed and some were drawn into the Big Hurrah design.

Culvert Improvement for Fish Passage (Livingston, Sunset, Rocky Mountain Creeks)
These are the 3 most likely streams to produce salmon that are on the Alaska Department of Transportation list of culverts needing work in the region.

Instream and Streamside Incubation Boxes
Instream and streamside incubation boxes were widely tested in the Norton Sound area in the 1990s. Generally, this type of project was discontinued due to the inability of the projects to document success. It was thought by ADF&G staff to have been successful at Boulder Creek, and also at Hobson Creek where a small building was constructed to protect incubators from freezing. It was thought to have failed at Shovel Creek, Next (or Quiktalik) Creek (near Elim), and Eldorado River. Inconclusive attempts were made at Anvil Creek, Kwiniuk River, and Salmon Lake. Generally, success was determined by the observation that the eggs had hatched and the fry had exited the incubator; however, this may or may not have produced adult salmon. Evaluation of success requires marking of the produced fish; marking of eggs or fry is problematic in most projects of this type. However, the Nome Fisherman Association, acting as authorized personnel on an ADF&G held research permit, was able to thermal mark otoliths in eggs incubated at Hobson Creek. If methods to efficiently mark the fish produced by this type of incubation box are developed, they potentially could be used in some situations to restore or rehabilitate runs.

Streamside Incubation Facilities
Residents of the Nome area have expressed support for continuing projects such as the one demonstrated at Hobson Creek, described above. This type of small inexpensive incubation

facility could be utilized as a central incubation facility (hatchery) for restoration or rehabilitation projects. It would require a consistent year-round flow of salmon-free water of at least 25 gpm, an offsite source of salmon broodstock and egg collection activities, and the ability to mark the eggs or fry prior to transport and release at an approved location. If enough water were available, this type of facility could potentially be utilized as a small production hatchery with a fishery enhancement objective, provided an appropriate release location could be identified and operational funding and PNP Hatchery permitting could be obtained. Hobson Creek, Boulder Creek and Sinuk River have been discussed as locations for utilizing this tool.

Central Incubation Facility (Hatchery)
Central incubation facilities are a type of salmon hatchery that are developed in locations that have available water and infrastructure, but not necessarily where salmon return. These hatcheries obtain eggs from offsite broodstock sources, transport the gametes to the hatchery for incubation and rearing, and finally transport the juvenile salmon to an offsite location for release and eventual adult return there. These types of facilities can be used for restoration, rehabilitation, and fishery enhancement projects, and are operated under PNP Hatchery Permits. The amount of available water will typically limit the size of the programs that can be conducted at this type of facility; however, with adequate funding it is possible to produce much more by utilizing recirculating technology. This type of facility would be expected to have significant monetary costs associated with development and operation. There has been support voiced, primarily in Nome, but also throughout the region, for development of this type of hatchery. NSEDC is currently evaluating Moon Light Springs in Nome as a potential site for this type of hatchery.

Production Hatchery
Production hatcheries are developed with a fishery enhancement objective. They are designed to create significant runs of harvestable salmon that would not otherwise exist. They typically require very large amounts of freshwater, 1 or more appropriate (segregated) release locations (terminal harvest areas), and significant development and operational funding. The funding mechanism for hatcheries of this type is cost-recovery harvest of returning salmon produced by the hatchery, and so the release numbers typically must be very large. These types of facilities can also be used for restoration and rehabilitation projects along with the fishery enhancement projects, and are operated under PNP Hatchery Permits. Although there has been some support voiced for this type of project, it is not very likely that a large production hatchery could be developed in the Norton Sound area primarily due to the limited quantities of available year-round freshwater.

6.3.3 Subdistrict 2 (Golovin)

No new projects have been identified for Subdistrict 2.

6.3.4 Subdistrict 3 (Elim/Moses Point)

Instream and Streamside Incubation Boxes
Residents of Elim express strong support for reestablishing former instream incubation box projects at Corral Creek and other locations near Elim. They also indicated support for finding new locations for this type of project. Efforts to rehabilitate regional salmon stocks using instream incubators require locating and developing reliable sites to insure increased survival of eggs to emerging fry. Investigations conducted in 1991 indicated that Quiktalik Creek, located about 2

miles west of Elim, had the biological and physical characteristics necessary for successful implementation of a salmon restoration project there. The system currently supports a run of chum salmon. This type of project is discussed in more detail in sections 6.2.2 and 6.3.2.

6.3.5 Subdistrict 4 (Norton Bay)

No new projects have been identified for Subdistrict 4.

6.3.6 Subdistrict 5 (Shaktoolik)

Tagoomenik River Chinook Planting

This tributary to the Shaktoolik River has supported a number of prehistoric settlements and most recently the community of Shaktoolik has been situated at its mouth since the 1930s. The river was colonized by beaver in the 1970s and today little of the former spawning areas are accessible to spawning salmon. On the other hand, extensive beaver pond terraces exist which might be utilized by juvenile salmon. Salmon transplanted to the upper river might find a productive habitat.

6.3.7 Subdistrict 6 (Unalakleet)

Culvert Replacement

The road to the hillside subdivision blocks one of the sloughs on the north side of the Unalakleet River estuary. The suggestion is to place a large culvert to provide better circulation and to prevent stranding of juvenile fish.

Central Incubation Facility (Hatchery)

Unalakleet residents contacted the governor's office and ADF&G in 2015 to inquire into the feasibility of establishing a hatchery in their area. They indicated that they envision utilizing such a facility to restore and rehabilitate depressed local runs. They had not determined a particular location or project design and were seeking assistance from the state to do so.

6.3.8 Other

6.3.8.1 St. Lawrence Island

No new projects have been identified for St. Lawrence Island.

6.3.8.2 Wooley Lagoon

No new projects have been identified for Wooley Lagoon.

6.3.8.3 Southern Coast of Norton Sound (beyond Subdistrict 6)

Nunvulnuk and Kuaik River Migration Barrier Removal

The coast of southern Norton Sound has extensive sheet flows of lava. Both these streams have a volcanic terrace that creates a stair-like step or velocity barrier near the coastal plane. The idea of breaking down the barrier to allow fish access to the upper reaches of the stream has been considered since 1996.

Counting Tower at Pikmiktalik

The Pikmiktalik is the largest salmon-producing stream in the reach between Stebbins and Kotlik. Community comment made favorable comments on restarting the cooperative project that Kawerak and USFWS operated on the lower river. This counting tower provides an index of salmon production of the coastal streams of the region. Subsistence harvests of most salmon species in the area have been conducted in the coastal streams and not on the migrating Yukon

stocks. There is concern that subsistence harvests might be curtailed unnecessarily based on just the Yukon indices.

6.4 RPT Project Review Criteria

New projects being proposed for inclusion in the potential project list must conform to the Mission Goals and Strategies section of the plan describe in Section 4.2. Appendix C lists the project review criteria in detail. The highest priority projects are those that address depleted wild stocks or rehabilitating habitat. Creating new common property fisheries will be of a lower priority. Consideration of impacts to wild stocks will be given and may be grounds for not supporting proposals. Alaska policies on fish health, genetics, and socioeconomics will be fully considered. Consideration of alternative actions will be considered to amend or replace proposals. Sustainability of projects does not just refer to biological sustainability; it includes project sustainability or funding support. The intended life of a project will affect the feasibility of a project. Short-term projects could be feasible with one-time funding, but long-term projects will need long-term support.

Project proposals for inclusion in the CSP will be considered at the RPT annual meeting. They can be proposed by the general public, the Northern Bering Sea Regional Aquaculture Association, or ADF&G. Additionally, the RPT may see a need and generate a potential project plan at their meeting.

The RPT is guided by regulation in its review of PNP hatchery permit applications and permit alteration requests as described in Section 1.1.7. The other permit type the RPT is required to review is the hatchery site suitability Fish Resource Permit. The RPT has no authority regarding any other permit type; however, this does not preclude the RPT from providing input during a public review of another type of permitting.

The RPT will consider the following questions when project proposals are brought before it for review and recommendations:

1. Will it make a significant contribution to the common-property fisheries?
The RPT will consider and make its recommendations on each species to be produced if there is a reasonable opportunity for common property harvest consistent with the average common property fishery exploitation rate for that species. For a site to be suitable for private nonprofit hatchery development there must be capability to generate common property harvest.

Considerations pertinent to determining the potential common property benefits include:

Does the application contain significant omissions or error in assumptions? If so, the use of more accurate assumptions might indicate decreased benefits to common property fisheries. Pertinent assumptions might include those relating to (1) interception (harvest) rates in common property fisheries and (2) survivals of green eggs to adults.

If returns cannot provide at significant common property benefit in the traditional fisheries, is there an adequate terminal area where new fisheries could be created for the desired common property benefit without endangering the wild stock?

If the application provides insufficient information for adequate RPT evaluation, the team will request additional information. If they conclude that basic production and harvest assumptions are not realistic, they will recommend that changes in the proposed projects be incorporated by the applicant.

2. Does it allow for continued protection of wild stocks?
Any judgment as to the acceptability of impacts on natural stocks from an enhancement project should be made on the actual and potential size of the affected wild stocks, and also on the extent of benefits from enhancement and alternative enhancement opportunities in the area that may have less impact on natural stocks. Considerations include:

- Can management or harvest strategies be developed to allow harvest of enhanced returns while protecting natural stocks?
- Does the affected stock actually or potentially support a commercial, sport, and/or subsistence fishery?
- Does the affected stock have unique characteristics or are there special circumstances (e.g., a unique early run of coho)?
- Will resultant increases in the affected stock have a potential negative effect on another important stock (i.e. coho salmon juveniles are known to prey on juvenile pink and chum salmon, etc.)?

3. Is the proposed project compatible with the Comprehensive Plan?
The goals and objectives of the Comprehensive Plan identify ongoing and proposed projects that are compatible with management strategies for the wild stocks. Thus, the goals, objectives, and recommendations contained in the plan provide a basis for evaluating all projects. The proposed project should also be compatible with management concerns and guidelines set forth in the plan and with specific recommendations concerning strategies and projects.

The RPT, in its recommendation to the commissioner, will take all of these factors into consideration in determining the project`s compatibility with the comprehensive plan.

4. Does it make the most appropriate use of the sites potential?
A number of opportunities for restoration and enhancement projects exist in the Norton Sound/Bering Strait region. If the plan goals and objectives, as well as substantial public benefits, are to be achieved, enhancement and restoration projects must be developed to their fullest potential with appropriate species using the best available technology. In many instances, investigation will show one strategy to be more effective than others. Within a given strategy, it will be important that the proposed project will develop the site appropriately and to its full potential.

Given technical feasibility, the RPTs determination of the appropriate development of a site will be based on such factors as the magnitude of its water supply, harvest potentials, manageability, and potentials to address user needs. The applicant, in his application and presentation to the RPT, should demonstrate adequate plans for the site and the capabilities to carry them out. If the applicant does not show adequate planning and documentation, the RPT cannot judge the proposed project's ability to satisfy any criteria or determine whether the proposed project would result in public benefit. An applicant should document to the RPT an ability to develop the site properly and to its full potential. This documentation should include plans for implementation and full development of long- and short-term production goals and objectives, and an adequate description of plans for incubation and/or rearing.

6.5 RPT Recommendation

The RPT will formulate a recommendation based on its review of the application and forward it to the commissioner. The RPT's recommendation should not be construed as denoting the decision to be made by the commissioner. ADF&G staff, as well as interested members of the public, may also

provide reviews and recommendations to the commissioner. The commissioner may uphold or reject the recommendations of the RPT after reviewing all the merits and potential problems associated with the proposal.

Since the RPT needs adequate review time prior to considering an application, it will generally require that applications and attendant materials be received by the RPT members at least 2 weeks before the meeting at which the application is to be considered. It may also request additional information during the initial review if information contained in the application is inadequate. A representative from the corporation making the application will be expected to make a presentation of the proposal at the RPT meeting.

Alaska statutes and regulations specifically grant the RPT an opportunity to review a permit suspension or revocation. However, revocation by the commissioner would occur only as a very last, unavoidable course of action. It is more desirable to identify problems early and attempt to remedy them. Existing procedures provide for an annual evaluation of operating projects. The annual report and/or AMP supplies information on the project's performance and RPT review of annual reports and/or AMPs may be considered part of ongoing planning duties. This departmental and RPT review allows for monitoring of project performance.

If ADF&G has determined that a project's performance is inadequate and that a permit suspension or revocation is being considered, the commissioner will notify the RPT, and the RPT will be provided with an opportunity to make a recommendation on the proposed action. In evaluating any PNP operation that is referred to the RPT by the commissioner, the RPT will use the specific performance criteria in their review, evaluation, and recommendation to the commissioner. The criteria are established in 5 AAC 40.860. The RPT, in this evaluation, will also consider any mitigating circumstances that were beyond the control of the project operators.

Contribution to the fisheries of the Norton Sound/Bering Strait region will be the ultimate measure of project performance; however, it is not easy to define this criterion in measurable terms or to delineate what actions should be taken if the criterion is not met. Furthermore, the buildup of production at any project may be slow, so that the ultimate success or failure may not be determined for many years. As experience with these restoration and rehabilitation projects is gained, the performance criteria should be reviewed and refined as needed. There is additional project review criteria for consideration in addition to those listed above.

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APPENDIX A: Terms and Definitions

ADF&G	Alaska Department of Fish and Game
alevins	newly hatched fish on which the yolk-sac is still apparent.
allocation	to apportion, through regulation, salmon harvest to various user groups (i.e., subsistence, sport, or commercial fishermen).
anadromous	fish such as salmon that are born in fresh water, migrate and feed at sea, and return to fresh water to spawn.
aquaculture	culture or husbandry of salmon (or other aquatic fauna/flora).
aquatic plant	any species of plant, excluding the rushes, sedges, and true grasses growing in a marine aquatic or intertidal habitat.
barter	the exchange or trade of fish or game, or their parts, taken for subsistence uses for (1) other fish or game or their parts or (2) other food or for nonedible items other than money, if the exchange is of a limited and noncommercial nature.
BSFA	Bering Sea Fishermen's Association
benthic	bottom-dwelling fish such as halibut and rockfish.
biomass	the combined weight of a group of organisms; for example, a school of herring.
broodstock	salmon contributing eggs and milt for supplemental culture purposes.
CF	Division of Commercial Fisheries
coded wire tag (CWT)	magnetically detectable pinhead-sized tag implanted in the nose of a young fish for identification as an adult.
commercial fishing	the taking, fishing for, or possession of fish, shellfish, or other fishery resources with the intent of disposing of them for profit, or by sale, barter, trade, or in commercial channels.
commissioner	principal executive officer of the Alaska Department of Fish and Game.
commissioner approval	formal acceptance by the commissioner of a CSP or other RPT product or recommendation.
comprehensive salmon plan	a statutorily mandated, strategic plan for perpetuation and increase of salmon resources on a regional basis.
criteria	accepted measures or rules for evaluation of programs, project proposals, and operations.
depressed stock	a stock (of fish) that is currently producing at levels far below its historical levels.

enhancement	strategies/procedures designed to supplement the harvest of naturally produced stock (e.g., salmon) beyond what could be naturally produced in its natural habitat. This can be accomplished by artificial or semi-artificial production systems or by an increase in the amount of productive habitat in the natural environment through physical or chemical changes.
epilimnion	layer of water overlying the thermocline of a lake and subject to action of the wind.
escapement	salmon that pass through the fisheries to return upstream to a spawning ground or to be used as brood stock and cost recovery in a hatchery.
euphotic zone	constituting the upper layers of a body of water into which sufficient light penetrates to permit growth of green plants.
exvessel value	price paid to the commercial fishermen for their catch.
eyed egg	stage in which the eyes of the embryo become visible.
fecundity	number of eggs per adult female salmon (or other fish).
fingerling	stage of salmon life between fry and smolt.
fishery	a specific administrative area in which a specific fishery resource is taken with a specific type of gear.
fish pass	fish ladder to enable salmon to get past a barrier (e.g., waterfall) to reach spawning grounds.
fish stock	a species, subspecies, geographic grouping, or other category of fish manageable as a unit.
fish wheel	a fixed, rotating device for catching fish that has no more than 4 baskets on a single axle and is driven by river current or other means.
fry	stage of salmon life from emergence from gravel until it doubles its emergence weight.
gillnet	a net primarily designed to catch fish by entanglement in the mesh and consisting of a single sheet of webbing hung between cork line and lead line and fished from the surface of the water: (a) a set gillnet is one that has been intentionally set, staked, anchored, or otherwise fixed and (b) a drift gillnet is one that has not been intentionally staked, anchored, or otherwise fixed.
goals	broad statements of what a RPT, with input from the user groups, hopes to see accomplished within a specified period of time.
green egg	stage of salmon egg development from ovulation until the eye becomes visible, at which time it becomes an eyed egg.

habitat	the place or type of site where a plant or animal naturally or normally lives and grows.
hatchery	facility in which people collect, fertilize, incubate, and rear fish under authority of an ADF&G issued hatchery permit.
incidental catch	harvest of a salmon species other than the desired species for which the fishery is managed. Fish of another species and/or stock caught during harvest of specific species and/or stock.
instream incubator	device located in or adjacent to a stream that collects water from the stream and is used to incubate and hatch salmon eggs.
limnology	the scientific study of physical, chemical, meteorological, and biological conditions in fresh waters.
littoral zone	pertaining to the shore and, in fresh waters, confined to those zones in which rooted vegetation occurs.
macrophytic vegetation	plant life on a body of water large enough to be viewed by the naked eye.
mixed stock fishery	harvest of salmon at a location and time during which several stocks are intermingled. Harvest of more than 1 stock at a given location and/or period.
natural production	salmon that spawn, hatch, and rear without human intervention (i.e., in a natural stream environment).
NSEDC	Norton Sound Economic Development Corporation
NSRPT	Norton Sound\Bering Strait Regional Planning Team.
otolith	calcified ear bones of fish that offer future environmental marking promise. Manipulation of water temperature can produce distinctive otolith banding patterns in juvenile salmon, and these patterns can be used to identify specific groups of hatchery fish or differentiate between other hatchery and wild fish stocks.
pelagic	pertaining to the open ocean as opposed to waters close to shore.
periphytic vegetation	relating to small plant organisms that live attached to underwater surfaces or substrate; e.g., algae, diatoms.
personal use fishing	the taking, fishing for, or possessing of finfish, shellfish, or other fishery resources by Alaska residents for personal use and not for sale or barter with gill or dip net, seine, fish wheel, long line, or other means defined by the Board of Fisheries.
pot	box-like or conical trap covered with mesh for catching fish or shellfish.
plan development	composing, drafting, revising, and finalizing a comprehensive salmon production plan document.

PNP	private nonprofit: level and/or operational status of a private-sector organization without profit motives. Required status to hold a hatchery permit in Alaska.
present condition	average catch for the last 5 years.
private nonprofit hatchery permit application	request presented by a private nonprofit corporation to ADF&G for a permit to operate a private nonprofit hatchery.
private sector	that group active in salmon resource development that is not employed by government.
production	perpetuation or increase of the salmon resource through maintenance, rehabilitation/restoration, or enhancement programs and techniques.
project	unit of work having a beginning, middle, and end that functions according to defined performance criteria.
projected status	continuation of the present condition without additional supplemental production.
public sector	that group active in salmon resource development that is employed by government.
recruitment	upcoming or next generation of fish.
regional aquaculture association (RAA)	AS 16.10.380. Statutorily authorized organization comprised of representatives of fisheries user groups organized for the purpose of enhancing salmon production.
regional planning team (RPT)	statutorily mandated planning group, composed of ADF&G staff and regional aquaculture association representatives, designated to develop a comprehensive salmon plan.
rehabilitation/restoration	procedures applied to a depressed natural stock of fish (e.g., salmon) to increase or rebuild it to historical abundance using management, fish culture, habitat protection/restoration, or other applicable strategies.
review and comment process	collection of accepted procedures to solicit and generate examination and remarks.
revised plan	comprehensive salmon planning document resulting from incorporation of commissioner-approved material into a plan.
roe	eggs of a fish.
run	returning salmon stock(s) bound for spawning area; these stocks are often further described by their timing and numbers.
run strength	total run of salmon, including escapement plus harvest.

salmon	Chinook (king) *Oncorhynchus tshawytscha* Chum (dog) *Oncorhynchus keta* Coho (silver) *Oncorhynchus kisutch* Pink (humpy or humpback) *Oncorhynchus gorbuscha* Sockeye (red) *Oncorhynchus nerka*
salmon stock	population of salmon identified with a specific water system, or portion thereof. Salmon of a single species that are produced from a single geographic location and are of the same genetic origin.
seine (purse)	a floating net designed to surround fish that can be closed at the bottom by means of a free-running line through 1 or more rings attached to the lead line.
seine (beach)	a floating net designed to surround fish that is set from and hauled to the beach.
seine (hand purse)	floating net designed to surround fish that can be closed at the bottom by pursing the lead line; pursing may only be done by hand power, and a free-running line through 1 or more rings attached to the lead line is not allowed.
smolt	salmon, trout, or char that have passed through the physiological process of becoming ready to migrate to salt water.
sonar	technology that uses sound waves in water to detect submerged objects such as schools of fish.
spawn	(verb) to produce or deposit eggs; (noun) a mass of spawned eggs.
spawning channel	engineered addition to natural salmon spawning habitat in which water flow, substrate, sedimentation, and predation are controlled to increase egg-to-fry survivals.
sport fishery	the taking of or attempting to take for personal use and not for sale or barter, any fresh water, marine, or anadromous fish by hook and line held in the hand, or by hook and line with the line attached to a pole or rod which is held in the hand or closely attended, or by other means defined by the Board of Fisheries.
stock	group of fish that can be distinguished by their distinct location and time of spawning.
stock restoration	*see* above definition for rehabilitation/restoration.
subsistence fishery	the taking of, fishing for, or possession of fish, shellfish, or other fisheries resources by a resident domiciled in a rural area of the state for subsistence uses with a gillnet, seine, fish wheel, longline, or other means defined by the Board of Fisheries.

subsistence use	the noncommercial, customary and traditional uses of wild, renewable resources by a resident domiciled in a rural area of the state for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation, for the making and selling of handicraft articles out of nonedible by-products of fish and wildlife resources taken for personal or family consumption, and for the customary trade, barter, or sharing for personal or family consumption.
supplemental production	salmon produced by method other than natural spawning using enhancement and/or rehabilitation methods.
take	taking, pursuing, hunting, fishing, trapping, or in any manner disturbing, capturing, or killing or attempting to take, pursue, hunt, fish, trap, or in any manner capture or kill fish or game.
terminal fishery	area where a terminal fishery harvest could be conducted.
thermal band	several closely grouped and equidistantly spaced thermal rings that visually blend together at low magnification (<100K).
thermal cycle	occurrence of 1 ambient and 1 treated water event at a pre-identified temperature differential and combination of hours; 1 thermal cycle produces 1 thermal ring. A band or separation cycle is a modified thermal cycle designed to separate thermal bands by 2.5 times the distance between the rings.
thermal mark (TM)	discrete complex of rings on otolith resulting from temperature manipulations; generally identifies a specific release group.
thermal marking	process where a visibly enhanced increment or ring is induced in the microstructure of the otolith through controlled and repeated temperature fluctuations of the incubation water; these fluctuations result in an ordered complex of rings.
thermal ring	a single dark ring on the otolith resulting from temperature decline within 1 cycle. Microscopic viewing at high magnification (>100K) is required to resolve ring structure. A hatchmark is a dark ring or a tight complex of rings that are naturally induced in the otolith during hatching. Its visual structure is often similar to a thermal ring; therefore, marking the prehatch embryo is preferred.
thermocline	layer of water in a lake separating an upper warmer lighter oxygen-rich zone for a lower colder heavier oxygen-poor zone.
total run (run strength)	number of salmon returning in a year for a stock or area (escapement plus harvest number).

trawl	a bag-shaped net towed through the water to capture fish or shellfish: (a) a beam trawl is a trawl with a fixed net opening utilizing a wood or metal beam; (b) an otter trawl is a trawl with a net opening controlled by devices commonly called otter doors; and (c) a pelagic trawl is a trawl where the net, trawl doors, or other trawl-spreading devices do not operate in contact with the seabed, and which does not have attached to it any protective device, such a chafing gear, rollers, or bobbins, that would make it suitable for fishing in contact with the seabed.
troll	this gear group consists of a line or lines with lures or baited hooks that are drawn through the water from a vessel either by hand trolling, strip fishing, or other types of trolling and retrieved by hand power or hand-powered crank (i.e., hand troll) or drawn and retrieved by electrical, hydraulic, mechanical or other assisting devices or attachments (i.e., power troll).
uniform procedures	those practices that have been accepted by planning participants as appropriate for conducting or accomplishing a task.
user group	identification by method and/or reason for the harvest of salmon (commercial, sport, or subsistence).
vessel	a floating craft powered, towed, rowed, or otherwise propelled, which is used for delivering, landing, or taking fish within the jurisdiction of the state, but does not include aircraft.
weir	fence, dam, or other device by which the stream migrations of salmon (or other fish) may be stopped or funneled through for enumeration or holding purposes.
wild stock	any stock of salmon that spawns naturally in a natural environment and is not subjected to human-made practices pertaining to egg deposition, incubation, or rearing. Stocks that are not being enhanced.
zooplankton	free-swimming, drifting, or floating organisms, mostly microscopic in size, which are found primarily in open water and are an important source of food for small fish.

APPENDIX B: Steps in the formation of a Regional Aquaculture Association

Table B-1. Steps in the formation of a regional aquaculture association.

Typical steps in the formation of a regional aquaculture association
1. Incorporators inform fisheries user groups of proposed development of RAA through advertised meetings; letters and word of mouth
2. First meeting held by incorporators to publicly discuss RAA formation and implications
3. Second meeting held to develop draft Articles of Incorporation, By-laws; and regional boundaries
4. Incorporators solicit nominations for Board of Directors of RAA
5. Board of Directors organizes and conducts first meeting and adopts Articles of Incorporation, and By-laws
6. Board of Directors files Articles of Incorporation with State of Alaska Division of Corporations
7. Board of Directors submits By-laws, letters of support, other required information, and cover letter to the Commissioner of ADF&G
8. Commissioner of ADF&G authorizes the RAA and designates the region.

Source: Adapted from Joint Northern/Southern Southeast Regional Planning Team. 2004. Comprehensive salmon enhancement plan for Southeast Alaska: Phase III. Unpublished document obtained from Sam Rabung, ADF&G PNP Hatchery Program Coordinator, Juneau.

APPENDIX C: Considerations for Fishery Enhancement Planning

GENERAL PROJECT REVIEW CRITERIA

FISHERY CONCERNS

1. Is supplemental salmon production needed and desirable?

    a. What is the socioeconomic impact on local residents and fishermen?
    b. Do the public and user groups want a restoration or enhancement project in that location?
    c. Will the project fulfill a substantial portion of the region's 15-year target goals?

SITE LOCATIONS

1. Can the restoration or enhancement project be implemented?

    a. Is the land available for use, and will the landowners consent to the project?
    b. What is the likelihood of the permit applications being approved or disapproved.
    c. Is the site area suitable and of sufficient size for the proposed project?
    d. Will the site require special biological and/or engineering studies and surveys (i.e., land, soil, water, and organisms)?
    e. Will the project be compatible with existing and future development in the area (i.e., potential habitat conflicts)?

2. Can the proposed project be operated and maintained?

    a. How accessible and logistically difficult will the project be to operate/maintain (i.e., access by road, air, or sea and distance from supply point)?
    b. Winter access and supply problems (i.e., bay ice conditions)?

3. Is the water supply adequate and suitable?

    a. Adequate flow year around for intended operations?
    b. Are water quality and seasonal temperature regimes within acceptable parameters?
    c. Are exclusive water rights available, and can water quality be maintained.
    d. Will future land/habitat uses conflict with quality or quantity of the water supply?

4. Can brood fish be obtained and held?

    a. Are local brood fish stocks available and in sufficient number at the right time?
    b. Is brood fish disease history known and are disease problems anticipated?
    c. Can brood fish be protected from the fishery and held in estuary or other holding area for ripening?

5. Can fry production be reared?

    a. Is the estuary suitable for saltwater rearing pens (i.e., protected from seas, sufficient depth, salinities, temperature, fouling organisms, etc.)?
    b. Can rearing be accomplished with land-based facilities (water and facility requirements)?

6. What is the capacity of the estuary and bay for additional salmon rearing?

a. Are food organisms abundant and available at time of release?
b. Will abundance of predatory and competitor species severely limit survival of hatchery fish?
c. Are estuarine and bay conditions suitable for good fry survival?

7. Can adult returns from projects be readily evaluated?

a. Will returning fish be mixed with other stocks?
b. What type and quantity of evaluation effort will be required to assess project success?

FEASIBILITY CONCERNS

1. Are cost/benefit ratios and Net Present Value (NPV) acceptable and justifiable?
2. Are there specific or special economic impacts, benefits, and costs involved?
3. If implemented, will the restoration or enhancement project distract from other worthwhile or perhaps more feasible projects and facilities for the region?

FRESHWATER PROJECT REVIEW CRITERIA

FISHERY STATUS

1. Is it a depressed fishery?
2. Has the fish population been decimated or eliminated?

FRESHWATER HABITAT ASSESSMENT

1. Lakes should be 5 acres in size or larger, at least 8 feet deep.
2. Predator/competitor concerns must be identified.
3. Available spawning area should be identified/estimated.
4. Water quality characteristics.
    - D.O., Temp., Alkalinity, Conductivity
    - Morphodaphic Index—richer lakes are stocked prior to poorer lakes.

ACCESS

1. Will it create new fisheries (has to have the potential)?
2. Accessible to the fishing public ?

EFFECT ON MANAGEMENT

1. New projects should not complicateexisting fisheries management plans.

LAKE STOCKING GUIDELINES

1. ADF&G guidelines should be adhered to with any new projects.

MARINE/SALTWATER FISHERIES PROJECT REVIEW CRITERIA

Regarding supplemental production from an enhancement project (e.g., hatchery):

1. What are the potential effects on management plans with the implementation of the enhancement project?
2. What effects will the proposed production, by species, have on present management schemes?
3. What effects will the enhanced stocks (and their harvest) have on natural stocks in the area?
4. Can returns be harvested to provide "significant" common property benefits in traditional fisheries?
5. Is there an adequate terminal area where new fisheries could be created to affect the desired common property benefit?
6. Does the project as proposed allow for the continued protection of natural stocks?
    a. Can management or harvest strategies be developed to allow harvest or enhanced returns while protecting natural stocks?
    b. Is there a segregated area for harvest that will provide adequate cost recovery without significantly impacting wild stocks?
    c. Does the affected wild stock actually or potentially support a commercial, sport, and/or subsistence fishery?
    d. Does the affected stock have unique characteristics or are there special circumstances (e.g., a unique early run of coho)?
    e. What is the degree of risk and the probable degree of loss to the natural stocks?
7. Does the enhancement proposal make the most appropriate use of the site's potential?
8. Does the proposed project pose any disruption to existing fisheries?
9. Genetics consideration that donor broodstock be taken from an appropriate stock as close to the area as possible, and that adequate numbers and run composition are included in donor broodstock.
10. Pathology consideration that donor broodstock have an acceptable disease history for the proposed project.

ELEMENTS OF BENEFIT /COST ANALYSIS

Steps for undertaking projects identified in this plan will incorporate variables such as the facilities and equipment, cost of operations, and the financing.

FEASIBILITY OF A PROJECT

In determining the feasibility of a project, the team may consider the following questions:

1. Are benefit/cost ratios and Net Present Value acceptable?
2. What special economic impacts, benefits, and costs are involved?
3. If a hatchery or other facility is constructed, will it detract from other more worthwhile projects in the region?
4. Will the cost for an annual hatchery or other facility operation and maintenance decrease funding available for other projects in the region?

COST OF A PROJECT

The cost of a project can generally be segregated into 3 major categories, depending upon the nature and the scope of the task. These are as follows:

1. Facility and Equipment

   a. Site section, including studies of alternative areas.
   b. Site acquisition.
   c. Construction costs, including planning fees.
   d. Equipment acquisition.

2. Operations

   a. Cost of labor, utilities, fish feed, personnel, and maintenance costs.
   b. Administrative.
   c. Project evaluation costs.

3. Financing

   a. Available funding sources.
   b. Source of continuing revenue for long term operations

Economic benefits to most groups directly affected by specific projects are easier to identify. However, the economics benefits of an enhanced fishery to subsistence, sport and personal use fishermen are very subjective and therefore difficult to assign a dollar value. The dollar impact to this group may not vary significantly from project to project and, when compared to the total economic benefit/cost ratio, may not have a significant effect on the overall analysis.

ECONOMIC BENEFITS TO COMMERCIAL FISHERMEN AND PROCESSORS

The economic benefits to these 2 groups can be expressed in dollar terms throughout the analysis of 2 major components; the anticipated increase product available for catch and the dollar value of the catch increase. Regardless of the nature of the project, however, the amount of product available depends on the annual adult salmon rate of return and the annual catch rate, expressed in terms of pounds of product.

VARIABLES TO CONSIDER IN DETERMINING THE PRODUCT VALUE

The value of the caught product includes a scrutiny of the following variables:

1. Type of product

2. Anticipated market price, including the effect of world supply and demand on the market price

3. Cost of catching and processing the product

In order to prepare a benefit/cost analysis for hatchery stock development, a spreadsheet which provides in detail the variables required to determine the quantity of catchable product, value of the catch, impact multipliers, and cost information relating the development of fish hatcheries should be developed. For more information, contact the ADF&G PNP Hatchery Program Coordinator.

STOCK APPRAISAL TOOL

Adapted from the Comprehensive Salmon Enhancement Plan for Southeast Alaska: Phase III [1]

The ADF&G genetic policy states that

> Stocks cannot be introduced to sites where the introduced stock may have significant interaction or impact on significant or unique wild stocks. (Davis et al. 1985, Sec. II.A)

The Stock Appraisal Tool identifies the criteria to be used by the regional planning teams and ADF&G biologists when evaluating the significance of a wild stock that may potentially interact with a hatchery release. The Stock Appraisal Tool attempts to inject as much objectivity as possible into determining the significance of a potentially impacted stock. In this context *significance* is defined as the importance of a stock in maintaining the overall viability and sustainability of the wild salmon resource as well as the importance of the stock in meeting fishery needs. *Significance* is more complex than simple production numbers. Some of our 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. Stock significance should be considered in developing appropriate straying studies or other assessments of the potential impact of a project on naturally occurring stocks.

