



**FAO-BASED RESPONSIBLE FISHERY MANAGEMENT CERTIFICATION
SURVEILLANCE REPORT**

For The
US Alaska Salmon Commercial Fisheries

Applicant Group
Alaska Seafood Marketing Institute (ASMI)

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Report Code:
AK/Sal/001.2/2013
Published August 2013

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I. Summary and Recommendations

The Alaska Seafood Marketing Institute, requested assessment of the Alaska salmon commercial fisheries to the FAO Based Responsible Fisheries Management (RFM) Certification Program.

The application was made in April 2010. Assessment commenced in April 2010 with assessment validation before proceeding to full assessment and final certification determination in March 2011.

This report is the **2nd Surveillance Report (ref. AK/Sal/001.2/2013)** for the Alaska salmon commercial fisheries following the 1st Surveillance activities and assessment report (ref. AK/Sal/001.1/2012) carried out in early 2012. The objective of the surveillance report is to monitor for any changes/updates in the management regime, regulations and their implementation since the previous surveillance assessment and to determine whether these changes (if any) and current practices remain consistent with the overall confidence rating scorings of the fishery allocated during initial certification and verified during the 1st surveillance report. In addition to this, the non conformance issued on the previous surveillance assessment is assessed for compliance as for 2013 using current evidence and the relative action plan received and published within the previous assessment report.

The US Alaska commercial salmon [all pacific salmon species: Chinook (*Oncorhynchus tshawytscha*); sockeye (*Oncorhynchus nerka*); coho (*Oncorhynchus kisutch*); pink (*Oncorhynchus gorbuscha*); and chum (*Oncorhynchus keta*)] fisheries; employ troll, purse seine, drift gillnet, set gillnet (and fish wheel in Upper Yukon River only) gear, in the four administrative Regions of Alaska, and are principally managed by the Alaska Department of Fish and Game (ADFG). The certification covers the entire Alaska Exclusive Economic Zone (EEZ) although the vast majority of the harvest is taken in the internal waters (0-3 nautical miles, and other enclosed waters) of the state of Alaska.

Based on the outcome of this 2nd Surveillance Assessment for the US Alaska Commercial Salmon Fisheries, Global Trust Certification confirms continued certification of these fisheries under the FAO Based Responsible Fisheries Management Certification Program. It should also be noted, that during the course of the surveillance audit, the assessment team were made aware of a currently unpublished research paper (Jasper et al. in press) reporting on the presence of genetic introgression caused from enhanced fishery stocks on wild chum in Prince William Sound. As this paper is currently not in a final published format, and therefore potentially subject to change, this Surveillance Assessment has not yet fully evaluated the outcome of this new evidence on the fishery conformance. The Surveillance Report provides a summary of findings on the noted research from available material (refer to page 172). Once a published manuscript of the research is available (expected September/October 2013), a further surveillance audit specific to its content will be undertaken and a revision to the outcome to this surveillance report will be undertaken.

The surveillance assessment was conducted according to the Global Trust procedures for FAO – Based Responsible Fisheries Management Certification using the FAO – Based RFM Conformance Criteria V1.2 fundamental clauses as the assessment framework.

The assessment was conducted by a team of Global Trust appointed Assessors comprising of two externally contracted fishery experts and Global Trust internal staff. Details of the assessment team are provided in Appendix 1. The main Key outcomes have been summarised in [Section 5 "Assessment Outcome Summary"](#)

Following this 2nd surveillance assessment, the Global Trust Certification assessment team confirms continued Certification under the FAO-Based Responsible Fisheries Management Certification Program to the U.S.A. Alaska commercial salmon fisheries. It is also noted that an upcoming review of clause 14 (enhancement activities) is planned for September/October 2013 due to a new peer reviewed paper dealing with Prince William Sound wild chum salmon introgression (Jasper *et al.* in press) which should be published at about that time. Clause 14 will be reviewed and re-scored as appropriate, at that time, and a new report determination will be made accordingly.

Sections 8, 9, 10 and 11 provide details of the existing non-conformance and corrective action. Click [here](#) to jump to the beginning of section 8.

II. Assessment Team Details

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1. Introduction

Unit of Certification

The US Alaska commercial salmon [all Pacific salmon species: Chinook (*Oncorhynchus tshawytscha*); sockeye (*Oncorhynchus nerka*); coho (*Oncorhynchus kisutch*); pink (*Oncorhynchus gorbuscha*); and chum (*Oncorhynchus keta*)] fisheries, employing troll, purse seine, drift gillnet, set gillnet gear (and fish wheel in Upper Yukon River only), in the four administrative Regions of Alaska principally managed by the Alaska Department of Fish and Game (ADFG), underwent their 2nd surveillance assessment against the requirements of the FAO-Based RFM Conformance Criteria Version 1.2 Fundamental clauses.

This 2nd Surveillance Report documents the assessment result for the continued certification of commercially exploited Alaska salmon fisheries to the FAO-Based RFM Certification Program. However, a further surveillance audit will be carried out in September/October 2013 relative to the contents of a research paper dealing with Prince William Sound wild chum salmon introgression. A revision to the outcome of this surveillance report will be made accordingly.

This is a voluntary program for the Alaska salmon fisheries that has been supported by ASMI who wishes to provide an independent, third-party certification program that can be used to verify that these fisheries are responsibly managed according to the FAO-Based RFM Program. The assessment was conducted according to the Global Trust procedures for FAO-Based RFM Certification GTC Version 1.2 Sept 2011 in accordance with EN45011/ISO/IEC Guide 65 accredited certification procedures. The assessment is based on the fundamental clauses specified in the FAO-Based RFM Conformance Criteria.

The assessment is based on 6 major components of responsible management derived from the FAO Code of conduct for Responsible Fisheries (1995) and Guidelines for the Eco-labeling of products from marine capture fisheries (2009).

- A The Fisheries Management System**
- B Science and Stock Assessment Activities**
- C The Precautionary Approach**
- D Management Measures**
- E Implementation, Monitoring and Control**
- F Serious Impacts of the Fishery on the Ecosystem**

These six major components are supported by 13 fundamental clauses (+ 1 in case of enhanced fisheries) against which a capture fishery certified under the FAO-Based RFM Program is assessed during the various assessment surveillance events. A summary of the site meetings is presented in Section 5. Assessors comprised of both externally contracted fishery experts and Global Trust internal staff (Appendix 1). This report documents the 2nd Surveillance Assessment of the Alaska salmon commercial fisheries, originally certified the 11th of March 2011, and the recommendation of the Assessment Team for continued FAO-Based RFM Certification.

1.1. Recommendation of the Assessment Team

The Assessment Team recommends that continued Certification under the FAO-Based Responsible Fisheries Management Certification Program is granted^a to the U.S.A. Alaska commercial salmon [all pacific salmon species: Chinook (*Oncorhynchus tshawytscha*); sockeye (*Oncorhynchus nerka*); coho (*Oncorhynchus kisutch*); pink (*Oncorhynchus gorbuscha*); and chum (*Oncorhynchus keta*)] fisheries, employing troll, purse seine, drift gillnet, set gillnet gear (and fish wheel in Upper Yukon River only), in the four administrative Regions of Alaska principally managed by the Alaska Department of Fish and Game (ADFG).

^a Note details on page 4 and 5 about the upcoming review of this report.

2. Fishery Applicant Details

Applicant Contact Information			
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3. Unit of Certification

Unit of Certification				
US ALASKA SALMON FISHERIES				
	Fish Species (Common & Scientific Name)	Geographical Location of Fishery	Gear Type	Principal Management Authority
1.	King/Chinook (<i>Oncorhynchus tshawytscha</i>) Sockeye/Red (<i>Oncorhynchus nerka</i>) Coho/Silver (<i>Oncorhynchus kisutch</i>) Pink/Humpback (<i>Oncorhynchus gorbuscha</i>) Keta/Chum (<i>Oncorhynchus keta</i>)	ADFG Admin Region 1: Southeast & Yakutat	Troll, Purse Seine, Drift Gillnet, Set Gillnet	Alaska Department of Fish and Game (ADFG)
2.	King/Chinook (<i>Oncorhynchus tshawytscha</i>) Sockeye/Red (<i>Oncorhynchus nerka</i>) Coho/Silver (<i>Oncorhynchus kisutch</i>) Pink/Humpback (<i>Oncorhynchus gorbuscha</i>) Keta/Chum (<i>Oncorhynchus keta</i>)	ADFG Admin Region 2: Central	Purse Seine, Drift Gillnet, Set Gillnet	Alaska Department of Fish and Game (ADFG)
3.	King/Chinook (<i>Oncorhynchus tshawytscha</i>) Sockeye/Red (<i>Oncorhynchus nerka</i>) Coho/Silver (<i>Oncorhynchus kisutch</i>) Pink/Humpback (<i>Oncorhynchus gorbuscha</i>) Keta/Chum (<i>Oncorhynchus keta</i>)	ADFG Admin Region 3: Arctic-Yukon-Kuskokwim	Drift Gillnet, Set Gillnet Fish wheel.	Alaska Department of Fish and Game (ADFG)
4.	King/Chinook (<i>Oncorhynchus tshawytscha</i>) Sockeye/Red (<i>Oncorhynchus nerka</i>) Coho/Silver (<i>Oncorhynchus kisutch</i>) Pink/Humpback (<i>Oncorhynchus gorbuscha</i>) Keta/Chum (<i>Oncorhynchus keta</i>)	ADFG Admin Region 4: Kodiak, Chignik, Alaska Peninsula, Aleutian Islands	Purse Seine, Drift Gillnet, Set Gillnet	Alaska Department of Fish and Game (ADFG)

4. Surveillance Meetings

Global Trust attendance: Vito Ciccia Romito and Geraldine Criquet. Notices of sites visits were posted at the ASMI website in advance of those, and emailed to various stakeholders out via an e-shot.

Organization	Time, day and representative	Items discussed
<p>Douglas Island Pink and Chum Inc. Juneau, Alaska, USA</p>	<p>7th March 2013, 9.00 am. Eric Prestegard, Rick Focht</p>	<ul style="list-style-type: none"> • Changes in guidelines, regulations or policies covering the management of hatcheries in SEAK or Alaska (e.g. affecting practices relating to disease control and genetics). • Changes in DIPAC’s salmon production by species over recent years and the last 12 months. • Changes to annual Development Plan 2012 and 2013. • ADFG interface and collaboration over 2012. • Regional Salmon Planning process to guide fisheries enhancement. Updates for 2012, 2013. • Request for permit alteration submitted and/or accepted by ADFG in 2012 and 2013. • Pathology issues in any DIPAC hatcheries. • Current ocean conditions conducive to survival rates. General salmon survival trends, expected trends for the coming years. • Release sites in SEAK: number and location, and distance relative to major wild salmon stocks and harvest areas. • Terminal Harvest Areas (THAs) and Special Harvest Areas (SHA), number and issues with interception of hatchery and wild salmon during harvest in THAs/SHA. Ability to manage and harvest all the hatchery returns. • Number of salmon used as brood for salmon production. Difference between salmon species? Use of brood stock. Is wild salmon incorporated in the salmon collection pool for egg take? If so, in what scale and for what species? • Hatchery brood stock diversity practices. • Productivity of brood stock. • Collection of broodstock for the hatcheries, stratification over spawn/run timing to maximize the heterogeneity of the gene pool. • Founder populations of broodstocks. • Broodstock management practices. • Disease avoidance practices and interface with ADFG pathology lab. • Genetic policy. • Latest studies relative to wild/hatchery salmon interaction. • Requirements for tagging/ otoliths marking of hatchery fish. % of hatchery fish marked by DIPAC and more generally in SEAK. • Information exchange process with Prince William Sound Science Center in relation to the large scale hatchery research program they have been awarded. In SEAK, 6 streams identified, 2 of these reassigned. • Involvement with the ADFG 2013 Chinook Research plan in response to the recent years “below escapement goal” Chinook runs. • SEAK Coastal monitoring Program. • Alaska salmon escapement management, how is salmon

		harvest managed when escapement goals are not set.
Alaska Department of Fish and Game. Juneau, Alaska, USA	08 th March 2013, 08.00 am. Jeff Regnart, Sue Aspelund, Erik Volk, Ron Josephson.	<ul style="list-style-type: none"> • Changes or significant updates in law, regulations or commercial fisheries operations affecting salmon management in any of the four management regions of Alaska (e.g. Salmon federal FMP). • Updates and interim reports for the large scale multi-year hatchery research work awarded to the PWS Science Center. • New studies (i.e. peer reviewed) relating to hatchery salmon straying and its genetic or ecological implications with wild salmon stocks. • Hatchery corporation permit alteration requests received by ADFG over the last 12 months and their treatment and decision (i.e. granted/declined and rationale for such decision). • Salmon populations estimated to be in the SEAK, Central, Westward and AYK management regions of Alaska. • Escapement Goals (EGs) for aggregate “populations”, rationale for setting aggregated stocks EGs. • Indicator stocks and their relation to less productive subcomponents in aggregate escapement goals. • Genetics studies throughout Alaska. Results and reports from the WASSIP program. Incorporation of results into escapement goal reviews. • Canada/Alaska harvest sharing arrangements and performance: Yukon, Taku, Stikine, Alsek rivers. • Review of escapement goals in 2012. Regions updated and key changes. • Management of salmon harvest in the absence of formal escapement goals. • Occasions where stocks have escapement goals but escapements are not measured. Reasons. • Issues relating to Chinook salmon returns over 2012. Number of fishery closures due to the insufficient returning salmon and effects on the commercial sector. Management responses. • Main objectives and timelines of completion for the newly developed Chinook Salmon Research Plan. • Bycatch data collection in the salmon fisheries. • Bycatch of Chinook and chum salmon in the groundfish fisheries (i.e. pollock) of Alaska: interaction between ADFG and federal management in terms of management actions to constrain Chinook and salmon bycatch. • Long term outcome resulting from placing certain stocks in the “Stock of Concern” program. • Assessment of climatic or oceanic effects that may be influencing the ocean survival of salmon.
Alaska Wildlife Troopers. Juneau Division, Alaska, USA	08 th March, 15.30 pm. Lt. Hall	<ul style="list-style-type: none"> • Salmon regulations. • Salmon enforcement. • Violations types and extent.
NOAA’s Ted Stevens Marine Research Institute. Juneau,	11 th March, 13.30 pm. Phil Mundy, William Heard Jeff Guyon,	<ul style="list-style-type: none"> • Salmon FMP. • Current ocean conditions conducive to salmon survival rates (e.g. warming Eastern Bering Sea related to Chinook). General salmon survival trends, expected trends for the coming year. Recent studies/references.

<p>Alaska, USA</p>	<p>Ed Farley, Ron Heintz</p>	<ul style="list-style-type: none"> • Large scale multi-year hatchery research program currently headed by the Prince William Sound Science Center (PWSSC). Information exchange process and/or involvement in genetic or ecological research of Ted Stevens MRI. • Recent years below escapement Chinook runs. Ted Stevens MRI research relating to Chinook salmon in Alaska. • Current studies headed by Ted Stevens MRI on hatchery-wild interactions (genetic/ecological). • Auke creek and Port Walter research. • Analysis of salmon stock composition as bycatch in the Groundfish fisheries. Evidence of provenience. • Interactions of terrestrial and marine environments mismatch research. • Amendment 91 and 93 BSAI and GOA Groundfish FMP. • WASSIP program genetic fingerprinting across Western Alaska. • Bioenvironmental variables for forecasting runs. • Ocean Research Activities (BSIERP, GOAIERP, SECM) on ecology, links with bioenvironmental parameters and species interaction.
<p>Prince William Sound Aquaculture Corporation. Cordova, Alaska, USA</p>	<p>12th March, 2013, 09.00 am, (Anchorage), Dave Reggiani.</p>	<ul style="list-style-type: none"> • Changes in guidelines, regulations or policies covering the management of hatcheries in PWS or Alaska (e.g. affecting practices relating to disease control and genetics). • Changes in PWSAC salmon production by species since 2012. • Annual Development Plan 2012 or 2013. Changes from the previous year. • ADFG interface and collaboration over the last 12 months. • Regional Salmon Planning process to guide fisheries enhancement. Updates for 2012, 2013. • Request for permit alteration submitted and/or accepted by ADFG in 2012 and 2013. • Pathology issues in any PWSAC hatcheries for any salmon species. • Current ocean conditions conducive to survival rates. • Release sites in PWS: number and location, and distance relative to major wild salmon stocks and harvest areas. • THAs and SHAs, how many in PWS? Are there significant issues with interception of hatchery and wild salmon during harvest in THAa/SHAs? • Ability to manage and harvest the hatchery returns, to avoid increased straying rates. • Hatcheries, siting from wild streams. • Recent study highlighting no straying from this facility. • Broodstock randomized sampling on size, colour, and different runs. • Original broodstock collection, guidelines and practices. • Egg production. Fecundity over the years. • Number of salmon used as brood for salmon production. Difference between salmon species. Gulkana hatchery, management of hatchery sockeye broodstock as a genetically integrated component of wild salmon. Strontium Chloride marking for Gulkana sockeye. Recent study highlighting no straying from this facility. • Tagging/marking of hatchery fish. % of hatchery fish marked in PWS.

		<ul style="list-style-type: none"> • Involvement or information exchange process with PWS Science Center in relation to the large scale hatchery research program they have been awarded. Start of ocean sampling. • Involvement with the ADFG 2013 Chinook Research plan in response to the recent “below escapement goal” Chinook runs. • Alaska salmon escapement management, salmon harvest management when formal escapement goals are not set. • Latest studies relative to wild/hatchery salmon interaction.
Alaska Wildlife Troopers. Kodiak Division, Alaska, USA	14 th March, 09.30 am. Lt. Ellis.	<ul style="list-style-type: none"> • Salmon regulations. • Salmon enforcement. • Violations types and extent.
Kodiak Regional Aquaculture Association (KRAA), Kodiak, Alaska, USA	14 th March 2013, 13.00 pm. Tina Fairbanks, Rachel Hamm.	<ul style="list-style-type: none"> • Overview of KRAA’ activities in Kodiak, enhancement activities in Kitoi Bay and Pillar Creek by species and volume. Management of hatchery broodstock. • Changes in KRAA’s salmon production by species over recent years. • Annual Development Plan 2012 or 2013. • ADFG interface and collaboration. • Regional Salmon Planning process to guide fisheries enhancement. Recent updates. • Request for permit alteration submitted to ADFG in 2012 and 2013. • Pathology issues in any KRAA hatcheries for any salmon species. • Current ocean conditions conducive to survival rates. • Release sites in Kodiak: number and location, and distance relative to major wild salmon stocks and harvest areas. • General salmon returns (e.g. above or below escapement goals) in the Kodiak Management Area over recent years. • Terminal Harvest Areas (THAs) and Special Harvest Areas (SHAs), number and location of THAs and SHAs in Kodiak. • Issues with interception of hatchery and wild salmon during harvest in THAa/SHAs. • Ability to manage and harvest the hatchery returns. • Number of salmon used as brood for salmon production. Difference between salmon species. • Requirements for tagging/ otoliths marking of hatchery fish. % of hatchery fish marked by KRAA. • Involvement with the ADFG 2013 Chinook Research plan in response to the recent years “below escapement goal” Chinook runs. • Studies related to salmon research or towards management of both enhanced and natural salmon stocks (e.g. Karluk lake enrichment, Spiridon Lake / Telrod Cove sockeye stocking, Waterfall Bay sockeye, Hidden Lake / Foul Bay sockeye, hydroacoustics, lake limnology).
Cook Inlet Aquaculture Association	20 th March 2013, 09.00 am. (Anchorage),	<ul style="list-style-type: none"> • Overview of CIAA’ activities in Eklutna, Trail Lakes, and Tutka Bay Lagoon salmon hatcheries, enhancement activities by species and volume. Management of hatchery broodstock.

<p>(CIAA), Kenai, Alaska, USA</p>	<p>Gary Fandrei.</p>	<ul style="list-style-type: none"> • Changes in CIAA’s salmon production by species over recent years. • Annual Development Plan 2012 or 2013. • ADFG interface and collaboration. • Regional Salmon Planning process to guide fisheries enhancement. Recent updates. • Request for permit alteration submitted to ADFG in 2012 and 2013. • Pathology issues in any CIAA hatcheries for any salmon species. • Current ocean conditions conducive to survival rates. • Release sites in Cook Inlet: number and location, and distance relative to major wild salmon stocks and harvest areas. • General salmon returns (e.g. above or below escapement goals) in the Cook Inlet Management Area over recent years. • Terminal Harvest Areas (THAs) and Special Harvest Areas (SHAs), number and location of THAs and SHAs in Cook Inlet. • Issues with interception of hatchery and wild salmon during harvest in THAa/SHAs. • Ability to manage and harvest the hatchery returns. • Number of salmon used as brood for salmon production. Difference between salmon species. • Requirements for tagging/ otoliths marking of hatchery fish. % of hatchery fish marked by CIAA. • Involvement with the ADFG 2013 Chinook Research plan in response to the recent years “below escapement goal” Chinook runs. • Other studies related to salmon research or towards management of both enhanced and natural salmon stocks.
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Stakeholder information input

Stakeholder Submissions: The Alaska Seafood Marketing Institute website provides an opportunity for stakeholders to provide information that relevant for the assessment or surveillance audit of fisheries within the Alaska FAO Based Responsible Fisheries Management Certification Program. Scientific, objective information provided to the assessment team is used within the assessment and referenced at the end of the report.

5. Assessment Outcome Summary

Fundamental Clauses: Summaries of evidence

Clause 1. *Alaska's salmon fisheries are managed under a clear structure of laws, regulations, treaties, and other legal mandates and instruments, at the international, national, and local levels. This management process is well-established and transparent. ADFG's Commercial Fisheries Division is responsible for conservation of Alaska's salmon stocks and for management of the commercial fisheries. ADFG's main priority is achieving escapement, which ensures that enough salmon escape the fisheries, and spawn in their natal rivers to provide maximum sustainable yield. The Alaska Wildlife Troopers are charged with protecting the fishery through reducing illegal harvest, waste and illegal sale of commercially and sport harvested fish, and by protecting fish and wildlife habitat in state waters.*

Clause 2. *The institutional capacity of existing agencies (e.g. ADFG, ADEC, ADNR, USFWS, ANILCA, OPMP and BOEM), and the existing intimate and routine cooperation between federal and state agencies managing Alaska's coastal resources is capable of planning and managing coastal developments in a transparent, organized and sustainable way. Moreover, the available public processes between fishermen and other users and between fishermen (i.e. NEPA and BOF process) tends to bring stakeholders together early during proposals about coastal developments and avoid conflict to various degrees. Courts of law are used when conflict cannot be resolved through other processes.*

Clause 3. *The BOF main role is to conserve and develop the fishery resources of the state. The BOF is charged with making allocative decisions, and ADFG is responsible for management based on those decisions. Management Plans are established by the BOF for each Region and incorporated into regulation in Title 5 Alaska Administrative Code. Those plans are implemented each season in each Region by the responsible ADFG biologist following the direction of the BOF. Management plans on recovery of depleted stocks are active policy of the state and are based on providing adequate 'escapement' or spawning stock in each generation. In December 2012 the NPFMC modified the Federal Salmon Fishery Management Plan to specifically exclude three historical commercial salmon fishing areas outside of state waters in the EEZ and the sport salmon fishery from the West Area EEZ in favour of continuing management by the State of Alaska. The FMP prohibits commercial salmon fisheries in the modified West Area and continues to delegate management authority to the State of Alaska for the directed commercial salmon troll fishery and the sport salmon fishery in the East Area of the EEZ.*

Clause 4. *Intensive monitoring of incoming run strength is required for successful abundance-based management of commercial salmon fisheries in Alaska. Fish weirs, counting towers, sonar, test fishing, fish wheels, and aerial surveys are the primary assessment tools. Fishery openings are targeted where production surplus to escapement goals is identified. Each assessment tool is designed to work best for the geographical and physical conditions encountered. The primary method of accounting for commercial fishery harvest is the ADFG's fish ticket system. By Alaska law (AS 16.05.690 Record of Purchase) each buyer of fish is required to keep a record of each purchase*

showing the name or number of the vessel from which the catch is taken, the date of landing, vessel license number, pounds purchased of each species, number of each species, and the ADFG statistical area in which the fish were taken, as well as other information ADFG may require for specific fisheries or areas. The new multi-generational hatchery salmon research program aims at providing a better account of the hatchery salmon stray proportion in wild salmon streams to improve escapement enumeration practices.

