Yakutat Comprehensive

Salmon Plan: Phase II

Photo of Yakutat Gillnetter with Mt. Fairweather in the background by Kaytlynn Graber

Alaska Department of Fish and Game

Developed by

Yakutat Regional Planning Team

THE STATE of ALASKA
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September 18, 2014

Mr. Garold Pryor, Chairman
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Dear Mr. Pryor:

This letter is to inform you and members of the Yakutat Regional Planning Team (YRPT) of my approval of the *Yakutat Regional Comprehensive Salmon Plan: Phase II (YCSP).*

Prior to submittal of this plan for my consideration, I understand that in compliance with AS.10.375, YRPT worked diligently to solicit public input for the second phase of the YCSP. For the past two years, the YCSP Phase II development has been on the agenda of all public meetings held by the YRPT. To provide additional opportunity for public involvement, the YRPT created a public survey questionnaire which was distributed to every post office box holder in Yakutat and to all Yakutat Management Area commercial salmon permit holders. The plan underwent a technical review by department staff and was made available to any interested party for review and comment. The public review draft was publicly noticed and posted on both Alaska Department of Fish and Game and the Yakutat Regional Aquaculture Associations' websites and the YRPT offered a public hearing and completed its final review of the draft and consideration of public comments at its August 14, 2014, meeting.

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 Yakutat region. It 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 this to be a useful and responsive planning document for salmon fishery enhancement efforts in the Yakutat region. I appreciate the efforts of the YRPT and all those involved in producing the *Yakutat Regional Comprehensive Salmon Plan: Phase II* and I offer my congratulations.

Sincerely,

Cora Campbell

Cora Campbell
Commissioner

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LIST OF ACRONYMS

AAC	Alaska Administrative Code
ADF&G or department	Alaska Department of Fish and Game
AMP	Annual Management Plan
ANILCA	Alaska National Interest Land Conservation Act
AS	Alaska Statute
AWC	Anadromous Waters Catalog
BMP	Basic Management Plan
BLM	Bureau of Land Management
CBY	City and Borough of Yakutat
Commissioner	Commissioner of Alaska Department of Fish and Game
DCF	ADF&G Division of Commercial Fisheries
DIPAC	Douglas Island Pink and Chum
DSF	ADF&G Division of Sport Fisheries
FMPD	ADF&G Fishery Monitoring, Permitting and Development Division
FRED	Fisheries Rehabilitation and Enhancement and Development Division
FTP	Fishery Transport Permit
LUD	Land use designation
MFA	Management Feasibility Analysis
NPS	National Park Service
NSRAA	Northern Southeast Regional Aquaculture Association
PNP	Private Non-profit Hatchery (PNP)
RAA	Regional Aquaculture Association
RPT	Regional Planning Team
SET	Salmon Enhancement Tax

SHA	Special Harvest Area
Stat week	statistical week
SSFP	Sustainable Salmon Fishery Policy
THA	Terminal Harvest Area
TLMP	Tongass Land Management Plan
USFS	United States Forest Service
YRAA	Yakutat Regional Aquaculture Association
YRPT	Yakutat Regional Planning Team

EXECUTIVE SUMMARY

In 1984, the Yakutat Comprehensive Salmon Plan, at times referred to as Phase I, was adopted by the commissioner of Alaska Department of Fish and Game (ADF&G). Since 1984, many changes have occurred in the Yakutat Region including economic, environmental, geological, and social changes. The Phase I plan encouraged rehabilitation and stream enhancement projects. As the rivers in the Yakutat Region have changed through glacial rebound, the wild stocks have diminished greatly in some systems. Some systems of wild stocks continue to fail even with rehabilitation and stream enhancement projects. Water volumes in Ophir Creek have significantly declined in recent years, causing a reduction in fish production (ADNR 1995). The West Fork of the Situk has been drying up over the last 20 years affecting sockeye and coho salmon. A habitat improvement project in Humpy Creek caused degradation to spawning habitat which led to a decline in pink salmon production. The Phase I plan discouraged supplementation (i.e., hatcheries and remote release strategies). While this reflected the view of the community at the time, local commercial fishermen buying permits in other regions of the state with fully developed fishery enhancement programs that provide better financial benefits, created an attitude of change towards hatcheries and salmon fishery enhancement in the Yakutat Region. Without a Regional Aquaculture Association (RAA) or a Regional Planning Team (RPT) there has been little investigation into fisheries enhancement, particularly supplementation opportunities over the last 28 years in the Yakutat region and no reason to update the Yakutat Comprehensive Salmon Plan (1984). In 2011, the Yakutat Fishermen's Alliance (YFA) voted to form a regional aquaculture association (RAA) for the Yakutat Region. In September 2011, the Commissioner of ADF&G (commissioner) recognized the Yakutat Regional Aquaculture Association, Inc. (YRAA) as the qualified regional aquaculture association for the Yakutat Region, and established a regional planning team (RPT).

According to McGee (2004), *"Regional comprehensive planning in Alaska progresses in stages. Phase I sets the long-term goals, objectives and strategies for the region. Phase II identifies potential projects and established criteria for evaluating the enhancement and rehabilitation potentials for the salmon resources in the region".* 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.

This revised and updated regional comprehensive salmon plan will be a combination of a Phase I & Phase II planning process, setting new goals, objectives and strategies while maintaining the same overall mission statement, "*To promote through sound biological practice, activities to increase salmon production in the Yakutat region for the maximum social and economic benefit of the users consistent with public interest*". The new goals, objectives and strategies are located in Chapter 3. This plan will explain the authority and provide a brief history of the salmon fishery enhancement program in the State of Alaska. This revised regional comprehensive salmon plan provides updated baseline information regarding the changes within the fishery and landscape over the last 28 years; new goals, objectives and strategies; results of the public survey conducted; planning, permitting and reporting regulations and policies; public benefits; followed by past, current and possible future project descriptions.

With the revised regional comprehensive salmon plan YRAA will be able to move forward on salmon fishery enhancement and supplementation. YRAA have already started project planning and received a management feasibility analysis (MFA) from the department for some potential remote release sites for either pink or chum salmon at Humpback Creek, Redfield Cove, Broken Oar Cove, Puget Cove, Monti Bay and Eleanor Cove. The first five sites were addressed together as they are located within existing traditional fishing areas. Concerns brought up in the MFA are wild salmon streams within each area, broodstock source, the need for 100% otolith marking of hatchery pink and chum salmon, straying (particularly into the Situk), step up production over time to allow for evaluation of the project during developmental stages, and placement of a large enough terminal harvest area (THA) to allow common property harvest of enhanced salmon while protecting wild stocks. A copy of the MFA can be accessed from the Yakutat Regional Aquaculture Association website, http://www.yraa.org.

CHAPTER 1: INTRODUCTION TO ALASKA'S ENHANCEMENT PROGRAM

1.1 OVERVIEW: AUTHORITY, PURPOSE AND HISTORICAL PERSPECTIVE

Comprehensive salmon planning represents an ongoing process of identifying fisheries enhancement, supplementation, rehabilitation, research, and management priorities for the salmon resources in Yakutat. This section will provide the legislative authority and background for the hatchery program in the State of Alaska, as well as the development of YRAA in 2011.

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 ADF&G. The 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 in compliance 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 IIIV - Natural Resources. These built in protections for sustained yield of fishery resources was a fundamental foundation of the Alaska hatchery program. The constitution says,

> **§ 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 replenishable resources belong 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] – 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 are to: (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

The 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 (DCF) 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 DCF is *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*

[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)

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 DCF. A small section in DFC called Fishery Monitoring, Permitting, and Development (FMPD) currently has the lead role for salmon fishery enhancement activities and permitting with the department. Four regional resource development biologist positions assist FMPD by coordinating efforts between FMPD and regional ADF&G offices (ADF&G 2010).The Division of Sport Fish Strategic Plan 2010-2014 (ADF&G 2010) states the Division of Sport Fish (DSF) 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 DSF 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 Habitat Division 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.*[3]

1.1.4 Authority for Salmon Planning

The commissioner has the authority 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 six members. Three are department personnel appointed by the commissioner, and three are appointed by the board of directors of the appropriate regional aquaculture association.

1.1.5 Regional Aquaculture Associations

The RAAs are formed under the commissioner's authority for the purpose of enhancing salmon production according 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 A provides a table that shows the steps necessary to form a RAA. Each RAA has a board of directors weighted toward the commercial fishing interests that initially incorporated them.

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

1.1.5.1 Yakutat Regional Aquaculture Association

On January 20, 2011, YRAA was formed at a Yakutat Fishermen's Alliance meeting by a group of commercial fishermen. On February 24, 2011, YRAA was incorporated as an association. On September 6, 2011, the commissioner recognized YRAA as the qualified regional association for the Yakutat Region. By May 2012, YRAA had a duly elected Board of Directors and was fully operational as a RAA. According to the by-laws adopted by YRAA, the board shall consist of 7 to 25 board members at least 19 years of age with at least 51% of the board seats representing commercial fishermen. In 2012, the YRAA Board finished electing a 15 member board of directors as per established by the bylaws consisting of 51% commercial – split between 4 - set gillnet, 2- hand and 2- power troll permit holders who were active in the previous year in the fishery in the Yakutat region. The remaining 7 members of the board consist of representatives of other groups directly affected by the salmon industry including: one subsistence fishermen; one representative of the sports fishery; one representative of regional or village corporation under Alaska Native Interest Land Conservation Act (ANILCA) or a shareholder; one representative from the municipality or Chamber of Commerce; one representative of the processing industry; two representatives from the public at large. 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 Team

The commissioner establishes each RPT. Each RPT consists of six members, three appointed by the commissioner and three appointed by the board of directors of the regional association. Additionally, non-voting members may be appointed by the commissioner. Each RPT elects a chairman, who may or may not be a member of the RPT, whose responsibilities are, defined in regulation 5 AAC 40.310 Chairman of Regional Planning Team.

Alaska Statutes (16.10.375-480) and regulations (5 AAC 40.300 – 5 AAC 40.370) define the duties of the RPT, and include among other things, as:

- Comprehensive plan development and amendment;
- Review of hatchery permit applications, permit alteration requests; and recommendations to the commissioner;
- Review 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 Yakutat Regional Planning Team

The commissioner's recognition of YRAA as a qualified RAA in turn caused the formation of the Yakutat Regional Planning Team (YRPT). In May 2012, the six members of the YRPT met for the first time. YRAA elected three commercial fishermen as the first RAA members to serve on the YRPT. Currently, the three department members are the DCF Regional Supervisor, DSF Regional Supervisor, and the Section Chief of FMPD or their delegates. The ADF&G Region 1 Resource Development Biologist was elected as chair.

1.1.7 Regulatory Background

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

In 1971 the Alaska Legislature in AS 16.05.092 created FRED to oversee and develop salmon fishery enhancement programs. FRED had four 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 1992, FRED was merged with DCF.

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 non-profit corporations (PNP). This was the method and means for establishing PNP 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".* [4]

In regards to salmon fishery enhancement, 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 and 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 wild and available for common use until they return to a SHA/THA.

Some pertinent statutes and regulations affecting enhanced fish are included below and the inclusion of or omission of a statute or regulation from this comprehensive salmon plan is not meant to provide any bias but meant to inform:

[4] Section 1 Chapter 111 Session Laws of Alaska

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 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 16.10.400-470. (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 non-profit 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:

1. The contribution the proposed hatchery would make to the common property fishery;
2. The provisions for protection of the naturally occurring stocks from any adverse effects which may originate from the proposed hatchery;
3. The compatibility of the proposed hatchery with the goals and objectives of the comprehensive plan for the region; and
4. 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 F. 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 fish see chapter 4.

CHAPTER 2: YAKUTAT COMPREHENSIVE SALMON PLAN 1984 – PHASE I

2.1 Background of the Yakutat Comprehensive Salmon Plan 1984

The Yakutat Comprehensive Salmon Plan adopted in 1984 also now referred to as Phase I was developed by a planning group. Lacking an organized RAA in the Yakutat area in 1984, a planning group was assembled with representatives from the ADF&G, the U.S. Department of Agriculture – Forest Service, the Yakutat Fish and Game Advisory Committee, the City of Yakutat, and Yak-Tat-Kwaan Corporation. The Yakutat Planning Group developed an overall mission statement of, "*To promote, through sound biological practices, activities to increase salmon production in the Yakutat area for the maximum social and economic benefit of the user groups consistent with the public interest*." They went on to state, "*To accomplish this mission, the plan encompasses all aspects relating to the health and utilization of the salmon stocks and serves as a direction for rehabilitation and enhancement of salmon."* (Yakutat Planning Group 1984).

This planning exercise was a combination of the passage of ANILCA of 1980 and salmon planning occurring to both the east and west of Yakutat. The Secretary of Agriculture was directed in ANILCA to implement cooperative fisheries enhancement planning on the Tongass National Forest so initial efforts were concentrated on the Tongass. The area of coverage was then expanded to include the area between Prince William Sound (PWS) and Southeast Alaska comprehensive planning regions. By considering the entire area extending from Cape Fairweather in the east to Cape Suckling in the west, comprehensive salmon planning for the Tongass National Forest and for the coastal areas from Dixon Entrance to Prince William Sound would be completed (Yakutat Planning Group 1984).

Although Yakutat is generally considered part of the Southeast region geographically, under the authority of AS 16.10.375 Regional Salmon Plans, the commissioner has designated Yakutat as a stand-alone region for purpose of salmon fishery enhancement planning with the adoption of the Yakutat Comprehensive Salmon Plan (Yakutat Planning Group 1984).

Phase I considered planning on a long term basis as well as setting intermediate harvest goals to be achieved by year 2000. The target date for achievement of the long range harvest goals and maximum sustainable salmon production were not specified.

The goals in Phase I were meant to be obtained through " . . . *constrained strategies which included strong habitat protection and maintenance, research on interceptive fisheries and ocean mortality, improved harvest management, and passive rehabilitation techniques would be the preferred strategies to be employed*" and "*large scale developments such as major hatcheries and the introduction of hybrid brood stocks in the area were determined to be unfeasible at this time"* (Yakutat Planning Group 1984).

The Yakutat Planning Group recognized that, "*it was important to point out that the employment of conservative management and rehabilitation techniques for rearing species may show positive results over the long-term but will, by necessity, require a longer period of time to return to the record levels of harvest then would be needed through employment of large-scale enhancement techniques. This is due, in part, to the relative difference in availability of control opportunities that affect the survival rates of*

salmon at the various stages of their growth and development. The lack of predictability of salmon dispersal and migration on the high seas and the unknown and changeable impacts of adverse oceanographic and planktonic conditions, disease, natural predation, and incidental fishing mortality result in a limited availability of control and monitoring options for this stage of development, when compared to the number of options available to influence survival during incubation and rearing stages" (Yakutat Planning Group 1984).

One purpose of the Phase I overall planning effort and this updated plan is an attempt to build and stabilize fish harvests in the Yakutat area to their optimal levels and to dampen the effects of extreme negative trends in wild production.

2.2 Harvest Goals – Phase I plan

Phase I had long term goals derived from historic records of salmon harvested in the Yakutat area. These goals were set at or above the record 30-year average harvest and are presumed to be reflective of the maximum productive potential of fisheries habitat in the area. Intermediate harvest goals were then derived with the expectation that they could be realistically achieved by the year 2000, given the constraints of strategy selection appropriate for the area.

Attainment of these goals by the year 2000 would have required increases in harvestable production and would still reflect shortfalls from historic harvest levels for some species of salmon. The Phase I plan used the term "historic harvest levels" throughout the plan without providing a definition. In updating this plan, we were unable to reproduce the data that the graphs were based on. The assumption is that "historic harvest levels" as used throughout the Phase I plan was different for each species and is assumed to mean the 30 year time period when the harvest was the highest for the species between 1900 and 1982. This assumption is based on the Yakutat Comprehensive Salmon Plan 1984, (page 80) Table 3. Record 30-year moving average annual harvests of Yakutat area fish.

The Yakutat Planning Group (1984) intermediate goals and long-term goals were:

1. Increase the average annual harvest of king salmon to 7,000 fish by year 2000, requiring production of an additional 4,000 harvestable fish and a long-term goal of 10,000.
2. Increase the average annual harvest of coho salmon to 175,000 fish by year 2000, requiring production of an additional 27,000 harvestable fish and a long-term goal of 200,000.
3. Increase the average annual harvest of sockeye salmon to 225,000 fish by year 2000, requiring production of an additional 66,000 harvestable fish and a long-term goal of 295,000.
4. Increase the average annual harvest of chum salmon to 13,000 fish by year 2000, requiring production of an additional 2,000 harvestable fish and a long-term goal of 15,000.
5. Increase the average annual harvest of pink salmon to 140,000 fish by year 2000, requiring production of an additional 30,000 harvestable fish and a long-term goal of 150,000.

The Phase I plan was meant to be dynamic and interactive with the assumptions, priorities, goals and objectives verified every five years (Yakutat Planning Group 1984). This will be the first public review and published update since 1984.

2.2.1 Overview

The Phase I plan provided graphs showing the historical trends of fish harvest by depicting the 30-year moving average annual harvests of total fish caught and the contribution of each species or area by combining the set gillnet, beach seine, troll, sport and subsistence harvests (Yakutat Planning Group, 1984, pages 39-42). The majority of the harvest is from the commercial fishery. The lowest catches occurred in the years around 1961 while the highest catches centered around 1921 near the beginning of the commercial fishery.

Below are summaries and graphs for each species that shows the current harvest since 1982 of setnet, troll, subsistence and sport fisheries in comparison to the intermediate year 2000 and long-term goals established in the Phase I plan.

The data on sport fisheries used throughout this plan are only for the 1996-2011 time series as the prior data is not comparable. The Revised Edition: Harvest, Catch and Participation in Alaska Sport Fisheries During 1996 (Howe et al 2001) provides for a full explanation in the Preface.

2.2.2 Chinook Salmon Goal Comparison

Chinook salmon harvest is heavily influenced by the Pacific Salmon Treaty and the allowable all gear treaty quota that is then allocated by the Board of Fisheries management plans 5 AAC 29.060(b) and 47.055. When the troll fishery (hand and power) harvest data in the Yakutat region is included, the Chinook salmon harvest has been above the intermediate year 2000 harvest level goal of 7,000 Chinook salmon for all years since 1984 except for three; 1988, 1989 and 1992. The harvest ranged from a low of 6,683 to a high of 18,244. The long-range goal was for a harvest of 10,000 Chinook salmon. This goal was reached between 1982 and 2011 13 times; 1982, 1985, 1986, 1990, 1993, 1995, 1996, 1997, 1998, 1999, 2002, 2003, 2004, and 2009.

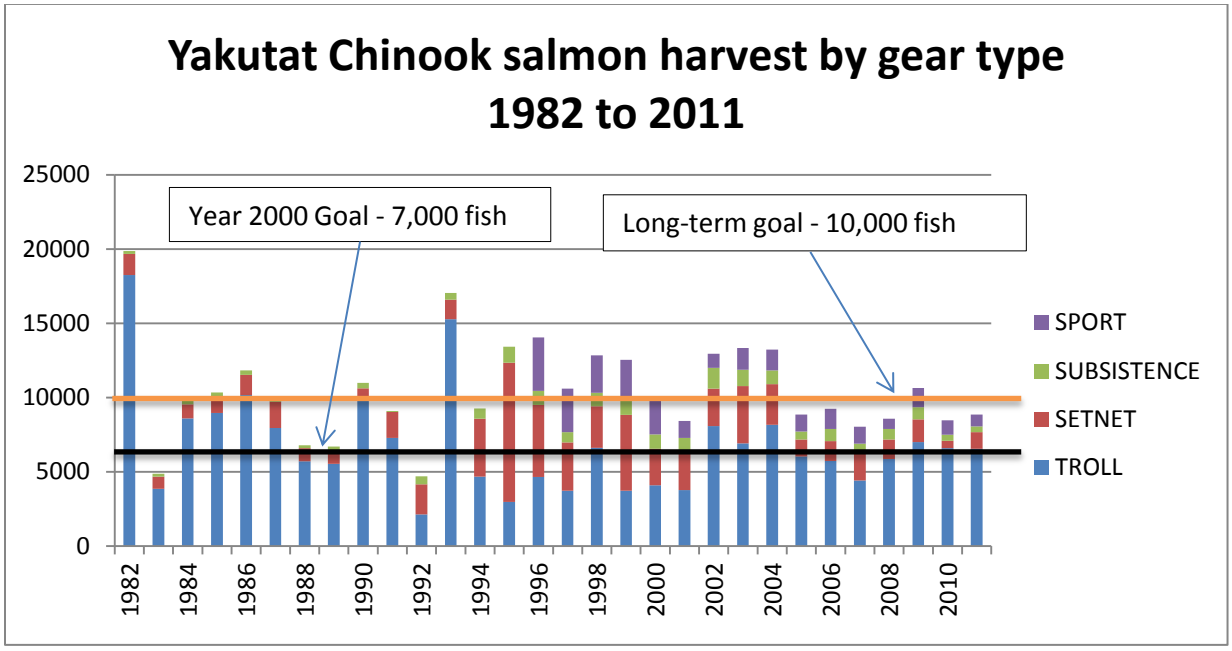

Figure 1. Yakutat Chinook salmon harvest by gear type 1982 to 2011 compared to the year 2000 goal of 7,000 Chinook salmon and the long-term goal of 10,000 Chinook salmon.

The Phase I plan excluded troll data because it is an interceptive fishery of mixed origins. When troll data is excluded from Chinook salmon harvest for comparative purposes, the intermediate year 2000 harvest goal was only reached in three years (Figure 2). The harvest was highest in 1995, even though sport fish harvest data was not included prior to 1996, at 10,444 Chinook salmon. The long-range harvest goal of 10,000 Chinook salmon was only reached once in 1995 when troll harvest was data was excluded. The lowest harvest was in 2010 with a combined harvest of 1,883 Chinook salmon.

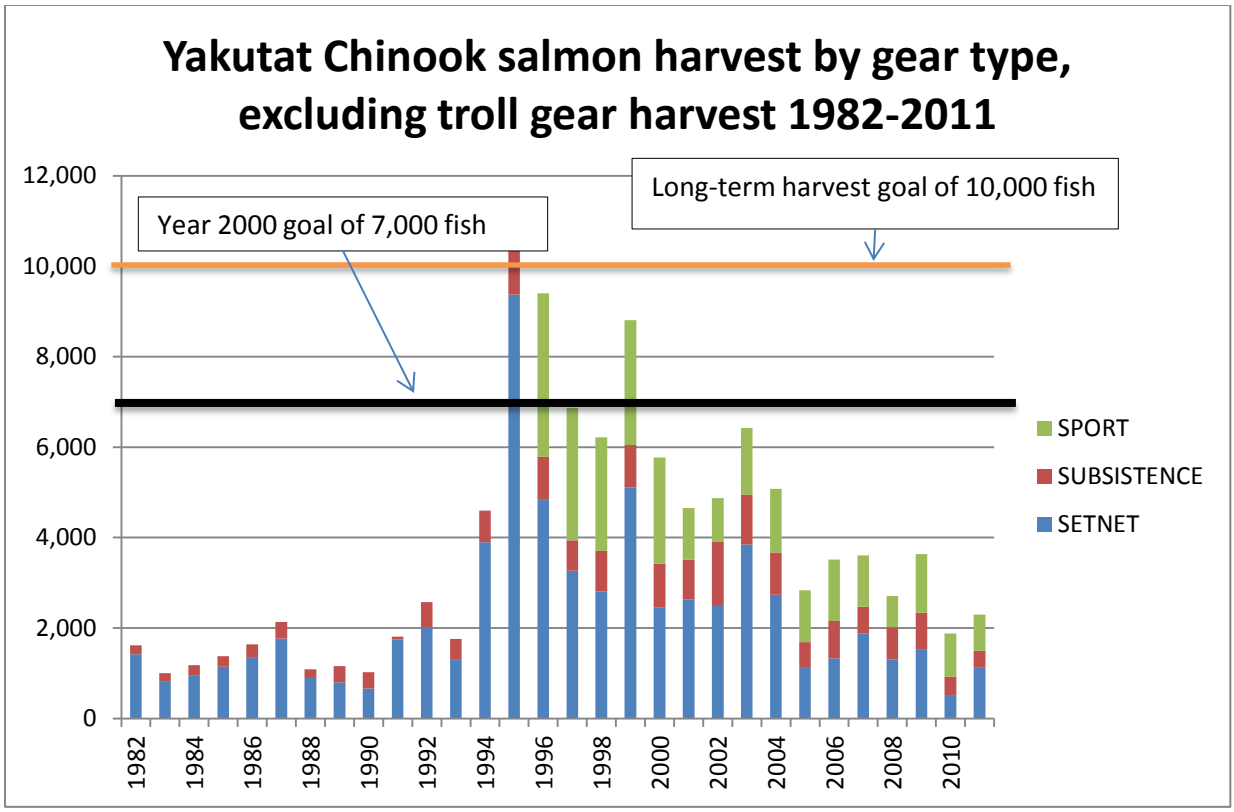

Figure 2. Yakutat Chinook salmon harvest by gear type, excluding troll gear harvest, 1982 to 2011 compared to the year 2000 harvest goal of 7,000 Chinook salmon, and the long-term harvest goal of 10,000 Chinook salmon.

2.2.3 Sockeye Salmon Goal Comparison

The Phase I sockeye salmon harvest goal required a 42% increase over the 1977-1981 average harvest but will still reflect a 43% shortfall from historic average harvest levels (Yakutat Salmon Group 1984 page 3).The Phase 1 plan identified the record historic average harvest for sockeye salmon to have occurred during 1906-1939. In the first 10 years of the Phase I plan (1984-1994) the combined sockeye salmon harvest was over the intermediate year 2000 harvest goal in seven of the ten years. After 1994, the sockeye salmon harvest reached the intermediate year 2000 harvest goal of 225,000 sockeye salmon in 2007. The lowest sockeye salmon harvest between 1982 thru 2011 occurred in 2008 with a combined total harvest of 45,090 sockeye salmon. The long-range harvest goal for sockeye salmon was 295,000, which was reached in 1989, 1990, 1992, and 1993.

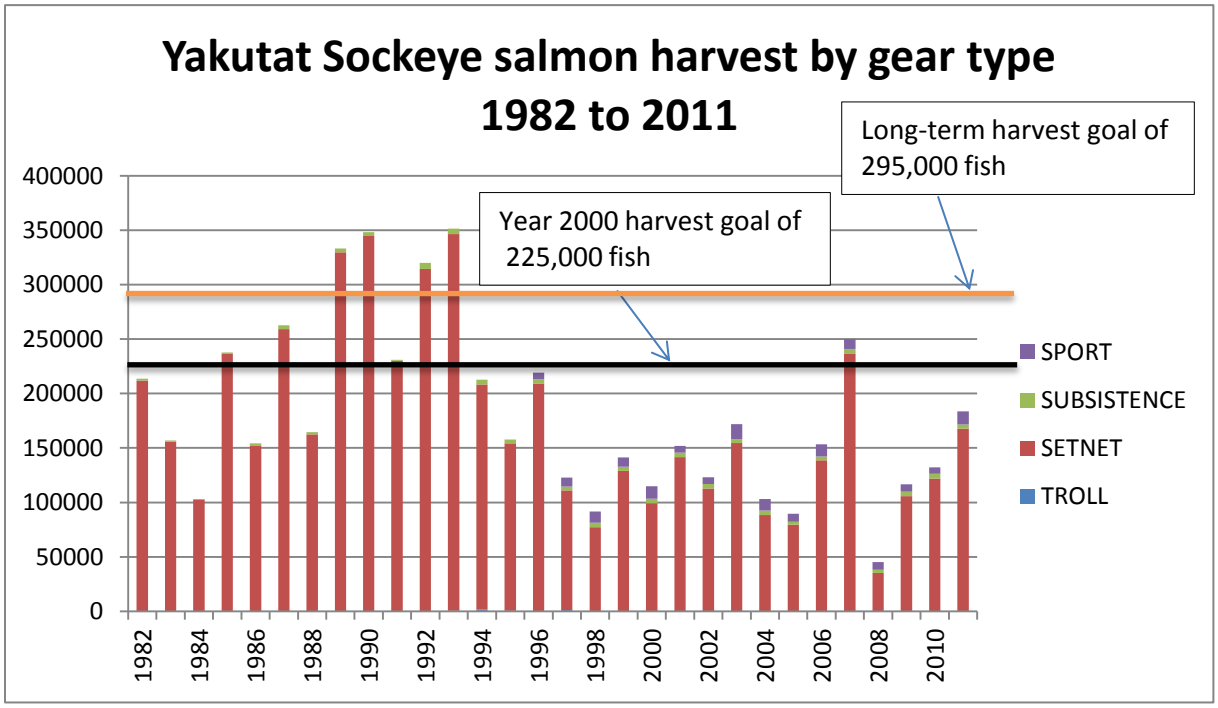

Figure 3. Yakutat sockeye salmon harvest by gear type 1982 to 2011 compared to year 2000 harvest goal of 225,000 and the long-term harvest goal of 295,000 sockeye salmon.

2.2.4 Coho Salmon Goal Comparison

The Phase I plan had an intermediate year 2000 harvest goal of 175,000 coho salmon, which required an 18% increase over the 1977-1981 average harvest but was equal to historic average harvest levels from 1910 to 1943. The long-term coho salmon harvest goal of 200,000 fish is 14% greater than historic average harvest levels. The long-term goal was based on the assumption of supplemental production adding to the current healthy wild stocks. The Phase I plan strategy for attainment of the goal was enhancement by increasing rearing habitat by utilizing barren and semi-barren natural systems through construction of additional man-made sites, and stocking these sites with recovered nomads. Troll data was included in Phase I Figure 1G. Since 1984, the combined harvest has met the intermediate year 2000 goal of 175,000 coho salmon for all years except 2003, 2005, 2006, and 2007, even with sport fish data not being included until 1996. The long-range goal was not met in those same years of 3002, 2005, 2006 and 2007, plus for an additional two years in 2009 and 2011. Troll effort was significantly down in the early to mid-2000's, and which would have affected the overall coho salmon harvest in the region in those years.

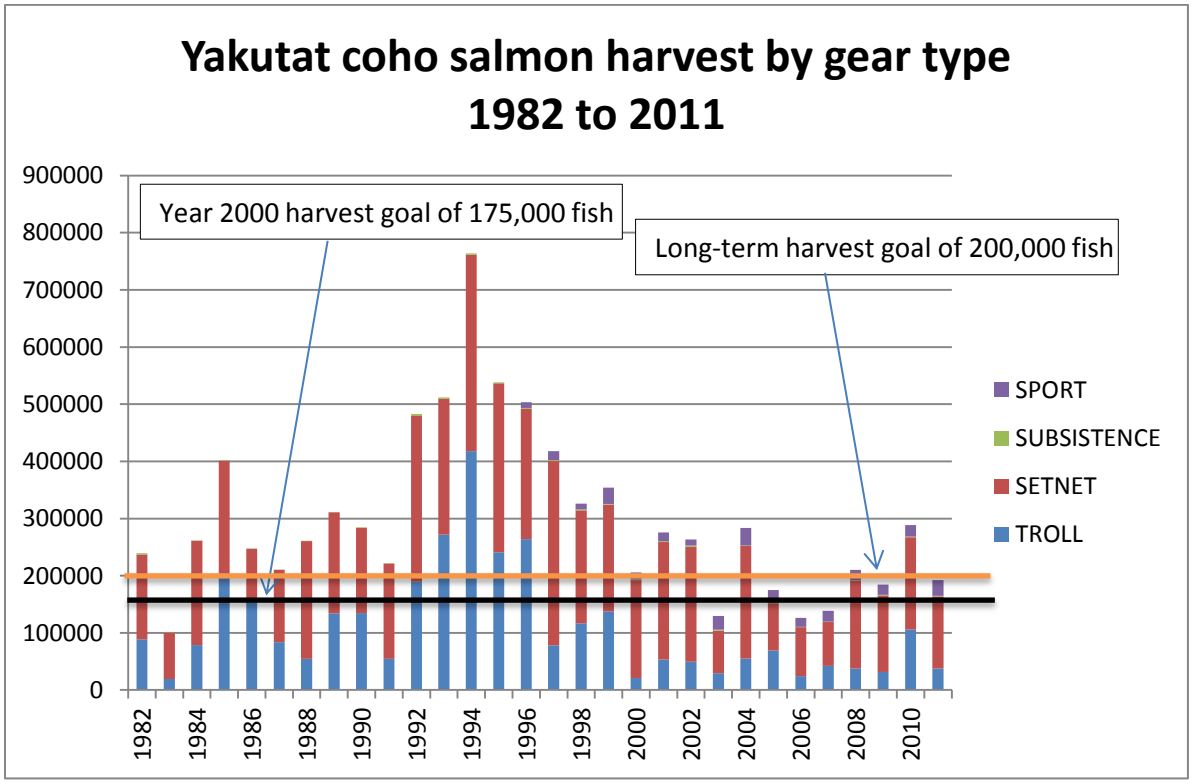

Figure 4. Yakutat coho salmon harvest by gear type 1982 to 2011 compared to the year 2000 harvest goal of 175,000 and the long-term harvest goal of 200,000 coho salmon. Sport fish data included from 1996 to present.

2.2.5 Pink Salmon Goal Comparison

The intermediate harvest goal for year 2000 in the Phase I plan was 140,000 pink salmon. This goal required a 27% increase over the 1977-1981 average harvest. Phase I summarized the 1977-1981 harvest as exceeding the historic average harvest level which reflected the healthy condition of local wild stocks at the time. In recent years, the intermediate year 2000 harvest goal was only exceeded in 2010 and 2011. The harvest ranged from a high of 205,261 pink salmon in 2011 to a low of 5,178 pink salmon in 1991.

The long-range harvest goal of 150,000 pink salmon was met in 2010 and 2011. The Phase I plan stated long-term increases will be dependent on continuation of current management practices and improved marketing conditions (Yakutat Salmon Group, 1984).

There is no directed commercial common property fishery on pink salmon in Yakutat. Pink salmon are harvested incidentally during sockeye and coho salmon fisheries. Harvesters using set nets generally use mesh sizes that are too large to effectively catch pink salmon. Their incidental pink salmon catch is dependent on abundance of pink salmon in the area. (G. Woods, Commercial Fish Biologist, ADF&G Yakutat, personal communication.)

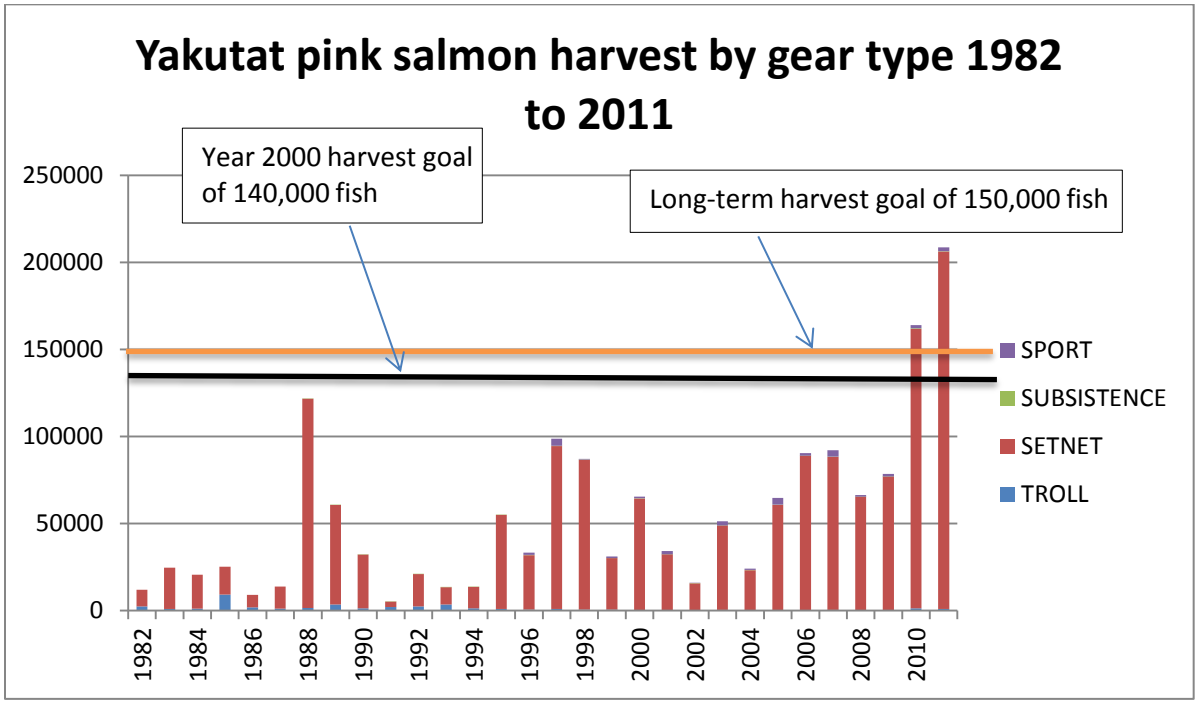

Figure 5. Yakutat pink salmon harvest by gear type 1982 to 2011 compared to year 2000 harvest goal of 140,000 and the long-term harvest goal of 150,000 pink salmon.

2.2.6 Chum Salmon Goal Comparison

The intermediate year 2000 harvest goal in the Phase I plan was 13,000 chum salmon. The goal required an 18% increase over the 1977-1981 average harvest and equals the historic average harvest from 1952-1981. The long-term harvest goal of 15,000 chum salmon is 15% higher than the historic average harvest level. It was anticipated that the long-term harvest goal would be achieved through the continuation of current management practices and improved marketing conditions.

Chum salmon are traditionally a non-target species and are harvested incidentally in sockeye and coho salmon fisheries. The East River has been the major producer of chum salmon but has been in decline in the last decade, probably due to changes in habitat (Woods and Zeiser 2012).

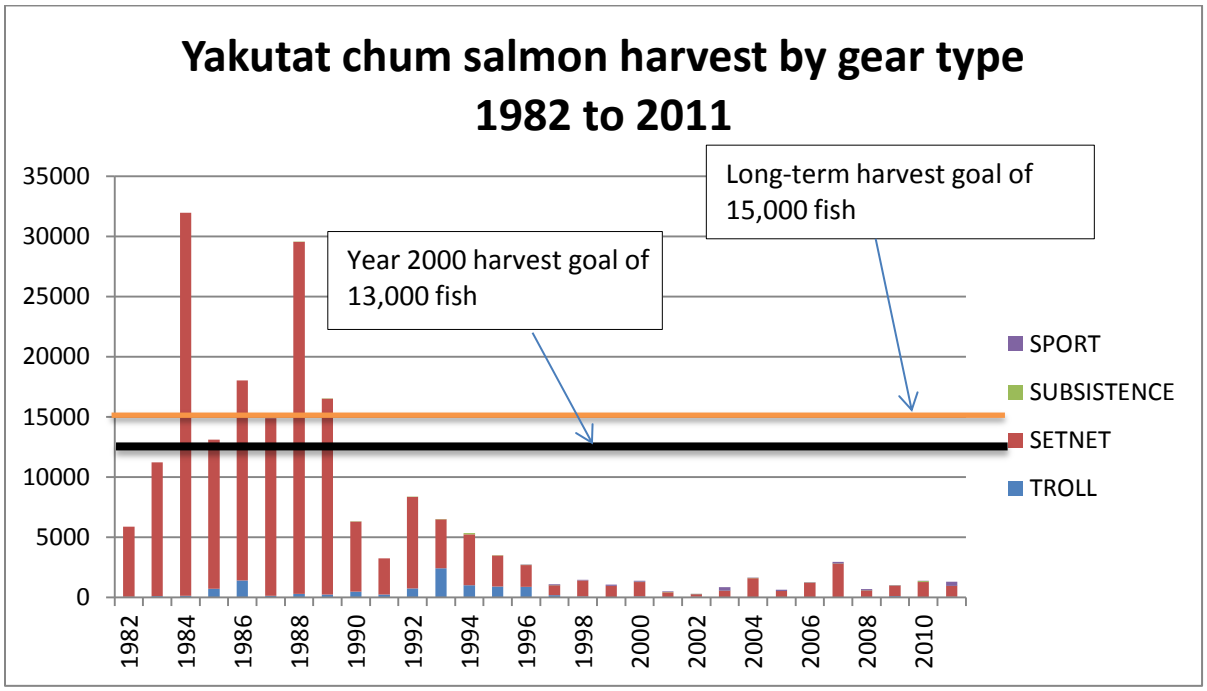

Figure 6. Yakutat chum salmon harvest by gear type 1982 to 2011 compared to year 2000 harvest goal of 13,000 and long-term harvest goal of 15,000 chum salmon.

2.2.7 Economic

The Phase I plan provided an estimate of possible economic benefits arising from achievement of the year 2000 harvest goals. The assumption in the Phase I plan was that the fishery could be worth $3.0 to $3.9 million annually a 29% increase in the value of the salmon fishery (Yakutat Salmon Group 1984). Since that economic estimate was made, the price of salmon has fluctuated and the assumed production goals were not consistently met.

The Phase I plan did not provide the basis for calculating economic benefits; therefore it is not possible to compare the economic value of the salmon harvest in the Phase I plan to the current adjusted gross value of the fishery. A simple qualitative analysis can be done by comparing the Commercial Fishery Entry Commission data[5] for the Yakutat setnet fishery. For the five-year average of 1978-1982 the setnet fishery earned an average ex-vessel value of $2,547,117, while the five-year average of 2008-2012 was $1,869,012. This is approximately a 26-27% decline in the economic benefit of the setnet fishery since 1984 with a similar decline in effort. Between 1978-1982 there were 147-159 permits actively fished while in 2008-2012 there were 113-128 permits actively fished (see Figure 11 and Table H-6).

[5] http://www.cfec.state.ak.us/bit/X_S04D.htm (Accessed August 2014)

CHAPTER 3: YAKUTAT COMPREHESIVE SALMON PLAN – PHASE II

3.1 Overview

The Phase I plan was prompted by ANILCA and written without input from an RAA or an RPT. The Phase I plan discouraged supplemental fishery enhancement efforts and relied on fishery management, rehabilitation, and habitat improvement projects to increase salmon harvest in the area. Failure to routinely meet the harvest goals set in the Phase I plan, as well as increased economic opportunity in other regions of the state with salmon fishery enhancement programs, lead to the formation of YRAA and YRPT. The primary duty of the RPT is to develop and amend comprehensive salmon plans. Phase II regional comprehensive salmon plans generally identify and prioritize opportunities for fisheries enhancement. This plan will be a combination of a Phase I & Phase II plan; setting new goals and priorities, outlining possible species and release sites, updating baseline information by covering some of the changes within the fishery and landscape over the last 28 years, and reviewing completed rehabilitation & habitat projects.