The Stock Appraisal Tool is modeled after one developed by Hatchery Scientific Review Group, for use in the Pacific Northwest (HSRG Recommendations 2002). Their version looks at 4 stock characteristics: wildness, uniqueness, isolation, and viability. Our version splits viability into *population size* and *population trend*, and adds a criterion that addresses the human use pattern. In the Pacific Northwest version, a numerical rating scale is used, which is possible because of the availability of a much greater amount of data on a smaller number of stocks compared with those in Alaska. In the Alaska model each of the 6 characteristics has a nonnumerical gradient ranging from the quality that would indicate less significance (left side of the scale) to the quality that would indicate more significance (right side of the scale). The combined assessments of the 6 characteristics provide a qualitative estimate of significance. Admittedly this is not a perfect method. However, it does provide a consistent framework upon which to make professional judgments about the significance of wild stocks in the neighborhood of a proposed project. When this assessment is documented, it provides a record of part of the project development process. A determination of *stock significance* must be based on existing knowledge. This would include any data from ADF&G, federal agencies, other agencies, and local knowledge.

[1] Joint Northern/Southern Southeast Regional Planning Team. 2004. Comprehensive salmon enhancement plan for Southeast Alaska: Phase III. Unpublished document obtained from Sam Rabung, ADF&G PNP Hatchery Program Coordinator, Juneau.

I. Wildness

Introduced .... Native

The *wildness* spectrum includes the degree of impact from previous stocking, as well as the likelihood of impacts from existing enhancement projects. It is important to remember that all species of salmon have a relatively low baseline propensity to pioneer, and that the same level of influx from an enhancement project should not compromise wildness, if an appropriate stock was used for the enhancement project and the wild stock escapement is large enough to absorb a low number of strays.

II. Uniqueness

Typical of other stocks in the area .... Has unique characteristics

Based on the best existing knowledge, is there anything unique about the life history or other biological characteristics of the stock, and to what extent are these characteristics irreplaceable? A stock that shares some characteristics with local stocks that are not shared with other, more distant stocks would occupy an intermediate point on the *uniqueness* scale.

III. Isolation

One of several stocks in the area .... Solitary

To what extent could a stock be considered part of a metapopulation? In other words, is it part of a *big gene bank* that through normal processes could mitigate for low levels of gene influx from an enhancement project?

IV. Population Size

Small spawning aggregate ……. ……. …….. …….. …….. ……..Very large stock

Large stocks serve as large reservoirs of genetic diversity and are important for the sustainability of the total resource. Small stocks are more susceptible than large ones to adverse environmental conditions (e.g., unfavorable marine conditions) that could result in reduced population viability. Large populations are buffered from such effects, and, as conditions improve, could become sources for recovery by providing a source of strays. Large populations may be critically important for maintaining species over wide geographic ranges by acting as the source populations for eventual recolonization when site-specific extinctions occur due to earthquakes, landslides, glaciers, etc. (Alex Wertheimer, NMFS Auke Bay Laboratory, personal communication).

Some of the region's largest stocks are also very important in maintaining existing fisheries. Fisheries monitoring data should be used to determine the importance of a stock in maintaining fisheries.

V. Population Trend

Escapement stable or increasing .... …….Escapement declining

The escapement trend of a population can be a measure of the stock's potential to thrive as a gene pool, and the potential to withstand an exogenous impact. A method for determining the escapement trend of a spawning population is outlined below (Baker et al. 1996).

Data requirements

- To calculate *long-term mean escapement*: A 10-year span of observations using the same survey method is needed. Observations must be made during at least half of the years between the first and the most recent observations.
- To calculate *short-term mean escapement*: Within the last 5-year period, at least 3 years of observations are needed.

Trend definitions

- *Increasing*: The short-term mean escapement is more than 50% greater than long-term mean escapement.
- *Stable*: Short-term mean escapement is $\pm$ 50% of the long-term mean escapement.
- *Declining*: Short-term mean escapement is less than 50% but greater than 20% of long-term mean escapement.
- *Precipitously declining*: Short-term mean escapement is less than 20% of long-term mean escapement.
- *Unknown*: Data requirement is not met.

Having sufficient data to answer all the questions regarding a spawning aggregate may prove to be the exception, rather than the rule. Addressing the genetic significance of small spawning populations remains a topic for future research.

VI. Fishery Support

Contributes to multistock harvest …. …… ……. ……supports targeted fishery

The first 5 criteria address biological or population characteristics that may call for increased awareness of potential enhanced/wild interaction. The final criterion takes into consideration the human-use pattern of a stock. A stock may be important for cultural or economic reasons, thereby increasing its overall rating of significance. For example, in this category a small sockeye stock near a village in Southeast Alaska may be situated on the right side of the scale, whereas a similar sized population in Bristol Bay may be situated on the left side of the scale. Another example might be a large transboundary river stock such as sockeye salmon from the Stikine River, where directed use by different parties (i.e., U.S./Canada) results in the significance of the stock in terms of management moving to the right side of the scale.

APPENDIX D: Roadmap for Hatchery Permitting and Process

Aquaculture Association Pre-Project Planning

1. Determine location of hatchery facility.
2. Test water quality and flow rates (1 year worth of data necessary in some cases).
1. Seek to secure water rights. (Must have at least temporary use authority to submit hatchery permit.)
3. Determine species to be reared and probable broodstock source.
4. Determine release site if not hatchery location and water quality data for site.
5. Request Management Feasibility Analysis (MFA) from ADF&G. An MFA request includes the location of the facility; the species desired for hatchery production; the run timing, by species; and incubation and rearing levels desired (by species) at start-up and at full capacity. ADF&G has 90 days to complete the MFA, which will include estimate of potential contributions to the common property fishery, potential size and location of a special harvest area, special management considerations or the need for additional studies, potential broodstock sources, assessment of production potentials for each species, and additional factors considered relevant to the proposed hatchery operation.
6. Determine financial feasibility of program (short and long-term funding sources).
7. Provide detailed statement of operational goals, objectives, and plans for hatchery permit application.
8. PNP Aquaculture Association formally adopts planned program.

Note: Some of the above items can be worked on simultaneously. PNP coordinator and/or area management biologist may provide assistance in preparing an application or conducting related activities.

PNP Application Process

9. Submit PNP application (must include the completed MFA).
10. PNP Coordinator formally accepts application as complete; a 135-day minimum time period further broken down into 2 phases for processing application begins.
11. Hatchery Permit Application Review – Schedule A (60 days)[1]
    Division of Commercial Fisheries technical staff (i.e., geneticist, pathologist, fish culturist) reviews application and either submits comments to the PNP coordinator or requests additional information.
    a. Department management and regional staff review the application and either submit comments to PNP coordinator or request additional information.

[1] If additional information is requested from the applicant by the PNP coordinator at any time during the review and approval process set out in 5 AAC 40.190, Schedule A, the remainder of the 60-day time period will be suspended until the requested information is received by the PNP coordinator and determined to be sufficient.

b. RPT reviews the application for compatibility with regional Comprehensive Salmon Plan and sends a recommendation to the commissioner (goals, significant and unique stock designation).
c. Basic management plan (BMP) is drafted by department area staff, the applicant, and the PNP coordinator working together.

12. Issuance of Private Nonprofit Hatchery Permit – Schedule B (75 days)
Public participation, finalization, and decision.
    a. Public hearing is scheduled and 30-day notice is published; completed application (includes the MFA) and draft BMP are provided.
    b. Public hearing is held; process concludes 15 days after oral hearing is held. ADF&G is to respond to specific objections (oral or written) within 10 working days after receipt.
    c. BMP is finalized by applicant and PNP coordinator.

If additional information is requested from the applicant by the PNP coordinator at any time during the review and approval process set out in 5 AAC 40.190, Schedule A, the remainder of the 60-day time period will be suspended until the requested information is received by the PNP coordinator and determined to be sufficient.

Review and Determination

13. The commissioner will review the application before rendering a decision (75 days). [2]
14. Application package submitted to the commissioner for review will include the recommendations from the regional planning team, recommendations resulting from ADF&G's review, and the results of the public hearing regarding the proposed facility.
15. PNP Permit is either issued or denied by the commissioner.

Other Considerations and/or Permits

Permits/agencies in this section are dependent upon the needs of the individual site and will vary. Not all permits/agencies may be listed. Items in this section can be worked on parallel to or in conjunction with the hatchery permit application.

Financing secured (Dept. of Commerce or other)
Dept. of Natural Resources (Water reservations/in-stream flow, Tideland Leases)
Dept. of Environmental Conservation (Domestic and hatchery discharge permits)
Dept. of Fish and Game (Habitat permits)
Army Corp of Engineers
U.S. Forest Service
U.S. Park Service
U.S. Bureau of Land Management
Commercial Fisheries Entry Commission Special Harvest Area Entry Permit

[2] See Review and Determination regulations, 5 AAC 40.220, for commissioner's considerations.

APPENDIX E: PNP Hatchery Permit Application

APPLICATION

PRIVATE NONPROFIT SALMON HATCHERY PERMIT

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

COMMERCIAL FISHERIES DIVISION

P.O. Box 115526

JUNEAU, ALASKA 99811-5526

GENERAL INSTRUCTIONS

1. Fill in the blanks on the form provided.
2. Where necessary to fully answer a particular question, attach additional pages marked with the corresponding appendix number in the application.
3. Applications Must Be Typed.
4. Applications must be signed by the legally authorized representative of the corporate applicant.
5. The application should be sent to the following address:

   STATE OF ALASKA

   DEPARTMENT OF FISH AND GAME

   COMMERCIAL FISHERIES DIVISION

   P.O. Box 115526

   JUNEAU, ALASKA 99811-5526

   ATTENTION: PNP HATCHERY PROGRAM COORDINATOR
6. Requests for assistance in preparation of the application or related activities should be directed to the PNP Hatchery Program Coordinator. Such requests will be honored to the extent available staff time and funds permit.
7. This application must be accompanied by a management feasibility analysis (MFA) prepared by the department in accordance with 5 AAC 40.130.
8. The application must be accompanied by a $100 nonrefundable application fee, in accordance with AS 16.10.400.

(Rev. 10/2011)

APPLICATION

PRIVATE NONPROFIT SALMON HATCHERY PERMIT

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

I. IDENTIFICATION OF APPLICANT

A. Private Nonprofit Corporation

Name_____

Address_____

_____

Phone_____

(Please attach a copy of Articles of Incorporation for the above nonprofit corporation organized in accordance with Alaska Statute 10.20)

B. Individual Completing This Form

Name_____

Address_____

_____

Phone_____

C. Relation to Above Nonprofit Corporation

_____

_____

II. STATEMENT OF APPLICANT'S GOALS AND OBJECTIVES

Explain why you have decided to apply for a hatchery permit and what you generally expect to accomplish by the operation of the proposed hatchery.

III. PRODUCTION GOALS AND HATCHERY SITE INFORMATION

A. Egg Capacities by species

	Millions of eggs required for hatchery at start-up at capacity

B. Location Description

1. Site (stream and/or lake name, ADF&G stream number, and exact geographical coordinates)

2. Site Physical Description (attach topographic map and photographs of proposed site).

a. Topography

b. Geology

c. Soils

C. Current Land Use and Ownership Status

1. Have the land or usage rights been acquired?

2. What is (will be) the legal form of any usage rights?

3. List the additional state and federal permits needed by the applicant to build and operate the proposed hatchery. Examples may include: U.S. Army Corps of Engineers Permit; Department of Natural Resources Water Use, Land Use, and Tidelands Lease Permits; and U.S. Forest Service Land Use Permit.

Use Permits (land and water)

D. Water Supply

The water quantity, minimum and Maxim temperatures, and the amounts of silt loading will be critical factors in the evaluation of water supply adequacy. Care should be exercised in the evaluation of these questions.

1. Source (e.g., lake, stream, well, spring). Have the water usage rights been acquired?

2. Water source characteristic (e.g., substrate, size of drainage area, gradient, ground water characteristics).

3. Water quality characteristics (in every case, cite the qualifications of the individual making the assessment and the method(s) used).

a. Recommended parameters to measure for evaluating potential hatchery water supply. Either fill out the table below or attach a copy of the water quality analysis conducted.

Water Qualities	Standards	Levels for the hatchery water source
Alkalinity	at least 20 mg/L as $caCO_3$	
Ammonia (unionized)	<0.0125 mg/L	
Arsenic	<0.05 mg/L	
Barium	<5.0 mg/L)	
Cadmium	<0.0005 mg/L (< 100 mg/L alkalinity <0.005 mg/L (≥ 100 mg/L alkalinity)	
Carbon dioxide	<1.0 mg/L	
Chloride	<4.0 mg/L	
Copper	<0.006 mg/L (< 100 mg/L alkalinity) <0.03 mg/L (≥ 100 mg/L alkalinity)	
Dissolved oxygen	>8.0 mg/L	
Hydrogen sulfide	<0.003 mg/L	
Iron	<0.1 mg/L	
Lead	<0.02 mg/L	
Magnesium	<15 mg/L	
Mercury	<0.0002 mg/L	
Nickel	<0.01 mg/L	
Nitrate (NO_3)	<1.0 mg/L	
Nitrate (NO_2)	<0.1 mg/L	
Nitrogen (N_2)	<110% total gas pressure (<103% nitrogen gas)	
Petroleum (oil)	<0.001 mg/L	
pH	6.5 - 8.0	
Potassium	<5.0 mg/L	
Salinity	<5.0 ppt	
Selenium	<0.01 mg/L	
Silver	<0.003 mg/L (fresh water) <0.003 mg/L (salt water)	
Sodium	<75.0) mg/L	
Sulfate SO_4^{-2}	<50.0 mg/L	
Total dissolved solids	<400.0 mg/L	
Total settleabel solids	<80.0 mg/L (25 JTU)	
Zinc	<0.005 mg/L	

Note: Synergistic and antagonistic chemical reactions must be considered when evaluating a water source against these criteria.

b. Attach a temperature profile (minimum of one year of data) of the hatchery water source. Also, provide vertical profiles if a lake water source is proposed.

See attached Appendix _____.

c. List monthly levels of dissolved oxygen in the hatchery water source. If a lake source, provide seasonal oxygen profiles.

See attached Appendix_____.

d. If a lake source, provide information on surface area, depth, and water storage capacity.

See attached Appendix_____.

e. Describe the silt load (include consideration of possible seasonal high water).

4. Water Flow Data

This information should be based on the equivalent of long-term USGS stream gauge data (10 years or more data) or the U.S. Forest Service Water Resources Atlas synthetic hydrograph model.

a. Attach a seasonal profile, including yearly minimum and maximum flows.

See attached Appendix_____.

b. List a historical range of water flow conditions, if available.

See attached Appendix_____.

5. Water Distribution System

Describe the water distribution system in at least the following dimensions:

a. Type, size, elevation and locations of water intake, screening, and water use/reuse system.

b. Size, length, and type of pipe, insulation, and distribution system. Include elevations of water surfaces at each point in the system from intake through incubation and rearing to fishladder or other discharge.

See attached Appendix_____.

c. If a hydroelectric generation system will be used, will effluent from this system be used in the hatchery? If so, describe plans to address possible problems with gas supersaturation.

d. Describe provisions for an emergency water system in the event of primary wate system failure.

6. Water Treatment System

Describe any water treatment facilities that you will employ to meet minimal water quality standards (influent or effluent).

7. Annual Water Budget

Attach a graph showing seasonal variation in flow required for eyeing, incubation, freshwater rearing, freshwater lens in saltwater pens, adult holding, and fishladder operations.

See attached Appendix_____.

IV. HATCHERY DESIGN AND CONSTRUCTION INFORMATION

A. Biocriteria for Design and Construction

Describe the critical operational assumptions and objectives which determine the design size and capacity of the proposed hatchery. Specific reference should be made to the following (for reference, a table of CFMD assumptions for salmon survival is provided, Table 1):

BROOD STOCK - SPECIES_____

1. Eggs per female spawner_____
2. Brood stock requirements at 1:1 sex ratio_____
3. Green egg requirements_____
4. Estimated holding mortality_____, _____%

HATCHERY FACILITY

5. Eyed eggs (_____% loss from green egg stage)_____
6. Eyed egg density per incubation unit_____
7. Total number of incubation units_____
8. Number of cabinets per unit_____
9. Water requirements at ____L/min/unit=_____L/min
10 Water requirements with_____% loss=_____L/min

FRESHWATER REARING UNITS

11 Number of emerging fry (_____% loss from eyed stage)_____
12 Initial fry weight at_____/kg=_____kg
13 Final Fry weight at _____/kg=_____kg
14 Initial freshwater fry rearing space required at _____kg/m^3 _____m^3
15 Final freshwater fry rearing space required at_____kg/m^3 _____ m^3
16 Maximum number of rearing units (_____m by_____m by_____m= _____
17 Maximum water requirements at _____kg/L/min and 10% loss_____L/min
18 Number of exchanges per hour (R-value) per raceway_____

MARINE REARING UNITS

19. Number of fry/fingerling/or smolts_____
20. Initial weight at _____/kg =_____kg
21. Final weight at _____/kg =_____kg
22. Initial rearing space required at _____kg/m^3 =_____ m^3
23. Final rearing space required at _____kg/m^3 _____ m^3
24. Maximum number of rearing units (_____m by_____m by_____m=_____ m^3)

PROJECTED RETURN

25. Number of returning fish at _____% ocean survival =_____

A. Biocriteria for Design and Construction (continued)

BROOD STOCK - SPECIES_____

1. Eggs per female spawner_____
2. Brood stock requirements at 1:1 sex ratio_____
3. Green egg requirements_____
4. Estimated holding mortality_____, _____%

HATCHERY FACILITY

5. Eyed eggs (_____% loss from green egg stage)_____
6. Eyed egg density per incubation unit_____
7. Total number of incubation units_____
8. Number of cabinets per unit_____
9. Water requirements at ____L/min/unit=_____L/min
10 Water requirements with_____% loss=_____L/min

FRESHWATER REARING UNITS

11 Number of emerging fry (_____% loss from eyed stage)_____
12 Initial fry weight at_____/kg=_____kg
13 Final Fry weight at _____/kg=_____kg
14 Initial freshwater fry rearing space required at _____kg/m^3 _____ m^3
15 Final freshwater fry rearing space required at_____kg/m^3 _____ m^3
16 Maximum number of rearing units (_____m by_____m by_____m= _____
17 Maximum water requirements at _____kg/L/min and 10% loss_____L/min
18 Number of exchanges per hour (R-value) per raceway_____

MARINE REARING UNITS

19. Number of fry/fingerling/or smolts_____
20. Initial weight at _____/kg=_____kg
21. Final weight at _____/kg=_____kg
22. Initial rearing space required at _____kg/m^3 =_____ m^3
23. Final rearing space required at _____kg/m^3 _____ m^3
24. Maximum number of rearing units (_____m by_____m by_____m=_____ m^3)

PROJECTED RETURN

25. Number of returning fish at _____% ocean survival =_____

A. Biocriteria for Design and Construction (continued)

BROOD STOCK - SPECIES_____

1. Eggs per female spawner_____
2. Brood stock requirements at 1:1 sex ratio_____
3. Green egg requirements_____
4. Estimated holding mortality_____, _____%

HATCHERY FACILITY

5. Eyed eggs (_____% loss from green egg stage)_____
6. Eyed egg density per incubation unit_____
7. Total number of incubation units_____
8. Number of cabinets per unit_____
9. Water requirements at ____L/min/unit=_____L/min
10 Water requirements wiith_____% loss=_____L/min

FRESHWATER REARING UNITS

11 Number of emerging fry (_____% loss from eyed stage)_____
12 Initial fry weight at_____/kg=_____kg
13 Final Fry weight at _____/kg=_____kg
14 Initial freshwater fry rearing space required at _____kg/m^3 _____ m^3
15 Final freshwater fry rearing space required at_____kg/m^3 _____ m^3
16 Maximum number of rearing units (_____m by_____m by_____m= _____
17 Maximum water requirements at _____kg/L/min and 10% loss_____L/min
18 Number of exchanges per hour (R-value) per raceway_____

MARINE REARING UNITS

19. Number of fry/fingerling/or smolts_____
20. Initial weight at _____/kg=_____kg
21. Final weight at _____/kg=_____kg
22. Initial rearing space required at _____kg/m^3 =_____ m^3
23. Final rearing space required at _____kg/m^3 _____ m^3
24. Maximum number of rearing units (_____m by_____m by_____m=_____ m^3)

PROJECTED RETURN

25. Number of returning fish at _____% ocean survival =_____

Table 1. Salmon survival goals at various life stages and fecundities[1] to use in budget documents and hatchery planning.

	Hatchery				Lake	Marine
Species	Green to eyed egg	Eyed Egg to emergent fry	Emergent fry to fingerling	Fingerling to smolt	Fry/fingerling to smolt	Survival to adult
Chum	.90 (.90)[2]	.95 (.855)[3]				.007 (.006)
	.90 (.90)	.95 (.855)	.90 (.770)[4]			.02 (.015)
Pink	.90 (.90)	.95 (.855)[3]				.007 (.006)
	.90 (.90)	.95 (.855)	.90 (.770)[4]			.02 (.015)
Coho	.90 (.90)	.95 (.855)[5]			.10 (.086)	.10 (.009)
	.90 (.90)	.95 (.855)	.90 (.770)[6]		.20 (.154)	.10 (.015)
	.90 (.90)	.95 (.855)	.90 (.770)	.80 (.616)[7]		.10 (.062)
Chinook	.90 (.90)	.95 (.855)[5]			.10 (.086)	.03 (.003)
	.90 (.90)	.95 (.855)	.90 (.770)[6]		.20 (.154)	.03 (.005)
	.90 (.90)	.95 (.855)	.90 (.770)	.80 (.616)[7]		.03 (.018)
Sockeye	.90 (.90)	.95 (.855)[5]			.10 (.086)	.10 (.009)
	.90 (.90)	.95 (.855)	.90 (.770)[6]		.20 (.154)	.10 (.015)
	.90 (.90)	.95 (.855)	.90 (.770)	.80 (.616)[7]		.10 (.062)

[1] Fecundities by species (eggs per female spawner): Chum - 2,200; Pink - 1,600; Coho - 2,800; Chinook - 6,500; Sockeye - 3,000
[2] Cumulative survivals in parenthesis.
[3] Fry to ocean.
[4] Fingerling to ocean.
[5] Fry to lake/stream.
[6] Fingerling to lake/stream.
[7] Smolt to ocean.

B. General Description

Attach a written description of the proposed facility. This description should represent a solid concept of the proposed hatchery design. Also include preliminary sketches and drawings of at least the following in an appendix.

1. Incubation and rearing site plan.
2. Hatchery floor plan.
3. Water supply system.
4. Incubation/operation building.
5. Facility layout.

The site plan should include a plan view of all facilities at a scale of 1:100 or larger, a USGS 1:63360 scale topographical map showing the entire watershed and all facility locations, and a NOAA marine chart of the largest scale available showing all tidewater-based facilities and local data.

See Attached Appendix _____.

C. Proposed Construction Timetable

Prepare a timetable for the construction period which indicates the critical milestones for the project.

See attached Appendix _____.

V. BROOD STOCK

A. Initial Donor Stock

1. Identification of source.
   Indicate stream name, ADF&G number or geographic coordinates, and salmon species for each proposed donor stock.

   a. Species _____

      Stream name _____

      ADF&G number or geographic coordinates _____

   b. Species _____

      Stream name _____

      ADF&G number or geographic coordinates _____

   c. Species_____

      Stream name_____

      ADF&G number or geographic coordinates_____

   d. Species_____

      Stream name_____

      ADF&G number or geographic coordinates_____

If more sources are being requested, attach an additional list.

2. Capture techniques and holding facilities at the donor stream.

   a. Capture techniques
      Describe in detail the capture techniques you will use to harvest adults and take eggs. Please provide a map identifying the exact location of the holding facilities.

_____

_____

_____

_____

_____

   b. Holding facilities
      Describe the holding facilities to be used for donor stock spawners (include schematics).List the loading rate [kg fish/ (L/min)] and density (kg fish/mg^3).

_____

_____

_____

3. Transportation
   Discuss method planned for transporting live fish and/or eggs

_____

_____

_____

4. Spawning and fertilization
   Discuss the spawning, fertilization, and disinfection procedures and the procedure for estimating percent fertilization.

_____

_____

_____

B. Brood Stock Returning to Hatchery

1. Capture techniques and holding facilities at the hatchery.

   a. Capture Techniques
      Describe in detail the techniques you will use to capture and ripen adults and take eggs.

_____

_____

_____

   b. Holding facilities
      Describe the holding facilities to be used for hatchery brood stock spawners (include schematics) and give the loading rate [kg fish/ (L/min)] and density (kg fish/mg^3).

_____

_____

_____

2. Transportation
   Discuss method planned for transporting live fish and/or eggs (if different from those described in Part A).

_____

_____

_____

3. Spawning and fertilization

Discuss the spawning and fertilization procedures (if different from those described in Part A).

_____

_____

_____

VI. INCUBATION AND REARING PLAN

A. Incubators and Rearing Units

Describe the type of incubators and rearing facilities to be used.

_____

_____

_____

B. Egg Handling

Describe the method by which you plan to handle the eggs from the spawning process through planting them in incubators.

_____

_____

_____

C. Chemical Treatment

What chemicals and concentrations will be used for controlling fungus on eggs until the eyed stage?

_____

_____

_____

D. Enumerations

Describe the method(s) to be used in estimating numbers of green eggs, eyed eggs, and fry.

_____

_____

_____

E. Rearing Plans

Describe any plans to rear the salmon including type of food.

_____

_____

_____

F. Disease Control

Describe plans for preventing or controlling disease during rearing.

_____

_____

_____

VII. RELEASE PLAN

A. Release Site(s)

1. Give exact location and description of proposed release site(s), including maps.

_____

_____

_____

_____

_____

_____

2. List proposed number and age of each species to be released at each site.

_____

_____

_____

_____

B. Transportation

Discuss the methods planned for transporting live fish from the hatchery to the release site(s).

_____

_____

_____

VIII. STAFFING

A. Technical Advisors

Attach information about each technical advisor to the nonprofit corporation, indicating that person's name, address, role and responsibilities, and a brief statement of technical qualifications.

B. Design and Construction

Attach a list of the names and qualifications of persons or corporations responsible for final design and construction of proposed facilities.

See attached Appendix_____.

C. Administrative Personnel

List the administrative personnel who will support this facility when operational.

Personnel Assigned (Titles)	Percentage of Time
1._____	_____
2._____	_____
3._____	_____

D. Operating Personnel

List the operating personnel who will be assigned to this facility when operational.

Personnel Assigned (Titles)	Percentage of Time
1._____	_____
2._____	_____
3._____	_____
4._____	_____
5._____	_____
6._____	_____
7._____	_____
8_____	_____
9._____	_____
10._____	_____

IX. FINANCIAL PLAN

An estimate of hatchery construction and operating costs should be detailed here. These estimates would provide an indication of the cost recovery requirements of the proposed facility on an annual basis. Acceptance of this application by the Department of Fish and Game in no way implies agreement by the Department of Commerce and Economic Development to commit state loan funds for this project.

See attached Appendix _____.

X. BASIC MANAGEMENT PLAN

The preparation of a draft Basic Management Plan will be completed prior to the public hearing. The applicant will be expected to work closely with ADF&G staff in developing the Basic Management Plan (see 5 AAC 40.820).

XI. DECLARATION AND SIGNATURE

I declare that the information given in this application is, to my knowledge, true, correct, and complete.

_____ _____

Name of Applicant

_____ _____

Signature of Applicant Date Signed

APPENDIX F: Genetic Policy and Background

Alaska Department of Fish and Game
Genetic Policy

1985

Followed by a copy of the

Background of the Genetic Policy of the Alaska Department of Fish and Game

1989

Alaska Department of Fish and Game
Genetic Policy
by
Genetic Policy Review Team
Bob Davis – ADF&G, FRED, Chairman

Other Team Members:

Brian Allee – PWSAC, Cordova
Don Amend – SSRAA, Ketchikan
Bruce Bachen – NSRAA, Sitka
Bill Davidson – SJC, Sitka
Tony Gharrett – UAJ, Juneau
Scott Marshall – ADF&G, Comm. Fish
Alex Wertheimer – NMFS, Auke Bay Lab

Approved:

Don W. Collinsworth, Commissioner
Alaska Department of Fish and Game
6/11/85

INTRODUCTION

Alaska's valuable salmon industry relies on production from wild systems and, increasingly, on fish produced by aquaculture programs. The importance of maintaining healthy wild stocks and implementing successful enhancement activities underlies the need for an effective genetic policy. The genetic guidelines created to steer Alaska's aquaculture efforts were established in the mid-70's and have been reviewed to ensure that they reflect current knowledge, and goals. A revised genetic policy has been established that contains guidelines, supporting information and recommendations.

The genetic policy contains restrictions that will serve to protect the genetic integrity of important wild stocks. Certainly in Alaska where wild stocks are the mainstay of the commercial fishery economy, it is necessary to protect these stocks through careful consideration of the impacts of enhancement activities. Another important aspect of the genetic policy is the orientation towards increasing the productivity of enhancement programs in the state. Adherence to the guidelines will help maintain adequate genetic variability ensuring that the enhanced stock will be able to adapt to changing environmental conditions. The policy also includes considerations for selective breeding for desirable characteristics.

Due to the limited amount of information available on the genetic impacts of salmon enhancement on wild stocks, much of the basis for these guidelines is theoretical or based on work done with other species. Consequently, the most important considerations used in writing the guidelines are presented as a mechanism for illustrating the intent of the policy. An understanding of the rationale behind the policy is imperative to its effective application to individual cases under the very diverse conditions found in Alaska. The importance of the genetic guidelines will continue to increase as aquaculture activities expand their production. This policy represents a consensus of opinion and should continue to be periodically reviewed to ensure that the guidelines are consistent with current knowledge. By doing so, we will be able to meet the goal of greater fish production through enhancement while maintaining healthy wild stocks.

POLICY STATEMENT

I. Stock Transport

Interstate: Live salmonids, including gametes, will, not be imported from sources outside the state. Exceptions may be allowed for trans-boundary rivers.

Inter-regional: Stocks will not be transported between major geographic areas: Southeast, Kodiak Island, Prince William Sound, Cook Inlet, Bristol Bay, AYK and Interior.

Regional: Acceptability of transport within regions will be judged on the following criteria.

Phenotypic characteristics of the donor stock must be shown to be appropriate for the proposed fish culture regions and the goals set in the management plan.

No distance is set or specified for transport within a region. It is recognized that transplants occurring over greater distances may result in increased straying and reduce the likelihood of a successful transplant. Although the risk of failure affects the agency transporting the fish, transplants with high probability of failure will be denied. Proposals for long distance transport should be accompanied by adequate justification for non-local stock.

II. Protection of Wild Stocks

Gene flow from hatchery fish straying and intermingling with wild stocks may have significant detrimental effects on wild stocks. First priority will be given to protection of wild stocks from possible harmful interactions with introduced stocks. Stocks cannot be introduced to sites where the introduced stock may have significant interaction or impact on significant or 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.

Stock Rehabilitation and Enhancement

A watershed with a significant wild stock can only be stocked with progeny from the indigenous stocks.

Gametes may be removed, placed in a hatchery, and subsequently returned to the donor system at the appropriate life history state (eyed egg, fry or fingerling). However, no more than one generation of separation from the donor system to stocking of the progeny will be allowed.

Drainage's should be established as wild stock sanctuaries on a regional and species basis. These sanctuaries will be areas in which no enhancement activity is permitted except gamete removal for broodstock development. Use of such reservoirs for broodstock should be considered on a case-by-case basis, and sliding egg take removal schedules applied to such systems should be conservative.

Fish releases at sites where no interaction with, or impact on significant or unique wild stocks will occur, and which are not for the purposes of developing, rehabilitation of, or enhancement of a stock (e.g., releases for terminal harvest or in landlocked lakes) will not produce a detrimental genetic effect. Such releases need not be restricted by genetic concerns.

III. Maintenance of Genetic Variance

Genetic diversity among hatcheries

A single donor stock cannot be used to establish or contribute to more than three hatchery stocks.

Off-site releases for terminal harvest rather than development or enhancement of a stock need not be restricted by III.A.1, if such release sites are selected so that they do not impact significant wild stocks, wild stock sanctuaries, or other hatchery stocks.

Genetic diversity within hatcheries and from donor stocks

A minimum effective population (Ne) of 400 should be used for broodstock development and maintained in hatchery stocks. However, small population sizes may be unavoidable with Chinook and steelhead.

To ensure all segments of the run have the opportunity to spawn, sliding egg take scales for donor stock transplants will not allocate more than 90% of any segment of the run for broodstock.

GUIDELINES AND JUSTIFICATIONS

I. Stock Transport

A. Interstate: It is generally accepted that population of salmonids which have existed over many generations in a given watershed have evolved traits that make them adapted for survival in that environment. The greater the distance that a population is transferred from its native environment or the greater the difference in environmental conditions between the donor and stream, the less likely the genetic characteristics of the population will fit the new environment. If the fitness of the population is indeed reduced in the new environment, then the probability of the transport succeeding would be affected. In addition, interbreeding of a transferred stock with indigenous stocks could transfer gene traits that would reduce the fitness of the native populations. In many states, discrete stocks cannot be identified because excessive movement and interbreeding have already occurred. The State of Alaska, therefore, desires to protect and develop local stocks by restricting the movement of live fish or eggs into the state. There are, however, several trans-boundary rivers penetrating British Columbia, Canada, that flow into the state of Alaska. In some instances, donors from these stocks might fit a well-designed management plan.

B. Inter-regional: The environment can vary greatly from one region to another in a state as large as Alaska. For similar reasons given in I.A. above, the transfer of fish from one region to another is restricted. Consideration may be given to regional border areas, especially when no suitable donor stock is available within a region.

C. Regional: Although it is recognized that indigenous stocks are best for donor stock development, there have been numerous successful transplants, especially if the environment at the new site is similar to that of the donor stock and distance between the sites is not great. There is insufficient scientific data to predict how far or how diverse the environment must be before a negative impact will occur. However, it is believed that within a region site matching opportunities may be available. As site matching characteristics decrease and transplant distance increases within the regional borders greater justification is required for the proposed transplant. The following should be considered when selecting a donor stock.

Matching: Phenotypic characteristics of the donor stock should be matched to the environment at the site and to the management goals. Water chemistry and temperature profiles should be considered. Island stocks should be matched to other islands or to short rivers of comparable characteristics where possible. Time of spawning and fry emergence should be matched or compensated with the hatchery temperature required. Any deviations should be addressed and justified in the permit application or the annual management plan.