Clause 5. *Stock assessment activities undertaken in Alaska represent a wide breadth of approaches in the provision of science-based advice in support of salmon resource management. The depth of the stock assessment toolkit in the state reflects a high scientific standard in support of optimal resource use and rivals that of any other agency in the Pacific Rim. Provision of advice for salmon fisheries management is not without its challenges. The sheer magnitude and diversity of salmon spawning population spread over the vast landscape of a State that is over 500,000 square miles of land mass and nearly 7000 miles of coastline is challenging enough, let alone the challenge of managing fisheries with 300 individual escapement goals. One of the greatest research challenges in Pacific salmon management throughout the north Pacific has been the identification of individual stocks in mixed-stock fisheries. The WASSIP genetic study of chum and sockeye has perhaps been the most intensive research program in that regard undertaken to quantify the accuracy and precision of stock-specific catch and harvest rate estimates. The governance structure for salmon management in the State and its policies that requires a 3-year cycle of stock assessment review reflects a high standard and commitment of ADFG staff and operational funding in support of sustainable resource management. Clause 5 is strongly supported by evidence of the policies and effective salmon stock assessment activities routinely undertaken in Alaska.*

Clause 6. *Escapement goals effectively represent reference points of the various Alaska salmon systems. There are currently 300 active salmon stock escapement goals throughout the state. These escapement goals cover mainly index systems but also individual streams. A variety of methods are used to develop escapement goals in Alaska. During the 2012-2013 Board of Fisheries cycle, reviews of the escapement goals were done for Bristol Bay salmon, Arctic-Yukon-Kuskokwim Region salmon and Alaska Peninsula and Aleutian Islands salmon in the Westward Region. An out-of-cycle assessment of Late-Run Chinook Salmon in the Kenai River was also reviewed. Where escapements chronically (4-5 years) fail to meet expectations for harvestable yield or spawning escapements, the department may recommend, and the board may adopt a stock of concern designation for those underperforming salmon stocks. Stock improvement following this designation is supported by data. A review of all the latest escapements (300) throughout Alaska indicates that the majority of escapement goals have recently been met, with exceptions for Chinook salmon statewide. In response to this Statewide decline in Chinook production, ADFG has been limiting and/or closing commercial fisheries to meet escapement goals and has initiated a \$30 million research projects aimed at elucidating Chinook stock dynamics and improving stock assessment and overall management for the species.*

Clause 7. *The Policy for the Management of Sustainable Salmon Fisheries codifies the precautionary approach in State regulation of salmon fisheries and habitats. This policy states that in the face of uncertainty, salmon stocks, fisheries, artificial propagation, and essential habitats are to be managed conservatively. It also includes provisions that address the potential effects of ecological changes on*

sustainable harvest in the respect that salmon fisheries must be managed to provide escapements within ranges necessary to conserve and sustain salmon production and to maintain normal ecosystem functioning. Based on the statewide decrease in Chinook salmon production, ADFG is limiting commercial and sport fisheries on the species to ensure escapement goals are met, as far as possible. ADFG is also leading the Chinook salmon stock assessment and research plan effort and has obtained initial funding for the year 2013. The assessment team considers that this management response is appropriate for the issue at hand, in line with improving the state of Chinook salmon stocks in Alaska and with a precautionary approach to management. Also results of the WASSIP program have been made public in 2012, this study represents a very comprehensive program of sampling and analytical effort that has effectively reduced uncertainty in stock composition, harvest and harvest rates of sockeye and chum salmon supporting the management regulatory process in western Alaska. As for the current issues surrounding the hatchery-wild interactions, the Prince William Sound Science Center (PWSSC) started the field work for the large scale hatchery salmon research project in late 2012. A specific schedule of tasks until 2016 has been provided by ADFG and a summary report for the 2012 activities has been published. No increase in pink or chum salmon hatchery production has been granted in PWS or SEAK in 2012. These last two items constitute the evidence supporting corrective action following the minor non-conformance issued last year under this clause. Progress is ongoing and following the agreed schedule.

Clause 8. *Escapement goals are essentially the harvest control rule used for management of Alaska salmon. Currently, there are 300 active salmon stock escapement goals throughout the state of Alaska. However, not all Alaska salmon fisheries and salmon stocks are managed with formal escapement goals, but instead, through inseason management and emergency orders. Inseason management involves opening and closing geographical areas and prosecuting (commercial, sport, subsistence) components of the fishery using emergency orders, based on run size projections, historical and contemporary escapement estimates, intensive harvest monitoring, fishing-effort monitoring, and escapement monitoring, environmental conditions, stock sampling data and any other available information. During the 2012 calendar year ADFG issued about 750 emergency orders to open and close commercial salmon fisheries in the Alaska. Fisheries regulations are published for the various areas in Alaska. These documents contain selected Alaska statutes enabling legal management of resources, statewide general provisions, management plans, gear allowances, closed and open areas, and all the other area specific provisions. These regulations may be changed inseason by emergency regulations or emergency orders at any time to allow sufficient escapements. The Alaska Commercial Fisheries Entry Commission (CFEC) issues permits and vessel licenses to qualified individuals in both limited and unlimited fisheries, and provides due process hearings and appeals for those individuals denied permits. A limited entry or interim-use permit entitles the holder to operate gear in a specific commercial fishery in accordance with BOF regulations. The term "fishery" refers to a specific combination of fishery resource(s), gear type(s), and area(s). Management measures specific to salmon hatcheries include Title 05, Fish and Game; Chapter 40: Private Non Profit Salmon Hatcheries; and Chapter 41: Transportation, Possession and Release of Live Fish; Aquatic Farming.*

Clause 9. *There are defined management measures designed to maintain stocks at levels capable of producing maximum sustainable levels. Escapement goals (BEGs, SEGs, OEGs and SETs) aim at allowing sufficient salmon to escape and spawn in their relative natal rivers, and enable them to*

produce, over the long term, maximum sustainable levels. The commercial Alaska salmon fisheries are limited entry fisheries. The CFEC manages the entry program by issuing permits and vessel licenses. Stocks that are deemed below the escapement goals are classified as: yield, management, or chronic inability concern. For stocks of concern, action plans dealing with their recovery are prepared and applied.

Clause 10. *Fishing operations are carried out by fishers with appropriate standards of competence in accordance with international standards and guidelines and regulations. Training programs for fishermen are widely available throughout Alaska.*

Clause 11. *The Division of Wildlife Troopers in the Department of Public Safety continues to be charged with protecting the state's natural resources through reducing illegal harvest, waste and illegal sale of commercially and sport harvested fish, and by safeguarding fish and wildlife habitat. The structure of ADFG, with management authority instilled at the area office level, allows it to monitor, control and enforce compliance with fishery regulations and emergency orders. Area Management Biologists are on the scene to actually watch the prosecution of the fishery in their area through aerial surveys and on-the-ground observations.*

Clause 12. *Alaska salmon management is supported by a framework for sanctions for violations and illegal activities of adequate severity to support compliance and discourage violations. Salmon management is entrusted to ADFG, pursuant to Alaska Statutes Title 16 (AS16) and Alaska Administrative Code Title 5 (5AAC). These laws and regulations are enforced by the Alaska Department of Public Safety, Alaska State Troopers, Division of Wildlife Troopers (AWT), the State enforcement agency with 0-3 nautical miles jurisdiction. AWT coordinates with, and is supported when required, by law enforcement personnel from USCG and NMFS Office of Law Enforcement (OLE). The US Forest Service and the US Fish and Wildlife Service also work with AWT on the enforcement of fish and game regulations (both state and federal) on federal public land.*

Clause 13. *Alaska's Sustainable Salmon Policy includes provisions addressing the potential effects of ecological changes/perturbations on sustainably allowable harvest in that salmon fisheries shall be managed to allow escapements within ranges necessary to conserve and sustain potential salmon production and maintain normal ecosystem functioning. Bycatch of non-targeted species is not a major issue in most Alaska salmon fisheries. Most non-targeted fish harvested in salmon fisheries are other species of salmon and are reported on fish tickets. Salmon bycatch in the groundfish fisheries in the Bering Sea Aleutian Islands and the Gulf of Alaska are formally managed by the NPFMC with regulations implemented by the NMFS. Gear used for commercial catches of Alaska salmon are not considered deleterious to physical habitats as they do not interact directly with it (unlike bottom trawl, dredges and pot gear used in other fisheries). Takes of endangered species, e.g. Chinook from the Columbia River system, are regulated (e.g. Pacific Salmon Treaty regulations). One potential negative ecological effect of the salmon fishery is represented by the dynamics surrounding the ecological and genetic interactions between wild and hatchery salmon. The PWSSC has initiated in the late summer of 2012 a large scale multi-generation research program to elucidate and address the issue of interactions of wild and hatchery pink and chum salmon in Prince William Sound and Southeast Alaska. Their contract for phase one of the project is running until 2016.*

Clause 14. *The Alaska enhancement program was designed with care, including a comprehensive regional planning process, to avoid the pitfalls experienced in the Pacific Northwest's hatchery programs. In contrast to these, which were built to replace wild production that was diminished or even extirpated by widespread habitat degradation and damming of many major salmon-producing rivers, the Alaskan hatchery program was developed to supplement and enhance fisheries that historically depend on wild production. Other aspects of this comprehensive planning process included the permitted capacity of each species to be raised in individual hatcheries, the use of broodstocks of local origin, and distance of hatcheries to wild stocks. Because the Alaska program was developed to enhance the salmon fishery and not mitigate for lost habitat, or help rebuild wild runs with infusions of hatchery fish, the siting of hatcheries became of paramount importance. Introduction of genetic material is prohibited and hatchery stock is selected from the terminal area stock and hence, all genetic material originates from that location. Selection techniques are designed to avoid artificial reduction in genetic material – i.e. fish are selected at random and not on external trait basis (size, shape, colour etc). An extremely wide, pre-determined number of returning fish are used for stripping of ova for hatchery rearing and release, this especially true for pink and chum salmon in PWS and SEAK. However, there have been a number of studies showing hatchery salmon are straying into wild streams in Prince William Sound and Southeast Alaska. Furthermore, a suite of other studies points to potential ecological and genetic negative effects to wild salmon resulting from hatchery-wild salmon interactions. However many of these studies are not specific to pink and chum salmon and reflect other effects caused by hatchery Programs radically different from the one in Alaska. To elucidate these potential issues, a large scale multi – generation hatchery wild salmon interaction study funded by state and industry in 2012 is currently ongoing. This should clearly reveal the scale of pink and chum straying in PWS and SEAK, the degree of interbreeding and introgression, and the relative genetic/fitness evaluation resulting from these interactions. No clear evidence of the potential negative effects (i.e. interbreeding with wild salmon, genetic dilution, decreased fitness) is yet available. However the Assessment Team is aware that a peer reviewed paper (Jasper et al. in press) on the subject should be published and become available around September or October 2013. This clause will be re-evaluated accordingly in light of this new evidence as soon as this peer reviewed paper becomes published.*

6. Conformity statement

Following this 2nd surveillance assessment, the Assessment Team recommends that continued Certification under the FAO-Based Responsible Fisheries Management Certification Program is granted to the U.S.A. Alaska commercial salmon [all pacific salmon species: Chinook (*Oncorhynchus tshawytscha*); sockeye (*Oncorhynchus nerka*); coho (*Oncorhynchus kisutch*); pink (*Oncorhynchus gorbuscha*); and chum (*Oncorhynchus keta*)] fisheries, employing troll, purse seine, drift gillnet, set gillnet gear (and fish wheel in Upper Yukon River only), in the four administrative Regions of Alaska principally managed by the Alaska Department of Fish and Game (ADFG).

7. FAO-Based Conformance Criteria Fundamental Clauses for Surveillance Reporting

A. The Fisheries Management System

1. There shall be a structured and legally mandated management system based upon and respecting International, National and local fishery laws, for the responsible utilization of the stock under consideration and conservation of the marine environment.

FAO CCRF 7.1.3/7.1.4/7.1.9/7.3.1/7.3.2/7.3.4/7.6.8/7.7.1/10.3.1
FAO Eco 28

Evidence adequacy rating:



High

Medium

Low

Rating Determination

Alaska's salmon fisheries are managed under a clear structure of laws, regulations, treaties, and other legal mandates and instruments, at the international, national, and local levels. This management process is well-established and transparent. ADFG's Commercial Fisheries Division is responsible for conservation of Alaska's salmon stocks and for management of the commercial fisheries. ADFG's main priority is achieving escapement, which ensures that enough salmon escape the fisheries, and spawn in their natal rivers to provide maximum sustainable yield. The Alaska Wildlife Troopers are charged with protecting the fishery through reducing illegal harvest, waste and illegal sale of commercially and sport harvested fish, and by protecting fish and wildlife habitat in state waters. In December 2012 the NPFMC modified the Federal Salmon Fishery Management Plan to specifically exclude three historical commercial salmon fishing areas outside of state waters in the EEZ and the sport salmon fishery from the West Area EEZ in favour of continuing management by the State of Alaska. The FMP prohibits commercial salmon fisheries in the modified West Area and continues to delegate management authority to the State of Alaska for the directed commercial salmon troll fishery and the sport salmon fishery in the East Area of the EEZ.

State Management

The Alaska Department of Fish and Game (ADFG) took over salmon management from the federal government following statehood in 1960. ADFG Commercial Fisheries Division is responsible for conservation of Alaska's salmon stocks and for management of the commercial fisheries. Alaska's commercial salmon fisheries are administered through the use of four salmon management areas throughout the state.

- **Southeast Region.**

- **Central Region** (Copper River, Prince William Sound, Upper Cook Inlet, Lower Cook Inlet, Bristol Bay).

- **Arctic-Yukon-Kuskokwim** (Kuskokwim, Norton Sound & Kotzebue, Yukon).

- **Westward Region** (Kodiak Island, Alaska Peninsula, Chignik, Bering Sea/Aleutian Islands).

Along with ADFG offices in several town and villages across Alaska, each ADFG Regional Office supervises and makes decision for its own Region. Local area management biologists have inseason management authority (i.e. issuing emergency orders) to address the rapidly changing inseason fishery management needs of salmon fisheries in Alaska.

Sustained Yield

The state constitution requires salmon be managed on a sustained yield principle, and adequate spawning escapement to assure sustained salmon populations is the highest management priority. After escapement goals are met, subsistence use takes priority over other salmon harvesters. Commercial, sport and personal use fisheries share equally in priority after escapement and subsistence use goals are met.

Board of Fisheries allocation

Salmon are “allocated” to the different use groups by the Alaska Board of Fisheries (BOF). Every three years, the board considers proposals on allocation and management of salmon in each of the management Regions in an open and public process. The Board considers proposals submitted by the public and management staff, and sets policy after public testimony and scientific presentations. Decisions are guided on the Sustainable Salmon Fishery Policy. The regional staff of ADFG manages salmon in each of the regions fisheries based on the rules and regulations adopted by the Board of Fisheries. Alaska’s Sustainable Salmon Policy directs ADFG to follow a systematic process for evaluating the health of salmon stocks throughout the State by requiring ADFG to provide the Board, in concert with its regulatory cycle, with reports on the status of salmon stocks and fisheries under consideration for regulatory changes. The policy also defines a process to identify stocks of concern (yield, management and conservation concern), and requires ADFG and the BOF to develop action plans to rebuild these stocks through the use of fisheries restrictions, improved research, and restoring and protecting habitat. The management arrangements and decision-making processes for Alaska salmon fisheries are organized in a very transparent manner, and are readily accessible to any person. The BOF actively and routinely encourages stakeholder involvement in the process, and meets four to six times per year in communities around the state to consider proposed changes to fisheries regulations around the state.

Research

ADFG Commercial Fisheries Division offices are situated in 23 locations throughout the range of commercial salmon fisheries. Institutional framework for fisheries management includes supervisory, administrative, technical, economic, biometric, research, and management staff. The staff is located within each management division as well as within the commissioner’s office. Each year, they define the data needs for management of each salmon fishery (reported in annual management reports, BOF reports, stock status reports, and preseason forecasts), develop statistically valid study designs (or operational plans) to obtain the necessary information, and collect, analyze, and report the data necessary for effective fisheries management following procedures detailed in its study plans. Each step of this process is guided by state policies, standards, and/or nationally recognized scientific standards. The state has a well-organized and adequately funded program. The escapement goals with which salmon are managed under, take into account all sources of mortality because escapement is the “net result” of all factors which have influenced salmon during its juvenile stages in freshwater, its oceanic migration, and the fisheries to which it is subjected.

Constitution, statutes and regulations

Almost all of Alaska’s salmon fisheries take place in the internal waters (0-3 nm, and other enclosed waters) of the State of Alaska. Alaska manages those fisheries under the authority of its Constitution, statutes (laws), and regulations (administrative code). Article VIII of Alaska’s Constitution states: Section 4. Sustained Yield: Fish, forests, wildlife, grasslands, and all other replenishable resources belonging to the State shall be utilized, developed, and maintained on the sustained yield principle, subject to preferences among beneficial uses.

“Alaska’s Constitution: A Citizen’s Guide (Fourth Edition)” explains: “The principle of sustained yield

management is a basic tenet of conservation: the annual harvest of a biological resource should not exceed the annual regeneration of that resource. Maximum sustained yield is the largest harvest that can be maintained year after year. State law defines maximum sustained yield as “the achievement and maintenance in perpetuity of a high level annual or regular periodic output of the various renewable resources of the state land consistent with multiple use” (AS 38.04.910). At the time of the constitutional convention, stocks of Alaska’s salmon had been reduced to a sad remnant of their past bounty by neglect of the sustained yield maxim. The qualifying phrase ‘subject to preferences among beneficial uses’ signals recognition by the delegates that not all the demands made upon resources can be satisfied, and that prudent resource management based on modern conservation principles necessarily involves prioritizing competing uses.”

Statutes (also termed “laws”) are enacted by the state Legislature. Title 16 of Alaska Statutes (AS16) “Fish And Game” sets forth the laws which govern the management of Alaska’s salmon fisheries, as well as myriad other living resources. Like all other statutes, Title 16 is consistent with the Constitution. Regulations (also termed “administrative code”) are developed and implemented by departments of the Executive branch of government, which is headed by the Governor. Title 5 of the Alaska Administrative Code (5AAC) “Fish And Game” is the body of state regulations by which Alaska’s salmon fisheries are managed. All regulations must be consistent with the governing statutes; that is, 5AAC is consistent with AS16.

Of particular relevance to this assessment are the following regulations relative to the commercial salmon fisheries (<http://www.adfg.alaska.gov/index.cfm?adfg=fishregulations.commercial>) -

- Commercial and Subsistence Fishing and Private Nonprofit Salmon Hatcheries (5 AAC 1 - 5 AAC 41)
- Fish and Game Advisory Committees. (5 AAC 96 - 5 AAC 98).

Federal FMP and salmon management

In December 2012 the NPFMC modified the Federal Salmon Fishery Management Plan (FMP) to specifically exclude three historical commercial salmon fishing areas outside of state waters in the EEZ and the sport salmon fishery from the West Area EEZ in favour of continuing management by the State of Alaska. The FMP prohibits commercial salmon fisheries in the modified West Area and continues to delegate management authority to the State of Alaska for the directed commercial salmon troll fishery and the sport salmon fishery in the East Area of the EEZ.

<http://alaskafisheries.noaa.gov/frules/77fr75570.pdf>

Enforcement

The Division of Wildlife Troopers in the Department of Public Safety (known as Alaska Wildlife Troopers, or AWT) is charged with protecting the state’s natural resources through reducing illegal harvest, waste and illegal sale of commercially and sport harvested fish, and by safeguarding fish and wildlife habitat. Biologists and other ADFG staff sometimes participate in enforcement activities and assist AWT. AWT enforces other types of regulations passed by the Board of Game and the Board of Fisheries. This includes those designed to:

- Preventing unlawful & illegal fisheries harvests, and sales of sport fish & commercial wild stocks.
- Preventing waste and illegal harvest of hunted or trapped species.
- Protecting watersheds and other important habitat areas, including by reducing non-compliance with environmental permits.
- Protecting Alaska’s native species from harmful invasive species, importation of exotic pets, and illegal export of animal parts from Alaska.
- Monitoring commercial big game services (pilots, transporters, etc.), and identifying illegal guiding and transporter activities.

The U.S. Coast Guard (USCG) also enforces boating safety laws and fishing vessels are often under

surveillance by AWT and the USCG during fishing operations. For fisheries under federal management, the NOAA Fisheries Office for Law Enforcement (OLE) enforces federal laws that protect and conserve Alaska's living marine resources and their habitat. The Alaska Limited Entry system only allows legally permitted vessels to operate in salmon fisheries. The "right to fish" is embodied in a permit card that is issued annually. Cooperation and coordination among ADFG, AWT, USCG, and OLE is frequent and routine.

Reference

<http://www.adfg.alaska.gov/static/home/library/PDFs/afrb/clarv12n1.pdf>
<http://www.adfg.alaska.gov/index.cfm?adfg=CommercialByFisherySalmon.main>
<http://www.adfg.alaska.gov/index.cfm?adfg=commercialbyfisherysalmon.salmonareas>
<http://www.adfg.alaska.gov/index.cfm?adfg=fishingCommercialByFishery.statmaps>
<http://ltgov.alaska.gov/treadwell/services/alaska-constitution/article-viii-96A0natural-resources.html>
<http://www.sfos.uaf.edu/salmontools/edu/workshops/2002/options/ArticleVIII-NaturalRes.pdf>
<http://www.adfg.alaska.gov/index.cfm?adfg=contacts.main>
<http://www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.main>
<http://www.adfg.alaska.gov/index.cfm?adfg=enforcement.main>
<http://www.dps.alaska.gov/AWT/default.aspx>
<http://www.uscg.mil/d17/images/D17%20Fact%20Sheet.pdf>
<http://www.uscg.mil/d17/>
<http://www.fws.gov/le/regional-law-enforcement-offices.html>
http://www.cfec.state.ak.us/RESEARCH/salmon/CHPT1_10_21_04.pdf

2. Management organizations shall participate in coastal area management institutional frameworks, decision-making processes and activities related to the fishery and its users, in support of sustainable and integrated resource use, and conflict avoidance.

FAO CCRF 10.1.1/10.1.2/10.1.4/10.2.1/10.2.2/10.2.4

Evidence adequacy rating:

High

Medium

Low

Rating Determination

The institutional capacity of existing agencies (e.g. ADFG, ADEC, ADNR, USFWS, ANILCA , OPMP and BOEM), and the existing intimate and routine cooperation between federal and state agencies managing Alaska’s coastal resources is capable of planning and managing coastal developments in a transparent, organized and sustainable way. Moreover, the available public processes between fishermen and other users and between fishermen (i.e. NEPA and BOF process) tends to bring stakeholders together early during proposals about coastal developments and avoid conflict to various degrees. Courts of law are used when conflict cannot be resolved through other processes.