3.2 Mission, Goals, Objectives and Strategies

Stewardship of Alaska's salmon fishery resources require a long-range comprehensive plan to direct efforts for maintaining and enhancing salmon production. Development of this long-range plan is best guided by four elements: (1) a mission statement to identify what is to be accomplished by the plan; (2) goals that elaborate upon the mission statement; (3) objectives or measurable manifestations of the goal statement; and (4) strategies that are specific methods of achieving the objectives. This Phase II plan maintains the same mission statement as the Phase I plan but the goals have changed.

Proposed projects will be evaluated on their contribution to achieving the goals and objectives of the comprehensive salmon plan. Regional goals support development of salmon fisheries (wild and enhanced) that address fish production, management, allocation, and net benefit. The integration of these four fishery elements is intended to provide the guidance, tools and process to fulfill user needs and expectations for enhanced salmon.

3.2.1 Mission Statement

To promote through sound biological practice, activities to increase salmon production in the Yakutat region for the maximum social and economic benefit of the users consistent with public interest.

3.2.2 Goals

1. Enhance the salmon fishery resources in the Yakutat region while minimizing the impact of enhancement on wild stocks.

2. Achieve an economically self-sustaining fishery that provides viable economic livelihoods and contributes economic benefits to peripheral segments of the industry.
3. Strive for a balance of harvestable surplus in wild and enhanced salmon fisheries between users, while minimizing changes to historic fishing patterns.
4. The YRPT will be a fully represented planning forum that addresses region specific fishery development needs and considers the interest of all user groups (commercial, subsistence and sport).

The interest in enhancement of salmon fisheries in the Yakutat region is to make commercial fishing an economically viable livelihood on which to raise a family. While the first goal is the most important consideration *(i.e. enhance the salmon fishery resources in Yakutat region while minimizing the impact of enhancement on wild stocks),* the remaining goals describe the enhanced fishery resource as a public benefit with an avenue toward greater economic and social stability within the community.

In considering goal number 3 to strive for a balanced harvest between users, if conflicts start to develop between users YRAA should be the responsible party for the development of an allocation plan for consideration by the Board of Fish to implement as a regulation when fish are returning to the region and the information in this Yakutat Comprehensive Salmon Plan will provide historical baseline information of harvest prior to enhancement occurring within the region.

3.2.3 Objectives

1. Minimize the impact of enhanced stocks on wild stocks (i.e., consider impacts on mixed stock fisheries, broodstock source, proximity to significant wild stock, run timing etc.) applying knowledge gained from Alaska's fisheries enhancement programs using the guidelines and best practices developed for Southeast Alaska (Appendix B) and more current information as it becomes available.
2. Maintain wild stocks while maximizing the potential for enhanced fishery production through the use of the Hatchery Permit Project Checklist and Stock Appraisal Tool (Appendix E).
3. Maximize the enhanced fish production to common property users for the public benefit (see 4.3.1 Public Benefits section).

The Legislature's letter of intent instructed the planner (RPT's) to establish realistic harvest objectives for some unspecified period. These objectives are expected to have a 20-year horizon or longer. In concert with the goals, the objectives are the strategic planning criteria by which the YRPT will evaluate proposed projects. The phase I planning process expressed goals as numbers of fish to historical levels through harvest management, habitat protection, habitat and wild stock rehabilitation and supplemental production (Yakutat Planning Group 1984). The phase I plan also assumed that no major supplemental production, i.e. hatcheries would occur.

While the phase I objectives are of interest as historical benchmarks (Section 2.2), they will not be retained as objectives in this plan.

3.2.4 Strategies

1. Fishery management
2. Habitat protection or modification
3. Fishery Enhancement
    a. Fishery supplementation
    b. Wild stock supplementation
    c. Colonization
4. Research and evaluation

Strategies are the methods and means by which the goals and objectives are achieved. Projects are the actions implemented to address specific components of the goals and objectives. The economic viability of the salmon industry is driven by changing market forces and varying survival rates. These factors can shift faster than fishery enhancement programs or harvest management strategies can be adjusted to compensate for them. Because of the fluid nature of salmon productivity and interacting social and economic values, strategies may be developed and evaluated by YRPT periodically in order to remain consistent with the goals and objectives of this plan.

Most commercial and sport fisheries in Alaska are managed for wildstock escapement. The fishery management strategies that have been implemented in Southeast Alaska during the last 20 years have been the key to sustaining wildstock production while increasing enhanced production (Joint Northern/Southern Southeast RPT 2004). SHAs and THAs are cooperatively managed by the department and the project operator for broodstock, contributions to the common property fisheries and cost recovery.

Habitat protection or modification strategies include projects such as fish passes, bank stabilization, and barrier removals. Since many of these types of projects would be located on federal land, the United States Forest Service (USFS) would likely be the lead agency in developing and implementing habitat protection or modification strategies.

Fishery enhancement strategies will play an important role in supporting the economic and social fabric of Yakutat's community. Most enhanced production will come from fishery supplementation projects such as hatcheries and remote release sites. The Southeast Alaska Comprehensive Salmon Plan: Phase III has a section entitled the *Guidelines for Enhancement Planning* which provides technical guidelines to address project elements and provides a "best practice" for each element. This information is included as informational in the appendix B because it provides good, practical information and allows the Yakutat region to benefit from the experience gained in Southeast Alaska.

Research and evaluation are fundamental components of these strategies because they help to inform whether projects will be or are successful.

3.2.5 Assumptions

1. The Yakutat Comprehensive Salmon Plan and its goals and objectives will continue to evolve through a periodic process of review and revision to maintain its relevance to current knowledge, resource, and needs.
2. Statutes and regulations governing enhanced fish production will be maintained.
3. Fishery management and enhancement organizations will continue to be progressive in incorporating new research, knowledge, and evaluation techniques that continue to protect wild stocks.
4. Research programs to generate the technical information needed to optimize the productivity and harvest of wild and enhanced salmon should be funded and implemented in a timely fashion as possible.
5. Monitoring needs will be determined in the project permitting phase and implemented.
6. Commercial fishing will become economically viable through a combination of historical wild stock fisheries and enhanced production.
7. Subsistence fishing is a priority and a critical component of the Yakutat lifestyle.
8. Sport fishing will remain important to the lifestyle of Alaskans and visitors to Alaska as well as important to the economic well-being of the community.

3.3 Area of Coverage

The area of coverage is similar to the Phase I plan and was established by YRAA in their Articles of Incorporation. This area includes all land and water within an area that has as its western boundary the longitude of Cape Suckling (144˚ W. long.), and as its southern boundary a line extending seaward from the western tip of Cape Fairweather at 58 ˚ 47.89’ N. lat., 137 ˚ 56.68’ W. long., to the intersection with the seaward limit of the three-nautical-mile territorial sea at 58 ˚ 45.91’ N. lat., 138 ˚ 01.53’ W. long., and the outside 3 miles waters associated with ADF&G Fishing Districts 189-50, 189-40 & 189-30.

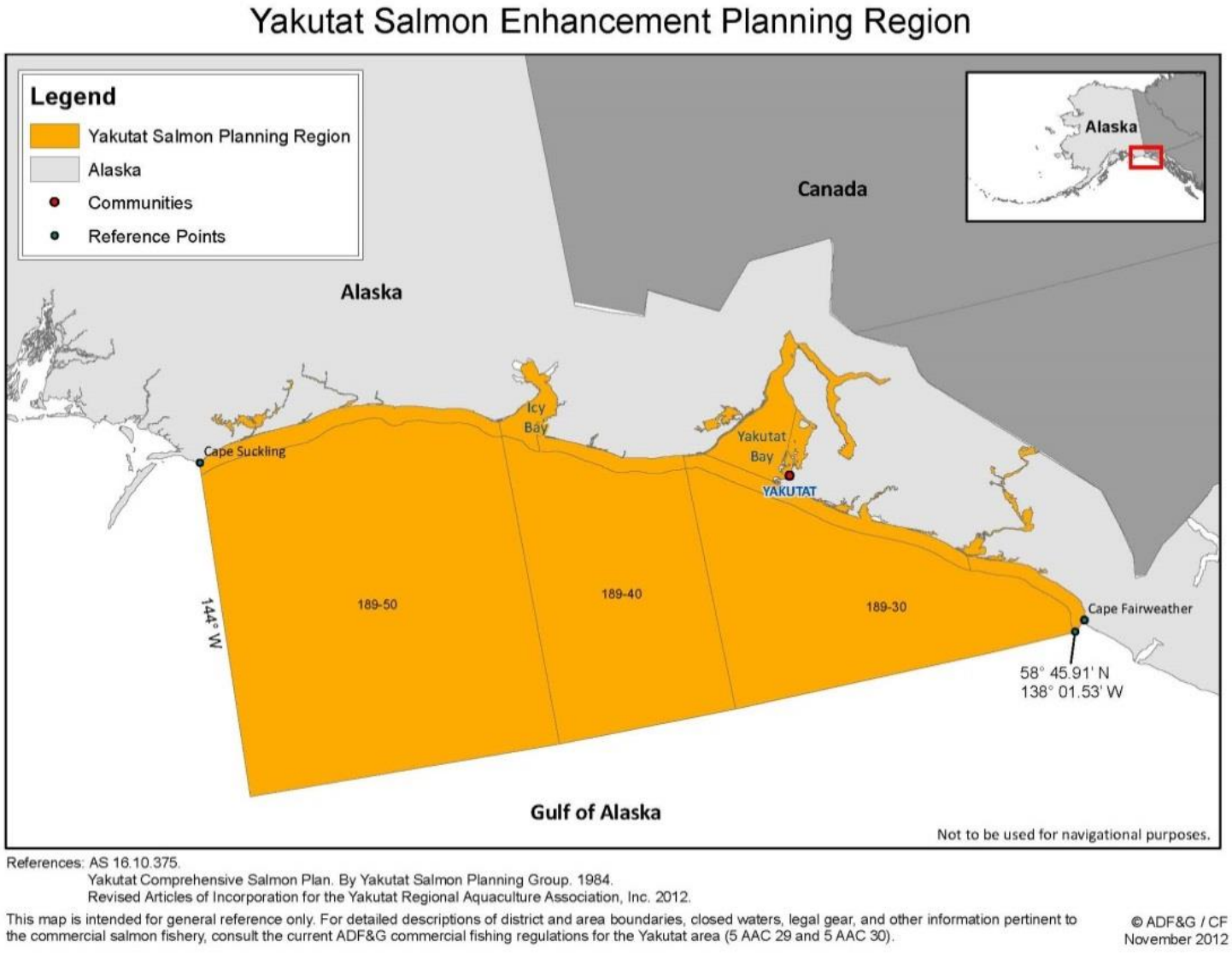

Figure 7. Area of Coverage – Yakutat Salmon Enhancement Planning Region

3.4 LAND OWNERSHIP AND MANAGEMENT

Land ownership has not significantly changed since Phase I (Yakutat Salmon Group 1984 Section 2.3.1.1. Land Status). There are five large public landowners in the Yakutat Borough: USFS, U.S. Bureau of Land Management (BLM), National Park Service (NPS), State of Alaska, and the City and Borough of Yakutat (CBY). Major private-sector land owners include the Yak-Tat-Kwaan Inc, Chugach Alaska Corporation, Sealaska Corporation, Yakutat Tlingit Tribe and hundreds of minor private landowners.

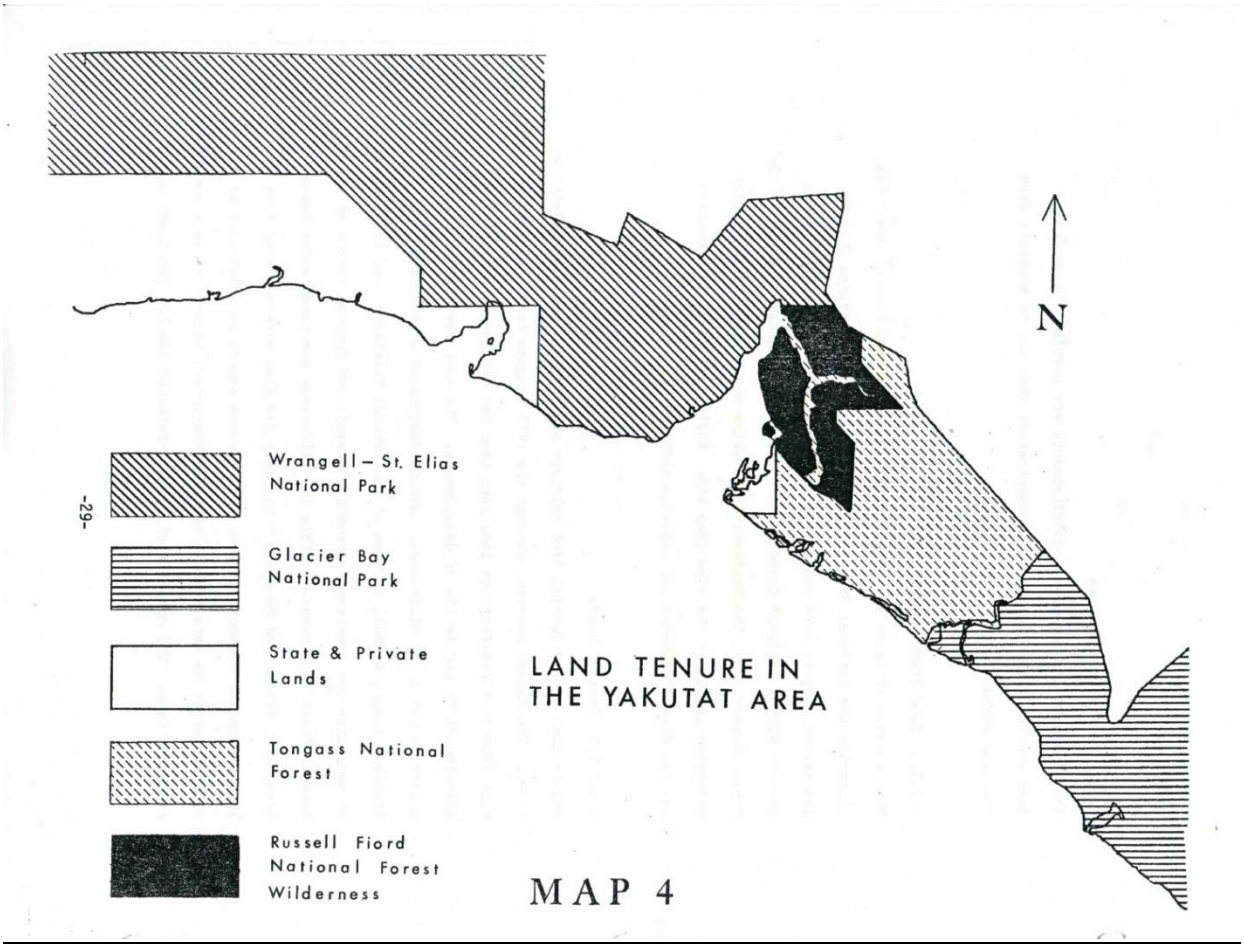

Figure 8. Land Tenure in the Yakutat Area (Yakutat Planning Group 1984 page 29)

3.4.1 Bureau of Land Management – National Park Service

The NPS land includes land in the Glacier Bay National Park and Wrangell-St. Elias National Park and Preserve.

The Wrangell-St. Elias National Park and Preserve land within the Yakutat Borough includes the Bagley Icefield, the Malaspina and Hubbard Glaciers and the area between Yakutat Bay and the edge of the Malaspina Forelands. Management of these areas are guided by the Wrangell-St. Elias Park and Preserve

Foundation Statement (NPS. 2010) and the Wrangell-St. Elias General Management Plan, Land Protection Plan and Wilderness Suitability review (NPS. 1986)

The NPS manages the area east of Dry Bay and the Alsek River to the Borough boundary on the southeast as part of the Glacier Bay National Park and Preserve. The General Management Plan Glacier Bay National Park and Preserve (NPS, 1984) sets the direction for management of natural and cultural resources, visitor use, and land protections and allows traditional commercial fishing throughout non-wilderness park and preserve waters subject to regulation while subsistence use is allowed in the preserve but not the park. Glacier Bay Preserve is entirely within the Borough of Yakutat and includes the Dry Bay area where the plan allows fish camps to be built on sand spits along rivers and the Gulf of Alaska. Commercial, sport and subsistence hunting and fishing activities are allowed in accordance with ANILCA and are guided by the management and goal of maintaining healthy fish populations and quality habitat. The Alsek River is managed to protect a segment of the river to ensure a quality wilderness experience, in accordance with ANILCA. Only specific fisheries are authorized in Glacier Bay National Park waters, and the rules differ between "Glacier Bay Proper" versus other park waters. Commercial fishing and associated buying and processing operations are prohibited in wilderness waters. Only fisheries occurring at the time the regulations were developed are authorized to continue in park waters. Any new or expanded fisheries are prohibited. Additional documents affecting management of park waters by the NPS since the adoption of the General Management Plan Glacier Bay National Park and Preserve (NPS 1984) includes the Glacier Bay National Park and Preserve Foundation Statement (NPS 2010) and Glacier Bay National Park and Preserve Strategic Plan 2001-2005 (NPS 2000).

Federal law states, "*With respect to the Cape Krusenstern National Monument, the Malaspina Glacier Forelands area of Wrangell-Saint Elias National Preserve and the Dry Bay area of Glacier Bay National Preserve, the Secretary may take no action to restrict unreasonably the exercise of valid commercial fishing rights or privileges obtained pursuant to existing law, including the use of public lands for campsites, cabins, motorized vehicles, and aircraft landings on existing airstrips, directly incident to the exercise of such rights or privileges except that this prohibition shall not apply to activities which the Secretary, after conducting a public hearing in the affected locality, finds constitute a significant expansion of the use of park lands beyond the level of such use during 1979*".[6]

In addition, BLM manages land within the Glennallen District which includes land within the Cape Suckling-Icy Bay area. This is managed under the East Alaska Resource Management Plan (BLM 2007). The goal for Fish management in the East Alaska Resource Management Plan (BLM 2007) is *"Maintain and protect fish habitat on BLM-managed lands and provide for the habitat needs of fish resources necessary to maintain or enhance such populations and to ensure the continued use, economic and subsistence populations and to ensure the continued public use, economic and subsistence benefits of*

[6] Pub. L. 96–487, title II, § 205, Dec. 2, 1980, 94 Stat. 2384, TITLE 16 – CONSERVATION; CHAPTER 1 - NATIONAL PARKS, MILITARY PARKS, MONUMENTS, AND SEASHORES; SUBCHAPTER LIX-F - ALASKAN NATIONAL PARKS; § 410hh–4. Commercial fishing

such resources." As well as, *"maintain wild stocks of salmon and steelhead".* In accordance with the goal of restoring and maintaining fish production in the State of Alaska to optimum sustained yield, ANILCA allows " *. . . the Secretary of Agriculture may permit fishery research, management, enhancement, and rehabilitation activities within national forest wilderness and national forest wilderness study areas designated by this Act"* (16 USC Chapter 51 Alaska National Interest Lands Conservation Act 01/26/98, Section 3203 Wilderness Management, (b) Aquaculture). The Prince William Sound Gulkana Hatchery, one of the few existing hatcheries on BLM land was started in 1973 by ADF&G FRED division prior to the enactment of ANILCA. The USFS in recent years generally does not permit hatcheries and long term remote release activities, preferring more restoration type projects such as placing large woody debris in streams, fish passes and ladders, and removing obstructions.

3.4.2 U.S.D.A. Forest Service – Tongass National Forest

The USFS manages land in the Tongass National Forest between the Alsek River and Yakutat Bay, as part of the Yakutat Ranger District. The Tongass National Forest Land and Resource Management Plan (USDA 2008) (TLMP) and by reference the 1997 TLMP guides all natural resource management activities and the 1997 version established Land Use Designations (LUD) and management standards and guidelines for the land within the forest. There are 10 LUD areas in the Yakutat Ranger District. The Russell Fiord Wilderness Area, congressionally designated in 1980 as a LUD II wilderness area includes the Yakutat Forelands east of the Dangerous River and the area of Disenchantment Bay and the 35 miles of Russell Fiord.

In 1990, the Yakutat Forelands (137,947 acres) was designated as LUD II (Land Use Designation) classification in the Tongass Timber Reform Act. The Conference Report for H.R. 987 Tongass Timber Reform Act went on to describe what LUD II meant.

> *TITLE II – TONGASS NATIONAL FOREST LANDS PROTECTION*
> *Section 201. LUD II Management Areas*
>
> *Title II of the senate amendment adds a new section 508 to ANILCA to provide that 12 areas of the Tongass are to be managed in perpetuity in accordance with Land Use Designation II (LUD II). The 12 areas were chosen for special management because of their critical importance for fish and wildlife habitat and their high value to tourism and recreation. The specific management criteria for LUD II areas, as defined in the TLMP (USDA 1997), as amended in the winter of 1985-1986 (pp. 8-9) are as follows:*
>
> *"(1) Purpose: Areas allocated to LUD II are to be managed in a roadless State to retain wildland character, but this would permit wildlife and fish habitat improvement and primitive recreational facility development."*

"(2) Management Implications: Commercial timber harvesting is not permitted. Timber can be salvaged only to prevent significant damage to other resources. Examples are removal of windfall in an important fish stream or control an epidemic insect infestation."

"Personal use of wood is allowed for cabin logs, firewood, float logs, trolling poles, and other similar uses."

"Water and power developments are permitted if they can be designed to retain the overall primitive characteristics of the allocated area."

"Roads will not be built except to serve authorized activities such as mining, power, and water developments, transportation needs determined by the State of Alaska and vital Forest transportation linkages."

"Mineral Development is subject to existing laws and regulations."

"Use of snowmachines, motorboats and airplanes on freshwater is permitted: however, restrictions may be imposed on a case by case basis if such use becomes excessive."

"Permanent improvements such as fishways, fish hatcheries, or aquaculture sites may be built. Appropriate landscape management techniques will be applied in the design and construction of such improvements to minimize impacts on recreational resources."

"Major concentrated recreational facilities will generally be excluded."[7]

The section *§507(a)* on Cooperative Fisheries Planning in ANILCA states, *"The Secretary of Agriculture is directed to implement a cooperative planning process for the enhancement of fisheries resources through fish hatchery and aquaculture facilities and activities in the Tongass National Forest. Participation in this process shall include but not be limited to the State of Alaska and appropriate non-profit aquaculture corporations. The Secretary may contract with private, non-profit associations for services in such planning. (b) Each subsequent revision of the National Forest Management plans under the Forest and Rangeland Renewable Resources Planning Act of 1974 and the National Forest Management Act of 1976 shall contain a report on the status of the planning process undertaken under this paragraph, including, but not limited to a description of current hatchery and aquaculture projects, an analysis of the success of these projects, and a prioritized list of projects anticipated for the duration of the management plan. The report shall be submitted by the Secretary of Commerce with recommendations for any legislative action which the Secretary may deem necessary to implement the proposed hatchery and aquaculture projects."*

[7] Congress 21 Session - House of Representatives Conference Report to accompany H.R. 987 Tongass Timber Reform Act (Pub L. 101-626) dated October23,1990

In the Phase I plan, it was stated that the NFS would integrate planning for Yakutat and Southeast (both North & South regions) to reflect fishery enhancement opportunities throughout the Tongass National Forest during the next Tongass Land Management Plan (TLMP) revision in 1985. The Tongass National Forest is now being managed under the 2008 Tongass National Forest Land and Resource Management Plan which superseded the 1997 and 1984 versions. The 2008 TMLP is currently under its five year review process with a determination to be made in 2014 on whether to undergo the revision process. In May of 2014, the Forest Service announced the formation of an advisory group to help with the revisions to the TLMP.

Over the past year, and published March 2013 the Tongass National Forest Service has worked diligently to create a 5-year schedule of integrated forest management activities and stated, *"We recently completed this effort, and wanted to share the resulting Tongass Integrated Plan with you. This plan is groundbreaking in that it incorporates community and collaborative input and priorities in a way the Forest has not done previously; aligns planning staff and budgets to increase efficiencies and effectiveness at the district and project level; and integrates multiple programmatic activities in larger landscapes. As part of the Tongass Integrated Plan a list of fish, watershed and soil related projects for a five year time plan was developed."*[8] There were no projects for the Yakutat Ranger District listed although there were other projects scattered around Southeast Alaska. It is not known if there are projects in the planning stage or currently underway by the USFS in the Yakutat region. Chapter 5 has a list of what projects that are known that the USFS as the lead agency or a collaborative partner participated in since 1984.

3.4.3 State of Alaska

Alaska state lands in the Yakutat region includes the Yakataga State Game Refuge, state managed uplands, all tidelands and submerged land and lands under navigable waterways. The Alaska Department of Natural Resources manages large blocks of land in the western borough in accordance with the University Settlement Agreement and the Yakataga Area Plan (ADF&G 1995, 2004). The University still owns two small parcels west of Cape Yakataga.

The Yakataga State Game Refuge was established in 1990 at 82,000 acres and is managed by the ADF&G. This area comprises the lowlands between Cape Yakataga and Cape Suckling, south of the Robinson Mountains and Bering Glacier Ice Fields, and fronting the north coast of the Gulf of Alaska. More precisely, the refuge is bounded on the west by the Seal River and on the east by the Kaliakh River. The southern boundary of the refuge is one mile inland from the mean high tide line, for most of the southern boundary. The primary drainages within the refuge are the Tsiu/Tsivat rivers system, the Midtimber Lake System (also known as Quonset Hut Lake) and the lower portions of the Kaliakh and

[8] http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5421164.pdf (Accessed Jan 2014)

Seal rivers. Alaska Department of Natural Resources added a 17,400 acre portion of the Yakataga Special Management Area to the refuge. This area includes most of the Kulthieth Mountain and the east bank of the Kaliakh River pushing the eastern boundary of the refuge to an area just west of the Duktoth River. The Yakataga State Game Refuge Management Plan (ADF&G 1999) directs the management of the refuge with the following three goals:

I. Protect the fish and wildlife habitat and populations, including salmon spawning and rearing habitat and critical goat and moose winter habitat.
II. Protect the public uses of fish and wildlife and their habitat, particularly commercial, sport and subsistence fishing, hunting, viewing, photography, and general public recreation in a high quality environment.
III. Protect the use and disposition of other resources when the activities are not inconsistent with goals I and II.

The Yakataga State Game Refuge Management Plan's policy is to allow enhancement of fish and wildlife populations and their habitats if it furthers the statutory goals of the refuge, especially enhancement of anadromous fish, moose, or mountain goat habitat. This shall not be at the expense of resource values (including diversity and abundance) nor interfere with public use and enjoyment. A Special Area Permit may be required for the activity (5AAC 95.420).

3.4.4 City and Borough of Yakutat

The CBY received management authority to 21,500 acres as part of its municipal entitlement. This contains 4,197 acres in the Yakutat townsite and the tidelands around the townsite, a 5,464 acre tract along the coast between Cape Suckling and the Seal River, a 9,804 acre tract between the Tsiu River and the Duktoth River, south of the Yakataga Game Refuge and a 5,538 acre tract at Icy Bay. The CBY also owns the tidelands around the townsite of Yakutat. The CBY prepared a Comprehensive Development Plan (City and Borough of Yakutat 2010) in 1976, and updated it in 1983, 1994 and 2010 which is a long-term planning guide for the broad development direction of the community. The CBY also frequently uses the Yakutat Coastal Management Plan (City and Borough of Yakutat 2006) for land management.

3.4.5 Private Lands

Yak-Tat Kwaan Corporation is the Yakutat village corporation formed under the Alaska Native Claims Settlement Act of 1971. Yak-Tat Kwaan received title to 23,040 acres of land. Since formation, it has purchased additional land in the Yakutat area.

Sealaska Corporation owns the subsurface estate of the Yak-Tat-Kwaan lands and has "over-selections" surrounding the townsite.

Allotments of up to 160 acres of land have been conveyed to approximately 20 natives as per the 1906 Native Allotment Act. Recipients receive private land ownership rights after conveyance. Additionally, there are 45 lots owned under the 1926 Native Townsite Act that have restricted deed status. Under this act, villages were surveyed into lots, block sheets and individual lots conveyed to native adults. These restricted deeds limit the native owner's ability to sell or transfer his property.

Chugach Alaska Corporation has two tracts of land in the CBY, the East Icy Bay tract totaling approximately 70,000 acres, and the Cape Yakataga tract at over 1,000 acres. Chugach has additional land selections pending conveyance at East Icy Bay, Cape Suckling, and the upper Kaliakh River/Robinson Mountain area.

3.5 Status of Fisheries

This section provides an update to the Phase I plan and will cover changes to some of the major river systems important to the Yakutat Region since 1984; as well as current escapement goals used for management and monitoring and the management and harvest of the commercial setnet, troll, subsistence and sport fisheries. This will provide new and current baseline information as we move forward with this updated comprehensive salmon plan. Baseline harvest information prior to any large scale fishery enhancement projects is important and can be useful if and when allocation issues arise between gear groups. Numeric tables of the harvest data presented in the graphs in this section can be found in Appendix H.

3.5.1 Commercial Setnet Fishery

The Yakutat set gillnet fisheries, commonly referred to as setnet fisheries, are divided into two main fishing districts: the Yakutat District, which extends from Cape Fairweather to Icy Cape; and the Yakataga District, which extends from Icy Cape to Cape Suckling. The Yakataga District fisheries only target coho salmon, while the Yakutat District primarily target sockeye and coho salmon although all five species of salmon are harvested. The bulk of the setnet harvest takes place in four major river systems, (Alsek River, Situk-Ahrnklin River, Tsiu River, and Yakutat Bay) although there are approximately 25 different areas open to commercial fishing each year. The setnet fishery is confined to the intertidal area

inside the mouths of the various rivers and streams, and to the ocean waters immediately adjacent to each.

The ex-vessel value of the Yakutat setnet fishery from 1980 to 2013 can be found in Figure 9. The highest ex-vessel value of $8,703,413 was attained in 1988 and the lowest value of $741,392 was attained in 2002 when low fish prices were coupled with low fishing effort. The average earning per Yakutat setnet permit from 1980 to 2013 can be found in Figure 10. The average earnings per permit ranged from a low of $ $8,130 in 2005 to a high of $54,738 in 1988[9].

The participation in the setnet fishery has varied between 87 permits and 161 permits actively fishing (Figure 11). This time series starts at the advent of limited entry in 1975.

Figures 12-18 show the 1960-2011 harvests in numbers of fish in the setnet fishery by individual species and total harvest all species combined. The two dominant species of harvest are sockeye and coho salmon.

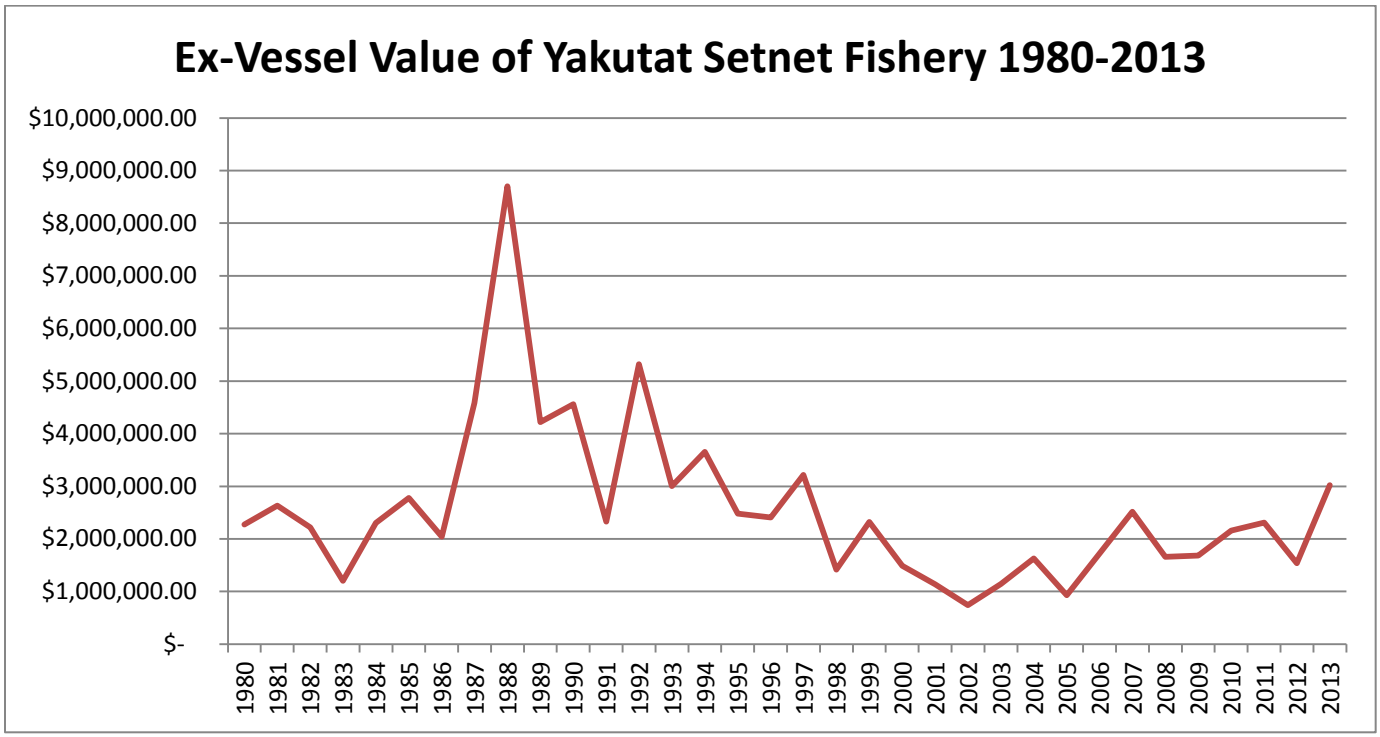

Figure 9. Ex-vessel value of Yakutat setnet fishery 1980 to 2013

[9] CFEC data tables http://www.cfec.state.ak.us/bit/X_S04D.htm accessed August 2014