Migration Routes: The probable migration routes and potential user groups should be identified. The applicant must determine a probable migration route based on the migration route of the proposed stock and characteristics (topography) of the transplant site. Coded wire tagging of hatchery releases can determine the accuracy of migration route predictions as well as assess possible impact on local stocks.

II. Protection of Wild Stocks

A. <u>Prevention of detrimental effects of gene flow from hatchery fish straying and interbreeding with wild fish.</u>

Straying of hatchery fish released at the hatchery or off-station can potentially impact the fitness of wild fish populations through interbreeding of wild and hatchery fish. This assumes that hatchery and wild fish are adapted to different environments and either would presumably be less fit in the environment of the other and that hybrids would be less fit for either environment. Wild stocks have presumably been rigorously adapted to their native environment. Because of the large number of loci involved in the adaptation, many "successful" combinations of genetic information are possible along with the enormous number of "unsuccessful" combinations. Hybridization between discrete populations may produce a stock that has reduced fitness and therefore reduced production. Hatchery fish have been subjected to selection pressure for survival within artificial culture regimes, and may also have been originally derived from another stock adapted to totally different conditions than the impacted wild stock. Continued influx of hatchery fish together with the return of hybrids may alter the wild gene pool, reduce stock fitness, and thus threaten the survival of the wild population.

An alternative perspective is that hatchery strays will have little genetic impact on wild stocks. The influx of new genetic material through straying is a natural process in the development and expansion of salmon populations. If adaptation of the natural population is indeed very specific and selection is intense, then selection will favor and maintain the genetic complex of the wild populations. If adaptation is less specific and less intensive, then the genetic impacts from gene flow are insignificant. It is true that some straying occurs among adjacent wild populations and in most cases has occurred for a long enough time that such populations are quite similar genetically. However, situations in which transplanted stocks are not analogous, as transplanted stocks would be less similar and gene flow would have a more profound effect. It is also true that the impact of introgression into the wild gene pool of genes from fish transplanted from a radically different environment may be limited by natural selection. Again the situations of concern do not necessarily lie near this extreme; hybrids and strays may be fit enough to dilute or replace the wild genome. Inherent homeostatic mechanisms for gene expression may compensate for some genetic influx.

The magnitude of straying relative to the size of the wild run is the most important criterion, as massive spawning by hatchery strays may jeopardize a wild population by displacement on spawning habitat and superimposition of redds, as well as, genetic influx. A conservative management approach dictates avoiding release sites where large numbers of hatchery strays can be expected to interact with significant or unique wild stocks. This approach can be achieved by spatial or temporal isolation of the hatchery and wild stock.

B. Regional designation of significant and unique wild stocks.

The magnitude of salmon populations varies between watersheds from intermittent runs maintained by straying to hundreds of thousands of fish. In evaluating the impacts of salmon enhancement projects, consideration must be given to the potential of detrimental effects from straying and intermingling with wild populations and possible resultant loss of wild production. Such consideration must take into account the benefits of the enhancement activity and the significance of the wild stocks impacted. Designation of criteria for runs of fish that are considered significant would greatly expedite the evaluation process. However, "significance" must be defined not only by the magnitude of the run, but also in the context of local importance and utilization. A small sockeye salmon stock near a village in southeast Alaska may be "significant", whereas the same size population may be too small to be considered a manageable entity in Bristol Bay. Because local utilization is an important concern, a regional planning group such as the Salmon Enhancement Regional Planning Teams, should consider what criteria will be used to determine significant stocks within a region and recommend such stock designations.

Stock rehabilitation and enhancement.

1. A watershed with significant wild stocks can only be stocked with progeny from the indigenous stocks. Rehabilitation of a watershed implies that there is insufficient production in habitat that formerly maintained a stock of some magnitude. Unless the indigenous stock has gone to extinction, use of an

exogenous stock has potential for genetic damage noted in II. A. This damage will be exacerbated by the imprinting and homing of the transplanted stock to the impacted watershed, and potential displacement of wild juveniles by the exotics stocked in the rearing habitat. Enhancement of habitat not naturally accessible to salmon involves stocking eyed eggs, fry, or fingerlings, thus gaining production from this unutilized habitat. Where the inaccessible habitat is located above the barriers on watersheds that maintain significant natural populations, stocking nonindigenous populations again has potential for genetic impacts noted in II.A., exacerbated by imprinting and homing of the transplanted stock to the watershed. For both rehabilitation and above barrier stockings, use of the indigenous stock alleviates these concerns.

2. When enhancing a stream using the indigenous stock, the fish used for stocking shall not be removed from the wild system to a hatchery for more than one generation.

Hatchery incubation and rearing select for a limited set of biological and behavioral traits which are not necessarily the most suitable for survival in the wild environment. Because of this potential for such selection, the transfer of hatchery fish to rehabilitate or enhance stocks in depleted or underutilized watersheds runs the risk of altering the genetic character of the wild stock, even if the indigenous stock was the original donor stock for hatchery population. By restricting the separation between the transfer to the hatchery and the stocking to no more than one generation (e.g., eggs taken in a given year are cultured to fry or fingerling release at the hatchery; eggs or fish from the returns to the hatchery of this donor transplant are used for stocking), the risk of negative effects due to selection in the hatchery are minimized.

3. Establishment of wild stock sanctuaries.

As noted in preceding sections, there is concern that hatchery culture of salmon through their freshwater (and in some cases, initial estuarine) life history phases may select for a limited set of biological traits that are not suitable for wild populations. Loss of genetic variability through intensive in-breeding for domestication and desired traits has often resulted in detrimental genetic effects in agronomy and agriculture, such as reduced resistance to disease or adverse environmental conditions. Original wild strains can provide the genetic variability needed to outbreed domestics and alleviate inbreeding depression. Because there is potential for detrimental impacts due to reduction of genetic variability, there is a need to preserve a variety of wild types for future broodstock development and outbreeding for enhancement programs. Designation of watersheds where hatcheries or hatchery plants are not allowed would allow wild stocks within these watersheds to be subjected to natural selection only, within the life history phases cultured at hatcheries. These watersheds would be “gene banks” of wild type genetic variability.

III. Maintenance of Genetic Variance

1. Genetic diversity among hatcheries.

There is general agreement that be introducing and maintaining a wide diversity of wild donor stock populations into the hatchery system that the prospects for long term success of the hatchery program in Alaska will be enhanced. Diversity tends to buffer biological systems against disaster, either natural or man-made. Developing and maintaining hatchery broodstock from a wide variety of donors will buffer the hatchery system against future catastrophes. Agricultural crop production in the U. S. provides a prime example of the dangers of genetic uniformity.

In an effort to increase yield, plant breeders have come to rely on a few highly productive strains. In 1970 approximately 15% of the corn production in the United States was lost to corn blight. The corn blight responsible, a mutant of the normal blight causing fungus, did not attack all strains. Only one strain of corn was vulnerable, but that strain of corn was grown by nearly every farmer in the country. Breeders

were able to recover from the corn blight epidemic by replacing Texas cytoplasm with normal cytoplasm. Recovery was rapid because adequate genetic variability was available. There are other examples.

How does this relate to salmonid culture? Salmonid stocks apparently differ in levels of disease resistance, temperature tolerance, acid tolerance, and in their response to artificial selection. It seems imprudent to assume that conditions similar to those found in agriculture will not occur in aquaculture. In addition, the ability to genetically improve hatchery broodstock performance in the future will depend on the availability of genetic variability such as is found among wild salmonid stocks. A hatchery system with a variety of diverse broodstocks will be a valuable resource.

Genetic diversity does not guarantee protection from disaster, but uniformity seems to invite catastrophe. Local failures are inevitable within the hatchery system. It seems prudent to provide the system with a level of insurance by developing and preserving diversity among hatcheries.

Off-site releases for terminal harvest, whether for the commercial fishery or for a put and take sport fishery should have no adverse genetic effect if they are released at sites selected so that they do not impact significant wild stocks, wild stock sanctuaries or other hatchery stocks. The success of this type of release from a genetic standpoint depends on the ability to manage and harvest the return. If returns can not be harvested, increased straying may result which might lead to an impact on wild stocks at a greater than expected distance from the release site.

2. Genetic diversity within hatcheries and from donor stocks.

There is a general consensus among geneticists that fitness (reproductive potential) is enhanced by heterozygosity (genetic variability). Any loss of genetic variation will be accompanied by a concomitant reduction in fitness. Genetic variation allows a population to adapt to a changing environment or to adapt to and colonize a new environment. Available genetic variation determines how rapidly a population will respond to either artificial or natural selection. On the other hand, selection, inbreeding and random genetic drift will reduce genetic variability in a population. Natural selection, that is selection for fitness, is a continuing process and should not be so intense that it has a significant effect in reduction of genetic variation, unless the population is in a new and quite different environment. Artificial selection on the other hand can be very intense, but can either be avoided or designed to assure that possible negative effects to fitness are offset by increased production efficiency due to the selection program, and by more efficient culture techniques. Inbreeding due to the deliberate mating of related individuals can be easily avoided in salmon hatcheries. Undoubtedly, in hatcheries and possibly in natural stocks the most important cause of loss of genetic variation is random genetic drift. In hatcheries reduction of genetic variation caused by inbreeding and genetic drift can easily by avoided by using adequate numbers of spawners.

Random genetic drift in general refers to fluctuations in gene frequency that occur as a result of chance. Such fluctuations occur, especially in small populations, as a result of random sampling among gametes. The amount of change but not the direction of change, can be predicted. The rate of this change is related inversely to effective population size (N_e). The smaller the effective population size the greater the fluctuation in gene frequencies. In small populations random genetic drift can result in inadvertent loss of genetic variability which may significantly reduce the fitness of the population.

Effective population size (N_e) is defined as the size of an idealized population that would lose genetic variability at the same rate as the sample population. An idealized population is one in which there is no mutation or selection, there are equal numbers of males and females, mating is random, etc. Obviously it is very unlikely that any natural population will meet all criteria for an idealized population.

Breeding structure of a population can profoundly affect the rate at which genetic variability is lost. However, we can determine the effective breeding size (N_e) for breeding structures and obtain the rate of inbreeding (ΔF) as

$$(\Delta F) = 1/2\ N_e\ \Delta©^{\wedge}$$

so the consequences of breeding structure can be related to the loss of variation.

Many breeding structure variations can influence the effective population size. Four seem likely to operate in a salmon hatchery population: (1) numbers of males and females in the breeding population; (2) unequal numbers in successive generations; (3) nonrandom distribution of offspring among families; and (4) overlapping generations. These are discussed in greater detail in Appendix A.

Any of these variations in breeding structure may have a marked effect on N_e . Although it may be impossible to control or even to measure variation in family size it is important to keep in mind the relationship to effective population size. Breeding plans that would aggravate or increase the variation of family size should be avoided. The effect of overlapping populations is to increase the effective population number, in that individuals mating in different years contribute to greater diversity. For example, it would take a larger number of pink salmon each year to maintain N_e = 400 than it would sockeye salmon.

The factor having the greatest potential effect in the hatchery and over which we have most control is sex ratio. As the formula indicates (Appendix A) the effective population size is affected most by the numbers of the least frequent sex. It is important to consider this in the breeding plan. In salmon, because a male can be used to fertilize the eggs of a large number of females, there is a temptation to do so. This temptation should be moderated by the necessity to maintain an effective population size which will assure that adequate genetic variation is maintained in the population. A minimum effective population (N_e) of 400 should be maintained. At this size the rate of in-breeding will be 0.125 percent per generation which should not have a significant effect on the long term fitness of the population.

In some cases, for example with Chinook and steelhead, small population size may be unavoidable. In such cases a plan should be developed to offset the effects of small population size by infusion of genes from a source outside the hatchery population, such as the original donor source. Help in designing these breeding plans can be obtained from the Principal Geneticist, FRED Division, (absorbed into Commercial Fisheries Division in 1994) Alaska Department of Fish and Game.

While developing hatchery stocks from wild donor sources it is important that the genetic variability in the donor stock be protected. Cropping of the early or late run segments of a donor stock can change the timing of that run, which will reduce genetic variability of the population and may be detrimental to the stock's prospects for long term survival. To prevent such selection, sliding egg take scales for donor stock transplants should allocate no more than 90% of any segment of a run for broodstock.

RESEARCH

The necessity for much of this policy arises from our ignorance of the genetics of wild salmon populations and the effects of their domestication in hatcheries. The policy is based more on extrapolation from other disciplines such as agriculture than from first-hand knowledge of our resource. As a result, the policy is a somewhat conservative interpretation of these data in order to assure the long-term viability of salmon populations. The Committee has identified several areas in which specific knowledge would clarify this policy and contribute to the effectiveness of salmon enhancement. The Committee encourages cooperative research efforts among the university, state, federal and private sectors directed toward the general areas listed below.

1. Development of performance profiles of hatchery stock and potential for genetic improvement. Information about stocks kept in culture will be useful in several ways. If taken in a standard manner, the data will be useful in determining the extent of variability in the species and will aid in the choice of stock to be used for outplanting or transplanting. The information will also be helpful in maximizing the production of a particular facility.

2. Potential for genetic improvement of cultured stocks. A sequel to the cataloging of the variability within and among stocks will be to experimentally assess the potential for genetic improvement by selective breeding. To do this, it is necessary to determine the heritability for traits of interest, which is the part of the phenotypic variability present in a population which results from genetic (heritable) causes as opposed to environmental causes. Traits such as size of adults, age of return and various timing parameters are particularly interesting to industry. Application of artificial selection is responsible for the enormous advances that have been made in agriculture; the potential also exists in aquaculture.
3. Assessment of the effect of introgression of genes from hatchery fish into wild populations. To examine this effect, one must first have an estimate of the rate of straying and the factors that influence straying. Such factors might include transplant distance, run strength, source of the hatchery stock and year-to-year environmental differences. By using a genetically marked stock, one can monitor the flow of "hatchery genes" into other populations. Because the effect of such introgression may develop over time, it is necessary that such an experiment be conducted over several generations. For this kind of study, it may be necessary to develop a means for marking fish cultured at production levels.

   The second part of this problem is to establish the impact of introgression. A range of potential interactions is possible ranging from introgression between 2 unrelated stocks to the introgression of fish subject to the selective pressures of a hatchery back into the wild stock from which they were derived. Research to examine these effects could best be done in an experimental hatchery where hybrid stocks could be produced and all releases marked. Port sampling and stream walking would be necessary to evaluate survival, straying and other phenotypic effects.
4. The effects of inbreeding and maintenance of inbred lines. Accompanying the artificial propagation of a species is the potential for inbreeding, loss of genetic variability and increased homozygosity. Information pertinent to the extent of inbreeding depression that results from various levels of inbreeding is necessary in determining adequate effective population sizes. This is especially important for species for which a large effective population size is difficult to maintain. In addition, this information would permit a judgment on the efficacy of enhancing very small remnant populations. This work could be done both by performing crosses designed to accomplish some level of inbreeding, and by the maintenance of small randomly breeding populations. In both cases, it is important to keep careful controls.

Appendix A

The relationship of breeding structure, effective population size, and rate of inbreeding.

Breeding structure can profoundly affect effective breeding size (N_e) of a population. We can, at least in theory, determine the effective breeding size for many breeding structures and obtain the rate of inbreeding (AF) as

$$AF = 1/2\ N_e$$

directly relating variation in breeding structure to loss of genetic variation. (Falconer. 1981) The following demonstrates the consequence of some breeding structures to effective population size.

Number of males and females: Unequal numbers of males and females in the breeding population reduce effective population size. Sex ratio is related to effective population number (N_e) as

$$N_e = 4NmNf/(Nm = Nf)$$

where Nm and Nf refer to the total number of males and females respectively. The effective population size is strongly influenced by the number of the least frequent sex.

Unequal numbers in successive generations: If the numbers of breeding individuals is not constant in successive generations the mean effective number is the harmonic mean of the number in each generation. Over generations the effective number is approximately,

$$1/Ne = 1/t(1/N1 + 1/N2 + 1/N3 + \ldots\ldots 1/Nt).$$

The generation that has the smallest number will have the largest effect.

Nonrandom distribution of offspring among families: When there is large variation in family size the next generation is made up of the progeny of a smaller than expected number of parents. This can be related to loss of genetic variation through effective population number as

$$N_e = 4N/(Vk + 2)$$

where Vk refers to the variance in family size. When variation of family size Vk is equal to 2, then N = N. When the number of males and females are unequal, the variance of family size may be unequal in the 2 sexes and

$$N_e = 8N(Vkm + Vkf + 4)$$

where Vkm and Vkf are the variance of family size for males and females respectively.

Overlapping generations: In species other than pink generations are not discrete, they are overlapping. When generations overlap the effective population size is

$$N_e = 4NcL\ (Vkm + 2)$$

When where L is the generation time and Nc is the number of individuals born in a year, that is the cohort size. The cohort size Nc is related to the total number (Nt) by Nc = Nt/E and E is the mean age at death. As before Vkm is the variation of family size. The effect of unequal sex ratio and unequal numbers in successive generations on population size can be easily estimated. On the other hand it will be difficult or perhaps impossible to estimate the variance of family size. Nevertheless, we should keep in mind the relationships of family size and overlapping generations. Overlapping generations will in general increase the effective population number in that individuals mating in different years contribute to greater diversity. Variance of family size can radically reduce effective population size. Procedures that contribute to variance of family size or separation of year classes should be avoided.

Background of the Genetics Policy of the Alaska Department of Fish and Game

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INTRODUCTION

The salmon industry of Alaska is dependent on production of salmon from wild populations. In the early 1970s, a system of public and private nonprofit hatcheries was created for the rehabilitation and enhancement of salmon populations. This came about largely because of several years of very low returns of salmon to many areas of Alaska. This depression of wild stocks was coupled with increases in knowledge of incubation and rearing requirements of salmon. However, the importance of the wild stocks of salmon to the state economy was recognized as paramount. It was also understood that the development and operation of a hatchery system could, if not done with care, have a detrimental impact on wild salmon populations. There has never been any intent to replace wild populations with hatchery fish. The intention is to augment wild production and, perhaps, even reduce fishing pressure on wild systems. A provisional genetic policy was developed in 1975 by the Department of Fish and Game (ADF&G) to protect wild stocks from enhancement activities. It has been revised twice (1978 and 1985). The revisions have extended the policy by developing guidelines that provide for the application of genetic principals to the development and management of broodstock for the hatchery system. The revisions also clarify the rationale for the policy guidelines, and reduce ambiguity in the policy. Protection of wild stocks remains the principal objective of the genetic policy.

Our goal is to discuss the genetic policy and the genetic principles on which it is based. We also will discuss some of the problems encountered in trying to implement the policy.

Finally, we will review the policy in an attempt to determine if, in its present form, it achieves the objectives for which it was developed.

PROBLEM

Genetic impacts to wild, indigenous fish stocks becomes a possibility when man decides to (a) transport fish from one locale and release them in another, and (b) when man decides to create by artificial means (hatcheries) fish to supplant those produced by nature. It is important to recognize that to conduct these activities does not automatically mean that genetic impact to wild stocks will follow. The attention man gives to preventing impact will determine whether any impact ensues. While not a topic for discussion here, it should be mentioned that the most clearly demonstrable genetic impact to wild salmon has been produced by commercial harvest.

What are the potential genetic hazards to wild fish populations brought by transport associated with enhancement? There are two. The first hazard is with the effects of gene flow between fish stocks. Gene flow occurs naturally between local stocks of the same species, but our concern is that fish released either at a hatchery or off-station may stray and interbreed with local wild stocks. If these stray fish are poorly adapted to the environment, the fitness of the local stocks potentially can be impacted. It is presumed that wild stocks have been adapted by natural selection to their native environment. Interbreeding with hatchery fish or transplanted wild fish, because these have adapted to a different environment, could reduce the fitness of the local stock. Although we are primarily interested in protection of wild fish stocks, the same dangers exist for hatchery brood stocks.

The second area of concern is with maintaining adequate genetic diversity both within and between fish populations. There are two components to the diversity in a species. There is the variation within each stock and also the diversity among stocks. Both of these components are important to the well-being of the species.

GENETIC CONCERNS

The science of Population Genetics has been developed over the past 70 years. It is true that there is little, if any, direct information on the genetic impacts of salmon enhancement on wild salmon stocks. However, there is a large body of theoretical and experimental work; the experimental work has been based on a wide variety of plants and animals other than fish. We have applied that body of knowledge to the development of the genetic policy.

What We Know

Genetic Variability and Fitness:

Our approach to policy development has been based on principles of population genetics theory. Population genetics deals with diversity, phenotypic diversity but, especially, with that portion of diversity that is caused by difference in genotype among individuals. A great deal of effort in population genetics is expended in determining the amount of genetic variation that exists both within and between natural populations. Genetic variability is the raw material which allows a population to adapt to its environment. Genetic variation, in addition, seems to increase the physiological stability of individuals and populations. In addition to genetic variability, a central factor in salmon population genetics is population structure. Salmon stocks home with remarkable precision to their “home” stream to spawn. Behavioral barriers to gene flow result in a significant degree of genetic diversity among salmon stocks. The amount of diversity is dependent on a number of factors, such as time since stocks separated and amount of gene flow between stocks. The amount of gene flow may be related to distance between stocks, or other impediments to migration.

Fitness can be defined as the probability that an individual will survive from conception to reproduction. However, we are primarily interested in the average fitness of the population or stock. It is very difficult to measure the total fitness of an individual because of the complexity of the trait. Anything that can increase or decrease the chance of an individual’s survival to maturity affects the fitness of that individual and, therefore, the average fitness of the population to which it belongs. Any loss of genetic variation results in a loss of fitness, but any gain in genetic variation may or may not improve fitness.

What We Think We Know

It follows from what we know about population genetics theory that wild stocks must be approximately in genetic equilibrium. Being in genetic equilibrium means that though the population is constantly subject to natural selection tending to increase fitness, the gene frequencies remain relatively stable and fitness does not improve. The reason this is the case is that additive genetic variance (that portion of genetic variance that will respond to selection) will, over time, have been removed from the population by natural selection. (This has been called the “Red Queen” hypothesis after the character in Alice In Wonderland

who said it was necessary to run as fast as they could to stay where they were.) Therefore, a wild stock at any particular location is assumed to be close to maximum fitness and, therefore, the stock best adapted for that location. We assume also that transplanted salmon will not home as accurately to the new location, at least initially, as native salmon. Homing of some transplanted salmon has improved rapidly over the first few generations at a new location. This lends support to our assumption.

Finally, genetic distance and geographic distance are assumed to be correlated. Although salmon home with a remarkable degree of accuracy, there is some straying. Chances are that they stray into nearby streams with greater regularity than into more distant streams. It is not unreasonable, therefore, to assume that gene flow between neighboring stocks would result in genetic similarity. Having made that assumption, we have to recognize that there will be exceptions to this general rule. Life history characteristics, environmental features, and geological formations can effectively block gene flow between stocks that are geographically close.

Given these assumptions, we might also consider factors that would enter into an objective consideration of any proposed enhancement project. What is the environment to which salmon adapt? We should recognize that the environment of a salmon population is extremely complex. First, their environment encompasses both freshwater and marine habitats. Both environments vary spatially as well as temporally. In addition, it seems clear that salmon populations are characterized by a great deal of plasticity. Most salmon stocks are able to physiologically adapt to a wide variety of environmental conditions. Further, much mortality in salmon populations is due to pure chance or phenotypic difference rather than genetic selection. "Much differential survival and fertility is purely accidental – an animal may survive because it happens to be in the right place at the right time. This is especially true of organisms that produce a great excess of progeny of which only a few survive to maturity" (Crow and Kimura, An Introduction to Population Genetic Theory, 1970. Harper and Row, New York). Many of the assumptions on which we base our policy decisions are tied to the notion that the genetic composition of indigenous wild salmon is determined primarily by selection. The value of these assumptions is not necessarily negated by the understanding that many differences between stocks have arisen by chance, and environment can perpetuate phenotypic differences without the populations undergoing genetic change. Our basic assumptions represent the most conservative approach to policy; however, we must recognize that these unknowns exist.

SOLUTION

The genetic policy is the solution to the problem of development of a salmon enhancement program while protecting wild salmon populations. As stated earlier, the genetic policy was developed in 1975 to protect wild stocks from possible detrimental effects of artificial propagation and management practices. However, since public and private nonprofit hatcheries have come on-line and proven successful, additional guidelines have been added to protect hatchery and enhanced stocks. The policy was reviewed and revised in 1978, and again in 1985. The purpose of the genetic policy is still to protect wild stocks. The following describes pertinent genetic considerations and how these have influenced the development of the genetic policy.

From the beginning of enhancement efforts, there has been a recognized need for controls on the movement of salmon stocks. The Fish Transport Permit (FTP) was developed to provide control of fish transport. In order for anyone to transport, possess, export from the state, or release fish into the waters of the state, they must hold an FTP issued by the Commissioner of ADF&G. Each FTP is reviewed and commented on by selected staff of ADF&G.

Control of fish transport is the only method available for limiting gene flow into fish stocks that need to be protected. Indiscriminate movement of stocks can result in decreased genetic diversity among stocks. Development of criteria for the genetic review of FTP applications has been a problem since the permit was established. Specific knowledge of salmon population genetics and the genetic impacts of salmon enhancement on wild stocks is limited. Consequently, the genetic policy is based more on information

from agriculture genetics and population genetics of other species than on knowledge of our own salmon resources. The result is a policy containing guidelines that are rather flexible. We have tried to develop nonambiguous criteria for judging fish transport permits. The policy suggests that because our knowledge is limited, we should apply the policy and presumably evaluate the FTPs conservatively. An attempt to act conservatively gives the appearance of being arbitrary and begs the comment that the policy is too ambiguous. Unfortunately, the present level of our knowledge forces us to be somewhat ambiguous in our guidelines. Conservative application of the genetic policy can occur only if we set somewhat arbitrary limits based on what we know about the genetics of populations.

APPLYING GENETIC POLICY

When stocks are moved, wild salmon are subjected to increased danger of genetic impact. Direct genetic impact requires first that gene flow occur from the transplanted stock to the indigenous wild stock and, second, requires that the fitness of the wild stock be reduced. Simple, starch gel electrophoresis of tissue proteins can often detect whether or not gene flow has occurred between two salmon stocks. But to prove genetic impact conclusively, it is necessary to demonstrate that the fitness of the indigenous wild stock has been reduced. Fitness is measured in terms of production of biomass by the stock, and any change in fitness must be a measure of that change in production ascribable only to gene substitution. Numerous environmental variables, both biotic and abiotic, also influence production by the stock, and so it borders on the impossible to measure any change in fitness (production) due to gene flow. Year-to-year variation in production due to this set of other variables masks any reduction in fitness that could be expected over a period of time. Hence, changes in fitness of salmon stocks due to interbreeding have never been measured. So it follows that direct genetic impact due to interbreeding has never been demonstrated in salmon.

The genetic policy has been developed to provide guidelines that will allow development of a hatchery/enhancement program while minimizing the potential for genetic impacts on wild stocks to an acceptable level. Stock interaction must allow for the long-term retention of natural communities under conditions that provide the potential for continuing evolution.

Significant Stocks

Salmon populations vary in size from intermittent runs, which may be maintained by straying, to runs of hundreds of thousands of fish. It seems reasonable that all salmon populations are not of equal importance. The effect of a salmon enhancement project depends to some degree on the relative value of the stock that might be impacted. The concept of significant stocks arose out of such considerations. Early versions of the policy (1975 and 1978) distinguished between introductions into systems with large indigenous stocks and into systems with few or no indigenous fish. The earlier policies made no attempt to set limits on population size but clearly had introduced the concept of significant stocks. The 1985 review and revision of the genetic policy was initiated because of a need to remove ambiguity and increase consistency in application of the policy. Members of the review committee were unable to define the term, “significant stock,” but did develop an approach to the problem. The committee felt that, while the size of the population is important, “significance” must be defined not only by the magnitude of the run, but also in context of local importance and utilization. The committee suggested as well that “Because local utilization is an important concern, a regional planning group such as the Salmon Enhancement Regional Planning Teams should consider what criteria will be used to determine significant stocks within a region and recommend such stock designations.” At this time, these suggestions have not been implemented.

Genetic and Geographic Distance

The idea that genetic distance and geographic distance are correlated has also been used in developing and applying the genetic policy. We are led to this idea by two facts of salmon biology. Salmon stocks home to their own spawning grounds with some accuracy and adapt to that particular environment. This

tends to cause some degree of genetic separation between stocks. However, there must be background levels of straying occurring between local salmon stocks. The fact that salmon species will repopulate barren streams is evidence that salmon stray; however, straying may also lead to reduced fitness of a recipient stock. Background levels of straying occur between neighboring, thus genetically similar, stocks. We become concerned when stocks that have been transported from distant locales stray because they are not genetically similar to local stocks. The chance that strays from one stock will interbreed with another is dependent on the distance between the two stocks. It would seem to follow that, other things being equal, two stocks that are separated by a short distance will be more alike genetically than two stocks that are separated by a greater distance. Every stock will have its own sphere of influence, circumscribed by the straying of its members. The influence of each stock will decrease with distance from its home stream.

Changes of location on the globe result in changes in the environment. That is, in general, environment also changes as a function of distance. This, coupled with the fact that natural selection works to adapt a stock to its environment, lends support to the assumption that genetic differences between stocks separated by a great distance are larger than genetic differences between neighboring stocks.

This relationship between genetic similarity and distance leads to two conclusions: First, local stocks transplanted to a site will have less genetic impact on indigenous populations because of their genetic similarity than stocks transplanted from a greater distance; and, second, stocks local to an area are best suited for transplant within the area or for development of a brood stock at a site within the area.

Salmon stocks have a genetic sphere of influence because of their life history characteristics. All stocks interact genetically with those around them. This concept has governed the way the genetic policy has been applied. It seems obvious as well that each hatchery or enhanced population will also have a genetic sphere of influence. The larger the production of the wild stock, hatchery stock, or enhanced stock, the greater its influence will be on surrounding stocks.

The effect of these genetic spheres of influence is that decisions made in the past seem bound to limit options for future projects. Consider what it means when all stocks influence and, in turn, are influenced by those around them. Transplanted stocks will impact the genetic composition of stocks adjacent to the release site. Because we assume that wild stocks are in approximate equilibrium, we must assume also that any genetic impact caused by a stock adapted to a different environment (a transplanted stock) will result in some loss of fitness to the indigenous wild stock. The reduction may not be critical; it is impossible to know. It is conceivable that the indigenous wild stock will derive some benefit from the introduction of genetic variation. The result would probably depend on the amount of gene flow that occurs. The amount of gene flow would depend, in turn, on ability to manage the enhanced stock so that straying of returns would be minimized. It would also depend on the degree of genetic difference between stocks and the reproductive success of the straying fish. This aspect of salmon population genetics is not understood. This problem reemphasizes the need to apply the genetic policy conservatively.

Transplants will modify to some degree the genetic composition of local stocks. When remote stocks are transplanted to areas with significant wild stocks, the wild stocks in this locale are changed to some degree genetically, and their status must be reconsidered. Future options may have been limited.

Multiple Use of Stocks

It is important to build stock diversity into the hatchery system. Salmon stocks differ in levels of disease resistance, temperature tolerance, acid tolerance, and in response to artificial selection. Stock diversity will tend to buffer the hatchery system against both natural and man-made disasters. Further, the ability to genetically improve hatchery brood stock performance in the future depends on the availability of genetic variability. Such variability would be present in a hatchery system with a variety of diverse brood stocks.

There is an apparent conflict between the need for stock diversity in the hatchery system and the need to start up individual hatcheries as economically as possible. It is more economical in the short run to

develop a hatchery brood stock from excess eggs of an existing brood stock than from a wild source. And, it is difficult to place a monetary value on the long-term value of stock diversity. The genetic policy limits to three the number of hatchery brood stocks that can be established from a single donor. It does not limit the number of release sites for terminal harvest. This limit on multiple use of stocks balances the need for short-term economy and the need to establish and maintain genetic diversity. It will limit the spread of a single stock.

CONCLUSION

Can the genetic policy in its present form be applied in a way that will achieve the objectives for which it was developed? The answer is yes. Although there is an inherent risk to wild stocks from the development and operation of a hatchery/enhancement program, this risk can be managed by reducing the genetic impact on wild stocks to an acceptable level. The need is not to avoid all genetic change, but to allow for the long-term retention of natural communities under conditions that would provide for continuing evolution. To achieve this goal, we have to apply the genetic policy conservatively. This means that if we know, for example, that genetic similarity decreases with distance and our decisions are not to be ambiguous, we must set arbitrary limits on distance a stock can be transported. An effective genetic policy must allow for implementing successful enhancement activities while protecting and maintaining healthy wild stocks. There are only two primary genetic concerns in protecting wild stocks and implementing a successful enhancement program. The first concern is possible genetic impacts due to gene flow into wild or enhanced stocks. The second concern is the loss of genetic variation within or among stocks. We are obviously concerned with both wild and enhanced stocks. However, Alaska's valuable salmon industry is founded on production from wild stocks, and wild stocks are the source of genetic variation for development of enhanced stocks; therefore, our primary concern is wild stocks. Both gene flow and loss of genetic variation can potentially cause the reduction of total fitness in wild stocks and hatchery broodstocks. The genetic policy addresses these problems in its three main topic areas. The topics addressed are Stock Transport, Protection of Wild Stocks, and the Maintenance of Genetic Variance. The genetic policy addresses the genetic concerns adequately. The policy describes the genetic concerns and presents guidelines that protect wild stocks from impacts of enhancement activities, as well as protecting hatchery brood stocks and enhanced stocks from the problems associated with loss of genetic variation.

The only problems with the policy are those of perception. It is our hope that this paper will serve to promote a better understanding of the policy. One important task remains to be accomplished: The Genetic Policy Review Committee (1985) outlined an approach to the problem of defining significant and unique wild stocks. Any designation of stocks as significant or nonsignificant will be arbitrary. However, some means of defining these terms is critical to the successful application of the genetic policy and must be found.

APPENDIX G: 5 AAC 39.222. Policy for the Management of Sustainable Salmon Fisheries

(a) The Board of Fisheries (board) and Department of Fish and Game (department) recognizes that

(1) while, in the aggregate, Alaska's salmon fisheries are healthy and sustainable largely because of abundant pristine habitat and the application of sound, precautionary, conservation management practices, there is a need for a comprehensive policy for the regulation and management of sustainable salmon fisheries;

(2) in formulating fishery management plans designed to achieve maximum or optimum salmon production, the board and department must consider factors including environmental change, habitat loss or degradation, data uncertainty, limited funding for research and management programs, existing harvest patterns, and new fisheries or expanding fisheries;

(3) to effectively assure sustained yield and habitat protection for wild salmon stocks, fishery management plans and programs require specific guiding principles and criteria, and the framework for their application contained in this policy.