ADFG

The ADFG protects estuarine and marine habitats primarily through cooperative efforts involving other state and federal agencies and local governments. ADFG has jurisdiction over the mouths of designated anadromous fish streams and legislatively designated state special areas (critical habitat areas, sanctuaries and refuges). ADFG’s Habitat Division is delegated by the Commissioner to implement the state’s Title 16 authority for Fish Habitat and Special Area permitting. Unlike many of Fish and Game’s regulations, which are developed through the Board process and address harvest, Fish Habitat and Special Area laws address land use activities in fish-bearing streams and in the state’s legislatively designated refuges, critical habitat areas, and sanctuaries through a project review and permitting process. Other statutory responsibilities of the Habitat Division include issuing permits for wildlife hazing in connection with petroleum and chemical spills (5 AAC 92.033), and reviews for fish habitat concerns under the Forest Resources and Practices Act (AS 41.17.010-AS41.17.950 and 11 AAC 95.185 – 11 AAC 95.900).

DEC

The Alaska Department of Environmental Conservation (DEC) implements statutes and regulations affecting air, land and water quality. DEC is the lead state agency for implementing the federal Clean Water Act and its authorities provide considerable opportunity to maintain high quality fish and wildlife habitat through pollution prevention (<http://dec.alaska.gov/>).

DNR

The Alaska Department of Natural Resources (DNR) manages all state-owned land, water and natural resources except for fish and game. This includes most of the state’s tidelands out to the three mile limit and approximately 34,000 miles of coastline. DNR authorizes the use of log-transfer sites, access across state land and water, set-net sites for commercial gill net fishing, mariculture sites for shellfish farming, lodge sites and access for the tourism industry, and water rights and water use authorizations. DNR also uses the state Endangered Species Act to preserve natural habitat of species or subspecies of fish and wildlife that are threatened with extinction (<http://dnr.alaska.gov/>).

USFWS

The U.S. Fish and Wildlife Service (USFWS) is a federal bureau within the Department of the Interior. Its objectives include 1) assisting in the development and application of an environmental stewardship ethic, based on ecological principles, scientific knowledge of fish and wildlife, and a sense of moral responsibility; 2) guide the conservation, development, and management of the US’s

fresh water fish and some marine and terrestrial wildlife resources, 3) administer a national program to provide the public opportunities to understand, appreciate, and wisely use fish and wildlife resources. The USFWS functions include enforcement of federal wildlife laws, protection of endangered species, management of migratory birds, restoration of nationally significant fisheries, conservation and restoration of wildlife habitat such as wetlands, help of foreign governments with their international conservation efforts, and distribution of hundreds of millions of dollars, through the Wildlife Sport Fish and Restoration program, in excise taxes on fishing and hunting equipment to State fish and wildlife agencies (http://www.fws.gov/help/about_us.html).

ANILCA

The Alaska National Interest Lands Conservation Act (ANILCA) directs federal agencies to consult and coordinate with the state of Alaska. State agencies responsible for natural resources management, tourism, and transportation work as a team to provide input throughout federal planning processes (<http://dnr.alaska.gov/commis/opmp/anilca/anilca.htm>).

OPMP

The Department of Natural Resources (DNR) Office of Project Management and Permitting (OPMP) coordinates the review of larger scale projects in the state. Because of the complexity and potential impact of these projects on multiple divisions or agencies, a project coordinator is assigned to each project in order to facilitate interagency coordination and a cooperative working relationship with the project proponent. The office deals with a diverse mix of projects including transportation, oil and gas, mining, federal grants, ANILCA coordination, and land use planning. Every project is different and involves a different mix of agencies, permitting requirements, statutory responsibilities, and resource management responsibilities (<http://dnr.alaska.gov/commis/opmp/>).

NEPA

For large scale federal process which may affect the environment, natural resources and their habitat, as well as the people depending on them, the federal National Environmental Policy Act (NEPA) process (essentially an environmental/biological socio-economic risk assessment of potential options) allows for comment and input from federal and state agencies as well as the public. The salmon fishery management organizations in Alaska (principally ADFG) may participate in coastal area management-related institutional frameworks through the federal National Environmental Policy Act (NEPA) processes, to proposals that may impact fisheries under their management. The state is a cooperating agency in the NEPA process for federal actions, giving the State of AK another seat at the table for federal actions. This includes decision-making processes and activities relevant to the fishery resource and its users in support of sustainable and integrated use of living marine resources and avoidance of conflict among users.

BOEM

The Bureau of Ocean Energy Management (BOEM) (previously Minerals Management Service) is responsible for managing environmentally and economically responsible development and provide safety and oversight of the offshore oil and gas leases. The activities of BOEM and the process for application and approval of oil exploration permits overlaps extensively with evaluation by ADNR, ADFG, and ADEC given the potential impacts of such activities on anadromous and other marine resources and their habitat. An example of this is provided by the *Cook Inlet Offshore Oil & Gas Exploration Permit Application & Approval Process* available at:

http://dog.dnr.alaska.gov/Permitting/Documents/Arcadis/Arcadis_Flowchart_CookInletOffshore_Draft.pdf

http://www.boem.gov/uploadedFiles/Proposed_OCS_Oil_Gas_Lease_Program_2012-2017.pdf

STAKEHOLDER ENGAGEMENT

With regards to conflict avoidance and resolution between different fisheries and/or users within fisheries, the Board of Fisheries (BOF) tend to avoid this by actively involving stakeholders in the process leading up to decision making. In addition, the Board of Fisheries (BOF) public meetings process provides a regularly scheduled public forum for all interested individuals, fishermen, fishing organizations, environmental organizations, Alaskan Native organizations and other governmental and non-governmental entities to participate in the development of policies and regulations for all salmon fisheries in the state. The BOF ensures that the process for the state's regulatory system relating to fish and wildlife resources operates publicly, efficiently and effectively. ADFG staff provides support for this public process, and ensures that the system is legal, timely, and accessible to the citizens of the state. The BOF is a seven member board appointed by the governor and confirmed by the legislature which sets fishing seasons, bag limits, methods and means for the state's commercial, subsistence, sport, guided sport, and personal use fisheries. It also sets policy and direction for management of the state's fishery resources and makes all decisions on allocation of those resources among users. The enabling statute for the BOF is AS 16.05.251. Regulations enacted by the BOF are found in the Alaska Administrative Code (AAC) Title 5, Chapters 1 – 77.

The Joint Boards of Fisheries and Game periodically meet for mutual issues such as non-subsistence use areas and the advisory committee system. Statutes describing the Joint Boards and the subsistence law include AS 16.05.258 and AS 16.05.315. Regulations enacted by the Joint Boards are found in the Alaska Administrative Code (AAC) Title 5, Chapters 96 and 99. Advisory Committees (AC) are local "grass roots" citizen groups intended to provide a local voice for the collection and expression of public opinions and recommendations on matters relating to the management of fish and wildlife resources in Alaska. ADFG staff regularly attend the AC meetings in their respective geographic areas to provide information to the public and hear local opinions on fisheries related activities. Currently, there are 82 advisory committees in the state. Of these, approximately 80% to 85% are "active", meaning they regularly meet, write proposals, comment and attend BOF meetings. The enabling statute for the AC system is AS 16.05.260. Regulations governing the ACs are found in the Alaska Administrative Code (AAC) Title 5, Chapters 96 – 97 <http://www.boards.adfg.state.ak.us/bbs/what/prps.php>.

Conclusion

The assessment team agrees that the institutional capacity of existing agencies (e.g. ADFG, ADEC, ADNR, USFWS, ANILCA, OPMP and BOEM), and the existing intimate and routine cooperation between federal and state agencies managing Alaska's coastal resources is capable of planning and managing coastal developments in a transparent, organized and sustainable way. Moreover, the available public processes between fishermen and other users and between fishermen (i.e. NEPA and BOF process) tends to bring stakeholders together early during proposals about coastal developments and avoid conflict to various degrees. Courts of law are used when conflict cannot be resolved through the NEPA or other processes.

Evidence

<http://www.fakr.noaa.gov/habitat/default.htm>

<http://www.adfg.alaska.gov/index.cfm?adfg=habitatresearch.main>

<http://dec.alaska.gov/water/MoreAboutWater.htm>

<http://www.fakr.noaa.gov/ram/>

<http://dnr.alaska.gov/commis/opmp/anilca/anilca.htm>

<http://dnr.alaska.gov/commis/opmp/>

3. Management objectives shall be implemented through management rules and actions formulated in a plan or other framework.

**FAO CCRF
7.3.3/7.2.2**

Evidence adequacy rating:

High

Medium

Low

Rating Determination

The BOF main role is to conserve and develop the fishery resources of the state. The BOF is charged with making allocative decisions, and ADFG is responsible for management based on those decisions. Management Plans are established by the BOF for each Region and incorporated into regulation in Title 5 Alaska Administrative Code. Those plans are implemented each season in each Region by the responsible ADFG biologist following the direction of the BOF. Management plans on recovery of depleted stocks are active policy of the state and are based on providing adequate ‘escapement’ or spawning stock in each generation. In December 2012 the NPFMC modified the Federal Salmon Fishery Management Plan to specifically exclude three historical commercial salmon fishing areas outside of state waters in the EEZ and the sport salmon fishery from the West Area EEZ in favour of continuing management by the State of Alaska. The FMP prohibits commercial salmon fisheries in the modified West Area and continues to delegate management authority to the State of Alaska for the directed commercial salmon troll fishery and the sport salmon fishery in the East Area of the EEZ.

Management of Alaska’s salmon fisheries have been well documented throughout history. Section 8.4 of the State of Alaska constitution mandates “Fish, forests, wildlife, grasslands, and all other replenishable resources belonging to the State shall be utilized, developed, and maintained on the sustained yield principle, subject to preferences among beneficial uses.”

Specific management plans and strategies exist that describe and document state management in a format easily understood by the various user groups and the public. At the backbone of management are Alaska State Statutes and the Alaska Administrative Codes derived under their guidance. Actual regulatory language is developed through the Alaska Board of Fisheries (BOF) process. Long-term objectives are defined in regulation under management of mixed stock salmon fisheries, management of sustainable salmon fisheries, and statewide salmon escapement goals:

- 5 AAC 39.220. Policy for the management of mixed stock salmon fisheries,
- 5 AAC 39.222. Policy for the management of sustainable salmon fisheries.
- 5 AAC 39.223. Policy for statewide salmon escapement goals.

The Alaska Administrative Code (AAC) addresses each fishery uniquely, in Chapters 3-40 of Title 5. Each salmon fishery is legally defined and addressed by specific geographical area, season, legal gears, vessel requirements (etc...) within its specific chapter. Regulations are available in paper and electronic formats.

[03. Arctic-Kotzebue Area. \(5 AAC 03.001 - 5 AAC 03.630\)](#)

[04. Norton Sound-Port Clarence Area. \(5 AAC 04.001 - 5 AAC 04.510\)](#)

[05. Yukon Area. \(5 AAC 05.001 - 5 AAC 05.510\)](#)

[06. Bristol Bay Area. \(5 AAC 06.001 - 5 AAC 06.990\)](#)

[07. Kuskokwim Area. \(5 AAC 07.001 - 5 AAC 07.792\)](#)

- [09. Alaska Peninsula Area. \(5 AAC 09.001 - 5 AAC 09.792\)](#)
- [11. Atka-Amlia Islands Area. \(5 AAC 11.001 - 5 AAC 11.392\)](#)
- [12. Aleutian Islands Area. \(5 AAC 12.001 - 5 AAC 12.792\)](#)
- [15. Chignik Area. \(5 AAC 15.001 - 5 AAC 15.792\)](#)
- [18. Kodiak Area. \(5 AAC 18.001 - 5 AAC 18.792\)](#)
- [21. Cook Inlet Area. \(5 AAC 21.001 - 5 AAC 21.992\)](#)
- [24. Prince William Sound Area. \(5 AAC 24.001 - 5 AAC 24.990\)](#)
- [29. Salmon Troll Fishery. \(5 AAC 29.001 - 5 AAC 29.200\)](#)
- [30. Yakutat Area. \(5 AAC 30.001 - 5 AAC 30.460\)](#)
- [33. Southeastern Alaska Area. \(5 AAC 33.001 - 5 AAC 33.792\)](#)
- [40. Private Nonprofit Salmon Hatcheries. \(5 AAC 40.005 - 5 AAC 40.990\)](#)

These AAC possess details about the management plans for the major salmon stocks in the 4 management regions of Alaska.

<http://www.touchngo.com/lglcntr/akstats/statutes.htm>

The implementation of the management objectives is then realized through management rules and actions formulated in the commercial fisheries regulations for the four regions. As for management of the salmon stocks in Alaska, the regulations outlined in these documents may be changed by emergency regulations or emergency orders (e.g. close and open fisheries) at any time given the highly flexible and responsive nature of escapement goal based management in Alaska. During the 2012 calendar year ADFG issued about 750 emergency orders to open and close commercial salmon fisheries in the Southeast, Central, Westward and Artic-Yukon-Kuskokwim management regions.

- [2013-2016 Alaska Peninsula, Atka-Amlia Islands, and Aleutian Islands Areas Commercial Salmon Fishing Regulations](#)
- [2012–2015 Commercial Salmon Fishing Regulations for Prince William Sound](#)
- [2012 –2015 Southeast Alaska and Yakutat Commercial Salmon Fishing Regulations](#)
- [2013-2016 Bristol Bay Commercial Salmon Fishing Regulations](#)
- [2011-2014 Chignik and Kodiak Areas Commercial Salmon Fishing Regulations](#)
- [2011-2014 Cook Inlet Area Commercial Salmon Fishing Regulations](#)

<http://www.adfg.alaska.gov/index.cfm?adfg=fishregulations.commercial>

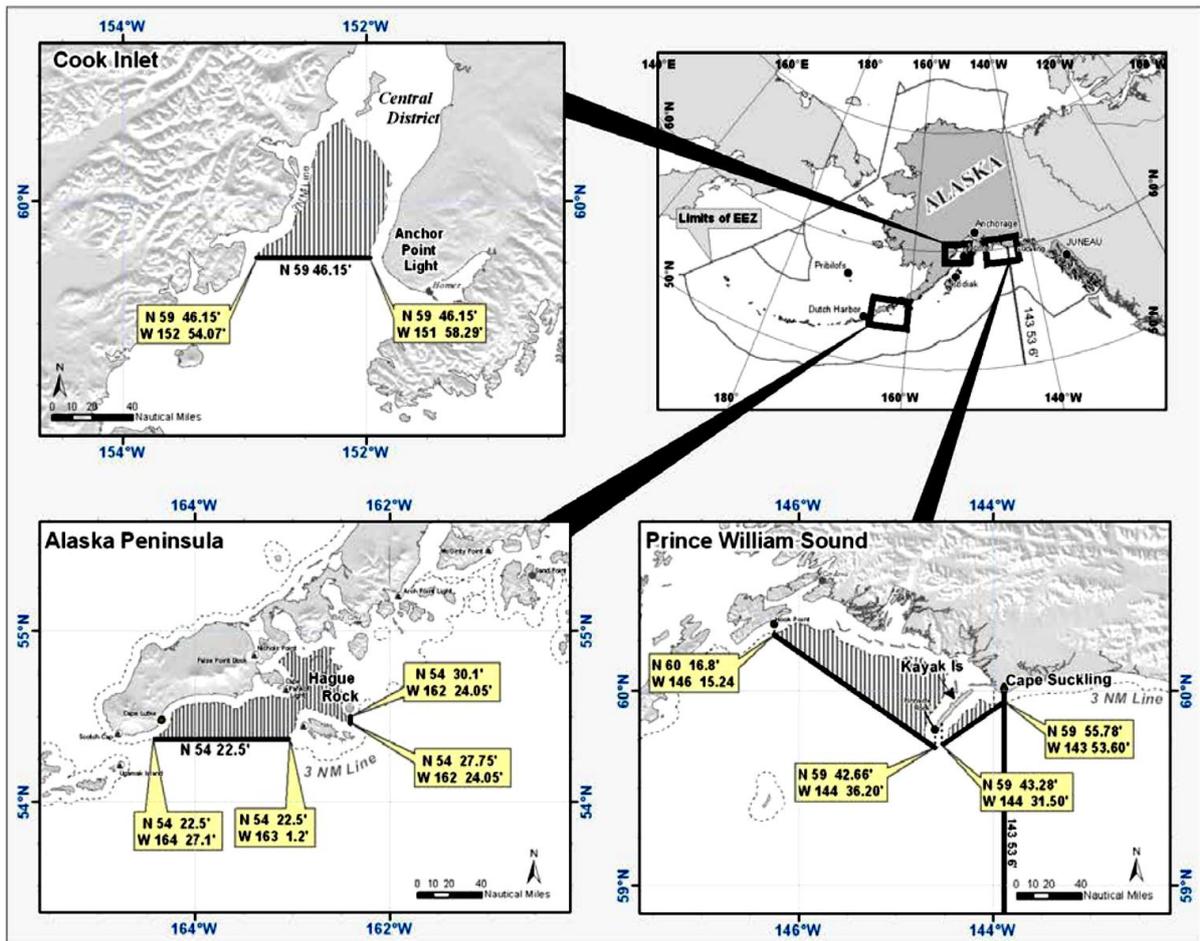
Changes in the Federal FMP for AK Salmon

Although the overwhelming majority of Alaska salmon is harvested within State waters (up to 3 nm) some harvest occurs within federal waters (3-200 nm). The King salmon troll fishery in Southeast Alaska is such an example. The *Fishery Management Plan for the Salmon Fisheries in the EEZ off the Coast of Alaska* (FMP) manages the salmon fisheries in the United States Exclusive Economic Zone (EEZ; 3 nautical miles to 200 nautical miles offshore) off Alaska. The North Pacific Fishery Management Council developed this FMP under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The FMP is being comprehensively revised to comply with the recent MSA requirements, such as annual catch limits and accountability measures, and to more clearly reflect the Council's policy with regard to State of Alaska management authority for commercial and sport salmon fisheries in the EEZ. The *Final Environmental Assessment/Regulatory Impact Review for Amendment 12: Revisions to the Fishery Management Plan for the Salmon Fisheries in the EEZ Off*

the Coast of Alaska, June 2012, provides decision-makers and the public with an evaluation of the environmental, social, and economic effects of alternative fishery management plans for the salmon fisheries in the EEZ and addresses the requirements of the National Environmental Policy Act and Executive Order 12866.

In December 2012 NMFS issued regulations to implement Amendment 12 to the Fishery Management Plan for Salmon Fisheries in the EEZ off the Coast of Alaska (FMP). Amendment 12 comprehensively revises and updates the FMP to reflect the Council salmon management policy and to comply with Federal law. In December 2011, the Council voted unanimously to recommend Amendment 12 to the FMP.

Amendment 12 comprehensively revises the FMP to reflect the Council’s salmon management policy, which is to facilitate State of Alaska (State) salmon management in accordance with the Magnuson-Stevens Act, Pacific Salmon Treaty, and applicable Federal law. To reflect the Council’s policy and objectives, Amendment 12 redefines the FMP’s management area to remove three small pockets of Federal waters adjacent to Cook Inlet, Prince William Sound, and the Alaska Peninsula from the West Area (see below).



The salmon fisheries in these areas are managed by the State. Amendment 12 also removes the sport fishery in the West Area from the FMP. The Council determined and NMFS agreed that State management of the stocks and fisheries occurring in the net fishing areas and the sport fishery in the West Area is consistent with the policies and standards of the Magnuson- Stevens Act, and that Federal management of the net fishing areas and the sport fishery in the West Area would serve no useful purpose or provide present or future benefits that justified the costs of Federal management.

The Council and NMFS determined that removing the net fishing areas and the sport fishery from the West Area allows the State to manage Alaska salmon stocks and directed fishing for those stocks as seamlessly as practicable throughout their range.

The FMP continues to apply to the vast majority of the EEZ west of Cape Suckling and maintains the prohibition on commercial salmon fishing in the redefined West Area. In the East Area, Amendment 12 maintains the current scope of the FMP and reaffirms that management of the commercial and sport salmon fisheries in the East Area is delegated to the State. The FMP relies on a combination of State management and management under the Pacific Salmon Treaty to ensure that salmon stocks, including trans-boundary stocks, are managed as a unit throughout their ranges and that interrelated stocks are managed in close coordination. Maintaining the FMP in the East Area leaves existing management structures in place, recognizing that the FMP is the nexus for the application of the Pacific Salmon Treaty and other applicable Federal law.

The primary new FMP provision is a mechanism to establish annual catch limits (ACLs) and accountability measures (AMs) for the salmon stocks caught in the East Area commercial troll fishery, the only commercial fishery authorized under the FMP. The mechanism to establish ACLs and AMs for the East Area commercial troll fishery builds on the FMP's existing framework for establishing status determination criteria. Amendment 12 does not establish a mechanism for specifying ACLs and AMs for Chinook salmon because the Magnuson-Stevens Act exempts stocks managed under an international fisheries agreement in which the United States participates from the ACL requirement (16 U.S.C. 1853). The Council recommended and NMFS approved an alternative approach because the State's escapement-based management system is a more effective management system for preventing overfishing of Alaska salmon than a system that places rigid numeric limits on the number of fish that may be caught.

Amendment 12 also revises the definition of optimum yield (OY). For Chinook salmon stocks in Tier 1, an all gear maximum sustainable yield (MSY) is prescribed in terms of catch by the Pacific Salmon Treaty and takes into account the biological productivity of Chinook salmon and ecological factors in setting this limit. Under Amendment 12, the portion of the all-gear catch limit allocated to troll gear represents the OY for that fishery and takes into account the economic and social factors considered by the State in making allocation decisions. For the redefined West Area under Amendment 12, commercial fishing is prohibited; therefore the directed harvest OY is zero. The redefined West Area has been closed to commercial net fishing since 1952 and commercial troll fishing since 1973, and there has not been any commercial yield from this area.

Finally, Amendment 12 adds a fishery impact statement to the FMP, revises the current FMP process for Federal review of State management measures to more fully describe the process and bring it into compliance with Magnuson-Stevens Act requirements (16 U.S.C. 1856(a)(3)(B)), and removes existing FMP language governing the issuance of Federal salmon permits. The Council recommended removing FMP language related to Federal salmon permits because all current participants have State of Alaska limited entry permits and Federal permits are no longer necessary. According to language included in the original 1979 FMP, provisions for Federal salmon permits were established to complement the State limited entry permit, in order to limit capacity in the EEZ so that persons who did not receive a State limited entry permit would not simply shift their fishing efforts into Federal waters.

http://www.fakr.noaa.gov/analyses/salmon/earir_salmonfmpamds0612.pdf

<http://alaskafisheries.noaa.gov/frules/77fr75570.pdf>

US-Canada Salmon Fisheries Management Arrangements

In May, 2008 the Pacific Salmon Commission recommended a new bilateral agreement for the conservation and harvest sharing of Pacific salmon to the Governments of Canada and the United States. The product of nearly 18 months of negotiations, the agreement represents a major step forward in science-based conservation and sustainable harvest sharing of the salmon resource between Canada and the United States of America. Approved in December, 2008 by the respective governments, the new fishing regimes are in force from the beginning of 2009 through the end of 2018.

The new fishing regimes (last updated on January 31st 2013) are contained in the following Chapters of the Treaty:

Chapter 1: Transboundary Rivers

Chapter 2: Northern British Columbia and Southeastern Alaska

Chapter 3: Chinook Salmon

Chapter 4: Fraser River Sockeye and Pink Salmon

Chapter 5: Coho Salmon

Chapter 6: Southern British Columbia and Washington State Chum Salmon

Chapter 7: General Obligations

Chapter 8: Yukon River (added December 4, 2002)

<http://www.psc.org/pubs/Treaty/Treaty.pdf>

Hatchery Program Policies

Beginning with the inception of Alaska's hatchery program, policies, statutes, and regulations were instituted to control hatchery development and, at the same time, protect wild stocks. Rigorous genetic and fish health policies were developed to guide the program.