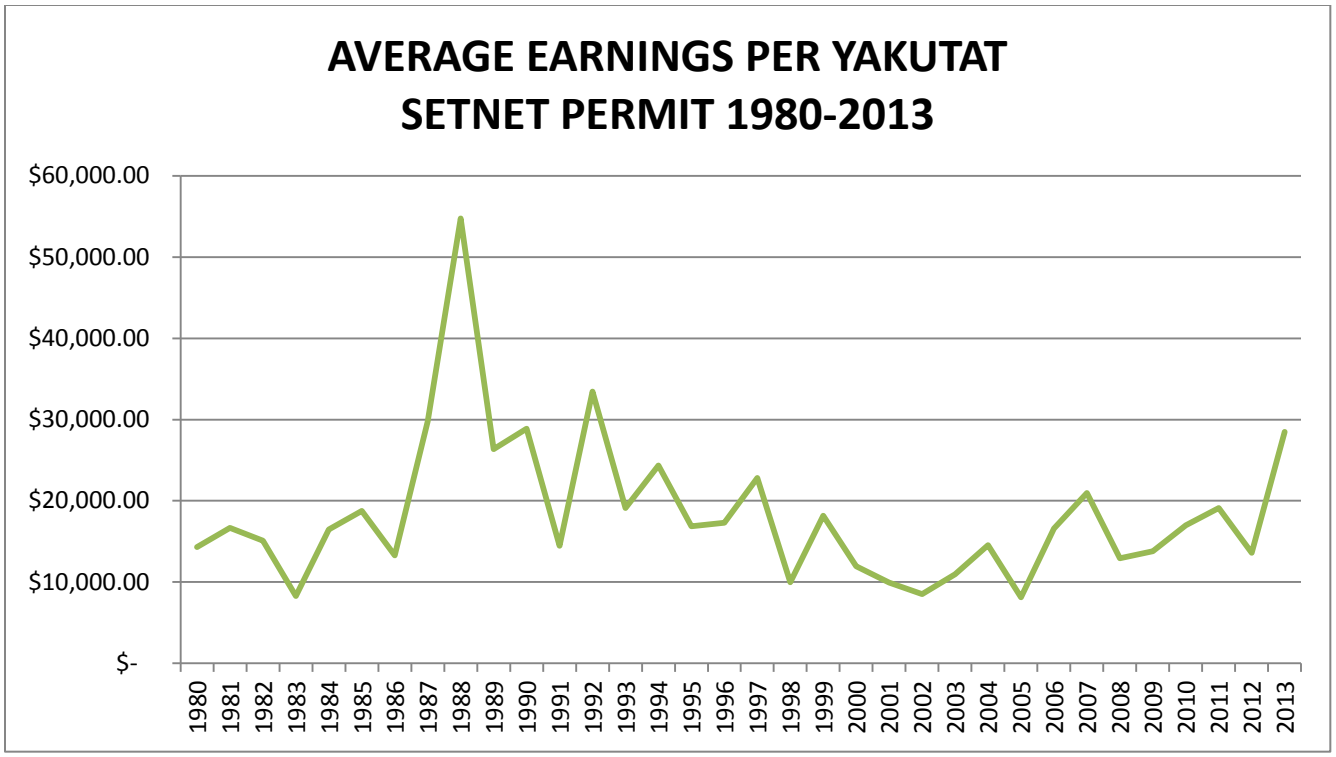

Figure 10. Average earnings per Yakutat setnet permit 1980 to 2013

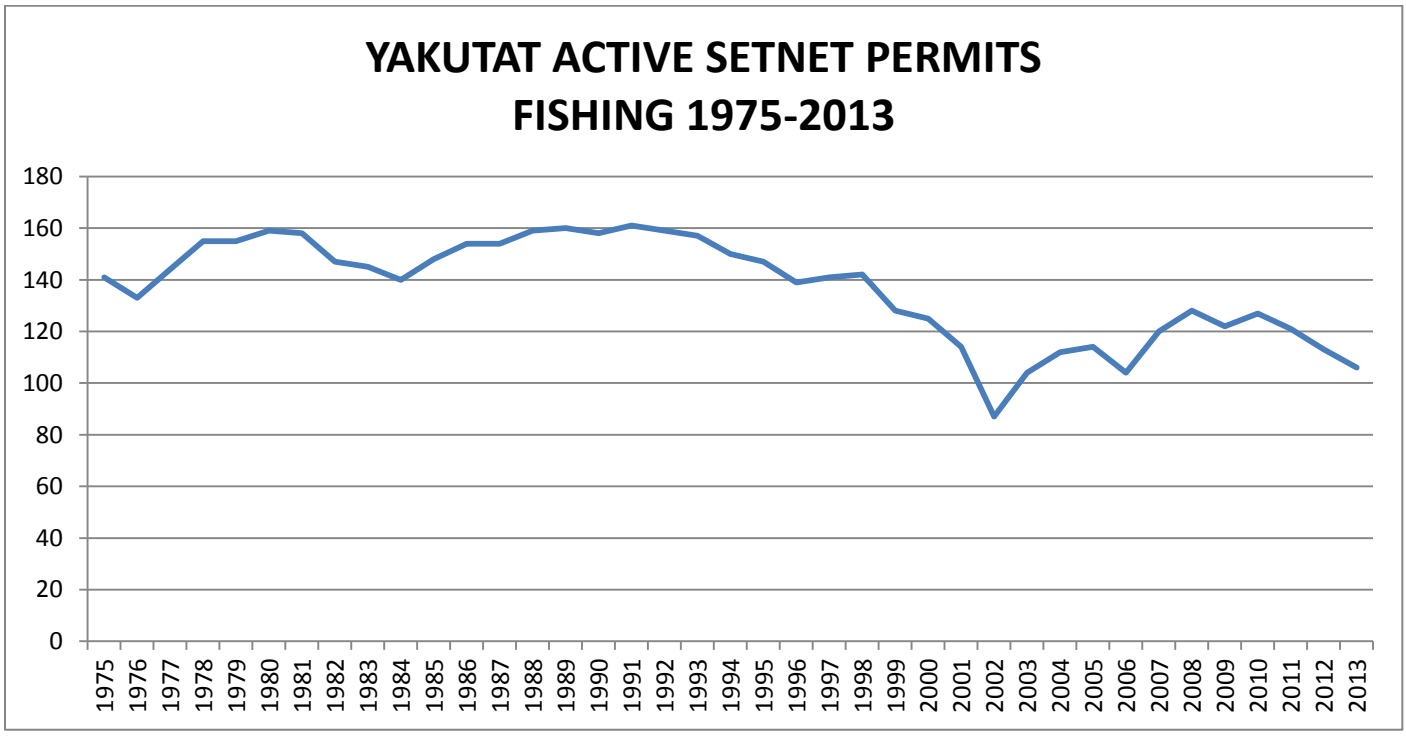

Figure 11. Yakutat active setnet permits fishing 1975 to 2013

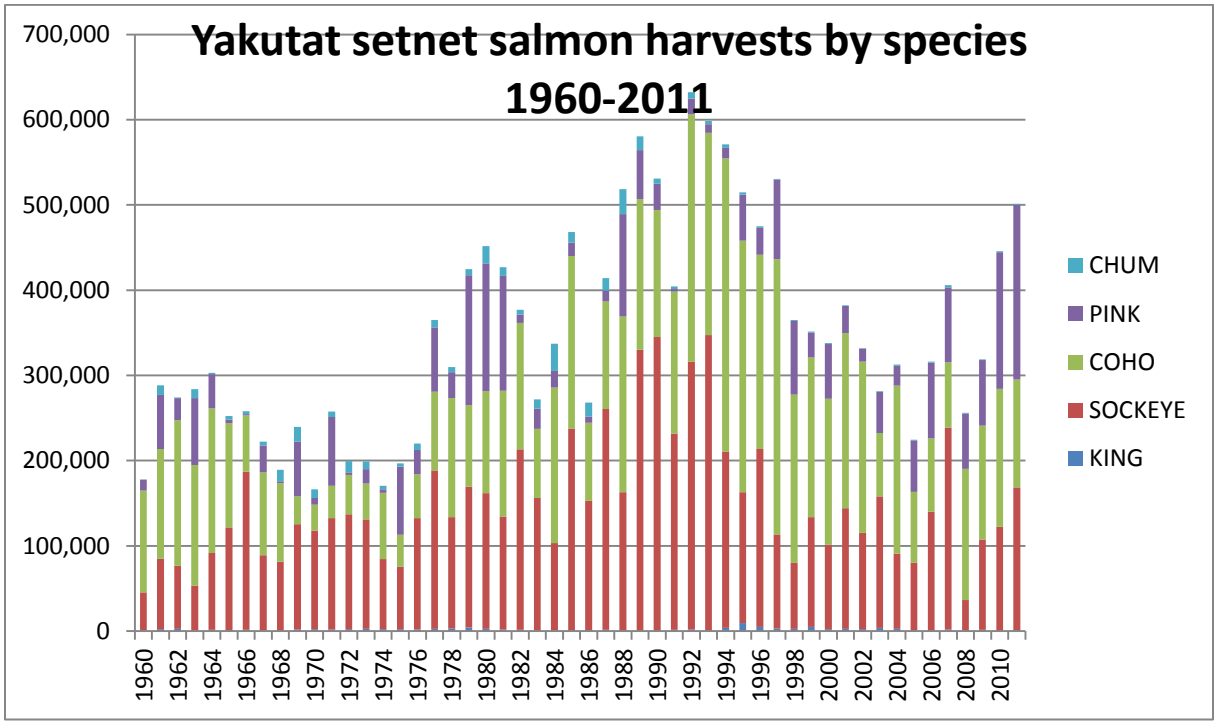

Figure 12. Yakutat setnet salmon harvest by Species 1960 to 2011

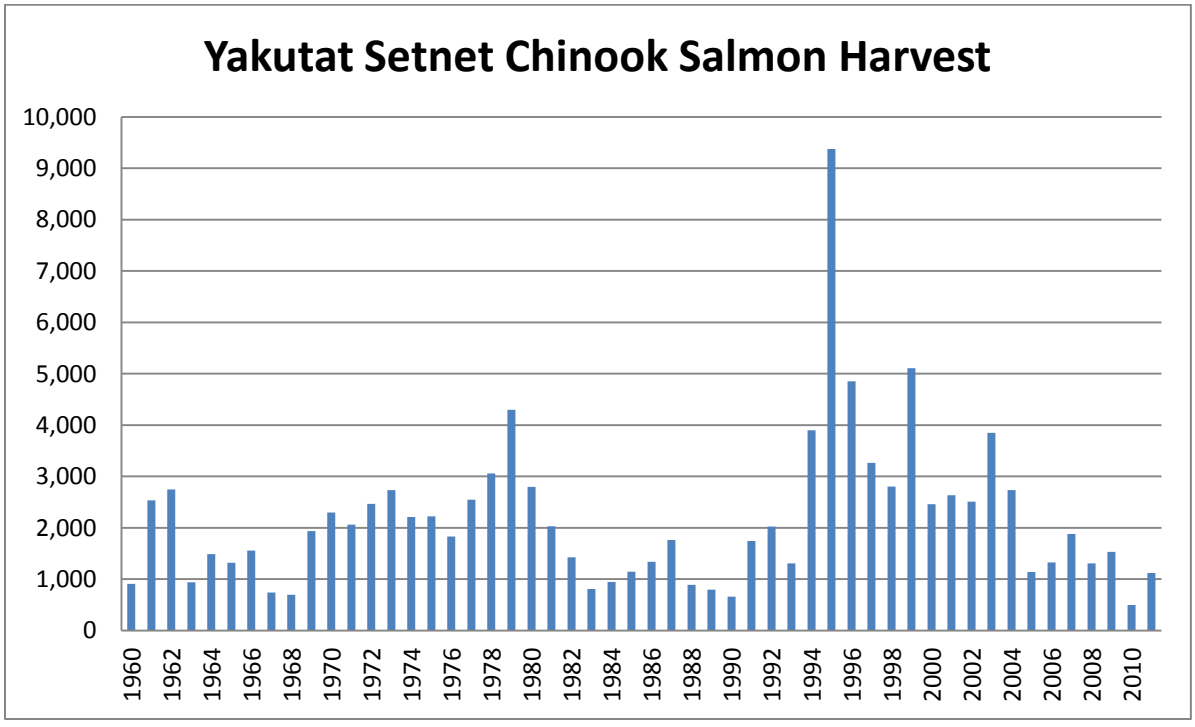

Figure 13. Yakutat setnet Chinook salmon harvest 1960 to 2011

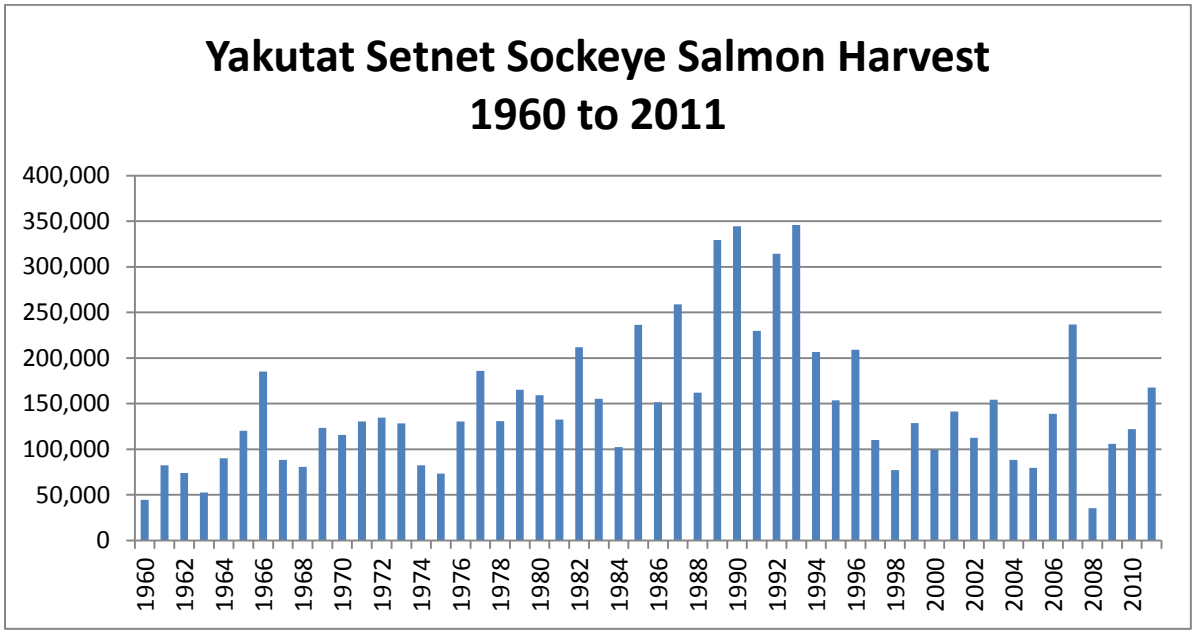

Figure 14. Yakutat setnet sockeye salmon harvest 1960 to 2011

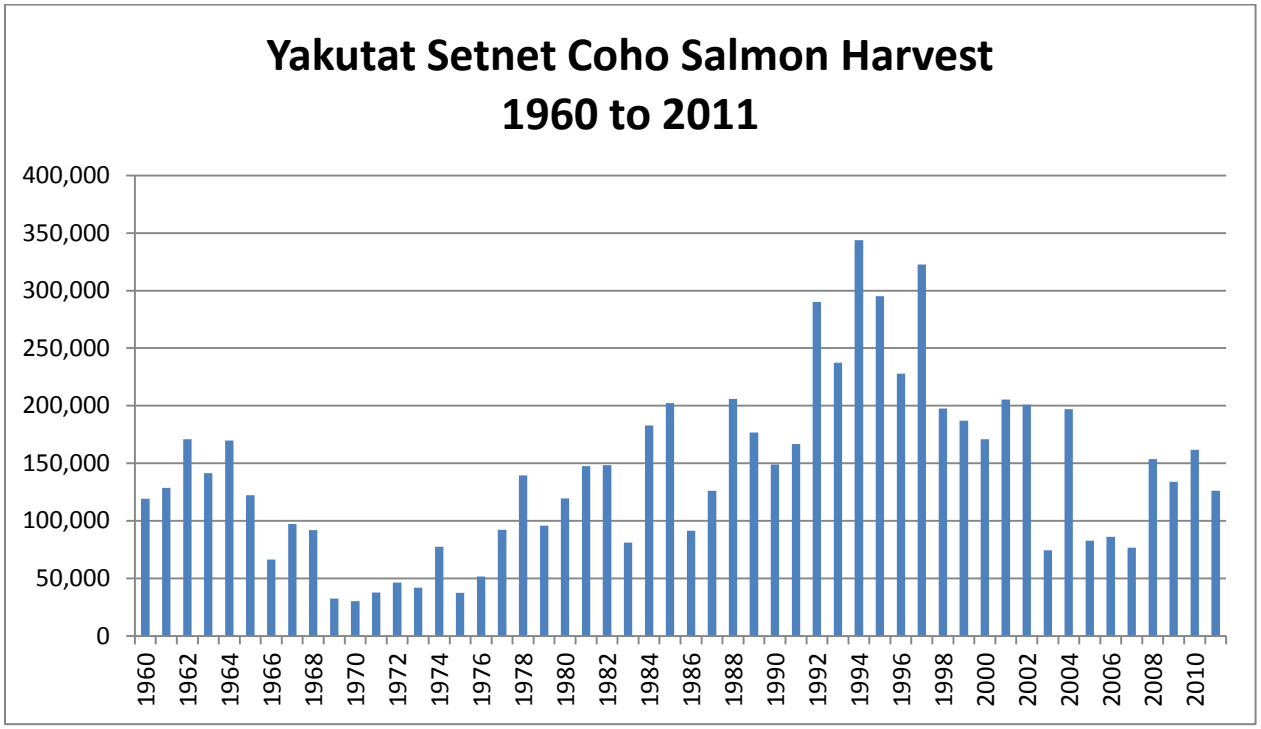

Figure 15. Yakutat coho salmon setnet harvest 1960 to 2011

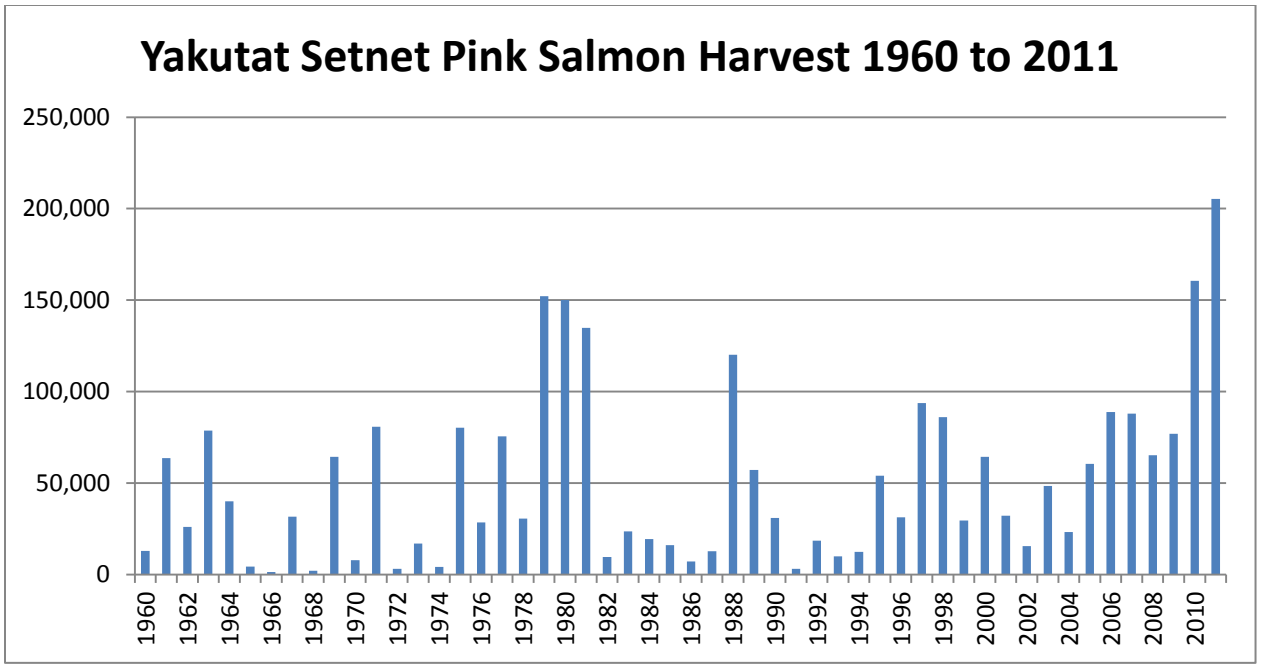

Figure 16. Yakutat pink salmon setnet harvest 1960 to 2011

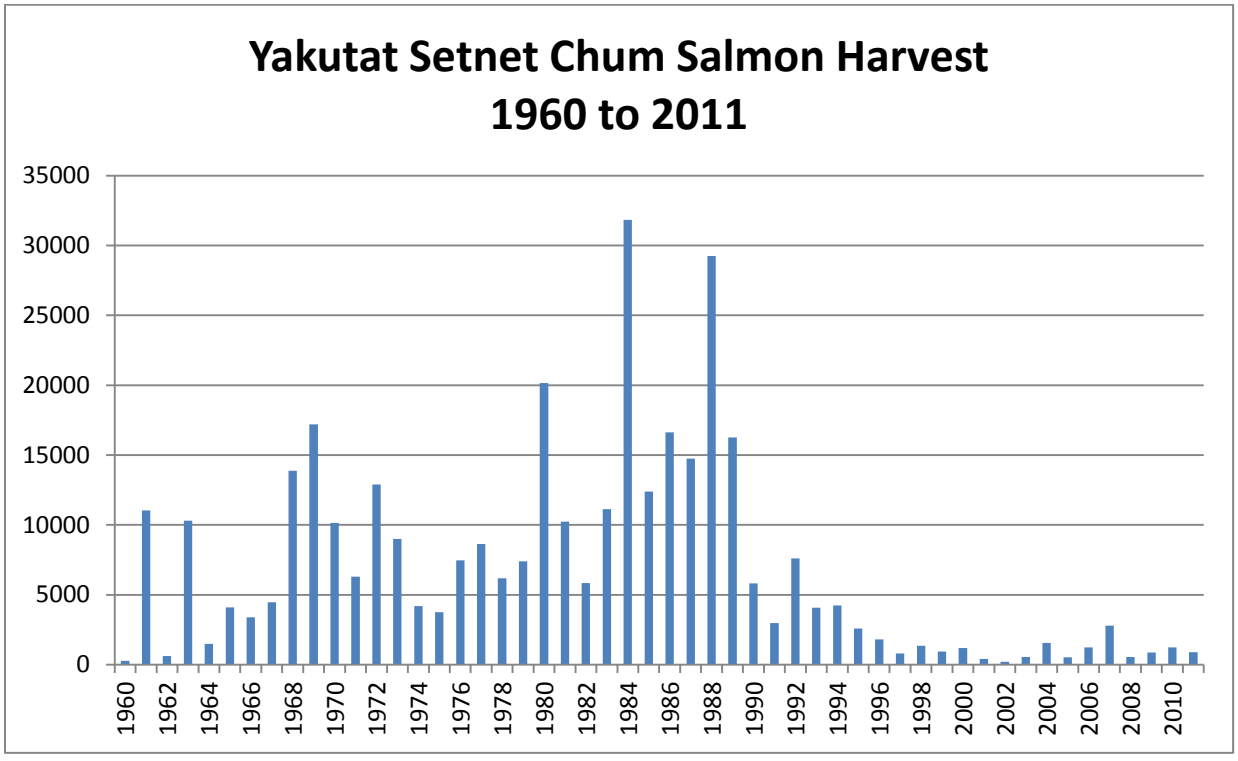

Figure 17. Yakutat chum salmon setnet harvest 1960 to 2011

3.5.2 Troll Fishery

Hand and power troll permits are statewide limited entry permits. By regulation this fishery occurs in Region 1 (Southeast Alaska and Yakutat) in Alaska waters and the Federal Exclusive Economic Zone east of the longitude of Cape Suckling. All other waters are now closed to commercial trolling. The troll fishery primarily targets Chinook and coho salmon. Since 1999, the Chinook salmon troll fishery has been managed under an abundance-based management regime as part of the Pacific Salmon Treaty and further restricted by Board of Fisheries regulations. The most current Pacific Salmon Treaty annex was signed in 2008 and will remain in effect through 2018, with a five-year Chinook salmon review scheduled for 2014.

The troll fishery has a winter and summer season. The winter season is defined as October 1st – April 30th, or until 45,000 non-Alaska hatchery-produced Chinook salmon are harvested. The fishery typically opens on October 11th and is restricted to those areas lying east of the "surf line" south of Cape Spencer and the waters of Yakutat Bay. All other coastal areas including the exclusive economic zone, are closed during the winter fishery. The summer season is divided into the spring and general summer fisheries. The spring fisheries are intended to increase the harvest of Alaska hatchery-produced Chinook salmon and occur primarily in inside Southeast waters near hatchery release areas or along migration routes of returning hatchery fish. These fisheries begin after the winter fishery closes and may continue through June 30. The spring troll fisheries can begin prior to May 1 if the winter fishery closes early, when the harvest cap of 45,000 non-Alaskan hatchery-produced Chinook salmon is reached. The general summer fishery opens July 1 and harvests the majority of the annual Chinook salmon quota during this time period. During the summer fishery, most waters of the Southeast Alaska/Yakutat area are open to commercial trolling, including outer coastal waters.

The troll fishery is managed on a region wide (Southeast & Yakutat) basis except for the spring troll fisheries which are managed individually by area based on hatchery contribution in Southeast Alaska and was established by Board of Fisheries regulation for Yakutat.

The Yakutat spring troll fishery was first adopted at the January 2006 Board of Fish meeting. Regulations were established that allow the department to open by emergency order, a spring salmon troll fishery for one day per week during the months of May and June in the Yakutat Bay area east of a line from Point Manby to Ocean Cape. The maximum harvest is 1,000 Chinook salmon and is not based on the composition of Alaska hatchery fish. This fishery may be open only if the projected in-river run of three-ocean age and older Chinook salmon to the Situk River weir is greater than 1,050 fish [5 AAC 30.365(c)(5)]. In 2012, the actual return was 322 large Chinook salmon, which was an improvement over 2011 but still too low to allow a commercial fishery.

At the 2012 Board of Fisheries southeast finfish meeting, the regulation was changed delinking the Yakutat spring troll fishery from the Situk Chinook salmon escapement goal projections, but the regulations were not changed in time for the 2012 fishery. In 2013, the first Yakutat spring Chinook salmon troll fishery occurred since 2006. The 2013 fishery has a preliminary estimate of 1,012 Chinook salmon harvested in Yakutat Bay by 31 permit holders during 7 openings. Those openings were held one

day per week during May and June (statistical (stat) weeks 19 through 25). This fishery was not opened the final week of June, since it was projected that the 1,000 fish limit would be reached prior to that. The average size was 11.7 lbs. and ranged from 16.6 lbs. in early May down to 10.7 lbs. by the last week it was opened. The price started off at $9.16 and ended at $4.96, for an average price $6.21 for the spring season. Preliminary estimates are a cumulative Alaska hatchery contribution of 5% of the total catch in the Yakutat spring troll fishery. No Alaska hatchery tags were recovered in stat weeks 19, 21, 23, and 24. Alaska hatchery contribution made up 17% of the stat week 22 catch and 8% of the stat week 25 catch. Hidden Falls Hatchery Chinook salmon were the major Alaska hatchery contributor in stat week 22. Information and data on the Yakutat hatchery spring fishery was provided by ADF&G (P. Skannes, Troll Fish Biologist, ADF&G, Sitka, personal communication). Appendix H has a table of hatchery contributions by week for the Yakutat region for 2013 and 2014.

The following graphs (Figures 18-22) show the troll harvests by species for only the Yakutat area of Region 1 (Districts 181, 183, 189 & 191). ADF&G website has a statistical area map showing the Yakutat Region salmon districts at:

http://www.adfg.alaska.gov/static/fishing/PDFs/commercial/maps/chart05e_salm_shell_yakutat.pdf (accessed January 2014).

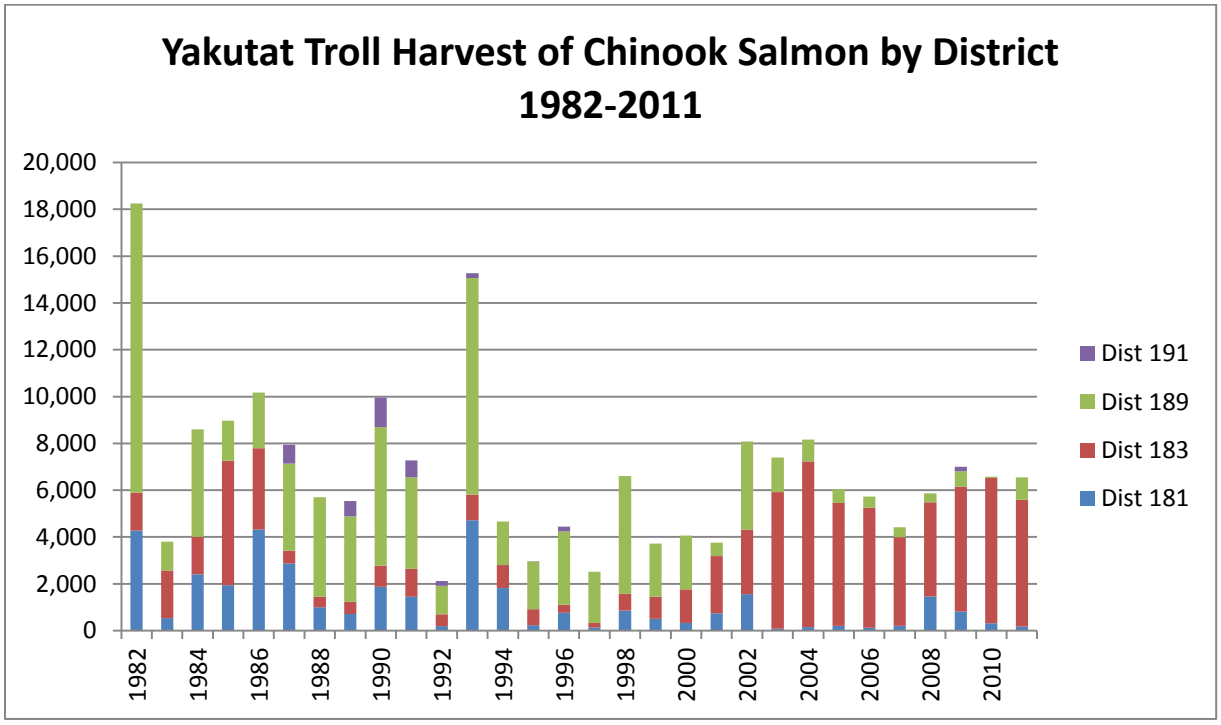

Figure 18. Yakutat troll harvest of Chinook salmon by district 1982-2011.

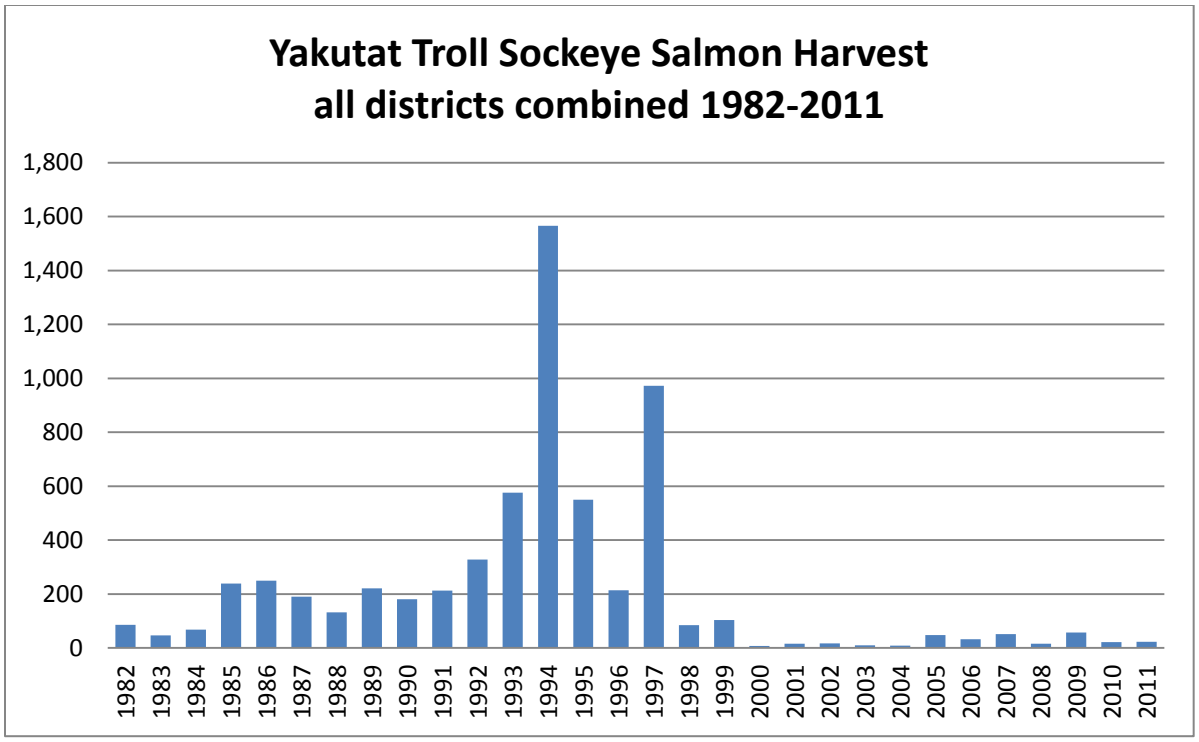

Figure 19. Yakutat troll sockeye harvest all districts combined 1982-2011.

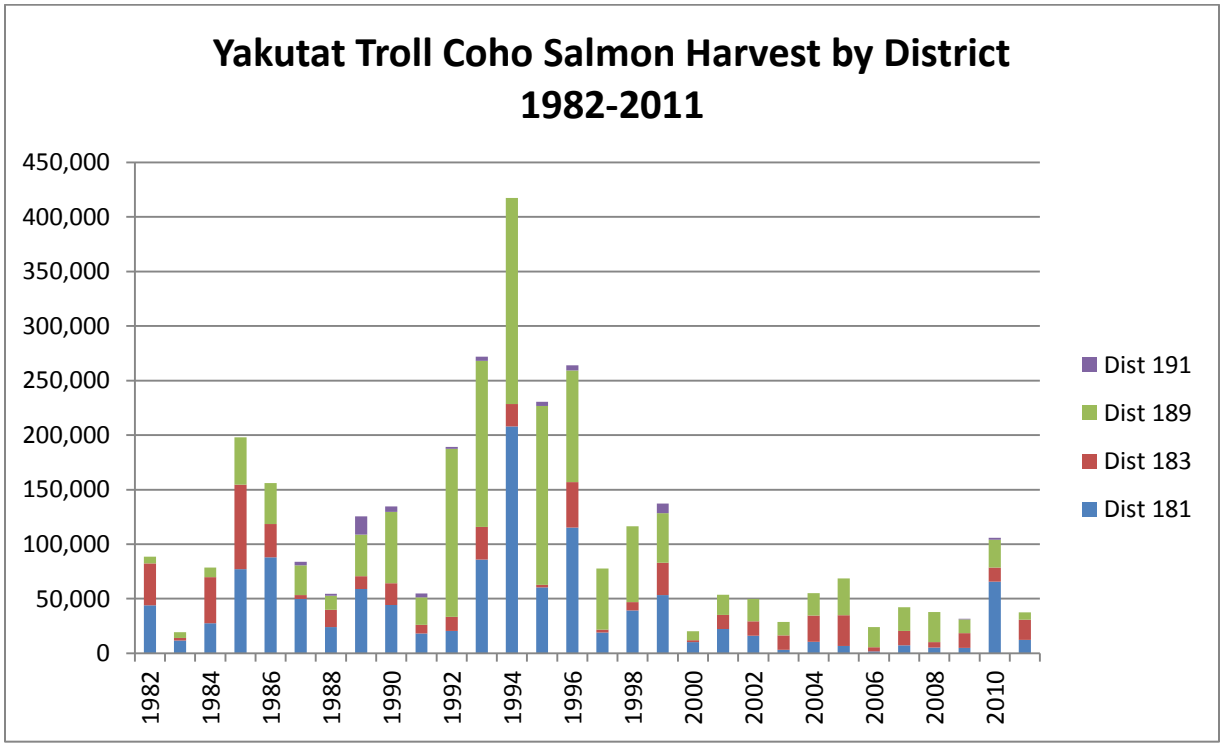

Figure 20. Yakutat troll coho salmon harvest by district 1982-2011.

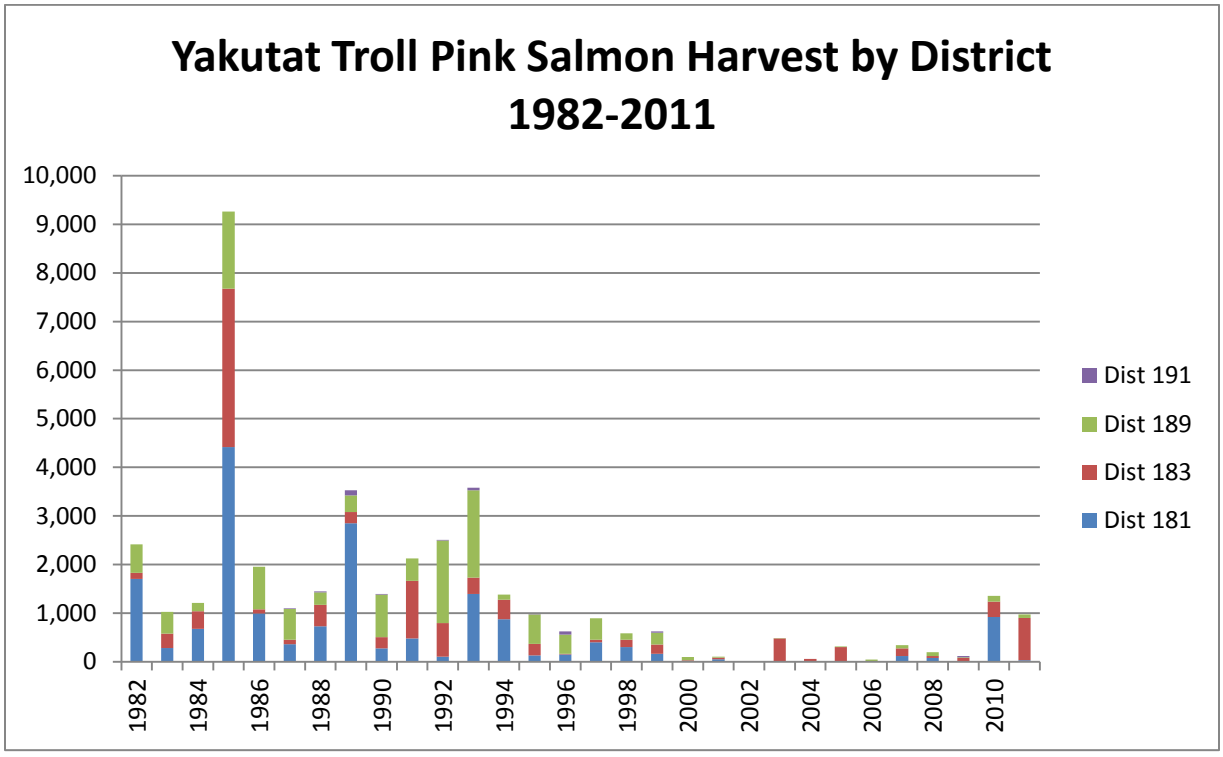

Figure 21. Yakutat troll pink salmon harvest by district 1982-2011.

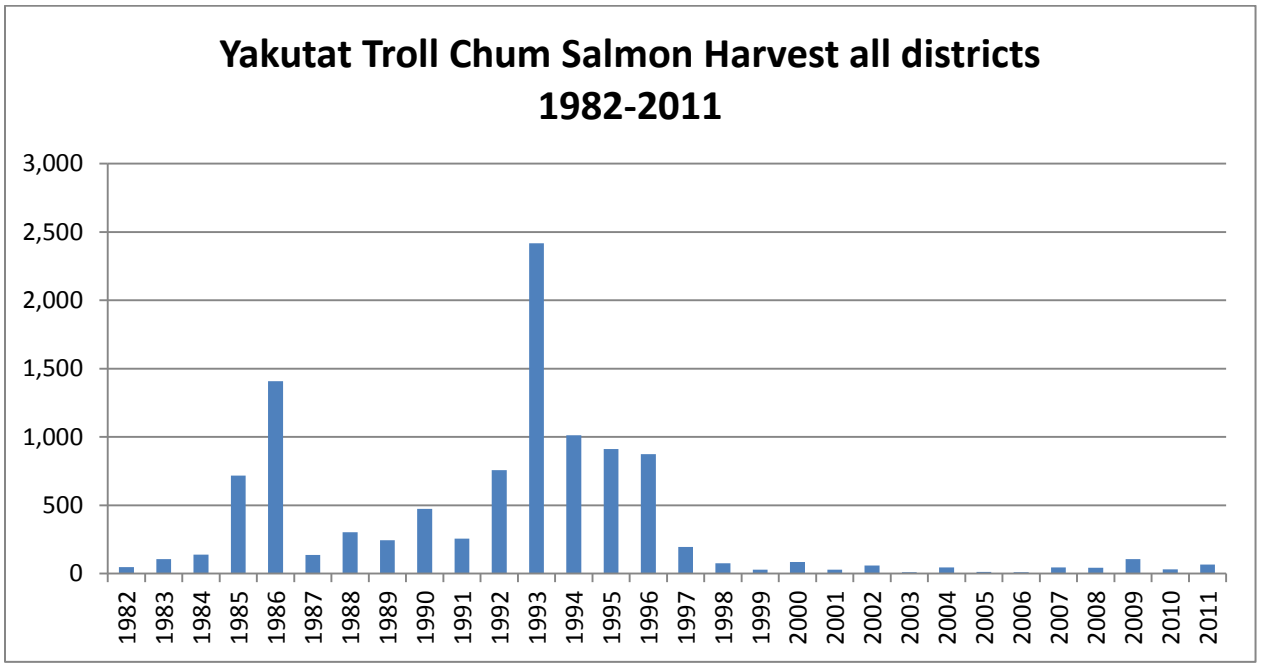

Figure 22. Yakutat troll chum salmon harvest all districts 1982-2011. Sub-district information is confidential.

3.5.3 Sport Fisheries

The Phase I plan acknowledged the Yakutat area as being "*renowned for their sport fishing with the heaviest pressure occurring close to the Yakutat village system roadways"* (Yakutat Planning Group 1984). Steelhead fishing on the Situk River is the most prized fishery; although coho salmon is the predominant species harvested. Data on the sport fishery is estimated through the Statewide Harvest Survey mail survey.

The Yakutat road system provides access to locations which still receives the most sport fishing effort in Yakutat; however, remote areas are becoming popular as roadside effort increases, and options for wilderness transportation increase. All five species of Pacific salmon are available in both fresh and salt water, although chum salmon are rare. Yakutat Bay and the inner islands provide a wide variety of marine fish species such as halibut and salmon. Over the last decade, the five species of salmon represented slightly more than three-quarters (77%) of the sports fishing harvest in the region, with coho salmon alone representing nearly half (48%) of the total harvest during that ten-year period (Sheinberg Associates, 2012, unpublished data).

Sport fishing is an important economic component of the Yakutat region. The overall tourism industry is the third most important economic segment of the Yakutat region following behind commercial fishing (2nd) and government (1st) (Sheinberg Associates, 2012, unpublished data). The average visiting angler spends an average of five days in the region (Sheinberg Associates, 2012, unpublished data). Between 2005 and 2012 there were 7-9 active businesses in the Yakutat region that turned in saltwater logbooks associated with salmon harvests and 15-21 businesses submitting freshwater logbooks as part of the requirements for guided fishing activities (H. Sigurdsson, Sport Fish Biologist, ADF&G, Anchorage, personal communication). There is also additional unguided recreational fishing occurring in the region.

Coho and Chinook salmon are fished throughout the Situk River drainage, although seasonal closures are in effect for Chinook salmon in spawning areas. Coho salmon are the big attraction in the Lost River, Tawah Creek systems and Ankau Lagoon system from late-August through mid-October. There are a number of remote fishing sites accessible by airplane. Situk Lake and Mountain Lake are accessible by trail or float plane. There are several very remote but very productive systems at the extremes of the area. To the east, the Italio, Akwe, and East Alsek Rivers, and to the west, the Tsiu River (pronounced sigh-you), are known mainly for their coho salmon runs.

Yakutat sport fisheries are managed by Board of Fisheries approved regulations and ADF&G emergency order authority. The main management tools used in the sport fishery are bag limits, time and area.

Sportfish angler effort in Figure 23 represents the angler use in numbers of anglers as determined by the Statewide Harvest Survey. Figure 24 represents the angler use in angler effort (angler days). An angler day is equal to one angler fishing during a day for any amount of time. Many individuals participate in both the freshwater and saltwater fisheries. Figures 26 to 29 show the total coho salmon harvest caught in saltwater or freshwater. Saltwater harvest is represented by boat or shoreline harvest and the freshwater harvest is separated into harvest in the Situk River and harvests in other systems.

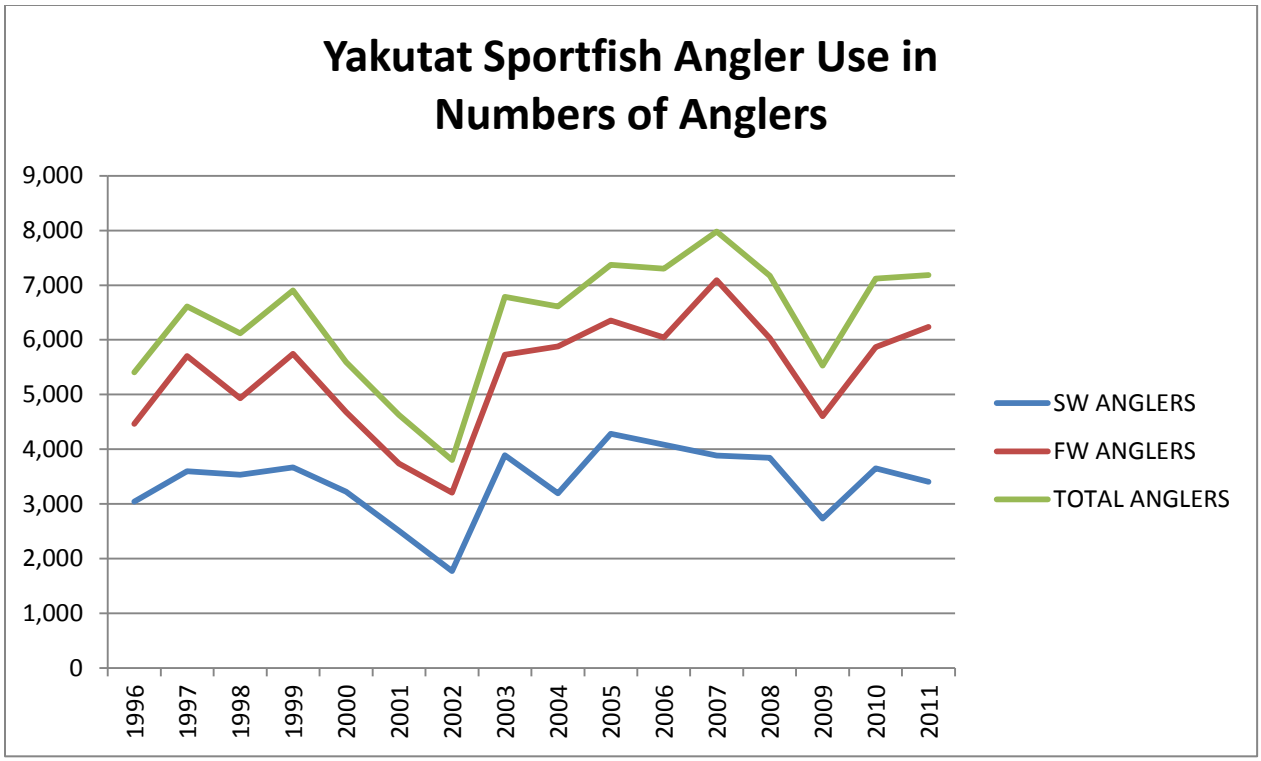

Figure 23. Yakutat sport fish angler use in numbers of anglers 1996 to 2011. Total includes anglers who fished in both fresh and saltwater.

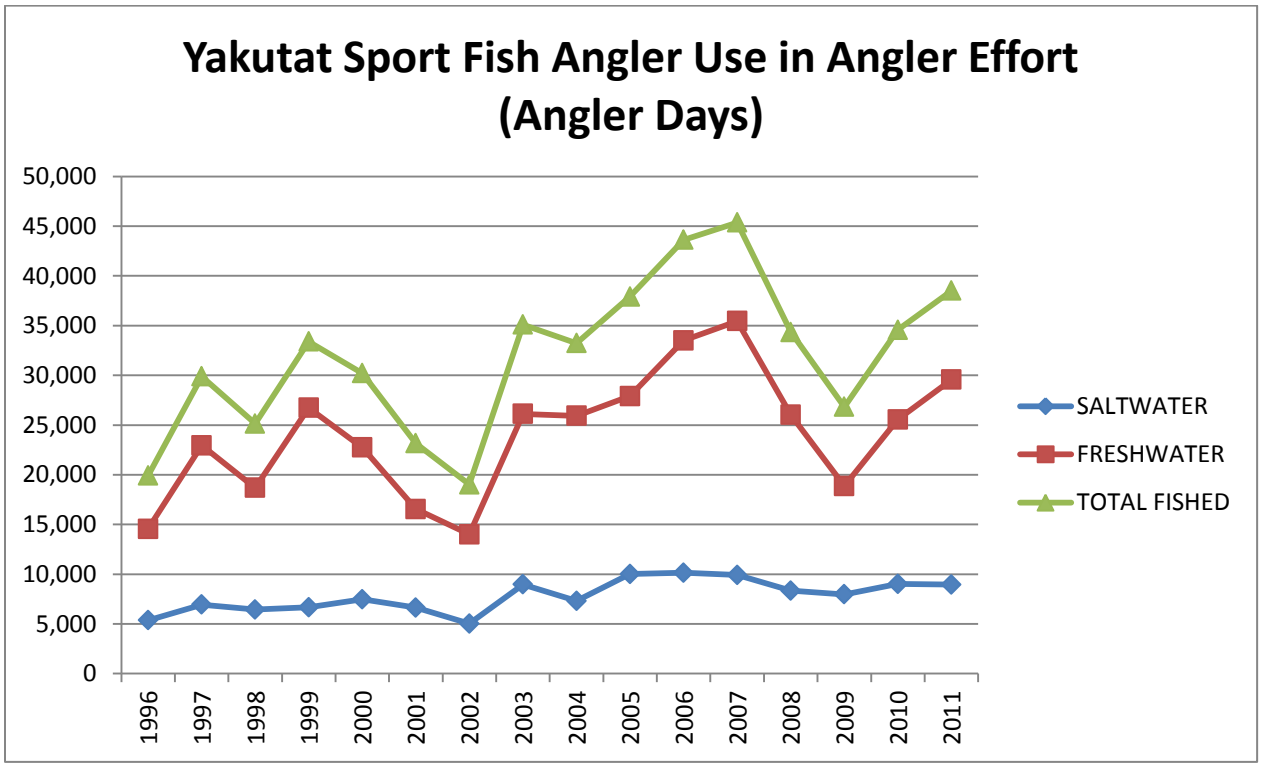

Figure 24. Yakutat sport fish angler use in angler effort (angler days) 1996 to 2011.