(b) The goal of the policy under this section is to ensure conservation of salmon and salmon's required marine and aquatic habitats, protection of customary and traditional subsistence uses and other uses, and the sustained economic health of Alaska's fishing communities.

(c) Management of salmon fisheries by the state should be based on the following principles and criteria:

(1) wild salmon stocks and the salmon's habitats should be maintained at levels of resource productivity that assure sustained yields as follows:

(A) salmon spawning, rearing, and migratory habitats should be protected as follows:

(i) salmon habitats should not be perturbed beyond natural boundaries of variation;

(ii) scientific assessments of possible adverse ecological effects of proposed habitat alterations and the impacts of the alterations on salmon populations should be conducted before approval of a proposal;

(iii) adverse environmental impacts on wild salmon stocks and the salmon's habitats should be assessed;

(iv) all essential salmon habitat in marine, estuarine, and freshwater ecosystems and access of salmon to these habitats should be protected; essential habitats include spawning and incubation areas, freshwater rearing areas, estuarine and nearshore rearing areas, offshore rearing areas, and migratory pathways;

(v) salmon habitat in fresh water should be protected on a watershed basis, including appropriate management of riparian zones, water quality, and water quantity;

(B) salmon stocks should be protected within spawning, incubating, rearing, and migratory habitats;

(C) degraded salmon productivity resulting from habitat loss should be assessed, considered, and controlled by affected user groups, regulatory agencies, and boards when making conservation and allocation decisions;

(D) effects and interactions of introduced or enhanced salmon stocks on wild salmon stocks should be assessed; wild salmon stocks and fisheries on those stocks should be protected from adverse impacts from artificial propagation and enhancement efforts;

(E) degraded salmon spawning, incubating, rearing, and migratory habitats should be restored to natural levels of productivity where known and desirable;

(F) ongoing monitoring should be conducted to determine the current status of habitat and the effectiveness of restoration activities;

(G) depleted salmon stocks should be allowed to recover or, where appropriate, should be actively restored; diversity should be maintained to the maximum extent possible, at the genetic, population, species, and ecosystem levels;

(2) salmon fisheries shall be managed to allow escapements within ranges necessary to conserve and sustain potential salmon production and maintain normal ecosystem functioning as follows:

(A) salmon spawning escapements should be assessed both temporally and geographically; escapement monitoring programs should be appropriate to the scale, intensity, and importance of each salmon stock's use;

(B) salmon escapement goals, whether sustainable escapement goals, biological escapement goals, optimal escapement goals, or inriver run goals, should be established in a manner consistent with sustained yield; unless otherwise directed, the department will manage Alaska's salmon fisheries, to the extent possible, for maximum sustained yield;

(C) salmon escapement goal ranges should allow for uncertainty associated with measurement techniques, observed variability in the salmon stock measured, changes in climatic and oceanographic conditions, and varying abundance within related populations of the salmon stock measured;

(D) salmon escapement should be managed in a manner to maintain genetic and phenotypic characteristics of the stock by assuring appropriate geographic and temporal distribution of spawners as well as consideration of size range, sex ratio, and other population attributes;

(E) impacts of fishing, including incidental mortality and other human-induced mortality, should be assessed and considered in harvest management decisions;

(F) salmon escapement and harvest management decisions should be made in a manner that protects non-target salmon stocks or species;

(G) the role of salmon in ecosystem functioning should be evaluated and considered in harvest management decisions and setting of salmon escapement goals;

(H) salmon abundance trends should be monitored and considered in harvest management decisions;

(3) effective management systems should be established and applied to regulate human activities that affect salmon as follows:

(A) salmon management objectives should be appropriate to the scale and intensity of various uses and the biological capacities of target salmon stocks;

(B) management objectives should be established in harvest management plans, strategies, guiding principles, and policies, such as for mixed stock fishery harvests, fish disease, genetics, and hatchery production, that are subject to periodic review;

(C) when wild salmon stocks are fully allocated, new fisheries or expanding fisheries should be restricted, unless provided for by management plans or by application of the board's allocation criteria;

(D) management agencies should have clear authority in statute and regulation to

(i) control all sources of fishing mortality on salmon;

(ii) protect salmon habitats and control non-fishing sources of mortality;

(E) management programs should be effective in

(i) controlling human-induced sources of fishing mortality and should incorporate procedures to assure effective monitoring, compliance, control, and enforcement;

(ii) protecting salmon habitats and controlling collateral mortality and should incorporate procedures to assure effective monitoring, compliance, control, and enforcement;

(F) fisheries management implementation and outcomes should be consistent with regulations, regulations should be consistent with statutes, and effectively carry out the purpose of this section;

(G) the board will recommend to the commissioner the development of effective joint research, assessment, and management arrangements with appropriate management agencies and bodies for salmon stocks that cross state, federal, or international jurisdictional boundaries; the board will recommend the coordination of appropriate procedures for effective monitoring, compliance, control, and enforcement with those of other agencies, states, or nations;

(H) the board will work, within the limits of its authority, to assure that

(i) management activities are accomplished in a timely and responsive manner to implement objectives, based on the best available scientific information;

(ii) effective mechanisms for the collection and dissemination of information and data necessary to carry out management activities are developed, maintained, and utilized;

(iii) management programs and decision-making procedures are able to clearly distinguish, and effectively deal with, biological and allocation issues;

(I) the board will recommend to the commissioner and legislature that adequate staff and budget for research, management, and enforcement activities be available to fully implement sustainable salmon fisheries principles;

(J) proposals for salmon fisheries development or expansion and artificial propagation and enhancement should include assessments required for sustainable management of existing salmon fisheries and wild salmon stocks;

(K) plans and proposals for development or expansion of salmon fisheries and enhancement programs should effectively document resource assessments, potential impacts, and other information needed to assure sustainable management of wild salmon stocks;

(L) the board will work with the commissioner and other agencies to develop effective processes for controlling excess fishing capacity;

(M) procedures should be implemented to regularly evaluate the effectiveness of fishery management and habitat protection actions in sustaining salmon populations, fisheries, and habitat, and to resolve associated problems or deficiencies;

(N) conservation and management decisions for salmon fisheries should take into account the best available information on biological, environmental, economic, social, and resource use factors;

(O) research and data collection should be undertaken to improve scientific and technical knowledge of salmon fisheries, including ecosystem interactions, status of salmon populations, and the condition of salmon habitats;

(P) the best available scientific information on the status of salmon populations and the condition of the salmon's habitats should be routinely updated and subject to peer review;

(4) public support and involvement for sustained use and protection of salmon resources should be sought and encouraged as follows:

(A) effective mechanisms for dispute resolution should be developed and used;

(B) pertinent information and decisions should be effectively disseminated to all interested parties in a timely manner;

(C) the board's regulatory management and allocation decisions will be made in an open process with public involvement;

(D) an understanding of the proportion of mortality inflicted on each salmon stock by each user group, should be promoted, and the burden of conservation should be allocated across user groups in a manner consistent with applicable state and federal statutes, including AS 16.05.251 (e) and AS 16.05.258 ; in the absence of a regulatory management plan that otherwise allocates or restricts harvests, and when it is necessary to restrict fisheries on salmon stocks where there are known conservation problems, the burden of conservation shall be shared among all fisheries in close proportion to each fisheries' respective use, consistent with state and federal law;

(E) the board will work with the commissioner and other agencies as necessary to assure that adequately funded public information and education programs provide timely materials on salmon conservation, including habitat requirements, threats to salmon habitat, the value of salmon and habitat to the public and ecosystem (fish and wildlife), natural variability and population dynamics, the status of salmon stocks and fisheries, and the regulatory process;

(5) in the face of uncertainty, salmon stocks, fisheries, artificial propagation, and essential habitats shall be managed conservatively as follows:

(A) a precautionary approach, involving the application of prudent foresight that takes into account the uncertainties in salmon fisheries and habitat management, the biological, social, cultural, and economic risks, and the need to take action with incomplete knowledge, should be applied to the regulation and control of harvest and other human-induced sources of salmon mortality; a precautionary approach requires

(i) consideration of the needs of future generations and avoidance of potentially irreversible changes;

(ii) prior identification of undesirable outcomes and of measures that will avoid undesirable outcomes or correct them promptly;

(iii) initiation of any necessary corrective measure without delay and prompt achievement of the measure's purpose, on a time scale not exceeding five years, which is approximately the generation time of most salmon species;

(iv) that where the impact of resource use is uncertain, but likely presents a measurable risk to sustained yield, priority should be given to conserving the productive capacity of the resource;

(v) appropriate placement of the burden of proof, of adherence to the requirements of this subparagraph, on those plans or ongoing activities that pose a risk or hazard to salmon habitat or production;

(B) a precautionary approach should be applied to the regulation of activities that affect essential salmon habitat.

(d) The principles and criteria for sustainable salmon fisheries shall be applied, by the department and the board using the best available information, as follows:

(1) at regular meetings of the board, the department will, to the extent practicable, provide the board with reports on the status of salmon stocks and salmon fisheries under consideration for regulatory changes, which should include

(A) a stock-by-stock assessment of the extent to which the management of salmon stocks and fisheries is consistent with the principles and criteria contained in the policy under this section;

(B) descriptions of habitat status and any habitat concerns;

(C) identification of healthy salmon stocks and sustainable salmon fisheries;

(D) identification of any existing salmon escapement goals, or management actions needed to achieve these goals, that may have allocative consequences such as the

(i) identification of a new fishery or expanding fishery;

(ii) identification of any salmon stocks, or populations within stocks, that present a concern related to yield, management, or conservation; and

(iii) description of management and research options to address salmon stock or habitat concerns;

(2) in response to the department's salmon stock status reports, reports from other resource agencies, and public input, the board will review the management plan, or consider developing a management plan, for each affected salmon fishery or stock; management plans will be based on the principles and criteria contained in this policy and will

(A) contain goals and measurable and implementable objectives that are reviewed on a regular basis and utilize the best available scientific information;

(B) minimize the adverse effects on salmon habitat caused by fishing;

(C) protect, restore, and promote the long-term health and sustainability of the salmon fishery and habitat;

(D) prevent overfishing; and

(E) provide conservation and management measures that are necessary and appropriate to promote maximum or optimum sustained yield of the fishery resource;

(3) in the course of review of the salmon stock status reports and management plans described in (1) and (2) of this subsection, the board, in consultation with the department, will determine if any new fisheries or expanding fisheries, stock yield concerns, stock management concerns, or stock conservation concerns exist; if so, the board will, as appropriate, amend or develop salmon fishery management plans to address these concerns; the extent of regulatory action, if any, should be commensurate with the level of concerns and range from milder to stronger as concerns range from new and expanding salmon fisheries through yield concerns, management concerns, and conservation concerns;

(4) in association with the appropriate management plan, the department and the board will, as appropriate, collaborate in the development and periodic review of an action plan for any new or expanding salmon fisheries, or stocks of concern; action plans should contain goals, measurable and implementable objectives, and provisions, including

(A) measures required to restore and protect salmon habitat, including necessary coordination with other agencies and organizations;

(B) identification of salmon stock or population rebuilding goals and objectives;

(C) fishery management actions needed to achieve rebuilding goals and objectives, in proportion to each fishery's use of, and hazards posed to, a salmon stock;

(D) descriptions of new or expanding salmon fisheries, management concern, yield concern, or conservation concern; and

(E) performance measures appropriate for monitoring and gauging the effectiveness of the action plan that are derived from the principles and criteria contained in this policy;

(5) each action plan will include a research plan as necessary to provide information to address concerns; research needs and priorities will be evaluated periodically, based on the effectiveness of the monitoring described in (4) of this subsection;

(6) where actions needed to regulate human activities that affect salmon and salmon's habitat that are outside the authority of the department or the board, the department or board shall correspond with the relevant authority, including the governor, relevant boards and commissions, commissioners, and chairs of appropriate legislative committees, to describe the issue and recommend appropriate action.

(e) Nothing in the policy under this section is intended to expand, reduce, or be inconsistent with, the statutory regulatory authority of the board, the department, or other state agencies with regulatory authority that impacts the fishery resources of the state.

(f) In this section, and in implementing this policy,

(1) "allocation" means the granting of specific harvest privileges, usually by regulation, among or between various user groups; "allocation" includes quotas, time periods, area restrictions, percentage sharing of stocks, and other management measures providing or limiting harvest opportunity;

(2) "allocation criteria" means the factors set out in AS 16.05.251 (e) considered by the board as appropriate to particular allocation decisions under 5 AAC 39.205, 5 AAC 75.017, and 5 AAC 77.007;

(3) "biological escapement goal" or "(BEG)" means the escapement that provides the greatest potential for maximum sustained yield; BEG will be the primary management objective for the escapement unless an optimal escapement or inriver run goal has been adopted; BEG will be developed from the best available biological information, and should be scientifically defensible on the basis of available biological information; BEG will be determined by the department and will be expressed as a range based on factors such as salmon stock productivity and data uncertainty; the department will seek to maintain evenly distributed salmon escapements within the bounds of a BEG;

(4) "burden of conservation" means the restrictions imposed by the board or department upon various users in order to achieve escapement, rebuild, or in some other way conserve a specific salmon stock or group of stocks; this burden, in the absence of a salmon fishery management plan, will be generally applied to users in close proportion to the users' respective harvest of the salmon stock;

(5) "chronic inability" means the continuing or anticipated inability to meet escapement thresholds over a four to five year period, which is approximately the generation time of most salmon species;

(6) "conservation concern" means concern arising from a chronic inability, despite the use of specific management measures, to maintain escapements for a stock above a sustained escapement threshold (SET); a conservation concern is more severe than a management concern;

(7) "depleted salmon stock" means a salmon stock for which there is a conservation concern;

(8) "diversity", in a biological context, means the range of variation exhibited within any level of organization, such as among genotypes within a salmon population, among populations within a salmon stock, among salmon stocks within a species, among salmon species within a community, or among communities within an ecosystem;

(9) "enhanced salmon stock" means a stock of salmon that is undergoing specific manipulation, such as hatchery augmentation or lake fertilization, to enhance its productivity above the level that would naturally occur; "enhanced salmon stock" includes an introduced stock, where no wild salmon stock had occurred before, or a wild salmon stock undergoing manipulation, but does not include a salmon stock undergoing rehabilitation, which is intended to restore a salmon stock's productivity to a higher natural level;

(10) "escapement" means the annual estimated size of the spawning salmon stock; quality of the escapement may be determined not only by numbers of spawners, but also by factors such as sex ratio, age composition, temporal entry into the system, and spatial distribution within the salmon spawning habitat;

(11) "expanding fishery" means a salmon fishery in which effective harvesting effort has recently increased significantly beyond historical levels and where the increase has not resulted from natural fluctuations in salmon abundance;

(12) "expected yields" mean levels at or near the lower range of recent historic harvests if they are deemed sustainable;

(13) "genetic" means those characteristics (genotypic) of an individual or group of salmon that are expressed genetically, such as allele frequencies or other genetic markers;

(14) "habitat concern" means the degradation of salmon habitat that results in, or can be anticipated to result in, impacts leading to yield, management, or conservation concerns;

(15) "harvestable surplus" means the number of salmon from a stock's annual run that is surplus to escapement needs and can reasonably be made available for harvest;

(16) "healthy salmon stock" means a stock of salmon that has annual runs typically of a size to meet escapement goals and a potential harvestable surplus to support optimum or maximum sustained yield;

(17) "incidental harvest" means the harvest of fish, or other species, that is captured in addition to the target species of a fishery;

(18) "incidental mortality" means the mortality imposed on a salmon stock outside of directed fishing, and mortality caused by incidental harvests, interaction with fishing gear, habitat degradation, and other human-related activities;

(19) "inriver run goal" means a specific management objective for salmon stocks that are subject to harvest upstream of the point where escapement is estimated; the inriver run goal will be set in regulation by the board and is comprised of the SEG, BEG, or OEG, plus specific allocations to inriver fisheries;

(20) "introduced stock" means a stock of salmon that has been introduced to an area, or portion of an area, where that stock had not previously occurred; an "introduced salmon stock" includes a salmon stock undergoing continued enhancement, or a salmon stock that is left to sustain itself with no additional manipulation;

(21) "management concern" means a concern arising from a chronic inability, despite use of specific management measures, to maintain escapements for a salmon stock within the bounds of the SEG, BEG, OEG, or other specified management objectives for the fishery; a management concern is not as severe as a conservation concern;

(22) "maximum sustained yield" or "(MSY)" means the greatest average annual yield from a salmon stock; in practice, MSY is achieved when a level of escapement is maintained within a specific range on an annual basis, regardless of annual run strength; the achievement of MSY requires a high degree of management precision and scientific information regarding the relationship between salmon escapement and subsequent return; the concept of MSY should be interpreted in a broad ecosystem context to take into account species interactions, environmental changes, an array of ecosystem goods and services, and scientific uncertainty;

(23) "mixed stock fishery" means a fishery that harvests fish from a mixture of stocks;

(24) "new fishery" means a fishery that new units of effort or expansion of existing effort toward new species, areas, or time periods, results in harvest patterns substantially different from those in previous years, and the difference is not exclusively the result of natural fluctuations in fish abundance;

(25) "optimal escapement goal" or "(OEG)" means a specific management objective for salmon escapement that considers biological and allocative factors and may differ from the SEG or BEG; an OEG will be sustainable and may be expressed as a range with the lower bound above the level of SET, and will be adopted as a regulation by the board; the department will seek to maintain evenly distributed escapements within the bounds of the OEG;

(26) "optimum sustained yield" or "(OSY)" means an average annual yield from a salmon stock considered to be optimal in achieving a specific management objective other than maximum yield, such as achievement of a consistent level of sustained yield, protection of a less abundant or less productive salmon stock or species, enhancement of catch per unit effort in sport fishery, facilitation of a non-consumptive use, facilitation of a subsistence use, or achievement of a specific allocation;

(27) "overfishing" means a level of fishing on a salmon stock that results in a conservation or management concern;

(28) "phenotypic characteristics" means those characteristics of an individual or group of salmon that are expressed physically, such as body size and length at age;

(29) "rehabilitation" means efforts applied to a salmon stock to restore it to an otherwise natural level of productivity; "rehabilitation" does not include an enhancement, which is intended to augment production above otherwise natural levels;

(30) "return" means the total number of salmon in a stock from a single brood (spawning) year surviving to adulthood; because the ages of adult salmon (except pink salmon) returning to spawn varies, the total return from a brood year will occur over several calendar years; the total return generally includes those mature salmon from a single brood year that are harvested in fisheries plus those that compose the salmon stock's spawning escapement; "return" does not include a run, which is the number of mature salmon in a stock during a single calendar year;

(31) "run" means the total number of salmon in a stock surviving to adulthood and returning to the vicinity of the natal stream in any calendar year, composed of both the harvest of adult salmon plus the escapement; the annual run in any calendar year, except for pink salmon, is composed of several age classes of mature fish from the stock, derived from the spawning of a number of previous brood years;

(32) "salmon" means the five wild anadromous semelparous Pacific salmon species *Oncorhynchus sp.*, except steelhead and cutthroat trout, native to Alaska as follows:

(A) Chinook or king salmon (*O. tschawytscha*);

(B) sockeye or red salmon (*O. nerka*);

(C) coho or silver salmon (*O. kisutch*);

(D) pink or humpback salmon (*O. gorbuscha*); and

(E) chum or dog salmon (*O. keta*);

(33) "salmon population" means a locally interbreeding group of salmon that is distinguished by a distinct combination of genetic, phenotypic, life history, and habitat characteristics, comprised of an entire stock or a component portion of a stock; the smallest uniquely identifiable spawning aggregation of genetically similar salmon used for monitoring purposes;

(34) "salmon stock" means a locally interbreeding group of salmon that is distinguished by a distinct combination of genetic, phenotypic, life history, and habitat characteristics or an aggregation of two or more interbreeding groups which occur within the same geographic area and is managed as a unit;

(35) "stock of concern" means a stock of salmon for which there is a yield, management, or conservation concern;

(36) "sustainable escapement goal" or "(SEG)" means a level of escapement, indicated by an index or an escapement estimate, that is known to provide for sustained yield over a 5 to 10 year period, used in situations where a BEG cannot be estimated or managed for; the SEG is the primary management objective for the escapement, unless an optimal escapement or inriver run goal has been adopted by the board; the SEG will be developed from the best available biological information; and should be scientifically defensible on the basis of that information; the SEG will be determined by the department and will take into account data uncertainty and be stated as either a "SEG range" or "lower bound SEG"; the department will seek to maintain escapements within the bounds of the SEG range or above the level of a lower bound SEG;

(37) "sustainable salmon fishery" means a salmon fishery that persists and obtains yields on a continuing basis; characterized by fishing activities and habitat alteration, if any, that do not cause or lead to

undesirable changes in biological productivity, biological diversity, or ecosystem structure and function, from one human generation to the next;

(38) "sustained yield" means an average annual yield that results from a level of salmon escapement that can be maintained on a continuing basis; a wide range of average annual yield levels is sustainable; a wide range of annual escapement levels can produce sustained yields;

(39) "sustained escapement threshold" or "(SET)" means a threshold level of escapement, below which the ability of the salmon stock to sustain itself is jeopardized; in practice, SET can be estimated based on lower ranges of historical escapement levels, for which the salmon stock has consistently demonstrated the ability to sustain itself; the SET is lower than the lower bound of the BEG and lower than the lower bound of the SEG; the SET is established by the department in consultation with the board, as needed, for salmon stocks of management or conservation concern;

(40) "target species" or "target salmon stocks" means the main, or several major, salmon species of interest toward which a fishery directs its harvest;

(41) "yield" means the number or weight of salmon harvested in a particular year or season from a stock;

(42) "yield concern" means a concern arising from a chronic inability, despite the use of specific management measures, to maintain expected yields, or harvestable surpluses, above a stock's escapement needs; a yield concern is less severe than a management concern, which is less severe than a conservation concern;

(43) "wild salmon stock" means a stock of salmon that originates in a specific location under natural conditions; "wild salmon stock" may include an enhanced or rehabilitated stock if its productivity is augmented by supplemental means, such as lake fertilization or rehabilitative stocking; "wild salmon stock" does not include an introduced stock, except that some introduced salmon stocks may come to be considered "wild" if the stock is self-sustaining for a long period of time;

(44) "action point" means a threshold value for some quantitative indicator of stock run strength at which an explicit management action will be taken to achieve an optimal escapement goal.

History: Eff. 9/30/2000, Register 155; am 11/16/2000, Register 156; am 6/22/2001, Register 158; am 6/10/2010, Register 194

Authority: AS 16.05.251

APPENDIX H: Summary of NS/BS Comprehensive Salmon Plan Public Input

Date	Location	Meeting
1/23/2012	Nome	Norton Sound Regional Planning Team
4/17/2012	Nome	NoBSRAA Board Meeting
4/25/2012	Nome	Norton Sound Regional Planning Team
7/9/2012	Nome	NoBSRAA Board Meeting
1/23/2013	Koyuk	Revised CSP initial scoping meeting
1/23/2013	Unalakleet	Revised CSP initial scoping meeting
1/24/2013	Shaktoolik	Revised CSP initial scoping meeting
1/30/2013	White Mountain	Revised CSP initial scoping meeting
1/30/2013	Elim	Revised CSP initial scoping meeting
1/31/2013	Golovin	Revised CSP initial scoping meeting
2/20/2013	Nome	Revised CSP initial scoping meeting
3/6/2013	Unalakleet	Norton Sound Regional Planning Team
11/19/2013	Nome	NoBSRAA Board Meeting
11/25/2013	Nome	Norton Sound Regional Planning Team
1/27/2014	Nome	NoBSRAA Board meeting
2/24/2014	Savoonga	Revised CSP initial scoping meeting
2/25/2014	Gambell	Revised CSP initial scoping meeting
3/5/2014	Saint Michael	Revised CSP initial scoping meeting
3/5/2014	Stebbins	Revised CSP initial scoping meeting
3/6/2014	Brevig Mission	Revised CSP initial scoping meeting
3/6/2014	Teller	Revised CSP initial scoping meeting
3/16/2014	Nome	NoBSRAA Board meeting
4/3/2014	Nome	NoBSRAA Board meeting
11/20/2014	Nome	NoBSRAA Board meeting
11/21/2014	Nome	Norton Sound Regional Planning Team
3/2/2015	Shaktoolik	Draft revised CSP meeting
3/2/2015	Unalakleet	Draft revised CSP meeting
3/3/2015	Stebbins	Draft revised CSP meeting
3/3/2015	Saint Michael	Draft revised CSP meeting
3/9/2015	Golovin	Draft revised CSP meeting
3/9/2015	White Mountain	Draft revised CSP meeting
3/10/2015	Teller	Draft revised CSP meeting
3/10/2015	Brevig Mission	Draft revised CSP meeting
3/11/2015	Elim	Draft revised CSP meeting
3/11/2015	Koyuk	Draft revised CSP meeting
3/11/2015	Nome	Draft revised CSP meeting
5/12/2015	Nome	Norton Sound Regional Planning Team
6/30/2015	Nome	Norton Sound Regional Planning Team

Koyuk CSP Meeting. January 23, 2013.

Comments: The community priority is a healthy subsistence fishery, although several commercial fishermen were in attendance; Concern over the Mukluktulik River remains. Comments on the effects of heavy beaver colonization on water quality, flow rates and the extirpation of chum salmon were expressed. Commenters believe that there are so many beavers they limit even the coho; There was a comment that salmon are important, but other freshwater species affect salmon abundance and provide subsistence opportunity. Those fish need to be inventoried as well as salmon. Pike, burbot, saffron cod, grayling and sheefish were mentioned specifically; King salmon are seen spawning on the Koyuk near Willow creek at the "first rapids".

Suggestions: The public wants more frequent updates on the tower counts; Commercial fishermen suggested markers be placed near the barge landing near Koyuk to delineate the inshore closure line on Norton Bay. The current regulation is mute on the inner boundary; One project for the future would be to inventory fish habitats for rearing and spawning, all species not just salmon. Locals believe the upper Koyuk is important for king salmon; The NoBSRAA needs to include contact information in future letters and meetings so comments can be sent in.

Unalakleet CSP Meeting. January 23, 2013.

Comments: Concerns over the impacts of Beaver and Dolly Varden on salmon abundance were top concerns; The function of the Unalakleet Weir was discussed and comments suggest more information to the public would help build confidence in the project; Local residents need to practice restraint in harvest and take only enough kings for use by the immediate family. Net tending and fish handling need to be priorities as well; Subsistence is a right, and is not given proper deference; The high impact on large kings by sport fishing was mentioned. Handling mortality was also mentioned; Spawning ground identification and a campaign to steer people away from impacting those areas was suggested; Support for rehabilitative projects was supported, but large hatchery projects were not.

Suggestions: The road across the flats from the runway to the hill only bridged one estuarine channel. This has affected the flow and is limiting the circulation of the rearing areas north of town. Either large culverts or a bridge needs to be installed; Increase harvest of Dolly Varden through commercial harvest and other means. Historically this species supported much more harvest which limited their impacts on salmon; Develop projects to involve the youth; knowledge will grow respect for the resource and the program. Fish culture, beaver dam breaking, and invertebrate counts were all activities suggested for this idea; Add streams south of town to the list of salmon streams, particularly Point Creek and Spruce Creek, Golsovia River if it is not in there, too.

Shaktoolik CSP Meeting. January 24, 2013.

Comments: Tagoomenik River is clogged with beaver dams to the point the current has slowed and the water is tainted. It was once a favorite place to seine coho, but today is only suitable for rod and reel casting. Pinks and chum were far more numerous in 1980; Coho have become more numerous on the main Shaktoolik River. Red salmon are increasing too; Unalakleet commercial fishermen are catching salmon close to Shaktoolik, but selling those fish at Unalakleet making it appear that the Unalakleet run is stronger than it is; There was beaver die-off two years ago due to deep freeze; Concern over sedimentation due to fall high water and increased boat traffic was

expressed. This seems to have affected chum and pinks the most; Firewood cutting on the river bank is discouraged, since these downed trees slow erosion and provide cover for juvenile fish; Some people try to cut fish up river to put nutrients back in river.

Suggestions: Consider the idea of putting spawning sloughs off limits to boat traffic. (Jacob's Slough) A threshold of 500 spawning coho would be required to allow fishing there. This would be important to chum and kings, in that season, too; Send water samples from the Tagoomenik to DEC to see if it is safe to drink; King Salmon planting at Tagoomenik River would be OK.

White Mountain CSP Meeting. Tribal Offices. January 30, 2013. 7:00 pm.

Attendees: June Lincoln, Dorothy Barr, Carol Brown, Charlie Lean, Phillip Brown, Andy Haviland, Willa Ashenfelter, Amos Brown, Sr., Rita Buck, Rose Fosdick, Peter Buck, Tom Gray, Katherine Bergamashi

Meeting started 7:05 pm, welcome by Willa Ashenfelter.

Discussion focused on outside influences on the state of the local salmon. There were several comments on the increased boat traffic from both local use and from the Nome Road system. Questions were asked on the effects of engine and boat wash, hydrocarbon pollution and difference in jet vs. prop impacts. There was concern for obtaining accurate escapement indices. The fact that the bulk of the chum spawn below the tower and the bypass channel at the current site caused concern. Aerial survey data was also questioned. It was pointed out that the 1996 plan did not recognize several important salmon streams. There was concern that commercial fishing would reduce salmon available for subsistence. It was pointed out there were more Dolly Varden than there had been in years, juvenile salmon are impacted by them.

Community comments: Road system (travelers) and predators (trout) impact salmon; Prefer pinks for dry fish with chums thrown in; Prefer pinks and silvers; We want to keep our fish numbers at good numbers; The number of boats in the river has a lot to do with how Nome is doing, if fisheries are closed at Nome we see more boats; We see more people interested in drying fish than 10 years ago; We see more boats on river with jet motors.

Community recommendations: Keep a tight rein on how much fisheries is commercial and how much is subsistence. EX: Historically when crabbing we got 60-70/day then commercial fisheries came into our area and now we're lucky to get 20/day; Tower should be reflective of percentage of fish going up different creeks/channels; If King salmon enhancement is a success you may want to consider doing same for silvers; Escapement goals are intended to have escapement over the long term be at the mid part of escapement goal range; The community plans to continue their inventory of salmon habitats in order to have baseline data to help direct future development; The community was supportive of exploring better salmon escapement ideas like the NSEDC investigation of weir sites in the reach from Fox River to WMO; The community would like more information on the coho harvest levels above the tower; The community would support longer windows in the commercial fishery to benefit both subsistence and escapement.

Visiting RAA comments: Chum and silvers look the same from the air, this is a comment for ADFG when they count using planes; Weirs are best on humpies and chum; Kings spawn in down-welling water in the same temperature regime as pinks but warmer than chum and silver; King redds contain large rocks, about 2 inches or larger; Beaver dams are good for silvers; Golovin Bay is a big mixing zone; The WMO/GLV harvest is about 9,000 pinks per year; 1984,

1994, 2004 were super pink years; The pressure wave caused by passing motor in rivers less than 18" is a killer to eggs; State of Alaska says any extra or surplus will made available to commercial fisheries; ADFG management is using upper/lower escapement goals, they are supposed to manage for the middle of the goals, they tend to manage for the low end of escapement; ADFG is obligated to meet minimum and middle part of goals.

Visiting RAA recommendations: Don't believe sonar is good for this river because the river is too broad.

Suggestion: encourage ADFG to allow commercial sale of trout in Nome; It's better to have a tower on the lower limits of spawning; When you have an issue – speak up. For example: when Elim stream was blocked due to the channel changing.

Questions by community and responses by RAA representatives:

Q. What about local projects?

A. Tagging is less stressful on fish now as WMO crew has identified the limits of habitat. You will have baseline information when major infrastructure changes are proposed.

Q. What about trout?

A. Trout return to spawn every other year. Everyone agrees dollys are a regional problem for salmon fry.

Q. Any hatcheries planned?

A. Looking into central incubation hatcheries.

Q. Any count planned for Fish River side for a better picture?

A. Will look for site below here and Fox River.

Q. What information do you have about commercial fishing in Golovin?

A. There has been commercial crabbing in Norton Sound since 1979 but local Norton Sound boats have only been involved for 15 years. The harvest is stable at 350,000 lbs.

Q. What is the timeline for the salmon plan?

A. RPT meets in March in UNK, draft report to be done by October 2013, approve plan 2014.

Questions by RAA representatives by and community responses:

Q. Missing rivers in the plan?

A. Fox River, Bear Creek, Rathlatulik River or [Arathlitulik and Etchepuk, tributaries of the Fish R.], Kachauik River, Howard Creek

Meeting ended 9:35 pm.

Elim CSP Meeting. January 30, 2013.

Comments: The Kwiniuk River bypass slough blockage was of great concern due to its effect on escapement of salmon on the Kwiniuk River and its effect on subsistence and commercial fishing. The channel also serves as a transportation route in times of rough seas. The Community was glad to hear of a plan to address it if it should be an issue again; Intercept fisheries, the Area M and Pollock fisheries, need to be addressed by the governmental agencies; There was support

for a hatchery. Several sites were suggested near Elim. Enhancement of coho, chum and odd year pinks were all of interest. Local employment was seen as a possible spin-off of a hatchery. King decline was also a problem that seemed to suggest the need for a hatchery. A big local hatchery would lead to a big local fishery; There was also support for the instream incubation project of the past at Corral Creek project.

Suggestions: The cut-off channel blockage correction project is of high importance and needs to be instituted when needed; Build a hatchery at Elim; A commercial fishery that includes pinks as well as other salmon is a high priority. Work to have full opportunity for harvestable surpluses. Regulations to allow new harvest methods, better buying efforts and responsive management are all needed.

Golovin CSP Meeting. January 31, 2013.

Comments: The declines of the Nome Area directly affect the subdistrict. Better documentation of intercept fishing and mining impacts at Nome will help to show what is at risk if the "road to Nome" were to be built; The salmon numbers of the 1980s should be the goal. The Golovin Fishery was the largest in the region; Thanks for the beach clean-up, when will that happen again?; Boat traffic is heavy and increasing. Impacts to spawning beds need to be documented. The depression of chum is concurrent with increased boat traffic; The Council vehicle ford is of great concern on the list of potential causes of decline; Chum and pink spawning areas more at risk from boat traffic than coho spawning and rearing areas; Invertebrate counts should be part of habitat assessment; Net marks are common early in the salmon season indicating interception fisheries.