Law, Policy and Regulation Chronology

- 1974 Private Non-Profit Hatchery Act
- 1974 Hatchery permitting policy
- 1975 Genetic policy
- 1976 Regional salmon planning statute
- 1978 Alaska Board of Fisheries hatchery management policy
- 1981 Fish transport and fish disease regulations
- 1985 PNP hatchery permitting regulations
- 1985 Revised genetic policy
- 1988 Fish pathology policy
- 1992 Wild stock priority statute
- 1992 Statewide salmon escapement goal policy
- 1993 Policy for the management of mixed stock salmon fisheries
- 1994 Sockeye salmon culture policy
- 1994 Fish resource permit policy
- 2000 Sustainable salmon management policy

<http://www.adfg.alaska.gov/static/fishing/PDFs/hatcheries/mcgeebrochure.pdf>

B. Science and Stock Assessment Activities

4. There shall be effective fishery data (dependent and independent) collection and analysis systems for stock management purposes.

FAO CCRF 7.1.9/7.4.4/7.4.5/7.4.6/8.4.3/12.4
ECO 29.1-29.3

Evidence adequacy rating:

<input checked="" type="checkbox"/> High	Medium	Low
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Rating Determination

Intensive monitoring of incoming run strength is required for successful abundance-based management of commercial salmon fisheries in Alaska. Fish weirs, counting towers, sonar, test fishing, fish wheels, and aerial surveys are the primary assessment tools. Fishery openings are targeted where production surplus to escapement goals is identified. Each assessment tool is designed to work best for the geographical and physical conditions encountered. The primary method of accounting for commercial fishery harvest is the ADFG’s fish ticket system. By Alaska law (AS 16.05.690 Record of Purchase) each buyer of fish is required to keep a record of each purchase showing the name or number of the vessel from which the catch is taken, the date of landing, vessel license number, pounds purchased of each species, number of each species, and the ADFG statistical area in which the fish were taken, as well as other information ADFG may require for specific fisheries or areas. The new multi-generational hatchery salmon research program aims at providing a better account of the proportion of hatchery salmon strays in wild salmon streams to improve escapement enumeration practices.

Fishery independent data

Intensive monitoring of incoming run strength is required for successful abundance-based management of commercial salmon fisheries in Alaska. In addition to catch and effort information gathered inseason by the fish ticket system, fish counting weirs, counting towers, sonar, test fishing, fish wheels, foot surveys and aerial surveys are the primary assessment tools. Fishery openings are targeted where production surplus to escapement goals is identified. Each assessment tool is designed to work best for the geographical and physical conditions encountered.

Arctic-Yukon-Kuskokwim (AYK) Region

The Arctic-Yukon-Kuskokwim (AYK) Region encompasses the coastal waters of Alaska and includes the rivers and streams that drain into the Bering, Chukchi, and Beaufort Seas. It stretches from its boundary at Cape Newenham with the Bristol Bay area to the border with Canada on the Arctic Ocean. The Yukon River, with the fifth largest drainage in North America, lies within this management region, as do many other major rivers; the Kuskokwim being second in size next to the Yukon. With the exception of Fairbanks, Bethel, and Nome, this is a region of villages. Salmon and herring are the most important fisheries resources in this region.

In the AYK management Region, large numbers of salmon are taken for subsistence and subsistence harvests can equal or surpass the numbers of fish harvested in commercial fisheries, especially Chinook salmon (<http://www.adfg.alaska.gov/index.cfm?adfg=fishingcommercialbyarea.interior>). The enumeration method in the following tables shows the type of system/method used to collect data to support escapement goal based management for the various salmon fisheries over the four management Regions throughout the State of Alaska (See <http://www.adfg.alaska.gov/FedAidpdfs/FMS11-06.pdf> for full details).

Also note that If no escapement goal is available in a given region for a given salmon species it is because there is no fishery for it (e.g. Yukon and Kuskokwim pink salmon). Escapement goals tend to be developed only where significant commercial fisheries exist.

Table 1. Methods used to enumerate and develop escapement goals for the Arctic-Yukon-Kuskokwim region Chinook, chum, coho, pink, and sockeye salmon stocks.

System	Enumeration Method	Goal Development Method
CHINOOK SALMON		
<u>Kuskokwim Area</u>		
	Single Aerial	
North (Main) Fork Goodnews River	Survey ^a	Percentile
Middle Fork Goodnews River	Weir Count	SRA ^b
	Single Aerial	
Kanektok River	Survey	Percentile
Kogrukluk River	Weir Count	Percentile
Kwethluk River	Weir Count	Percentile
Tuluksak River	Weir Count	Percentile
George River	Weir Count	Percentile
	Single Aerial	
Kisaralik River	Survey	Percentile
	Single Aerial	
Aniak River	Survey	Percentile
	Single Aerial	
Salmon River (Aniak R)	Survey	Percentile
	Single Aerial	
Holitna River	Survey	Percentile
	Single Aerial	
Cheeneetnuk River (Stony R)	Survey	Percentile
	Single Aerial	
Gagarayah River (Stony R)	Survey	Percentile
	Single Aerial	
Salmon River (Pitka Fork)	Survey	Percentile
<u>Yukon River</u>		
East Fork Andreafsky River	Weir Count	Percentile
	Peak Aerial	
West Fork Andreafsky River	Survey ^c	Percentile
	Peak Aerial	
Anvik River	Survey	Percentile
Nulato River (forks combined)	Peak Aerial	Percentile

	Survey	
Chena River	Tower, Mark-Recapture	SRA
Salcha River	Tower, Mark-Recapture	SRA
Canada Mainstem	Sonar	Agreement (U.S./Canada Joint Technical Committee)
<u>Norton Sound</u>		
Fish River/Boston Creek	Peak Aerial Survey	Percentile
Kwiniuk River	Tower Count	SRA
North River (Unalakleet R)	Tower Count	Percentile
Shaktoolik River	Peak Aerial Survey	Theoretical SRA
Unalakleet/Old Woman River	Peak Aerial Survey	Theoretical SRA
CHUM SALMON		
<u>Kuskokwim Area</u>		
Middle Fork Goodnews River	Weir Count	Percentile
Kanektok River	Single Aerial Survey	Percentile
Kogruklu River	Weir Count	Percentile
Aniak River	Sonar	Percentile
<u>Yukon River Summer Chum</u>		
East Fork Andreafsky River	Weir Count	SRA
Anvik River	Sonar	SRA
<u>Yukon River Fall Chum</u>		
Yukon River Drainage	Calculated - Multiple Surveys	SRA
Tanana River	Mark-Recapture	SRA
Delta River	Multiple Foot Surveys	Proportion of Tanana River Goal
Upper Yukon River Tributaries	Sonar & Weir Count	SRA
Chandalar River	Sonar	Proportion of Upper Yukon River Tributaries Goal
Sheenjok River	Sonar	Proportion of Upper Yukon River Tributaries Goal
Fishing Branch River (Canada)	Weir Count	Agreement (U.S./Canada Joint Technical Committee) IMEG

		Percentile
Yukon R. Mainstem (Canada)	Mark-Recapture	Agreement (U.S./Canada Joint Technical Committee) IMEG SRA
<u>Norton Sound</u>		
Subdistrict 1 Aggregate	Calculated - Multiple Surveys	SRA
Nome River	Weir Count	Proportion of Aggregate Goal
Snake River	Tower/Weir Count	Proportion of Aggregate Goal
Eldorado River	Peak Aerial Survey (Expanded)	Proportion of Aggregate Goal
Niukluk River	Tower Count	Risk Analysis
Kwiniuk River	Tower Count	SRA
Tubutulik River	Peak Aerial Survey (Expanded)	SRA
Unalakleet/Old Woman River	Peak Aerial Survey	Empirical Observation
<u>Kotzebue Sound</u>		
Kotzebue Sound Aggregate	Peak Aerial Survey (Expanded)	SRA
Noatak and Eli Rivers	Peak Aerial Survey	Proportion of Aggregate Goal
Upper Kobuk w/ Selby River	Peak Aerial Survey	Proportion of Aggregate Goal
Salmon River	Peak Aerial Survey	Proportion of Aggregate Goal
Tutuksuk River	Peak Aerial Survey	Proportion of Aggregate Goal
Squirrel River	Peak Aerial Survey	Proportion of Aggregate Goal
COHO SALMON		
<u>Kuskokwim Area</u>		
Middle Fork Goodnews River	Weir Count	Percentile
Kogruklu River	Weir Count	Percentile
Kwethluk River	Weir Count	Empirical Observation
<u>Yukon River</u>		
Delta Clearwater River	Boat Survey	Percentile
<u>Norton Sound</u>		

	Peak Aerial	
Kwiniuk River	Survey	Theoretical SRA
Niukluk River	Tower Count	Percentile
	Peak Aerial	
North River (Unalakleet R.)	Survey	Theoretical SRA
PINK SALMON		
<u>Kuskokwim Area</u>		
There are no escapement goals for pink salmon in the Kuskokwim Management Area.		
<u>Yukon River</u>		
There are no escapement goals for pink salmon in the Yukon River drainage.		
<u>Norton Sound</u>		
Nome River (odd year)	Weir Count	Empirical Observation
Nome River (even year)	Weir Count	Empirical Observation
Kwiniuk River	Tower Count	Empirical Observation
Niukluk River	Tower Count	Empirical Observation
North River	Tower Count	Empirical Observation
SOCKEYE SALMON		
<u>Kuskokwim Area</u>		
	Single Aerial	
North (Main) Fork Goodnews River	Survey	Percentile
Middle Fork Goodnews River	Weir Count	SRA
	Single Aerial	
Kanektok River	Survey	Percentile
Kogrukluk River	Weir Count	Percentile
<u>Yukon River</u>		
There are no escapement goals for Sockeye in the Yukon River drainage.		
<u>Norton Sound</u>		
	Peak Aerial	
Salmon Lake/Grand Central River	Survey	Empirical Observation
<p>^a Typically single survey done around time of presumed peak of the run with no expansion of counts.</p> <p>^b SRA = Spawner-recruit analysis.</p> <p>^c One or more aerial surveys are attempted during the peak of the run. Peak count is used to index the escapement.</p>		

Westward

The Westward Region includes the Kodiak archipelago, the north and south sides of the Alaska Peninsula (including Chignik, the Shumagin Islands, and Port Moller), and the Aleutian Islands. Dutch Harbor, the number one fishing port in the nation, in pounds landed, is situated in the Aleutian Islands.

This region encompasses all Pacific Ocean waters extending south from the Kodiak Archipelago and west of the longitude of the eastern side of Cook Inlet, as well as Bering Sea waters east of the maritime boundary between Russia and the United States. The islands of St. Matthew and the Pribilofs, as well as the Chukchi-Beaufort seas, also fall within the Westward Region.

Important salmon and herring fisheries occur throughout the coastal waters of this management region (<http://www.adfg.alaska.gov/index.cfm?adfg=fishingcommercialbyarea.southwest>).

Table 2. Methods used to enumerate and develop escapement goals for Westward Region (Alaska Peninsula/Aleutian Islands, Kodiak, and Chignik areas) Chinook, chum, coho, pink and sockeye salmon stocks.

System	Enumeration Method	Goal Development Method
CHINOOK SALMON		
<i><u>AK Peninsula</u></i>		
Nelson River	Weir, Peak Aerial Survey ^a	Spawning Habitat Model, SRA ^b
<i><u>Chignik</u></i>		
Chignik River	Weir Count	SRA
<i><u>Kodiak</u></i>		
Karluk River	Weir Count	SRA
Ayakulik River	Weir Count	SRA
CHUM SALMON		
<i><u>AK Peninsula</u></i>		
Northern District	Peak Aerial Survey	SRA
Northwestern District	Peak Aerial Survey	SRA
Southeastern District	Peak Aerial Survey	Percentile
South Central District	Peak Aerial Survey	Percentile
Southwestern District	Peak Aerial Survey	Percentile
Unimak District	Peak Aerial Survey	Risk Analysis
<i><u>Chignik</u></i>		
Entire Chignik Area	Peak Aerial Survey	Risk Analysis
<i><u>Kodiak</u></i>		
Mainland District	Peak Aerial Survey	Percentile, Risk Analysis
Kodiak Archipelago	Peak Aerial Survey	Percentile

Aggregate		
COHO SALMON		
<u>AK Peninsula</u>		
Nelson River	Peak Aerial Survey	Risk Analysis
Thin Point Lake	Peak Aerial Survey	Empirical Observation
Ilnik River	Peak Aerial Survey	Risk Analysis
<u>Chignik</u>		
There are no coho salmon stocks with escapement goals in Chignik Area		
<u>Kodiak</u>		
Pasagshak River	Foot Survey	Theoretical SRA
Buskin River	Weir Count	SRA
Olds River	Foot Survey	Theoretical SRA
American River	Foot Survey	Theoretical SRA
PINK SALMON		
<u>AK Peninsula</u>		
Bechevin Bay Section (odd year)	Peak Aerial Survey	Risk Analysis
Bechevin Bay Section (even year)	Peak Aerial Survey	Risk Analysis
South Peninsula Total (odd year)	Peak Aerial Survey	SRA
South Peninsula Total (even year)	Peak Aerial Survey	SRA
<u>Chignik</u>		
Entire Chignik Area (odd year)	Peak Aerial Survey, Weir Count	Yield Analysis
Entire Chignik Area (even year)	Peak Aerial Survey, Weir Count	Yield Analysis
<u>Kodiak</u>		
Mainland District	Peak Aerial Survey	SRA
Kodiak Archipelago (odd year)	Peak Aerial Survey	SRA
Kodiak Archipelago (even year)	Peak Aerial Survey	SRA
SOCKEYE SALMON		
<u>AK Peninsula</u>		
Cinder River	Peak Aerial Survey	Percentile

Ilnik River	Weir Count	Percentile, Euphotic Volume Model, Zooplankton Model
Meshik River	Peak Aerial Survey	Percentile
Sandy River	Weir Count	Percentile
Bear River Early Run	Weir Count	Spawning Habitat Model, Percentile, Euphotic Volume Model, Zooplankton Model, Lake Surface Area
Bear River Late Run	Weir Count	Spawning Habitat Model, Percentile, Euphotic Volume Model, Zooplankton Model, Lake Surface Area
Nelson River	Weir Count	SRA
Christianson Lagoon	Peak Aerial Survey	Spawning Habitat Model
Swanson Lagoon	Peak Aerial Survey	Percentile
North Creek	Peak Aerial Survey	Percentile
Orzinski Lake	Weir Count	Percentile
Mortensen Lagoon	Peak Aerial Survey	Spawning Habitat Model, Percentile, Euphotic Volume Model, Zooplankton Model, Lake Surface Area
Thin Point Lake	Peak Aerial Survey	Spawning Habitat Model, Percentile, Euphotic Volume Model, Zooplankton Model, Lake Surface Area
McLees Lake	Weir Count	Percentile
<u>Chignik</u>		
Chignik River Early Run	Weir Count	Yield Analysis, Euphotic Volume Model, Zooplankton Model
Chignik River Late Run	Weir Count	SRA, Euphotic Volume Model, Zooplankton Model
<u>Kodiak</u>		
Malina Creek	Peak Aerial Survey	Percentile, Zooplankton Model
Afognak (Litnik) River	Weir Count	SRA
Little River	Peak Aerial Survey	Risk Analysis
Uganik Lake	Peak Aerial Survey	Percentile
Karluk River Early Run	Weir Count	SRA
Karluk River Late Run	Weir Count	SRA
Ayakulik River Early Run	Weir Count	Zooplankton Model and historical escapement
Ayakulik River Late Run	Weir Count	Zooplankton Model and historical escapement
Upper Station River Early Run	Weir Count	SRA
Upper Station River Late Run	Weir Count	SRA
Frazer Lake	Weir Count	SRA
Saltery Lake	Weir Count	SRA, Zooplankton Model

Pasagshak River	Peak Aerial Survey	Percentile
Buskin Lake	Weir Count	SRA

^a One or more aerial surveys are attempted during the peak of the run.
Peak count is used to index the escapement.

^b SRA = Spawner-recruit analysis.

Central Region

Southcentral Alaska commercial fisheries are composed of four distinct management areas that include Bristol Bay, Prince William Sound and Copper River, Upper Cook Inlet, and Lower Cook Inlet. Although all 5 species of salmon are harvested in each area, sockeye and pink salmon are the most abundant and most valuable. This area encompasses some of the largest and most valuable salmon fisheries in the world. From Bristol Bay, home of the largest sockeye salmon fishery in the world, to the Copper River where sockeye and Chinook salmon fetch some of the highest prices per pound paid to commercial fishermen. Cook Inlet commercial fisheries occur near the largest population center in Alaska, providing salmon to numerous niche and local markets, as well as fresh salmon to markets in other states. Prince William Sound adds productive pink, chum, and sockeye salmon fisheries to the region.

<http://www.adfg.alaska.gov/index.cfm?adfg=fishingcommercialbyarea.southcentral>

Table 3. Methods used to enumerate and develop escapement goals for the Central Region (Bristol Bay, Cook Inlet, and Prince William sound/Copper River) Chinook, chum, coho, pink, and sockeye salmon stocks.

System	Enumeration Method	Goal Development Method
CHINOOK SALMON		
<i><u>Bristol Bay</u></i>		
Nushagak River	Sonar	SRA ^a , Yield Analysis
Togiak River	Single Aerial Survey ^b	Risk Analysis
Naknek River	Single Aerial Survey	Risk Analysis
Alagnak River	Single Aerial Survey	Risk Analysis
Egegik River	Single Aerial Survey	Risk Analysis
<i><u>Upper Cook Inlet</u></i>		
Alexander Creek	Single Aerial Survey	Percentile
Campbell Creek	Single Foot Survey	Risk Analysis
Chuitna River	Single Aerial Survey	Percentile
Chulitna River	Single Aerial Survey	Percentile
Clear (Chunilna) Creek	Single Aerial Survey	Percentile
Crooked Creek	Weir Count	Percentile
Deshka River	Weir Count	SRA
Goose Creek	Single Aerial Survey	Percentile

Kenai River - Early Run	Sonar	SRA
Kenai River - Late Run	Sonar	SRA
Lake Creek	Single Aerial Survey	Percentile
Lewis River	Single Aerial Survey	Percentile
Little Susitna River	Single Aerial Survey	Percentile
Little Willow Creek	Single Aerial Survey	Percentile
Montana Creek	Single Aerial Survey	Percentile
Peters Creek	Single Aerial Survey	Percentile
Prairie Creek	Single Aerial Survey	Percentile
Sheep Creek	Single Aerial Survey	Percentile
Talachulitna River	Single Aerial Survey	Percentile
Theodore River	Single Aerial Survey	Percentile
Willow Creek	Single Aerial Survey	Percentile
<u>Lower Cook Inlet</u>		
Anchor River	Sonar, Weir Count	SRA
Deep Creek	Single Aerial Survey	Percentile
Ninilchik River	Weir Count	Percentile
<u>Prince William Sound</u>		
Copper River	Mark-Recapture	Empirical Observation
CHUM SALMON		
<u>Bristol Bay</u>		
Nushagak River	Sonar	Risk Analysis
<u>Upper Cook Inlet</u>		
Clearwater Creek	Peak Aerial Survey ^c	Percentile
<u>Lower Cook Inlet</u>		
Port Graham River	Multiple Foot Surveys ^d	Percentile
Dogfish Lagoon	Multiple Foot Surveys	Percentile
Rocky River	Multiple Foot Surveys	Percentile
Port Dick Creek	Multiple Aerial or Foot Surveys	Percentile
Island Creek	Multiple Aerial or Foot Surveys	Percentile
Big Kamishak River	Multiple Aerial Surveys	Percentile
Little Kamishak River	Multiple Aerial Surveys	Percentile
McNeil River	Multiple Aerial Surveys	Percentile
Bruin River	Multiple Aerial Surveys	Percentile
Ursus Cove	Multiple Aerial Surveys	Percentile
Cottonwood Creek	Multiple Aerial Surveys	Percentile
Iniskin Bay	Multiple Aerial Surveys	Percentile

Prince William Sound

Eastern District	Multiple Aerial Surveys	Risk Analysis
Northern District	Multiple Aerial Surveys	Risk Analysis
Coghill District	Multiple Aerial Surveys	Risk Analysis
Northwestern District	Multiple Aerial Surveys	Risk Analysis
Southeastern District	Multiple Aerial Surveys	Risk Analysis

COHO SALMON

Bristol Bay

There are no coho salmon stocks with escapement goals in Bristol Bay

Upper Cook Inlet

Fish Creek (Knik)	Weir Count	Percentile
Jim Creek	Single Foot Survey	Percentile
Little Susitna River	Weir Count	Percentile

Lower Cook Inlet

There are no coho salmon stocks with escapement goals in Lower Cook Inlet

Prince William Sound

Copper River Delta	Peak Aerial Survey	Percentile
Bering River	Peak Aerial Survey	Percentile

PINK SALMON

Bristol Bay

There are no pink salmon stocks with escapement goals in Bristol Bay

Upper Cook Inlet

There are no pink salmon stocks with escapement goals in Upper Cook Inlet

Lower Cook Inlet

Humpy Creek	Multiple Foot Surveys	Percentile
China Poot Creek	Multiple Foot Surveys	Percentile
Tutka Creek	Multiple Foot Surveys	Percentile
Barabara Creek	Multiple Foot Surveys	Percentile
Seldovia Creek	Multiple Foot Surveys	Percentile
Port Graham River	Multiple Foot Surveys	Percentile
Port Chatham	Multiple Foot Surveys	Percentile
Windy Creek Right	Multiple Foot Surveys	Percentile
Windy Creek Left	Multiple Foot Surveys	Percentile
Rocky River	Multiple Foot Surveys	Percentile
Port Dick Creek	Multiple Aerial or Foot Surveys	Percentile
Island Creek	Multiple Aerial or Foot Surveys	Percentile

S. Nuka Island Creek	Multiple Aerial or Foot Surveys	Percentile
Desire Lake Creek	Multiple Aerial Surveys	Percentile
Bruin River	Multiple Aerial Surveys	Percentile
Sunday Creek	Multiple Aerial Surveys	Percentile
Brown's Peak Creek	Multiple Aerial Surveys	Percentile
<u>Prince William Sound</u>		
Eastern District (even year)		Percentile
Eastern District (odd year)		Percentile
Northern District (even year)		Percentile
Northern District (odd year)		Percentile
Coghill District (even year)		Percentile
Coghill District (odd year)		Percentile
Northwestern District (even year)		Percentile
Northwestern District (odd year)		Percentile
Eshamy District (even year)		Percentile
Eshamy District (odd year)		Percentile
Southwestern District (even year)		Percentile
Southwestern District (odd year)		Percentile
Montague District (even year)		Percentile
Montague District (odd year)		Percentile
Southeastern District (even year)		Percentile
Southeastern District (odd year)		Percentile
SOCKEYE SALMON		
<u>Bristol Bay</u>		
Kvichak River	Tower Count	SRA, Yield Analysis
Alagnak River	Tower Count	Risk Analysis
Naknek River	Tower Count	SRA, Yield Analysis
Egegik River	Tower Count	SRA, Yield Analysis
Ugashik River	Tower Count	SRA, Yield Analysis
Wood River	Tower Count	SRA, Yield Analysis
Igushik River	Tower Count	SRA, Yield Analysis
Nushagak River	Sonar	SRA, Yield Analysis
Kulukak Bay	Single Aerial Survey	Risk Analysis
Togiak River	Tower Count	SRA, Yield Analysis
<u>Upper Cook Inlet</u>		
Crescent River	Sonar	SRA
Fish Creek (Knik)	Weir Count	Percentile

Kasilof River	Sonar	SRA
		Brood Interaction Simulation Model
Kenai River	Sonar	
Packers Creek	Weir Count	Percentile
Russian River - Early Run	Weir Count	SRA
Russian River - Late Run	Weir Count	Percentile
Chelatna Lake	Weir Count	Percentile
Judd Lake	Weir Count	Percentile
Larson Lake	Weir Count	Percentile
<u>Lower Cook Inlet</u>		
English Bay	Peak Aerial Survey, Weir Count	Percentile
Delight Lake	Peak Aerial Survey, Weir Count	Percentile
Desire Lake	Peak Aerial Survey	Percentile
Bear Lake	Weir Count	Percentile
Aialik Lake	Peak Aerial Survey	Percentile
Mikfik Lake	Peak Aerial Survey, Video	Percentile
Chenik Lake	Peak Aerial Survey, Video	Percentile
Amakdedori Creek	Peak Aerial Survey	Percentile
<u>Prince William Sound</u>		
Upper Copper River	Sonar	Percentile
Copper River Delta	Peak Aerial Survey	Percentile
Bering River	Peak Aerial Survey	Percentile
Coghill Lake	Weir Count	SRA
Eshamy Lake	Weir Count	SRA

^a SRA = Spawner-recruit analysis.