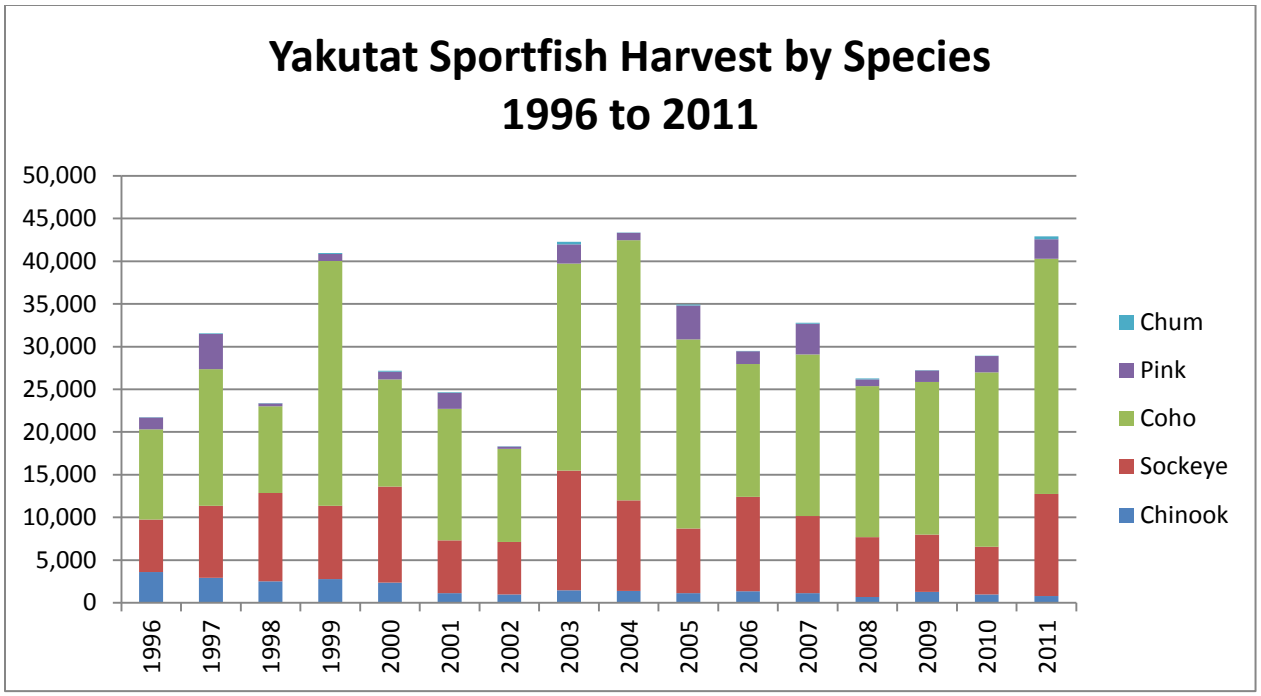

Figure 25. Yakutat sport fish harvest by species 1996 to 2011.

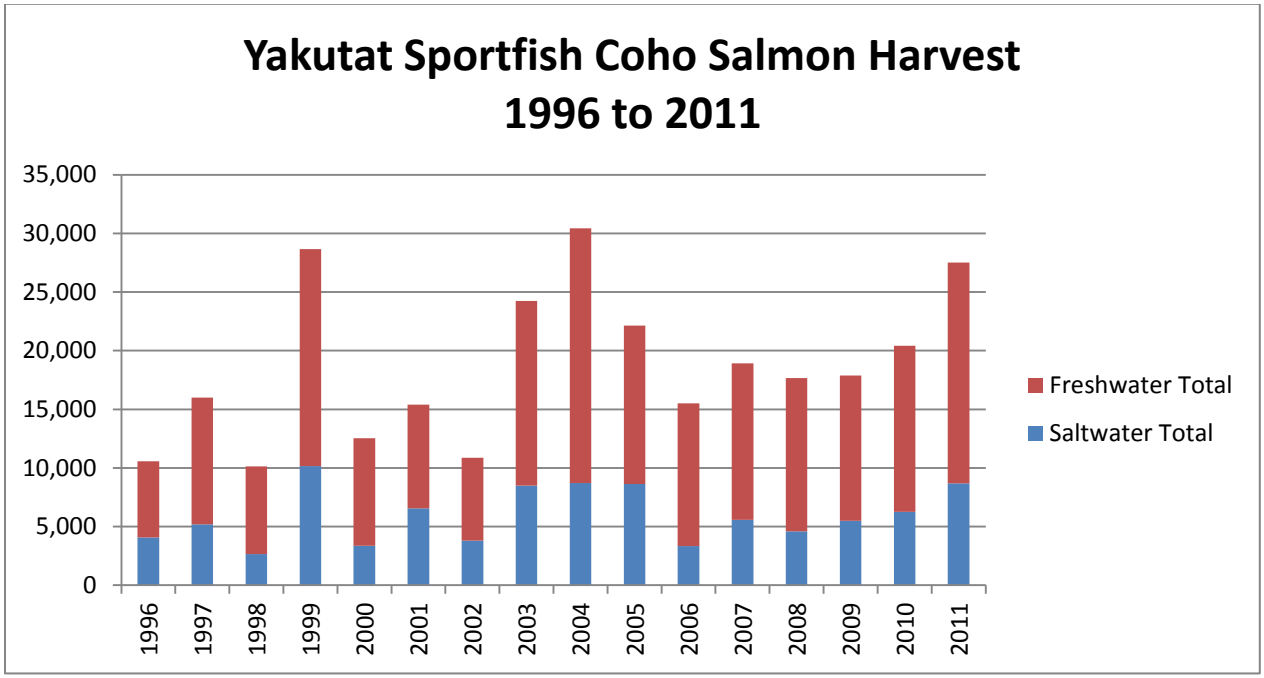

Figure 26. Yakutat sport fish coho salmon harvest 1996 to 2011.

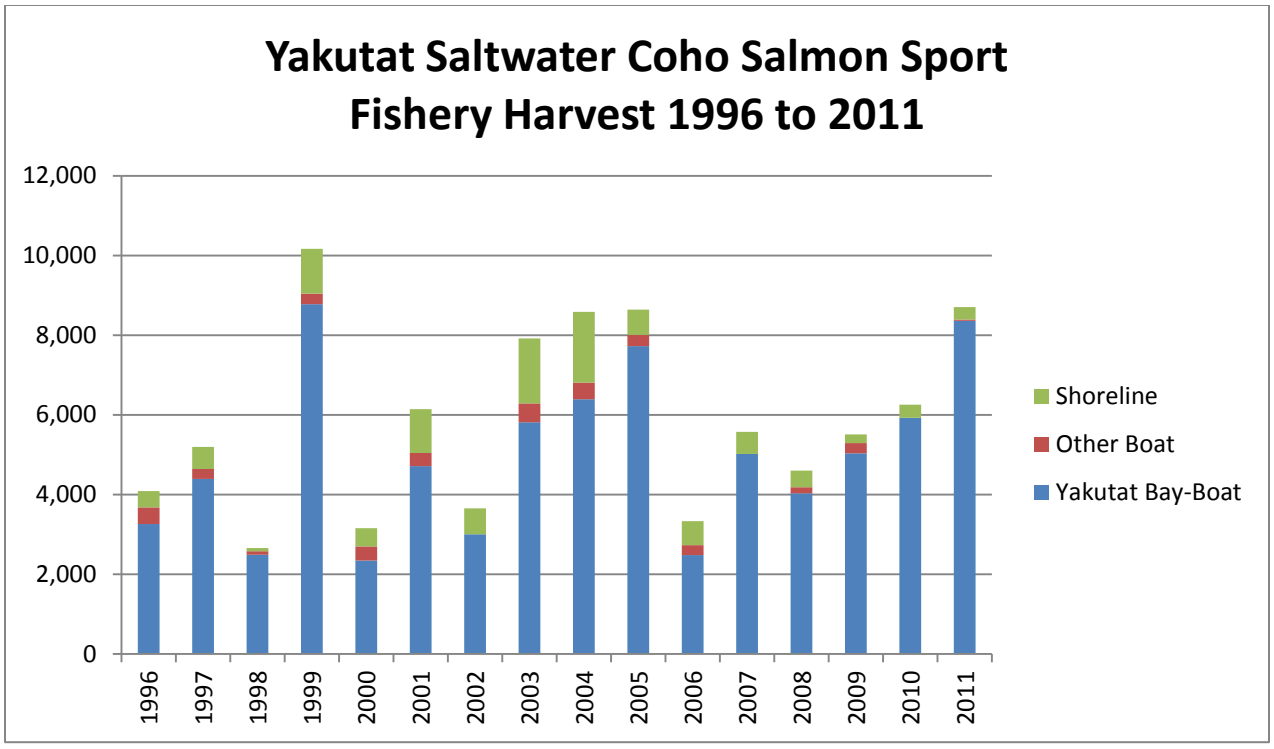

Figure 27. Yakutat saltwater coho salmon sport fishery harvest 1996 to 2011.

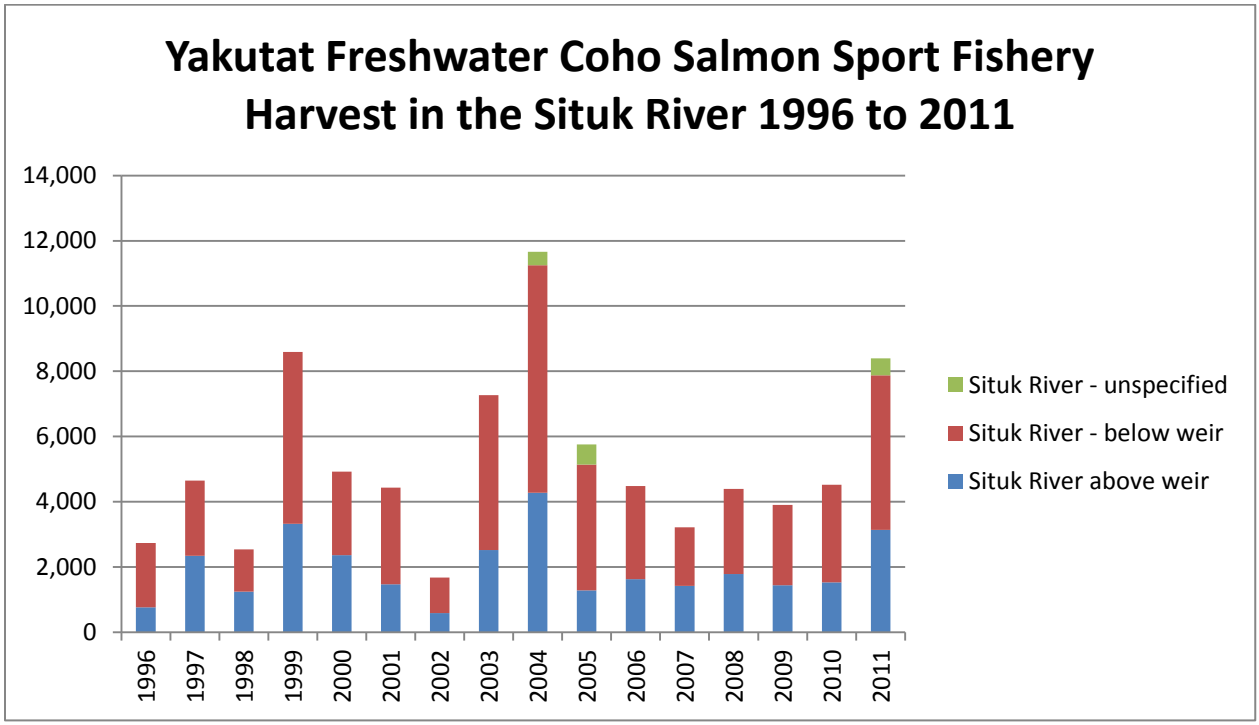

Figure 28. Yakutat freshwater coho salmon sport fishery harvest in the Situk River, 1996 to 2011.

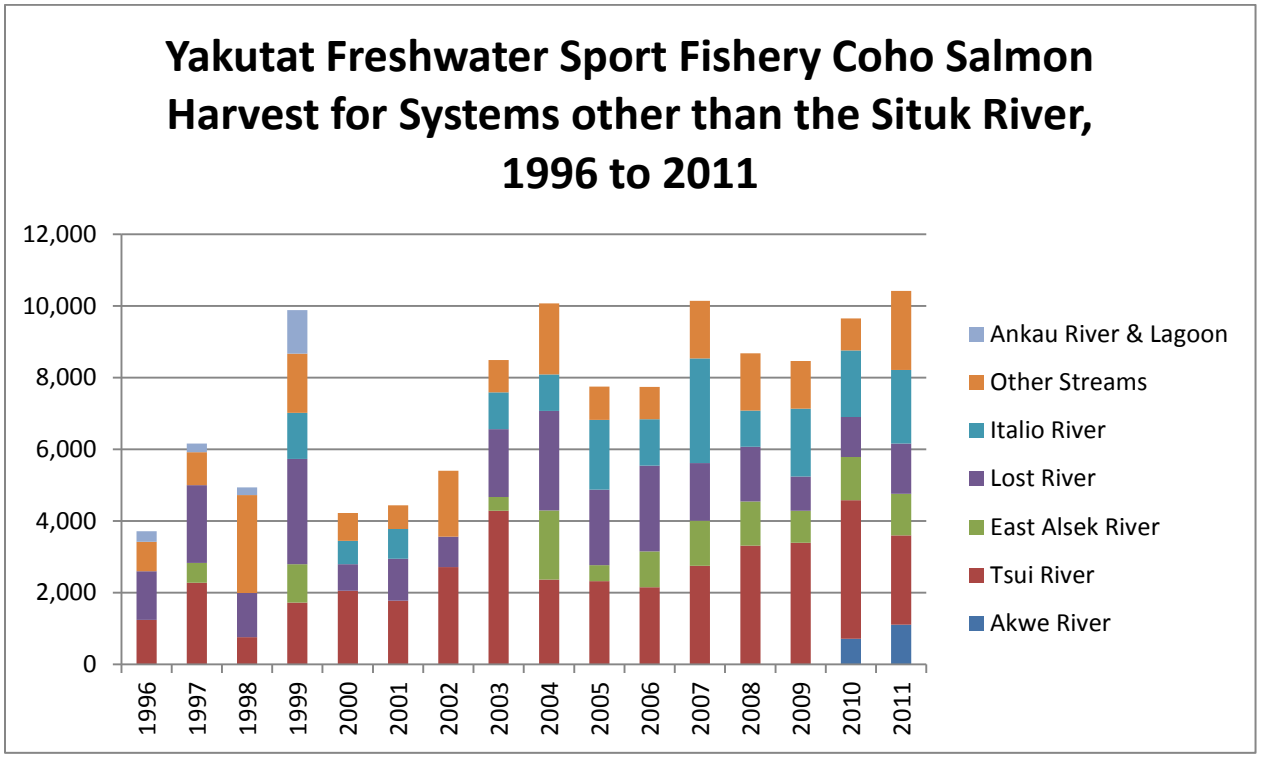

Figure 29 Yakutat freshwater coho salmon sport fishery harvest for systems other than the Situk River, 1996 to 2011.

3.5.4 Subsistence Fisheries

Yakutat has one of the strongest subsistence economies of Alaska's coastal areas. The region is rich with abundant food resources. While not part of the local cash economy, subsistence activities are critically important to the overall Yakutat economy, lifestyle and culture. Nearly all (91%) subsistence foods harvested in the CBY are seafood. According to National Oceanic and Atmospheric Administration (NOAA), 54% of the subsistence resources harvested are salmon (Sheinberg Associates, 2012, unpublished data).

Yakutat residents use a stretch of about 200 miles of coastline, most of it within CBY, for subsistence harvest activities. Three comprehensive studies in 1984, 1987 and 2000, were used to track subsistence harvest in Yakutat. Sheinberg Associates in an unpublished report Yakutat Community and Economic Indicators for the City of Yakutat (2012) summarized the results as:

- *Over 95% of the Yakutat households use/receive subsistence resources.*
- *Average household harvests for 2000, 1987 and 1984 are (respectively) 1,045, 1,385, and 1,107 pounds of fish.*
- *Total estimated per capita subsistence harvest has remained virtually the same over the last two decades at 385 pounds of fish per capita for 2000.*
- *The total estimated salmon harvest for household use by residents of Yakutat was 16,081 fish in 2000.*
- *If these subsistence resources had been purchased at a grocery store, at an average of even $3 per pound, the value to each household in 2010 (using 2000 subsistence harvest numbers, and 270 households) the value would be $846,450 annually.*

The subsistence fishery in Yakutat is under the management responsibility of the Division of Commercial Fisheries. The Board of Fish has identified customary and traditional (C&T) findings (5AAC 01.666 (a)(3)) for salmon in the fresh waters upstream from the terminus of streams and rivers of the Yakutat Area from the Doame River to the Tsiu River, in the waters of Yakutat Bay and Russell Fjord inside a line from the Westernmost point of Point Manby to the southernmost point of Ocean Cape, and in the waters of Icy Bay inside a line from the westernmost tip of Point Riou to Icy Cape Light (Fall and et al, revised 2012, page 164). The Board of Fish determined that 5,800 to 7,832 salmon are reasonably necessary for subsistence uses in the Yakutat waters previously described.

The Board of Fisheries adopted regulations for Yakutat waters that include the following clauses: 1) a subsistence permit is required; 2) fishing periods are 6:00 am Friday to 6:00 pm Saturday from the beginning of the commercial salmon net fishing season to the end of the commercial salmon net season unless extended by emergency order; 3) rod and reel is not allowed but otherwise gear type used for harvest is not specified; 4) sport harvest and subsistence harvest may not occur on the same day; 5) subsistence gillnet gear must be attended while fishing the Situk River; and 6) the dorsal fin must be clipped on any salmon caught while subsistence fishing. Annual subsistence salmon harvest assessments have been estimated since 1989. Subsistence harvests also come from commercial catches.

The following graphs show the number of permits that have been issued since 1989, the estimated number of permits fished, the reported subsistence harvest by species, and the total reported salmon subsistence harvest. Subsistence data for the graphs came from ADF&G published reports. (Tingley and Davidson, 2007 and Conrad and Davidson 2013)

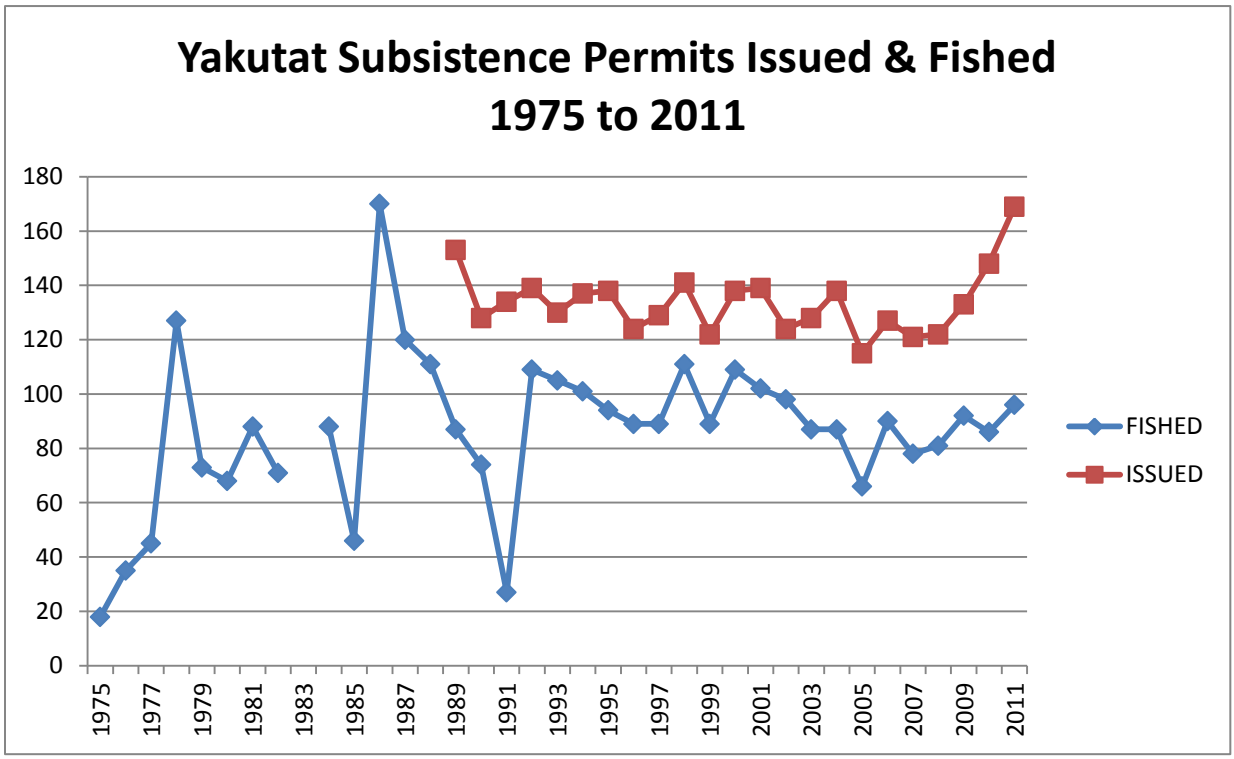

Figure 30. Yakutat subsistence permits issued and fished 1975 to 2011.

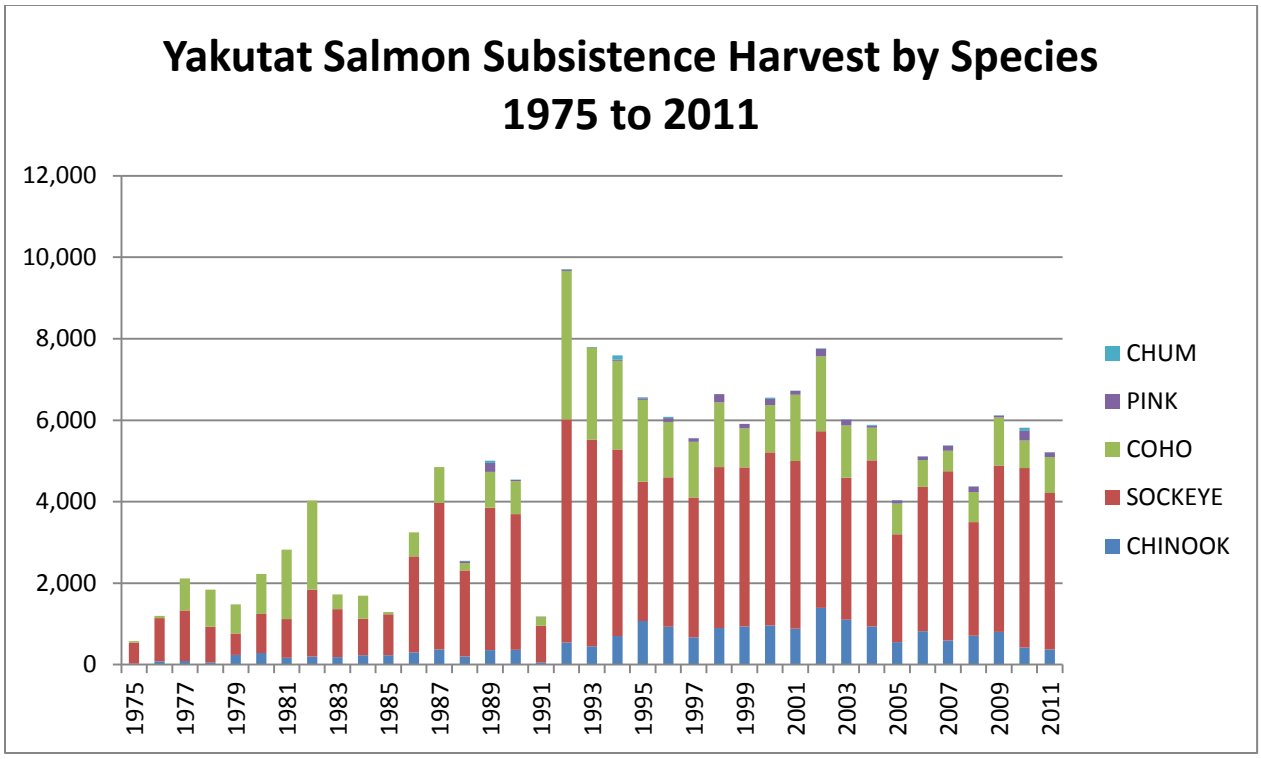

Figure 31. Yakutat salmon subsistence reported harvest by species, 1975 to 2011.

3.6 Escapement Goals and Management Strategies

Fisheries are managed to ensure that escapement goals are met. In the case of glacial systems, it is often difficult to see escapement or escapement doesn't become visible until long after the fishery has occurred. Escapement counts performed in-season become the driving force in establishing commercial openings, closures, and fishing times for the setnet fishery. Fisheries performance data in the form of catch per unit of effort may be compared with historical data to estimate relative run strength for commercial fisheries management on some systems in the Yakutat area. The Alsek River is the only system in the Yakutat area where catch per unit of effort is used as a commercial fisheries management tool on a regular basis (Woods & Zeiser 2012).

Two saltwater setnet fisheries occur in Yakutat Bay that target sockeye salmon; the Manby Shore and the Yakutat Bay Fishery. Historical stock analysis of these fisheries indicates that the majority of the sockeye salmon harvested, especially during the first six or seven weeks of the season are of Situk-Ahrnklin origin. These fisheries are managed in accordance with the Situk-Ahrnklin escapement goals (Woods and Zeiser 2012)

Escapement goals have been established for many of the river systems and species. See table 1 below for current escapement goals established in the region and escapements for 2000-2013.

Table 1. Escapement Goals

Species	System	Range	Year Establ.	Escapement 2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Chinook	Klukshu River (Alsek River)	800-1,200	2013	1,321	1,738	2,141	1,645	2,451	1,034	568	676	466	1,466	2,159	1,667	665	1,261
	Alsek River (total)	3,500-5,300	2013														
	Situk River	450-1,050	2003	1,785	562	1,000	2,163	698	599	695	677	413	902	167	240	322	912

	System	Range	Year Establ.	Escapement 2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Sockeye	East Alsek-Doame	13,000-26,000	2003	23,200	18,545	14,200	36,400	33,300	50,000	29,000	40,100	8,000	12,250	19,500	26,000	21,500	26,500
	Klukshu River	7,500-11,000	2013	5,422	9,248	23,587	32,120	13,721	3,167	12,890	8,479	2,731	5,731	18,546	21,389	17,267	3,800
	Alsek River	24,000-33,500	2013														
	Lost River	1,000	2009	2,245	1,440	1,800	3,000	1,100	1,500	1,018	180	146	na	1,525	1,006	453	587
	Situk River	30,000-70,000	2003	41,554	60,334	68,774	89,720	43,278	66,476	87,080	61,799	22,520	83,959	47,865	89,943	62,476	118,600

Species	System	Range	Year Establ.	Escapement 2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Coho	Lost River	2,200	1994	1,572	3,190	8,093	6,394	5,047	1,241	3,500	2,542	na	3,581	2,393	1,221	2,200	2,593
	Situk River	3,300-9,800	1994		5,030	40,000	6,009	10,284	2,514	7,950	5,763	na	5,814	11,195	3,652	3,007	14,853
	Tsiu/Tsivat Rivers	10,000-29,000	1994	12,000	17,000	31,000	35,850	na	16,600	14,500	14,000	25,200	28,000	11,000	21,000	11,000	47,000

	System	Range	Year Establ.	Escapement 2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Pink	Situk River	33,000 through weir by August 5	2012	331,510	-	98,790	-	145,914	-	115,100	-	140,000	-	776,000	-	30,548	-
		(old 42-105K)	2012	-	121,267	-	375,333	-	279,648	-	229,000	-	62,300	-	170,000	-	133,585

ADF&G data: S. Kelley, Southeast Regional Supervisor, ADF&G, Juneau, personal communication (2013)

3.7 Major Fishery Systems

Chapter 3.2.1 Introduction to Status of Fish Stocks of the Phase I plan (Yakutat Salmon Group, 1984) stated, *"In the Yakutat area, the production of individual streams and rivers has been highly variable through time. This is thought to be based on the following factors: fishing pressure, the effects of rapid geomorphological change (such as uplift, advancing/retreating glaciers, and meandering stream and river channels), the processes of eutrophication through the accumulation of organic materials, and long term changes in ocean survival rates."* This has been apparent in the changes that have occurred since 1984. In this section, an updated overview of major changes in the area of coverage and a review of the some of the more important systems to the fisheries individually will be provided.

3.7.1 Overview of the Region:

The Yakutat region is the most glaciated area of North America. Glaciers in the region include: the Malispina Glacier (largest piedmont glacier at 1,500 square miles), Valerie Glacier, Turner Glacier, Hubbard Glacier (largest tidewater glacier), Nunatak Glacier, Yakutat Glacier and Dry Bay glaciers (including the Grand Plateau Glacier), Alsek Glacier, Chamberlain Glacier, Rodman Glacier, Fassett Glacier, Martin Glacier and the Canyon Glacier. The Yakutat region is surrounded by 200 miles of the Saint Elias mountain range, the highest coastal range in the world, and the Fairweather Range surrounds Dry Bay area.

The fastest rates of glacier rebound in the world currently exist in the Yakutat/Glacier Bay region (Gubernick and Paustian 2004, and Motyka et al. 2007). Extreme uplift and sea level changes have been documented, and the uplift east of Yakutat was measured with peak rates of 32mm/yr. These studies documented rapid and continuous total sea level changes of up to 5.7 m in less than 250 years. The rising land also is continually changing the geomorphic texture of shoreline throughout the region and causing changes in hydrologic patterns, erosion, and sedimentation (Motyka et al. 2007).

Hubbard Glacier, Russell Fiord and Situk River are in a constant state of motion. This area is an extremely active and dynamic landscape with an advancing tidewater glacier, two major seismic faults, and a maximum net isotactic uplift rate of 0.44 cm/yr (Gubernick and Paustian 2004). Hubbard Glacier's history is different than that of other Alaskan glaciers. During the little Ice Age, when most glaciers in the vicinity had advanced to their maximum position, the Hubbard Glacier was engaged in a large-scale retreat (Barclay et al. 2001). Over the last 50 years when most glaciers in Southeast Alaska have been thinning and retreating at record rates, the Hubbard Glacier advanced. Since 1895, Hubbard Glacier has advanced 1.5 miles. Between 1986 and 2002 Hubbard Glacier has advanced by an average of 90 feet per year.

The southern end of Russell Fiord is confined by a terminal moraine whereas the northern end of the fiord flows into Yakutat Bay. In 1986 and 2002, the advance of Hubbard Glacier blocked the northern end of Russell Fiord from Yakutat Bay, temporarily creating Russell Lake. Subsequent failure of the ice or moraine dams produced the two largest glacial outburst floods in historic times. Both of these dams

failed before the lake had risen to an elevation that would have caused it to spill over the terminal moraine at the southern end of Russell Fiord into the Situk River drainage (Gubernick and Paustian 2004). It is not possible to quantify the probability of a closure of Russell Fiord by Hubbard Glacier for an extended time period with any certainty. However, given the more-or-less continuous advance of the glacier since 1895, it seems likely that this probability is significant (Daly et al 2011).

The first effect of a sustained closure would be to turn Russell Fiord into Russell Lake, a lake with no immediate outlet. A hydrological model was developed to estimate the inflows into Russell Lake. Once the water level of Russell Lake has risen approximately 137 feet above mean lower low water, the inflows into Russell Lake would spill out through the Notch area and into the Situk River system. In effect, the drainage area of the Situk River would increase over 20 times, with a corresponding increase in flow. This increase in flow would significantly affect almost every aspect of the Situk River.

3.7.2 Situk-Ahrnklin River:

The Situk River is a small river approximately 22 miles in length. The headwaters of the Situk River are made up of Situk and Mountain lakes. The Situk, Ahrnklin and Lost rivers all flow into the Situk-Ahrnklin lagoon before entering the Gulf of Alaska. This area including the Situk-Ahrnklin River estuary and Black Sand Spit (along the mouth of the Situk River), has recently been modified by earthquake, isotactic rebound and coastal erosion/deposition processes (Shepard 1995). The Yakutat area has had five major earthquakes since 1899 resulting in up to 15 m of uplift in portions of Yakutat Bay (Combellick and Motyka 1995). This tectonic activity altered groundwater tables and probably had long lasting effects on groundwater exchange with stream segments in affected areas. Portions of former perennial streams, such as Ophir Creek have become intermittent over the last few decades. Long-shore transport and deposition of sediment derived from large glacial rivers is another significant agent of coastal change. Expansion of Black Sand Spit has pushed the mouth of the Situk River 2.4 km to the northwest over the last 50 years (Shepard 1995). Chinook salmon are managed under the terms of 5AAC 30.365, *Situk-Ahrnklin Inlet and Lost River King Salmon Management Plan.*

The ten-year average value (2002-2011) of the Yakutat setnet fishery is $945,837. The Situk-Ahrnklin River harvest accounts for 60% of the earnings. (Woods 2013).

Appendix H has a table with Situk River weir counts for all five species with a longer time series than provided earlier in Table 1 page 56.

Table 2. Ex-vessel value of Situk-Ahrnklin setnet fishery relative to the total Yakutat area ex-vessel set gillnet fishery, 1992-2012 (Woods and Zeisner 2013)

YEAR	Yakutat Setnet Fishery Value	Situk River Setnet Fishery Value	Percent Value of Situk River Fishery
1992	$5,238,058	$2,063,000	39%
1993	$2,916,782	$1,192,148	41%
1994	$3,331,851	$1,686,803	51%
1995	$2,968,274	$1,716,842	58%
1996	$2,375,047	$1,351,005	57%
1997	$2,975,854	$1,687,084	57%
1998	$1,350,752	$ 652,129	48%
1999	$1,960,794	$1,097,412	56%
2000	$1,487,207	$ 740,165	50%
2001	$1,130,969	$ 705,325	62%
2002	$ 745,218	$ 601,704	80%
2003	$1,135,551	$ 782,143	69%
2004	$1,606,082	$1,156,074	72%
2005	$ 911,193	$ 488,192	54%
2006	$1,695,830	$ 889,519	52%
2007	$2,479,100	$ 911,724	37%
2008	$1,693,845	$1,092,913	64%
2009	$1,641,423	$ 858,378	52%
2010	$2,185,611	$1,372,001	63%
2011	$2,382,753	$1,305,724	55%
2012	$1,496,399	$ 772,554	52%

Table 3. Harvest of salmon in the Situk-Ahrnklin setnet fishery, 2007-2012 with 5 year average (Woods and Zeiser 2013)

YEAR	BOATS	CHINOOK	SOCKEYE	COHO	PINK	CHUM	TOTAL	DAYS
2007	77	83	62,059	41,900	61,591	415	166,048	54.5
2008	80	91	10,625	95,874	43,250	166	150,006	45.0
2009	84	307	49,016	69,978	66,640	147	186,088	69.8
2010	85	50	72,185	70,727	143,234	310	286,506	58.0
2011	85	22	65,661	79,911	142,061	307	287,962	68.5
2012	71	89	53,168	48,328	21,395	254	123,234	44.5
'07-'11Avg.	**80**	**107**	**52,119**	**67,786**	**79,695**	**267**	**215,322**	**59.2**

3.7.3 Lost River

Previous to 1999, the Lost River discharged directly into the Gulf of Alaska but has now shifted and discharges into the Situk-Ahrnklin estuary. Areas of the Situk-Ahrnklin estuary were closed by Board of Fish regulation to protect Lost River stocks. This closure forced the displacement of some traditional

fishing sites and many of these fishermen have elected to transfer their operations to either the Situk-Ahrnklin Inlet or to Yakutat Bay. It is assumed that fish previously harvested in the Lost River are now harvested in the Situk-Ahrnklin fishery. The lower end of the Situk-Ahrnklin estuary appears highly mutable and the conservation measures enacted from 1999 to 2012 will continue to be necessary in the future (ADF&G 2012).

3.7.4 Tsiu River

The Tsiu River, located in the Yakataga District, is a productive coho salmon system prized by sport fishermen and important to the commercial fishery. The Tsiu River is a dynamic system which leads to changing river conditions. The holding pools above the regulatory markers at Duck Camp Island have become less productive as they fill in with sand and vegetation. The distance from Duck Camp Island to the terminus of the river can vary anywhere from 2.5 to 4.5 miles due to the shifting nature of the lower sand stretch. In recent years, the river portion has been getting longer, but at any given time, the mouth of the river can break through the sand spit to the west, which lops off as much as 2 to 2.5 miles of river length (ADF&G 2012).

The Tsiu River is in a remote location without processing facilities. Commercial harvest must be transported from the site in a DC-3, or similar aircraft, to reach a processor. Commercial fishing can only occur when the weather is nice enough to fly the fish to market. A processor has provided a buying station for the Tsiu River fishery eight times between 2001 and 2012.

Table 4. Harvest of salmon in the Tsiu River setnet fishery, 2007-2012 with 5 year average (Woods and Zeiser 2013)

YEAR	BOATS	CHINOOK	SOCKEYE	COHO	PINK	CHUM	TOTAL	DAYS
2007	12	0	5	22,318	0	0	22,823	28
2008	10	0	2	49,292	1	0	49,293	23
2009	10	0	74	43,723	121	2	43,920	23
2010	19	6	3	77,780	0	3	77,792	20
2011	21	0	16	34,745	171	2	34,934	34
2012	13	0	0	45,821	0	6	45,827	12
'07-'11Avg.	**14**	**1**	**20**	**45,572**	**59**	**1**	**45,752**	**25.6**

3.7.5 Alsek River:

The Alsek River begins in Yukon Territory, Canada, and runs 240 miles to the Gulf of Alaska. The Alsek River is managed as a transboundary river, in cooperation with the Canadian Department of Fisheries and Oceans under the auspices of the Pacific Salmon Treaty. The Tatsenshini River is a major tributary of the Alsek River. Both the Alsek River and the Tatsenshini River have been designated Canadian Heritage River Systems. The Klukshu River is an important tributary of the Tatsenshini River in the Upper Alsek drainage in Canada. There are escapement goals for the Klukshu River for sockeye and Chinook salmon that are agreed upon by a bilateral process through the Pacific Salmon Commission (PSC) and allocations of sockeye salmon in the Pacific Salmon Treaty Annex. Additional information on Klukshu River weir escapement of Chinook, sockeye, and coho salmon can be found in appendix H, Table H-20.

Table 5. Harvest of salmon in the Alsek River setnet fishery, 2007-2012 with 5 year average (Woods and Zeiser 2013)

YEAR	BOATS	CHINOOK	SOCKEYE	COHO	PINK	CHUM	TOTAL	DAYS
2007	21	685	20,057	134	0	1	22,028	47
2008	20	593	2,870	2,668	0	2	6,133	33
2009	14	602	12,906	3,454	0	20	16,982	38
2010	19	273	12,668	1,884	0	9	16,498	17
2011	18	546	24,169	1,614	0	11	26,358	59
2012	16	510	18,217	536	0	1	19,264	20
'07-'11Avg.	**18**	**540**	**14,534**	**1,951**	**0**	**9**	**17,600**	**38.8**

3.7.6 East River and Doame River:

It is assumed that at one time the East River was once a branch of the Alsek River. The East River and the Doame River were at one time separate rivers but in 1966-67, an ice blockage at the outlet of the Doame River caused the two river estuaries to join into one, utilizing the East River outlet. The connecting shallows allow fish movement during most water conditions into the Doame River. The two river systems are managed as a single fishery. The East River outlet changes often**,** even from week to week (Thomason and Woods 1988). The East River has undergone major geological changes over the past several decades which have forced salmon stocks to adapt to their new environment (Woods and Zeiser 2013).

The East River and Doame River share a biological sockeye salmon escapement goal. Commercial fishing does not open on the East River until escapement of 13,000 sockeye has been observed. The East and Doame rivers are two separate systems with genetically distinct sockeye salmon populations; run timing for each is completely different. The department believes that the sockeye salmon population may be in a state of transition due to changes in habitat within the drainage. It appears that the Doame River stock is increasing in abundance and developing a later run timing. It also appears that East River stocks are shifting from returning at age-0.4 to an age-1.5 return timing. (Woods and Zeiser 2013).

In 1970s and 1980s the East River was the peak sockeye salmon producer in Yakutat. In 2007, those glory days were seen again, however, in 2008 it was the poorest return on record and the commercial fishery was not opened.

The East River had been the only consistent producer of fall chum salmon in the Yakutat area; however the chum salmon run in the East River has been in decline for more than a decade, probably due to changes in habitat (Woods and Zeiser 2013).

Table 6. Harvest of salmon in the East River setnet fishery, 2007-2012 with 5 year average (Woods and Zeiser 2013)

YEAR	BOATS	CHINOOK	SOCKEYE	COHO	PINK	CHUM	TOTAL	DAYS
2007	33	13	63,080	56	203	1,256	64,608	51
2008	3	0	1	165	0	0	166	18
2009	22	10	7,388	1,042	4	275	8,719	33
2010	5	0	103	680	0	214	997	17
2011	17	0	14,867	99	0	330	15,390	39
2012	17	5	12,124	78	4	1,223	13,434	27
'07-'11Avg.	**16**	**5**	**17,088**	**408**	**41**	**415**	**17,976**	**31.6**

3.7.7 Yakutat Bay

Sockeye salmon pass through Yakutat Bay on their journey to all of the rivers east of the bay; Lost, Situk-Ahrnklin, Dangerous, Italio and Akwe rivers, and to a lesser degree, to both the Alsek and East rivers. The migration route carries the fish around Ocean Cape, and from there eastward they stay just outside the outermost breakers all the way down the coast.

Yakutat Bay has never been a major coho salmon producer, perhaps due to the concentration of effort elsewhere during the coho salmon season.

Pink salmon have not been targeted in Yakutat Bay in recent years due to the decline of the Humpy Creek Fishery. Fishing effort at Humpy Creek declined in the early 1990's and there has not been a directed fishery since 1996. Systematic surveys to estimate spawning escapement into Humpy Creek have not been conducted since the mid-1990s. In 2005, the escapement goal for Humpy Creek was eliminated (Woods and Zeiser 2013).