Suggestions: Count boats as well as fish at the tower. Document water quality on peak days vs. low traffic days; The need for an earlier escapement index is obvious. What about a test fishery in the commercial subdistrict?; Regulation of tugs and barges taking refuge in the inner bay of Golovin can cause masses of eel grass to be eroded. This can be prevented by regulation which is missing; Add the following rivers to the plan: McKinley Creek, Chenik Creek, Kachauvik Creek, Klockerblock River, and several tributaries of the Fish River (see White Mt.)

Nome CSP Meeting. February 20, 2013.

Comments: Confusion over the terms in the CSP particularly "hatchery"; Too much talk and no action on salmon recovery; Hobson Creek has a facility ready to go; Hobson Creek is an excellent site for future projects or a larger hatchery; Disagreement on the attainment of production goals and the level of production to strive for in the future, in particular the number of red salmon at Salmon Lake, the number of pink salmon in the Nome River; The average age of subsistence fishers is getting younger; The old fishers are cycling out; Majority of comment supported the idea that pink salmon are an important subsistence species; Concern over salmon predators, in particular Dolly Varden; Regulation has changed subsistence practices; A strong enhancement program would result in stability of the subsistence fishery; People would gear-up for that opportunity and there would be less running around; More coho, reds and kings needed; Are we using management tools well?; Placer mining did not adversely affect salmon, mining may have helped; We need more pink and chum in the Nome and Snake Rivers; We need a draft of the CSP to comment on.

Suggestions: Consider setting up a working group like the Kuskokwim; We need to have a study on the habitat needed for Salmon; We need a plan to bring back the Solomon River; Increase

Dolly Harvest – bounties?; Increase pinks to benefit both people and coho on the Nome River; Work to bring back a 200,000 sockeye run to Salmon Lake; Do not over- escape Salmon Lake or we will see a crash again; Improve coho habitat by creating ponds and consider fertilization; Bear Creek is a potential site.

Savoonga CSP meeting. February 24, 2014.

About 30 community residents were in attendance. Sterling Gologergen welcomed/thanked participants for attending & introduced Charlie Lean at 1:20pm. Charlie gave an overview of NoBSRAA, the Comprehensive Plan Survey and the purpose of the meeting. Charlie requested community input, issues, concerns, ideas, and emphasized the importance of their local knowledge of salmon areas on St. Lawrence Island.

There was discussion on types and sizes of nets used for salmon.

Sam Mokiyuk: Half mile to 2 miles out, fish are going north, surveys are needed on Island.

Truman Kava: Current is mostly east and salmon are coming west, that's our problem.

Paul Rookok, Sr.: Caught 1 silver this summer.

Charlie Lean gave a summary of a hatchery under consideration and how it would work.

Mitchell Kiyuklook: Gave Charlie a chart of Island ocean current data.

Charlie provided information on other salmon population enhancement activities, including incubation, fisheries research in partnership w/Kawerak Fisheries & State Fish & Game. Habitat improvement work was described as well. He also gave a brief overview of different AK area commercial salmon fishing activity.

Questions were asked about the freshwater habitat on the southern lagoons and the Koozata River were discussed. There was interest in local employment opportunities with fisheries enhancement work.

Paul Rookok, Sr.: Invasive/non-indigenous species showing up on Island, including wolves, rabbits, sharks, and potentially beaver. Come across from Soviet Far East to Island. Charlie gave input to beaver impacts to salmon.

After the presentation by Charlie a wide ranging discussion of fishery resources around the Island ensued. Participants went over SLI maps w/Charlie and he marked salmon type and use areas for the rest of the meeting at Savoonga. The results of the discussion were recorded in the form of marks on the map where different species were caught and where salmon spawned. No specific salmon projects were proposed. Savoonga residents said that Gambell residents had asked about establishing a commercial king salmon fishery just east from Gambell along the north shore.

Gambell CSP meeting. February 25, 2014.

In attendance were Charlie Lean and Sterling Gologergen (NSEDC), Jenefer Bell (ADFG), Ramona Tungiyan (NoBSRAA and City of Gambell), Pearl Uglowook, Carson Oozeva, Jr., Marvin Kulowiyi, Jr., Malcolm Oozevauseuk, Lewis Oozeva, Roger Oozevaseuk, Casey Iyakitan, Dexter Irigoo.

Sterling Gologergen welcomed/thanked participants for attending & introduced Charlie Lean at 1:20pm.

Charlie gave an overview of NoBSRAA, the Comprehensive Plan Survey, the purpose of the group.

Charlie requested community input, issues, concerns, ideas, and emphasized the importance of their local knowledge of salmon areas on St. Lawrence Island.

Note: This meeting had started off w/participants, but as soon as open water & good weather came, all the hunters left. Charlie took input w/assistance from Ramona Tungiyan, BSRA member. He has marked maps of salmon use and type areas.

Saint Michael CSP Meeting. March 5, 2014. 12:08 pm.

Introductions: Charlie Lean, NSEDC; Jenefer Bell, ADF&G research biologist; Freida Moon-Kimoktoak, Kawerak- NR Special Projects Assistant; Milton Cheemuk, NoBSRAA Rep – Southern Norton Sound

Purpose of meeting: Gathering information about salmon from the Community of Saint Michael.

Charlie: There are Regional Aquaculture Associations throughout the State. NoBSRAA was active in 1996 – 2000 then fell apart and now is getting back together. A (CSP) Community Salmon Plan was written in 1996 and the RPT is now updating the CSP with information gathered from Regional community members. In the past there have been talks of salmon habitat improvement in the Saint Michael Canal. Chums used to go all the way up the Nunokogak River in the past and can't now due to Beaver dams; The situation is somewhat better in the Pikmiktalik River.

Community: Salmon go up the Canal to get to Nunvulnuk River. Sheefish are still in the area. Reds are seen occasionally. In the 80's the Communities of St. Michael and Stebbins requested the Board of Fish to open the area up for fishing but this got thrown out due to the Yukon Fishermen. Salmon have been caught that smell like fuel and have soft meat. Would like to see it get to where you don't need a permit to get your subsistence food. A lot of pinks go up the Yukon which are not well utilized.

Charlie: Does not see a commercial fishery opening up in Saint Michael due to allocative politics.

Community: Saint Michael has always had a subsistence way of life.

Saint Michael occasionally gets buzzed by Saint Mary's Fish and Wildlife officers (life jacket checks, etc.) Where is Saint Michael as far as subsistence?

Charlie: Last talk w/ F&G, Saint Michael was considered to be catching local stocks with the exception of King salmon which were thought to be primarily Yukon stocks. Fish in local areas are most likely to spawn there and not go up the Yukon and Unalakleet area. Does not see Saint Michael getting shut down.

Community: What has come of the DNA samples?

Charlie: Not many findings in the chums/kings. Chums in the Nulato Hills area are genetically similar (cousins.) Koyuk area chum are differently related.

Jenefer: Isn't much genetic resolution at this point. Can't really differentiate Western coastal Alaska. Kings may have differential markers but chums, we can't differentiate much.

Charlie: You can tell Kotzebue chums apart from Norton Sound chums. Has Saint Michael noticed any changes in chums?

Community: They have been late. One or two come by, sometimes none.

Charlie: Notice any declines in kings?

Community: I haven't seen any declines in fish, they're running.

Charlie: Heard of kings caught in Stebbins in October. As for the silvers and chums in the Nome area, there are twice as many silvers and a decline in chums. Are there any changes like that here? Silvers like beaver dams, a lot of silvers can be found around there.

Community: There are not as many subsistence users in Pikmiktalik (SP) as ten years ago; The ice stays longer than normal when trying to fish for kings; Saint Michael people are still putting away fish; Fall/Summer drying has been difficult with rainy weather; Expensive gas; Mesh size on net is too small for chums, the fish get caught on their midsection.

Charlie: 5 7/8 is a favorite size in Unalakleet. During the king decline on the Yukon they insisted on using 7 ½, 8 ¾ because prior to that they had been catching a lot of females. Females are important to the population, they can be 5-7 years old. Old females produce the best and largest eggs. Kings may not be so big in the future, may end up with chum sized kings.

Twenty years ago there was interest in the community to do more commercial fishing. Putting silvers in the Niukluk system. This is possible with habitat change, it would be a 7 day project, changing the falls to a rapids. How does the community feel about that? The project may affect the sheefish population but may improve the salmon runs.

Community: It needs to be done. Stebbins and Saint Michael are locked in due to the Yukon.

Charlie: Hanasaki/Spiny crab are being seen at St Lawrence Is., have any been seen around here?

Community: No.

Charlie: They may hang around the points.

Community: What did you say about the rapids?

Charlie: At Nunvulnuk, at the far end of the lake there is a lava ledge, a 5 foot waterfall. Break it down and put rocks underneath so that it's a gradual incline and the fish can swim up. That may affect the sheefish population.

Community: There are sheefish in Kuiak, next river over.

Charlie: Do not think all the sheefish would be lost? The Saint Michael Canal has slow moving water, it's a good whitefish stream. Sheefish eat other white fish. Is the community not interested in commercial fishing anymore?

Community: Saint Michael is subsistence. There are not enough people at this meeting to speak for the whole community.

Charlie: NSEDC talks about building a hatchery, it would be an expensive project. A place is needed where it would be used. There are discussions on building a hatchery in Nome with different units and place growth in different places. One place in mind was Kliktarik. If they are placed there, they can be fished for in 3-4 years. Other possible places are near Elim, Nome and Feather river. NSEDC would like to rebuild runs that got fished out. Rehabilitation.

Community: I don't feel the need for it, everyone is getting enough fish.

Charlie: It would be more commercial than subsistence.

Community: Would that be a new district?

Charlie: Yes, it would be a whole new subdistrict. If it were to happen, a camp would need to be set up and the lagoon would need to be cleaned out with an excavator. This is where the fish would need to be placed so they would imprint and return. There would be pontoons out there, nets, guys to stay with the fish.

Jenefer: Is Saint Michael interested in commercial fishing? The last study done was in 1978. Technology is advanced enough to try a project. There may be a difference, there may be no change. Looking for funding in Nome, looking at what rivers are salmon going into in Nome. Potential to repeat study done 25 years ago.

Charlie: Silvers were not even addressed in that study.

Community: Is a cannery still in the talks?

Charlie: Kilikiktarik Bay area would only be used for commercial fishing, this is just an idea.

Community: Can roe come from subsistence caught fish?

Charlie: No, it needs to come from spawned out fish. One place was almost wiped out- Karluk river, from using the wrong roe.

Jenefer: Katie is midwater trawling to capture king smolt. The mouth of the Yukon is a staging area, where they are before heading off to the Bering Sea shelf. Why are the kings declining? We're trying to figure that out. There are 10-11 years of data collected. There is a bump up of the juvenile kings caught, enthusiastic for 2017. Looking at kings as they enter salt water, NOAA was doing this and F&G may be taking over. Capturing kings close to shore. If you know of spawning sites for capelin (cigar fish) let F&G know.

Charlie: The trawling may be done by Point Romanoff.

Meeting finished at 1:30pm.

Stebbins CSP Meeting. March 5, 2014.

This meeting occurred the same day of the St. Michaels meeting. The introductory statements and staffing were the same for both meetings. Approximately 10 community members participated in the meeting. Stebbins community members have some Yukon Commercial Fishery permits. There was a brief discussion on this and the fact that previous attempts to develop a commercial fishery had been frustrated. There is a harvestable surplus of pink salmon that is not utilized in the community's mind. Subsistence is very important and the general consensus was that further attempts to develop commercial activity would bring unwelcome regulation and oversight to the local salmon harvests. Other concerns discussed focused on the health of salmon and potential threats to health. In the past summer infected pink salmon were common running sores. Chinook salmon were caught after school began, this is unheard of. There were questions on the potential impacts of the long term dumping of navigational aid batteries off Cape Stephan by the Coast Guard. There were no proposals for rehabilitation or enhancement brought to the discussion. Passive management of the salmon resource was appreciated and change was very much opposed.

Brevig Mission CSP Meeting. March 06, 2014. 12:03 pm.

Introductions: Charlie Lean, NSEDC; Jenefer Bell, ADF&G research biologist; Freida Moon-Kimoktoak, Kawerak, NR Special Projects Assistant; Johnee Seetot, NoBSRAA Bering Strait Representative

Charlie: Talking about the Port Clarence drainages and as far South as the community wants to talk about, what run of salmon would the community like to talk about? Would the community like to talk about commercial or subsistence fishing? In 1995 the RAA was formed and he CSP was written in 1996. In the process now of going through the CSP and inputting new information and making changes. Determining where the salmon are. Working on projects that both the state and locals approve of. Report needs and gather information from the communities. Forward information to F&G on ideas to better projects. Focus on salmon streams that drain into Port Clarence? In 1995 the listed salmon streams in the CSP were Agiapuk, Bluestone, Cobblestone, Kuzitrin, and Pilgrim. There is a difference in river and lake spawning grounds for reds. We now know that some reds spawn in the Cobblestone River and maybe along the shore at Windy Cove. Saw fish that couldn't be identified in the little streams of Imuruk Basin.

Community: There are whitefish in the Windy Cove area. Probably find way through streams going up the Pilgrim River.

Charlie: Glacial Lake is at the head of the Sinuk River, it's the same elevation as Salmon Lake. Fish sense he mineral composition to return to their home. Lakes are clear and alkaline. At Cobblestone, the water drains off the mountains. Where are the red salmon? Which fish does the community fish on, lake or river fish?

Community: Both. From Port Clarence to Grantley Harbor. Giiapuk.

Charlie: Biologists think about river VS lake spawners. Are the Windy Cove creeks important to red salmon?

Johnee: Does F&G have anything to back this up? It's not a typical gathering spot.

Jenefer: Do you notice a difference in the sockeye you are handling?

Johnee: Fish don't come with fishing license to tell me where they came from.

Jenefer: Is there a distinction in size?

Johnee: Are there any microchips? Should look at the species in the rivers and document.

Jenefer: It works well if the locals recognize.

Community: There are hardly any sockeyes during the summer. I got four, some are small. They used to be big. The reds seem to mostly be juvenile. We catch them at the Grantley Harbor side.

Charlie: Red salmon are usually five years old when they return to spawn. The Pilgrim weir pulled 7 year olds, the rest were four year olds, younger and smaller. Confusion with the four year old runs, may be due to ocean conditions. Reds spend two years in the ocean, there are indicators that reds stayed in the ocean for four years.

Community: Last summer, not one fish went to Sunset. Pinks didn't go up beyond Jones Creek and California Creek.

Charlie: The pinks are two years old when they return. Factors may be: Weather in prior years, the fish could have frozen out during a long, cold spell or bitter year. Humpies are easy to freeze

out, they're not very smart. Agiyapuq chums are focused, they spawn where springs are, humpies spawn anywhere. During dry years, humpies do better. Reds spawn in lakes and a lake surface is constant. There is a research project available if the community is interested in it. It's a fish scale project. Lake and river fish scales look different. You can be hired to pull fish scales from the fish dying in your fish rack. This way we can determine where the salmon are coming from.

When the Imuruk Basin and Tuksuk get warm, the salmon die off. They come down into the streams to cool off. Go back to Pilgrim and up to the Lake. If mines strip graphite, that action will warm up the waters, affecting the salmon.

Community: Not only salmon spawn there, so do whitefish, herring and pike. The whitefish with the short, broad nose. Seals and young ugruk hang out at Imuruk Basin year round. Beavers are jeopardizing the spawning areas, creeks are drying up. Overpopulated with pike.

Charlie: In the 80's there were beaver in the Koyuk River but none in the Elim area. Now there are beaver in the Elim area and up to ten years ago they are here as well. Adult chums and pikes can't get over beaver dams but they are a good incubation system for silvers. It's a tradeoff. There's an odd-even year with pinks and now there is an odd-even year with silvers. Silvers make a lunch out of other salmon. I think silvers are a bigger problem than pike.

Community: A graphite mine would affect the salmon.

Charlie: It would be good to do a baseline survey in the mining area to find out what species are there.

Johnee: It seems like F&G would have baseline data on this.

Community: Pikes are eating salmon from upriver. Caught a big pike with a whitefish net. Warmer temperatures are coming to this area.

Charlie: Kuzitrin pike numbers are the strongest in the state. They are less used and bigger than those at Manley Hot springs, on the road system. During studies on pike,. Fifteen years ago, people were catching more pike.

Community: There are a lot of bullheads around here, they get caught in the nets. Every now and then we catch a wolfish in the bay, coming from the deep sea ocean. There are different fish coming in the Bay.

Charlie: Where shall we focus work on? Concerns on mining, port development?

Community: There is increased parking in the Bay, an increase of big ships. Our salmon had a fuel taste two years ago.

Charlie: The Nome Port Commission- City of Nome are interested in having an Arctic Port at Nome, but the Coast Guard is interested in Port Spencer. The state and mining people want it at Cape Riley. The Corp of engineers did a survey on where to place it. The Coast Guard is interested in redeveloping their area. There's a freight train coming at you, there is a big port coming. Brevig Mission is in the crosshairs. Brevig and Teller should get together and write down where it should be and who should manage it so when an oil company shows up, someone here has a piece of paper to give to them. People tend to show up when everyone is out of town, hunting or doing summer activities.

Community: We have a meeting scheduled with Teller about the port, after Iditarod.

Charlie: The old bridge by Brevig Lagoon is a third potential dock place in Port Clarence. There are still more possible sites at the City of Nome or in Golovin Bay.

Community: What about Kotzebue?

Charlie: Thinking Port Clarence because it's close to the Bering Straits. Rigs fuel up right out here, no one inspects them. A port may be a source of revenue, it could receive income and use that to pay someone to inspect them and manage the traffic.

Community: Within a two mile radius, the rest is State navigable waters.

Johnee: Federal or government authority?

Community: City.

Johnee: Brevig needs to establish who has authority over what.

Community: The state, feds, private companies are trying to blast through this as fast as they could. What we can do is charge fuel companies .05 to .10 cents a gallon and use this to offset costs to inspect their boats.

Charlie: The City of Nome charges about one cent per gallon and have HAZMAT people inspect each ship.

Community: The boat that sits out here has a bunch of hoses on it.

Johnee: Need to investigate who does re-fueling.

Charlie: After the Kougarak Road was completed past Salmon Lake, the salmon stock crashed. It got fished down by Nome residents in the 50's and 60's. Now it goes up and down. Fertilization started in 1997. 2004 was the best year, 100,000 returned. Some were caught and some spawned. There were so many, they ate all the plankton and were starved. Too much fish were put in the lake. Look at it as over escaped, the juvenile salmon killed off the lake plankton. We now try for a much smaller target. The original plan assumed that is if the population of salmon was high we could establish a commercial fishery. Five years ago, Brevig Mission did not want commercial fishing, I'm not asking the community if they want commercial fishing now. We have modified our goal to only produce enough salmon for subsistence use.

Community: Imuruk Basin has heavy bloom.

Charlie: There is nothing eating the plankton due to bad years of salmon numbers. An ideal lake run would look like 10,000 harvested, 20,000 escapement.

Community: What about the further South commercial fisheries? The kings are overfished there. It's a good thing to have money but it's a good thing to eat too.

Charlie: In SVA, GAA, WBB, SMK people were not interested in commercial fishing. In other communities they want commercial fishing. Half want commercial fishing, half don't.

Community: Brevig Mission is a subsistence place.

Charlie: Talking to elders, fishing was good when they were young. Pilgrim River had strong runs in 1958.

Johnee: What are you basing your numbers on?

Charlie: 1980's in Nome, subsistence and commercial.

Community: King salmon up here are nonexistent. Ten to fifteen years ago we got two to three a day. We are lucky to catch one today, they are hardly seen anymore.

Charlie: Stebbins says he same thing. Not just in Brevig Mission, Alaska as a whole is in terrible shape for kings, in the Southeast and other places. There are changes in recent years, some natural, some manmade. The cigar fish population dropped, in the 80's they were everywhere. There was a run in July 2013, which was one month late. Cigar fish are a major food source for kings. Capelin went away and kings switched to herring. Herring carry *ichthyophonus* and infects 1-2% of the population each year. There's a die off of bigger kings for other reasons too. Sports fishermen like large fish and commercial fishers use big nets to catch big females and they are the ones that have the most eggs and the largest individual eggs that have the best chance of survival. Should be eating the 5 year olds and letting the 6-7 year olds spawn

Community: The jack kings are not coming in until towards the end of fishing, during the fall. They're not big and there aren't a lot, maybe five to six.

Charlie: I don't see kings coming back for years.

Jenefer: The Yukon gets a lot of attention, Norton Sound gets put on the wayside. There is a statewide problem with kings. Nushagak is one bright spot. The legislature is pumping money in a study. Cannot highlight specific reason of decline of kings. There is a pattern of highs and lows with kings, a cycle to kings absence and presence. Right now we're in a low spot. A 30-35 year cycle?

Johnee: Saw a nugget article declaring a fish disaster in the Yukon and Kuskokwim.

Jenefer: In the Norton Sound, the kings have gone down a lot while other species are doing well such as crab, other species of salmon, land animals. Count yourselves lucky in the Norton Sound.

Johnee: The councils need to come up with their most important salmon stocks.

Charlie: Last summer a test fish crew went up the Cobblestone to catch reds but they went up too late. An idea to put thermometers in rivers to show there are cold water spots in Tuksuk Channel and Imuruk Basin. Test fishing needs to be done at Windy Cove to see if reds are spawning or just going through there.

Community: The time to fish for reds is in July when the South winds come in. Cool water goes in the Imuruk and they start their runs when the water is higher and cooler. We don't fish during South wind, it's too rough. River fish that swim upriver lose their fat and that's when we like to get them. Other fish, we catch when they first come in, when they have salmon roe. During the first run of 2012 they smelled like gas, two years ago. This year I didn't notice anything. That was the time the transfer barge was there, transferring oil to bigger barges.

Jenefer: We heard that from Stebbins people also.

Community: After pan frying my fish, they smelled like gas. I tasted gas in my fish. My bellies tasted like gas. We need a harbor master. The bycatch by the Pollock industry, is that being addressed? 300,000 bycatch last year, that's a lot of eggs that were to be hatched. Due to the Pollock industry.

Charlie: Kings and chums get caught as bycatch. The numbers have been cut in half. Bycatch by trawlers in the Pollock industry focused on kings. Half the bycatch are bound for western Alaska

happens during the first week of June to the first two weeks of July. Bycatch is catching less kings but there are also less kings.

Community: Does F&G know we catch shrimp? During the 80's studies a lot of shrimp were near Cape Riley

Charlie: Snail fisheries investigated but… If king salmon eggs were planted in Salmon Lake, the kings would eat the reds. People need to think about their choices, shrimp, etc.

Johnee: How come they can't get their own fishermen?

Charlie: They do have their own fishermen.

Johnee: What can we do to help you in the future? Besides taking scales off fish.

Charlie: For diseased fish, get it in a plastic bag, out it in the fridge and send it in. Do not freeze. Brevig Mission does not want commercial fishing, is concerned about subsistence. Know the importance of the graphite mining area, do you do subsistence activities at Cape Riley? The stretch of Coast at the old bridge site is a deep end. At one time there was talk about a dock there. Consider where the Port may be.

Community: Gets bad at Kuuslok during fall storms, bad South winds. There's a new channel out there, every year it changes. During the last fall storm, some subsistence camps were lost.

Charlie: Brevig Mission people know where it should be.

Community: We need to protect our area and our way of life. I don't think we'll be able to stop the state once they figure out where they want to the port. This is going to affect our subsistence way of life, it will affect our salmon. We need to put it on paper how it's going to affect our way of life and that we don't want this to happen. Regardless, it's still going to happen. Majority of the people miss red salmon here, it was used for eating and bartering. Humpies are used heavily in Brevig Mission.

Johnee: We need to develop a local person to get answers, some questions asked are not answered. Document our own local data, temperatures, etc.

Community: We're starting to see sheefish.

Johnee: There are plenty of young people here than can go to data collection training.

Charlie: There is a new kind of crab, a spiny crab that showed up for the first time 5 years ago in Diomede and then on to Saint Lawrence Island. It's tough, good eating and increasing in population. Last year the first one was caught in Golovin Bay, I wouldn't be surprised if you start seeing them here soon. They are caught in Japan and all over Asia.

Community: Any new species coming from that area since the earthquake?

Charlie: Taking water samples from Gambell. Stellar sea lions that are branded with numbers have been seen at Forrester Island near Ketchikan and then on to Saint Lawrence Island in the same year.

Community: I saw a sea lion in Grantley Harbor last July, they're fast.

Charlie: They eat salmon.

Community: I saw on the news that spider crabs 14 feet long were seen in Russia.

Charlie: We're likely not to see anything from the Japanese tsunami due to the current pattern. As far as invasive species go, these crab are extending their range.

Johnee: What about with increased shipping?

Jenefer: In the ballast water it can be possible.

Johnee: Is there any documentation of non-invasive species already in the area?

Jenefer: If locals are getting anything, give someone a call.

Community: I saw a different species at the Point, it was long and had lots of feet. The head had no eyes and it had a sucker on the bottom.

Charlie: They are found in deep water. I think you saw a polychaete worm.

Community: We don't want to see any more trawling boats around here. They disturb the vegetation that the fish live off of. A few years ago there was one going back and forth.

Johnee: How many more studies are there?

Charlie: There will be more, can request the State not to go close to shore.

Community: What gets killed off gets washed to shore.

Charlie: Golovin had the same problem. We can talk to NSEDC and any boats they hire about not going close to shore.

Community: More clams are being washed up in the Port Jackson area.

Charlie: During the big fall storm, animals from 30-40 feet were pulled up.

Community: Is there going to be a report after this?

Charlie: Writing a report, where the salmon are, communities ideas. Information like how kings are in the decline, reds are a major source, projects that communities feel would be acceptable in their areas. The King Islanders are seeing more chums at Wooley Lagoon. There are different needs in different places.

Community: At Teller Spit there is a lot of snagging going on. Not only Teller but Nome residents snag there. We seine for reds at the weir.

Charlie: Fish cops are there a lot.

Community: Teller people – stay out of withdrawl water, navigable waters are free.

Charlie: There is no authority over navigable water.

Community: Wales people told our young hunters that they can't hunt walrus in their waters.

Johnee: Does a federally recognized tribe have any authority at all?

Jenefer: Not on navigable waters.

Charlie: Up to the wood stacks on the beach.

Community: Is there any water temperature studies on the coastline? Is it changing?

Jenefer: Information does exist, collection of basis survey on oceanographic data from Bering Sea to the Chuckchi Sea for quite a while. There are warming trends but it can't really be said that it's warming up.

Charlie: The trawl surveys were doing deeper underwater temperature recordings.

Jenefer: Due to ice cover stationary water temperature recordings were not able to be done.

Community: Do currents have anything to do with escapement? Some summers we have low tide.

Charlie: Cocolithophore diatoms it has a glass like shell and is bright green in the Imuruk Basin, if fish eat it they die. Fish have been found that died from that, it's bad news for reds. In the satellite images, there are large blooms of that.

Community: I've seen them, they sit right on top the water.

Charlie: We've tried to get some, scientists think it's a deep ocean algae. I've seen it onshore. Good algae is good food for the fish but there are also bad algae. In cold years you don't get the bad algae, in warm years, you do.

Community: One summer there was reports of salmon sharks, are they still washing up?

Charlie: Heard about that on SLI. Heard about great whites near SLI. Great whites eat sea lions.

Community: We see sea lions every now and then. Do sea lions like warm or cold water?

Charlie: All the sea lions that have been seen are males, from Diomede, Fairway Rock, Brevig Mission and Saint Lawrence Island. No females or young have been seen. Southeast Alaska sees sea lions all over the place.

Community: Nome River used to catch a lot of fish, I heard it slowed down like at Brevig Mission area. Is it due to warmed water?

Charlie: Safety Sound has come back. Commercial fisheries overfished in the 70's and 80's. Eldorado and Flambeau have enough water for good streams. Others are too low and freeze down. Pilgrim and Kuzitrin are good enough to where they do not freeze down. Where are the salmon? When you subsistence fish, do they go up the Agiapuk?

Community: There are fish up there for drying. It's getting expensive.

Charlie: Gas costs are making people pull back everywhere.

Community: Over the years, climate has been the main factor for changing everything. Long ago we had 80 to 90 degree temperatures and full fish racks of reds. Another factor is rain and weather. Fish spoil quickly in the rain. Growing up I was told we would switch weather with warmer climates and then there would be a deep freeze. Springtime there has been no snow in the beach and our ugruk spoil, it's getting worse every year. There are Dolly Varden in Don Creek. There are trout in California Creek. Trout spawn in iuluk.

Charlie: Dolly Varden can spawn in the coldest places.

Community: Beluga used to go up the Imuruk Basin, they don't anymore.

Charlie: Due to the machine vibrations off the coast guard station?

Community: Starting to see beluga again.

Charlie: Beluga are matriarchal and pass down habitual knowledge to young. Beluga females should not be killed off.

Community: Are there any other fish studies?

Charlie: Crab, herring, tomcod epidemic, there is a fungus that gets in the gills.

Community: In the past we had early freeze ups in October. The Bay is still moving around too, broken ice. Lost River – no one has seen anything in there.

Teller CSP Meeting March 6, 2014. 5:10 pm.

Present: Charlie Lean, NSEDC/NoBSRAA, Jenefer Bell, ADF&G, Freida Moon-Kimoktoak, Kawerak, and community members

Joe: Jack kings come in late Fall just before freeze-up, they're good eating. They have bright red flesh, grey skinned and are not marred. There are also salmon (Maybe steelhead) that look like a red but not as bright, under the ice upriver. They're bland tasting but good for drying. Bigger than a humpy with a big, thick tail. Doesn't taper very much, the upper side is dark blue with a line down the middle.

Charlie: Plan written 20 years ago, trying to re-write it. Add salmon that may not be on the list. Teller was for subsistence more than commercial. Half of the communities surveyed say subsistence is preferred over commercial. King stocks need help, silvers are doing well. There are different ideas for a hatchery. There are no plans to do anything in the Teller area. The closest plans to Teller would be work in the Feather River, Tusuk River.

Agnes: Leave Tuqsuk Channel alone. Elders want to set net salmon nets upriver when the fish are running, F& G said no.

Jenefer: There haven't been restrictions on Imuruk Basin for a while.

Agnes: F&G stopped people from setting nets in Imuruk. No salmon hatchery around Teller, we have enough problems.

Charlie: That's what Brevig Mission says too.

Joe: Was NSEDC going to abandon hatchery ideas? Was that the plan?

Charlie: Not abandoned but put years back. The plan is to keep going with rehabilitation programs and work with existing runs that need help.

Joe: In Nome? Is everyone else content?

Charlie: Communities want to do something, Council, Elim, White Mountain is thinking about it.

Agnes: The salmon taste funny.

Charlie: Brevig Mission said it tasted like gasoline? Saint Michael said the same thing.

Joe: That was a couple years ago.

Agnes: It tasted funny, I just dumped the salmon I was cooking.

Charlie: Cost to rent Boulder Creek over fifty years would be expensive. If we can't do kings in a hatchery then why build a hatchery. Can't do silvers, could do chums but why do chums when it isn't needed.

Joe: What size of commercial fishing is Western Alaska getting. No one is ready for commercial fishing here. If king numbers were higher. People here are relying on food stamps and that's going to dry out. Can build a commercial industry for the future. Subsistence is a priority in this area. Chums are sporadic.

Charlie: Focus is on the kings. Kings take a lot more water in a hatchery.

Joe: A hatchery is on the backburner. Rehabilitate the weakest runs and not develop anything new.

Charlie: It was an odd year for pinks on the Nome River for subsistence fishing.

Joe: Teller is getting increased fishing pressure. Not uncommon for ten Nome people to be fishing in Teller. They're after chum. Building chums up in Nome would be a good idea.

Charlie: Chums are put in Snake River and the Nome River in the past. They're all doable. Small streams like Sunset Creek, during a cold winter they freeze down. Solomon and Penny River freeze down, it depends on the weather. A big scale hatchery would cost 10 million including a least of 1.5 million a year. A joint silver/chum hatchery. A chum heat hatchery would cost half that.

Joe: The aquaculture meetings are not the RPT team? Does F&G write parts too?

Jenefer: F&G writes the stocks and harvest portion.

Charlie: Writes where fish occur, what's working, what's not.

Joe: Who is the aquaculture paid for by?

Charlie: NSEDC – 100,000 this year. Kawerak is employed by that through the grant.

Joe: Salmon has been the backbone of our existence. It's traded, bartered, commercial and subsistence fished. Salmon has not been a steady run, these past few years have been sporadic runs.

Charlie: At the graphite mine site in Windy Cove, schools of fish have been seen along the shore and going up Cobblestone. One theory is that the schools of fish are going up to cool down.

Joe: Climate change.

Agnes: The River got warmer in August, partly in July too.

Charlie: At Pilgrim all the streams come out of the mountain. Kuzitrin gets warm, Pilgrim not as warm.

Agnes: The Imuruk Basin stream has warm water.

Charlie: The USGS put thermometers in the water; it was very warm for two months. It stayed 60 degrees and warmer.

Joe: The lake is definitely warmer than the River. Chums are having a weaker run here, reds bounce back and forth. Kings are down. Heard somewhere, maybe Columbia where they completely re-built the king run. They were down to 78 kings and got them up to gang busters. Must have cost a lot of money.

Jenefer: The numbers are probably significant due to being so low.

Charlie: In Sacramento the feds do the fish work, not the state. They tag fish and can tell how fish are related, they can go back 3-4 generations.

Joe: Is Brevig Mission happy with chums?

Charlie: Yes.

Jenefer: Their favorite is reds.

Joe: Here the reds are the top of the food chain also. Chums are the money maker. Not enough chums to sustain dry salmon culture.

Charlie: Where would you put it?

Joe: Leave the Pilgrim to reds. Iguipak, Kuzitrin? Kavairlook Creek? Any counting on Igiupuk?

Charlie: Aerial surveys.

Agnes: Leave Igiupuk River alone.

Charlie: Igiupuk had big fall chums. The Pilgrim and Nome River chums are summer salmon and not as big. In Igiupuk, the dolly's looks like Kotzebue fish. The Norton Sound chum and Kotzebue chum detect the geology of rocks and minerals , they home in on the smells that are similar.

Agnes: There are too many bears, they break into camps.

Charlie: Small increase in bears, no bounty. Everyone has seen an increase in bears.