^b Single survey done around time of presumed peak of the run with no expansion of counts.

^c Multiple aerial surveys are attempted throughout the run. Peak count is used to index the escapement.

^d Multiple surveys throughout run (at least 1 per week). Area under the curve method (AUC) used to estimate annual escapement.

The Southeast Region

The Southeast Alaska/Yakutat Region (Region I) consists of Alaska waters between Cape Suckling on the north and Dixon Entrance on the south. Salmon are commercially harvested in Southeast Alaska with purse seines and drift gillnets; in Yakutat with set gillnets; and in both areas with hand and power troll gear.

There are more than 1,200 streams and rivers in Southeast Alaska for which ADFG has a record of at least one annual adult chum salmon spawning count since 1960, and counts of 1,000 or more chum salmon were obtained at approximately 450 of those streams prior to 1985 (ADFG Integrated Database). Long time series of escapement information are not available, however, for the vast

majority of those streams. Of the chum salmon populations that have been consistently monitored, most have been monitored through aerial surveys, though several have been monitored annually by foot surveys. Inriver fish wheel counts have been used to monitor salmon escapements to the Taku and Chilkat rivers, two large glacial, mainland river systems (http://www.adfg.alaska.gov/index.cfm?adfg=commercialbyareasoutheast.salmon_managementplans)

Table 4. Methods used to enumerate and develop escapement goals for Southeast Region Chinook, chum, coho, pink, and sockeye salmon stocks.

System	Enumeration Method	Goal Development Method
CHINOOK SALMON		
Blossom River	Peak Aerial Survey ^a	SRA ^b
Keta River	Peak Aerial Survey	SRA
Unuk River	Mark-Recapture	SRA
Chickamin River	Peak Aerial Survey	SRA
Andrew Creek	Peak Aerial Survey (Expanded)	SRA
Stikine River	Mark-Recapture	SRA
King Salmon River	Peak Aerial Survey (Expanded)	SRA
Taku River	Mark-Recapture	SRA
Chilkat River	Mark-Recapture	Theoretical SRA
Klukshu (Alek) River	Weir Count	SRA
Situk River	Weir Count	SRA
CHUM SALMON		
Southern Southeast Summer	Peak Aerial Survey	Percentile
Northern Southeast Inside Summer	Peak Aerial Survey	Percentile
Northern Southeast Outside Summer	Peak Aerial Survey	Percentile
Cholmondeley Sound Fall	Peak Aerial Survey	Percentile
Port Camden Fall	Peak Aerial Survey	Risk Analysis
Security Bay Fall	Peak Aerial Survey	Percentile
Excursion River Fall	Peak Aerial Survey	Percentile
Chilkat River Fall	Mark-Recapture, Fish Wheel	SRA
COHO SALMON		
Hugh Smith Lake	Weir Count	SRA
Taku River	Mark-Recapture	Agreement ^c , SRA
Auke Creek	Weir Count	SRA
Montana Creek	Foot Survey	Theoretical SRA
Peterson Creek	Foot Survey	Theoretical SRA
Ketchikan Survey Index	Peak Aerial Survey	Theoretical SRA

Sitka Survey Index	Foot Survey	Theoretical SRA
Ford Arm Lake	Weir Count	SRA
Berners River	Mark-Recapture	SRA
Chilkat River	Mark-Recapture, Foot Survey	SRA
Lost River	Foot Survey	SRA
Situk River	Peak Aerial Survey	SRA
Tsiu/Tsivat Rivers	Peak Aerial Survey	SRA
PINK SALMON		
Southern Southeast	Peak Aerial Survey	Yield Analysis
Northern Southeast Inside	Peak Aerial Survey	Yield Analysis
Northern Southeast Outside	Peak Aerial Survey	Yield Analysis
Situk River	Weir Index	Percentile
SOCKEYE SALMON		
Hugh Smith Lake	Weir Count	Risk Analysis, Theoretical SRA
McDonald Lake	Expanded Foot Survey	SRA
Mainstem Stikine River	Run Reconstruction	Professional Judgement ^c
Tahltan Lake	Weir Count	SRA
Speel Lake	Weir Count	SRA
Taku River	Mark-Recapture	Professional Judgement ^c
Redoubt Lake	Weir Count	SRA
Chilkat Lake	Sonar, Mark-Recapture	SRA
Chilkoot Lake	Weir Count	SRA
East Alsek-Doame River	Peak Aerial Survey	SRA
Klukshu River	Weir Count	SRA
Lost River	Foot/Boat Survey	Percentile
Situk River	Weir Count	SRA

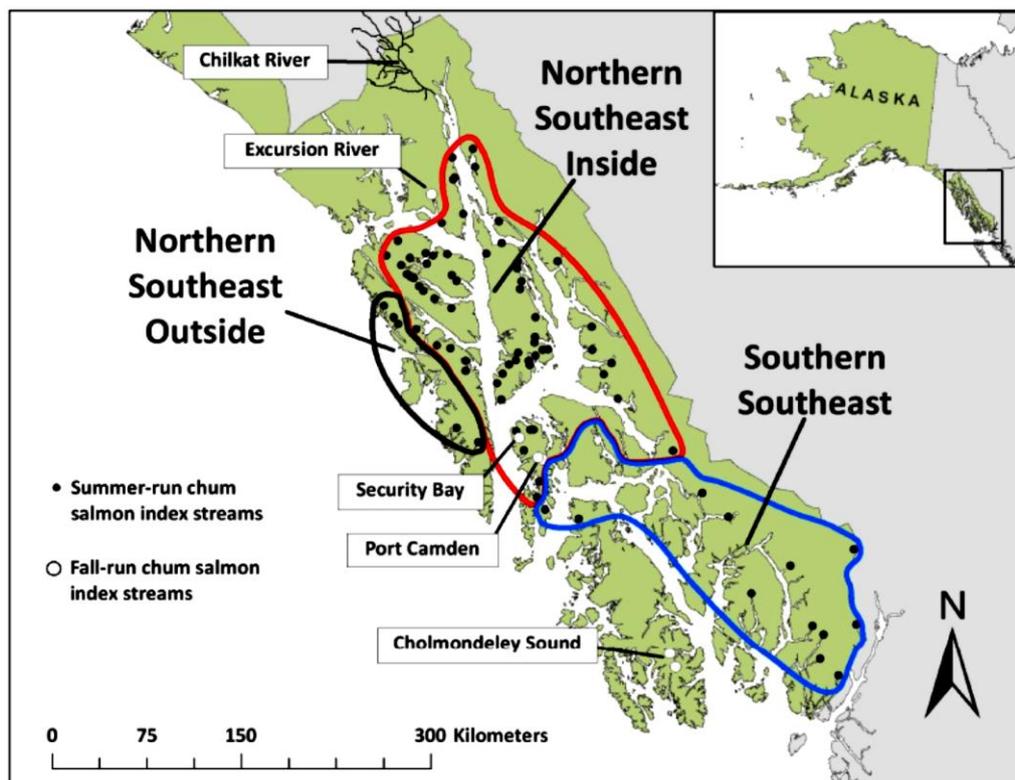
^a One or more aerial surveys are attempted during the peak of the run. Peak count is used to index the escapement.

^b SRA = Spawner-recruit analysis.

^c Transboundary Technical Committee, Pacific Salmon Commission.

From the Munro and Volk 2013 report "Summary of Pacific salmon escapement goals in Alaska with a review of escapements from 2004 to 2012" <http://www.adfg.alaska.gov/FedAidPDFs/FMS13-05.pdf> . Note some of the data in the report are considered preliminary and subject to change.

SEAK Region ADFG Chum salmon index streams



<http://pinkandchum.psc.org/Presentation/Piston.pdf>

Hatchery-wild salmon interactions, issues relating to escapement quantification

Hatchery salmon in samples can be recognized because virtually 100% of hatchery pink and chum salmon production in PWS and SEAK has been batch-marked (thermal marks on otoliths). One of the issues related to straying of hatchery salmon is that it maybe necessary to account for the excess hatchery strays in wild salmon streams to arrow for correct quantification of escapements without being confounded by hatchery strays inflating escapement values.

The currently ongoing large scale multi generation hatchery research project headed by the Prince William Sound Science Center focuses two of its three key objectives at 1) further document the degree to which hatchery pink and chum salmon straying is occurring in PWS and SEAK and 2) assess the range of interannual variability in the straying rates. The project is currently ongoing following the planned timelines and a report of the 2012 activites has been posted at the ADFG website, also available here [Interaction of Wild and Hatchery Pink and Chum Salmon in Prince William Sound and Southeast Alaska, Annual Report 2012](#) . Results for this portion of the study will be available in 2016.

In support of this issue, a recent study on stray rates carried out in Southeast Alaska by Piston and Heintl (2012b) reports that modification of summer chum salmon escapement indices to account for the proportion of hatchery strays observed in Northern Southeast Inside over recent years would result in little or no change to current escapement goals due to the method used to establish goals.

Alaska Statewide

Fishery Dependant data, catch data

The Alaska all-species salmon harvest for 2012 totaled 127.1 million, which was about 5.0 million less than the preseason forecast of 132.1 million. This combined harvest was composed of 349,000 Chinook, 35.4 million sockeye, 3.1 million coho, 68.0 million pink, and 20.2 million chum salmon.

Table 5. Preliminary 2012 Alaska Commercial salmon harvests, by fishing area and species, in thousand of fish.

Fishing Area	Species					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Southeast Region Total	282 ^a	947	2,084	21,288	12,372	36,974
Prince William Sound	12	3,690	209	27,234	3,818	34,963
Upper Cook Inlet	3	3,134	108	468	270	3,982
Lower Cook Inlet	0	187	0	256	55	499
Bristol Bay	17	20,557	110	910	666	22,261
Central Region Total	32	27,567	428	28,869	4,809	61,704
Kodiak Area	15	2,231	208	16,873	866	20,194
Chignik	4	1,800	33	138	171	2,146
South Peninsula and Aleutians	8	2,000	87	650	612	3,358
North Peninsula	1	764	37	1	284	1,088
Westward Region Total	27	6,796	366	17,662	1,934	26,785
Arctic-Yukon-Kuskokwim Region Total	8	91	255	205	1,051	1,611
Total Alaska	349	35,402	3,133	68,025	20,166	127,074

Note: Missing data indicates no harvest, and zeros indicate harvest activity but <1,000.

Note: Columns may not total exactly due to rounding.

^a Total commercial harvest of Chinook salmon for the October 1, 2011–September 30, 2012, catch accounting period.

Table 6. Preliminary 2012 Alaska Commercial salmon harvests, by fishing area and species, in thousands of pounds.

Fishing Area	Species					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Southeast Region Total	3,653	5,906	13,339	75,393	112,421	210,711
Prince William Sound	255	24,785	1,683	107,187	27,188	161,098
Upper Cook Inlet	43	21,339	644	1,775	2,153	25,954
Lower Cook Inlet	1	928	1	815	472	2,217
Bristol Bay	237	117,833	577	2,849	4,465	125,961
Central Region Total	537	164,885	2,905	112,626	34,277	315,230
Kodiak Area	109	12,402	1,451	60,417	6,824	81,202
Chignik	50	12,266	226	452	1,535	14,529
South Peninsula and Aleutians	121	11,869	523	2,014	610	15,138
North Peninsula	17	4,405	255	3	2,132	6,814
Westward Region Total	298	40,942	2,455	62,887	11,101	117,683
Arctic-Yukon-Kuskokwim Region Total	125	617	1,578	429	6,987	9,737
Total Alaska	4,613	212,350	20,277	251,335	164,786	653,361

Note: Missing data indicates no harvest, and zeros indicate harvest activity but <1,000.

Note: Columns may not total exactly due to rounding.

^a Total commercial harvest of Chinook salmon for the October 1, 2011–September 30, 2012, catch accounting period.

Salmon catches by region

Southeast Alaska and Yakutat Region

Table 7. Preliminary 2012 Southeast Region Commercial salmon harvests, by fishing area and species, in thousands of fish.

Fishery	Chinook ^a	Sockeye	Coho	Pink	Chum	Total ^{b, c}
Purse Seine						
Southern Purse Seine Traditional	5	144	229	17,194	1,921	19,493
Northern Purse Seine Traditional	0	16	7	1,688	214	1,926
Hatchery Terminal	17	11	39	291	2,699	3,057
Total Purse Seine	22	170	275	19,173	4,835	24,475
Drift Gillnet						
Tree Point	1	62	62	204	314	644
Prince of Wales	2	45	121	130	104	403
Stikine	8	22	20	16	241	307
Taku-Snettisham	1	126	24	192	566	909
Lynn Canal	3	207	23	293	1,352	1,878
Drift Gillnet Hatchery Terminal	11	36	15	104	940	1,106
Total Drift Gillnet	26	498	265	939	3,518	5,246
Set Gillnet (Yakutat)	1	125	99	27	2	254
Troll						
Hand Troll						
Traditional	9	0	81	11	6	108
Hatchery Terminal	0		0	0	1	1
Spring Areas	4	0	1	0	1	5
Total Hand Troll	13	0	82	11	8	114
Power Troll^d						
Traditional	174	3	1,115	149	385	1,826
Hatchery Terminal	1	0	1	6	60	67
Spring Areas	21	0	3	3	23	50
Total Power Troll	196	3	1,119	158	468	1,944
Total Troll	209	3	1,201	169	476	2,058
Annette Island Reservation						
Seine	0	5	5	499	127	636
Drift Gillnet	1	17	38	309	341	706
Troll	0		0	0		0
Hand Troll	0		0	0		0
Power Troll						
Trap						
Total Annette Island Reservation	2	22	42	808	468	1,342
Hatchery Cost Recovery	20	126	200	137	3,055	3,537
Miscellaneous^e	2	3	2	36	18	61
Southeast Region Total	282	947	2,084	21,288	12,372	36,974

^a Chinook salmon adults and jacks are totaled.

^b Missing data indicates no harvest, and zeros indicate harvest activity but <500.

^c Columns may not total exactly due to rounding error.

^d Catch accounting period for the 2012 Chinook salmon season goes from October 1, 2011, to September 30, 2012.

^e Includes salmon that were confiscated or caught in sport fish derbies or commercial test fisheries and sold.

Central Region

Table 8. Preliminary 2012 Central Region Commercial salmon harvests, by fishing area and species, in thousands of fish.

Fishing Area	Species					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Purse Seine						
Eastern District	0	12	8	10,594	102	10,716
Northern Dist.	0	1	1	3,677	2	3,680
Coghill Dist.	0	53	3	2,312	199	2,567
Northwestern Dist.		0	0	87	0	87
Southwestern Dist.	0	85	10	5,722	165	5,982
Montague Dist.		0	0	187	0	188
Southeastern Dist.	0	5	0	225	36	266
Unakwik Dist.		0		0	0	1
Drift Gillnet						
Bering River District	0		46	0		46
Copper River Dist.	12	1,867	130	6	27	2,042
Coghill Dist.	0	383	8	1,126	2,257	3,774
Eshamy Dist.	0	988	0	89	255	1,332
Montague Dist.	0	0	0	14	325	339
Unakwik Dist.		1		0	0	1
Set Gillnet						
Eshamy Dist.	0	295	0	17	24	336
Hatchery ^a	0	1	2	3,177	425	3,606
Prince William Sound Total	12	3,690	209	27,234	3,818	34,963
Southern District	0	48	0	187	1	236
Kamishak District		55		0	2	58
Outer District	0	0	0	69	51	121
Eastern District		84		0	0	84
Lower Cook Inlet Total	0	187	0	256	55	499
Central District	1	3,111	95	464	267	3,939
Northern District	1	23	13	4	2	43
Upper Cook Inlet Total	3	3,134	108	468	270	3,982
Naknek-Kvichak District	1	9,992	0	4	123	10,120
Nushagak District	12	2,702	93	877	268	3,952
Egegik District	0	4,890	1	0	38	4,929
Ugashik District	0	2,347			30	2,377
Togiak District	5	626	16	29	207	883
Bristol Bay Total	17	20,557	110	910	666	22,261
Central Region Total	32	27,567	428	28,869	4,809	61,704

Note: Missing data indicates no harvest and zeros indicate harvest activity but <1,000.

Note: Columns may not total exactly due to rounding.

^a Hatchery sales for operating expenses and broodstock harvests.

Arctic-Yukon-Kuskokwim Region**Table 9.** Preliminary 2012 Arctic-Yukon-Kuskokwim Commercial salmon harvests, by fishing area and species, in thousands of fish.

Fishing Area	Species					Total ^a
	Chinook	Sockeye	Coho	Pink	Chum	
Kuskokwim River	0	3	86		65	154
Kuskokwim Bay	8	88	57		86	239
Kuskokwim Area Total	8	91	143		151	393
Lower Yukon River			69		477	546
Upper Yukon River			6		132	138
Yukon River Total			75		609	684
Norton Sound		0	37	205	63	305
Kotzebue Sound					228	228
Arctic-Yukon-Kuskokwim Region Total	8	91	255	205	1,051	1,611

Note: Missing data indicates no harvest and zeros indicate harvest activity but <1,000.

^a Columns and rows may not total exactly due to rounding error.

Westward Region**Table 10.** Preliminary 2012 Westward Region Commercial salmon harvests, by fishing area and species, in thousands of fish.

Fishing Area	Species					Total ^a
	Chinook	Sockeye	Coho	Pink	Chum	
Kodiak	15	2,231	208	16,873	866	20,194
Chignik	4	1,800	33	138	171	2,146
South Peninsula and Aleutians Islands	8	2,000	87	650	612	3,358 ^b
North Peninsula	1	764	37	1	284	1,088 ^b
Alaska Peninsula Total	9	2,765	124	651	896	4,446
Westward Region Total	27	6,796	366	17,662	1,934	26,785

^a Columns and rows may not total exactly due to rounding error.

^b Catches includes test fishery catch.

<http://www.adfg.alaska.gov/FedAidPDFs/SP13-03.pdf>

Anadromous Water Catalogue

The **Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes** and its associated Atlas (the Catalog and Atlas, respectively) currently contain over 17,000 streams, rivers or lakes around the state which have been specified as being important for the spawning, rearing or migration of anadromous fish. Based upon thorough surveys of a few drainages it is believed that this number represents less than 50% of the streams, rivers and lakes actually used by anadromous species. It is estimated that at least an additional 20,000 or more anadromous water bodies have not been identified or specified under AS 16.05.871(a).

The Catalog and Atlas are important because they specify which streams, rivers and lakes are

important to anadromous fish species and therefore afforded protection under AS 16.05.871. The Catalog is a numerically-ordered list of the water bodies with documented use by anadromous fish for these purposes. The Atlas shows cartographically the location, name and number of these specified water bodies, the anadromous fish species using these water bodies, and the fish life history phases for which the water bodies are used (to the extent known). Water bodies that are not "specified" within the Catalog and Atlas are not afforded that protection. Protection of these specified water bodies is addressed by other sections of AS 16.05.871, which requires persons or governmental agencies to submit plans and specifications to ADFG and receive written approval in the form of a Fish Habitat Permit prior to beginning the proposed use, construction or activity that would take place in specified water bodies. More detailed information about AS 16.05.871, the types of activities requiring permits, and permit application procedures. To be protected under AS 16.05.871, water bodies must be documented as supporting some life function of an anadromous fish species (salmon, trout, char, whitefish, sturgeon, etc.) Anadromous fish must have been seen or collected and identified by a qualified observer. Most nominations come from Department of Fish and Game fisheries biologists. Others are received from private individuals, companies and biologists from other state and federal agencies.

Format

The Atlas and Catalog are divided into six volumes corresponding to Alaska's six fish and game resource management regions (Arctic, Interior, Western, Southwestern, Southcentral, Southeastern) established in 1982 by the Joint Boards of Fisheries and Game. The Catalog is a numerical listing of the water bodies documented as being used by anadromous fish. Also listed are the U.S. Geological Survey (USGS) quadrangle (quad) map, latitude, longitude, anadromous fish documented in the water body and a legal description for the mouth and upper known extent of anadromous fish use for each specified water body.

Limitations

Location information (latitude/longitudes, legal descriptions) and graphic representations used in the Atlas and Catalog are primarily derived from USGS quad maps, from field observations, and in some cases from aerial photos. ADFG use the most recent editions of these quad maps, when possible, to depict as accurately as possible the locations of water bodies found in the Atlas and Catalog. The intent is to avoid any confusion when referring to a specific water body. In some parts of Alaska, however, channel and coastline configurations have changed since the relevant USGS quad map was published, making it not entirely accurate for on-the-ground use. Locations listed in the catalog should be compared to the water body locations depicted on Atlas maps, not to field-surveyed or photo-extracted locations.

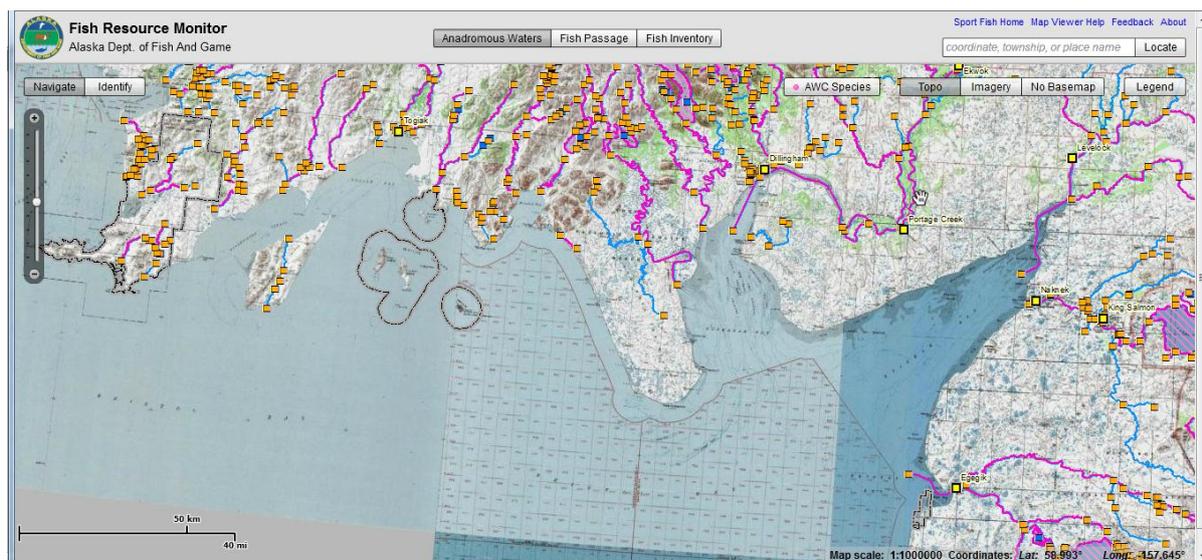
In some instances, polygons are used to specify areas containing a number of water bodies supporting anadromous fish that are impossible to depict legibly and accurately on 1:63,360-scale maps. Generally used by juvenile anadromous fish for rearing, water bodies in these polygons are highly productive and are considered important for anadromous fishes.