Gear restrictions are applied to the saltwater setnet fishery in the Yakutat area. Inside Yakutat Bay, north and east of a line from the southernmost point of Ocean Cape to Point Manby the use of 75 fathom gillnets are allowed. The fishery outside of Yakutat Bay is limited to a 15 fathom gillnet.

Table 7. Harvest of salmon in the Yakutat Bay setnet fishery, 2007-2012 with 5 year average (Woods and Zeiser 2013)

YEAR	BOATS	CHINOOK	SOCKEYE	COHO	PINK	CHUM	TOTAL	DAYS
2007	56	788	59,602	6,384	25,808	1,100	93,682	50.5
2008	56	518	14,976	2,072	21,869	362	39,737	47.5
2009	56	380	15,367	3,246	9,258	348	28,599	60.5
2010	46	92	15,092	1,052	17,200	377	33,813	54.5
2011	50	257	27,612	6,646	62,774	215	97,504	67.0
2012	39	247	23,836	2,672	5,275	280	32,310	48.0
'07-'11Avg.	**53**	**407**	**26,530**	**3,880**	**27,382**	**480**	**58,667**	**56.0**

3.7.8 Manby Shore Ocean Fishery

The Manby Shore ocean fishery is located along the western shore of Yakutat Bay, including the waters of Manby Stream, Sudden Stream, Spoon River, and Esker Creek. This fishery harvests stocks that are destined for the Situk River and Manby Shore streams. Historical data is difficult to interpret because, prior to the mid-1980s, harvests from the ocean fishery were combined with harvests from the area's inside waters (Woods and Zeiser 2013). Also, before 1950, all the harvests from Manby Shore and Manby Shore streams were recorded with those from Yakutat Bay. It is likely the ocean fishery for sockeye developed in 1977 since fairly consistent sockeye salmon harvests begin to appear in the record at that time. Sudden Stream and Manby Shore streams produce both sockeye and coho salmon, while the Esker Creek and Spoon River fisheries target only coho salmon.

Table 8. Harvest of salmon in the Manby Shore setnet fishery, 2007-2012 with 5 year average (Woods and Zeiser 2013)

YEAR	BOATS	CHINOOK	SOCKEYE	COHO	PINK	CHUM	TOTAL	DAYS
2007	8	6	1,014	1	42	1	1,063	51.5
2008	6	14	885	21	2	6	928	37.0
2009	12	100	2,830	60	378	33	3,401	48.0
2010	13	33	8,938	52	5	71	9,099	48.0
2011	15	111	9,203	503	29	11	9,857	56.5
2012	7	55	5,084	25	1	12	5,177	44.5
'07-'11Avg.	**10**	**38**	**3,417**	**34**	**107**	**28**	**3,623**	**48.2**

3.7.9 Italio Rivers

Three different rivers comprise the Italio River system: Old, Middle, and New Italio rivers. The Old Italio River has always been a separate river flowing into the Gulf of Alaska just east of the mouth of the Dangerous River. Geological changes in the mid-1980s changed the Italio River and created two distinct rivers where only one had existed before. The main river is now called the New Italio River, and the original river channel is the Middle Italio River. All three systems support coho salmon populations, and the New Italio River also has a small run of sockeye salmon. Since 1987, commercial fishing for sockeye salmon has been closed in the New Italio River due to low return numbers, but the sockeye salmon run appears to be rebuilding (Woods and Zeiser 2013).

3.7.10 Akwe River

Akwe River has historically been a turbid river, but as the Chamberlain Glacier has retreated, the water has been clearing up. As the waters clear, aerial surveys are becoming more effective for escapement monitoring.

Table 9. Harvest of salmon in the Akwe River setnet fishery, 2007-2012 with 5 year average (Woods and Zeiser 2013)

YEAR	BOATS	CHINOOK	SOCKEYE	COHO	PINK	CHUM	TOTAL	DAYS
2007	9	238	24,087	1,987	0	10	26,322	45.0
2008	8	72	3,120	2,535	1	3	5,731	36.5
2009	5	90	7,251	2,270	56	15	9,682	32.0
2010	7	43	6,080	6,351	30	255	12,759	34.0
2011	7	178	21,360	1,639	225	24	23,426	43.0
2012	5	36	5,888	1,187	564	381	8,056	39.0
'07-'11Avg.	**7**	**124**	**12,380**	**2,956**	**62**	**61**	**15,584**	**38.1**

3.7.11 Humpy Creek

Historically pink salmon returning to Humpy Creek were targeted in the Yakutat Bay fishery, but there has not been a directed fishery on these pink salmon since 1996. In 1984, a connection was blasted to divert water from Slow-Flow into Humpy Creek. This had unexpected results as the increased water flow forced spawning gravel that was utilized by pink salmon into Yakutat Bay, severely reducing the pink salmon return to Humpy Creek. The water table has also likely been affected in the Humpy Creek drainage from the clear cut logging. Beavers have been trying to help and have closed off the Slow Flow – Humpy Creek connection but the damage has been done. In addition, diverting the water from Slow-Flow into Humpy Creek reduced the water flowing into the West Fork tributary of the Situk River. The West Fork tributary has been drying up over the last 20 years and now goes dry in some years, which

has severely impacted sockeye and coho salmon returns to this system. (G.Woods, Commercial Fish Biologist, ADF&G, personal communication 2013)

3.8 Yakutat Chum Salmon Resource

With YRAA's interest for a summer chum salmon program, the issue of a suitable chum salmon broodstock is being discussed, particularly at the Yakutat RPT meeting May 21, 2014. While there has been studies and sampling programs to the east and west of Yakutat (Prince William Sound and Southeast), there has been no studies or sampling conducted in the Yakutat region. Chum salmon from Prince William Sound and Southeast have shown distinct genetic differences but it is not know where the stock separation occurs. In 2014, the area fishermen and ADF&G will be involved in a cooperative genetic chum salmon sampling program in Yakutat. The results will hopefully help determine if a Prince William Sound or Southeast broodstock would be a better genetic fit.

Chum salmon are incidentally harvested in the Yakutat area sockeye, Chinook and coho salmon fisheries. There is some limited weir data that was collected incidentally during sockeye and coho salmon weir operations but does not show a complete picture of any of the chum salmon returns or the timing of the returns. The Commercial Area Management Biologist stated at the YRPT meeting that the chum salmon returns are believed to be a fall stock. This is reinforced by general chum salmon harvest data comparing the Yakutat harvest of chum salmon for the region, excluding Yakutat Bay, in comparison to DIPAC Amalga Harbor summer chum salmon harvest data and Prince William Sound Coghill District (223) summer chum salmon harvest data from in front of Wally Noerenberg Hatchery shown below (R. Josephson, Section Chief PNP Hatcheries & Mariculture, ADF&G personal communication May 2014).

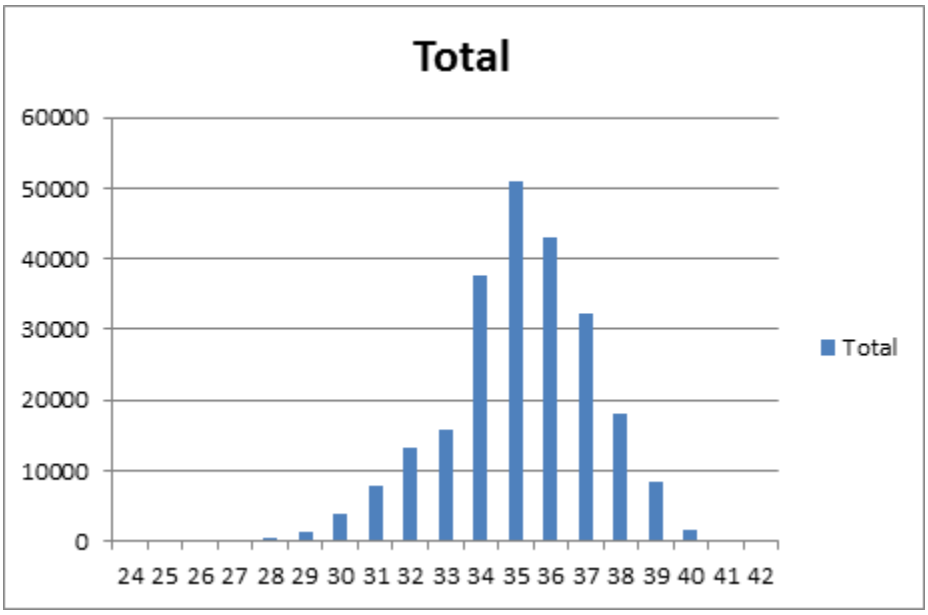

Figure 32. Yakutat chum salmon harvest by statistical week.

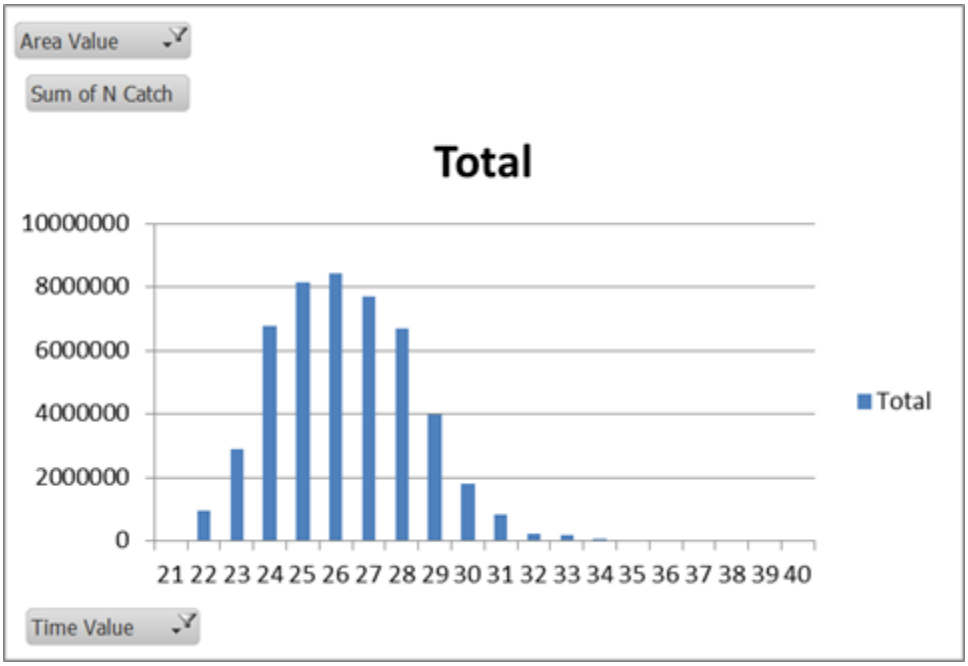

Figure 33. Prince William Sound Coghill District (223) in front of Wally Noerenburg Hatchery summer chum salmon harvest by statistical week.

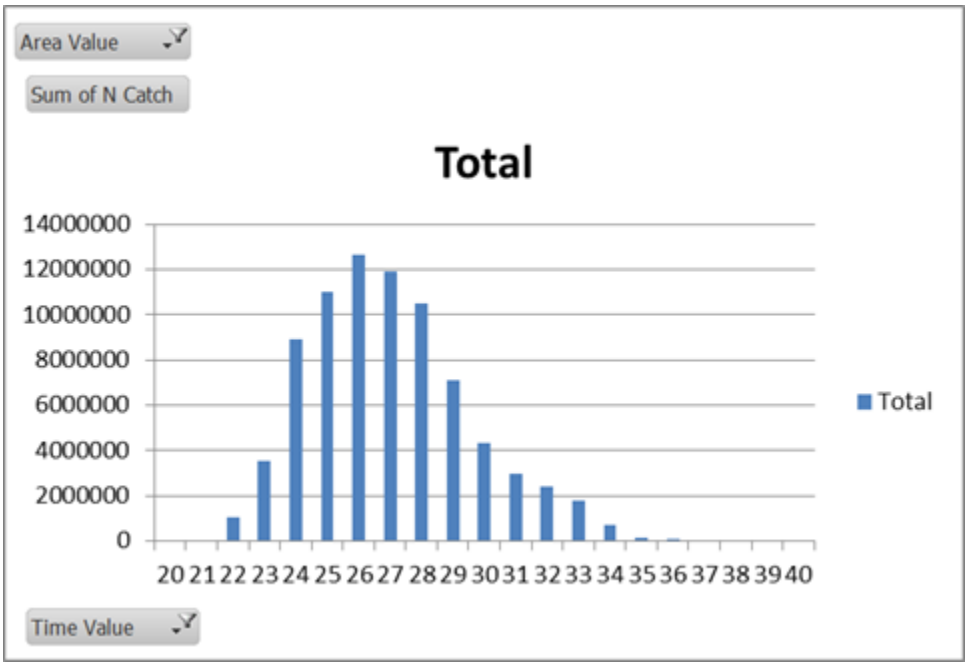

Figure 34. DIPAC Amalga Harbor summer chum salmon harvest by statistical week.

Looking at these three charts, the Wally Noerenburg Hatchery has a slightly earlier summer chum salmon return than DIPAC, while both are earlier than the Yakutat harvests.

The Wally Noerenburg Hatchery generally start their summer chum salmon egg takes around stat week 26 whereas DIPAC's summer chum salmon egg takes start a month later. If broodstock was taken from Prince William Sound it should provide more temporal separation with the local Yakutat chum salmon stocks (R. Josephson, Section Chief PNP Hatcheries & Mariculture, ADF&G personal communication May 2014).

In 2013, there were 785 chum salmon harvested in the East River during the first two weeks of August. There was no coho salmon fishery in the East River that year so there are no harvest records after that time. The East River has always been considered a fall run of chum salmon. See also section 3.7.6 for specific information about the East River. The Akwe River had a harvest of 123 chum salmon, with 100 of them taken the last week of July and the first week of August. The Situk River shows the earliest timing of the three river systems with 317 chum salmon harvested from stat week 28 (second week of July) to stat week 39, towards the last week of September. The peak Situk River harvest was between July 20 and August 10th when 181 chum salmon were caught (G. Woods, Commercial Fisheries Biologist, ADF&G personal communication, May 2014). Appendix H-19 shows Situk River weir escapements with a very erratic showing of chum salmon (0-283) through the weir from May to early August so is not a useful measure of escapement. It is not known if these harvests come from small well established populations or if these observations are of transient populations.

Using local stocks for the broodstock source reduces the risk of negative genetic effects when straying occurs. What is currently known of the chum salmon systems in the Yakutat region makes using local chum salmon broodstock seem impractical (RPT Draft minutes May 21, 2014). Importing summer run chum salmon from an existing Southeast or Prince William Sound hatchery would be unique when compared to salmon transfer practices currently used in other regions of the state.

3.9 Public Participation

To gather information for the development of this phase of the comprehensive plan, a public survey was developed modeled after the survey used by the Kodiak RPT for their Phase III Comprehensive salmon plan. This survey was mailed to every post office box holder in Yakutat, all Yakutat permit holders and setnet permit holders regardless of residency, and presented at a YRAA board meeting.

The purpose of the survey was to determine the preferences of individuals and various user groups for each salmon species. The questionnaire further solicited respondents' priorities and opinions on how to increase salmon production by species. The survey requested opinions and suggestions on salmon management, research, enhancement, rehabilitation, and habitat activities.

The response rate for the survey was extremely low, but this was not unexpected as the YRAA board was just recently formed and many are still doubtful about the success of the association. The results of the survey are statistically invalid due to the low response. While the majority of the responses were supportive of supplemental fishery enhancement (particularly mentioned was a chum salmon program) there were some responses indicating concern about harming wild stocks with enhancement activities and these opposite ends of the spectrum likely show the range of thoughts about enhancement in Yakutat. Detailed information about the survey, results, and comments received are located in Appendix G.

A public hearing on the Phase II draft plan was held in Yakutat on August 14, 2014 after initial reviews by YRAA and YRPT. There were no public comments received that needed to be addressed by the YRPT.

CHAPTER 4 – PLANNING, PERMITTING & REPORTING REGULATIONS, POLICIES AND PUBLIC BENEFITS

4.1 Regulations

4.1.1 Overview of the PNP Permitting Regulations

Hatcheries are heavily regulated. The PNP Hatchery permits are authorized under AS 16.10.400-480 and AS 16.43.410-440 and under regulations in 5AAC Part 1 Commercial and Subsistence Fishing and Private Non-Profit Salmon Hatcheries, Chapter 40 and 41. These regulations and statutes require four main documents for operation: hatchery permit with basic management plan (BMP), annual management plan (AMP), fish transport permit (FTP), and annual report. This section should provide enough information to understand the permitting process; regulations and policies; and how they interact with each other. This section will also 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.

The following figure 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.

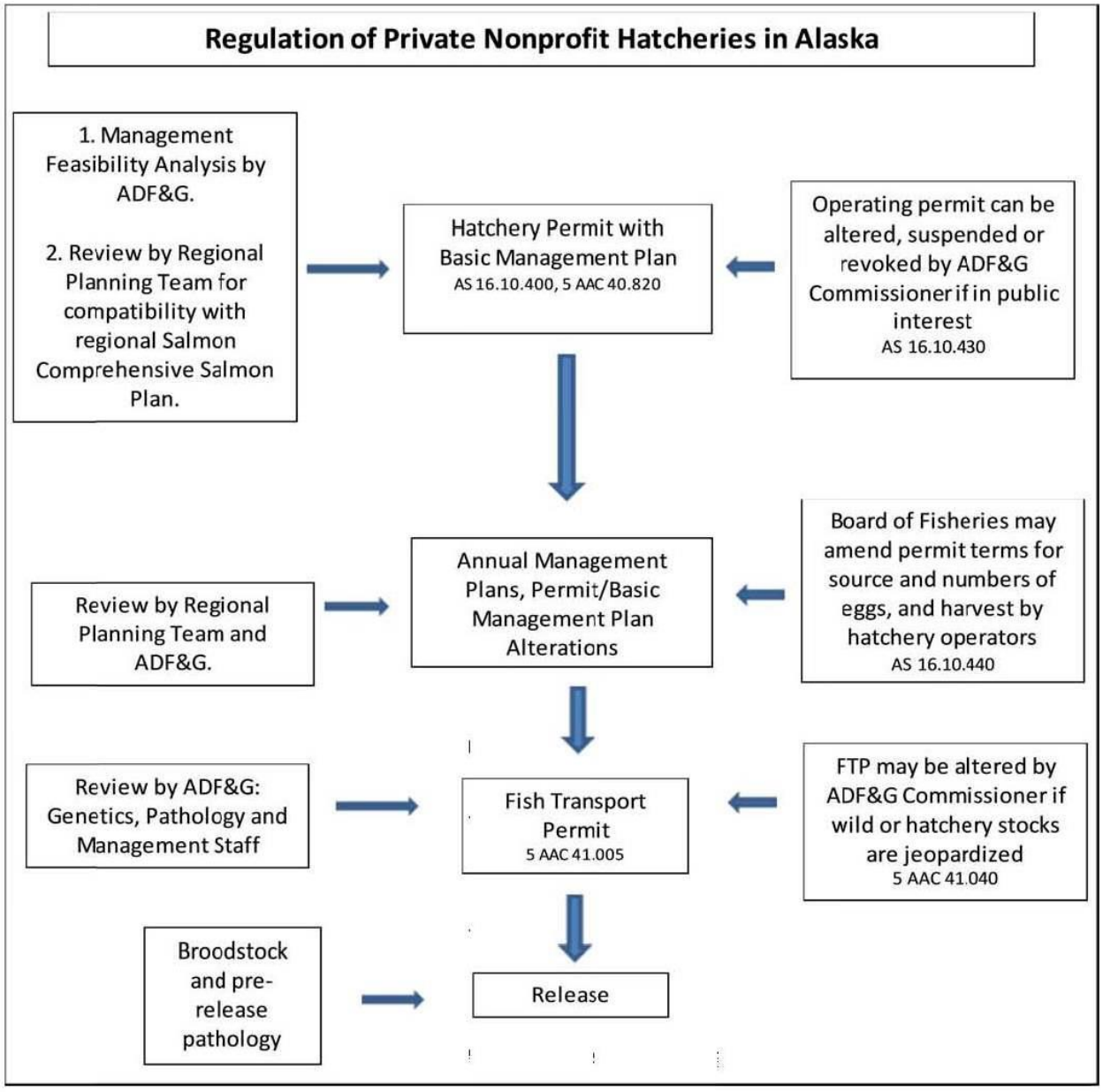

Figure 35. Regulation of private non-profit hatcheries in Alaska (Stopha 2013)

4.1.1.1 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 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 non-transferable 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. The department and 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 the department based on information provided by the applicant. Information required is: (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; (5) incubation and rearing levels desired at full capacity, by species. After submittal of a request for a MFA, the department 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 the department to be relevant to the proposed hatchery operation. Regulations regarding the MFA are located at 5 AAC 40.130.

4.1.1.2 Annual Management Plan

The Annual Management Plan (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 and comment on the AMP.

4.1.1.3 Fish Transport Permit

Fish Transport Permits 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, 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. Fish transport permits 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[10].

4.1.1.4 Annual Report

The Annual Report is due by December 15th 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 required by AS 16.10.470. The department takes information from all the submitted annual reports and prepares a summary annual report provided to the Alaska State Legislature.

4.1.2 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 the department 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.

4.1.3 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 special harvest areas (SHA) established by the department (AS 16.10.440). Operation of the SHA falls under the authority of AS 16.43.400-440. 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.

4.1.3.1 Special Harvest Area

[10] http://www.adfg.alaska.gov/index.cfm?adfg=otherlicense.aquatic_overview (accessed January 2014)

A definition of a SHA is provided in 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.

4.1.3.2 Terminal Harvest Area

A definition of a terminal harvest area (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 the department 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 or just a directive from the department. In order to facilitate clean up 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. Commercial fishermen may in the future wish to approach the Board of Fisheries and ask for gear modifications within the THA to more effectively harvest returning enhanced fish. For example, "harvesting of pink salmon has shown to be ineffective with set gillnet gear in Yakutat Bay" (G. Woods, Commercial Fish Biologist, ADF&G, personal communication). If hatchery-produced pink salmon were returning to a THA, some possible modifications that might be requested by commercial fishermen could include: extending the length of the gear used within the THA; use of power with setnet gear; or the use of drift gillnet gear (this might be as an extra privilege with stacking of 2 or more setnet permits).

4.1.4 Performance Review of Hatcheries

The department 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:

Table 10. Minimum hatchery survival standards

	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 as well as 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).

4.2 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 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 including: Alaska Department of Fish and Game Genetic Policy (Davis et al. 1985); Regulation Changes, Policies, and Guidelines for Fish and Shellfish Health and Disease Control (Meyers 2010); and fisheries management policies, such as the **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).

4.2.1. 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. The Alaska Department of Fish and Game Genetic Policy (Davis et al. 1985) 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 can be located as a reference tool in Appendix D.

The Alaska Department of Fish and Game Genetic Policy (Davis et al. 1985) statement is broken down into three parts: stock transport, protection of wild stocks, and maintenance of genetic variance. Guildlines and justifications are presented to further explain policy statement. Stock transport is broken down into three categories: interstate, interregional, 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. *Interregional:* 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.

4.2.1.1 SIGNIFICANT OR UNIQUE STOCKS (Genetic Policy)

The Alaska Department of Fish and Game Genetic Policy (Davis et al. 1985) also requires the identification and protection of "*significant and unique"* wild stocks: "Significant or unique wild stocks must be identified on a regional and species basis so as to define sensitive and non-sensitive areas for movement of stocks." In addition, the Alaska Department of Fish and Game Genetic Policy (Davis et al. 1985) suggests that drainages be established as wild stock sanctuaries where no enhancement activity is permitted except for gamete removal for broodstock development. The wild stock sanctuaries were intended to preserve a variety of wild types for future broodstock development and outbreeding for enhancement programs.

These stock designations are interrelated with other restrictions of the Alaska Department of Fish and Game Genetic Policy (Davis et al. 1985), 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 Alaska Department of Fish and Game Genetic Policy (Davis et al. 1985) 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 Regional Planning Teams, 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 (Cook Inlet RPT 2007) further defined the terms "significant" and "unique" and then as they reviewed each system and 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: king salmon – 400 fish; coho salmon and chum salmon 800 fish; sockeye salmon – 2,000 fish and pink salmon – 5,000 fish. *(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 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 "non-significant" stocks. Applying this designation amounts to identifying the major discrete components of the total salmon resource of the planning unit being considered.)* CIRPT, for their planning purposes defined a "unique stock" as an "atypical stock" that can be identified by exhibiting gross characteristics that are noticeably different from the prevailing regional patterns for that species. *(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.)* 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 (Cook Inlet RPT 2007 pages 3-12 & 3-16).

In the Comprehensive Salmon Enhancement Plan for Southeast Alaska: Phase III, (Joint Northern/Southern Southeast RPT 2004) they developed a "stock appraisal tool" that looks at four 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 six characteristics has a non-numerical 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 six 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 (Joint Northern/Southern Southeast RPT 2004).

The Kodiak Comprehensive Salmon Plan Phase III, 2010-2030 (Kodiak RPT 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, (Prince William Sound RPT 1994) also did not define any "significant or unique" stocks but did develop a checklist for new project evaluations but have not been consistently using the form (Stopha 2013).

The Yakutat Comprehensive Salmon Plan (Yakutat Planning Group 1984) did not address significant or unique stocks as the genetic policy was adopted and published after publication of the comprehensive plan. In this updated version, Yakutat Comprehensive Salmon Plan: Phase II a stock appraisal tool & project checklist was developed for use by YRAA and the YRPT to determine significant or unique stocks when evaluating a project. This combined form was modeled after the Joint Southeast Regional Planning Team stock appraisal tool and the Prince William Sound RPT Project Criteria Check List and is located in Appendix E.

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 ADF&G Genetics Policy. It is meant to be an objective and consistent framework for use by ADF&G biologists, hatchery associations and the YRPT when planning a project and evaluating permit applications. It will look at the five characteristics of population trend, supplementation, isolation, uniqueness, and human use pattern of the stock using a non-numerical 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 five characteristics will provide a qualitative estimate of significance or uniqueness that can be used in the development and evaluation of a project.

The checklist portion identifies and provides supplemental information to the hatchery permit application. The project checklist focuses questions for consideration in five categories: project feasibility; land use; management; cost and stock identification. An aquaculture association should be evaluating and considering the items in the project checklist during the development of a project. With this form, the information will be passed on to the RPT for their consideration during the review of the hatchery permit application.

It is the intent that the stock appraisal tool and project checklist can be updated and adjusted by the RPT as appropriate over time without having to update or amend the whole comprehensive plan.

4.2.2 Pathology

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 including: suggested changes to 5 AAC 41.080, guidelines for fish transports, broodstock screening, diagnostic procedures, and disease histories can be found in *Regulation Changes, Policies, and Guidelines for Fish and Shellfish Health and Disease Control* (Meyers 2010). 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 one 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 (Myers 2010).

4.2.3 Salmon Escapement Goal Policy

Alaska Department of Fish and Game 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.

Table 1 page 56 shows the formal escapement goals for the Yakutat region.

4.2.4 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 two 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 (Joint Northern/Southern Southeast RPT 2004) page 9. In reference to the Food and Agriculture Organization of the United Nations (FAO 1996), "The FAO (1996) 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." FAO (1996) 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.

4.3 Public Benefit and Hatchery Funding

4.3.1. Public Benefits

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. Maximizing the number of hatchery-produced fish contributed to common property users is an objective in Section 3.2.3.

4.3.2 Hatchery Funding Overview

Hatchery facilities and programs are expensive to start and operate. In regions of the state with developed aquaculture programs, both regional aquaculture associations and non-regional 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 4.3.4. The intent of this tax was to provide organizational funds, collateral for loans and operating expenses. Hatcheries 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 4.3.5. 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.

4.3.3 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.

4.3.4 Salmon Enhancement Tax

In 1980 the legislature adopted the Salmon Enhancement Act. This legislation established statutes (AS 43.76.001 – 040) authorizing either a salmon enhancement tax (SET) upon a 51% affirmative vote of all commercial salmon permit holders within the region. The salmon enhancement assessment tax is levied on the ex-vessel value of salmon harvested in the region. Department of Revenue is responsible for the collection of the salmon enhancement tax. The tax revenues are then deposited in the General Fund, and appropriated yearly by the Legislature to the regional aquaculture association for the region. Only regional aquaculture associations are legally allowed to receive salmon enhancement taxes, non-regional associations must rely on cost recovery to fund operations or grants/donations on collaborative projects with the regional aquaculture association.

The YRAA voted in a 2% salmon enhancement tax with the funds beginning to be collected on May 1, 2013. Prince William Sound RAA collects a 2% SET and Southeast RAAs collect a 3% SET. It was estimated that the 2% SET in the Yakutat region would generate approximately $60,000 to $100,000 annually. For the 2013 fishing season, (partial year starting May 1st) YRAA will receive $81,611 in salmon enhancement taxes. The price of fish greatly influences the amount of funds generated.

4.3.5 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 was 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. Alaska statute **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 AS 16.43.400-440. A PNP hatchery permit holder may be issued a SHA entry permit that is valid for one year and applies to a SHA designated by ADF&G. Authorized gear for cost recovery fishing in the SHA is designated by the Board of Fisheries. It is the intent of YRAA that designated gear for their SHAs will include purse seine, hand purse seine, beach seine, fyke net, drift gillnet, set gillnet, dip net, and troll to provide the most flexibility in conducting cost-recovery operations.

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 to collect 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 Department of Revenue sets the rate of the assessment levied on salmon taken in the THA in consultation with the 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; projected price to be paid for the salmon; 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. In 2012 and 2013, this method of cost recovery was used by Northern Southeast Regional Aquaculture Association (NSRAA) for the chum salmon fishery in the Hidden Falls THA. A tax assessment of 20% was suggested by the NSRAA board and approved to by the Department of Revenue both years.

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.

CHAPTER 5 – FISHERY ENHANCEMENT PROJECTS

5.1 Past and Current Project Descriptions

The following are projects that have been implemented, investigated or currently underway since 1984 for rehabilitation, restoration or enhancement in the Yakutat region.

Ophir Creek
Yakutat Salmon Board/Multi-agency effort
1995-1999

Studies of juvenile smolt in the Ophir Creek watershed and groundwater monitoring took place as part of a multi-agency restoration effort in 1995-1999. Prior to 1995, it was noticed that the amount of usable fish habitat in the Ophir Creek watershed has decreased significantly. Management activities such as timber harvest in riparian areas, road construction and ditching, along with natural processes such as glacial uplift, have resulted in reduced stream flows. At times during low-flow periods in summer and winter months, much of the Ophir Creek watershed will go dry, resulting in mass mortality of salmon eggs and fry in these areas. Smolt yield was monitored to determine the present salmonid production of the creek prior to, and during, restoration efforts. The low numbers of smolt to spawner ratio indicates (one year escapement versus spawners) that Ophir Creek is not a primary rearing habitat for the system. It is likely that the majority of juveniles rear below the trapping areas in the lower reaches of Ophir, Summit Lake, the Ankau Salt Chucks and the Airport/Tawah/Lost River reaches. These habitats are larger palustrian channels and lakes that provide ample water, food and cover for rearing fish.

It is evident that some excavation can increase the amount of surface water available to spawning and rearing salmon in Ophir Creek. The high output of salmon smolt and parr in 1999 suggest some benefits to the excavations that occurred. The intent of the smolt trapping was to measure the success of stream treatments.

The summary information for this project all came from the unpublished report, Downstream Migration of Juvenile Salmonids in Ophir Creek, 1995-1999[11].

Chinook Test Incubation Facility at "Little Dock"
Yakutat Salmon Board/City of Yakutat
2009

[11] Lucey, B., V. Harke. Summary Report: Downstream Migration of Juvenile Salmonids in Ophir Creek, 1995-1999 for Yakutat Salmon Board, City of Yakutat. unpublished data.

In 2009, D. Young of Hawken LLC was hired to apply for a fish resource permit with ADF&G to test a Chinook salmon incubation facility at the City's property known as the "Little Dock". The intent was to spawn 30 pairs of Chinook salmon for 100,000 eggs using Situk River Chinook salmon as the broodstock source. The purpose of the project was to test the feasibility and ultimate success of incubating, rearing and releasing Situk River Chinook salmon into Monti Bay as zero check smolts. The application was received by ADF&G but a request for additional information was not answered and the permit process lapsed.

Ankau Culvert
Yakutat Salmon Board
2004 – 2005

In 2004, two culverts on the Ankau were permitted to be replaced. In July of 2005, the site was visited by an ADF&G Habitat biologist who considered the new culverts an improvement over the previous double culverts it replaced. There was some concern about possible erosion around the new culverts because of the steepness of the bank and since the banks had been seeded with grass but had not begun to grow[12].

Ophir Creek Bridge
Yakutat Salmon Board
2005

The Ophir Creek mainstem bridge and West Fork bridge were replaced. The Ophir Creek bridge replacement was due to rotting sill logs. The West Fork bridge replacement was sagging in the middle (Nate Catterson, Biologist, U.S. Forest Service personal communication 2/21/13).

Ophir Creek ATV Bridge
Yakutat Salmon Board
2004

An ATV bridge was built over Ophir Creek (permit FH04-I-0116).In July of 2005, ADF&G conducted a site visit and commented that the bridge was of a good design, although the creek was dry at that time (Nate Catterson, Biologist, U.S. Forest Service personal communication 2/21/13).

[12] Cameron, S. ADF&G Memorandum from Department of Natural Resources, Office of Habitat Management and Permitting dated July 28, 2005 – Subject: Trip report Yakutat 7/28/05

Ophir Creek Flow Improvement
ADF&G
1989

Try to improve low flow in a degraded stream system.

Italio Falls Fish Pass
U.S. Forest Service
1986-2008

A fish pass was created by blasting step pools into the granite falls below Italio Lake. The purpose was to allow salmon (primarily sockeye salmon) access to spawning habitat in Italio Lake. This project is being monitored by a weir in 2012 and 2013 (Nate Catterson, Biologist, U.S. Forest Service personal communication 2/21/13).

Humpy Creek Fishpass
U.S. Forest Service
1987

A fish pass was created by blasting two moraines in upper Humpy Creek to allow coho salmon access to Humpy Creek and Slow Flow Lake. A study in 1994 and site visits in 2009 and 2010 were used to monitor the project. (Nate Catterson, Biologist, U.S. Forest Service personal communication 2/21/13).

Slow Flow Large Woody Debris
U.S. Forest Service
1989

Trees were fallen into Slow Flow Lake to increase the productivity of the lake by adding structure (Nate Catterson, Biologist, U.S. Forest Service personal communication 2/21/13).

Rust Lake
U.S. Forest Service
1994

A scoping project had the objective to connect Rust Lake to Slow Flow but was not implemented (Nate Catterson, Biologist, U.S. Forest Service personal communication 2/21/13).

Greens Pond
U.S. Forest Service
1986-1987

The purpose of this project was to improve Greens Pond by connecting the pond to a gravel pit and adding an inlet ditch to encourage oxygenation. This site was selected because it lies outside of the Hubbard Glacier flood zone (Nate Catterson, Biologist, U.S. Forest Service personal communication 2/21/13).

10 mile Bog
U.S. Forest Service
2000

This project closed an ATV trail through a stream in 10 Mile Bog in order to restore wetlands and stream banks in an area degraded by ATV use, and build a new trail. (Nate Catterson, Biologist, U.S. Forest Service personal communication 2/21/13).

Tawah Veg Clearing
U.S. Forest Service
1996

Allow sockeye salmon access to Summit Lake by clearing thick vegetation in Tawah Creek between Cannon Beach bridge and Summit Lake (Nate Catterson, Biologist, U.S. Forest Service personal communication 2/21/13).

Colorado Roads
U.S. Forest Service/Yakutat Tlingt Tribe
2004-2012

This is a multi-year project for large scale wetland and stream channel restoration done in cooperation with YTT. This project rehabilitated multiple stream channels damaged by oil and gas exploration by reconnecting streams that were intercepted by an oil and gas exploration access ditch (Nate Catterson, Biologist, U.S. Forest Service personal communication 2/21/13). This ongoing project has two phases. In 2006, Phase 1 completed reconnecting 10 of the 11 upper tributaries to the Situk River that were diverted, restoring 5 miles of rearing habitat that had been redirected to the Lost River by the Colorado Trail. Phase 2, will reconnect the remaining 20 streams along the Colorado Trail portion and 40 streams

along the Colorado Road portion. This will add approximately 42 miles of habitat and divert current stream flows away from the airport drainage system[13].

Old Situk River
Alaska Department of Fish and Game
2010-2011

ADF&G submitted to the Department of Natural Resources an application for Reservation of Water within the Old Situk River including all connected sloughs, side channels, and floodplains, from the confluence of Situk River and Old Situk River at river mile 0 and extends upstream to river mile 7.2, the upper extent of Anadromous Waters Catalog stream number 182-70-10100-2020. This stream reservation is for the purpose of protecting fish and wildlife habitat, migration and propagation. The water rights have been recorded and the following flow rates are reserved.

Table 11. Old Situk River reserved water flows.

Time Period	Flow Rate (ft^3/sec)	Time Period	Flow Rate (ft^3/sec)
January	36	July	18
February	29	August	19
March	25	September	38
April	30	October	57
May	29	November	48
June	20	December	42

Anadromous Waters Catalog
Yakutat Salmon Board
2009-2011

The Yakutat Salmon Board investigated and submitted nominations to update the Anadromous Waters Catalog (AWC). In 2010, nominations to the AWC were made for Akwe Meadow, Cabin Slough, Cannery Creek, Clear Creek, E Akwe River, Emile Creek, Lower Akwe River, Muddy Creek, Square Lake Overflow, Tanis River, Upper Tanis River, Usty River and Williams Creek. Investigations were made in Tanis Mesa and Tanis River and nominations for Akwe River, Gines Creek, and Italio (B. Lucey, Yakutat Salmon Board, personal communication). The AWC can be accessed online at:

http://www.adfg.alaska.gov/sf/SARR/AWC/index.cfm?ADFG=main.home

[13] Letter to Lee Benson, Yakutat Ranger District from Doug Mecum acting for Jim Balsiger of National Marine Fisheries Service, Juneau Alaska. Dated February 19, 2008

Yakutat Bay Genetics
City and Borough of Yakutat/Yakutat Salmon Board
2013-2015

This was a planned collaborative three-year effort between City of Yakutat, ADF&G and USFS to collect genetic samples in Yakutat Bay to determine the makeup of stock composition by river to the fisheries total harvest. Sockeye salmon genetic work did not occur in 2013 although Chinook salmon harvest in the spring troll fishery and sport fish creel census were sampled to determine what percentage of the catch in Yakutat Bay is from the Situk River (G. Woods, Biologist Commercial Fisheries Division, ADF&G, Yakutat personal communication).

Yakutat Habitat Assessment
City and Borough of Yakutat/Yakutat Salmon Board/Corp of Engineers
2013-2015

Project has the goals of: Stream characterization around Yakutat; Periodic beach seining to document near shore use of wild salmon and prey fish; continuation of stream gauges to monitor flows, and alternate enhancement site investigations.

Hatchery Chum Straying Studies in Southeast Alaska, 2008-2010
ADF&G
2008-2010

ADF&G collected otoliths from chum salmon throughout Southeast Alaska in streams used for wild stock indexes and non-index streams to document the presence and distribution of stray hatchery fish. The highest proportions of hatchery strays were found in streams located within 50 km of hatchery release sites, although there was significant year-to-year variation in the proportion of hatchery fish in four of nine streams that were sampled in multiple years. In Southeast Alaska, index streams are grouped in the aggregate into three main sub-regions – Southern Southeast (SSE); Northern Southeast Inside (NSEI) and Northern Southeast Outside (NSEO). In the NSEI sub-region, stray hatchery fish were found in excess of 5% at the majority of index streams, in the NSEO region for all three years, the estimated overall proportion of hatchery strays was less than 2% and in SSE although a representative sample of the sub-region wasn't able to be collected, the results collected suggest the overall hatchery strays was less than 5% (Piston, 2012). While no sampling occurred in Yakutat, this study and the next one mentioned could influence development of pink and chum salmon projects in Yakutat.

Interactions of Wild and Hatchery Pink and Chum Salmon in Prince William Sound and Southeast Alaska

ADF&G/Hatchery Operators
2013-2017

A long-term research project was designed by a science panel composed of current and retired scientists from aquaculture associations, ADF&G, University of Alaska and National Marine Fisheries Service. This science panel had a broad range of experience in the science of wild and hatchery fish, management, and salmon fishery enhancement. The purpose of the study is to evaluate whether or not fitness of natural-origin (wild) versus stray hatchery-origin salmon differ when spawning in the wild, survival of both types of fish and their relative spawning success. The initial four year study will improve the understanding of hatchery and wild stock interactions and provide Alaska-specific guidance for assessing Alaska's hatchery program, including recommendations for escapement goals, fisheries management, hatchery production levels, and hatchery practices (Stopha 2013).

Data Loggers
Yakutat Regional Aquaculture Association
2013

Yakutat Regional Aquaculture Association put out data loggers for temperature data in 5 potential release sites of Broken Oar Cove, Redfield Cove, Humpback Creek, Monti Bay, and Puget Cove.

5.2 Potential Future Projects

The mention of a project in this section does not mean that ADF&G has approved of or will permit a project.

Pink or Chum Salmon Remote Release
Yakutat Regional Aquaculture Association

YRAA is investigating remote release sites using summer chum salmon or late pink salmon. They are considering a chum salmon release initially of 10 million chum salmon eggs and/or a 9 million pink salmon release. Potential release sites are Broken Oar Cove, Redfield Cove, Humpback Creek, Monti Bay, or Puget Cove.

The department provided a Management Feasibility Analysis dated October 26, 2012, this as well as a copy of the site visit report by S. Reifenstuhl of Northern Southeast Regional Aquaculture Association is available on the YRAA website http://www.yraa.org under documents and resources.

Broodstock for a chum salmon program will be problematic. The East Alsek River was the largest contributor of chum salmon to the region but is at low levels of abundance due to habitat degradation and is unlikely suitable for a broodstock source and was a fall stock. Given this, a non-indigenous stock

would probably be required to start the program and would need to get approval from genetics and pathology division during the permitting process for the use of a stock. Using eyed eggs from another hatchery makes more logistical sense than trying to use fry (ADF&G Management Feasibility Analysis).

As noted in the project above, water information of potential release sites are being investigated.