Joe: Re-build the red run, as for the chums I'm not happy with the run. Got enough but it was twice the job it used to be.

Charlie: Chums are down and are going down. Trading chums for coho's. For the silvers, the beavers provide a nice habitat.

Joe: As for the beaver, there has been no snow cover, I have a suspicion that beavers froze out. No snow, cold snap in December and I've seen no sign of beaver around the beaver huts.

Agnes: Ice isn't as thick as it used to be when we go pike fishing.

Joe: The little creeks sapped down.

Charlie: I saw one beaver hut at Anvil creek but no activity.

Joe: The bycatch issue. Pollock fishery with NSEDC has been going on for 21 years with all the villages. The industry turns a blind eye towards bycatch. They do not want to kill the goose that lays the golden egg. At the rate they're harvesting Pollock, I don't know how fast Pollock reproduces. Are Pollock going to be re-built? They are the cornerstone of the Bering Sea. Is it going to affect us here or are we already feeling the effects?

Charlie: Chums and kings are caught by bycatch. The bycatch of kings is troubling. The industry catches half of what they used to. I don't think it's a big deal for the chums. Suggestion for the industry to turn off Pollock fishing during late June and early July. Asian Fish are away more to the West. Bycatch of ¾ of chum are bound for Asia. In my opinion, catch the Asian chum. If anything, that's when it should be done. Pollock fishing is the biggest one in the industry. Kings are caught in winter, keep going in summer. Best strategy.

Joe: NPSI, two years ago they talked with long liners. All for salmon enhancement, the cure all for us. Not so sure they would help finance it. The Pollock industry is here to stay, with researching the Pollock industry I haven't found the entire reproductive history of Pollock.

Charlie: The roe content on Pollock are low, average size Pollock are small. Roe quality was up this year.

Joe: Kings statewide are basically on the decline. Everything else will follow suit in due time.

Jenefer: May never really pinpoint what is going on with the kings.

END OF MEETING: 6:30pm.

Nome Community meeting (NoBSRAA). Nome Eskimo Community, Trigg Hall. April 03, 2014.

NoBSRAA board members present introduced themselves: Roy Ashenfelter, Lieudell Goldsberry, Tom Gray, Kevin Keith, Charlie Lean, Perry Mendenhall

Others present at the meeting: Jim Menard and Scott Kent (ADFG), Freida Moon-Kimoktak, Louie Green, Jr., Megs Testamarta, Earl Merchant, Chuck Fagerstrom, Kevin Bopp, Adam Boeckman, Austin Ahmasuk Bill Danker, Ashley Brown, Michael Sloan, Paul Kosto, Wilfred Anollin (sp?), Mikey Lean, Rose Fosdick, Nancy Mendenhall, Patrick Katongan.

Charlie Lean went over the functions of the Northern Bering Sea Regional Aquaculture Association (NoBSRAA or RAA) and the Regional Planning Team (RPT) and introduced the NoBSRAA Frequently Asked Questions (FAQ) sheet. The RAA is recognized by ADF&G, and recently signed an agreement with the State of Alaska to draft a regional comprehensive salmon plan. The RAA board represents 12 groups from the Bering Straits Region. The RAA will meet in November and shortly thereafter the regional planning team will meet. The RPT is the team that reviews and approves the regional comprehensive salmon plan and this should be completed by 2015. This plan will be a working document meaning it may be revised each year. Portions of the plan are written by Alaska Department of Fish and Game. The plan will include descriptions of projects from the past and provide information on whether they were successful or not. The majority of the communities in the region have been visited to gather input for the draft updated plan.

Scott Kent provided a power point presentation regarding salmon fishery enhancement policies, overview of Pilgrim, Nome, Golovin subdistricts and salmon stock harvest and escapement trends, and described past and ongoing projects.

Discussion of potential rehabilitation and enhancement priorities for each area and/or river.

Tom Gray posed the question “What kind of fish does Nome want?” The following comments were brought up during public comments: Silvers from the Nome River; Reds, silvers and kings; Build a hatchery; Silvers in any ecosystem; A hatchery can be built at Moonlight Springs without impact; Family fishes on the Nome River for pinks and coho; Family goes to Nuuk, Flambeau, Sinuk and Eldorado, prefer pink, chum and silvers; DOT removed pavement on road and family does not dryfish at their camp anymore, it’s too dusty; Drop in abundance and diversity in Cripple and Penney; Put chums and coho in the Nome River; Fertilize Salmon Lake; Reds, Silvers, coho; Commercial fisherman would like to commercial fish in Nome but has to go to Golovin or Unalakleet; Create terminal fishery on the Nome River, Hastings Creek or Anvil Creek; Fish produced in a hatchery need to be segregated from wild stock; Pinks for dried fish, coho for freezing; Indian tribes in Washington and Oregon started hatcheries in the 90’s and their fish numbers are back; Certain streams are better for certain species, think of it as a community, reds here, chums there, silvers here.

Meeting adjourned at 8:25pm

Shaktoolik CSP meeting. Annex Building. March 2, 2015. 2:00 pm.

In attendance were Dale Sookiyak, Gary Bekoalak (sp?), Toni Sagoonik, Eugene Asicksik, Rhoda Asicksik, Charlie Lean, Scott Kent, Art Nelson.

Charlie Lean provided a review of the information in the draft of the CSP pertinent to the Shaktoolik area. There seemed to be agreement that this information was accurate. Additional concerns that were raised include: A desire to return to 7" gillnet gear for king salmon fishing; Complaints that some people set gillnets all the way, or nearly so, across the rivers and a lack of enforcement about this; Observations of occasional sockeye salmon in the Shaktoolik River. One participant noted that he caught 3 last summer; Concerns about too many beavers and the low value of pelts that keeps trapping effort low. A discussion about the tradeoffs of beaver-altered habitat followed. Beaver-altered habitat also creates algae/aquatic plants and this can clog jet units on outboard motor, not to mention the sticks beaver leave in the river. It was noted that the Tagoomenik River, in particular, has a lot of beavers and beaver dams; A concern was raised about the fact that Shaktoolik fishing is tied to Unalakleet, and a desire to de-couple management actions for the two subdistricts; It was pointed out that many subsistence harvesters now bring their upriver catch back to town to process, instead or processing them upriver and putting the carcasses back into the river, resulting in fewer nutrients feeding the river; Someone pointed out that the since the 1980's there hasn't been a lot of shifting in the channels of the Shaktoolik River, especially in the last 3 or 4 years. Except in one side channel where there had been upwelling and a spot where fall chum salmon would spawn. This area of upwelling is now in the main channel and lot good spawning habitat for the fall chum salmon. This was near the area of Jacob's slough Bonilla's Camp.

Unalakleet CSP meeting. Unalakleet Community Center. March 2, 2015. 6:00 pm.

In attendance were Chuck Degnan, Fran Degnan, Wes Jones, Merlin Johnson, Wade Ryan, Charlie Lean, Scott Kent, and Art Nelson.

Charlie Lean provided background on the development of the draft CSP and summarized the issues raised and suggestions from the prior meeting in Unalakleet which have been incorporated into the draft. There seemed to be general agreement that those were still accurate.

Charlie asked for clarification about Point Creek and Spruce Creek, where there used to be fish racks and if those were for salmon or trout. People replied that area was used opportunistically for salmon, herring and trout. Charlie asked if those creeks had salmon returns and one person replied that it depended on temperature and water levels.

It was suggested that the CSP address the impact of salmon bycatch in the Bering Sea fisheries, and consideration should be given to those who live in small communities and depend heavily upon the salmon resources. Charlie Lean replied that there is a section that talks about bycatch.

Concern was voiced about the impact of catch and release mortality on Chinook salmon by sport fishing in the Unalakleet River. It seems that C&R is being encouraged, and people feel strongly that sport, including catch and release, should be completely closed when Chinook conservation measures are needed.

Someone pointed out that the drying season is important for salmon harvesting.

Health issues are becoming more of a problem as people shift away from a traditional subsistence diet. Foods from the store aren't as healthy and lead to increased obesity, diabetes,

etc. It was also noted that with high transportation costs, store-bought foods are expensive and people don't need to spend as much on purchased food if the salmon resource is plentiful.

A question was asked about mercury content in salmon and Scott Kent pointed out that mercury levels in fish are more of a concern in fish that are long-lived and higher up the food chain. This is generally not a concern for salmon but can be for species like pike.

Someone said that there should be better or full utilization of salmon processing waste, like heads, bellies, etc. What some see as waste is actually the most nutritious parts of the salmon.

Someone asked about allowing hook and line for subsistence and Scott Kent pointed out that when previous proposals to allow this, Unalakleet did not want it, so it was excluded. It was also pointed out that the Board of Fisheries proposal deadline was approaching and people could submit a proposal for this if they wanted the Board to consider the matter. A discussion of the pros and cons followed, with most agreeing that it was not a good idea since all Alaska residents would qualify and it would be a sport fishing loophole.

Someone pointed out the importance of historical barter and trade within and between villages. Villages with salmon trade with other villages for items like muktuk which may not be locally available.

It was requested that when the CSP is finalized, a copy should be sent to the Bering Straits Coastal Association, Scott Dickens project manager (phone 625-1414)

Stebbins CSP meeting. Stebbins City Hall. March 3, 2015. 11:00 am.

In attendance were Brian Steve Sr., Francis Pete Sr., Joe Washington, Morris Nashalook, and 4 other residents, Charlie Lean, Justin Leon, Art Nelson

Charlie Lean began by explaining the process being undertaken to update the CSP, and summarized how the comments from the previous meeting in Stebbins have been incorporated to the current draft. He summarized those points and there seemed to be general agreement that this was accurate.

Specific additional discussion went into the point that most people in the community would prefer to not have a commercial fishery in their area out of concern for its impacts on the local subsistence opportunities and to also allow subsistence fishing to occur with a few or no restrictions.

One resident spoke of the need to count/document the salmon runs in their local rivers—particularly the Nunakogak and Pikmiktalik Rivers in order to prove that there are local fish to harvest and are not primarily catching fish bound for other management areas like the Yukon…and this can help avoid fishery restrictions from these other areas being extended to the local area.

Several residents raised concern about the number of beavers in this area and their impacts on salmon populations. Charlie Lean explained that while beaver dams may impact some salmon like pink and chum, they are likely to be beneficial for coho salmon populations. Charlie also said that a very cold winter in recent years killed a lot of beavers but in many streams their dams still remain and aren't getting washed out when flooding occurs.

One person observed that there were many more very small Chinook salmon in 2014 than usual. Charlie Lean said that there have been some other indications that 2016 may see a better return of Chinook salmon and this observation of small kings is consistent with that.

Charlie Lean spoke to the habitat-related idea to help fish (salmon and sheefish, in particular) passage above the volcanic shelf in the Nunvulnuk River.

One person asked about the commercial whitefish fishery that occurs on the Yukon and if something like that would be possible in their area. Charlie Lean spoke about NSEDC's efforts to help develop this whitefish market along with YDFDA and said it would be helpful if they had a better idea about which whitefish species are present in certain amounts. He suggested local fishers provide them with fish samples in order to determine the species present.

Saint Michael CSP meeting. Saint Michael Community Room. March 3, 2015. 2:00 pm.

In attendance were Bobbie Andrews, Emily Lockwood, Emily Kobuk, [airport driver?], Charlie Lean, Justin Leon, Art Nelson

Charlie provided background on the process to develop this update to the CSP and the prior meeting held in Saint Michael. He summarized the information from that meeting which had been incorporated into the draft. There seemed to be general agreement that this information was still accurate.

Similar to the meeting immediately prior in Stebbins, the general sentiment was against commercial fisheries in the local area out of concern for its effects upon local subsistence opportunity and that it could bring restrictions to the subsistence fishery. It was pointed out that this wasn't universally supported in the area, but that most people felt this way.

The attendees all arrived very late due to conflicting meetings and miscommunicated scheduling. The Presenters had a plane scheduled and weather was going down which contributed to the termination of the meeting as scheduled. Draft copies of the plan and contact information were distributed to allow for further comments.

One individual mentioned that commercial fishing in the Unalakleet subdistrict often has a noticeable effect on the fish abundance in the Golsovia area. Charlie pointed out that the Golsovia River was in the southern Unalakleet Subdistrict which allows commercial fishing very close to the mouth.

Golovin CSP meeting. Golovin Tribal Building. March 9, 2015. 11:00 am.

In attendance were Jack Fagerstrom, Carol Oliver, Curt Oliver, Charlie Brown, Shawn Peterson, Annette Aukongak, Toby Anangazuk, Washington Takak, Charlie Lean, Art Nelson, Jim Menard

Charlie explained the previous CSP from the mid-1990's and the process being undertaken now to revise the CSP. He summarized the input received at the earlier meeting in Golovin, held on January 31, 2013. Charlie also summarized the way this input has been included in the current draft of the revised CSP.

Jim Menard provided a handout with salmon harvest information from this part of Norton Sound and spoke about the patterns/trends among these harvests.

Comments were made that trout were in all the rivers and that they were a predator on salmon eggs and juvenile salmon. Trout fishing is very good when the small salmon are leaving the rivers. There are also a lot of terns that feed on the young salmon.

Concerns were raised about all the additional sport fishing traffic since the recent State record grayling was caught from the Fish River in 2008.

The Niukluk River vehicle crossing/ford at the community of Council is a concern because of the harm to fish habitat and the pollutants that wash into the river from the cars and trucks.

There will be a need to eventually limit boat size and horsepower on the Fish/Niukluk Rivers to minimize habitat disturbance. Charlie Lean spoke about the findings from some studies on the effect of boats in shallow river waters and impacts to salmon eggs in the gravel; generally that as long as the disturbance was at least 18" above the bottom, the impact was less, but became worse in shallow waters, and with jet units/jet motors.

Increased vessel traffic in the region has at times, led to disturbed bottom habitat in the shallower waters and eelgrass in Golovin Bay when ships/tugs have pulled into the bay to seek refuge from rough water/storms out in Norton Sound.

Whitefish are predators on small salmon and someone asked about the possibility of a local commercial harvest on whitefish. Charlie Lean and Jim Menard mentioned there is already some limited opportunity to fish for whitefish and explained the licenses steps that people should follow.

There a lot of pike in many of the sloughs of the Fish River and concerns were expressed about their predation on young salmon.

Several people commented that the announcement to close subsistence hook and line fishing for Chinook salmon in 2014 was confusing and some thought it meant a complete closure to subsistence fishing.

Sockeye are caught occasionally as the chum run is tapering off and before the coho salmon begin to show up in better numbers. Charlie Lean mentioned that there are certainly some river spawning sockeye in the Fish/Niukluk rivers and there is a particular spring in the Niukluk River that almost always has "a few hundred" spawning sockeye salmon.

Last year (2014) grass and algae became more of a problem than other years. It fouls up nets and clogs jet motors.

Concern about impacts of shallow-running boats, especially jet motors, on salmon eggs in the gravel.

In response to a question about salmon hatcheries and instream incubation boxes, Charlie Lean spoke to NSEDC's difficulty finding an adequate water source (in both quality and quantity) for a hatchery facility. Charlie also said that instream boxes have very specific needs like adequate flow, quality and head (force at which the water will flow).

Sheefish haven't been very commonly caught in this area in 20 years. People used to catch them in the spring, before salmon arrive.

Someone asked if there would be any more beach cleaning efforts in the region. Charlie Lean said that the grant that funded that in the past has run out, and without additional funding NSEDC can only do it on a much smaller scale.

Concern about radioactive debris or water from the nuclear disaster in Japan. Charlie Lean explained that seafood in Alaska has been tested and shows no detectable radiation above what is naturally occurring.

In response to a question about diseased fish, Charlie Lean explained that people can call ADF&G or NSEDC and ask about sending in diseased fish for pathology testing; it is very expensive and has strict handling requirements (must be refrigerated and not frozen, only certain kinds of containers, etc.). He also said that ADFG has a very helpful book that explains common fish diseases (with pictures).

A question was asked about a tagging program on northern pike in the Fish River. Jim Menard said he was unaware of any ADF&G study involving pike tagging, but perhaps this is something being done by BLM. Menard said he would inquire about this.

Peters Creek has a lot of pink salmon in some years.

Charlie Lean asked if anyone goes over to Portage Creek for salmon. Replies said "no", but that some people did go over there for herring roe on kelp in the spring.

Concern expressed about the amount of beavers in area rivers, and especially for Chenik Creek. Additional concern because Chenik Creek is Golovin's water supply. Charlie Lean explained that ponds created by beavers were probably beneficial for coho salmon, but not likely good for chum and pink salmon.

White Mountain CSP meeting. White Mountain Tribal Hall. March 9, 2015. 2:00 pm.

In attendance were Peter Buck, Henry Titus, Amos Brown, Carol Brown, Colin Lincoln, Charlie Lean, Jim Menard and Art Nelson.

Charlie Lean began the meeting by explaining the need to update the old CSP and the process being undertaken to do this. He summarized the comments and concerns that were heard during the last meeting in White Mountain (January 30, 2013), and how those had been incorporated into the current draft of the CSP.

A question was asked about the high water that interrupted operations at the Fish River counting tower last summer (2014). Charlie Lean explained that all towers or weirs have periods of high water that interrupt operations. He pointed out that 2014 was the first year of this new project but acknowledged it was down longer than it should have been.

Someone asked if fish eggs are tested for contaminants/pollutants with they are collected for hatchery incubation. Charlie Lean replied that they are not, but are tested for disease (pathology). Charlie further explained that contamination or accumulation of pollutants was more of a concern for longer lived fish, predatory fish that don't migrate long distances.

Jim Menard provided a handout containing harvest information for the area and spoke about the patterns of trends of subsistence and commercial catches.

Someone asked about salmon bycatch in the Bering Sea and it was explained that Chinook bycatch occurs more during the winter months in the pollock fishery, and chum bycatch is more in the summer. 2014 had higher Chinook than the previous three years but it is still relatively low. Vessels delivering to the shore-based processing plants have more of a problem avoiding salmon bycatch than do mothership and catcher/processor operations.

For local fishers, king salmon are not as important because there aren't very many. Chum and pink and coho are more important for subsistence and commercial fishing in this area.

Charlie Lean asked if people felt that there were enough chum salmon at this time. It was said that chum numbers seem to be okay but are not as high as they have been in the past. They are caught at about the same time with pinks which are very strong in the even-numbered years. The chums can be harder to dry if the weather is bad and because they are larger fish than the pinks. Drying is the preferred method of preparation for both chums and pinks.

People were asked about coho salmon and they replied that the coho can be valuable, but are sometimes hard to catch since they move upriver quickly when the water gets high.

Someone asked if Asian-origin chum salmon have ever been caught in this area. Charlie Lean explained that a small (~5%) percent of salmon will stray from their home river. He also explained that studies on Dolly Varden have showed that they regularly go back and forth between spawning in Russian and Alaska waters. Charlie explained that it's certainly a possibility that Asian chums have strayed into local waters on occasion.

Someone pointed out that the Federal Subsistence Board is planning to bring together all of the Regional Advisory Councils (RAC) for a meeting in Anchorage next year and that it will be good to have the opportunity to talk and learn from the other RAC's.

Someone asked how the chum salmon stocks were doing in the Nome area. Charlie Lean explained that the numbers of chum salmon are better, though still not as high as they have been in the past. Locals voiced concern about the high numbers of people from Nome who come to fish the Nuikluk and Fish Rivers when subsistence fishing is poor in Nome.

There was concern raised about radioactive debris from the nuclear disaster in Japan. Not really getting much of that debris up here yet but wondering if there will be more in the future.

Teller CSP meeting. Teller Community Hall. March 10, 2015. 11:00 am.

In attendance were Sam Komok, Ray Foster, Marvin Okleasik, Charlie Lean, Jim Menard, Art Nelson.

Charlie Lean summarized the discussion from the previous meeting in Teller (held on March 6, 2014), and how those comments are being incorporated into the current draft of the CSP. He stated previous comments expressed about a commercial fishery and what it would look like if it happened. People wanted local participation only and some were completely opposed to a commercial fishery. Many wanted the area to remain primarily subsistence.

In response to a question about the status of the Salmon Lake/Pilgrim River sockeye salmon returns, Charlie Lean replied by providing a history of the fertilization efforts at Salmon Lake and the returns those provided including the more recent crash. He stated that he was hopeful 2015 would be better.

Someone spoke about seeing large schools of jumping fish in 2010 when they were building shelter cabin. This was in the area of new igloo and Pass Creek slough and Grand Union Creek. They weren't sure which species of fish it was.

Charlie Lean spoke about some of the recent sampling they have been doing on juvenile salmon and invertebrates in this area. He talked about the mixing and/or stratification (layering) of fresh and salt water in the large estuarine area around here. Charlie explained that they are trying to

collect more baseline data in case a proposed graphite mine is developed in the area. He has concerns about possible increases in water temperature in the area around the proposed mine.

Charlie Lean asked if Davidson Landing or Kavairilook Creek ever had salmon? He said that it's the largest creek in the area that doesn't have salmon that he's aware of. No one was aware of salmon there, and Charlie explained that he believes it may be because the water freezes down to the bottom.

Charlie Lean stated that there is the possibility of small commercial fishery for salmon in this area, but understands there are strong concerns locally about protecting subsistence. A meeting participant stated that he would rather see things reserved for subsistence.

Charlie spoke about the importance of fresh and salt water mixing zones to young salmon making the transition from river to ocean. The three different mixing areas in this area are ideal for salmon making this change. In areas where creeks or rivers empty directly into the marine environment, the extent of winter sea ice is much more important as it helps dilute the salt water as it melts in the spring when young salmon are leaving the rivers.

Charlie Lean asked if many people from Teller went over and fished for fall chum salmon at the Agiapuk River. Participants replied that yes, some do go fish there. Jim Menard provided handouts containing salmon harvest information for the area and added that there were 3 permits returned from last year (2014) indicating that they fished there.

Someone pointed out that when recent road work was done right at Teller, the new culvert blocks fish movement into the salt pond right next to town. Charlie Lean replied that in the past, he has observed herring moving into that pond.

Charlie Lean asked about a recent algae bloom in Imuruk Basin. A meeting participant noted that it was greenish in color and was stinky at times. Charlie Lean indicated that he is concerned it might be a bloom of coccolithophores, a small diatom which can be harmful if eaten by young salmon. Charlie Lean is hoping to get a sample of this bloom in the future for identification.

Brevig Mission CSP meeting. Brevig Mission Multipurpose Building. March 10, 2015. 1:30 pm.

In attendance was Bertha Barr, Sarah Henry, Ruthann Rock (sp?), Clara Adams, Johnee Seetot, Leonard Adam, Walter Seetot, Reggie Barr, Robert Smith, Rita Olanna, Ronald Seetot, Helena Seetot, Elmer Seetot, Charlie Lean, Jim Menard and Art Nelson.

Charlie Lean began the meeting by explain the process being undertaken by the Regional Planning Team to update the old CSP. He summarized the comments heard during the previous meeting in Brevig Mission March 6, 2014 and how those were being incorporated into the current draft.

There was a question about a recent algal bloom in the area and Charlie Lean explained that he is hoping to get a sample of this bloom. He believes it may be something which is harmful if young salmon eat it. Charlie also explained the work the NSEDC is conducting in the area to develop better baseline information to weigh the possible impacts of a proposed graphite mine in the area, particularly as it relates to water temperature. He said it is important for salmon to have sources of cool water as they migrate upstream or down.

Charlie Lean pointed out that an important aspect of the CSP is that it can point out habitat-related projects that need to be done and these can be selected in the future if work is being done that requires remediation work in the area. Charlie pointed out an example of a culvert that is placed too high that was just mentioned in the meeting in Teller earlier that day.

Jim Menard provided a handout which contained harvest information and explained the patterns and trends in salmon harvests in the area.

Someone asked about herring stocks in this area. Charlie Lean replied that there is not much spawning habitat (aquatic plants) for herring in the immediate area around Brevig Mission.

Someone spoke about catching smelt in the lagoon near the reindeer station and at the mouth of the river there. Someone else pointed out that they catch them all winter long by the cliffs at 4 Mile Point, just to the east of Teller.

Charlie Lean spoke about the comments heard from the community during the last meeting and the general opposition to a commercial fishery in this area. Many people commented about the importance of subsistence and spoke about the harvest patterns. Generally, most people use gillnets, but some use rod and reel. Local kids, in particular, use rod and reel frequently for pink and coho salmon.

Someone asked a question about pike and said they don't see them very often in the immediate area around Brevig Mission. Charlie Lean explained that pike generally avoid salt water so it isn't surprising that they aren't around the immediate area but there are certainly more as you get closer to and in the local rivers.

Sheefish are caught occasionally in salmon nets and in the fall.

A pollock was caught recently in someone's gillnet.

Someone spoke about a recent permit application for underwater gold mining in Grantley Harbor. They said the local government is working to oppose the permit and asked about ways to go about that? They were advised to contact the Alaska Department of Natural Resources, as that is the agency responsible for issuing permits. People are concerned about nearshore mining impacting local subsistence fishing and pointed out a recent conflict between subsistence fishermen and gold miners in Nome.

Someone observed that gold miners are from outside the region and that's where the benefit goes but it is the local community that has to deal with the impacts. When they try to speak up with their concerns they are labeled troublemakers.

Concerns were raised about pike predation on young salmon as they move through the lagoons.

Concerns were raised about a lot of beavers and that more people should be hunting and trapping for them to keep their numbers under control. There are concerns about giardia in the water because of all the beavers. Charlie Lean discussed how beavers alter salmon habitat and they may be good for coho salmon but are bad for pink and chum salmon. He stated that beavers are brought up as a concern in almost all of the communities that he has visited.

It was said that locals preferred red salmon over chum salmon but they can also barter or trade their chums to other people who may prefer chums.

When the south wind blows, the sockeye salmon migrate through a different area and are difficult to catch.

Someone stated that they don't want to see commercial fishing in this area for sockeye salmon. There is no real money to be made anyway, especially with the high cost of gas. They suggested that if someone wants to commercial fish, they should do it for chum salmon instead.

There are a lot of pike in the rivers and they seem to be increasing. They are good eating if you know how to cut them without the bones.

In response to a question about fertilization at Salmon Lake, Charlie Lean replied that they are now fertilizing the lake at a lower level to make sure they don't crash the system and have too many fish return, and their young will overgraze the food available in the lake. The initial idea was to produce enough for a commercial fishery but based on the local concerns, the amount of production has been scaled back.

With the wet summer of 2014, a lot of people lost their fish to spoilage.

An elder observed that the beach at Brevig Mission used to drop off much more sharply; now the beach is going further out.

There was concern raised about the dumping of waste and ballast water in the region with increased vessel traffic. Charlie Lean stated that through the Coast Guard, new rules are being put in place that will hopefully avoid problems, but noted that things are still largely unregulated in Russia's waters, which are very close to this region.

Someone noted that when there were search and rescue divers here last summer, they said that they saw a lot of shrimp underwater. They asked how could they try to catch those?

Someone noted that their priority of fish is: red, chum, pink and then silver.

There was interest expressed in small commercial fishery opportunity for other species like whitefish, ciscoes or herring. Charlie Lean and Jim Menard both discussed opportunities and requirements for these fisheries.

Elim CSP meeting. Basement room, City Offices. March 11, 2015. 11:00 am.

In attendance were Russell Saccheus, Oscar Takak, Morris Nakarak, Shane Saccheus, Christine Amaktoolik, Allen Daniels, Lewis Nakarak, Sheldon Nagaruk, Emily Nagaruk, Carol Nagaruk, Richard Nassuk Sr., Victor Nylin Sr., Charlie Lean, Jim Menard, Sam Rabung and Art Nelson.

Charlie Lean provided an overview of the Regional Planning Team's process to revise the CSP. He summarized comments heard at the previous meeting in Elim (Jan 30, 2013), and explained how those comments have been incorporated into the current draft.

Charlie explained that the plan can serve as a menu of choices for restoration or enhancement of salmon. It is also a clearinghouse for habitat-related projects and noted that the culvert at Iron Creek near Elim was a project listed in the previous CSP and has since been repaired when road work was being done here.

Agsauruq Channel was discussed as another habitat project that needs to be fixed. Storms and erosion have closed off this channel/entrance to the Kwiniuk River. It would be valuable to re-open this channel. Charlie Lean explained that NSEDC has been working on getting the necessary permits to do this work and was hopeful that it would be completed in the spring/summer of 2015. Charlie said it would be important to not damage nearby beach grass when this work is being done in order to prevent further bank erosion at this location. Comments

from residents indicated that this would really help local fishermen, and noted that there would need to be a revision to the fishing closure markers if the channel is restored.

Concern was raised about the effects of global warming and it was asked if the draft CSP discusses this. Charlie Lean replied that the plan doesn't really address impacts of global warming. The CSP is only intended to cover 15-20 years of planning and global warming is a much longer-term issue.

There was a question about the incubator box work that was attempted last summer (2014) and if there was funding to try this again in 2015. Sam Rabung explained that the funds for last year were a one-time situation, where funds from another project were reprogrammed. Unless additional funds can be found, this will not take place in 2015. Several residents expressed their support for the work to continue if funding can be found.

Many people voiced their support for the previous incubator box work that was on the Kwiniuk River and Corral Creek. They said that they definitely noticed better returns from these boxes and wanted to see this kind of work restored. Charlie Lean and Jim Menard mentioned that local involvement is critical to any project like this, because it needs regular monitoring throughout the winter and this needs to be done by area residents. Someone asked if local residents can be trained to do this work.

Someone noted that a part of the Kwiniuk River, called "high bank" is eroding quickly and may establish a new channel as it cuts through. It was acknowledged that this likely did not pose a threat to salmon, but may make navigation difficult as the channel reestablishes itself on a new path.

Charlie Lean asked if anyone knew of a spring on Walla Walla Creek. He indicated that if there was adequate water from a spring-fed source, this may be a good location for an incubator box project. Several individuals replied that not many people go into that area because the brush is so heavy. Charlie indicated that heavy brush might be an indicator of thawed ground because of the presence of a spring.

Jim Menard provided a handout which summarized subsistence and commercial fishery harvests in the area and discussed the harvest trends and patters in recent years.

Concern about the cost of annual permit renewal costs when there is no fishery. Jim Menard explained that if there is no fishery at all, the CFEC will waive or forgive the renewal fee. Charlie Lean said that technically, the limited bait fishery for herring counts as some fishing, so the herring renewal fees are still subject to payment. Jim Menard noted a recent article in the Alaska Dispatch News that highlighted how much Japanese culture has changed in recent years and the impact this has had on markets for some seafood products like herring roe.

Charlie Lean noted another recent article that cited the difficulty that all herring fisheries are having lately, and said that even the Togiak herring fishery may fall well short of its harvest quota because of weak demand.

Someone noted that there used to be a fall fishery for herring at a place called "penis point". This herring was salted.

Residents noted that when the king salmon restrictions were in place last year in the Unalakleet and Shaktoolik subdistricts, there were way more king salmon around Elim. Jim Menard pointed out that the escapement of kings into local rivers was also markedly higher than previous years.

A resident commented that there seemed to be two different runs of kings. One that had a mixture of sizes and another that seemed to be mostly large fish.

Several residents voiced concern about the handling of salmon in the commercial fishery and that things should be done to help the fishermen do better. Several participants noted that ice is becoming more readily available thanks to NSEDC, but said there is still room for improvement. People should be bleeding and layering their fish with ice; quality starts with the fishermen.

Someone asked if salmon species interbreed. In response, Jim Menard and Charlie Lean spoke about seeing occasional hybrids between pinks+chums, pinks+kings, and pink+coho.

Someone asked about seeing salmon with lots of tiny bumps right under the skin. Charlie Lean replied that there is a worm which can do that to salmon. Charlie said there is a helpful book, with pictures) of some of the most common fish diseases and parasites. This book can be requested from ADFG as Common Diseases of Wild and Cultured Fishes in Alaska, T.Meyers et. al., July 2008., 105pp.

Sam Rabung asked if people knew of other sites, like Iron Creek or Corral Creek, where there might be the right kind of conditions for other incubator boxes. If people notice other places with spring-fed water, they should pass that information along to ADFG and NSEDC.

Sam Rabung also asked how people felt about a larger, hatchery-style facility in their region as opposed to instream incubator boxes. Many people expressed strong support for the instream boxes, but had some reservations about a large facility in their area.

Concern was expressed about increased shipping traffic in the Norton Sound and Bering Strait region and dumping or pollution that may be associated with this increase.

Koyuk CSP meeting. Koyuk City Community Hall. March 11, 2015. 2:30 pm.

In attendance were Ruby Nassuk, Becky Anasoga, Beverly Leonard-Taxac, Leslie Charles, Charlie Lean, Jim Menard, Sam Rabung and Art Nelson

Charlie introduced the meeting by explaining the process underway to revise the CSP for the region. He summarized comments from the previous meeting in Koyuk (Jan 23, 2013), and how those comments were being incorporated into the new draft of the CSP.

Concerns were raised about possible contaminants in our fish and asked if testing was done on a regular basis. They asked if other communities have also brought forth this concern. Charlie Lean replied that other communities have been mentioning their concerns about contaminants. He said that in a species like salmon, the concern is smaller because they are relatively short-lived and migrate widely. Other species that live longer and remain in the same area are more likely to accumulate contaminants. Sam Rabung mentioned that there has been some testing on Alaska seafood for radiation from the nuclear disaster in Japan and there was no noticeable radiation above normal background levels. Charlie said there was extensive testing many years ago in the Nome area when the BIMA dredge was operating.

Someone mentioned seeing black marks on tomcod, and Charlie Lean said that others have noted this and it's likely a well-known fungal infection. Someone asked if this could be related to contamination, and Charlie said it was more likely related to warmer temperatures. He highlighted the differences between testing fish for pollution or contaminants or testing them for disease and parasites.

Many participants expressed concern about the large number of beavers in the Koyuk area. Charlie Lean explained that while beaver dams may make things better for silver salmon, it is likely bad for pinks and chum.

The Mukluktulik River used to have king salmon but it is believed to have been fished out, a desire was expressed to see king salmon restored into this river. Charlie Lean said that he has looked for a suitable site in that river for instream incubator boxes but so far he hasn't found any suitable sites. Charlie explained what kind of site is needed for these boxes and asked if anyone was aware of such a place.

There was concern that the counting tower on the Inglutalik River wasn't in a very good location and that the people hired to work at the counting tower were guessing what species of fish they were counting. Charlie Lean said that the site is definitely going to move to a different location but isn't sure exactly where that will be. He said they lost a considerable amount of equipment to a wash-out during the 2014 season.