Fisheries surveys are important tools protecting anadromous fish habitat, and for managing sport, personal use, subsistence and commercial fisheries. Data are collected by various methods including aircraft, boat, and foot. Due to timing, water clarity, temperature, survey method or other factors, a survey for a particular species may fail to gather complete life-phase information, or observe juvenile fish, non-targeted anadromous fish species, or the actual upper limit of anadromous fish use. Therefore, the upper points of stream reaches listed in the Catalog and shown in the Atlas usually reflect the extent of fish surveys or known anadromous fish use in a particular water body rather than the actual limits of anadromous fish occurrence or of habitat use.

In addition, only a limited number of the water bodies in Alaska have actually been surveyed. Virtually all coastal water bodies in the state provide important habitat for anadromous fish, as do many unsurveyed tributaries to known anadromous fish-bearing waterbodies. Anadromous fish often rear in small tributaries, flood channels, intermittent streams, and beaver ponds. Due to the remote location, small size, or ephemeral nature of these systems, most have not been surveyed and are not included in the Catalog or Atlas.

Snapshot of the Atlas, Northern Bristol Bay streams with recorded presence, rearing and spawning of sockeye salmon (violet).

<http://extra.sf.adfg.state.ak.us/FishResourceMonitor/?mode=awc>



Update Procedures

Procedures are in place, which provide for regular updating of the AWC. Water bodies, or particular stream reaches, can be added or deleted and the upper range of anadromous water bodies changed as more current surveys document the presence or absence of anadromous fish. Anyone can submit a proposal for additions or changes to the AWC. However, proposals from other than ADFG staff may be subject to field verification prior to approval by ADFG.

The Catalog indicates that the extent of surveyed, and harvested salmon throughout the State is likely significant and that not all salmon in Alaska is subject to fishery harvest. The GIS Atlas can be found at the following link: <http://extra.sf.adfg.state.ak.us/FishResourceMonitor/?mode=awc>

Purpose and use of the Catalog (http://www.adfg.alaska.gov/static-sf/AWC/PDFs/awc_pn_intro.pdf).

Summary

The approaches taken to monitor the abundance of salmon in spawning systems in Alaska meets the scientific standards required for fisheries management. ADFG has continued to expand the use of higher quality monitoring tools beyond the less reliable visual survey methods (foot and aerial surveys). These include fish counting weirs, counting towers, sonar (e.g. DIDSON), test fishing and fish wheels. Although there are differences in the reliability of the escapement enumeration methods depending on the region and species, the assessment tools are generally well designed to

account for varying geographical and physical conditions, the intensity of harvest impact and finite budgets. The new multi-generational hatchery salmon research program aims at providing a better account of hatchery salmon strays proportion in wild salmon streams to improve escapement enumeration practices. In conclusion, Clause 4 is effectively supported in the approaches to salmon escapement monitoring, the collection of fishery dependent catch and effort information and the laws and policies governing those processes.

5. There shall be regular stock assessment activities appropriate for the fishery, its range, the species biology and the ecosystem, undertaken in accordance with acknowledged scientific standards to support its optimum utilization.

**FAO CCRF
7.2.1/12.2/12.3/12.5/12.6/12.7/12.17
FAO Eco 29-29.3**

Evidence adequacy rating:

High

Medium

Low

Rating determination

Stock assessment activities undertaken in Alaska represent a wide breadth of approaches in the provision of science-based advice in support of salmon resource management. The depth of the stock assessment toolkit in the state reflects a high scientific standard in support of optimal resource use and rivals that of any other agency in the Pacific Rim. Provision of advice for salmon fisheries management is not without its challenges. The sheer magnitude and diversity of salmon spawning population spread over the vast landscape of a State that is over 500,000 square miles of land mass and nearly 7000 miles of coastline is challenging enough, let alone the challenge of managing fisheries with 300 individual escapement goals. One of the greatest research challenges in Pacific salmon management throughout the north Pacific has been the identification of individual stocks in mixed-stock fisheries. The WASSIP genetic study of chum and sockeye has perhaps been the most intensive research program in that regard undertaken to quantify the accuracy and precision of stock-specific catch and harvest rate estimates. The governance structure for salmon management in the State and its policies that requires a 3-year cycle of stock assessment review reflects a high standard and commitment of ADFG staff and operational funding in support of sustainable resource management. Clause 5 is strongly supported by evidence of the policies and effective salmon stock assessment activities routinely undertaken in Alaska.

General framework for stock assessment activities for salmon in Alaska.

Currently, there are 300 active salmon stock escapement goals throughout the state of Alaska (reference the 2013 ADFG Pacific salmon escapement goal summary). The number of goals in 2012 was 287. Escapement goals are derived using a variety of quantitative techniques. The increase of escapement goals from 2011 to 2012 is mainly due to the development of specific district goals for Prince William Sound pink salmon. The development of science-based escapement goals is founded in the sustained yield principle highlighted in the Alaska Constitution (Article VIII, section 4) and in state statute (AS 16.05.020). Several policies in Alaska Administrative Code also provide guidance for establishing escapement goals including the policy for the management of sustainable salmon fisheries (SSFP: 5AAC 39.222), the policy for statewide salmon escapement goals (5 AAC 39.223) and the policy for the management of mixed stock fisheries (5 AAC 39.220). These policies provide detailed definitions of specific escapement goal types, outline the responsibilities of the ADFG and the BOF in establishing goals, and provide general direction for development and application of escapement goals.

The policies call for review of salmon escapement goals every 3 years in concert with the regulatory cycle for each management area, and provide process and criteria to be followed. The SSFP defines 3 types of escapement goals that can be established by the department. These are defined to be biological or sustainable escapement goals or sustainable escapement threshold as follows:

Biological Escapement Goal (BEG) is defined as an escapement range that provides the greatest potential for maximum sustained yield. A BEG will be the primary management objective for the

escapement unless an optimal escapement or in-river run goal has been adopted. The BEG will be developed from the best available biological information and should be scientifically defensible on the basis of available biological information. A 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.

Sustainable Escapement Goal (SEG) is defined as a level of escapement, indicated by an index or a range of escapement estimates that is known to have provided for sustained yield over a 5 to 10 year period. A SEG is used in situations where a BEG cannot be estimated due to the absence of a stock-specific catch estimate. The SEG is the primary management objective for the escapement, unless an optimal escapement or in-river run goal has been adopted by the board, and will be developed from the best available biological information. An SEG will be determined by the department and will be stated as a range that takes into account data uncertainty. The department will seek to maintain escapements within the bounds of the SEG.

Sustained Escapement Threshold (SET) is defined as a threshold level of escapement, below which the ability of the salmon stock to sustain itself is jeopardized. In practice, an 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. An SET is established by the department, in consultation with the board, as needed, for salmon stocks of management or conservation concern.

Methods for escapement goal development, evaluation

A variety of methods are used to develop escapement goals. A brief description of each are summarized below. The most commonly used methods are listed first, followed by the less common methods.

Percentile Method: A method for establishing sustainable escapement goals (SEG) developed by Bue and Hasbrouck (Unpublished). Contrast of the observed annual escapements (largest escapement divided by smallest escapement) and exploitation rate of the stock are used to select percentiles of observed escapements for estimating lower and upper bounds of the escapement goal.

Spawner-Recruit Analysis (SRA): Analysis of the relationship between escapement (number of spawners) and subsequent production of recruits (i.e. adults) in the next generation. There are several SRA models, but the Ricker production model (Ricker 1954) is almost exclusively used for salmon populations in Alaska.

Risk Analysis: Risks of management error, unneeded management action or mistaken inaction, in future years are estimated based on a precautionary reference point established using past observations of escapement (Bernard et al. 2009). This method is primarily used to guide establishment of a lower-bound SEG for non-targeted stocks of salmon.

Yield Analysis: Graphical or tabular examination of yields produced from observed escapement indices from which the escapement range with the greatest yields is identified (Hilborn and Walters 1992).

Theoretical Spawner-Recruit Analysis (Theoretical SRA): Used in situations where there are few or no stock specific harvest estimates and/or age data. Information from nearby stocks, or

generalizations about the species, are used in a spawner-recruit production model to estimate the number of spawners needed to achieve maximum sustained yield (e.g., Clark 2005).

Empirical Observation: Goal development methods classified as “Empirical Observation” generally are ad hoc methods for stocks with limited or sparse data. Goals are based on observed escapements over time and may be calculated as the average escapement or the value of a low escapement for which there is evidence that the stock is able to recover (e.g., Norton Sound pink salmon escapement goals, ADFG 2004).

Zooplankton Model: This model estimates the number of sockeye salmon *Oncorhynchus nerka* smolts of a threshold or optimal size that a lake can support based upon measures of zooplankton biomass and surface area of the lake (Koenings and Kyle 1997). Adult production is then estimated from predicted smolt production by applying marine survival rates for a range of smolt sizes.

Spawning Habitat Model: Estimates of spawning capacity or number of spawners that produce maximum sustained yield are based on relationship with watershed area, available spawning habitat in a drainage, or stream length. Spawning habitat models have been developed for sockeye salmon (Burgner et al. 1969), coho salmon *O. kisutch* (Bradford et al. 1999; Bradford et al. 1997) and Chinook salmon *O. tshawytscha* (Parken et al. 2004).

Euphotic Volume (EV) Model: Measurement of the volume of a lake where enough light penetrates to support primary production (i.e. euphotic volume) is used to estimate sockeye salmon smolt biomass (Koenings and Burkett 1987) from which adult escapement is then estimated using marine survival rates.

Lake Surface Area: Similar to spawning habitat models, the relationship between the lake surface area and escapement are used to estimate adult sockeye salmon production (Honnold et al. 1996; Nelson et al. 2006).

Conditional Sustained Yield Analysis: Observed escapement indices and harvest are used to estimate if, on average, surplus production (yield) results from a particular goal range (Nelson et al. 2005). Estimated expected yields are conditioned on extreme values of measurement error in the escapement indices.

Brood Interaction Simulation Model: This model simulates production using a spawner–recruit relationship that modifies the simulated production for the year of return using an age-structured sub-model, and estimates resulting catches and escapements under user-specified harvest strategies (Carlson et al. 1999). This is a hybrid of a theoretical SRA and yield analysis that has only been used to develop the escapement goal for Kenai River sockeye salmon.

The particular method for establishing goals is depends on the specific life history of the species and stock, fishery structure and on the data quality available including the quality of escapement, harvest, age composition and habitat/ecological inputs. The fundamental approach for establishing biologically-based, management reference points of Pacific salmon (e.g. S_{MSY} , U_{MSY}) is based on the concept of stock and recruitment involving a stock-recruitment analysis (SRA) of escapement and brood-year returns-at-age data. Variants of the classical Ricker model now used routinely in data rich situations to capture parameter uncertainty include Bayesian state-space models with time-varying productivity. See Fleischman, S.J. and McKinley, T.R. 2013 for an example of this recently applied to Late-run Kenai River Chinook salmon reviewed by the BOF in 2013.

The quality of escapement and stock-specific harvest data is lacking in most salmon stocks

throughout the Pacific Rim and this precludes the use of stock-specific SRA models in those cases. This is generally true for most exploited salmon stocks in Alaska with some notable exceptions (e.g. Bristol Bay sockeye). Opportunities may exist within the Bayesian SR framework to “borrow” key parameter estimates from nearby stocks assuming they are representative. This approach is identified as a Theoretical SRA by ADFG in the preceding list.

The list of escapement goal methods provided by ADFG includes a variety of juvenile and habitat models that, depending on the species/stock, allows the use of habitat (e.g. euphotic volume, spawning/rearing habitat) and life history (e.g. marine survival) models information to estimate key management parameters. These methods are also used in other jurisdictions in the Pacific Rim (Bodtker and Peterman 2007; Bradford et al. 1999; Bradford et al. 1997; Parken et al. 2004; Shortreed et al. 2000).

Ultimately, science advice for sustainable fisheries management depends, to a large extent, on the quality of escapement data. It is the single most important information source for developing management reference points and assessing management performance of exploited salmon stocks relative to the reference points. ADFG employs a wide variety of methods to estimate spawning escapement including weirs, towers, hydroacoustics, mark-recapture and visual aerial, foot and/or boat surveys. Typically, the most reliable escapement estimates are based on complete census counts (e.g. weirs, towers, hydroacoustics), followed by accurate and precise estimates using mark-recapture experiments or multiple visual survey methods. The least reliable escapement estimates are from visual escapement estimates or indices from single foot/aerial surveys

Coupled with estimates of harvest and return age data, where they exist, ADFG defines a range of data quality as follows:

Rating	Description	Type of goal supported
Excellent	Good accuracy and precision of escapement estimates by weir or hydroacoustics. Age estimates available in sufficiently long time series. and escapement and return estimates in sufficient time series to construct a brood table and estimate MSY	BEG
Good	Fair to good accuracy and precision of estimates of escapement from mark-recapture experiments or multiple foot/aerial surveys. Escapement and age estimates available, but may have gaps. Time series may or may not be sufficient to allow construction of brood table.	BEG or SEG
Fair	Fair to good accuracy, but precision estimates missing or inadequate. Escapement estimates or indices available. Age estimates missing or incomplete (e.g., not available from stock-specific harvest). Time series of escapement data may or may not be sufficient to allow estimate of Sustainable Escapement Goal.	SEG or none
Poor	Fair accuracy in escapement count or index data (e.g., single foot/aerial survey); no harvest or age data; time series of escapement data may result in high uncertainty in estimates of Sustainable Escapement Goal.	SEG or none

Of the 300 statewide escapement monitoring programs conducted in 2012, 60% were based on visual survey methods using multiple or peak/single survey methods. Of those, 72% were reportedly done using the less reliable single/peak survey methods. Visual surveys are known to underestimate total escapement and the harvest rate when estimated directly as the catch divided by the sum of escapement plus catch. Given the vast, isolated landscape of the salmon spawning habitat,

challenging environmental conditions and the large number of salmon populations, most escapement monitoring in Alaska is conducted using aerial surveys.

There are regional and species differences in the type of escapement surveys conducted. In the Central and Westward regions a higher proportion were done using visual survey methods (71% and 60% respectively). The Central Region had the highest number of surveyed systems (117) and the lowest percentage (29%) of surveys done using more reliable fixed-site (weirs, towers, sonar) or mark-recapture methods. Statewide, most pink salmon surveys (88%) were based on visual boat, foot or aerial methods. Visual survey methods comprised 65% of the surveys for Chinook, 63% for coho, 58% for chum and 33% for sockeye.

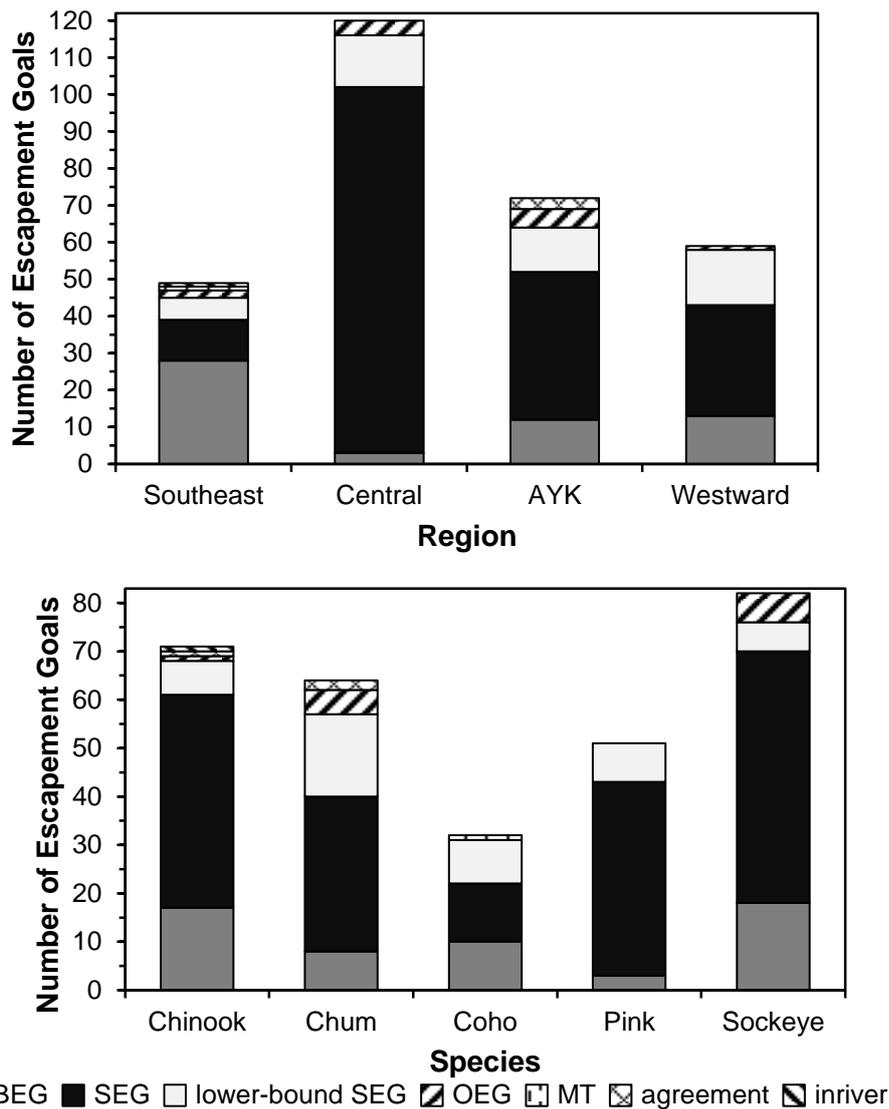


Figure 1. Statewide summary of the 300 escapement goals in effect during the 2012 spawning season for (upper) the four Division of Commercial Fisheries regions and (lower) by species. BEG is biological escapement goal, SEG is sustainable escapement goal, OEG is optimal escapement goal (set by the Alaska Board of Fisheries), MT is management target and agreement goals are established through international treaties.

From the Munro and Volk 2013 report "Summary of Pacific salmon escapement goals in Alaska with a review of escapements from 2004 to 2012" <http://www.adfg.alaska.gov/FedAidPDFs/FMS13-05.pdf> . Note some of the data in the report are considered preliminary and subject to change.

The quality of stock assessment data directly impacts the accuracy and precision of the escapement goal. The percentile method, noted above, was developed mainly for stocks without reliable stock-specific catch data. Most salmon stocks are not associated with reliable stock-specific catch estimates and therefore the percentile method is the most common method for setting escapement goals. In 2012, 49% of the statewide escapement goals were derived as SEGs from the percentile method. Of the total number of percentile goals, nearly half were derived from typically less reliable peak/single visual survey methods. The remaining statewide surveys (51%) were based on more accurate approaches using weir, tower, sonar, mark-recapture or multiple visual survey methodologies. Those survey methods are typically associated with higher quality methods for deriving escapement goals, including SRA.

Changes in the number of escapement goals between 2012 and 2013 stem from recent reviews of Copper and Bering rivers and Prince William Sound (PWS) salmon stocks (Fair et al. 2011). The all-districts even- and odd-year combined goals for pink salmon in PWS were discontinued in favour of 7 district- specific goals. PWS pink salmon are managed at the District level. The existing District management targets for PWS pink salmon were converted to SEG ranges based on the percentile approach. The previous all-district goal was based on a Ricker SRA and Morkov yield table. The SRA was deemed inappropriate because of the poor fit of the Ricker model to the data. Applying the percentile approach for PWS pinks decreased the lower bounds of the SEG range for each even- and odd-year district goals. The upper bound of the escapement goal range decreased as well in 7 of the 8 districts. The recommended escapement goal range of Coghill Lake, Bering River District and Upper Copper sockeye salmon expanded in 3 of the 5 sockeye systems based on Fair et al. (2011). A review of pink salmon in the Southeast Region in the 2011-12 cycle (Piston and Heintz, 2011) resulted in a change in the method used to establish the escapement goal from a BEG (SRA) to a SEG (percentile) for Situk River even- and odd-year returns. Based on that review, a decrease in the lower bound of the SEG (weir count to August 5) was adopted for Sikut River pink salmon. Other changes reported in the recent AK salmon escapement goals summary (ADFG, July 2013) include a change from the percentile method to a SRA for Russian River (Central Region) sockeye, the addition of a Delight Lake sockeye (Central Region) SEG (percentile) and a McLees Lake sockeye (Westward Region) SEG (percentile) and a change in goal range and type from an empirical observation to a SRA for Buskin Lake sockeye (Westward Region).

Aggregate escapement goals, accounting for small stock/population components

In Alaska there are hundreds of individual salmon spawning populations distributed over a vast landscape from Southeast Alaska to the Arctic. The challenge is to develop escapement monitoring programs within a finite budget that are representative of the productivity and abundance of exploited populations. In reality, the data collected range from presence/absence information to the full suite of stock assessment data including annual estimates of absolute abundance at various life stages (adult spawning abundance, size-age composition, stock-specific harvest, smolt production). Data from many stocks represent aggregates of "sub-stocks" that individually may have different productivity and abundance trends as a result of varying ecological and genetic properties. Some stocks are represented in the data by indicator or index spawning populations. The use of escapement indicator systems is a common approach used throughout the Pacific Rim for stock assessment of salmon. In this respect, the notion that escapement and coded-wire-tagged (CWT) indicator stocks are broadly representative of neighboring unindexed stocks is the fundamental premise of the Pacific Salmon Commission's (PSC) indicator stock program for abundance-based management of Chinook and coho stocks intercepted by Parties of the Canada-US Salmon Treaty (http://www.psc.org/publications_psctreaty.htm).

The assumption is that the particular indicator system represents the productivity and abundance typically of a larger or group on unindexed stocks. There are 13 stocks for which the escapement goals in the ADFG database are reportedly derived from the Theoretical SRA method. That approach, as defined above, “borrows” SR parameters from other systems where SR parameters are estimated directly from more data rich indicator stocks. The ADFG (2013) stock assessment and research plan for Alaska Chinook provides a comprehensive proposal for establishing rigorous stock assessment data for 12 Chinook indicator stocks throughout the State.

There are 11 Arctic-Yukon Koskokwim Region chum salmon spawning systems in the ADFG database (ADFG 2013) that report the escapement goal method as the proportion of an aggregate system. The escapement for the Chandalar and Sheenkek rivers are proportions of the aggregated tributaries of the Upper Yukon River tributaries for which the escapement goal range is based on an aggregate SRA. The goals for the Nome, Snake and Eldorado are proportions of the Norton Sound Sub-district 1 aggregate derived from a SRA for the stock aggregate. Similarly, the escapement goals for the Noatak, Upper Kobuk/Selby, Salmon, Tutuksuk and Squirrel rivers are based on the proportion of SRA goal for the Kotzebue Sound Aggregate. Currently, the catch of the individual stock components cannot be separated from the aggregates. As a result, the productivity and abundance of the individual component stocks cannot be estimated directly. In the future, genetic data such as from the Western Alaska Salmon Stock Identification Program summarized below could help distinguish the harvest of these individual stocks in mixed-stock fisheries. The outcome may improve precision in managing the component stocks based on their individual productivity and abundance levels.

WASSIP Program

ADFG announced the publication of results of the Western Alaska Salmon Stock Identification Program (WASSIP) in 2012. Results can be found in 9 reports on the ADFG website: <http://www.adfg.alaska.gov/index.cfm?adfg=wassip.tds>. This follows 8 years of a stakeholder-driven program with scientists to address long-standing questions about harvest patterns of commercial and subsistence fisheries in western Alaska. The process involved 11 signatories representing fishing, Alaska Native and government interests that served as an Advisory Panel along with a 4-member Technical Committee.