The Management Feasibility Analysis (MFA) looked at either chum or pinks salmon for a remote release site with potential release sites of Broken Oar Cove, Redfield Cove, Humpback Creek, Monti Bay and Puget Cove. The department has concerns about the size of THA that could be developed at most of the sites. Monti Bay the largest of all the potential THAs is a key traditional setnet fishery with wild salmon stocks prevalent in the area.

Forest Service

The U.S. Forest Service in the *Situk River-West Forelands Watershed Restoration Plan* (Thompson, J. 2005 (draft) suggested the following projects for consideration that would affect fishery habitat in the watershed. Some or a portion of these projects are listed in the section above.

- Conduct comprehensive planning for roads, foot trails, and ATV trails for the West Foreland (including private holdings). Determine what road and trail systems are necessary to meet access objectives and update maintenance and rehabilitation plans to meet specific soil and water resource improvement objectives. Road rehabilitation activities should focus on maintaining natural distribution of surface and groundwater in the West Fork Situk, Day Glo, Old Situk and Ophir-Tawah Creek sub-basins. These watersheds have a very high density of unclassified roads. The Forest Service announced a proposed rule (2005) to require each forest to designate a system of roads, trails and areas slated for motor vehicle use. Once these designations are complete, ATVs would be confined to these routes and areas and off road use would be prohibited. The development of an ATV trail system and rehabilitation of "undesignated" tracks on foreland must also include ATV user education and enforcement of area closures.
- Avoid further excavation in Ophir Creek headwaters, which appears to accelerate export of groundwater from the watershed. The high porosity of glacial deposits in the Ophir watershed requires careful management of groundwater to maximize its ability to sustain low flows.
- Avoid excavation in Situk River headwaters (moraine and outwash areas), which appears to accelerate export of groundwater from the watershed. Potential effects of the Humpy Creek fish project associated with diverting Redfield Lake runoff from the West Fork of the Situk should be assessed to determine if mitigation measures are warranted.
- Consider large woody debris removal restrictions for river guides and float users on the Situk, Ahrnklin and other navigable rivers. Existing practices for clearing river obstructions can negatively impact fish habitat conditions. A balance between Forest Plan Fish Habitat Management Objective for instream large woody debris and navigation safety needs is a primary objective.

Coho Lake Rearing
Yakutat Regional Aquaculture Association

The Yakutat region holds potential for lake rearing of coho salmon. In Southeast Alaska, several coho salmon lake projects are now using net pen complexes within the lake for rearing. After the fry are hatched they are reared in the net pens in the lake through the summer and well into the fall. The fish are taken off the feed sometime in late fall (mid-November) when the water is very cold. The fish at this time enter a dormant stage similar to hibernation with mammals. Feeding of the fish is resumed in the spring as the water starts to warm. They are fed regularly for a short time period prior to release when they reach the smolt stage. The net pen strategy has also helped prevent predation from other species such as cutthroat trout in the lake rearing stage. At this point they are released from the net pens and allowed to out migrate from the lake. After 14 months at sea the fish that survive will return to the system they left as adults. If the fish are going to be released into the lake for overwinter rearing, it is sometimes necessary to fertilize the lake with liquid fertilizer. Lake fertilization was done at NSRAA's Deer Lake project before they started holding the fish in net pens through the winter. The Deer Lake project also had a problem with mortality associated with emigration over the barrier falls. This problem was overcome by building a pipeline to transport the fish safely over the falls.

Spawning Channels and Incubation Boxes[14]
Yakutat Regional Aquaculture Association

Spawning channels and incubation boxes have been a successful strategy used in Northern Southeast Alaska. NSRAA has developed design criteria for spawning channels to provide for a more successful project siting. The most important considerations include elements such as ample groundwater discharge to oxygenate eggs during critical low water flow periods in the winter; native gravel-sized substrate to avoid the need to import spawning gravels during channel construction and sufficient landscape topography to construct channel with enough slope to prevent mainstream rivers from backwatering into it which prevents siltation of spawning gravel and provide sufficient flow velocities for infiltrating redds and oxygenating the eggs. Additional considerations may be accessibility by road; run timing and constructed away from areas currently used by the public.

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APPENDIX A

Table A-1. Steps in the formation of a regional aquaculture association (Joint Northern/Southern Southeast RPT 2004 page 17).

Steps in the formation of a regional aquaculture association

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Incorporators inform fisheries user groups of proposed development of RAA through advertised meetings; letters and word of mouth

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First meeting held by incorporators to publicly discuss RAA formation and implications

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Second meeting held to develop draft Articles of Incorporation, By-laws; and regional boundaries

↓

Incorporators solicit nominations for Board of Directors of RAA

↓

Board of Directors organizes and conducts first meeting and adopts Articles of Incorporation, and By-laws

↓

Board of Directors files Articles of Incorporation with State of Alaska Division of Corporations

↓

PNP Corporation submits By-laws, letters of support, other required information, and cover letter to the Commissioner of ADF&G

↓

Commissioner of ADF&G authorizes the RAA and designates the region.

APPENDIX B

GUIDELINES FOR ENHANCEMENT PLANNING[15]

Southeast Alaska's hatchery corporations work with ADF&G to develop new projects that benefit fishermen and minimally impact wild salmon resources. The standards for successful projects, which form the basis for decisions to approve them, are already used in an informal process. Documenting these standards and offering guidelines for project development will provide a systematic approach to the decision-making process and be helpful to all those involved in future salmon enhancement activities.

Technical Guidelines

Many elements must be considered in developing a project. The following technical guidelines address elements that have implications for the sustainability of the wild salmon resource as well as those that relate to a project's "fit" into the Southeast Alaska ecosystem and economy. Elements related specifically to fish culture practices and project logistics, while important for maximizing fish survivals and adult returns, are outside the scope of this salmon enhancement plan.

In this section, the project elements are listed and discussed and a "*Best practice"* is given for each element. Based on the history of fisheries enhancement practices in Alaska and related available literature, these best practices represent a general consensus among fish biologists and fish culturists from regional and nonregional PNP hatchery corporations, ADF&G, NMFS and Forest Service. References in the literature are included for some of the guidelines. In other cases, ad hoc research or the collective wisdom of approximately 30 years of enhancement is used to demonstrate that some strategies are more effective than others. With additional knowledge, the guidelines are expected to change over time and should be reflected in future annexes to this plan.

Recognizing a best practice does not mean that other strategies cannot be used. It is not possible or prudent to use the same strategies for all projects; each project presents a unique set of circumstance and is addressed with a unique solution. In Southeast Alaska, a number of alternate strategies have been used successfully. A functional project is the result of a specific blend of logistics, fish culture practices, and strategies to protect wild salmon resources. In the following sections, standards and best practice guidelines are provided for projects designed to supplement fisheries, supplement wild stocks, and colonize new areas.

I. **Fishery Supplementation**[16]

The majority of enhancement projects in Alaska are fishery supplementation projects that are designed to provide increased numbers of fish to be harvested. Four standards must be addressed and

[15] Joint Northern/Southern Southeast RPT. 2004. pages 83-101

[16] The letters and numbers preceding headings in the guidelines section correlate to Tables B-1, B-2 and B-3 beginning on page 124

documented in developing a fishery supplementation project: (A) the release site has an adequate freshwater supply and is not in close proximity to significant wild stocks; (B) fish are adequately imprinted to the release site; (C) enhanced fish are marked and identifiable in traditional fisheries and contribute to the harvest without jeopardizing the sustainability of wild stocks; and (D) the terminal harvest area design and management plan enable harvest or containment of all returning adults.

The following best practices are suggested to meet the standards:

A. Release site selection

1. Characteristics of release site freshwater supply:

Look for a release site where the freshwater influence is consistent and strong. Solazzi and others (1991) found that straying of adult coho increased as releases occurred at increasing distances from a consistent freshwater source – notably, a 4.1% straying rate for coho released 2 km up a river; 6.1% straying rate for a release 19 km offshore in the river's plume, and 21% from 19 km offshore outside of the river's plume.

Best practice: Choose an imprint/release site with a strong and consistent supply of fresh water.

2. Location of release site relative to rearing site:

The generally accepted theory of sequential imprinting (discussed in section *I. B. Imprinting to the release site*) includes the corollary that a homing adult salmon will reverse the sequence of their outmigration as juveniles by following olfactory clues. Transport to a remote release site could break this sequence; however, if the fish can detect water from an earlier rearing site at the release site, it could interfere with homing precision to the release site (Labelle 1992).

Some studies have strongly indicated that a genetic component may influence the homing behavior of transplanted Chinook (McIsaac and Quinn 1988), pink (Bams 1976), and coho salmon (Labelle 1992). In each of these studies, the exact type(s) of inherited responses has not been defined, but possibilities include (1) an innate preference for non-site-specific physical criteria such as water temperature, flow, or substrate characteristics that resemble the stock's native stream, (2) "preprogramming" to swim for a distance or period of time after entering fresh water, or (3) an innate response to population-specific pheromones previously demonstrated for coho (Quinn and Tolson 1986) and sockeye (Groot and others 1986). These three types of responses would not pose problems for a fishery supplementation project where adult fish return to a terminal harvest area, provided that the stock's native stream is not in close proximity. There is evidence that genetic factors – though not clearly defined – could influence the homing response and therefore should be considered when selecting a stock for a transplant project.

ADF&G's genetic policy recognizes that ". . . transplants occurring over greater distances may result in increased straying . . ."[17] Selection of the best stock for a project involves incorporating the use of a local stock with a release site that will not offer any cues that could confuse the homing response. Clearly, effective imprinting is crucial to project success.

Best practice: Choose a remote release site that is unaffected by water from the rearing site but still shares general characteristics of the stock's native stream.

3. Proximity of significant wild stocks:

It is generally accepted that gene flow between conspecific salmon populations is a natural occurrence. It is also generally accepted that a decrease in population productivity can occur when there is introgression of genetic material from introduced fish at rates above the natural rate, depending on the genetic relationship of the donor and recipient populations. The extent of the decreased productivity and its persistence in the population are the subject of ongoing research and debate.

The stock appraisal tool (Appendix E)[18]will be used as a guideline by the regional planning team and ADF&G biologists when charged with evaluating the biological significance of naturally occurring stocks near the proposed release site. The stock appraisal tool is a qualitative method that identifies the criteria to be considered when defining significance: (1) wildness, (2) uniqueness, (3) isolation, (4) population size, (5) population trend, and (6) fishery support. Because of the general lack of quantitative data to measure these criteria for most stocks, the stock appraisal tool will provide a foundation upon which to make professional judgments about the significance of a stock. The stock appraisal criteria will be applied to stocks along the assumed adult migration route, if it is reasonable to think those wild stocks could be impacted. Proximity to a significant wild stock becomes more important if the project includes practices that do not maximize the imprinting of fish prior to release.

Best practice: Choose a release site that is not proximal to the natal streams of any highly significant wild stocks of the same species or other species with similar run timing and habitat utilization characteristics.

4. Early marine interactions and cumulative effects of multiple interactions:

Predation and other sources of mortality during the early marine, near-shore phase of the salmon life cycle can significantly affect their survival rates.[19] Also, the potential for competitive interaction between hatchery-reared and wild smolts must be considered on a case-by-case basis. Flagg et al. (2000) refer to 17 studies of intraspecific competition between wild and hatchery Chinook salmon or wild and hatchery steelhead trout and conclude with a "gut feeling" that intraspecific competition in the estuarine environment was minor when good hatchery rearing and release protocols were used. Some fishery supplementation projects in Southeast Alaska have modified the timing of hatchery releases to

[17] Sec. I.C.2

[18] Appendix E of the Comprehensive Salmon Enhancement Plan for Southeast Alaska: Phase III (Joint Northern/Southern Southeast RPT 2004) starting page 273 and is not included in this document.

[19] See discussions of early marine mortality, by species, in Groot and Margolis (1991)

minimize early marine interaction with wild coho and pink salmon fry (i.e., Neets Bay coho, Klawock Lake coho). When planning any new production, the potential for undesirable inter- and intraspecific interactions and possible cumulative effects of multiple interactions should be anticipated. Project strategies should be designed to avoid negative impacts of hatchery-reared smolts on wild populations, based on the contemporary best data and understanding of these topics.

Best practice: Choose a site location and release timing that minimizes potential near-shore interaction with wild stocks.

5. Land use designation:

Most of Southeast Alaska is part of the Tongass National Forest (TNF). If the proposed project is within or adjacent to the TNF, the Land Use Designation (LUD) and existing land uses must be considered prior to project approval. Local Forest Service staff and that agency's ex officio member of the regional planning team should be contacted. Fisheries enhancement activities are compatible with the management prescriptions of many LUDs.[20] Siting an enhancement project in or near a development LUD would be the least restrictive situation. Development LUDs include the following categories: scenic viewshed, modified landscape, timber production, minerals, and transportation and utility system. These non-wilderness, non-national monument sites should be considered first for enhancement projects.[21] Enhancement projects could be allowed in lands designated LUD II; however, the forest plan goal calls for maintaining the wildland character and roadless condition of LUD II areas. Resource manipulation is least compatible with and is most closely regulated in the natural setting LUDs. The three most restrictive natural setting LUDs with respect to enhancement projects, are wilderness, wilderness national monument, and non-wilderness national monument. These three designated area also most closely approximate the "sanctuaries for salmon" described by Lichatowich (2000).

Additional restrictions and safeguards might be applied to projects proposed in natural setting LUDs: (1) congressionally designated LUD II; (2) old growth habitat area; (3) research natural area; (4) remote and semi-remote recreation; (5) wild, scenic, and recreational rivers; (6) special interest area; (7) experimental forest; and (8) municipal watershed. For a project in or near a natural setting LUD, it is important to consider the potential impact on the ecosystem, including increased human use. Impacts should be balanced with the need to provide well distributed fisheries that support sport and commercial fisheries, subsistence activities and community stability.

Best practice: Consider the upland management intent adjacent to a proposed project site and minimize potential conflicts or move the project elsewhere if that is not possible.

<u>B. Imprinting to the release site</u>

[20] For complete management prescriptions and other information on management of resources within the Tongass National Forest, *see* USDA Forest Service (1997)

[21] Forest Service Manual, Chapter 2300 (Recreation, Wilderness, and Related Management), Alaska Region Supplement No. 23020-99-3. The manual is available at any Forest Service office.

The factors that affect the quality of the freshwater imprint in salmon are complex and intertwined. Although the imprinting process is not completely understood, both research and experience suggest strategies that will most likely produce strongly imprinted smolts. There is general agreement that the most positive imprint occurs when salmon are reared in and released from the same freshwater source. The process of outmigration from a rearing site into salt water may further optimize the imprint (Dittman and others 1996; Heard 1996). This mimics the natural situation. Salmon living in the wild experience a sequence of olfactory imprint events during rearing and outmigration. When returning adults reach the nearshore environment, reversing the sequence leads the salmon to suitable spawning areas, with some of them actually homing to the reach within the stream where they emerged from the gravel (reviewed in Quinn 1993). Transport to and release from a remote release site have resulted in successful fishery supplementation projects in Southeast Alaska (e.g., Deep Inlet chums, Ward Lake summer coho). The idea is to break the imprinting sequence from the natal site and imprint the fish effectively to the release site. Not all remote release projects have produced adults that demonstrate accurate homing. Clearly, a combination of factors is involved in effective imprinting. As with all other guidelines, continued research will result in continued refinement of the following best practices.

1. Transport timing:

Transporting salmon to a remote release site very early in the rearing process allows the maximum opportunity for imprinting. Given the apparent learned responses associated with the process, transporting during the fry stage is ideal. Operationally, this is not always possible and in actual practice has not proven necessary. Transport at the end of the freshwater rearing phase (smolt stage) also can result in a strong imprint when release-site characteristics and imprint strategies are adequate; however, when imprinting is inadequate, experienced professionals in the Alaska hatchery program have generally confirmed that unacceptable levels of adult straying will occur. [22]

Existing evidence points to the importance of thyroid-produced hormones in olfactory imprinting (Dittman et al. 1994; Grau et al. 1985; Lin et al. 1985). It is now generally accepted that olfactory learning is greatly facilitated in the presence of elevated thyroxine levels and the most significant thyroxine surge occurs during the parr-smolt transformation process (Dittman et al. 1996). Surges may also occur at other times during freshwater rearing; they have been linked to environmental cures such as temperature changes, a new water source, and changes in food intake or flow rates. During freshwater rearing, a salmon is likely to experience cues like these that trigger olfactory imprint events.

Researchers have found wide variation in surges of plasma T4, the most commonly used measure of thyroid function, in hatchery fish undergoing the smolt transformation (reviewed in Dittman et al. 1994). It does appear, however, that all salmonids approaching the parr-smolt transformation become primed by hormonal or other factors to imprint. When the imprint/release site is in salt water, transferring fish as early as they can tolerate the ambient salinity is the best strategy to assure a strong imprint.

Best practice: Transfer fish to the imprint/release site as early as possible during juvenile rearing.

[22] Jim Seeb, principal geneticist, ADF&G, Division of Commercial Fisheries, personal communication.

2. Saltwater entry:

Allowing natural volitional arrival at the site of saltwater entry is likely the best strategy to assure a strong imprint. Dittman et al. (1996) noted that ". . . results suggest that while migration may not be absolutely required for olfactory imprinting, the combination of stimuli associated with migration and physiological changes involved in smolting may be important for optimal imprinting and homing." This also suggests that if juveniles are transported between watersheds, they should be released as high in the new watershed as is reasonable for a timely and safe migration to salt water. Heard (1996) summarized evidence that sequential imprinting by hatchery-reared salmon during downstream migration results in more accurate adult homing than simply releasing fish at the mouth of a stream.

There are numerous successful hatchery projects where downstream migration does not occur. It would pose obvious logistical problems for projects where fish are reared or acclimated in saltwater net pens. Clearly, a combination of factors is involved in effective imprinting. Where operationally feasible, downstream migration is recommended to increase the likelihood of a strong imprint.

Best practice: Allow smolts to migrate downstream volitionally from their freshwater rearing site to salt water.

3. Length of exposure to release-site fresh water:

The "three-week rule" for imprinting salmon smolts in net pens is a strategy that has withstood the test of time in Southeast Alaska. The origin of the rule is unknown. There have been no scientific studies to support this length of time as optimal for Pacific salmon. It is possible that imprinting occurs in a much shorter period of time, but the use of three-week window encompasses the actual imprinting *in most cases*, provided juveniles are transported when they begin smolting. Given the success of projects that imprint for three weeks or longer, there is no logical reason to change the rule.

Some evidence to support the three-week rule comes from research with Atlantic salmon (*Salmo salar*). Morin et al. (1989) found that the optimal period for long-term olfactory learning, which coincided with the peak level of thyroid activity, occurred in 21 to 28 days after the beginning of the parr-smolt transformation. If the timing is similar for Pacific salmon, the three-week rule would result in an effective imprint. A reasonable corollary to the rule would be to contain the fish at the imprint site until all outward signs indicate they are fully smolted.

Perhaps just as important as causing a strong imprint, the three-week rule also provides protection for fish as they acclimate to the saltwater environment and takes them through any disorientation period that might occur. Evidence from an Alaskan project indicates that the consequence of *not* holding fish in pens at the release site was decreased survival rather than straying.[23]

Best practice: Immerse smolts in the imprint fresh water for a minimum of three weeks and release the fish only when they are fully smolted.

[23] John Burke, general manager, SSRAA, personal communication.

C. Harvest contribution

1. Identification in the fisheries:

All releases of enhanced fish must be adequately marked. Marking provides the only valid quantitative means of evaluating the success of enhancement programs. Fishery managers must be comfortable that they can distinguish between wild and enhanced stocks in traditional, mixed stock fisheries because management decisions must be based on the strength of wild stocks. If a mark-recovery program is not in place for significant interception fisheries, there should be a reasonable expectation that such a program will be implemented by the time that first enhanced adults return.

Best practice: Adequately mark all groups of fish and, where needed for effective management of traditional fisheries, plan to implement a mark-recovery program to assist resource managers.

2. Effect on traditional and near-terminal fisheries:

The release-site location will affect the route that returning adults take through the traditional fisheries. Before the project is implemented, this route can only be assumed; however, fisheries management biologists will want to evaluate the potential impact of enhanced fish on management capability. This will be especially important if any stocks of concern are harvested in fisheries where more intense effort may be focused on the enhanced fish. The department has the authority to stop a harvest in a traditional or near-terminal fishery if unacceptable detrimental impacts to wild stocks are occurring.

Best practices: Do not intensively harvest groups of fish where the overharvest of wild stocks will occur.

3. Cumulative effect of multiple enhancement projects on traditional fisheries:

Currently, there are a few fisheries in Southeast Alaska where the cumulative numbers of enhanced fish from several projects have reached a level that could make determination of the prevalence of wild stocks fairly difficult (e.g., fall run coho in some southern Southeast management districts). When uncertainty as to stock origin occurs, fisheries are managed conservatively; therefore, new enhanced production that would contribute to management uncertainty should be carefully considered before being approved. In some situations, increased marking and mark recovery will help alleviate the problem. The added costs need to be weighed against the increased benefit.

Best practices: Do not allow the harvest of new production to pose management challenges in traditional fisheries that cannot be reasonably addressed by managers.

D. Terminal area function

1. Configuration of terminal area:

Certain attributes are desirable for terminal areas where mop-up harvests by net gear are conducted. If the terminal area is a well-defined shoreline indentation such as a bay, it will provide a natural containment area. It is also desirable to have bottom substrate contours that allow an efficient net

harvest. In some cases, it is desirable to block the fish from entering fresh water with a barrier seine or weir. The physical ability to effectively harvest returning fish should be a consideration in site selection.

Best practice: Delineate a terminal area that both confines returning adults and facilitates their harvest.

2. Containment of fish:

From a biological perspective, the best passive strategy to avoid straying of returning adults is to allow them access to their own home stream. It has been observed that if returning adults are unable to enter the fresh water to which they were imprinted, they will move instead to another stream. Furthermore, unless prevented from doing so, the crowding of returning adults in a home stream may prompt some of them to back out, which increases the likelihood that they will enter another stream. A more active strategy to prevent straying is to harvest all adults while they are still in salt water or as they first enter the fresh water of their home stream.

Best practice: Allow returning adults clear access to adequate freshwater habitat in their home stream or quickly harvest them in salt water immediately adjacent to their home stream.

3. Harvest management strategy:

Whether returning adults are in salt water or fresh water, allowing them to hold in the terminal area for any length of time is not a good strategy for maximizing the economic yield to the fisheries. One objective of the terminal-area harvests is to capture the maximum number of fish in the best possible condition. This means conducting the harvest as early as possible when fish arrive in the area and while flesh quality is at a premium. A quick harvest also minimizes the possibility of a build-up of fish that exceeds the harvesting capacity of the fleet or the available fish-processing capacity. Harvest methods should be employed that will contain adults in the terminal area, but if it is especially important to prevent straying to a nearby stream, then harvests should be conducted quickly and efficiently to prevent fish from dispersing. A management plan for each terminal harvest area must be in place before there are significant adult returns from a fishery supplementation project.

Best practice: Design a terminal harvest area management plan that effectively maximizes the quality of fish harvested while minimizing any potential undesirable outcomes.

4. Incidental harvest of wild stocks:

Siting a project near a wild stock may result in an increased harvest of that stock in the terminal area. Differences in run timing and migration pattern can serve to separate the enhanced and wild returns.

Best practice: Implement a terminal harvest plan that will not affect the sustainability of incidentally harvested wild stocks.

5. Broodstock management:

Each generation of terminal area returns carries the full diversity of genetic material that has survived the specific culture and marine environments for that stock. Maintaining the diversity in each brood will

enable the stock to survive the variability in environmental conditions they will face. All diversity of fish in the terminal return should be carried forward into the next generation by taking gametes from all significant segments of the run; ideally, gametes should be taken in proportion to the magnitude of each segment. The environmental conditions unique to the life history of the stock will again act on this next generation to carry it further toward adaptation to those unique conditions. Adaptation is a continual process and a moderation of diversity. Allowing adaptation to proceed with a minimum of human interaction (i.e., no selection of characteristics) will avoid errors that may result in a decreased return. Allowing a stock to adjust to its environment, whether natural or artificial, is likely to result in the best survival and return.

Best practice: Collect gametes from all significant segments of the run.

II. Wildstock Supplementation

For the most part, the health of freshwater habitat and effectiveness of fisheries management strategies in Southeast make supplementation of wild stocks unnecessary. Under certain uncommon circumstances, it may be desirable to supplement a wild stock with hatchery production because the numbers of returning adults have declined to levels consistently below the established escapement goal. For example, natural events such as earthquakes and landslides or anthropogenic impacts from timber harvest, mining, or urbanization may degrade habitat and result in reduced productive capacity. Unintended harvest pressure may result in overexploitation of a stock. In rare instances it is possible that the sustainability of a stock may be jeopardized. Wildstock supplementation, habitat modification, and fishery management changes are three possible tools that can be included in an action plan to restore productivity. When appropriate, action plans are developed by ADF&G in conjunction with hatchery corporations and other agencies to direct the activities of all the participating entities.

The following standards must be addressed and documented during development of a wildstock supplementation project: (A) project objective relative to the wild stock is clearly defined, (B) wildstock characteristics are preserved as much as possible in the supplemental production, (c) imprinting strategy for the supplemental production mimics the process in the wild as much as possible, (D) enhanced/wild juvenile interactions are anticipated and impacts on wild fish are minimized as much as possible, and (E) hatchery-incubated fish are marked and identifiable in the fisheries and in the freshwater spawning habitat.

A. Project objective

The possible objectives of wildstock supplementation projects fall into two categories: (1) jump-start the recovery of a population that has declined for correctible reasons or (2) perpetually enhance the productivity of a population in order to (a) restore and maintain it at historical productive levels or (b) circumvent bottlenecks in the productive capacity of a natural system. If the intent is to continually enhance the productivity of a population and therefore increase its yield to the fisheries, active habitat manipulation (such as lake fertilization) should be considered as well as planting hatchery-incubated fish from the same stock back into the system.

When the intent is to jump-start stock recovery, the project should have a predetermined end point defined by ADF&G. Examples of end points include consistently achieving for a period of three years a biological escapement goal (BEG), an optimal escapement goal (OEG), or a sustainable escapement goal (SEG). Before a project starts, there must be agreement on the significance of enhanced adults: will they count toward the escapement goal (an OEG) or will only wild-spawned fish (including F_1 progeny of enhanced fish) count toward the goal (a BEG or SEG)? It may also be desirable to define the criteria for inseason determination of whether or not to proceed with egg takes in any given year.

Best practice: Clearly define the project objectives relative to the wild stock, including (if appropriate) the project end point and annual decision criteria.

B. Preservation of wildstock characteristics

1. Separation of populations:

Spawning populations are groups of adults that have some degree of separation from each other (i.e., geographic, temporal, or behavioral separation). Without sophisticated research, it would be impossible to tell the amount of genetic interchange between groups of fish that spawn in different specific locations at different specific times. It would be difficult or impossible to discern the existence or extent of local adaptation in a spawning population. It is assumed these differences equate to the amount of specific adaptation that separates each group. The precautionary assumption is that these differences exist and could potentially have consequences (however small) on maximizing production.

Best practice: Target only one discrete spawning population for each egg take.

2. Broodstock composition:

It is important to include enough adults in the broodstock to be reasonably assured that the allele frequency in the supplemental production mimics that of the spawning population. Although some "numbers of spawners" tables have been published, none of them are appropriate for all situations. The genetics section of ADF&G must be consulted for each individual project. Gametes should be taken from all significant segments of the run and in proportion to the run timing to mimic the genetic variation of the wild population in the enhanced segment.

Best practice: Time eggtakes and utilize adequate broodstock numbers to assure that the genetic composition of the supplemental production mimics the wild stock.

C. Effective imprinting

If the greatest chance for breeding success in the supplemental fish occurs within their population of origin (Tallman and Healey 1994), then releasing them where they will imprint on the stream of origin is likely to result in the greatest benefit (in terms of numbers of fish produced) from the supplementation project.

Best practice: Rear and release juvenile fish in freshwater in their stream of origin.

D. Minimizing enhanced/wild impacts

1. Percentage of enhanced juveniles:

The objective of each project is to supplement, not replace, wild fry production; therefore, any strategy that minimizes competition between enhanced and wild fish should be considered first. A guideline of ≤50% enhanced juveniles mixed with a wild stock has been used for projects in Southeast for many years and unless future research shows this to be incorrect, it should remain in effect. Extenuating circumstances, such as saving a stock from extirpation, may call for exceeding the 50% guideline.

Best practice: Keep the number of enhanced fry less than the number of wild fry from the same spawning population.

2. Release strategy:

According to McMichael et al. (2000) in their work with steelhead trout, the impact of supplemental fish on wild fish can be minimized by releasing actively migrating smolts. Minimizing this impact must be balanced with the probability of effectively imprinting juveniles when they are released as smolts. Also, enhanced fish should be released into a wild population when they are no larger than their wild counterparts – a difficult standard to achieve for enhanced fish reared to smolt stage off-site. McMichael's work also suggests that steelhead interactions with wild fish are decreased when water temperatures are below 8°C; therefore, he recommends planting fish during times of low water temperature. The extent to which these observations and recommendations for steelhead trout can be applied to other salmonids is unknown; they are presented here to spark interest in research and to encourage discussion.

Best practice: Take all wild/enhanced fish interactions into account before determining the time and size of release of enhanced fish in order to minimize potential adverse impact on wild fish.

E. Identifying supplemental production

Wildstock supplementation is the most closely monitored type of enhancement project because of its clearly defined objectives and intentional integration with wild stocks. Supplemental fish cultured in a hatchery should be marked according to the recommendation for that species before release into the wild. Project planners should consider mass marking Chinook and coho for wildstock supplementation in addition to coded wire tagging because it may be important to distinguish wild from enhanced individuals in fresh water and early marine environments.

Best practice: Mass mark all hatchery fish and additionally coded-wire-tag the recommended proportion of Chinook and coho.

II. Colonization

Colonization by salmon occurs under natural conditions as new habitat opens up (e.g., glaciers recede, beaver dams wash out, and geological processes reshape the landscape). Anadromous fish that colonize

new habitat are usually pioneers from the same stream below the former barrier or strays from stocks in the immediate vicinity. Full colonization, which is defined as equilibrium with the new habitat and resident species, occurs over a long span of time when it proceeds under natural conditions.

Instead of waiting for natural colonization to occur, resource agencies have opted to plant juvenile salmon in the new accessible habitat above many of Southeast Alaska's fish passes (*see* list and descriptions in Appendix A and Appendix Table A-1[24]). These projects have the potential to greatly decrease the length of time to full colonization. The following standards must be considered and documented during the development of a colonization project: (A) need for project and potential for success are clearly defined, (B) colonization strategy mimics the natural process as closely as possible, (C) adequate evaluation of ecological impacts will occur, and (D) hatchery-incubated fish are marked and identifiable in the fisheries and in freshwater spawning habitat.

A. Project need and potential for success

Colonization projects are unique in that they introduce a stock into a habitat where it is absent, with the intent that it will be self-sustaining after the initial life cycle. If the stock had been historically present but extirpated from the area, then the desirability of reintroduction and the potential for success may be high. The introduction of an anadromous stock into an area not known to be previously accessible is an ecosystem modification that should be discussed with all concerned agencies and interested members of the public. In Southeast, the Forest Service has been the lead agency in nearly all barrier modification projects. Their scoping and review process for these projects should include proposals for colonization. Also, before a barrier to anadromous fish is intentionally modified, a thorough survey of the upstream habitat and biota should be conducted to evaluate the probability of colonization success.

A careful analysis of 31 fish pass projects in Southeast showed that 17 (55%) were moderately or fully successful in producing the expected number of new fish.[25] The same analysis noted that for fish passes built for coho (the most commonly targeted species for fish pass projects), the presence of substantial upstream habitat was the most common predictor of colonization success.

Best practice: Evaluate project need during project planning. In addition, plan projects in streams with substantial upstream habitat without ecological conditions that might jeopardize project success.

B. Colonization strategy

As with wild stock supplementation projects, the assumption is made that the greatest chance of colonization project success with the least amount of biological risk comes with simulating the natural process. Using fish from the same stream or a nearby stream assumes the best possible preadaptation

[24] Appendix A and Appendix Table A-1 are not duplicated in this document.
[25] Richard Aho, fish biologist, U.S. Forest Service, Tongass National Forest, personal communication.

to the area. Moving fry or adults from below the barrier should be considered as a first priority, utilizing no more than 50% of the available fish of that life stage. In some cases in Southeast Alaska, eggs have been taken below the barrier or from a nearby stream, incubation has occurred at a hatchery, and the progeny have been planted above the newly constructed fish pass.

Allowing colonization to proceed without intervention could be the preferable method when a sizeable salmon population is already using the stream below the barrier. Accordingly, the total cost of the project would be considerably less; however, project objectives normally anticipate full production sooner than it would take a totally passive strategy to achieve it.

Best practice: Colonize unused salmon habitat with the stock that occurs naturally in that system using the least intrusive means that will accomplish the project objectives.

C. Evaluation of impacts

Colonization projects have occurred in locations that are typical of the broader ecosystem and absent of unique elements that would be compromised by the introduction of anadromous species. Thorough investigations of potential spawning and rearing habitat and any resident fish species are conducted before barriers are modified.

Rigorous follow-up assessments have been conducted for two colonization projects in Southeast Alaska at Slippery Lake (Wright et al. 1997) and Margaret Creek (Bryant and McCurdy 1995). No significant detrimental impacts to the resident species (i.e., cutthroat trout and Dolly Varden char) were found during the evaluation period at either site. Having intensively evaluated these colonization projects, the decision to conduct a follow up evaluation of ecological impacts for any future project will be made on a case-by-case basis.

Best practice: Conduct a pre-colonization assessment of the habitat to be colonized and consider a post-colonization assessment of the impacts of anadromous fish to the habitat and biota.

D. Identification of hatchery-produced fish

Juveniles produced in a hatchery for colonization should be marked according to the recommendation for the species. For Chinook and coho, otolith marking in addition to coded wire tagging is recommended if any evaluation of their freshwater phase is planned; e.g., relative abundance of hatchery and naturally produced fry. For subsequent generations produced in the wild, a subset of these projects should be intensively monitored to determine the long-term success of colonization. In conjunction with these evaluation studies, fish may be marked.

Best practice: Mass mark all hatchery-produced fish and additionally coded-wire-tag the recommended proportion of Chinook and coho.

Benefits and Goals of Enhancement Projects

Fisheries enhancement projects have the potential to provide a number of benefits for common property resource users. Because numerous benefits are possible, each project general will not result in all the possible benefits. In this section, some of the possible benefits are listed and a generalized goal is given for each benefit. A specific set of project goals will be developed for each proposed project.

I. Fishery Supplementation

The central goal of fishery supplementation is to increase the overall harvest and value of the harvest. Projects that meet this goal can provide significant benefits to Southeast Alaska. A carefully planned enhancement project (i.e., stock selection, site selection, culture techniques, etc.) may provide benefits in addition to increased harvests. Potential benefits and corresponding goals include, but are not limited to, the following:

A. Benefit: provide additional fish for harvest by one or more user groups.

Goal: provide the projected number of harvestable fish to the intended user groups in traditional fisheries or in new fisheries over an extended period of years.

B. Benefit: create a new harvest opportunity that will deflect fishing effort from traditional fisheries.

Goal: effectively and consistently attract commercial, sport, and/or personal-use fishing effort away from vulnerable wild stocks.

C. Benefit: mitigate for lost fishing opportunity related to the Pacific Salmon Treaty or other international or internal political agreement.

This potential benefit is related to the preceding benefit (i.e., I. B.). Both benefits describe the redistribution of fishing effort away from areas where it may have undesirable biological or political consequences and redirection of effort toward enhanced stocks.

Goal: allow no net loss to common property harvesters in a specific fishery as a result of the Pacific Salmon Treaty or other political agreement.

D. Benefit: provide balance for the allocation of enhanced fish between traditional harvest gear groups.

The Joint RPT has the authority to review the status of allocation of enhanced fish and make recommendations regarding production changes to the commissioner. The Joint RPT has historically chosen *NOT* to recommend production cuts to reduce harvest value for the advantaged gear group. Rather, it has chosen to look at proposed new production and recommend projects that would have a balancing effect by providing more harvest opportunity for the disadvantaged gear group.

Goal: increase the total harvest value for a disadvantaged gear group without taking existing resources from other gear groups.

E. Benefit: add value to the overall commercial fishery in Southeast Alaska

As the value of Southeast Alaska's fisheries is diminished in the competition with farmed fish, enhancement projects can compensate by selectively increasing production of species that have retained market value.

Goal: increase the overall value of the region's fisheries by a projected amount.

II. Wildstock Supplementation

Under the recently enacted policy for the management of sustainable salmon fisheries (ACC 39.22), a chain of events and decisions will precede the decision to begin any new wild stock supplementation project. Although each project will be directed at achieving a specific goal, other benefits may accrue. Potential benefits and goals follow:

A. Benefit: an increase in wildstock productivity as measured by an increase in the number of adults in the total return.

Goal: Increase the number of adult fish produced by the stock to a predetermined level within a reasonable period of time and then discontinue supplementation if required by the project plan.

B. Benefit: harvest adjustments allow for increased harvest of other more plentiful stocks as well as the supplemented stock. If harvest restrictions have been enacted because of reduced productivity of a stock, the supplementation project may result in lifting or liberalizing those restrictions.

Goal: increase the number of adults from the supplemented stock to a level where harvest restrictions are lifted, resulting in a net increase in fishing opportunity.

III. Colonization

A colonization project would potentially provide some combination of the benefits associated with fishery supplementation and/or wildstock supplementation.

Collateral Benefits

Collateral benefits are not reasons for implementing an enhancement project; rather, they are desirable consequences of such a project. Examples of collateral benefits resulting from enhancement projects follow:

A. Increased overall freshwater ecosystem productivity.

Collateral benefits may accrue whenever enhanced fish are introduced to freshwater habitat for fishery supplementation (e.g., coho lake stocking), wildstock supplementation, or colonization. One broad impact might be an increased infusion of organic nutrients into the freshwater habitat as a result of increased number of adults in the escapement. It has been shown that an increase in marine nutrients carried into freshwater habitat by escaping adult salmon can boost ecosystem productivity (Reimchen and others 2003).

B. Increased size or numbers of resident or other anadromous salmonids that prey on the supplemented stock in fresh water.

It is assumed that an increase in the supplemented species would lead to a revised equilibrium where an increase in the predator species also occurs. For example, a cutthroat trout population may increase in both numbers and size of individuals following sockeye fry plants. Improvements in the size or quantity of desirable predator species could have the beneficial outcome of providing improved sport fishing opportunity. While it is highly unlikely that a planning document for a proposed project would include this benefit as a goal, it certainly could be a desirable outcome.

C. A terminal harvest or other activity that yields a cost recovery product whose value is high enough to cover project expenses.

A collateral benefit of some fishery supplementation projects is the harvest of a portion of the adult returns to cover project expenses. Generating revenue is not a valid reason for developing a fishery project, but financial planning to cover project expenses is a necessary part of project planning. In some cases, depending on the value of the species in the cost recovery revenue from one project may be used to pay expenses for another.

Project Evaluation

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

A. Marking

Most hatcheries in Southeast Alaska either have the capability to thermally mark fish or are moving ahead with plans to provide that capability. Thermal marking imposes a permanent specific pattern of bands on the otoliths of a fish before it emerges from the incubator. For species harvested primarily in net fisheries, this type of mass mark has become the standard in Southeast.

The evaluation of enhanced Chinook and coho production is integrated into a coastwide stock assessment program based on coded wire tags; the need to coded-wire-tag a representative portion of releases of these species is not expected to change in the foreseeable future. The default tagging rate for Chinook is 10%, with a minimum of 20,000 tags per release group. For coho projects, the tagging rate has ranged from 2% to 10% with a minimum of 20,000 tags per group. The tagging rate for each coho project will be determined by a number of considerations, including the projected marine survival rate, intensity of tag-recovery programs along with interception route, and the desired precision of harvest estimates.

In recent years the percentage of enhanced coho in some traditional fisheries has approached 25%. At this level the current ability to assess the strength of wild returns is limited; therefore, the estimate of the wildstock component may not be precise enough for effective fishery management, resulting in more conservative approach to managing a fishery. The problem could be alleviated by (1) increasing the tagging fraction of all coho releases that contribute to the harvest, (2) thermal marking all coho releases found in the harvest, (3) reducing the number of enhanced coho that contribute to the harvest, or (4) increasing the evaluation of wild coho populations in areas of concern. The thermal marking alternative would require an expanded mark-recovery program.

There is considerable merit to mass marking all enhanced fish released from hatcheries. In addition to allowing better precision in harvest management, thermal marking is presently the best known means of identifying all individual enhanced fish in marine or freshwater environments. Tracking stock movements in the open ocean and evaluating homing precision are two examples of endeavors that would be greatly facilitated by 100% marking. Increased knowledge of enhanced fish will only lead to better decisions regarding enhancement programs. Applying an otolith mark to *all* enhanced fish produced in Southeast Alaska is a strategy worth considering for implementation.

The evaluation of naturally occurring fish production resulting from colonization or wildstock supplementation projects poses a challenge. Coded wire tagging or visible implant tagging are the only types of reliable, persistent marks available for juveniles in their natural habitat. The choice depends on the data requirements and mark-recovery options. A wildstock marking procedure that causes minimal disruption to the fish and no dislocation from their home range should be used, even if it is not the most convenient method for fisheries staff. If it is desirable to evaluate adult parameters such as stream life or spawning location, a wider range of visible marking techniques is available (e.g, anchor tag or fin punch). Again, marks must be applied with minimal delay and disruption of fish movement.

Best practice: Beginning in 2004, mass mark all hatchery-produced chum, pink and sockeye. Continue to coded-wire-tag Chinook and coho in the recommended ratios; additionally mass mark all these fish when used for wildstock supplementation or colonization.

B. Mark Recovery

Mark recovery is the primary means for evaluating all project benefits associated with adult returns. This information is also essential in the forecasting of future returns of enhanced fish. Therefore, it is critically important that available resources for this activity are used as effectively as possible.

Oversight of the mark-recovery program has been provided by ADF&G since the program's inception in the 1970s. At the present time ADF&G continues to conduct structured catch-sampling programs in commercial and sport fisheries. Sampling in terminal harvest areas and hatchery escapement has sometimes been the responsibility of hatchery operators, with varying degree of oversight by ADF&G.

An evaluation plan should include an assessment of ADF&G's port sampling efforts in fisheries where enhanced fish are intercepted, including terminal and near-terminal fisheries where enhanced fish comprise most of the harvest. Hatchery corporations may need to augment ADF&G's sampling program or provide the funding for increased ADF&G sampling. In order to make future run projections for species with multiple age classes, marks should be recovered from clean-up or cost recovery harvests to assess the relative strengths of those classes. Mark recovery in terminal areas will indicate whether significant numbers of naturally reproduced fish were taken in the harvest. An evaluation plan should specify where marks will be read and how data will be shared.