Concern was voiced about bycatch in the Bering Sea. Charlie Lean mentioned that this was discussed in the draft and that the impact to any one river in Norton Sound is likely to be low. He noted that it is still very important to keep the bycatch low and explained efforts underway to do that.

There are a lot of pike in this area, and someone asked if they could be eradicated? It was pointed out that since pike are native to this area, it is unlikely that eradication would be allowed. It would also be very unlikely to succeed and would cause significant harm to other fish stocks, as well. There was concern about pike feeding on salmon and Art Nelson pointed out management measures in other parts of the State that are intended to manage pike to minimize their impact on salmon. He said that small pike are the ones that eat young salmon, and larger, older pike eat larger prey including smaller pike. The larger pike are protected and limits on smaller pike are liberalized.

It was noted that they are starting to see more pike in the Inglutalik River.

Trout eat a lot of salmon eggs, and Charlie Lean pointed out that trout are likely feeding on eggs that are rolling down the bottom of the river and are most likely dead eggs. This could actually be beneficial. Someone also pointed out that they caught a big, fat trout last year and when they cut it open, it had tons of very small salmon inside its belly. From this description, Charlie Lean pointed out that this was likely young chum or pink salmon, instead of king or coho salmon.

Lots of trout are feeding on young salmon when they are going out to the ocean in the early part of June.

Nome CSP meeting. Nome Eskimo Community, Trigg Hall. March 11, 2015. 6:30 pm.

In attendance was Mike Sloan, Ashley Brown, Kevin Keith, Charlie Lean, Jim Menard, Sam Rabung and Art Nelson.

Charlie Lean began the meeting by describing the process that has been undertaken so far to update the Comprehensive Plan and the meetings that have been held. Charlie summarized the comments received at the previous Nome community meeting and he described how those comments have been incorporated into the current draft of the plan. Charlie also described how the plan is intended to serve as a multi-purpose reference for things like enhancement/restoration

permitting, genetics policies, lists of salmon producing streams in the region, etc. The plan is intended to serve as a list of possible future enhancement, restoration or habitat projects.

Sam Rabung summarized other comments or points that had been raised in previous Nome meetings of the Regional Planning Team such as support for a hatchery, a desire to move quickly, and a strong desire to protect subsistence fishery resources. There has not been any opposition voiced, in Nome, to enhancement, however there were different preferences expressed about which salmon species and which rivers should be enhanced or restored.

There was discussion among the participants that many Nome residents seem to prefer sockeye salmon, though this is not a universal sentiment. Jim Menard agreed that many Nome residents have been focusing their subsistence harvests on the Pilgrim River sockeye salmon returns in recent years.

Someone asked about a commercial fishery in the Nome area for chum salmon. They commented that there seemed to be a surplus of fish above recent subsistence harvests and escapement needs. Could a commercial fishery take place without impacting subsistence needs?

Charlie Lean spoke to the comments received at the recent meetings in Teller and Brevig Mission in opposition to commercial fishing for sockeye salmon. He stated that NSEDC is not currently considering a commercial fishery for sockeye salmon in that area. Charlie talked about the need to harvest excess sockeye and expressed doubt about the effectiveness of a commercial harvest, if needed, on short notice but expected that subsistence harvest effort can be effective.

In response to a question about subsistence fishing opportunity on the Sinuk River, Charlie Lean replied that almost all of the pink and chum salmon that return to the Sinuk River spawn well below the bridge on the Teller Highway, so there is very limited in-river subsistence harvest opportunity for those two species, for people traveling by road. Charlie went on to explain that there could be an opportunity to release pink and/or chum salmon fry at Wooly Lagoon/Feather River (where there is an existing subsistence camp) and that there would likely be enough time for the releases to imprint and return to the release site.

There was a question from a meeting participant about how broodstock sources could be obtained for rivers that had such low (inadequate) natural returns. In response, Sam Rabung explained that it would be important to document how low these returns were in order to justify bringing in and releasing another source of broodstock.

There was discussion about two rivers, Solomon River and Hastings Creek, which have significant freeze-down during the winter and that these could be good sites for remote releases. There appears to be adequate flow and runoff in the springtime to imprint released salmon fry, but overwinter conditions would not likely allow for the survival of the offspring of any of the returning adults that may attempt to spawn.

Jim Menard provided a handout that summarized the subsistence and commercial harvests in the region and trends for the Nome subdistrict. He spoke about the change in harvest patterns from the Tier II fishery and the migration of effort to both the Niukluk/Fish Rivers and to the Pilgrim River.

There was discussion among the participants about the mixed preference for harvesting salmon in rivers or the ocean among Nome subsistence users.

It was mentioned that most subsistence users would certainly appreciate more opportunity for Chinook salmon where possible, or sockeye salmon.

SURVEY

In 2014, a written survey was distributed widely throughout all of the communities in the region. The survey is included below for reference followed by a summation of the responses. Sixty-8 surveys were returned from communities throughout the region, but the returns were most heavy from the Nome and Bering Strait subregions.

Norton Sound/Bering Strait Comprehensive Salmon Plan
2014 Public Survey

Norton Sound/Bering Strait Regional Planning Team

Thank you for taking the time to complete this very important survey. You will be asked questions about your use of salmon, your priorities of use and ways to sustain or increase salmon. Please share with us your opinions about current and new projects, about management, research and enhancement, and about how to pay for needed projects. This survey is anonymous and will be kept confidential.

The *Norton Sound/Bering Strait Regional Planning Team* (RPT) was formed under Alaska State regulations with the primary purpose of preparing a Comprehensive Salmon Plan for supplementing natural salmon production and rehabilitating Norton Sound salmon stocks. A Comprehensive Salmon Plan should assemble and integrate all relevant information regarding the development and protection of the salmon resource, for a long range period of time. This plan must define salmon production goals by species, area, and time. The RPT will consider the needs of all user groups and ensure that the public has an opportunity to participate in the development of the comprehensive salmon plan.

The RPT is interested in your priorities and opinions concerning improving salmon resources in the Norton Sound Area. *Thank you for your participation!*

1. What community do you live in? _____

   What is your zip code of residence? _

   Which river system supports the bulk of your salmon harvest?

---

2. Do you have any initial comments or suggestions regarding Norton Sound area salmon management, research, enhancement, rehabilitation and how to fund such projects (You will be asked a similar question at the end of this survey).

---

3. How do you use salmon?

a) I catch salmon:

For subsistence ..... YES ☐ How many years? _____ yrs.
NO ☐

Where? Which river?_____ or Saltwater?

For sport ..... YES ☐ How many years? _____ yrs.
NO ☐

For sale (commercial)..... YES ☐ How many years? _____ yrs.
NO ☐

Which subdistrict? _____

I am a Commercial Salmon Permit Holder YES ☐ NO ☐

b) I work in processing ..... YES ☐ How many years? ___ yrs.
NO ☐

c) I guide sport fishermen ..... YES ☐ How many years? _____ yrs.
NO ☐

Where? Which river? _____or Saltwater?

4. How do you prefer to catch salmon? (Check all that apply)

Commercial ..... ☐ Subsistence..... ☐ Sport ..... ☐

5. Please tell us of your relative priority of the different types of fishing from highest to lowest, 1 being your highest priority and 3 being your lowest priority. For each fishing priority please rank your preferred species to catch, 1 being the most preferred and 5 being your least preferred. (See example below, then complete table which follows it.)

EXAMPLE	*Priority*	*Chinook*	*Sockeye*	*Chum*	*Pink*	*Coho*
(1, 2, or 3) Rank of preferred species to catch- 1 (High) through 5 (Low)						
Commercial	*2*	*5th*	*1st*	*4th*	*2nd*	*3rd*
Subsistence	*1*	*2nd*	*1st*	*4th*	*5th*	*3rd*
Sport	*3*	*1st*	*4th*	*3rd*	*5th*	*2nd*

Please list your priorities and species preferences below:

	Priority	Chinook	Sockeye	Chum	Pink	Coho
(1, 2, or 3) Rank of preferred species to catch- 1 (High) through 5 (Low)						
Commercial						
Subsistence						
Sport						

6. Please list, from 1 to 5, your priority or preference for <u>increasing fishing resources</u> by type (species), through management, stocking or other enhancement projects, with 1 being the highest (top priority for increases) and 5 being the lowest (least priority for increases):

Chinook (King) Salmon _____

Sockeye (Red) Salmon _____

Chum (Dog) Salmon _____

Pink (Humpy) Salmon _____

Coho (Silver) Salmon _____

7. Please list any stocking or enhancement projects you would like to see developed:

_____

_____

_____

_____

8. Please rank the following approaches (a-e), which might be used to sustain or increase Norton Sound salmon numbers, with 1 being the highest priority and 5 being the lowest. If you have more specific comments about each approach, please include in the space provided.

Rank ___

a) Enhancement (expansion of salmon stocks beyond historic levels) projects for salmon and fisheries: _____

How? Examples include hatchery releases, stocking lakes, lake fertilization, fish ladders, etc. Please comment…

Rank ___

b) Rehabilitation (restoring populations to historic levels) of weak salmon stocks: _____

How? Examples include hatchery rearing and restocking, lake fertilization, etc. Please comment . . .

Rank ___

b) Management of Norton Sound salmon and fisheries: _____

How? Examples include more management personnel, more escapement counts using weirs or aerial surveys, more fisheries monitoring, etc. Please comment…

Rank ___

c) Research of Norton Sound salmon and fisheries: _____

How? Examples include study of adult or young salmon, salmon survival, salmon needs, salmon food sources (plankton), lake chemistry, freshwater or nearshore habitat, etc. Please comment…

Rank ___

d) Improve or Protect salmon habitat: _____

How? Please comment…

9. Please use the following space to share any other thoughts you may have concerning Norton Sound salmon, give us your comments or suggestions regarding Norton Sound area salmon management, research, enhancement, rehabilitation and who should fund such projects.

_____

_____

_____

_____

_____

_____

_____

_____

Thank you for completing this survey! Please return it to Rose Fosdick at Kawerak, Inc. at the following address:

Rose Fosdick

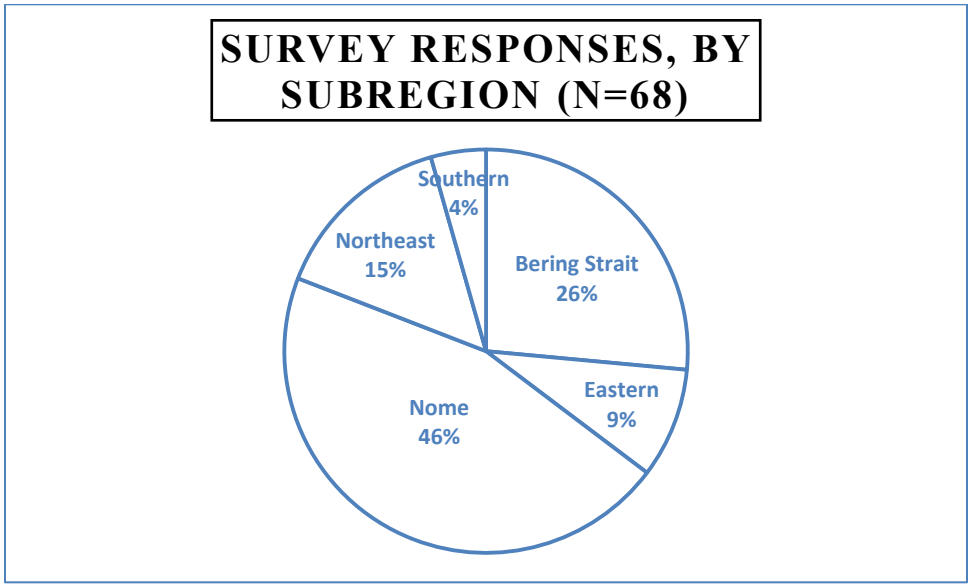
Kawerak, Inc. – NoBSRAA Manager

P.O. Box 948

Nome, AK 99762

Sixty-eight surveys were returned from communities throughout the region, but the returns were most heavy from the Nome and Bering Strait subregions.

Figure H-1. Survey responses, by subregion



Respondents were asked to provide initial comments regarding Norton Sound management, research, enhancement, rehabilitation and how to fund such projects:

Table H-1. General comments provided by respondents at the beginning of the survey.

Region	2. Initial comments
Bering Strait	I understand you are behind due to bylaws, etc. These should be minimum issues. The salmon decline needs attention ASAP. Priority #1 should be the bycatch of salmon by the pollock industry which you should be addressing at this time and future.
Bering Strait	Just thanking …crew how much they have tried to manage our fisheries
Bering Strait	State is planning on a deep water port near our area, due to the port being built, we are looking at losing our subsistence, such as birds that migrate, lay their eggs, many many varieties of fish we live on
Bering Strait	Put a counting tower at American River to see how much fish is coming to our river
Bering Strait	You are doing a good job on this research
Bering Strait	Would need more King salmon, hardly didn't get any
Bering Strait	I think the port project will impact our area immensely. It's hard for people that have lived off the land for generations to become administrators and politicians and lawyers, etc. In my experience trying to force a culture onto one that exists does not work (assimilation)

-continued-

Table H-1. Page 2 of 4.

Region	2. Initial comments
Bering Strait	I think the port project will impact our area immensely. It's hard for people that have lived off the land for generations to become administrators and politicians and lawyers, etc. In my experience trying to force a culture onto one that exists does not work (assimilation)
Bering Strait	Give the people what were the outcomes of each study that is being done to the community
Bering Strait	Continue research on King salmon
Bering Strait	Lock into the feasibility of a fish hatchery in our area to help revitalize our fish stock
Bering Strait	Go after commercial bycatch, reduce commercial fishing nearby, limit commercial fishing seasons
Bering Strait	Look into salmon parasites
Eastern	Keep our fish healthy
Eastern	How could ADF&G help with the above, besides telling us we have less and less Chinook salmon. NSEDC has a great program going in (illegible) for Chum and Coho (illegible) for Chinook
Nome	Keep going! Good information on charts! Thanks. Don't overload Nome River w/ conflicting species. Very good for Coho now but fishermen at mouth crowded for H+L. Only a couple places good for beach seine, or must open up more upriver for seine. Open up other rivers under fished. *Don't meet at NEC. Can't hear audience. (echoes)
Nome	Protect salmon from disturbance by gold miners by rules and enforcement.
Nome	Just do rehabilitation and enhancement. Talk to the Native corporations about funding
Nome	The State of Alaska should pay for salmon programs. NSEDC should not be counting fish, they should only fund economic development projects
Nome	The State of Alaska is responsible for managing our salmon resources for sustainable yield for all users
Nome	Subsistence before commercial
Nome	NSEDCs egg-planting seems like a good idea. Doing something creative for a living instead of commercial fishing might mean more fish are available for subsistence use…benefitting for more people
Nome	The State of Alaska should buy commercial permits back from fisherman when they close down fisheries
Nome	State of Alaska should maintain subsistence levels and commercial levels of fish in all waterways. Needed hatcheries should be the responsibility of the State of Alaska
Nome	I strongly support enhancement of stock in many Nome-area rivers, especially the Nome (River) due to its close proximity to the City of Nome
Nome	Continue enhancing Salmon Lake as was done in the past. Place higher regard in local knowledge
Nome	It seems commercial fishing is given more priority than local residents

-continued-

Table H-1. Page 3 of 4.

Region	2. Initial comments
Nome	The State of Alaska should pay for salmon programs. NSEDC is another funding source but should only fund economic development projects. NSEDC should not be counting fish or be the only public member of the RPT. NSEDCs investment in the Pollock trawl fisheries creates a conflict of interest and puts it at odds with the Norton Sound salmon users who have a right to participate in directing salmon enhancement planning.
Nome	I hope it's not too late for a comprehensive rehabilitation and enhancement program
Nome	Too many dredgers/miners leaking fuel/oil in and around Nome River and Snake River. Fish don't taste as good as used to
Nome	Give Hobson Creek hatchery a new lease to stay there. The hatchery is ready to produce all the salmon fry for all the local rivers. It's ready to go in 10 years in the future. We need salmon enhancement now. We wait for a new hatchery the salmon stock may be gone
Nome	I strongly agree with having a hatchery in/around Nome! Suggest our Native corporations support this/fund the project. I and my family would volunteer to help, I feel the State of Alaska needs to step up and the corporations need to also!
Nome	We need state/federal/NSEDC funds to build and operate a fish hatchery that can supplement salmon runs in several area streams for both subsistence, recreational, and commercial needs
Nome	I believe our aquaculture should start a gaming perming to fund various projects and research. Start pull tabs or bingo hall
Nome	ADF&G should manage salmon programs
Nome	ADF&G should manage salmon. NSEDC who has a conflict of interest in the Pollock industry and should not be in control of any salmon management. NSEDC should not be on the RPT in any form of representation because of the bycatch of Chum and Chinook salmon in the Bering Sea. This is a big conflict of interest especially when it comes to hatchery enhancement and monitoring counting towers and weirs. NSEDC does not represent the subsistence users and discourages any public participation whenever they have influence at the board and committee level of difference organizations
Nome	Suggest ADF&G allow beach seining on certain rivers that have traditionally used beach seines. Open the season of beach seining for the month of July
Northeast	You need more fish in rivers. Start fish farm
Northeast	King salmon, hardly catch Kings in Fish River
Northeast	Suggest that there be more enhancement projects and cohos
Northeast	Keep our seas, rivers clean, and don't bother our food, fish
Northeast	I think it is very important to start a salmon rehabilitation project *now* as future generations will be impacted by our fishing we do today
Northeast	I want enhancement

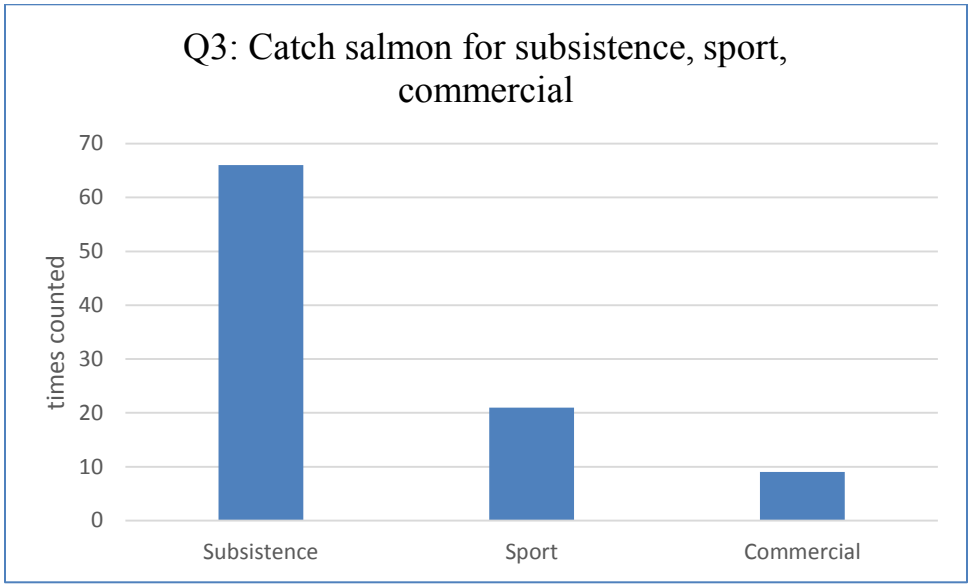
-continued-

Table H-1. Page 4 of 4.

Region	2. Initial comments
Northeast	Keep our fish wild and hire local for research
Northeast	Keep it wild, hire locals in villages for your jobs that are available
Southern	Help Elders
Southern	Need to restock the Norton Sound hatchery for all species of salmon in designated hub in Norton Sound

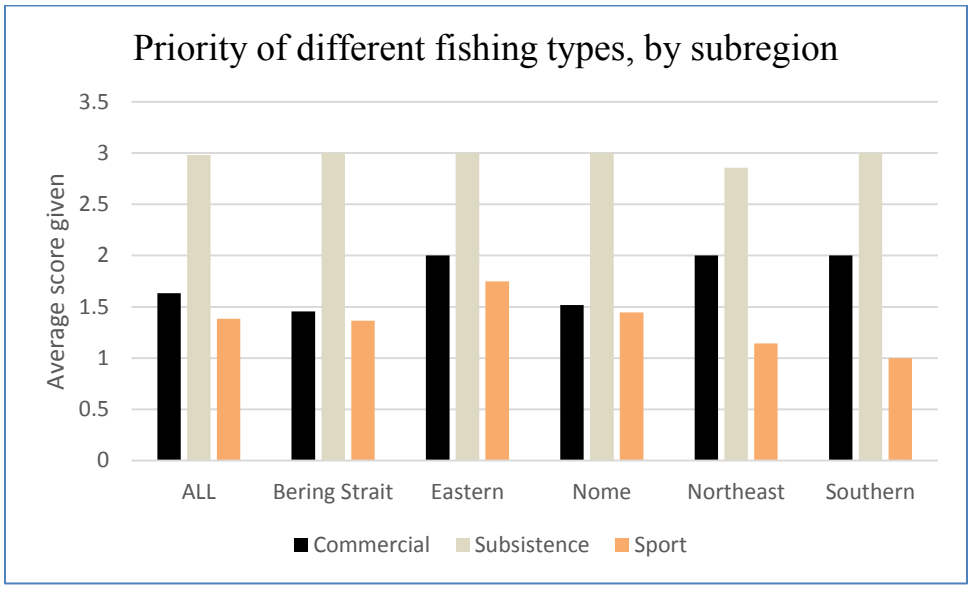
Surveys asked if they catch salmon for subsistence, sport or commercial. Respondents were allowed to choose multiple use types. The following graph shows how many times each use type was selected.

Figure H-2. Fishing types (subsistence, commercial, sport) identified by survey respondents.



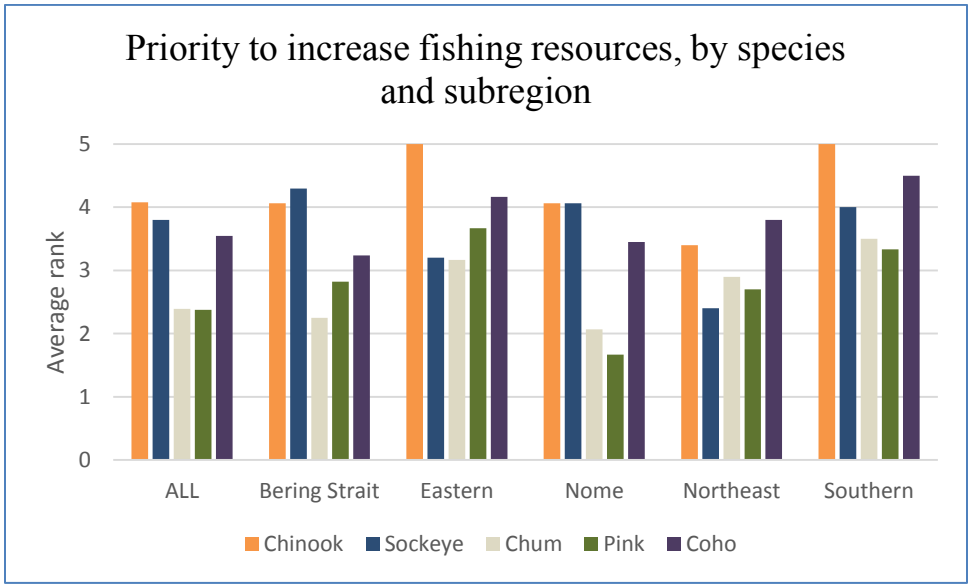
Surveys asked respondents to rank the type of use (subsistence, commercial and sport) in order of priority. 98% of respondents ranked subsistence as the highest use type, with sport and commercial having mixed rank results, but with commercial having a slightly higher overall score than sport (note: respondents were asked to rank 1 as highest. For analysis, we inverted these scores, making 3 the highest, and then summed the responses by use type). The following graph depicts these results.

Figure H-3. Ranked importance of different fishing types (subsistence, commercial, sport), combined and by subregion.



Another question asked respondents to rank their priorities for which salmon species should be enhanced. There were interesting differences between subregions within the Norton Sound/Bering Strait region.

Figure H-4. Respondents preferred salmon species for increased fishing opportunity, combined and by subregion.



Question #7 asked people to list any stocking or enhancement projects they would like to see developed.

Table H-2. Comments from respondents about stocking or enhancement projects they would like to see developed, by subregion.

Region	7. Comment
Bering Strait	Sockeye declined in this area due to someone playing God in the Salmon Lake. Now it's pretty well fertilized for plants, not fish.
Bering Strait	As a subsistence fisherman I don't know how to list them in order to enhance our salmon runs. I have no business on commercial or sport fishing
Bering Strait	Stocking - King salmon and Sockeye
Bering Strait	Any kind of fish being counted like white fish, pikes, and trout
Bering Strait	Recovery of King salmon and Red salmon
Bering Strait	King salmon
Bering Strait	I would like to be able to feed my family healthy salmon, not have to go to the store to buy commercially harvested salmon. Determine what levels of fish that rivers and lakes can produce for sustain
Bering Strait	There was a heavy bloom of algae-plankton? Imuruk Basin in 2013 so thick it changed acoustics of boat splash and even seemed to slow boats down. What about methane?
Bering Strait	More King salmon
Bering Strait	Our fish runs need a push start as we are experiencing fewer fish and runs each year! It is very expensive to buy food and if we cannot subsidize that cost with hunting and fishing what are we to do?
Bering Strait	None, stocking and enhancement projects will change the river systems by introducing salmon where they are not native to that river system. Reduce commercial salmon catch seasons, and bycatch instead
Bering Strait	I would like a closer look at the parasite problem, which is developing in most sea life - especially salmon
Eastern	2
Eastern	New complete processing building
Eastern	King spawning grounds
Eastern	Move Chinook enhancement. Hatchery wouldn't help with our wild stock. As they wouldn't be going back to the streams. What NSEDC is doing is Nome for Chums and Coho and in Unalakleet for Chinook is a good idea! Unalakleet needs to be able to egg takes even in smaller scale if we don't meet escapement
Nome	Very cautious on hatcheries: Protect wild fish! Conflicts between species. 3. Rebuild Solomon (choose Coho or Chum?) 4. Develop less used rivers - Penney, etc. 1. Enhance Pinks only in odd year. 2. Keep up fertilization of Pilgrim.

-continued-

Table H-2. Page 2 of 3.

Region	7. Comment
Nome	Sorry, don't know enough about enhancement projects to recommend any and what would work here. My only experience is a visit to the salmon hatchery in Sand Point. So I would have to say salmon hatcheries?
Nome	Hatchery
Nome	A hatchery in the Nome area would be very valuable and helpful for increasing the numbers of salmon caught in our rivers. Look at other hatcheries in other parts of the state. Seward has a healthy silver salmon population that was/is built by a hatchery
Nome	I think the instream incubators protect the wild stock best. If we start introducing hatchery fish they will be so much bigger as to destroy what's left of our natural stock
Nome	The Hobson Creek hatchery should be the number one priority permitted to go into production for harvest supplementation. Our number one salmon, the Sockeye should be enhanced by hatchery production in the Pilgrim and Sinuk Rivers to produce 200,000+ fish run through the Hobson Creek hatchery agency
Nome	The Hobson Creek hatchery should be in production. Red salmon should be supported by hatchery production. All projects should contribute to future yields to ensure the protection of all salmon species in the Norton Sound area
Nome	Stop the Frankenfish!
Nome	Isn't the main reason for low numbers that commercial fishing has been excessive? If we stop that, will numbers improve?
Nome	The Hobson hatchery, Sockeye in Pilgrim and Sinuk River and Salmon Lake
Nome	Stocking of all salmon, trout, grayling species in the Norton Sound region. Maintain fish counting to continue data collection. Tax commercial and sport fisheries to help pay for programs
Nome	Nome River (Sockeye, Chum, Pinks, Coho). Pilgrim River (Reds)
Nome	The Hobson hatchery, Sockeye in Pilgrim and Sinuk River and Salmon Lake (duplicate wording with Survey 51)
Nome	Monitor seepage from Nome landfill. Clean up debris and broken net lines in rivers
Nome	The Hobson Creek hatchery should be permitted to go into production for harvest supplementation. Red salmon should be enhanced by hatchery production in the Pilgrim and Sinuk Rivers to produce a 200,000 fish run. Projects intended to give the appearance of doing something while not actually contributing to harvest should be stopped
Nome	1. Hatcheries: in communities for Silvers and Kings. 2: Fertilization projects continued Salmon Lake and Glacial Lake. 3: I'm no expert but we have to start doing more! No more studies we need action NOW!
Nome	Pilgrim - Reds. Sinuk - Reds increased. Nome River Chinook increased
Nome	More hatcheries, less commercial fishing with allowable bycatch

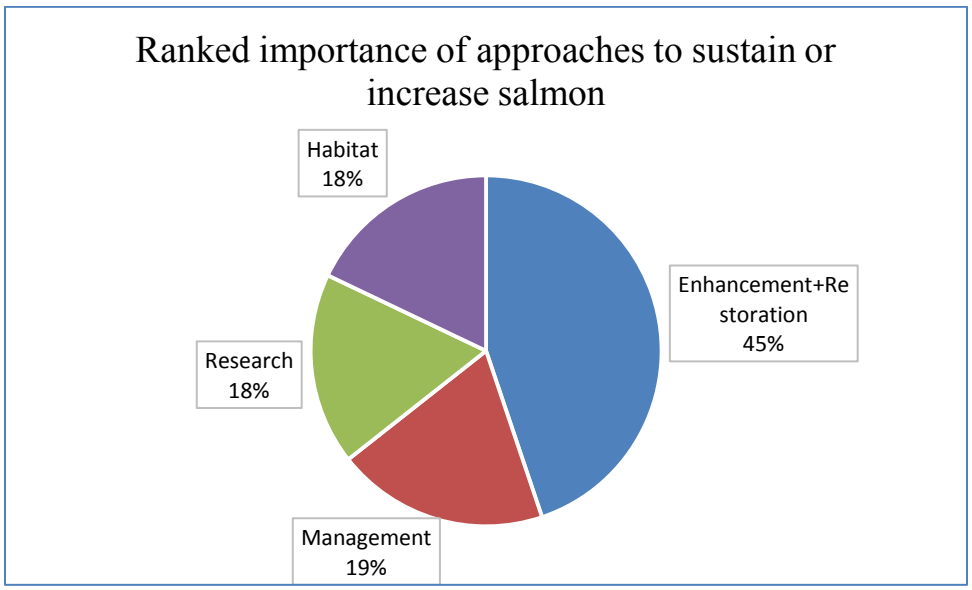
-continued-

Table H-2. Page 3 of 3.

Region	7. Comment
Nome	Open the Hobson Creek hatchery. It works now. Give the Hobson Creek a permit to gather roe for salmon enhancement for all the salmon species
Nome	A hatchery for the increase of our salmon. Our Red salmon is nearly non-existent! Why cannot the corporations and State of Alaska work on opening up Hobson Creek to raise Reds/Kings
Nome	Continue fertilization at Salmon Lake to stabilize and improve sockeye returns on Pilgrim River. Build a new hatchery to enhance and supplement various stocks in area rivers
Nome	I'd like to see habitat enhancement on the Solomon, Bonanza, and Nome Rivers. I would like to see Reds in a nearby river of Nome. I know NSEDC started planting salmon on the Solomon River but would like to see a hatchery somewhere
Nome	The Hobson Creek hatchery should be permitted immediately
Nome	The Hobson Creek hatchery should be permitted as a production facility immediately to start producing salmon for human consumption. Chum salmon and Coho salmon on the Nome River should be enhanced with the Hobson Hatchery. King salmon smolt should be released in the Nome River for subsistence, personal use and sport fishing purposes. The King salmon are extinct in the Nome River so transplanting, say Kenai River Chinook shouldn't be a problem
Nome	Nome River egg incubation/planting. Clean up/concentrate (illegible) on Solomon River
Northeast	Fish farm chums
Northeast	Chinook
Northeast	King salmon
Northeast	I think all five species of salmon should have its own stocking and enhancement projects for future generations
Northeast	I want Kings back in every river!
Northeast	Keep Alaska wild!
Southern	Help Elders!!
Southern	Norton Sound salmon stocking and enhancement project - Nome Alaska

In question #8, survey participants were asked to rank the importance of various approaches which could be used to sustain or increase fishing resources.

Figure H-5. Respondents ranked importance of the approaches to sustain or increase salmon resources.



Along with the question that asked participants to rank these different approaches, space was provided for additional comments, which are grouped by the category under which they were provided.

Table H-3. Comments provided about enhancement, by subregion.

Region	8a. Comment (Enhancement)
Bering Strait	Stop the pollock industry from salmon bycatch. This will have more effect in the recovery of historic levels of reds.
Bering Strait	When I was growing up there weren't any of these harvest management production so I don't know how to rank them
Bering Strait	Continue to use fertilizer
Bering Strait	Sockeye need more Red
Bering Strait	Encourage people to fish successfully and traditionally
Bering Strait	I would hope that our young people growing up today can work to help restore our fisheries
Bering Strait	Stop or reduce commercial salmon fishing
Eastern	Natural stock
Nome	This is risky scientifically?
Nome	I am still for the instream incubators and lake fertilization and removing predatory species, e.g. trout and pike
Nome	There is no meaningful quantitative information on historic numbers prior to the impacts brought about by historic gold mining during the 1900s
Nome	What are the historic levels?
Nome	Increased Reds and Silvers
Nome	Enhancement yes, but what were historic levels?
Nome	There is no meaningful quantitative information on salmon numbers prior to the impacts brought about by historic gold mining beginning in 1900
Nome	Lake fertilization is cheap and works. Continue to expand programs if able. We need hatcheries to target and enhance populations that have been (illegible)
Nome	Hatchery releases, lake fertilization
Nome	Increase fertilization of Salmon Lake, allow Hobson Creek hatchery to operate and produce for all the local rivers
Nome	Where is the information on the numbers/impact before or during the Gold Rush?
Nome	Lake fertilization – Salmon Lake. Hatchery releases in area rivers
Nome	Nome River salmon enhancement. Hatchery production. Salmon and Glacial Lake fertilization
Nome	We do not know the historic levels from the past. We need to put salmon back into our river systems then over time we will be able to know what those historical data are after the salmon reach that point on their own with our help
Northeast	Once a hatchery is started I think all salmon species need enhancement
Northeast	Enhance all rivers!

Table H-4. Comments provided about rehabilitation, by subregion.