Most of the catch of sockeye and chum salmon comes from terminal fisheries near spawning locations but mixed-stock fisheries do occur in non-terminal (non-local) areas. Unless non-local fisheries are accounted for in the total harvest, estimates of stock-specific catch, harvest rates, run size and productivity will be biased. Uncertainty about the magnitude, frequency, location and timing of non-local harvest was the motivation for the WASSIP study. WASSIP was designed to use genetic data in mixed-stock analysis (MSA) to reduce the uncertainty. MSA has been used effectively for estimating stock composition in mixed-stock fisheries throughout the Pacific Rim.

Estimates of stock composition in mixed-stock fisheries are derived by comparing genotypes of salmon of unknown origin with a baseline measured from salmon stocks of known origin that potentially contribute to the harvest. The baseline data for sockeye comprises populations ranging along a coastline of about 6,000 km and genetic markers using single nucleotide polymorphisms (SNPs). The current WASSIP baseline for sockeye is comprised of 39,205 fish, 294 populations and 96 SNPs. This represents 10,000 additional fish and twice the number of markers compared to the previously published baseline (2010). The current WASSIP baseline for chum is comprised of 32,817 fish, 310 populations and 96 SNPs and represents an increase in the number of populations and markers reported in previous studies.

More than 225,000 samples of sockeye and chum collected from Chignik to Kotzebue over a 3 year

period (2006-2008) were analyzed to determine stock-specific composition, catch and harvest rates of sockeye and chum salmon. In all, the study represents a very comprehensive program of sampling and analytical effort that has effectively reduced uncertainty in stock composition, harvest and harvest rates of sockeye and chum salmon supporting the management regulatory process in western Alaska.

From a stock assessment perspective, the results of the WASSIP are linked to escapement monitoring initiatives for purposes of estimating stock-specific harvest rates, run size and productivity. Outputs of those estimates are key to conducting state-of-the-art stock-recruitment analysis and reducing uncertainty in stock-specific impacts of fishing and other human impacts on sockeye and chum stocks. Ultimately, more reliable estimates of key management reference points derived from the WASSIP will improve precision in science-based advice for fisheries management of sockeye and chum in western Alaska.

Issues

The published WASSIP reports acknowledge and account, to the extent possible, for uncertainty not only in stock composition estimates, as is regularly done in MSA, but also uncertainty in commercial and subsistence harvest numbers, and in escapement estimates. Escapement monitoring based on aerial surveys are biased low and generally less reliable than estimates based on weirs, towers, DIDSON or mark-recapture techniques. For most stocks of sockeye and chum in the WASSIP study, estimates of escapement are based on aerial surveys. The WASSIP reports acknowledge that the point estimates of harvest rates are over-estimates in cases where aerial surveys are used given that estimates of harvest rates are calculated as the catch divided by the sum of catch plus escapement.

Further genetic research towards mixed-stock fisheries management

Copper River Area

Researchers are working on developing a genetics database for Chinook and sockeye salmon within the Copper River watershed. A project was carried out to delineate major geographic and temporal stocks of Chinook salmon (*Oncorhynchus tshawytscha*) within the Copper River, investigate run timing within the Copper River, and characterize the timing and relative magnitude of Copper River stocks in the fisheries of the Copper River District. The system exhibits significant genetic divergence both within and among its major drainages. With some exceptions, populations adhere to an isolation-by-distance model in that populations closest geographically are also closest genetically.

The broad groups include a heterogeneous collection of populations in the Upper Copper River, a homogeneous group from the Gulkana River drainage, and a diverse set of Lower Copper River glacial lake populations from the Tazlina, Klutina, Tonsina, and Chitina drainages. Within the Lower Copper River group, 2 single collections were particularly divergent, Tebay River from the Chitina River drainage and Mendeltna Creek from the Tazlina River drainage. The inriver collections from Baird Canyon and collections from the marine fisheries consistently showed that the Upper Copper River stocks contributed early followed by the Gulkana River and Lower Copper River populations. Similar results were observed for the marine collections. The results also indicate that the marine fisheries are, to a great extent, targeting Chinook salmon bound for the Copper River.

Also another recent study identified four SNP loci from a panel of 42 as candidates for diversifying selection (referred to here as nonneutral SNPs) in sockeye salmon *O. nerka* from the Copper River and adjacent coastal drainages in south-central Alaska. In general, sockeye salmon populations from the Copper River and adjacent coastal drainages exhibited a pattern of genetic isolation-by-distance.

That is, along a continuum, populations were genetically more similar to nearby populations than to more distant populations.

Further, populations nearer to the coast (i.e. with a shorter upstream migration distance) generally exhibited greater within-population genetic diversity and lesser among-population diversity than populations spawning further inland. However, interesting exceptions to this general trend demonstrated the influences of historical demographic processes.

New research into sockeye salmon genetics may be formally included in the next review of escapement goals for this management area in 2014.

Seeb, L. W., N. A. DeCovich, A. W. Barclay, C. T. Smith, and W. D. Templin. 2009. Timing and origin of Chinook salmon stocks in the Copper River and adjacent ocean fisheries using DNA markers. Alaska Department of Fish and Game, Fishery Data Series No. 09-58, Anchorage.

Michael W. Ackerman, Christopher Habicht, Lisa W. Seeb. 2011. Single-Nucleotide Polymorphisms (SNPs) under Diversifying Selection Provide Increased Accuracy and Precision in Mixed-Stock Analyses of Sockeye Salmon from the Copper River, Alaska. Transactions of the American Fisheries Society. Vol. 140, Iss. 3.

Forecasts for the 2013 All Salmon Alaska Season

ADFG prepares forecast for salmon runs that affect major fisheries around the state as shown below.

Southeast	pink salmon
Prince William Sound	Wild chum, sockeye, and pink salmon
Copper River/ Copper River Delta	Chinook and sockeye salmon
Upper Cook Inlet	sockeye salmon
Lower Cook Inlet	pink salmon
Kodiak	
KMA	pink salmon
Spiridon Lake	sockeye salmon
Ayakulik River	sockeye salmon
Karluk Lake (Early and Late Runs)	sockeye salmon
Alitak District, Frazer and Upper Station	sockeye salmon
Chignik (Early and Late Runs)	sockeye salmon
Bristol Bay	sockeye salmon
Nushagak District	Chinook salmon
Alaska Peninsula	
South Alaska Peninsula	pink salmon
Bear River (late run)	sockeye salmon
Nelson River	sockeye salmon
Arctic-Yukon-Kuskokwim	
Yukon Area	fall chum salmon

Salmon runs to be forecasted are selected using several criteria, including economic importance, feasibility, compatibility with existing programs, and management needs. For the 2013 fishing year, forecast fisheries are as follows:

Table 11. Projections of 2013 Alaska commercial salmon harvests, by fishing areas and species, in thousands of fish.

Fishing Area	Species					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Southeast Alaska						
<i>Natural Production</i>		854	2,390	54,000	2,701	59,945
<i>Hatchery Production^a</i>					10,803	10,803
Southeast Region Total	^b	854 ^c	2,390 ^a	54,000	13,504	70,747
Prince William Sound						
<i>Natural Production</i>	15	1,380 ^d	222 ^e	4,751	312	6,680
<i>Hatchery Production^f</i>		1,379	198	33,603	2,925	38,106
Upper Cook Inlet	9 ^c	4,900	147 ^c	99 ^c	152 ^a	5,307
Lower Cook Inlet						
<i>Natural Production</i>	0	127 ^c	1	104	86 ^c	318
<i>Hatchery Production</i>		145 ^g		196		341
Bristol Bay	45	16,590	82	1 ^h	1,554 ^c	18,272
Central Region Total	69	24,521	650	38,755	5,029	69,024
Kodiak						
<i>Natural Production</i>	19 ^c	2,207 ⁱ	238 ^c	6,800 ^j	687 ^c	9,951
<i>Hatchery Production^k</i>		496 ^k	14	10,200	171	10,881
Chignik ^l	5	2,581	108	1,066	298	4,058
South Peninsula & Aleutians	6 ^c	1,837 ^c	176 ^c	6,792 ^m	978 ^c	9,790
North Alaska Peninsula	2 ^c	1,672 ⁿ	62 ^c	109 ^h	224 ^c	2,069
Westward Region Total	32	8,792	599	24,967	2,358	36,748
Arctic-Yukon-Kuskokwim Region Total	9	93	265	100	1,858	2,324
Statewide Total	110	34,260	3,904	117,822	22,748	178,844

Note: Columns and rows may not total exactly due to rounding.

^a Hatchery projections made by Southern Southeast Regional Aquaculture Association, Northern Southeast Regional Aquaculture Association, Douglas Island Pink and Chum, Armstrong-Keta, Inc., Kake Nonprofit Fisheries Corporation, and Metlakatla Indian Community less broodstock (500,000). Wild chum salmon catch estimated as 20% of total catch.

^b Southeast Chinook treaty forecast not available. The allowable catch of Chinook salmon in Southeast Alaska is determined by the Pacific Salmon Commission and the Commission has not published the quota for 2013. Release of the 2013 Chinook salmon quota for Southeast Alaska is expected in late March or early April.

^c Average harvest for the five-year, 2008–2012 period.

^d Includes harvest estimates for Coghill and Eshamy lakes, Unakwik District and Copper River sockeye salmon.

^e Five-year average harvest (2008–2012) in the Copper River and Bering River districts.

^f Hatchery projections made by Prince William Sound Aquaculture Corporation and Valdez Fisheries Development Association. Gulkana Hatchery projection made by ADF&G.

^g Includes common property plus cost recovery harvests.

^h Average previous five odd-year harvests, 2003–2011 period.

ⁱ Total Kodiak harvest of 2.207 million natural run sockeye salmon includes projected harvests from formally forecasted systems, projected Chignik harvest at Cape Igvak, and projected harvest from additional minor systems totaling 869,000 fish.

^j See formal pink salmon forecast.

^k Hatchery projections made by Kodiak Regional Aquaculture Association. Sockeye salmon hatchery projections include KRAA projections (125,000); enhanced Spiridon sockeye salmon run harvest forecast (371,000) was developed by ADF&G staff.

^l Chignik Chinook, coho, pink, and chum salmon harvests based on five-year (2008–2012) average harvests (postcooperative fishery); Chignik sockeye salmon based on a formal forecast with projected harvest at Igvak and Southeastern District Mainland excluded.

^m Based on South Peninsula formal forecast and the Aleutian Islands average previous three odd-year harvests, 2007–2011 period.

ⁿ Five-year average (2008–2012); sockeye salmon includes formal forecasts for Bear late run (172,000), Nelson stocks (227,000).

A variety of information is used to forecast salmon runs. In most cases the principal indicator of future abundance is the escapement magnitude of parental stocks. Other information that might have been considered includes spawning stock of distribution, outmigrating smolt numbers, returns

to date from sibling age classes of the projected return, and environmental conditions. A range of run possibilities are predicted for each forecasted fishery. In general, based on past experience, the actual run can be expected to fall within the range (between the lower and upper limits) less than half the time.

Catch projections based on quantitative forecasts of salmon runs generally reflect potential harvests, and are made for most of the major sockeye salmon fisheries and pink salmon fisheries in Southeast Alaska, Kodiak, PWS, and Alaska Peninsula. Forecast for large hatchery runs including pink, sockeye, and chum salmon runs to the SEAK, Kodiak and the PWS areas are provided by private non profit hatchery operators. For other fisheries, the catch projections are made based on recent catch levels and are reflective of recent levels of fishing effort, thus recent catch levels are reflective of both market conditions and recent levels of salmon runs. Harvest projections for these fisheries may not be indicative of potential harvest levels.

Salmon Species Projections

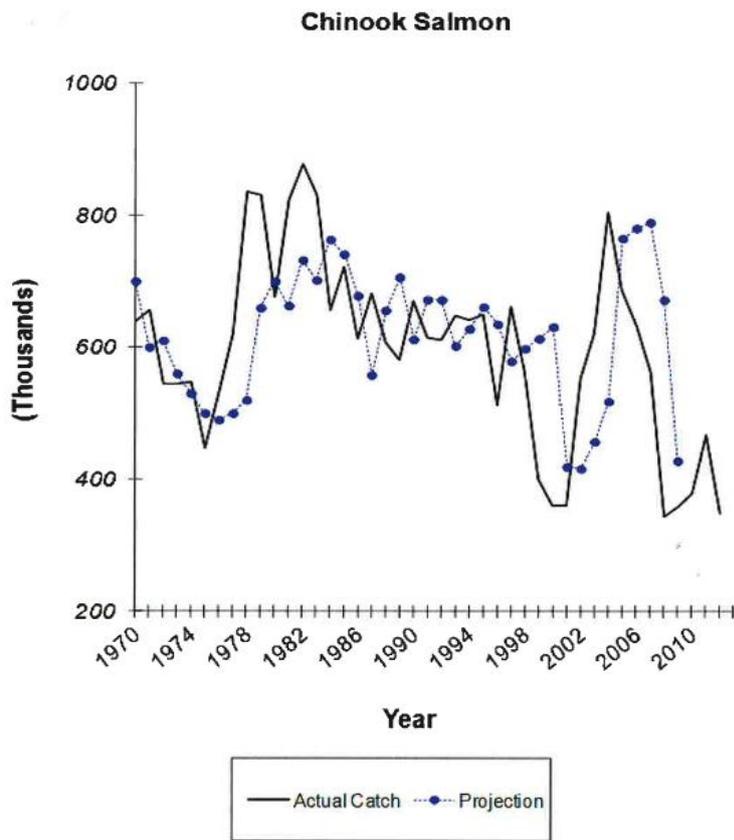


Figure 2. Relationship between actual catch and projected catch in thousands, for Alaska Chinook salmon fisheries from 1970 to 2012, 2011-2013 projection not available.

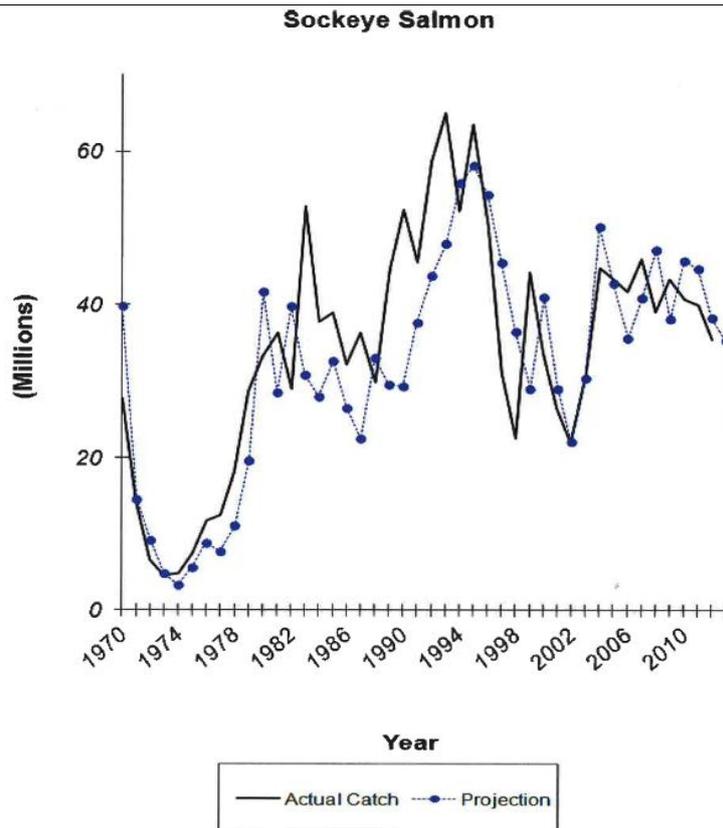


Figure 3. Relationship between actual catch (millions) and projected catch (millions), for Alaskan sockeye salmon fisheries from 1970 to 2012, with the 2013 projection.

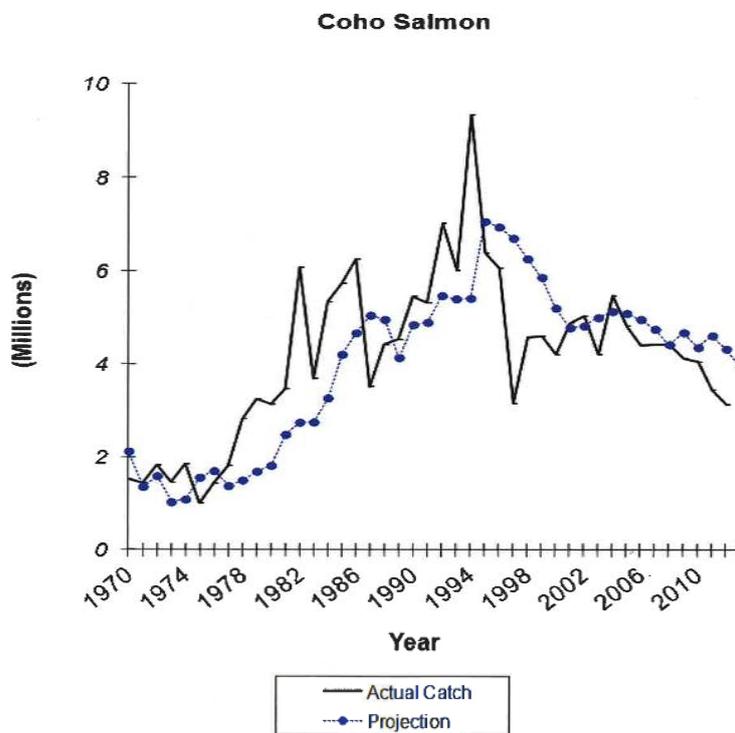


Figure 4. Relationship between actual catch (millions) and projected catch (millions), for Alaskan coho salmon fisheries from 1970 to 2012, with the 2013 projection.

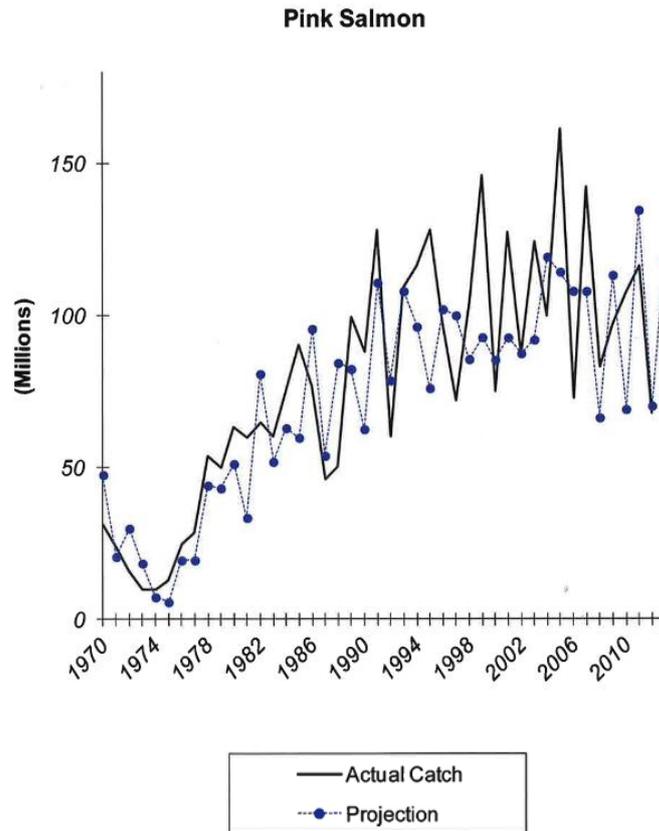


Figure 5. Relationship between actual catch (millions) and projected catch (millions), for Alaskan pink salmon fisheries from 1970 to 2012, with the 2013 projection.

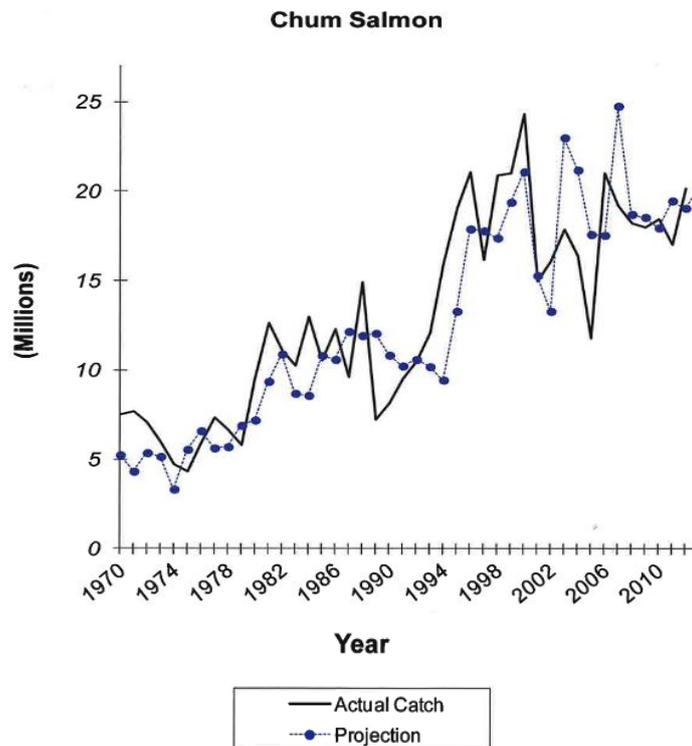


Figure 6. Relationship between actual catch (millions) and projected catch (millions), for Alaskan chum salmon fisheries from 1970 to 2012, with the 2013 projection.

<http://www.adfg.alaska.gov/FedAidPDFs/SP13-03.pdf>

Summary

Stock assessment activities undertaken in Alaska represent a wide breadth of approaches in the provision of science-based advice in support of salmon resource management. The depth of the stock assessment toolkit in the state reflects a high scientific standard in support of optimal resource use and rivals that of any other agency in the Pacific Rim. Provision of advice for salmon fisheries management is not without its challenges. The sheer magnitude and diversity of salmon spawning population spread over the vast landscape of a State that is over 500,000 square miles of land mass and nearly 7000 miles of coastline is challenging enough, let alone the challenge of managing fisheries with 300 individual escapement goals. One of the greatest research challenges in Pacific salmon management throughout the north Pacific has been the identification of individual stocks in mixed-stock fisheries. The WASSIP genetic study of chum and sockeye has perhaps been the most intensive research program in that regard undertaken to quantify the accuracy and precision of stock-specific catch and harvest rate estimates. The governance structure for salmon management in the State and its policies that requires a 3-year cycle of stock assessment review reflects a high standard and commitment of ADFG staff and operational funding in support of sustainable resource management. In conclusion, Clause 5 is strongly supported by evidence of the policies and effective salmon stock assessment activities routinely undertaken in Alaska.

C. The Precautionary Approach

6.	<p>The current state of the stock shall be defined in relation to reference points or relevant proxies or verifiable substitutes allowing for effective management objectives and targets. Remedial actions shall be available and taken where reference point or other suitable proxies are approached or exceeded.</p>	<p><i>FAO CCRF 7.5.2/7.5.3 Eco 29.2/29.2bis/30-30.2</i></p>
Evidence adequacy rating:		
<input checked="" type="checkbox"/> High	Medium	Low

Rating Determination

Escapement goals effectively represent reference points of the various Alaska salmon systems. There are currently 300 active salmon stock escapement goals throughout the state. These escapement goals cover mainly index systems but also individual streams. A variety of methods are used to develop escapement goals in Alaska. During the 2012-2013 Board of Fisheries cycle, reviews of the escapement goals were done for Bristol Bay salmon, Arctic-Yukon-Kuskokwim Region salmon and Alaska Peninsula and Aleutian Islands salmon in the Westward Region. An out-of-cycle assessment of Late-Run Chinook Salmon in the Kenai River was also reviewed. Where escapements chronically (4-5 years) fail to meet expectations for harvestable yield or spawning escapements, the department may recommend, and the board may adopt a stock of concern designation for those underperforming salmon stocks. Stock improvement following this designation is supported by data. A review of all the latest escapements (300) throughout Alaska indicates that the majority of escapement goals have recently been met, with exceptions for Chinook salmon statewide. In response to this Statewide decline in Chinook production, ADFG has been limiting and/or closing commercial fisheries to meet escapement goals and has initiated a \$30 million research projects aimed at elucidating Chinook stock dynamics and to improve stock assessment and overall management for the species.