The region-wide transition to a more extensive use of thermal marks must include a region-wide plan for mark recovery and data management. The largest hatchery organizations in Southeast have been proactive in setting up and operating otolith reading labs and, in some cases, sampling fisheries where an indication of run strength helps them plan the management of their terminal area activities. The department stands to gain much from the increased use of thermal marks; i.e., increased precision of fishery management and increased ability to exercise effective oversight of enhancement activities. It is incumbent on ADF&G, as the lead public agency for management of the fish resource, to maintain oversight of all mark-recovery and data management activities and to participate as fully and as effectively as possible in harvest sampling, especially where common property harvest decisions could be affected. Department oversight of mark recovery during cost recovery and clean-up operations in terminal harvest areas is a lesser priority; however, when private organizations conduct mark-recovery activities, they need to adhere to the same sampling standards that ADF&G employs so that results can be used meaningfully expand that agency's ability to manage the resource. As sampling and data management become more complex, additional funding will be needed to enable ADF&G to maintain its oversight responsibilities.

Best practice: ADF&G will provide oversight for all mark-recovery activities related to common property harvest management. Mark-recovery activities conducted by entities other than ADF&G will yield data that is complementary to data collected directly by ADF&G.

C. Ecological and Genetic Impacts

One of the objectives of the technical guidelines is to suggest strategies that will minimize the impacts of enhanced fish on other freshwater and saltwater biota. For each project, the combination of technical elements should indicate the likelihood of an unintended impact occurring. If warranted, a strategy for detecting a specific impact should be included in the evaluation plan. The intensity of the evaluation program should be commensurate with the seriousness of the potential consequences; i.e., if a wild stock near an enhancement project is considered "significant" then it will be of increased importance to know if any interaction is taking place. On the other hand, it may be less important to dedicate time and money for evaluating a possible impact when there is little perceived concern for serious consequences. When it is advisable to evaluate the possibility that a project will have an ecological or genetic impact, an evaluation plan should include responses to the following questions:

- What change will be used as an indicator of impacts?
- What pre-project baseline data are needed?
- What constitutes an impact and what is an unacceptable level of impact?
- What changes to the project will be proposed in response to an unacceptable level of impact?
- Who will be responsible for data collection and who will analyze it?

1. Ecological impacts:

Projects that include a freshwater phase are begun with the understanding that freshwater ecosystems will change because they are complex, dynamic, and continually adjusting to achieve balance. Fish from enhancement projects have the potential to impact other freshwater species in both positive and negative ways (Pearsons and Hopley 1999).

The evaluation of ecological impact of introduced salmon in freshwater habitats has been the subject of intensive research projects in Southeast at Slippery Creek (Wright and others 1997) and Margaret Lake (Bryant and others 1994, 1995, and 1999). Initial evaluations, which spanned several years after fish pass installation and fish stocking, indicated some increased complexity in food webs and changes in resident population characteristics but no broad-scale displacement or replacement by introduced species. Investigation of the long-term effects continues for the Slippery Creek project. Thorough evaluations such as these can increase the cost of colonization project by 5 to 10 times; and considering the low level of adverse impacts detected, Forest Service staff believe that most future projects could be less rigorously evaluated.[26] It may be adequate to intensively evaluate only a sample of colonization projects, depending on the ecological importance of the water body.

Releases of large numbers of juvenile salmon in fresh water or salt water have the potential to impact the environment in the vicinity of the release site. There are numerous theories and opinions on the types of impacts and whether or not they might affect other species or the ecosystem in lasting and significant ways. Research to determine the causes of the decline of the Taku River fall chum population

[26] Forest Service staff comments on preliminary draft of the phase III plan, personal communication.

is currently underway, and early marine competition with hatchery chums is considered a possible contributing factor[27]. This type of research is especially important where there are indications that possible long-term consequences to a wild stock may be occurring. By and large, few documented early marine ecological impacts have been attributed to enhancement projects in Southeast Alaska, quite possibly because of a very healthy marine ecosystem that can adjust and rebalance when relatively minor impacts occur.

Allegations of the harmful cumulative impact of *all* Southeast Alaska enhanced fish on the Bering Sea or North Pacific Ocean ecosystems are not well supported. Current research by NMFS will expand understanding of these areas. Evaluating the impact of a new project on a faraway ecosystem is well beyond the means of any hatchery corporation; however, if 100% of enhanced fish were otolith marked, it would help all research efforts along their migratory path.

Best practice: Evaluate the ecological impact of a fisheries supplemental project if the department and the regional planning team believe supplementation is threatening a significant wild stock or an important ecosystem function in a specific place and time.

2. Genetic impacts:

Colonization projects essentially seed habitat with a stock that will be left alone for "shaping" by the environment into a naturally reproducing stock. If the new spawning habitat is attractive to adult salmon, straying rates will be within normal limits and the risk of adverse genetic impacts to neighboring stocks will be therefore low. Excessive straying would call for reevaluation of the accessibility and characteristics of the colonized habitat.

In wildstock supplementation projects, the F_1 offspring of wild fish are reintroduced so that they will interbreed with the rest of the wild population. There is some speculation but no data – that incubation in an artificial environment exerts selective pressure on salmon eggs and alevins and results in genetic differentiation from the parent population. Limiting reintroductions to the F_1 generation is the precautionary strategy for minimizing any possible genetic effect of artificial propagation.

The primary impact of concern in fishery supplementation projects is the introgression of genetic material from straying enhanced fish into wild populations. All species of salmon have been observed to stray to some degree. Straying rates of wild salmon vary both between species and for different stocks of the same species. For example, Tallman and Healey (1994) found straying rates in three populations of chum salmon in the same inlet in British Columbia to range from 9% to 54%. Straying rates of wild pink salmon tagged in six different streams ranged from 9% to 53% (Sharp et al. 1994); in Southeast Alaska, straying rates have been observed from 1.5% to 9.2% (Mortensen et al. 2002; Thedinga et al.

[27] Reese, C. and et al. 1997. "In summary, our results indicate that interactions in Taku Inlet between hatchery and wild chum salmon from the Taku River are possible because of the co-occurrence of these fish, particularly in the littoral habitat of the outer inlet, and the large proportion of early-released hatchery fry with larger body size. However, direct indications of competitive effects on wild fry, such as poor condition or reduced apparent growth rates in the presence of abundant hatchery fry, were not observed in this study."

2002). From an evolutionary standpoint, straying is necessary to help maintain genetic diversity and to colonize new habitat. It is assumed that the straying rate in the wild in balance with each stock's ability to integrate new genetic material and either incorporate it when advantageous or discard it when it is not. More realistically, most wild salmon populations if left undisturbed over time would likely be examples of the metapopulation model of population dynamics: occasional extinction of a local population followed by recolonization of the vacant habitat by pioneers from other sites (Hanski and Gilpin 1991)

It is reasonable to expect that properly imprinted hatchery fish will home as precisely and "pioneer" as frequently as their wild conspecifics. Quinn (1993) concludes that "evidence is limited and equivocal on whether hatchery rearing per se increases the tendency of salmon to stray." The more important question, with regard to enhancement project impacts, is what percent of a neighboring wild stock's genetic material come from enhanced fish each year? If exogenous genetic material is introduced into a wild stock at a rate in excess of its ability to deal with it, a decrease in productivity could result over time. Scientists generally agree that the decrease can be reversed if the rate of influx of genes is slowed or stopped.

True strays are most likely to be found within a few miles of the release site (Heard 1996; Labelle 1992). Survey data from prespawning fish may include a number of strays that have wandered into a stream but, if left alone, would back out and go elsewhere. "Wandering" behavior has been well documented for coho salmon. Labelle (1992) reports "back-out" rates of 16.8%, 4.1%, and 3.3% in consecutive years for coho salmon at the Trent River weir on Vancouver Island, where the escapement was a mixture of wild and enhanced fish. At Margaret Lake in southern Southeast Alaska, some of the adult coho that had been marked with visible tags at the top of a 7-meter vertical-rise fish pass, 1.5 km from salt water, were subsequently recovered at Neets Bay Hatchery, 25 kilometers to the north. One of these marked adults was recovered in a commercial fishery a month later and 80 kilometers away (Bryant and Frenette 1992, Frenette and Bryant 1993). When coded wire tags were recovered from eight adipose-clipped cohos at the top of the fish pass, six were from Margaret Lake smolts and two were from Neets Bay Hatchery (Bryant and others 1994). No inference about straying rates can be drawn from these data since killing the fish to recover coded wire tags eliminated the possibility of knowing where any of these fish would have spawned. Where this behavior has been quantified, wandering adult salmon are a relatively small proportion of the tagged fish observed. Therefore, recovery of prespawning tagged fish is roughly indicative of potential spawning by those tagged groups in a watershed.

Survey data should clearly document whether strays are sympatric with wild spawners, because strays recovered either temporally or spatially isolated from the wild spawning population would have low potential for genetic interaction. Similarly, a stray found in habitat where it cannot successfully reproduce poses no genetic threat, although it is exhibiting straying behavior.

Surveys of actively spawning or postspawning fish provide more accurately data on straying rates than counts of prespawners; however, finding postspawners in wild systems is not easy in many cases, and sample numbers might be small. For either prespawners or postspawners, straying rates cannot be evaluated with any reasonable degree of precision unless the enhanced fish are 100% marked.

Distinguishing enhanced and wild fish by scale pattern analysis or by a visual difference in freshwater scale patterns is a possible tool for long-rearing species. Coho released as smolt into Klawock River can be distinguished from wild returns to that system with reasonably good reliability. For enhanced fish released as fry, the method has been successfully applied; however, it is labor-intensive because it requires a tremendous amount of scale collection and analysis before and during project implementation in order to detect differences (Baer and Honnold 2002.)

Recent projects in Southeast Alaska where straying has been evaluated have used a 2% incidence of prespawning strays in a neighboring wild stock as the "trigger point" for concern and for consideration of project modification to reduce straying. The "2% rule" is based on the theoretical rate of loss of alleles in a wild population described by Withler (1997). At a 1.5% influx of genes in each generation, the replacement of 50% of alleles in a wild population could occur in 25 generations. It is assumed that the replacement of alleles would result in a decrease of fitness and a consequent decrease in productivity of the wild population. Withler's numbers assume there is no selection pressure acting to slow the rate of allele replacement. Tallman and Healey (1994) compared the incidence of enhanced chum carcasses in three wild populations with the electrophoretic evidence of gene flow. They found that gene flow was an order of magnitude less than the observed rate of straying (as much as 46% of the population composed of strays but less than 5% gene flow). For whatever reason, (e.g., mate selection, dropout of hybrids, etc), actual allele replacement did not correlate with the incidence of strays in the population. On the other hand, a native-stray hybrid that fails to thrive and reproduce in the wild population constitutes an increment of reduced productivity.

The potential for straying adults from a supplementation project is greatly reduced by adhering as closely as possible to the best practice guidelines, which maximize juvenile imprinting to the release site. According to the *Stock Appraisal Tool*[28], the requirement to assess straying for any project should be appropriate to the (1) potential for straying based on the project strategies and (2) significance and proximity of local conspecific wild populations. While no population is insignificant, use of the assessment parameters in the *Stock Appraisal Tool* recognizes that a possible small, reversible decrease in productivity is a more acceptable trade-off for populations that do not meet certain criteria. An acceptable rate of straying for a proposed project will be defined in relation to specific neighboring wild stocks. Setting the acceptable rate will depend on many factors, including (but not limited to) the likelihood of temporal overlap on the spawning grounds, significance of the wild stock, and how closely the two stocks are related.

The stray survey protocol recommended for a project could range in intensity from counting marks among prespawners (low intensity) to a series of thorough and systematic surveys of the entire spawning area to count marks in postspawners (high intensity). The intensity of the stray survey protocol must be adequate to detect the trigger point for corrective action of project modifications. The

[28] Comprehensive Salmon Enhancement Plan for Southeast Alaska: Phase III – Appendix E is not reproduced in this document.

evaluation plan will include the predetermined acceptable percentage of strays in a specific wild stock and what action will be taken if strays in excess of that percentage are observed.

Best practice: If considered necessary by the department and regional planning team, develop a plan to evaluate the genetic impact of a proposed project. The intensity of the evaluation will be appropriate to the likelihood of straying and the potential for a significant impact on a specific wild stock.

D. Fishery Management Impacts

An evaluation of the impact of new enhanced production on fishery management should occur when the project reaches full production and all age classes of adults are represented in the harvest. The project evaluation plan should indicate the year when a report should address how well the project has measured up to the stated goals for fishery management and include answers to the following questions:

- Has the project provided the intended harvest opportunities?
- Are there unintended mixed-stock fishery impacts?

For fishery supplementation projects the report should also address the following questions:

- Has the terminal area proven appropriate to accommodate the fishing effort?
- Has the primary harvest in the terminal area been comprised of enhanced fish?
- Are the terminal harvest fish in adequate condition for the intended economic benefit?

Best practice: Define the questions and issues a project may have for managers, how those questions and issues will be resolved as the project evolves, and who will be responsible for this process.

E. Reporting

Project reports draw together all the information about a project at scheduled times. Having all the relevant information in one place is not just a convenience – it is conducive to making good decisions on project modification, if necessary. The *Policy for the Management of Sustainable Salmon Fisheries* advocates the "initiation of any necessary corrective measure without delay and prompt achievement of the measure's purpose . . ." as part of the precautionary approach to artificial propagation.[29] Reports should be distributed to the RPT and made available to any other interested persons.

Project reports should contain information on how closely the project plan is being followed. In some cases the original strategies proposed for a project may prove impossible or not advisable in actual practice. If deviations have occurred, the report should explain the new strategies and how they will address the standards. Actual project benefits should be compared to the original goals to determine if the project is meeting expectations. If it is not, operational adjustments may be made that would help or perhaps the original goals are unrealistic in light of current biological or economic conditions. The

[29] ACC 39.222(c)(5)(A)(iii)

project report should also describe collateral and unanticipated benefits as well as summarize all impact assessment activities that have been conducted. Enough detail should be presented to allow informed decisions on corrective measures, if necessary.

More than one organization or agency may be involved with implementing and evaluating a project, but the responsibility for reporting should be clearly assigned to one person or position. The evaluation plan should establish the reporting schedule and responsibility before the project begins.

Best practice: Before a project begins, designate the person or position responsible for reporting as well as the persons or positions who will receive the reports; also develop a schedule for reporting.

Tables B1, B2 and B3 schematically summarize the technical guidelines, provide examples of benefits and goals, and describe the process of project evaluation.

Table B-1. Technical guidelines.

I. Fishery Supplementation

Standards	Elements	Best Practice
A. The release site has an adequate freshwater supply and is not in close proximity to significant wild stocks	A. Release site selection	
	1. Characteristics of release site freshwater supply	Choose an imprint/release site with a strong and consistent supply of fresh water.
	2. Location of release site relative to rearing site	Choose a remote release site that is unaffected by water from the rearing site but still shares general characteristics of the stock's native stream.
	3. Proximity of significant wild stocks	Choose a release site that is not proximal to the natal streams of any highly significant wild stocks of the same species or other species with similar run timing and habitat utilization characteristics.
	4. Early marine interactions and cumulative effects of multiple interactions	Choose a site location and release timing that minimizes potential nearshore interaction with local wild stocks.
	5. Land use designation	Consider the upland management intent adjacent to a proposed project site and minimize potential conflict or move the project elsewhere if that is not possible.
B. Fish are adequately imprinted to the release site	B. Imprinting to the release site	
	1. Transport timing	Transfer fish to the imprint/release site as early as possible during juvenile rearing.
	2. Saltwater entry	Allow smolts to migrate downstream volitionally from their freshwater rearing site to salt water.
	3. Length of exposure to release-site fresh water	Immerse smolts in the imprint fresh water for a minimum of three weeks and release the fish only when they are fully smolted.
C. Enhanced fish are marked and identifiable in traditional fisheries and contribute to the harvest without jeopardizing the sustainability of wild stocks	C. Harvest contribution	
	1. Identification in the fisheries	Adequately mark all groups of fish and, where needed for effective management of traditional fisheries, plan to implement a mark–recovery program to assist resource managers.
	2. Effect on traditional and near-terminal fisheries	Do not intensively harvest groups of enhanced fish where the overharvest of wild stocks will occur.
	3. Cumulative effect of multiple enhancement projects on traditional fisheries	Do not pose management challenges in traditional fisheries that cannot be reasonably addressed by managers because of the harvest of new production.
D. The terminal area design and management plan enable harvest or containment of all returning adults	D. Terminal area function	
	1. Configuration of terminal area	Delineate a terminal area that both confines returning adults and facilitates their harvest.
	2. Containment of fish	Allow returning adults clear access to adequate freshwater habitat in their home stream or quickly harvest them in salt water immediately adjacent to their home stream.
	3. Harvest management strategy	Design a terminal harvest area management plan that effectively maximizes the quality of fish harvested while minimizing any potential undesirable outcomes.
	4. Incidental harvest of wild stocks	Implement a terminal harvest plan that will not affect the sustainability of incidentally harvested wild stocks.
	5. Broodstock management	Collect gametes from all significant segments of the run.

Table B-1 cont.

II. Wildstock Supplementation

Standards	Elements	Best Practice
A. Project objective relative to the wild stock is clearly defined	A. Project objective	Clearly define the project objectives relative to the wild stock, including (if appropriate) the project end point and annual decision criteria.
B. Wildstock characteristics are preserved as much as possible in the supplemental production	B. Preservation of wild stock characteristics	
	1. Separation of populations	Target only one discrete spawning population for each egg take.
	2. Broodstock composition	Time egg takes and utilize adequate broodstock numbers to assure that the genetic composition of the supplemental production mimics the wild stock.
C. Imprinting strategy for the supplemental production mimics the process in the wild as much as possible	C. Effective imprinting	Rear and release juvenile fish in fresh water in their stream of origin.
D. Enhanced/wild juvenile interactions are anticipated and impacts on wild fish are minimized as much as possible	D. Minimizing enhanced/wild impacts	
	1. Percentage of enhanced juveniles	Keep the number of enhanced fry less than the number of wild fry from the same spawning population.
	2. Release strategy	Take all wild/enhanced fish interactions into account before determining the time and size of release of enhanced fish in order to minimize potential adverse impacts on wild fish.
E. Hatchery-incubated fish are marked and identifiable in the fisheries and in the freshwater spawning habitat	E. Identifying supplemental production	Mass mark all hatchery fish and additionally coded-wire-tag the recommended proportion of chinook and coho.

III. Colonization

Standards	Elements	Best Practice
A. Need for the project and the potential for success are clearly defined	A. Project need and potential for success	Evaluate project need during project planning. In addition, plan projects in streams with substantial upstream habitat without ecological conditions that might jeopardize project success.
B. Colonization strategy mimics the natural process as closely as possible	B. Colonization strategy	Colonize unused salmon habitat with the stock that occurs naturally in that system using the least intrusive means that will accomplish the the project objectives.
C. Adequate evaluation of ecological impacts will occur	C. Evaluation of impacts	Conduct a precolonization assessment of the habitat to be colonized and consider a postcolonization assessment of the impacts of anadromous fish to the habitat and biota.
D. Hatchery-incubated fish are marked and identifiable in the fisheries and in freshwater spawning habitat	D. Identification of hatchery-produced fish	Mass mark all hatchery-produced fish and additionally coded-wire-tag the recommended proportion of chinook and coho.

Table B-2. Benefits and goals: examples.

I. Fishery Supplementation

Benefit	Goal
A. Provide additional fish for harvest by one or more user groups	Provide the projected number of harvestable fish to the intended user groups in traditional fisheries or in new fisheries over an extended period of years.
B. Create a new harvest opportunity that will deflect fishing effort from traditional fisheries	Effectively and consistently attract commercial, sport, and/or personal-use fishing effort away from vulnerable wild stocks
C. Mitigate for lost fishing opportunity related to the Pacific Salmon Treaty or other international or internal political agreement	Allow no net loss to common property harvesters in a specific fishery as a result of the Pacific Salmon Treaty or other political agreement.
D. Provide balance for the allocation of enhanced fish between traditional harvest gear groups	Increase the total harvest value for a disadvantaged gear group without taking existing resources from other gear groups.
E. Add value to the overall commercial fishery in Southeast Alaska	Increase the overall value of the region's fisheries by a projected amount.

II. Wild Stock Supplementation

Benefit	Goal
A. An increase in wild stock productivity as measured by an increase in the number of adults in the total return	Increase the number of adult fish produced by the stock to a predetermined level within a reasonable period of time and then discontinue supplementation if required by the project plan.
B. Harvest adjustments allow for increased harvest of other more plentiful stocks as well as the supplemented stock	Increase the number of adults from the supplemented stock to a level where harvest restrictions are lifted, resulting in a net increase in fishing opportunity.

III. Colonization

A colonization project would potentially provide some combination of the benefits associated with fishery supplementation and/or wildstock supplementation.

Collateral Benefits: Wild Stock Supplementation and Colonization

A. Increased overall freshwater ecosystem productivity
B. Increased size or numbers of resident or other anadromous salmonids that prey on the supplemented stock in fresh water
C. A terminal harvest or other activity that yields a cost recovery product whose value is high enough to cover project expenses

Table B-3. Project evaluation.

The Evaluation Plan Includes:	Elements	Best Practice
A. Fish identification (marking) method to be used	A. Marking	Beginning in 2004, mass mark all hatchery-produced chum, pink, and sockeye. Continue to coded-wire-tag chinook and coho in the recommended ratios; additionally, mass mark all of these fish when used for wildstock supplementation or colonization.
B. Mark–recovery plan for common property and terminal site harvests	B. Mark Recovery	ADF&G will provide oversight for all mark–recovery activities related to common property harvest management. Mark–recovery activities conducted by entities other than ADF&G will yield data that is complementary to data collected directly by ADF&G.
C. Identification of potential ecological and genetic impacts that might warrant evaluation, a strategy to detect them, and criteria to determine when measured impacts would warrant project modification	C. Ecological and Genetic Impacts	
	1. Ecological Impacts	Evaluate the ecological impact of a fisheries supplemental project if the department and the regional planning team believe supplementation is threatening a significant wild stock or an important ecosystem function in a specific place and time.
	2. Genetic Impacts	If considered necessary by the department and regional planning team, develop a plan to evaluate the genetic impact of a proposed project. The intensity of the evaluation will be appropriate to the likelihood of straying and the potential for a significant impact on a specific wild stock.
D. Description of how impacts to fishery management will be evaluated	D. Fishery Management Impacts	Define the questions and issues a project may have for managers, how those questions and issues will be resolved as the project evolves, and who will be responsible for this process.
E. Plan for dispersing information about the project	E. Reporting	Before a project begins, designate the person or position responsible for reporting as well as the persons or positions who will receive the reports; also develop a schedule for reporting.

APPENDIX C

Table C-1. Roadmap for Hatchery Permitting & Process

<u>Aquaculture Association Pre-Project Planning</u>

Determine **location** of hatchery facility

Test **water** quality and flow rates (1 year worth of data necessary in some cases)

Seek to **secure water rights**. (Must have water rights
(at least temporary rights to submit hatchery permit)

Determine **species** to be reared and probable broodstock source

Determine **release site** if not hatchery location and water quality data for site

Request **Management Feasibility Analysis** (MFA) from ADF&G – MFA request includes: the location of the facility; the species desired for hatchery production; the run timing, by species; 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.

Financial Feasibility of program (Short and long-term funding sources)

Detailed statement of operational goals, objectives and plans for hatchery permit application

(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 Aquaculture Association formally adopts planned program

↓

PNP Application Process

Submit PNP application (must include the completed MFA)

PNP Coordinator formally accepts application as complete,
135 day time period further broken down into two phases for processing application begins

↓

Hatchery Permit Application Review – Schedule A (60 days)*

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;

Department management and regional staffs review the application and either submits comments to PNP coordinator or requests additional information;

RPT reviews the application for compatibility with regional Comprehensive Salmon Plan and sends a recommendation to the commissioner (goals, significant & unique stock designation);

Basic Management Plan (BMP) is drafted by department area staff, the applicant, and the PNP coordinator working together;

↓

Issuance of Private Non-profit Hatchery Permit – Schedule B (75 days)
(Public Participation, Finalization and Decision)

Public Hearing is scheduled and 30 day notice is published; completed application (includes the MFA) and draft BMP are provided;

Public Hearing is held – process concludes 15 days after oral hearing is held. The department to respond to specific objections (oral or written) within 10 working days after receipt.

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

The commissioner will review the application before rendering a decision (75 days).^

Application package submitted to the commissioner for review will include the recommendations from the regional planning team, recommendations resulting from the department's review, and the results of the public hearing regarding the proposed facility.

PNP Permit is either issued or denied by the commissioner;

^See Review and Determination regulations, 5 AAC 40.220, for commissioner's considerations.

↓

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 might be listed

Financing secured (Dept. of Commerce or other)

Dept. of Natural Resources
(Water reservations/in-stream flow)
(Tideland Leases)

Dept of Environmental Conservation
(Sewage and effluent permits)

Army Corp of Engineers
US Forest Service
US Park Service
US Bureau of Land Management
State of Alaska

Note: Items in this section can be worked on parallel to or in conjunction with the hatchery permit.

Note: Information is this appendix was developed and reviewed with the help of L. Vercessi, Commercial Fish Biologist, ADF&G, Juneau (personal communication).

APPENDIX D

Alaska Department of Fish and Game
Genetic Policy

1985

Followed by a copy of the

Background of the Genetics 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

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

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

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

1. 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.

2. 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

A. 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.

B. 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.

C. Stock Rehabilitation and Enhancement

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

2. *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.*

D. *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.*

E. *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

1. *Genetic diversity among hatcheries*

    1. *A single donor stock cannot be used to establish or contribute to more than three hatchery stocks.*
    2. *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.*

2. *Genetic diversity within hatcheries and from donor stocks*
    1. *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.*

    2. *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.

1. 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.

2. 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. Prevention of detrimental effects of gene flow from hatchery fish straying and interbreeding with wild fish.

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.

2. 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 heritabilities for traits of interest, that 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 two 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

<u>The relationship of breeding structure, effective population size, and rate of inbreeding.</u>

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. (See D.S. Falconer. 1981. Introduction to Quantitative Genetics. Longman Inc., New York)
The following demonstrates the consequence of some breeding structures to effective population size.

<u>Number of males and females:</u> 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 two 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 1970's, 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 the

Department of Fish and Game. Each FTP is reviewed and commented on by selected staff of the department.

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 E

Hatchery Permit Project Checklist and Stock Appraisal Tool

Yakutat RPT Hatchery Permit Project Checklist:

Project Name: _____

Applicant Name and date of submission: _____

The Yakutat RPT will review salmon fishery enhancement projects proposed by any agency or entity. This checklist is not meant to be a definitive technical analysis but to provide supplemental information to the hatchery permit application. The RPT will evaluate projects on their contribution to achieving the goals and objectives of the regional comprehensive salmon plan.

PROJECT FEASIBILITY

1. Are enhancement methods proven or experimental? (Describe them)

2. What is the project's brood stock requirement?

3. How will brood stock be acquired?

4. If it is necessary to culture a new brood stock, for future collection at hatchery site or another location, how long will it take, where will original broodstock come from, if from another hatchery, have you secured a commitment for broodstock for time necessary, how will you collect broodstock when it starts to return to hatchery site or other? (Please describe and explain)

5. How long are you planning on holding juveniles at the release site for imprinting?

6. How will the juveniles be transported if remote released? What is the estimated time of transport?

LAND USE:

1. The landholder of the site is?

1a. Has an agreement between the landholder and PNP association been agreed to and signed?

1b. Is there a time frame imbedded in the lease? If so for how long?

2. Is project compatible with adjacent land use policies? (Please list which land use policies/agencies were consulted?

3. Can the project be implemented without interfering with existing uses of the area?

MANAGEMENT:

1. What are your assumptions about how enhanced fish can be harvested while protecting natural stocks?

2. What are your assumptions on how the project can be implemented without conflicting with the existing commercial, recreational or subsistence fishery? (Please explain)

3. Which users groups are expected to benefit from the project? For each user group, will the harvest occur in a historical fishing location or in a new terminal harvest area? What is the expected benefit/contribution to each user group?

4. Will the project contribute to a fishery that is manageable in time and area for all users?

5. What are the assumptions for how management of corporate brood and cost recovery escapement will occur? Will you possibly have to impact a traditional common property fishery if restrictions are necessary in order to get broodstock?

6. Will cost recovery be necessary to support the project? Where will the cost recovery occur if necessary? Will the cost recovery possibly cause interference with traditional fisheries? How much of the anticipated return will be necessary for cost recovery? What price assumption was used for this estimate?

7. Can the harvest be managed to achieve high fish quality?

COST:

1. How do you intend to fund the project? What is the cost of the project? Please consider both implementation start-up costs and operational costs?

2. Is the project financially feasible?

3. Will the project result in costs to other entities/agencies? (i.e sampling, monitoring) If so who?

STOCK IDENTIFICATION:

For the hatchery site or a remote release site, list any streams or rivers in the immediate vicinity of the site listed in the Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes and its associated Atlas (AWC) (ADF&G). For each stream or river listed please provide the following data:

1. River name and atlas number.

2. List the species and life stages specified in the AWC.

3. Consult ADF&G and list information about any escapement data known, and any historical catch in a common property fishery by sport, personal use, subsistence and commercial fisheries in the immediate vicinity.

4. Why do you believe that this project can be implemented without impacting local wild stocks in the area?

Stock Appraisal Tool

The stock appraisal tool identifies some key factors for determining whether a stock impacted by an fishery enhancement project should be considered "significant or unique" under the ADF&G Genetics Policy. Section II.A. of the 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*." The stock appraisal tool 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. This stock appraisal tool is modeled after the one developed by the Southeast RPT during their Phase III plan.

A determination of stock significance must be based on the best existing knowledge from all sources including ADF&G data, federal agencies, hatchery associations and local knowledge brought forward from the public.

This stock appraisal will look at the five characteristics of population trend, supplementation, isolation, uniqueness, and use pattern of the stock using a non-numerical 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 the five characteristics will provide a qualitative estimate of significance that can be used in the development and evaluation of a project.

I. Population Trend

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

The escapement trend of a population of the species being supplemented can be a measure of a stock's potential to thrive as a gene pool and the potential to withstand external impacts. Escapements of other species in the area can help pinpoint possible habitat degradation and a rehabilitative project may have the goal to try and reverse a stock decline or a stock that needs protection. Available information on escapements may be found in ADF&G's "Alexander" database that includes all existing escapement data for the region as well as the most recent stock status reports published. Having sufficient data for every stream in a region is an unrealistic expectation.

II. Supplementation

Introduced ….. ….. ….. ….. ….. ….. ….. ….. ….. ….. ….. ….. ….. Native

The supplementation spectrum includes the degree of impact from previous stocking, as well as the likelihood of impacts from the planned project being evaluated. It is important to remember that all species of salmon have relatively low inclination to stray and colonize and that the same level of influx from a fishery enhancement project should not compromise the native wild stocks, 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.

III. Isolation

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

To what extent is a stock part of a larger aggregate stock population or insolated and likely it's own discrete population. A larger aggregate stock (metapopulation) through the normal processes could mitigate for low levels of gene influx from a fishery enhancement project better than an isolated solitary population. Large stocks serve as 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 against 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 because of glacial rebound, earthquakes, landslides etc.

IV. Uniqueness

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

Based on 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. A good starting point for information is the publication, Biological Characteristics and Population Status of Anadromous Salmon in Southeast Alaska (Halupka 2000) which provided a thorough review of data in existence in the late 1990's.

V. Use Pattern of Stock

Contributes to multi-stock harvest ….. ….. ….. ….. ….. ….. ….. ….. ….. Supports targeted fishery

The first four 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 it's 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 from the Taku 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 (Joint Northern/Southern RPT 2004).

APPENDIX F

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 G
Yakutat Public Survey

C-1 Public Survey Questionnaire

The YRPT distributed over 450 surveys and received 25 completed surveys from the public, only a 5% response rate. This is a low response rate, but is not unexpected, due to the YRAA having just formed the previous year, and many still doubtful about the success of the association.

Yakutat residents participate in multiple commercial fisheries as well as sport, personal use and subsistence. Local residents that are not involved in the commercial fishery, participate in the subsistence and sport fisheries. For this reason, respondents were given an opportunity to prioritize the importance of each of the 5 species of Pacific Salmon for each fishery. With regard to these preferences, survey respondents were also asked to rank their priorities, by species for production in the Yakutat region. Survey respondents were asked to state their preference for methods by which to increase Yakutat salmon production, by fishery enhancement projects, rehabilitation of weak stocks, management of salmon and fisheries, research, or habitat improvement or protection. Finally they were asked for their ideas on projects they felt important to either a specific district or the Yakutat region as a whole. A copy of the questionnaire follows this section.

C-2 Public Survey Results:

The majority of the survey respondents, 80% were Yakutat residents, 4% out of state and 16% didn't indicate their residency. Not surprisingly, survey responses indicated that they considered themselves part of two or more user groups. These individuals participate in Yakutat salmon harvest through multiple fishing methods (for example, many commercial salmon fishermen were also subsistence harvesters and some also identified themselves as sport fishermen). Eighty-seven percent (87%) identified themselves as subsistence harvesters, while seventy-six percent (76%) participated in the commercial fishery, seventy-two percent (72%) in the sport fishery, twenty percent (20%) in the Sport-fish-guide industry and twenty percent (20%) in the commercial processing industry. These numbers provide some obvious overlap.

Every respondent indicated that they use and eat salmon and the average number of years being 27 from those that responded with a range of 2 years to 50 years with two responding by all their life. 88% or 22 of the respondents participate in Subsistence fishing with a range of 3 years to 47 years or an average of 19.5 years. 72% or 18 respondents participate in sport fisheries, for an average of 27 years with a range of 2 or for life. 76% or 19 respondents participate in commercial fisheries for an average of 16 years with a range of 2 to 41 years. Of those respondents that participate in commercial fisheries, 14 held Yakutat set permits, 2 held Hand troll permits, 7 held power Troll permits, and one held another type of permit. 4 respondents held a commercial crew license, 5 stated they work in the Processing sector and 5 participate in the guide sport industry.

We asked the respondents how they prefer to harvest salmon and to mark all responses that apply. From the results it is apparent that they use a combination of methods for gathering their home consumption. 17 answered commercial, 18 subsistence and 12 sport fishing.

Respondents were asked to rank their priority species to CATCH for different methods of fishing. In relation to commercial fishing, Chinook was the highest priority, followed by Chum, Sockeye and Coho ranked similarly with pinks the least desired species to catch. Subsistence ranked sockeye the highest followed by Chinook, Coho, chum and pinks. Sport ranked Chinook and Coho as the highest priorities, followed by sockeye, chum and pink.

When the respondents were asked what their priority species for preference for increasing fishing resources through management, stocking or other enhancement projects, the top priority was Chinook, followed by chum, sockeye, Coho and pinks. Immediately following this priority listing, respondents provided the following suggestions for stocking or enhancement projects they would like to see developed. These responses ranged from a generalized suggestion of a hatchery – what area is or may be suitable; produce as many salmon as possible; to if you could increase the resource – you would have years ago; to more specific suggestions, with 7 respondents specifically suggesting a chum hatchery/release site; to zero-check Chinook, egg incubation boxes in existing streams; clean out "West Situk" of debris, fertilize Situk Lake, move the weir up to 9 mile bridge and shutdown or reduce bag limits on kings and sockeyes; Release sites suggested (some sites were for a specific species, some were just possible sites) Yakutat Bay, new evolving streams in Yakutat forelands, log dump, Humpy Creek, Monti Bay, Broken Oar Cove, Hump Creek area, Situk and Lost Rivers, Mamby Shore, Icy Bay; and specifically Increase Chinook salmon in Situk/Lost River and Bays surrounding Yakutat without jeopardizing naturally wild salmon.

The survey asked respondents to rank the following approaches which might be used to sustain or increase Yakutat salmon numbers.

C-3 Enhancement Projects for salmon fisheries

20 respondents prioritized this approach with 11 or 55% ranking this as the number 1 priority, 2 ranked as their second priority, 4 as the third priority and 3 or 15% as their least priority. Comments to this approach included from those who had this marked as the highest priority: hatchery release sites; a well-planned hatchery; and putting a hatchery in the log dump would be a great place to have one. One comment was received from a participant who ranked this as the second priority was: to do this in a slow and controlled manner – really should be done simultaneously with (d) research of Yakutat salmon species. The two comments received from those that had this listed as the third priority: Terminal hatchery fisheries would help increase available resources for commercial fishermen and to not harm natural runs; and any enhancements should be reared from local stock, keep Yakutat salmon wild. From those that ranked this as the lowest priority or commented with no ranking we received the following comments: A hatchery is a threat to the wild stocks; Chum salmon would benefit a few commercial fishermen while posing a risk to traditional subsistence and sport fishing tourism; and from the same person a negative comment about hatcheries, while at the same time saying fish enhancement boxes

work w/wild stock; sockeye hatchery in local lake; and I've been told it would benefit to release fry in the rivers that are not currently fished in case the Hubbard Glacier closes off.

C-4 Rehabilitation of weak salmon stocks:

19 respondents prioritized this approach with 5 or 26% ranking this as the highest priority, 5 ranked this as their second priority, 6 as the third priority, 2 as the 4th priority and 1 as the lowest priority. Comments from those who ranked this as the highest priority were: locate habitats that are decreasing; what would happen to all the fisheries in Yakutat if the Situk king salmon become extinct?; shut down sport fishing – no catch and release; and a good place for restocking sockeye would be the Situk Lake. For those who responded that this was their 2nd priority: Fisheries management and enforcement would enhance a healthy, but dwindling fishery; hatcheries to boost weak runs and a respondent who had this listed as their 3rd priority said Hatchery rearing and restocking. One comment was received from someone who didn't rank this approach was to clean weeds out of East River.

C-5 Management of Yakutat salmon and fisheries:

10 of 20 respondents marked this as a top priority, 6 ranked this number 2 priority, 2 marked it the 3rd priority and 2 ranked it number 4 and no-one marked it as the lowest priority. Comments were only received from those who had this ranked as number 1 or 2. The comments were: more monitoring of escapement, smolt production, halt illegal fishers; better management of the sports fishing industry; As evidenced by several fisheries collapses in the past, fisheries management needs a total overhaul from the present complacent, numbers driven style to one of accountability and caring for the resource. With extensive, unregulated (double – triple dipping of bag limits) sport fishing above the fish counting weir, there is no way an accurate escapement count can be determined. An investigation should be conducted ASAP to protect the dwindling salmon runs; would like to see more accountability with the local fish and game and for processors to not have so much influence with the local biologist and enforcement; weir on East Alsek River; larger escapement and management for the commercial; better management and monitoring of the sport fishing; 1 use sonar – I don't trust aerial surveys because of human error; better weir count/ and also electronic counts of other river systems not looked at, not all rivers are checked for product harvest; management is poor. Need better surveys. For instance Tsiu River was too conservatively managed which resulted in over-escapement this year (2012); direct correlation with fish and game management and the fishermen. Monitoring of targeted species without heavy by-catch (king salmon and steelhead); and do not overstaff, so people have so much idle time. Have specific job descriptions so staff carries out their responsibilities.

C-6 Research of Yakutat salmon and fisheries:

2 of 19 respondents marked this as a top priority, 5 ranked it as number 2, 2 ranked it 3rd, 6 ranked it 4th and 4 marked it as the lowest priority. The comments on this section were: a study of uplift and salmon survival would be good; studies should be done to confirm the health of an already healthy river system; and believe research is overrated, and No one knows what is happening with these fish when they are in the ocean.

C-7 Improve or protect salmon habitat:

5 of 20 respondents marked this as a top priority, none ranked it as number 2, 3 ranked it 3rd, 5 ranked it 4th and 7 marked it as the lowest priority #5. The comments regarding improving or protecting salmon habitat included: protect the existing habitat; clear fall down trees out of salmon rearing streams; Prevent logging in the future near streams; clean the rivers in certain places, especially West Situk; habitat enhancement has been ongoing for several years and continuing; no damage I can see in future; to my experience stream restoration has been pointless and corrupt in the local area, primarily way to waste funds and collect more, but ground movement in the local area means the ground water level changes and dredging of Dry stream beds is ineffective but clearing blockages is a good step; leave it the same; survey of the total area needs looked at – a lot of water ways not fished; get rid of Park Service and Forest Service ability to block enhancement; and I feel bad for putting this one on the back burner. Our rivers are the cleanest streams on earth, let's let them remain this way!

C-8 Survey Comments or Suggestions

We started the survey with the general question, "Do you have any initial comments or suggestions regarding Yakutat area salmon management, research, enhancement, rehabilitation and how to fund such projects" and at the end of the survey we asked, "Please use the following space to share any other thoughts you may have concerning Yakutat salmon and then asked the same question we started the survey with. The following comments were provided at the beginning of the survey:

- I am very excited about the prospect of a chum fishery in Yakutat;
- We need to enhance Yakutat salmon runs any way possible. I like the idea of a hatchery to pay for it. We should get a loan from the state and then do cost recovery;
- Yakutat stocks are healthy and do not need to be supplemented or rehabilitated. Those activities pose a risk to the existing wild stocks;
- You better start doing something real about the problems other than just talking about it;
- Sports fishermen are really meat mongers and are taking a substantial amount of fish after they pass the weir where they are counted. I also believe due to politics, other variables affecting fish returns such as intercept fisheries is overlooked or ignored;
- Poor complacent management & enforcement seems to be causing dwindling stocks. A hatchery would be very beneficial for fishermen to make a decent living;
- We need a king salmon hatchery;
- Allow subsistence fishing with sport fishing equipment to help lower by-catch;
- Need to continue to working to get a project in place as soon as possible;
- If any enhancement is done, let it be to promote high value species such as sockeye, otherwise don't mess with an ecosystem that is already working;
- I am not sure introducing species not from Yakutat stream systems is the answer to productivity. Hatcheries are relatively new technology. How would this affect all other species in Yakutat Bay. And do we want them here forever?; and
- Use strict management of salmon returns before it is too late and fishing has to be closed. Projects can be funded by saving on government waste.