Region	8b. Comment (Rehabilitation)
Bering Strait	Because of the climate changes we don't know if any of these programs would work out as planned.
Bering Strait	Increase the hatchery
Bering Strait	Need for King salmon and Reds
Bering Strait	Chinook never catch one last year
Bering Strait	Hatching, rearing
Bering Strait	Only if salmon were or are native to a river system
Eastern	Natural stock
Eastern	Not so much for hatchery more enhancement
Nome	Include Youth as much as possible! Egg planting, included boxes where practical. Important, but after adequate research and public education.
Nome	Also habitat improvement to rehab stocks
Nome	1. Open a hatchery
Nome	The systems are the same for enhancement
Nome	See above comment. Since Salmon Lake fertilization stopped, the Sockeye salmon has dramatically declined. The elders and the communities of Brevig Mission and Teller know that for a fact!
Nome	Populations are weak now. How to improve the river environments for the fish?
Nome	See comment above. This is a red herring. No one knows what historic levels were
Nome	Hatchery rearing and restocking is the only way we will see results in our life time
Nome	Hatchery rearing and restocking
Nome	There are no historic levels
Nome	Solomon River restoration of spawning habitat. Also Big Harrah River restoration of habitat. Hatchery releases in area streams
Nome	Please start a hatchery as soon as possible. I just saw an article on ICTMN - it took 23 years to revitalize their Chinook salmon (Northwest US)
Nome	Habitat is fine. Just need salmon
Nome	Do adequate fertilization of Salmon Lake and Glacial Lake. There is no historical data to rehab salmon runs to in our rivers but the lakes can be bottom (?)
Northeast	I think this is where the effort should start. There are already low salmon numbers being reported
Northeast	Hatchery

Table H-5. Comments provided about management, by subregion.

Region	8c. Comment (Management)
Bering Strait	Continue counting all salmon
Bering Strait	More monitoring and escapement counts
Bering Strait	Down South need more restriction on any kind of salmon. We hardly catch certain kind of fish
Bering Strait	Shorter commercial salmon seasons
Eastern	Better communication to communities
Nome	More internships, teams, etc. Local scientists know what's needed. But, please put back recording on phone regarding openers and closures so we can use cell phone to get updates. Radio not always timely.
Nome	More management personnel on (illegible) and large area trawlers
Nome	Reduce bycatch in the Pollock trawl fisheries. Reduce impact of local/non-local intercept salmon fisheries. Stop wasting so much money counting fish: we know our salmon stocks are going extinct! Especially the Sockeye
Nome	Reduce salmon bycatch of the Pollock fishery
Nome	Less management personnel
Nome	Reduce bycatch in Pollock fisheries. Stop commercial fishing for Coho that (illegible) Fish River and Niukluk river
Nome	State management of sewer and water pollution from the communities in the Norton Sound and Bering Strait need appropriate sewer and water treatment
Nome	Figure out a better way to catch Pollock or reduce areas of catch – stop commercial fishing for a few years
Nome	Reduce bycatch in the Pollock trawl fisheries. Reduce impact of local and non-local salmon fisheries. Stop wasting so much money counting fish. Conduct applied experiments on increasing escapements
Nome	Programs in place seem to be adequate, we now need to concentrate on rehabilitation and enhancement
Nome	Escapement counts using weirs
Nome	The management of Norton Sound has not worked. Open the Hobson Creek hatchery. Give them the permits needed to start up again
Nome	Waste so much money on counting fish. Stop the Pollock trawls
Nome	Less obtrusive methods other than counting weirs to determine run size and timing. Use technology to improve counts while causing less disruption
Nome	Less weirs, more aerial surveys
Nome	Limit bycatch in Pollock industry
Nome	Do meaningful enhancement projects. Limit bycatch in the Pollock fishery. Do accurate aerial counts and check those counts with test fishing! ADF&G needs to be accountable for their actions or their no-action management
Northeast	I think the public should be more informed of any meeting dates and what decisions are made regarding our salmon

Table H-6. Comments provided about research, by subregion.

Region	8d. Comment (Research)
Bering Strait	Research all kinds of salmon
Bering Strait	Sockeye. Chinook. Coho
Bering Strait	Imuruk Basin chemistry, Port Clarence chemistry
Bering Strait	Find out which rivers have or are native to which area
Eastern	More research like smolt work
Nome	Volunteers if possible. It builds sense of responsibility. Education for all! Research is important but conclusions must be accessible to lay people. Scientists can't just end project and walk away.
Nome	Research global warming effects and ability of salmon to adapt
Nome	Apply the Norton Sound salmon and restoration plan and relevant portions of the AYK SSI
Nome	Apply the salmon plan goals and stick to them
Nome	Apply the Norton Sound Research and Restoration plan and relevant portions of the AYK SSI. Research is unlikely to produce useful results for a variety of reasons
Nome	Concentrate on young survival and adult mortality due to high seas fishing and bycatch
Nome	Effect of more water vehicles on fish movement
Nome	Nutrients study. At-sea life cycle of salmon with focus on competition with hatching fish. Use hatchery fish to help make case with Board of Fisheries and NMFS on incidental bycatch in Bering Sea and Area M
Nome	Work with tribes to look into the Tribal Wildlife Grant for research to protect habitat
Nome	Stick to the plan. Norton Sound Salmon Research and Restoration Plan was on the table once
Northeast	After numbers 1 and 2 are stabilized I think more research on all salmon species would benefit future projects
Northeast	Salmon food sources

Table H-7. Comments provided about habitat, by subregion.

Region	8e. Comment (Habitat)
Bering Strait	Stop playing around Salmon Lake!
Bering Strait	Every fishing season we have a lot of south winds we can't even leave our gillnets out
Bering Strait	Stop other countries from fishing within our area
Bering Strait	Stop other countries fishing in Alaska
Bering Strait	Find way to improve spawning areas
Bering Strait	May (?) stuff we sure need or eat mostly
Bering Strait	Improve the stock
Bering Strait	Find what is their main diet in a river system, and find ways to increase their food source
Eastern	Natural stock
Eastern	Keep invasive species out of region!
Nome	Salmon can't survive without habitat. Nothing comes before this.
Nome	Adding the (illegible) to salmon streams to provide (illegible)
Nome	It's a waste of money to improve or protect salmon habitat in our region. Habitat quality is not the problem for Norton Sound salmon and there is no cost effective way to increase harvest by improving habitat
Nome	We need salmon in our rivers
Nome	No big hunting
Nome	Waste of money and a useless distraction. Habitat quality is not the problem for Norton Sound salmon and there is no cost effective way to increase harvest by improving habitat except by putting more fish in the rivers
Nome	Sorry no ideas. Do beavers help or hurt habitat? Do we need to trap more beaver or others?
Nome	More stringent regulations on dredges and mining operations in and around local rivers
Nome	Hatchery. Habitat?
Nome	Snake River gets moved around by development every few years. Maybe look at providing better habitat and spawning areas on this river
Nome	I believe this needs to happen on all rivers
Nome	Lack of salmon. Habitat is excellent
Nome	Habitat of Norton Sound rivers is excellent, just put more fish in our rivers and the fish will make conditions better. The lack of salmon decreases the ability for other fish species to thrive. Without salmon on the spawning grounds leads to concentration of spawning beds which in turn leaves less spawning area for returning future runs
Northeast	Enforcing salmon permits for sport fisherman on the Niukluk (?) and Fish Rivers
Northeast	Please stop trolling bottom
Northeast	Eliminate bycatch or give it to Natives in a timely manner to process
Southern	Improve and protect salmon
Southern	By doing a scientific study

Lastly, respondents were asked to provide any final comments they wished to add after completing the survey:

Table H-8. General comments provided by respondents at the end of the survey.

Subregion	9. Follow up thoughts
Bering Strait	I was a member of this team in 2012 and got out because the same president and others who failed to carry this program out in 1995 failed and will fail again! Change the president and Charlie Lean if you plan on succeeding this second round.
Bering Strait	Since everything was explained clearly in this meeting now I know why we have poor salmon runs the past few years
Bering Strait	Why are the salmon getting sores and lots of worms? We need more research why the fish are getting sick. Fix to find out the problem why sores are on the fish and worms
Bering Strait	Continue to count and do more hatching salmon
Bering Strait	Need to monitor Port Clarence Bay from break up to freeze up for barges and tugs using the bay as a deep water port
Bering Strait	Fish and Game should get stricter toward fishing down South. More regulation. So we can see some of the fishes that's dying out
Bering Strait	No local funds available for matching grant funds to conduct surveys or specific studies that will document or establish baseline data for our village. Maybe there is a need for more baseline data that effect local salmon catch (harvests)
Bering Strait	My thoughts are that the local population for generation has managed fish and wildlife very well. I believe that since commercialization created negative impacts and waste of money traveling around trying to tell residents that making money is more important than sustaining natural resources that support our lives - broad statement
Bering Strait	Having no subsistence closers for gillnet fishing. We don't subsist fish whenever we have south winds and rainy months
Bering Strait	Need more Kings and Red salmon
Bering Strait	Shorten salmon commercial fishing seasons, monitor wasteful salmon uses, either subsistence or commercial fishing. Areas with the highest salmon habitat should manage, research, and enhance their own salmon habitat and funded by Kawerak, Inc.
Bering Strait	I believe NSEDC should be the #1 entity to lead the program in finances and major role
Eastern	Stop trawlers
Eastern	Federal government should fund this to save our natural resources
Eastern	I think enhancement and rehabilitation go hand in hand. I believe a hatchery will only benefit a handful not many user or I should say subsistence users. I believe NSEDC Fisheries Research Department could expand in the region on all fish. If that is what the people of the region want

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Table H-8. Page 2 of 4.

Subregion	9. Follow up thoughts
Nome	Be careful and do it right. Don't repeat mistakes made elsewhere where information is available. Don't crowd rivers - ours are small. Commercial is not important for 95% of people and subsistence is for 80% and sport for Coho. Coho open commercial for a very few (w/ our small rivers). Tier II caused people to give up fishing near Nome...some near reestablished areas. This meant some young people never learned to fish and process fish. Sad. There was no question here in this document about protecting wild fish. This needs to continue to be considered and is state law to not endanger wild salmon stock. It was very hard to set a net in the ocean last summer. Many people gave up. Then, fish caught couldn't dry. The unstable weather may likely continue. People need to have access to rivers or learn to use a pulley rig like set netters at Bristol Bay. People must learn to smoke fish if it's going to keep being rainy. Otherwise wasted. Cohos - freezer fish or smoke. Kings - freezer fish or smoke.
Nome	We need to anticipate the future trends and protect our fisheries from possible threats: warming water, shipping traffic, gold mining offshore
Nome	Put a low limit on commercial fishing
Nome	We need continual fish count stations to monitor the numbers of fish that still come in
Nome	The State of Alaska has a constitutional mandate to manage Norton Sound salmon for sustained yield. Sustained yield should mean maximum sustained yield, not just maintaining a return. CDQ program funds can be appropriately used to support projects, that provide economic development but that doesn't mean counting fish. Enough money has been spent in Norton Sound by the various entities to have increased harvest. We need to identify the political reasons that this spending has produced no measurable harvest increase. For once, put politics aside and listen to the people who live off the sea
Nome	The State of Alaska should not allow special interest groups such as Kawerak and NSEDC to control the constitutional mandate that the state has to manage salmon for sustained yield. Salmon as a food resource should not be a political issue as it is now
Nome	Hobson Creek hatchery needs to be producing salmon for us. This survey is very confusing
Nome	Keep politics and big business the hell out!
Nome	I would just hope that we can work with other organizations to keep our fish running and healthy for Nome and villages
Nome	Again, I may be wrong, but if low numbers are due to excessive commercial fishing, then limiting commercial fishing should improve numbers automatically
Nome	The State of Alaska needs to get better at managing our fish resources and keep political aspects out of it
Nome	Pollution of the Norton Sound and Bering Strait should be under the protection of the federal government. River ways pollution protection should be under State of Alaska or federal government as assigned

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Table H-8. Page 3 of 4.

Subregion	9. Follow up thoughts
Nome	I urge all individuals and entities to strive for enhancement of Nome-area rivers, especially the Nome (River) by the enhancement efforts of the hatchery at Hobson Creek. Hatcheries such as this are attempting to restock fish in an already "depleted" river such as the Nome. It's imperative to keep the Hobson Creek hatchery running/operational. We need fish!
Nome	Why does the income of some hold priority over subsistence of everyone else in the area
Nome	I am not a scientist but the declining numbers are devastating to impoverished people who depend on the harvest. Subsistence users must be given top priority
Nome	The State of Alaska has a constitutional mandate to manage Norton Sound salmon for sustained yield. Sustained yield should mean maximum sustained yield, not just maintaining a return. CDQ program funds can be appropriately used to support projects that provide economic development but that doesn't mean counting fish. Enough money has been spent in Norton Sound by the various entities to have increased harvest. We need to identify the political reasons that this spending has produced no measurable harvest increase (see attached statement by Peter Rob). In addition to the opposition to Bering Sea salmon hatchery production from ADF&G, the primary reason that we have been so stunningly unsuccessful in increasing Norton Sound salmon harvesting opportunity is the unwillingness of people in control of organizations like Kawerak, NSEDC, and NoBSRAA to allow participation by more than a handful of local people in the comprehensive planning process and in influencing management policies through the Alaska Board of Fisheries and the NPFMC. This needs to change. Bottom line: We didn't do anything meaningful to enhance Norton Sound salmon stocks last season except Salmon Lake fertilization and nothing is planned for the coming season.
Nome	We need action now. We have been controlling sport limits and studying for over 30 years and there has been no improvement. We and the fish can wait no longer. There needs to be robust rehabilitation and enhancement projects started immediately. Funding federal money from (illegible) act? NSEDC and ADF&G, Fish and Wildlife. Tim Smith has proven hatcheries work and can be run cheaply. Let's take his example and scale it up
Nome	Seems like the state is allowing too much commercial fishing and comes down too hard or (illegible) subsistence fishers
Nome	As you know the Hobson Creek hatchery has been fought against with politics without scientific reasoning, purely personal conflict. Please go beyond that and help open up the hatchery, we need freezers full of salmon and fish racks full of salmon. Not politics. Stopping that you're denying all the subsistence people in need of salmon, stopping the hatchery from opening
Nome	Full production at Hobson Creek. Hatchery of all salmon species important to the Norton Sound subsistence users. The problem is too much money spent on entities and politics
Nome	All funding sources need to be considered. Maybe pull tabs sold for operating funds for hatchery operations

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Table H-8. Page 4 of 4.

Subregion	9. Follow up thoughts
Nome	I believe this area needs a hatchery, yesterday. We need to move to get the ball rolling to start up and be ready for development this summer. I believe the regional aquaculture association should start fundraising and start applying for a gaming permit for pull tabs and bingo
Nome	This is a confusing survey. I want Hobson Creek hatchery to be permitted
Nome	ADF&G continues to manage our salmon runs under a sustained yield policy which is stuck with (1) spawner (1) return to replace that spawner (?). The Department needs to shift to a maximum yield approach. The ADF&G, Kawerak and NSEDC have spent millions of dollars with no measureable success for about a 15 year period. Why? What are the political reasons there have been no increase of our salmon runs? We need to communicate and be on the same page and act professional to make sound decisions for our future children and grandchildren.
Nome	The State of Alaska should not issue dredging permits in Norton Sound unless ADF&G certifies rivers are healthy and productive and the salmon populations can handle declines. Money from dredging permits should go toward salmon population monitoring
Nome	The Chinook salmon decline all over the state worries me. I would also like to know if the Japan nuclear plant that got destroyed during the tsunami has any effect on the salmon around the state and if it is safe to eat
Northeast	Fish farms. How to fun it: raffle tickets, take pay from senators, rob bank
Northeast	Keep the research up and keep the salmon numbers up
Northeast	I think there should be a joint effort between the CDQ and State of Alaska. The local Native corporations should also be included in case any land issues arise
Northeast	Next time you make a survey, please make it simple, because a lot of elders would like to do these without any confusion! Please look at the question marks. This is the most confusing survey; it gave me a head ache from all the confusion!
Northeast	Thank you for your continued support on ensuring the livelihood of our subsistence needs
Southern	Norton Sound salmon - funded and partnership with federal and state agencies

APPENDIX I: Data Tables

Table I-1.–Commercial salmon and Dolly Varden harvest from the Norton Sound and Kotzebue districts, 1999–2013.

Year	Norton Sound					Kotzebue	
	King Salmon	Sockeye Salmon	Coho Salmon	Pink Salmon	Chum Salmon	Chum Salmon	Dolly Varden
1999	2,508	0	12,662	0	7,881	139,120	1,502
2000	752	14	44,409	166,548	6,150	159,802	7
2001	213	44	19,492	0	11,100	211,672	0
2002	5	1	1,759	0	600	8,390	30
2003	12	21	17,060	0	3,560	25,423	176
2004	22	47	42,016	0	6,296	51,038	124
2005	151	12	85,523	0	3,983	75,971	181
2006	20	3	130,808	0	10,042	137,961	278
2007	19	2	126,136	3,769	22,431	147,087	960
2008	83	60	120,309	75,525	25,124	190,550	1,629
2009	84	126	87,041	17,364	34,122	187,562	960
2010	140	103	62,079	31,557	117,743	270,343	1,323
2011	185	369	58,917	7,141	110,555	264,321	400
2012	197	134	37,056	205,498	62,772	227,965	300
2013	151	247	53,802	8,338	118,709	319,062	114
2003–2012 Average	84	109	77,902	34,069	39,791	157,708	494
2008–2012 Average	130	154	73,007	67,384	70,046	227,919	922

Source: Menard et al. 2015.

Table I-2.–Salmon escapement goals and documented salmon escapements in Norton Sound, 2003–2013.

River/Fish	Escapement Goal	Type	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Nome River													
Chum	2,900-4,300	SEG-Weir	1,958	3,903	5,584	4,128	7,034	2,607	1,565	5,906	3,582	1,987 [b]	4,811
Pink	>13,000 (even years)	SEG-Weir	11,402	1,051,146	285,759	611,550	24,395	1,186,554	16,490	171,760	14,403	149,119 [b]	10,257
Coho			548	2,283	5,848	8,126	2,437	4,605	1,370	4,114	1,833	224 [b]	2,624
Snake River													
Chum	1,600-2,500	SEG-Weir	2,179	2,145	2,967	4,128	8,147	1,244	891	6,973	4,343	673 [b]	2,755
Pink			2,829	126,917	13,813	73,734	4,634	145,761	769	51,099	7,011	5,954 [b]	1,333
Coho			489	474 [a]	2,925	4,926	1,781	5,206	50 [b]	2,243	343 [b]	14 [b]	1,203
Eldorado River													
Chum	6,000-9,200	SEG-Weir	3,589	3,273	10,426	41,985	21,312	6,746	4,943	21,211	16,227	13,348 [b]	26,121
Pink			173	60,861	12,356	22,368	833	244,641	1,119	48,316	489	59,318 [b]	1,029
Coho			115	1,149	679	523	2	38	2	2	1	0 [b]	15
Pilgrim River													
Chum			15,192	10,228	9,715	45,410	35,334	25,008	5,427	25,379	41,740	25,521	47,557
Pink			14,100	50,757	13,298	18,701	3,616	92,641	483	29,237	3,364	46,134	1,060
Coho			677	1,556	304	962	605	260	18	272	269	95	890
Sockeye (Salmon Lake)	4,800-9,600	SEG-Aerial	42,729	85,520	56,484	52,223	43,432	20,448	953	1,654	8,849	7,085	12,428
Niukluk River													
Chum	>23,000	SEG-Tower	10,158	10,791	25,596	29,199	50,994	12,078	15,879	48,561	23,607	19,576	[c]
Pink	>10,500	SEG-Tower	75,855	1,022,302	270,424	1,371,919	43,617	669,234	24,204	434,205	15,425	249,212	[c]
Coho	2,400-6,100	SEG-Tower	1,282	1,833 [b]	2,727	11,169	3,498	13,779	6,861	9,042	2,405	1,729 [b]	[c]
North River													
King	1,200-2,600	SEG-Tower	1,452	1,105	1,019	906	1,950	903	2,352	1,256	864	996	564
Chum			9,859	9,624	11,984	5,385	8,046	9,502	9,783	16,131	19,898	9,042 [b]	10,518
Pink	>25,000	SEG-Tower	280,212	1,149,294	1,670,934	2,169,890	583,320	240,286	189,939	150,807	123,892	147,674 [b]	46,668
Coho			5,837	9,646	19,189	9,835	19,944	15,648	22,226	7,608	3,624	3,036 [b]	8,834
Kwiniuk River													
King	300-550	SEG-Tower	749	645	342	195	258	237	444	135	57	54	15
Chum	10,000-20,000	OEG-Tower	12,117	10,371	12,083	39,519	27,756	9,462	8,739	71,388	31,604	5,577 [b]	5,631
Pink	>8,400	SEG-Tower	22,332	3,045,915	341,048	1,347,090	54,255	1,442,237	42,960	634,220	30,023	393,302 [b]	13.212
Coho	650-1,300	SEG-Aerial	5,484	10,523	12,950	22,341	9,429	10,680	9,036	8,049	3,288	777 [b]	3,940

[a] Incomplete count because of high water; 1,916 coho salmon counted by aerial survey in the Snake River.

[b] Incomplete count because of high water or tower not run through end of season.

[c] Niukluk River tower project discontinued due to loss of land lease for tower site.

Table I-3.–Subsistence salmon harvest in the Norton Sound, Port Clarence, and Kotzebue Districts, 1999–2013.

Year	Norton Sound						Port Clarence						Kotzebue
	King Salmon	Sockeye Salmon	Coho Salmon	Pink Salmon	Chum Salmon	Total Salmon	King Salmon	Sockeye Salmon	Coho Salmon	Pink Salmon	Chum Salmon	Total Salmon	Chum Salmon
1999	4,331	866	12,233	19,193	13,049	49,672	287	1,665	1,759	7,812	2,621	14,144	94,342
2000	3,690	324	13,455	37,864	12,989	68,322	89	2,392	1,030	786	1,936	6,233	65,975
2001	4,751	750	11,293	29,822	13,963	60,579	72	2,851	935	1,387	1,275	6,520	49,232
2002	4,792	443	11,773	56,311	13,095	86,414	74	3,692	1,299	1,183	1,910	8,158	16,880
2003	4,728	522	11,446	46,336	9,498	72,530	133	3,732	2,194	3,394	2,699	12,152	19201
2004	4,419	458	10,892	70,945	3,592	90,306	177	4,495	1,434	4,113	2,430	12,649	24,637
2005	4,848	914	16,127	60,427	13,765	96,081	276	8,288	1,031	5,817	2,501	17,913	10,616
2006	2,876	572	17,242	56,579	5,992	83,261	152	8,492	726	6,615	2,479	18,464	ND
2007	2,646	938	12,023	21,039	12,048	48,694	85	9,484	705	1,468	4,454	16,196	4,568
2008	2,465	363	17,604	54,927	8,709	84,068	125	5,166	562	7,652	2,517	16,022	ND
2009	4,222	394	17,121	26,610	11,337	60,384	40	1,643	804	1,882	3,060	7,429	ND
2010	2,120	546	11,863	42,254	16,201	72,987	63	824	596	5,202	5,232	1,197	ND
2011	1,359	414	8,538	17,166	14,566	42,043	57	1,611	393	2,610	4,338	9,009	ND
2012	1,235	424	9,573	43,551	12,399	67,182	44	1,422	703	5,200	7,802	15,171	26,693[a]
2013	861	572	13,372	18,045	15,504	48,354	38	5,243	651	1,788	6,588	14,308	ND
2003–2012 Average	2,902	556	12,937	43,855	9,898	70,149	112	5,167	694	4,537	3,910	14,420	18,775
2008–2012 Average	2,112	424	12,495	36,802	12,164	63,997	66	2,114	602	4,484	4,576	11,842	26,693

Note: ND indicates years when no subsistence harvest survey was conducted.

[a] Includes the villages of Ambler, Kiana, Kobuk, Noatak, Noorvik, and Shungnak only.

207

Table I-4.–King salmon sport harvest and catch in Seward Peninsula/Norton Sound rivers, 1999–2013.

	Harvest								
Year	Nome	Pilgrim	Unalakleet	Fish-Niukluk	Sinuk	Snake	Solomon	Other	Total
1999	0	0	415	44	0	0	0	171	630
2000	0	0	345	174	0	0	0	370	889
2001	0	0	250	0	0	0	0	84	334
2002	0	0	544	75	0	0	0	183	802
2003	0	103	97	39	0	0	0	0	239
2004	0	0	356	22	0	0	0	157	535
2005	0	0	216	37	0	0	0	308	561
2006	0	0	394	0	0	0	0	33	427
2007	0	0	147	0	0	0	0	130	277
2008	0	0	580	0	0	0	0	0	580
2009	13	0	248	30	0	0	0	0	291
2010	0	0	61	0	0	0	0	0	61
2011	0	0	53	0	0	0	0	8	61
2012	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0
2003–2012 Average	1	10	215	13	0	0	0	64	303
2008–2012 Average	3	0	188	6	0	0	0	2	199

	Catch								
Year	Nome	Pilgrim	Unalakleet	Fish-Niukluk	Sinuk	Snake	Solomon	Other	Total
1999	0	20	669	55	0	0	0	279	1,023
2000	0	0	1,045	207	0	0	57	711	2,020
2001	0	0	542	21	0	0	0	105	668
2002	24	0	835	111	0	0	0	1026	1,996
2003	0	268	505	515	0	0	0	13	1,301
2004	0	0	1,930	22	0	0	0	401	2,353
2005	0	0	431	74	0	0	0	569	1,074
2006	0	0	2,511	0	0	0	0	65	2,576
2007	0	0	776	0	0	0	0	162	938
2008	0	0	796	0	0	0	0	0	796
2009	13	0	515	95	0	0	0	0	623
2010	0	0	99	0	0	0	0	0	99
2011	0	0	534	32	0	0	0	8	574
2012	0	0	17	0	0	0	0	0	17
2013	0	0	184	0	0	0	0	0	184
2003–2012 Average	1	27	811	74	0	0	0	122	1,035
2008–2012 Average	3	0	392	25	0	0	0	2	422

Source: Alaska Sport Fishing Survey database [Intranet]. 2000–2013 . Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited February 19, 2015). Available from: https://intra.sf.adfg.state.ak.us/swhs_est/ (userid/password required).

Table I-5.–Coho salmon sport harvest and catch in Seward Peninsula/Norton Sound rivers, 1999–2013.

	Harvest								
Year	Nome	Pilgrim	Unalakleet	Fish-Niukluk	Sinuk	Snake	Solomon	Other	Total
1999	219	33	2,691	1,365	0	209	22	1,043	5,582
2000	342	179	4,150	1,165	11	209	32	1,353	7,441
2001	297	29	2,766	969	62	175	39	465	4,802
2002	217	0	2,937	298	0	35	0	724	4,211
2003	68	113	1,604	216	0	11	0	1,027	3,039
2004	270	45	3,524	291	13	163	90	1,410	5,806
2005	1,001	48	3,959	400	230	182	0	2,079	7,899
2006	2,768	150	4,985	948	191	414	156	2,671	12,283
2007	797	118	4,117	786	54	142	337	546	6,897
2008	1,793	57	6,029	1,986	322	563	63	1,134	11,947
2009	229	15	5,027	928	74	55	130	121	6,579
2010	602	40	3,006	1,069	210	131	122	696	5,876
2011	68	0	2,493	700	15	9	0	297	3,582
2012	259	0	3,283	1,163	20	103	20	251	5,099
2013	279	0	4,068	1,227	343	86	0	1,064	7,067
2003–2012 Average	786	59	3,803	849	113	177	92	1,023	6,901
2008–2012 Average	590	22	3,968	1,169	128	172	67	500	6,617

	Catch								
Year	Nome	Pilgrim	Unalakleet	Fish-Niukluk	Sinuk	Snake	Solomon	Other	Total
1999	231	77	9,593	2,151	0	606	185	1,540	14,383
2000	385	200	9,287	2,952	21	209	53	1,273	14,380
2001	377	29	5,399	1,739	96	214	39	629	8,522
2002	549	5	3,691	1,549	53	156	35	1,522	7,560
2003	90	203	2,832	1,447	0	11	0	1,603	6,186
2004	428	124	12,655	1,653	13	307	90	2,376	17,646
2005	1,523	48	14,396	1,586	742	325	0	7,563	26,183
2006	4,607	185	9,397	1,320	1,428	597	156	3,232	20,922
2007	919	201	8,967	1,014	184	184	381	1,547	13,397
2008	2,507	222	11,511	7,752	749	941	94	4,488	28,264
2009	270	15	14,425	2,095	131	55	193	136	17,320
2010	680	106	8,968	1,273	558	131	159	2,370	14,245
2011	68	0	9,802	1,279	15	9	0	654	11,827
2012	623	0	6,696	1,657	20	144	20	270	9,430
2013	344	0	5,938	914	454	86	0	1,621	10,357
2003–2012 Average	1,172	110	9,965	2,108	384	270	109	2,424	16,542
2008–2012 Average	836	69	10,280	2,811	295	256	93	1,584	16,217

Source: Alaska Sport Fishing Survey database [Intranet]. 2000–2013 . Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited February 19, 2015). Available from: https://intra.sf.adfg.state.ak.us/swhs_est/ (userid/password required).

Table I-6.–Pink salmon sport harvest and catch in Seward Peninsula/Norton Sound rivers, 1999–2013.

	Harvest								
Year	Nome	Pilgrim	Unalakleet	Fish-Niukluk	Sinuk	Snake	Solomon	Other	Total
1999	0	0	2,946	80	0	0	0	13	3,039
2000	578	6	961	51	10	103	113	1,064	2,886
2001	0	0	188	161	0	0	0	11	360
2002	312	0	1,378	254	0	0	0	2,359	4,303
2003	12	437	29	196	0	0	97	1,451	2,222
2004	3,369	0	2,003	353	156	60	0	2,368	8,309
2005	1,193	23	473	58	62	12	23	1,183	3,027
2006	2,422	67	891	134	330	430	100	943	5,317
2007	402	0	618	30	0	0	281	270	1,601
2008	2,954	0	2077	969	175	539	141	1,404	8,259
2009	178	0	579	23	12	35	12	466	1,305
2010	1,716	0	535	99	49	121	63	134	2,717
2011	85	0	391	10	0	0	0	80	566
2012	1,264	0	20	636	329	152	0	819	3,220
2013	302	0	886	0	242	0	0	376	1,806
2003–2012 Average	1,360	53	762	251	111	135	72	912	3,654
2008–2012 Average	1,239	0	720	347	113	169	43	581	3,213
	Catch								
Year	Nome	Pilgrim	Unalakleet	Fish-Niukluk	Sinuk	Snake	Solomon	Other	Total
1999	13	0	3,475	187	0	0	13	147	3,835
2000	876	109	3,982	3,989	21	103	288	2,618	11,986
2001	32	0	1,197	279	11	21	407	748	2,695
2002	3,090	0	2,463	772	0	0	192	6,881	13,398
2003	73	1,044	3,762	626	68	0	97	3,294	8,964
2004	6,189	163	10,332	10,176	1,352	223	195	15,430	44,060
2005	2,095	38	8,778	1,283	279	70	47	13,324	25,914
2006	6,242	134	4,791	700	2,327	1790	267	8,294	24,545
2007	745	0	4,256	178	121	234	311	909	6,754
2008	8,785	49	15,470	3,491	1,202	810	236	8,587	38,630
2009	238	0	5,593	351	133	35	47	1,404	7,801
2010	2,206	0	3,074	674	581	264	329	1,066	8,194
2011	85	0	2,301	10	0	0	80	658	3,134
2012	2,576	0	814	1,257	632	152	0	1,565	6,996
2013	302	0	2,286	629	242	0	0	688	4,147
2003–2012 Average	2,923	143	5,917	1,875	670	358	161	5,453	17,499
2008–2012 Average	2,778	10	5,450	1,157	510	252	138	2,656	12,951

Source: Alaska Sport Fishing Survey database [Intranet]. 2000–2013 . Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited February 19, 2015). Available from: https://intra.sf.adfg.state.ak.us/swhs_est/ (userid/password required).

Table I-7.–Chum salmon sport harvest and catch in Seward Peninsula/Norton Sound rivers, 1999–2013.

	Harvest								
Year	Nome	Pilgrim	Unalakleet	Fish-Niukluk	Sinuk	Snake	Solomon	Other	Total
1999	0	0	211	0	0	0	0	0	211
2000	0	0	403	0	0	0	0	694	1,097
2001	0	0	714	439	0	0	0	556	1,709
2002	0	0	607	45	0	0	0	166	818
2003	0	0	191	101	0	0	0	0	292
2004	0	0	47	435	0	0	0	16	498
2005	0	0	36	0	0	0	0	294	330
2006	0	0	224	0	0	0	0	120	344
2007	0	0	85	11	0	0	0	9	105
2008	0	0	175	166	0	0	0	414	755
2009	0	0	258	71	0	0	0	83	412
2010	0	0	59	0	0	0	0	59	118
2011	0	0	77	29	0	0	0	33	139
2012	0	0	118	74	0	0	0	17	209
2013	139	0	354	0	0	0	0	1,874	2,267
2003–2012 Average	0	0	127	89	0	0	0	105	320
2008–2012 Average	0	0	137	68	0	0	0	121	327

	Catch								
Year	Nome	Pilgrim	Unalakleet	Fish-Niukluk	Sinuk	Snake	Solomon	Other	Total
1999	0	0	1,916	265	0	0	0	234	2,415
2000	20	24	3,652	952	12	0	278	781	5,719
2001	13	11	2,030	543	0	78	0	5,857	8,532
2002	220	0	1,653	747	23	0	81	2,132	4,856
2003	0	548	1,681	258	14	0	0	303	2,804
2004	14	33	1,473	979	149	14	0	1,168	3,830
2005	0	64	1,822	177	477	54	0	675	3,269
2006	122	0	1,628	0	709	116	11	300	2,886
2007	121	128	554	190	91	15	105	1,842	3,046
2008	157	0	4,055	277	120	92	204	1,056	5,961
2009	0	0	1,885	71	8	0	0	149	2,113
2010	53	0	2,127	501	52	0	0	124	2,857
2011	13	0	3,944	144	0	17	101	84	4,303
2012	111	0	2,583	190	0	0	0	17	2,901
2013	374	0	1,791	646	0	0	0	1,789	4,600
2003–2012 Average	59	77	2,175	279	162	31	42	572	3,397
2008–2012 Average	67	0	2,919	237	36	22	61	286	3,627

Source: Alaska Sport Fishing Survey database [Intranet]. 2000–2013 . Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited February 19, 2015). Available from: https://intra.sf.adfg.state.ak.us/swhs_est/ (userid/password required).