Comments received at the end of the survey were:

- We need to develop hatcheries, remote release sites (salmon runs) in Yakutat as this is a fishing town and most of our runs are or seem to be dying and the town is shrinking, people are leaving and selling out if they can, the school enrollment is way down and I see this as our last chance to save our town;
- Whatever means may help any or all salmon species;
- Chum salmon will stray into the Situk River and upset the balance of what is the most productive per mile salmon streams in the world; get started before we all have to move to Juneau;
- Fish and Game biologists need to get out in the field more, walk the streams and get more hands on. Sport fishing has turned into meat hunting – many of these sports fishermen are selling this when they go back to where they are from. Regulation of the sports fishing industry needs to be significantly tightened up. Politics need to be put aside and an objective comprehensive research needs to be done on possible intercept fisheries;
- It was a catastrophe here this year, ¼ run, a statewide problem, how, why – is it a global deterioration, all species are running later and later, papers have been filed on the death of one of the milo-plankton affecting sockeye, The Gov seems to be trying to kill the king, to my knowledge subsistence has priority over troll king but they close subsistence & extend troll king??? Who is in charge? What a mess;
- Just do it;
- I think commercial fishermen & the state should fund projects (com) 10 – (state) 90;
- Yakutat needs to have current ADF&G management old ways change to more aggressive to manage salmon fisheries. No disrespect . . . I really feel & see mis-management – have many e-mails backing up confusing management that contradicts from one year to the next;
- Don't wait until it is to late to lower the number of fish that can be taken of any species. All need to contribute for healthy fish population;
- Both nature's systems upgrade and enhancement a new fishery to help the area problems, depleted stock not making full recovery thru several cycles;
- I wish I was more informed – all I really do is end up listening to all forms of fisherpersons complain;
- What will happen when no king salmon make it into the Situk River? This is a topic that not many talk about on the commercial fishing side. This would be very bad news for the people here in Yakutat. It is the one thing that would change lifestyles here;
- I am strongly opposed to the idea of a chum fishery introduced to Yak Bay. My main concern is having to pick worthless fish out of my nets. I have fished for chums in other fisheries and have seen when it is not worth the effort to catch them. Markets may be good at this point in time but that can easily change; and
- Steps to insure that local salmon are not over harvested by either sport or commercial and improving of local salmon stocks by hatchery or other proven methods.

Following is a copy of the survey that was sent out.

Yakutat Comprehensive Salmon Plan
2012 Public Survey

Yakutat Regional Aquaculture Association, Inc. & Yakutat 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 *Yakutat Regional Planning Team* (YRPT) was formed under Alaska State regulations with the primary purpose of preparing a Comprehensive Salmon Plan for supplementing natural salmon production and rehabilitating Yakutat 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 YRPT 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 YRPT is interested in your views and opinions concerning improving salmon resources in the Yakutat Area. ***Thank you for your participation!***

1. Do you have any initial comments or suggestions regarding Yakutat area salmon management, research, enhancement, rehabilitation and how to fund such projects (You will be asked a similar question at the end of the survey).

   _____

   _____

   _____

2. Do you use salmon? (Mark all that apply)

   a.) I eat salmon ……YES ☐ NO ☐

   If yes, How many years? _____ years

   b.) I catch salmon:

   For Subsistence ……YES ☐ NO ☐

   If yes, How many years? _____years

   For Sport ……YES ☐ NO ☐

   If yes, How many years? _____ years

   For Commercial Sale……YES ☐ NO ☐

   If yes, How many years? _____years

I am a Commercial Salmon Permit Holder YES ☐ NO ☐
Yakutat Set Gillnet ☐ Hand Troll ☐ Power Troll ☐ Other ☐
I am a Commercial Salmon Crewman YES ☐ NO ☐
Yakutat Set Gillnet ☐ Hand Troll ☐ Power Troll ☐ Other ☐

c.) I work in Processing……YES ☐ NO ☐
If yes, How many years? _____ years

d.) I guide sport fishermen……YES ☐ NO ☐
If yes, How many years? _____ years

3. How do you prefer to harvest salmon (Check all that apply)
Commercial… ☐ Subsistence… ☐ Sport… ☐

4. 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 you least preferred. (See example below, then complete the table following)

EXAMPLE					
Priority	**Chinook**	**Sockeye**	**Chum**	**Pink**	**Coho**
(1, 2, or 3)	*Rank of preferred species to harvest – 1 (High) through 5 (Low)*				
Commercial 2	4th	5th	1st	3rd	2nd
Subsistence 1	2nd	1st	4th	5th	3rd
Sport 3	1st	4th	3rd	5th	2nd

Please list your priorities and species preference below:

EXAMPLE					
Priority	**Chinook**	**Sockeye**	**Chum**	**Pink**	**Coho**
(1, 2, or 3)	*Rank of preferred species to harvest – 1 (High) through 5 (Low)*				
Commercial					
Subsistence					
Sport					

5. Please list, from 1 to 5, your priority or preference for increasing fishing resources 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 _____

6. Please list any stocking or enhancement projects you would like to see developed and where: _____
_____
_____
_____
_____

7. Please rank the following approaches (a-e), which might be used to sustain or increase Yakutat 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 Projects for salmon and fisheries: _____
How? *Examples include hatchery releases, stocking lakes, lake fertilization, fish ladders etc.* ***Please comment****. . .* _____
_____
_____
_____

b) Rehabilitation of weak salmon stocks: _____
How? *Examples include hatchery rearing and restocking, lake fertilization etc.* ***Please Comment*** *. . .*
_____
_____
_____

c) Management of Yakutat salmon and fisheries: _____
How? *Examples include more management personnel, more escapement counts using weirs or aerial surveys, more fisheries monitoring, etc.* ***Please Comment*** *. . . .*
_____
_____
_____

d) Research of Yakutat 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*** *. . . .*

_____

_____

_____

e) Improve or Protect salmon habitat: _____

How? *Please comment . . .*

_____

_____

_____

8. Please use the following space to share any other thoughts you may have concerning Yakutat salmon, give us your comments or suggestions regarding Yakutat area salmon management, research, enhancement, rehabilitation and who should fund such products.

_____

_____

_____

_____

_____

_____

9. What community do you live in? _____

What is the zip code?_____

Thank you for completing this survey!

Return Survey to: **Yakutat Regional Comp Plan**
C/O Kathy Hansen
9369 North Douglas Hwy
Juneau, AK 99801

APPENDIX H

Harvest Data Tables[30]

Table H-1. Yakutat region Chinook harvest by user group 1982 – 2011

YAKUTAT REGION CHINOOK SALMON HARVEST DATA 1982-2013

YEAR	TROLL	SETNET	SUBSISTENCE	SPORT	TOTAL
1982	18,244	1,424	198		19,866
1983	3,852	812	188		4,852
1984	8,600	944	233		9,777
1985	8,963	1,146	230		10,339
1986	10,172	1,341	301		11,814
1987	7,941	1,766	372		10,079
1988	5,696	894	196		6,786
1989	5,532	798	359		6,689
1990	9,956	663	361		10,980
1991	7,277	1,747	61		9,085
1992	2,117	2,025	549		4,691
1993	15,273	1,311	449		17,033
1994	4,662	3,897	700		9,259
1995	2,970	9,374	1,070		13,414
1996	4,650	4,854	934	3,612	14,050
1997	3,718	3,264	675	2,929	10,586
1998	6,607	2,804	899	2,517	12,827
1999	3,722	5,108	938	2,760	12,528
2000	4,080	2,460	963	2,349	9,852
2001	3,763	2,633	880	1,143	8,419
2002	8,084	2,510	1,395	966	12,955
2003	6,917	3,847	1,103	1,476	13,343
2004	8,157	2,734	936	1,406	13,233
2005	6,018	1,140	552	1,141	8,851
2006	5,729	1,330	823	1,364	9,246
2007	4,414	1,879	594	1,134	8,021
2008	5,859	1,309	711	690	8,569
2009	6,998	1,533	807	1,294	10,632
2010	6,577	501	422	960	8,460
2011	6,545	1,123	374	803	8,845
2012	6,111	942	199	291	7,543
2013	7,733	1,401	505	n/a	9,639

[30] Data in tables in Appendix H is from ADF&G and Commercial Fisheries Entry Committee. Data was received from G. Woods, Commercial Fish Biologist, ADF&G; P. Skannes, Troll Biologist, ADF&G; and B. Marston Sport Fish Biologist, ADF&G (personal communication).

Table H-2. Yakutat region sockeye harvest by user group 1982 - 2011[31]

YAKUTAT REGION SOCKEYE SALMON HARVEST DATA 1982 - 2013

YEAR	TROLL	SETNET	SUBSISTENCE	SPORT	TOTAL
1982	85	211,895	1,645		213,625
1983	46	155,545	1,175		156,766
1984	68	102,274	890		103,323
1985	239	236,582	1,003		237,824
1986	249	151,672	2,357		154,278
1987	190	258,884	3,598		262,672
1988	132	162,188	2,119		164,439
1989	221	329,454	3,494		333,169
1990	180	344,606	3,332		348,118
1991	212	229,903	896		231,011
1992	328	314,175	5,469		319,972
1993	576	345,887	5,073		351,536
1994	1,566	206,683	4,586		212,835
1995	550	153,723	3,419		157,692
1996	214	209,029	3,666	6,133	219,042
1997	972	110,078	3,428	8,437	122,915
1998	84	77,189	3,951	10,358	91,582
1999	103	128,751	3,905	8,609	141,368
2000	7	99,182	4,250	11,271	114,710
2001	15	141,534	4,119	6,153	151,821
2002	17	112,656	4,334	6,176	123,183
2003	9	154,441	3,488	13,995	171,933
2004	8	88,282	4,078	10,598	102,966
2005	47	79,443	2,649	7,554	89,693
2006	32	138,734	3,540	11,048	153,354
2007	51	236,869	4,152	9,016	250,088
2008	15	35,282	2,791	7,002	45,090
2009	57	105,825	4,082	6,692	116,656
2010	21	122,020	4,405	5,612	132,058
2011	23	167,704	3,836	11,954	183,517
2012	7	124,780	3,264	5,819	133,870
2013	14	168,356	3,490	N/A	171,860

[31] Data was received from G. Woods, Commercial Fish Biologist, ADF&G; P. Skannes, Troll Biologist, ADF&G; and B. Marston Sport Fish Biologist, ADF&G (personal communication).

Table H-3. Yakutat region coho harvest by user group 1982 - 2013[32]

YAKUTAT REGION COHO SALMON HARVEST DATA 1982 -2013

YEAR	TROLL	SETNET	SUBSISTENCE	SPORT	TOTAL
1982	88,469	148,384	2,180		239,033
1983	19,409	80,974	360		100,743
1984	78,523	182,720	572		261,815
1985	199,115	202,166	59		401,340
1986	155,969	91,284	586		247,839
1987	83,883	126,103	883		210,869
1988	54,451	205,866	176		260,493
1989	134,033	176,773	880		311,686
1990	134,719	148,891	809		284,419
1991	54,807	166,731	213		221,751
1992	189,213	290,095	3,645		482,953
1993	271,995	237,446	2,263		511,704
1994	417,594	343,843	2,169		763,606
1995	241,243	295,030	2,007		538,280
1996	264,039	227,802	1,359	10,563	503,763
1997	77,784	322,776	1,368	16,006	417,934
1998	116,518	197,629	1,589	10,124	325,860
1999	137,318	187,055	959	28,650	353,982
2000	21,203	170,948	1,163	12,528	205,842
2001	53,573	205,265	1,626	15,412	275,876
2002	49,759	200,888	1,836	10,884	263,367
2003	29,596	74,343	1,281	24,250	129,470
2004	55,205	196,930	801	30,450	283,386
2005	68,855	82,887	756	22,150	174,648
2006	24,067	86,085	659	15,541	126,352
2007	42,332	76,550	507	18,932	138,321
2008	37,818	153,712	736	17,674	209,940
2009	31,787	133,808	1,178	17,875	184,648
2010	105,913	161,584	672	20,428	288,597
2011	37,641	126,215	887	27,524	192,267
2012	25,527	98,677	656	19,102	143,962
2013	79,524	158,046	626	N/A	238,196

[32] Data was received from G. Woods, Commercial Fish Biologist, ADF&G; P. Skannes, Troll Biologist, ADF&G; and B. Marston Sport Fish Biologist, ADF&G (personal communication).

Table H-4. Yakutat region pink harvest by user group 1982 – 2013[33]

YAKUTAT REGION PINK SALMON HARVEST DATA 1982-2013

YEAR	TROLL	SETNET	SUBSISTENCE	SPORT	TOTAL
1982	2417	9,506			11,923
1983	1026	23,615			24,641
1984	1215	19,387			20,602
1985	9259	16,070			25,329
1986	1953	7,183			9,136
1987	1087	12,690			13,777
1988	1450	120,205	46		121,701
1989	3528	57,195	221		60,944
1990	1391	30,840	35		32,266
1991	2125	3,052	1		5,178
1992	2497	18,526	37		21,060
1993	3578	9,909	6		13,493
1994	1386	12,324	32		13,742
1995	979	54,041	45		55,065
1996	627	31,295	96	1,392	33,410
1997	896	93,658	86	4,106	98,746
1998	587	86,066	200	353	87,206
1999	625	29,554	107	826	31,112
2000	100	64,349	149	927	65,525
2001	108	32,230	91	1,881	34,310
2002	16	15,590	187	247	16,040
2003	479	48,418	137	2,249	51,283
2004	61	23,207	45	878	24,191
2005	319	60,436	77	3,980	64,812
2006	47	88,864	90	1,500	90,501
2007	345	87,997	125	3,579	92,046
2008	200	65,227	131	784	66,342
2009	117	76,956	51	1,335	78,459
2010	1358	160,470	237	1,903	163,968
2011	972	205,261	116	2,309	208,658
2012	73	27,343	101	500	28,017
2013	184	67,344	2	N/A	67,530

[33] Data was received from G. Woods, Commercial Fish Biologist, ADF&G; P. Skannes, Troll Biologist, ADF&G; and B. Marston Sport Fish Biologist, ADF&G (personal communication).

Table H-5. Yakutat region chum harvest by user group 1982 – 2013[34]

YAKUTAT CHUM SALMON HARVEST 1982-2013

YEAR	TROLL	SETNET	SUBSISTENCE	SPORT	TOTAL
1982	47	5,837			5,884
1983	107	11,119			11,226
1984	138	31,838			31,976
1985	718	12,399			13,117
1986	1,409	16,635			18,044
1987	137	14,744			14,881
1988	303	29,247	2		29,552
1989	245	16,259	51		16,555
1990	474	5,825	2		6,301
1991	257	2,984	0		3,241
1992	758	7,604	12		8,374
1993	2,417	4,065	1		6,483
1994	1,012	4,229	102		5,343
1995	912	2,585	21		3,518
1996	875	1,803	31	11	2,720
1997	196	808	6	88	1,098
1998	75	1,351	0	50	1,476
1999	28	928	0	110	1,066
2000	86	1,185	27	99	1,397
2001	29	406	10	65	510
2002	60	204	13	12	289
2003	10	542	1	304	857
2004	45	1,555	26	16	1,642
2005	13	525	5	108	651
2006	11	1,225	6	49	1,291
2007	45	2,782	3	122	2,952
2008	44	546	6	104	700
2009	106	871	4	11	992
2010	32	1,239	80	16	1,367
2011	67	900	1	337	1,305
2012	17	2,162	4	500	2,683
2013	286	1,428	26	N/A	1,740

[34] Data was received from G. Woods, Commercial Fish Biologist, ADF&G; P. Skannes, Troll Biologist, ADF&G; and B. Marston Sport Fish Biologist, ADF&G (personal communication).

Table H-6. Economic Value of Yakutat Setnet Fishery 1975 – 2013[35]

YAKUTAT SETNET INCOME 1975-2013

YEAR	SETNET INCOME	ACTIVE PERMITS	AVER. EARNINGS/PERMIT
1975	$ 617,769.00	141	$ 4,381.00
1976	$ 1,266,918.00	133	$ 9,526.00
1977	$ 2,165,108.00	144	$ 15,035.00
1978	$ 2,588,725.00	155	$ 16,701.00
1979	$ 3,022,174.00	155	$ 19,498.00
1980	$ 2,272,641.00	159	$ 14,293.00
1981	$ 2,631,179.00	158	$ 16,653.00
1982	$ 2,220,866.00	147	$ 15,108.00
1983	$ 1,200,401.00	145	$ 8,279.00
1984	$ 2,305,102.00	140	$ 16,465.00
1985	$ 2,777,108.00	148	$ 18,764.00
1986	$ 2,044,606.00	154	$ 13,277.00
1987	$ 4,587,640.00	154	$ 29,790.00
1988	$ 8,703,413.00	159	$ 54,738.00
1989	$ 4,217,986.00	160	$ 26,362.00
1990	$ 4,560,978.00	158	$ 28,867.00
1991	$ 2,330,261.00	161	$ 14,474.00
1992	$ 5,320,994.00	159	$ 33,465.00
1993	$ 3,000,832.00	157	$ 19,114.00
1994	$ 3,653,893.00	150	$ 24,359.00
1995	$ 2,479,193.00	147	$ 16,865.00
1996	$ 2,406,670.00	139	$ 17,314.00
1997	$ 3,216,870.00	141	$ 22,815.00
1998	$ 1,416,481.00	142	$ 9,975.00
1999	$ 2,324,296.00	128	$ 18,159.00
2000	$ 1,491,218.00	125	$ 11,930.00
2001	$ 1,134,695.00	114	$ 9,953.00
2002	$ 741,392.00	87	$ 8,522.00
2003	$ 1,140,130.00	104	$ 10,963.00
2004	$ 1,629,266.00	112	$ 14,547.00
2005	$ 926,824.00	114	$ 8,130.00
2006	$ 1,724,122.00	104	$ 16,578.00
2007	$ 2,516,647.00	120	$ 20,972.00
2008	$ 1,657,225.00	128	$ 12,947.00
2009	$ 1,681,645.00	122	$ 13,784.00
2010	$ 2,157,567.00	127	$ 16,989.00
2011	$ 2,311,802.00	121	$ 19,106.00
2012	$ 1,536,822.00	113	$ 13,600.00
2013	$ 3,018,685.00	106	$ 28,478.00

[35] Commercial Fishery Entry Commission data tables online at: http://www.cfec.state.ak.us/bit/X_S04D.htm (accessed August 2014)

Table H-7. Yakutat setnet salmon harvest by species and active permits 1960 – 2013[36]

YAKUTAT SETNET SALMON HARVEST BY SPECIES AND ACTIVE PERMITS 1960-2013

YEAR	CHINOOK	SOCKEYE	COHO	PINK	CHUM	TOTAL	PERMITS FISHED
1960	908	44,671	119,149	12,911	277	177,916	
1961	2,534	82,403	128,670	63,608	11,038	288,253	
1962	2,747	73,937	170,776	26,063	616	274,139	
1963	941	52,517	141,365	78,697	10,294	283,814	
1964	1,488	90,175	169,780	40,038	1,481	302,962	
1965	1,323	120,417	122,207	4,402	4,094	252,443	
1966	1,555	185,360	66,252	1,405	3,396	257,968	
1967	742	88,431	97,211	31,580	4,459	222,423	
1968	697	80,776	92,005	2,130	13,866	189,474	
1969	1,935	123,540	32,537	64,271	17,203	239,486	
1970	2,299	115,795	30,279	7,841	10,147	166,361	
1971	2,062	130,547	37,848	80,797	6,306	257,560	
1972	2,467	134617	46,293	3,092	12,887	199,356	
1973	2,733	128,466	41,776	16,990	8,995	198,960	
1974	2,214	82,418	77,593	4,211	4,185	170,621	
1975	2,224	73,291	37,403	80,277	3,761	196,956	141
1976	1,830	130,603	51,540	28,493	7,462	219,928	133
1977	2,549	186,001	92,230	75,530	8,623	364,933	144
1978	3,057	130,681	139,500	30,525	6,181	309,944	161
1979	4,232	164,813	95,866	151,937	7,399	424,247	158
1980	2,800	159,564	119,684	143,135	20,151	445,334	150
1981	2,069	149,273	132,579	133,756	10,655	428,332	152
1982	1,456	212,882	148,857	9,850	6,320	379,365	149
1983	976	152,571	81,573	25,278	11,195	271,593	131
1984	1,062	102,565	182,256	19,870	32,230	337,983	137
1985	1,231	234,896	202,772	16,410	12,468	467,777	149
1986	1,428	150,770	92,097	7,263	16,616	268,174	153
1987	2,072	259,989	124,407	12,920	14,555	413,943	155
1988	893	162,168	205,926	120,212	29,256	518,455	160
1989	798	329,454	176,773	57,195	16,259	580,479	164
1990	663	344,606	148,891	30,840	5,825	530,825	161
1991	1,747	229,903	166,731	3,052	2,984	404,417	162
1992	2,025	314,175	290,095	18,526	7,604	632,425	165
1993	1,311	345,887	237,446	9,909	4,065	598,618	158
1994	3,820	206,760	343,843	12,324	4,229	570,976	151

[36] Data was received from G. Woods, Commercial Fish Biologist, ADF&G (personal communication).

YEAR	CHINOOK	SOCKEYE	COHO	PINK	CHUM	TOTAL	PERMITS FISHED
1995	9,374	153,723	295,030	54,041	2,585	514,753	148
1996	4,854	209,029	227,802	31,295	1,803	474,783	140
1997	3,264	110,078	322,776	93,658	808	530,584	142
1998	2,804	77,189	197,629	86,066	1,351	365,039	144
1999	5,108	128,751	187,055	29,554	928	351,396	129
2000	2,460	99,182	170,948	64,349	1,185	338,124	125
2001	2,631	141,449	205,344	32,230	406	382,060	115
2002	2,510	112,656	200,888	15,590	204	331,848	88
2003	3,842	154,384	74,343	48,418	542	281,529	104
2004	2,734	88,282	196,930	23,207	1,555	312,708	112
2005	766	79,221	82,887	60,436	525	223,835	115
2006	1,208	138,510	86,085	88,864	1,225	315,892	105
2007	1,562	236,289	76,550	87,997	2,782	405,180	120
2008	850	35,227	153,712	65,227	546	255,562	129
2009	1,533	105,825	133,808	76,956	871	318,993	123
2010	501	122,022	161,460	160,470	1,239	445,692	128
2011	1,123	167,704	125,830	205,261	900	500,818	122
2012	942	124,780	98,677	27,343	2,162	253,904	113
2013	1,401	168,356	158,046	67,344	1,428	396,575	106

Note: 1975 was the first year of limited entry

Table H-8. Yakutat region Chinook troll harvest by district 1982 - 2013[37]

YAKUTAT TROLL CHINOOK HARVEST 1982-2013

YEAR	Dist 181	Dist 183	Dist 189	Dist 191	TOTAL
1982	4,274	1,621	12,349		18,244
1983	531	2,040	1,231		3,852
1984	2,402	1,605	4,593		8,600
1985	1,945	5,311	1,707		8,963
1986	4,314	3,472	2,386		10,172
1987	2,877	545	3,717	802	7,941
1988	993	452	4,251		5,696
1989	706	522	3,646	658	5,532
1990	1,869	903	5,924	1,260	9,956
1991	1,449	1,185	3,918	725	7,277
1992	191	507	1,215	204	2,117
1993	4,712	1,092	9,263	206	15,273
1994	1,824	975	1,863		4,662
1995	238	676	2,040	16	2,970
1996	771	342	3,130	207	4,650
1997	132	203	2,177		3,718
1998	859	719	5,029		6,607
1999	509	945	2,268		3,722
2000	335	1,430	2,293		4,080
2001	734	2,455	574		3,763
2002	1,556	2,764	3,764		8,084
2003	78	5,838	1,485		6,917
2004	145	7,087	925		8,157
2005	199	5,255	594		6,018
2006	130	5,121	478		5,729
2007	208	3,783	423		4,414
2008	1,457	4,022	380		5,859
2009	817	5,330	657	194	6,998
2010	311	6,214	52		6,577
2011	184	5,406	955		6,545
2012		2,307	162		2,469
2013	626	6,096			6,722

[37] Data was received from P. Skannes, Troll Biologist, ADF&G (personal communication).

Table H-9. Yakutat region sockeye salmon troll harvest by district 1982-2013[38]

YAKUTAT TROLL SOCKEYE HARVEST 1982-2013

YEAR	Dist 181	Dist 183	Dist 189	Dist 191	TOTAL
1982	11	63	11		85
1983	9	16	21		46
1984	38	13	17		68
1985	172	29	38		239
1986	123	46	80		249
1987	72	28	77	13	190
1988	57	33	41	1	132
1989	145	10	52	11	221
1990	73	19	80	8	180
1991	66	43	103		212
1992	34	25	268	1	328
1993	226	56	265	29	576
1994	245	49	1271		1,566
1995	151	34	362	3	550
1996	61	12	137	4	214
1997	232	3	737		972
1998	17	3	64		84
1999	48	27	25	3	103
2000	1	2	4		7
2001	10	3	2		15
2002	6	2	9		17
2003		9			9
2004	2	4	2		8
2005	8	10	29		47
2006	1	2	29		32
2007	7	10	34		51
2008	7		8		15
2009	26	11	20		57
2010	7	10	4		21
2011	4	7	12		23
2012			2		2
2013	11	3			14

[38] Data was received from P. Skannes, Troll Biologist, ADF&G (personal communication).

Table H-10. Yakutat region coho salmon troll harvest by district 1982-2013[39]

YAKUTAT TROLL COHO HARVEST 1982-2013

YEAR	Dist 181	Dist 183	Dist 189	Dist 191	TOTAL
1982	43,869	38,426	6,174		88,469
1983	11,604	2,418	5,387		19,409
1984	27,571	42,222	8,720		78,523
1985	77,118	77,320	43,482		199,115
1986	87,889	30,585	37,487		155,969
1987	49,914	3,430	27,424	3,115	83,883
1988	23,982	15,938	12,817	1,714	54,451
1989	59,017	11,636	38,158	16,662	134,033
1990	44,160	19,985	65,495	5,079	134,719
1991	18,087	8,040	25,236	3,444	54,807
1992	20,502	12,822	154,235	1,654	189,213
1993	85,879	30,033	152,234	3,849	271,995
1994	207,989	20,647	188,708		417,594
1995	60,360	2,351	163,932	3,800	241,243
1996	115,319	41,541	102,470	4,709	264,039
1997	18,950	2,596	56,238		77,784
1998	39,135	7,853	69,530		116,518
1999	53,288	29,613	45,466	8,951	137,318
2000	10,299	1,664	8,363		21,203
2001	22,144	12,997	18,432		53,573
2002	16,061	13,311	20,387		49,759
2003	3,213	13,268	12,370		29,596
2004	10,413	24,231	20,561		55,205
2005	6,725	28,015	33,990		68,855
2006	1,751	3,714	18,602		24,067
2007	7,238	13,155	21,939		42,332
2008	5,192	5,074	27,552		37,818
2009	5,006	13,437	12,577	767	31,787
2010	65,567	12,958	25,606	1,782	105,913
2011	12,383	18,336	6,922		37,641
2012			2,388		2,388
2013	54,854	14,416	7,070	3,161	79,501

[39] Data was received from P. Skannes, Troll Biologist, ADF&G (personal communication).

Table H-11. Yakutat region pink salmon troll harvest by district 1982-2013[40]

Yakutat Troll Harvest Pink 1982-2013

YEAR	Dist 181	Dist 183	Dist 189	Dist 191	Total
1982	1,707	122	588		2,417
1983	283	297	446		1,026
1984	680	360	175		1,215
1985	4,419	3,258	1,582		9,259
1986	994	85	874		1,953
1987	360	97	632	8	1,087
1988	731	440	255	24	1,450
1989	2,850	233	342	103	3,528
1990	276	233	873	15	1,391
1991	484	1,183	458		2,125
1992	109	685	1,704	10	2,497
1993	1,399	331	1,801	47	3,578
1994	877	400	105		1,386
1995	134	236	608	1	979
1996	153	9	395	70	627
1997	400	56	440		896
1998	301	154	132		587
1999	162	193	247	23	625
2000	22	10	68		100
2001	52	33	23		108
2002	5	5	6		16
2003	1	477	1		479
2004	2	59			61
2005	5	300	14		319
2006	1	8	38		47
2007	120	158	67		345
2008	83	37	80		200
2009	7	72	13	25	117
2010	923	317	118		1,358
2011	32	870	70		972
2012				8	8
2013	145	34	5		184

[40] Data was received from P. Skannes, Troll Biologist, ADF&G (personal communication).

Table H-12. Yakutat region chum salmon troll harvest 1982-2013[41]

Yakutat Troll Harvest Chum Salmon 1982-2013

YEAR	Total
1982	47
1983	107
1984	138
1985	718
1986	1,409
1987	137
1988	303
1989	245
1990	474
1991	257
1992	758
1993	2,417
1994	1,012
1995	912
1996	875
1997	196
1998	75
1999	28
2000	86
2001	29
2002	60
2003	10
2004	45
2005	13
2006	11
2007	45
2008	44
2009	106
2010	32
2011	67
2012	17
2013	286

Chum harvest was confidential at the district level.

[41] Data was received from P. Skannes, Troll Biologist, ADF&G (personal communication).

Table H-13. Yakutat region sport fish angler effort and angler days 1996 - 2012[42]

YAKUTAT SPORT FISH ANGLER EFFORT 1996 TO 2012

YEAR	SW ANGLERS	FW ANGLERS	TOTAL ANGLERS
1996	3,042	4,464	5,403
1997	3,595	5,703	6,613
1998	3,535	4,934	6,120
1999	3,667	5,743	6,902
2000	3,226	4,680	5,592
2001	2,509	3,738	4,629
2002	1,774	3,208	3,800
2003	3,890	5,726	6,789
2004	3,194	5,880	6,613
2005	4,285	6,352	7,374
2006	4,086	6,041	7,304
2007	3,887	7,089	7,979
2008	3,841	6,033	7,171
2009	2,730	4,602	5,527
2010	3,650	5,869	7,119
2011	3,404	6,236	7,182
2012	3,088	4,947	6,155

YAKUTAT SPORT FISH ANGLER DAYS 1996 TO 2012

YEAR	SALTWATER	FRESHWATER	TOTAL FISHED
1996	5,352	14,551	19,903
1997	6,936	22,947	29,883
1998	6,439	18,691	25,130
1999	6,661	26,726	33,387
2000	7,462	22,747	30,209
2001	6,626	16,537	23,163
2002	5,025	13,994	19,019
2003	8,970	26,124	35,094
2004	7,315	25,920	33,235
2005	10,014	27,909	37,923
2006	10,134	33,500	43,634
2007	9,917	35,449	45,366
2008	8,330	26,018	34,348
2009	7,971	18,861	26,832
2010	9,015	25,550	34,565
2011	8,947	29,563	38,510
2012	6946	24,459	31,405

[42] Data was received from B. Marston Sport Fish Biologist, ADF&G (personal communication).

Table H-14. Yakutat region sport fish salmon harvest by species 1996 – 2012[43]

Yakutat Sport Fish Data by Species 1996 to 2012

YEAR	Chinook	Sockeye	Coho	Pink	Chum	Total
1996	3,612	6,133	10,563	1,392	11	21,711
1997	2,929	8,437	16,006	4,106	88	31,566
1998	2,517	10,358	10,124	353	50	23,402
1999	2,760	8,609	28,650	826	110	40,955
2000	2,349	11,271	12,528	927	99	27,174
2001	1,143	6,153	15,412	1,881	65	24,654
2002	966	6,176	10,884	247	12	18,285
2003	1,476	13,995	24,250	2,249	304	42,274
2004	1,406	10,598	30,450	878	16	43,348
2005	1,141	7,554	22,150	3,980	108	34,933
2006	1,364	11,048	15,541	1,500	49	29,502
2007	1,134	9,016	18,932	3,579	122	32,783
2008	690	7,002	17,674	784	104	26,254
2009	1,294	6,692	17,875	1,335	11	27,207
2010	960	5,612	20,428	1,903	16	28,919
2011	803	11,954	27,524	2,309	337	42,927
2012	291	5,819	19,102	500	17	25,279

[43] Data was received from B. Marston Sport Fish Biologist, ADF&G (personal communication).

Table H-15. Yakutat region saltwater sport fish coho salmon harvest by system 1996-2012[44]

SALTWATER SPORT FISH COHO SALMON HARVEST BY SYSTEM 1996-2012

YEAR	Yakutat Bay-Boat	Ankau Lagoon	Other Boat	Yakutat Bay-Shoreline	Ankau Lagoon-Shoreline	Other Shoreline	Saltwater Total
1996	3,259		415	415			4,089
1997	4,392		245	178		379	5,194
1998	2,486		91			76	2,653
1999	8,774		268	440		687	10,169
2000	2,342	220	358		321	136	3,377
2001	4,712	406	326		339	765	6,548
2002	3,005	149	0		202	447	3,803
2003	5,812	577	473		1066	567	8,495
2004	6,395	131	417	613	822	340	8,718
2005	7,724		278	229	332	78	8,641
2006	2,481		245		403	204	3,333
2007	5,014			121	326	115	5,576
2008	4,028		153	134	288		4,603
2009	5,035		257			216	5,508
2010	5,922					335	6,257
2011	8,359		36	306			8,701
2012	4,783		341				5,124

[44] Data was received from B. Marston Sport Fish Biologist, ADF&G (personal communication).

Table H-16. Yakutat region freshwater sportfish coho salmon harvest by system 1996-2012[45]

YEAR	Situk River above weir	Situk River - below weir	Situk River - unspecified	Akwe River	Tsui River	East Alsek River	Lost River	Italio River	Other Streams	Ankau River & Lagoon	Freshwater Total
1996	761	1,973			1,244		1,353		822	302	6,474
1997	2,345	2,304			2,283	546	2,169		920	245	10,812
1998	1,245	1,289			764		1,228		2,732	213	7,471
1999	3,320	5,274			1,728	1,068	2,934	1,285	1,656	1,216	18,481
2000	2,356	2,567			2,057		742	653	776		9,151
2001	1,464	2,964			1,783		1,164	835	654		8,864
2002	589	1,085			2,713		851		1,843		7,081
2003	2,514	4,751			4,286	385	1,892	1,027	900		15,755
2004	4,273	6,974	418		2,372	1,923	2,781	1,018	1,973		21,732
2005	1,281	3,855	620		2,325	450	2,104	1,943	931		13,509
2006	1,629	2,849			2,158	995	2,395	1,295	896		12,181
2007	1,415	1,802			2,752	1,259	1,609	2,915	1,604		13,356
2008	1,778	2,617			3,317	1,231	1,529	1,008	1,591		13,071
2009	1,436	2,462			3,399	885	959	1,896	1,330		12,367
2010	1,522	2,997		719	3,862	1,207	1,115	1,857	892		14,171
2011	3,135	4,745	520	1,108	2,490	1,159	1,402	2,055	2,209		18,823
2012	2,126	2,281	406		3,417	1,369	845		3,534		13,978

[45] Data was received from B. Marston Sport Fish Biologist, ADF&G (personal communication).

Table H-17. Yakutat region reported subsistence salmon harvest and effort 1975-2013[46]

YAKUTAT AREA REPORTED SUBSISTENCE SALMON HARVEST FROM 1975 TO 2013

YEAR	SALMON SPECIES						PERMITS	
	CHINOOK	SOCKEYE	COHO	PINK	CHUM	TOTAL	FISHED	ISSUED
1975	27	510	40			577	18	
1976	83	1,060	55			1,198	35	
1977	92	1,242	781			2,115	45	
1978	59	870	912			1,841	127	
1979	238	525	720			1,483	73	
1980	284	961	982			2,227	68	
1981	167	952	1,701			2,820	88	
1982	198	1,645	2,180			4,023	71	
1983	188	1,175	360			1,723	0	
1984	233	890	572			1,695	88	
1985	230	1,003	59			1,292	46	
1986	301	2,357	586			3,244	170	
1987	372	3,598	883			4,853	120	
1988	196	2,119	176	46	2	2,539	111	
1989	359	3,494	880	221	51	5,005	87	153
1990	361	3,332	809	35	2	4,539	74	128
1991	61	896	213	1	0	1,171	27	134
1992	549	5,469	3,645	37	12	9,712	109	139
1993	449	5,073	2,263	6	1	7,792	105	130
1994	700	4,586	2,169	32	102	7,589	101	137
1995	1,070	3,419	2,007	45	21	6,562	94	138
1996	934	3,666	1,359	96	31	6,086	89	124
1997	675	3,428	1,368	86	6	5,563	89	129
1998	899	3,951	1,589	200	0	6,639	111	141
1999	938	3,905	959	107	0	5,909	89	122
2000	963	4,250	1,163	149	27	6,552	109	138
2001	880	4,119	1,626	91	10	6,726	102	139
2002	1,395	4,334	1,836	187	13	7,765	98	124
2003	1,103	3,488	1,281	137	1	6,010	87	128
2004	936	4,078	801	45	26	5,886	87	138
2005	552	2,649	756	77	5	4,039	66	115
2006	823	3,540	659	90	6	5,118	90	127
2007	594	4,152	507	125	3	5,381	78	121
2008	711	2,791	736	131	6	4,375	81	122
2009	807	4,082	1,178	51	4	6,122	92	133
2010	421	4,325	672	187	50	5,655	85	148
2011	341	3,290	816	116	1	4,564	96	159
2012	199	3,264	656	101	4	4224		141
2013	505	3,490	626	2	26	4649		131

[46] Tingley, A., and W. Davidson. 2007; Pontius, K., and W. Davidson. 2011; Conrad and Davidson 2013 and Data from G. Woods, Commercial Fish Biologist, ADF&G (personal communication)

Table H-18: Yakutat Spring Troll Fishery Hatchery Contribution 2013 & 2014[47]

2013 Yakutat Spring Troll Harvest and Hatchery contribution (Here is a summary of AK% by week☺

Week	Catch	AK Contrib	AK%
19	35		0%
20	50	1.1125	2%
21	141		0%
22	130	22.39685	17%
23	99		0%
24	207		0%
25	350	27.86652	8%
Season totals	1012	**51.37587**	5%

AK	BC	OR	WA
5%	6%	10%	4%

The bottom two rows of the chart, shows the percentage of total Yakutat catch during the spring troll fishery based on coded-wire tags by origin. A very small percent were wild (0.4%) in 2013, based on coded wire tag data. They were Chilkat River and Hanford Reach.

2014 Yakutat Spring Troll Harvest and Hatchery contribution

Week	Harvest	AK contrib	AK %
19	83	13.147	16%
20	133		
21	78		
22	21		
23	13		
24	7		
25	7		
26	44		
Season totals	386	13.147	3%

AK	BC	OR	WA
16%	12%	1%	3%

[47] P. Skannes, Troll Management Biologist, ADF&G personal communication

Table H-19. Situk Weir escapement counts, 1988–2012[48]

Year	Dates of Operation	Chinook[a]	Sockeye[b]	Coho[c]	Pink[d]	Chum
1988	6/7–8/21	885	46,404	1,694	78,754	228
1989	5/31–8/17	637	84,383	0	288,246	0
1990	6/1–7/28	1,274	61,375	0	0	0
1991	6/10–7/27	1,613	67,737	0	4,168	3
1992	4/18– 8/5	1,985	63,877	0	29,278	0
1993	6/10–8/5	4,091	62,110	0	16,285	0
1994	5/21– 8/4	4,416	72,474	4	79,055	4
1995	5/10– 8/3	8,231	42,463	4	66,273	17
1996	5/6–8/6	4,151	61,269	65	157,012	15
1997	5/7–8/8	5,001	42,051	18	466,267	35
1998	5/3–8/5	5,329	50,546	8	97,392	0
1999	5/9–8/6	2,786	61,544	2	27,586	0
2000	5/10–8/8	3,091	41,544	189	332,510	53
2001	5/20–8/8	696	60,330	20	121,267	13
2002	5/10–8/8	1,024	68,743	40	98,190	22
2003	5/8–8/8	2,615	89,720	1	375,333	12
2004	5/8–8/9	798	42,544	184	145,914	111
2005	5/8–7/31	613	66,476	137	279,648	0
2006	5/11–8/13	749	90,383	320	115,079	283
2007	5/11–8/15	677	61,799	39	224,024	18
2008	5/11–7/23	414	22,540	0	1,275	6
2009	5/12–8/5	904	83,959	10	62,287	2
2010	5/11–8/5	170	47,865	2706	84,594	1
2011	5/9–8/7	240	89,993	46	169,908	112
2012	**6/1–8/7**	**321**	**62,467**	**17**	**33,620**	**11**
1989–2010 Average		2,183	61,755	229	138,348	39

Note: In 1992 and from 1994 to the present, the weir has been operated by Division of Sport Fish in May and early June to count emigrant steelhead.

[a] Chinook salmon weir counts are for large, three ocean or older, fish. The Chinook salmon escapement goal range of 450–1,050 fish is for large fish.

[b] Sockeye salmon escapement goal range is 30,000–70,000 fish.

[c] The Situk weir is not operated through the end of the coho salmon return and is not a useful measure of escapement for this species.

[d] Pink salmon escapement goal (SEG) is 33,000 fish passed through the weir by August 5.

[48] Woods & Zeiser 2013

Table H-20. Klukshu River Weir escapement, 1976–2012[49]

Year	Chinook[a]	Sockeye[b]	Coho[c]
1976	1,278	11,691	1,572
1977	3,144	26,791	2,758
1978	2,976	26,867	30
1979	4,405	12,308	175
1980	2,637	11,739	704
1981	2,113	20,323	1,170
1982	2,369	33,699	189
1983	2,537	20,492	303
1984	1,672	12,727	1,402
1985	1,458	18,620	350
1986	2,708	24,880	62
1987	2,616	10,504	202
1988	2,037	9,341	2,774
1989	2,456	23,542	2,219
1990	1,915	25,995	315
1991	2,489	18,977	8,540
1992	1,366	20,215	1,145
1993	3,302	16,740	788
1994	3,735	15,038	1,232
1995	5,678	22,202	3,650
1996	3,602	8,317	3,465
1997	2,757	11,012	307
1998	1,347	13,580	1,961
1999	2,190	5,069	2,371
2000	1,365	5,551	4,832
2001	1,825	10,290	748
2002	2,240	25,711	9,921
2003	1,671	32,120	3,689
2004	2,525	15,348	750
2005	1,070	3,373	683
2006	568	13,455	420
2007	677	8,956	300
2008	436	2,731	4,275
2009	1,568	5,731	424
2010	2,357	18,936	2365
2011	1,670	18,960	2,365
2012	**665**	**17,267**	**572**
2002–2011 average	1,478	14,775	2,495

[a] Chinook salmon escapement goal range was 1,100 to 2,300 fish changed in 2013 to 800 to 1,200.

[b] Sockeye salmon escapement goal range was 7,500 to 15,000 fish changed in 2013 to 7,500 to 11,000.[c] Coho numbers are an index; weir is removed before run is over.

[49] Woods & Zeiser 2013