Escapement goals supporting policy

Escapement goals effectively represent reference points of the various Alaska salmon systems. Currently, (reviewing the 2012 season) there are 300 active salmon stock escapement goals throughout the state. A variety of methods are used to develop escapement goals in Alaska. Reviews of the escapement goals were done for Bristol Bay salmon, Arctic-Yukon-Kuskokwim Region salmon and Alaska Peninsula and Aleutian Islands salmon in the Westward Region. An out-of-cycle assessment of Late-Run Chinook Salmon in the Kenai River was also reviewed. Where escapements chronically (4-5 years) fail to meet expectations for harvestable yield or spawning escapements, the department may recommend, and the board may adopt a stock of concern designation for those underperforming salmon stocks. During the 2011/2012 board meeting cycle, 1 new stock of concern (Swanson Lagoon sockeye) was recommended. The board also board recommended that Kvichak River sockeye stock of concern status be removed.

Escapement goals are based on a number of scientific evaluation methods, founded in the sustained yield principle highlighted in the State Constitution (Article VIII, section 4) and in state statute (AS 16.05.020). Several policies in Alaska Administrative Code also provide guidance for establishing escapement goals including the policy for the management of sustainable salmon fisheries (5AAC 39.222), the policy for statewide salmon escapement goals (5 AAC 39.223) and the policy for the management of mixed stock fisheries (5 AAC 39.220). These policies provide detailed definitions of specific escapement goal types, outline the responsibilities of the ADFG the BOF in establishing goals, and provide general direction for development and application of escapement goals in Alaska.

Escapement goal review

Escapement goals for the various regions are reviewed every 3 years by the Board of Fisheries. The Department has prepared and presented several stock status and escapement goal reviews for the 2013 cycle: 1) Bristol Bay salmon, 2) select Arctic-Yukon-Kuskokwim Region salmon and 3) Alaska Peninsula and

Aleutian Islands salmon. Additionally, an assessment of Late-Run Chinook Salmon in the Kenai River was also reviewed (<http://www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.meetinginfo>).

Bristol Bay

The ADFG interdivisional escapement goal review committee evaluated stock-recruitment data for sockeye salmon spawning in 10 river systems, Chinook salmon in 5 systems and chum salmon in the Nushagak River. The review also evaluated escapement goals for Nushagak River coho and pink salmon that were eliminated in 2006 (<http://www.adfg.alaska.gov/static/regulations/regprocess/fisheriesboard/pdfs/2012-2013/bristolbay/fms12-04.pdf>).

Since the last review in 2009 there have been significant changes to the escapement monitoring methods for the Nushagak River affecting goals for Chinook, chum and sockeye salmon. This involved a transition from the Bendix sonar to state-of-the-art DIDSON technology and the application of a correction factor to convert annual historical escapement data for these species to DIDSON equivalents. The correction factors were based on comparisons of Bendix and DIDSON counts at various times since 2002. The other significant development was an extensive run-reconstruction of historical Bristol Bay sockeye salmon brood tables using comprehensive genetic-based stock composition estimates derived since 2006 and older genetic estimates from selected scale DNA samples dating back to the early 1960s. The revision of historical brood tables had little effect on estimates of sockeye S_{MSY} . Most revised total recruits were similar to previous estimates and annual escapements were largely unaffected by the run reconstructions. Nushagak sockeye escapements were affected by the conversion from Bendix to DIDSON escapement estimates. The extent of recommended changes to the escapement goals varied by species and river depending on the fit of the stock-recruitment model. The 2012 stock assessment report advocated an incremental or conservative approach to changing escapement goals given that many of the goals had not changed for 10 to 30 years. If the SR model fit to the data was good then similar emphasis was placed on the model predictions and observed historical yields versus escapements. For systems where the model fit was poor, less emphasis was placed on SR model predictions. A summary of current and recommended goals is provided in the 2012 ADFG report (Table 3).

Changes in the escapement goal ranges were recommended for 8 systems based on the 2012 review: Egegik, Igushik, Naknek, Nushagak, Ugashik, and Wood River sockeye salmon, and Nushagak River Chinook and Chum salmon. The recommendations for all 8 sockeye systems would result in a shift to higher escapement goal ranges. On average the lower range interval increased by 19% and the higher interval increased by 31%. As a result of a reduced level of uncertainty in the stock assessment analysis, the escapement goal type was changed in four sockeye systems (Igushik, Naknek, Nushagak, Wood) from a “sustainable escapement goal” (SEG) to a “biological escapement goal” (BEG). All else being equal, this should increase the precision (and sustainability) of the fishery management process. ADFG recommended that escapement goals for sockeye spawning in the Kulukak River be eliminated because the spawning escapement has not been assessed since 2004 and because escapement goals do not affect management actions of the stock. ADFG also recommended that the goals for Chinook in the Egegik and Togiak rivers be eliminated because of very poor escapement data quality and few management tools to control harvest as reported for the Togiak system in the ADFG report. As a result of the move to DIDSON escapement estimation methodology in the Nushagak River, the recommended SEG goal for Nushagak Chinook represents an increase in the goal range from 40,000-80,000 to 55,000-120,000 fish. For Nushagak chum, the recommended minimum goal is slightly higher (190,000 versus 200,000). New goals were established for Nushagak River coho and pink salmon. The recommended changes in escapement goals based on the 2012 assessment implies a reduction in future harvest rates.

Arctic-Yukon-Kuskokwim

An ADFG review team reviewed salmon escapement goals for select river systems in the Arctic-Yukon-Kuskokwim Region in 2012 (<http://www.adfg.alaska.gov/FedAidPDFs/FMS12-07.pdf>). Improvements in stock assessment advice and escapement goals in the AYK Region reflect advances in escapement monitoring programs since 2000. The advances include the addition of counting weirs, towers and mark-recapture programs. Radio-telemetry projects conducted in the mid-2000s has advanced the knowledge of salmon distribution in the region. Sonar-based counts are now routinely used to estimate absolute escapement for several stocks. The 2013 review cycle focused on the evaluation of goals established in the 2010 cycle.

Escapement goals evaluated in the 2010 cycle include 25 Kuskokwim area stocks, 15 Yukon area stocks, and 29 Norton Sound-Port Clarence and Kotzebue area stocks. In 2013 cycle, the review team also evaluated stocks that were considered in the 2010 cycle but for which goals were not recommended due to low data quality. These included 19 Kuskokwim stocks, 8 Yukon stocks, and 17 Norton Sound-Port Clarence and Kotzebue area stocks. The stocks under review included cases where drainage-wide or aggregate stocks are the basic unit of assessment.

For stocks with existing goals, the review team looked for any significant changes in stock assessment methods, fisheries, and trends or patterns in the data series for each stock that would warrant a reanalysis of the goal. They also reviewed management needs and how each escapement goal was utilized in management and how well it performed. For stocks without existing goals, the review team evaluated available data from each stock to determine whether they met established escapement goal criteria. Stock assessment criteria included having sufficient data and sufficient contrast in the data between high and low abundance. Only stocks having at least 10 years of continuous data, extending across several generations of fish, met the minimum criterion for sufficient data. Available data type and quality were also matched to the guidelines for the type of goal being considered (e.g. Sustainable Escapement goal (SEG); Biological Escapement Goal (BEG)). The majority of the existing escapement goals are SEGs because most salmon catches in the AYK Region are from mixed stock fisheries without reliable estimates of stock composition. The results of the extensive Western Alaska Salmon Stock Identification Program that effectively has increased the precision of stock composition estimates for AYK sockeye and chum systems may result in more reliable catch estimates and future stock assessment advice for management for these salmon species.

For the very limited number stocks considered to have sufficient stock-recruitment data, Ricker stock-recruitment model predictions of S_{MSY} were assessed using Bayesian inference in some cases to capture uncertainty in key management parameters. A summary of current and recommended goals is provided in the 2012 ADFG report (Tables 4-8).

The review team recommended establishing a new, drainage-wide goal (SEG) for Kuskokwim River Chinook salmon and a re-evaluation of the contributing Chinook spawning systems included in the drainage-wide Kuskokwim system. The review team recommended revising Chinook salmon SEGs on the Kwethluk, George, and Kogrukluk rivers and eliminating the SEG on the Tuluksak River. The review team concluded that SEGs based on the average proportion of drainage-wide escapements contributed by each tributary stock would be more representative. The goal recommendations were determined by multiplying

the upper and lower bounds of the recommended drainage-wide goal by the average proportional escapement in each tributary. The revised goals for the Kwethluk, George, and Kogrukluk systems were all lower than the current goals. The revisions were supported by a habitat model analysis that indicated the existing goals for those Chinook systems were too high. Other existing Chinook salmon goals on Kuskokwim River tributaries and goals on the Goodnews and Kanektok rivers, which drain into Kuskokwim Bay, are reportedly adequate and new goals were not recommended for other Kuskokwim area Chinook salmon stocks.

The ability to establish a drainage-wide escapement goal for Kuskokwim River chum is currently limited because information on total abundance, stock-specific run timing and stock composition of harvest is limited. Of the four Kuskokwim chum systems, ADFG recommended that the goal for one stock (Kanektok River) be eliminated due to low escapement survey quality. No changes were recommended for the other three chum systems. Exploitation on chum salmon is reportedly low but could be affected by the high priority placed upon Chinook salmon management in the Kuskokwim River. The review team reported that further work on a drainage-wide goal for chum was needed. No changes were recommended for Kuskokwim River coho and sockeye goals.

The Yukon Management Area includes the U.S. portion of the Yukon River drainage and coastal waters between Point Romanof and the Naskonat Peninsula. Of the 15 salmon stocks with goals, 6 Chinook stocks, 2 summer chum stocks, 6 fall chum stocks and 1 coho stock were reviewed in the 2013 cycle. Changes were not recommended for any of the Yukon area salmon stocks with existing goals. Stocks without goals were selected for review during the 2013 cycle based upon potential of a fishery impact and assessment data quality. Information from 1 Chinook, 2 summer chum, 1 fall chum, and 2 coho stocks without existing escapement goals were reviewed. Included in the potential new goals considered were Yukon River drainage-wide goals for summer chum and coho salmon. No new goals for stocks without existing goals were recommended due to data limitations.

In the Norton Sound-Port Clarence Management Area, 23 existing escapement goals for 5 Chinook salmon, 8 chum salmon, 3 coho salmon, 5 pink salmon, and 2 sockeye salmon stocks were reviewed. No changes were recommended except that the goal for Shaktoolik River Chinook be eliminated due to poor aerial survey escapement data quality.

Alaska Peninsula and Aleutian Islands

The escapement goal of 28 salmon spawning systems in the Alaska Peninsula and Aleutian Islands were reviewed by the Alaska Board of Fisheries in 2012 (<http://www.adfg.alaska.gov/static/regulations/regprocess/fisheriesboard/pdfs/2012-2013/area-m/fms13-01.pdf>). The review acknowledges that escapement goal evaluations are limited by low escapement data quality in most cases. Stock-specific catch data are not available for any stock except Nelson River Chinook and sockeye and late-run Bear Lake sockeye. Currently, 14 sockeye spawning systems have escapement goals. Of these, 6 have counting weirs and the remaining are enumerated using aerial surveys. In previous reviews, a variety of methods were used to estimate escapement goals for sockeye. These include euphotic volume, smolt biomass as a function of zooplankton biomass and lake survey area methods. In order to determine whether a further review of sockeye goals was warranted, the recent escapement series (since the last review) was assessed to determine if the degree of change was important enough to

trigger a further review. For all sockeye systems with escapement goals, the current goals were not reviewed in 2012 given the consistency of recent escapement trends with historical estimates. As a result of continued low escapement to one system (Swanson Lagoon), the stock was recommended as a stock of concern.

Escapement goals for coho are in place for 3 systems but many coho systems are not monitored due to the difficulty and costs of escapement monitoring in the late fall spawning period. Escapement estimates for 2 coho systems in the recent review period were deemed consistent with previous estimates and the review team agreed to recommend maintaining the existing goals. The recent escapement series for 1 coho system (Thin Point Lake) was inconsistent with previous estimates and the team conducted further analysis to assess the relevance of the goal. The team recommended that the goal for Thin Point Lake coho should be eliminated because of poor data quality and minimal fishing effort on the stock.

A total of 4 pink stock-aggregate escapement goals are in place based on the sum of escapement objectives for 165 individual index streams that are monitored using aerial surveys. The stock aggregates correspond to even- and odd-year returns in the South Peninsula and Bechevin Bay areas. Changes in the even- or odd-year SEGs for the south peninsula were not recommended. There was consensus to eliminate the previous goal for even- and odd-year Bechevin Bay pink salmon due to poor data quality and low fishing effort.

Currently there are 6 stock-aggregate escapement goals for chum salmon based on aerial surveys of 136 individual streams. There are no escapement goals for chum spawning systems on the Aleutian Islands due to the difficulty and expense of conducting aerial surveys in that region. The SEG remains unchanged in 5 stock aggregates. The ADFG team recommended that the goal for the remaining system (Unimak District) be eliminated because of poor data quality.

There is a single BEG derived from SR analysis for Chinook based mainly on weir counts on the Nelson River and terminal gillnet catches. That goal was not reviewed in 2012. There are no documented Chinook spawning systems on the south side of the peninsula or on the Aleutian Islands. The current escapement goals and 2012 recommendations by species and system are summarized in Table 1 of the ADFG report. Recommended goals remain unchanged for 24 of the stocks with no changes for Chinook and sockeye salmon. For the 4 other stocks, ADFG recommended dropping the goals due to very poor data quality. These include 1 coho stock, 2 pink salmon stocks and 1 chum salmon stock.

Late-Run Kenai River Chinook

An out-of-cycle review was conducted in 2013 for Late-Run Kenai River Chinook due to the difficulty of managing large runs of sockeye in the presence of declining Chinook abundance (<http://www.adfg.alaska.gov/static/regulations/regprocess/fisheriesboard/pdfs/2012-2013/statewide/fms13-02.pdf>). ADFG is currently transitioning to DIDSON-based estimates of escapement for the run. DIDSON technology was first used for Chinook escapement estimation in 2010. The objectives of the 2013 assessment were three-fold: 1) conduct a Bayesian, state-space stock-recruitment analyses using a Ricker model and time-varying productivity that models uncertainty in run reconstruction estimates of abundance and S_{MSY} management reference points; 2) recommend an interim SEG based on DIDSON abundance estimates; and 3) update annual estimates of abundance, catch and age composition for 1986-2012. The assessment process resulted in a recommended Chinook escapement goal, evidence that productivity has fluctuated over time and that trends in abundance are well estimated

from historical data. Current abundances are the lowest in recent history. The analysis of stock productivity, capacity and yield failed to find evidence that the stock has been over-exploited with exploitation rates well below estimates of U_{MSY} . Escapements have exceeded the lower bounds of the goal in every year and in recent years they have exceeded S_{MSY} in all but 2010 and 2011. ADFG recommended an interim SEG of 15,000 to 30,000 late-run Chinook.

Escapements goals versus actual escapements performance

Statewide, for those spawning systems with escapement goals, given the presence of an adequate assessment of stock status, there was an increase in the proportion of stocks that have not met their lower escapement goal starting in 2008. The average percentage increased from 12% in 2004-2007 to 27% thereafter, the bulk being Chinook salmon. The proportion of stocks maintained within their escapement goal range has been slightly increasing over the 2004-2012 period. The proportion of stocks that exceeded the upper goal over the same period has declined. For all stocks/species combined, the increase in the proportion of stocks that have not met their goal occurred in 3 of the 4 regions (Central, AYK, Westward) starting in about 2008. In all areas there was an increase in the proportion of stocks below the lower goal in 2012 compared to 2011. The proportion below the goal for all species and regions combined was 24% in 2011 and 29% in 2012.

The table below presents the assessment of stock status for the 300 Alaska salmon systems with formal escapement goals from 2003 to 2012. Since the escapement goal is effectively the target, limit reference point and harvest control rule for these stocks, an evaluation of stock status and management performance in this regard can be made. As illustrated below, it is clear that the vast majority of these stocks have met or exceeded their escapement goals (and therefore target reference point) over recent years. This performance implies that these stocks are maintained at high biological productivity and towards avoidance of recruitment overfishing. Having said that there is also ample evidence that stocks who have not met their escapement goals for one, two, three or more years have rebounded to acceptable biological levels (i.e. to meet or exceed their escapement goals) following management actions by ADFG. Also to be noted is the recent years low Chinook return trends which have triggered, apart from severe restrictions in commercial, sport and even subsistence fisheries, further management actions to improve research, knowledge and management of these stocks (see ADFG Chinook Salmon Stock Assessment and Research Plan, 2013).

Area	Species	System	Enumeration Method	Goal Method	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Stock of Concern?
SEAK	Chinook	Blossom River	Peak Aerial Survey	SRA	Under	Met	Met	Met	Under	Met	Under	Met	Under	Met ^a	No
SEAK	Chinook	Keta River	Peak Aerial Survey	SRA	Met	Met	Met	Over	Met	Met	Under	Met	Under	Met ^a	No
SEAK	Chinook	Unuk River	Mark-Recapture	SRA	Met	Met	Met	Met	Met	Met	Met ^b	Over	Met	Under	No
SEAK	Chinook	Chickamin River	Peak Aerial Survey	SRA	Over	Met	Over	Over	Met	Over	Met	Over	Met	Under	No
SEAK	Chinook	Andrew Creek	Peak Aerial Survey	SRA	Met	Over	Over	Over	Over	Met	Under	Met	Met	Under	No

			(Expanded)													
SEAK	Chinook	Stikine River	Mark-Recapture	SRA	Over	Over	Over	Met	Met	Met	Under	Met	Met	Met	No	
SEAK	Chinook	King Salmon River	Peak Aerial Survey (Expanded)	SRA	Under	Met	Met	Met	Met	Met	Under	Met	Met	Met	No	
SEAK	Chinook	Taku River	Mark-Recapture	SRA	Met	Over	Met	Met	Under	Under	Met ^a	Met	Met	Met	No	
SEAK	Chinook	Chilkat River	Mark-Recapture	Theoretical SRA	Over	Met	Met	Met	Under	Met	Over	Met	Met	Under	No	
SEAK	Chinook	Klukshu (Alsek) River	Weir Count	SRA	Met	Over	Under	Under	Under	Under	Met	Met	Met	Under	No	
SEAK	Chinook	Situk River	Weir Count	SRA	Over	Met	Met	Met	Met	Under	Met	Under	Under	Under	No	
SEAK	Chum	Southern Southeast Summer	Peak Aerial Survey	Percentile	NA	NA	NA	NA	NA	NA	Under	Under	Met	Met ^c	No	
SEAK	Chum	Northern Southeast Inside Summer	Peak Aerial Survey	Percentile	NA	NA	NA	NA	NA	NA	Under	Under	Under	Met ^c	No	
SEAK	Chum	Northern Southeast Outside Summer	Peak Aerial Survey	Percentile	NA	NA	NA	NA	NA	NA	Under	Met	Met	Met	No	
SEAK	Chum	Cholmondeley Sound Fall	Peak Aerial Survey	Percentile	NA	NA	NA	NA	NA	NA	Met	Over	Over	Over	No	
SEAK	Chum	Port Camden Fall	Peak Aerial Survey	Risk Analysis	NA	NA	NA	NA	NA	NA	Under	Met	Under	Met	No	
SEAK	Chum	Security Bay Fall	Peak Aerial Survey	Percentile	NA	NA	NA	NA	NA	NA	Met	Met	Met	Met	No	
SEAK	Chum	Excursion River Fall	Peak Aerial Survey	Percentile	NA	NA	NA	NA	NA	NA	Under	Met	Under	Under	No	
SEAK	Chum	Chilkat River Fall	Mark-Recapture/Fish Wheel	SRA	NA	NA	NA	NA	NA	NA	Over	Met	Over	Over	No	
SEAK	Coho	Hugh Smith Lake	Weir Count	SRA	Over	Met	Over	Met	Over	Over	Over ^a	Over	Over	Over	No	
SEAK	Coho	Taku River	Mark-Recapture	SRA	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	No	
SEAK	Coho	Auke Creek	Weir Count	SRA	Over	Met	Met	Over	Met	Over	Met	Met	Over	Over	No	
SEAK	Coho	Montana Creek	Foot Survey	Theoretical SRA	Over	Met	Met	Meta	Under	Met	Met	Met	Met	Under	No	
SEAK	Coho	Peterson Creek	Foot Survey	Theoretical SRA	Met	Met	Met	Over ^a	Met	Over	Met	Over	Met	Met	No	
SEAK	Coho	Ketchikan Survey Index	Peak Aerial Survey	Theoretical SRA	NA	NA	NA	Met	Met	Over	Met	Met	Met	Over	No	
SEAK	Coho	Sitka Survey Index	Foot Survey	Theoretical SRA	NA	NA	NA	Over	Over	Over	Over	Over	Over	Over	No	
SEAK	Coho	Ford Arm Lake	Weir Count	SRA	Over	Over	Over	Over	Met	Over	Met	Met	Met	Met	No	
SEAK	Coho	Berners River	Mark-Recapture	SRA	Over	Over	Met	Met	Under	Met	Met	Met	Met	Met	No	

SEAK	Coho	Chilkat River	Mark-Recapture/Foot Survey	SRA	NA			Over	Under	Met	Met	Over	Met	Met	No
SEAK	Coho	Lost River	Foot Survey	SRA	Met	Met	Under	Met	Met	NA	Met ^d	Met	Under	Met	No
SEAK	Coho	Situk River	Peak Aerial Survey	SRA	Met	Over	Under	Met	Met	NA	Met	Over	Met	Under	No
SEAK	Coho	Tsiu/Tsivat Rivers	Peak Aerial Survey	SRA	Over	NA	Met	Met	Met	Met	Met	Met	Met	Met	No
SEAK	Pink	Southern Southeast	Peak Aerial Survey	Yield Analysis	Over	Met	Over	Met	Over	Met	Met ^e	Met	Met	Met	No
SEAK	Pink	Northern Southeast Inside	Peak Aerial Survey	Yield Analysis	Met	Under	Met	Met	Met	Under	Met ^e	Met	Over	Under	No
SEAK	Pink	Northern Southeast Outside	Peak Aerial Survey	Yield Analysis	Over	Over	Over	Over	Over	Met	Met ^e	Met	Over	Met	No
SEAK	Pink	Situk River	Weir Count	Percentile	Over	NA	NA	NA	NA	NA	NA	NA	NA	Under ^f	No
SEAK	Sockeye	Hugh Smith Lake	Weir Count/Risk Analysis	Theoretical SRA	Over	Over	Over	Over	Over	Under	Met	Met	Over	Met	No
SEAK	Sockeye	McDonald Lake	Expanded Foot Survey	SRA	Over	Under	Under	Under ^a	Under	Under	Under ^a	Met	Met	Met	No
SEAK	Sockeye	Mainstem Stikine River	Run Reconstruction	Professional Judgement	Over	Met	Met	Met	Met	Under	Met	Met	Met	Met	No
SEAK	Sockeye	Tahltan Lake	Weir Count	SRA	Met	Over	Over	Over	Met	Under	Over	Met	Over	Under	No
SEAK	Sockeye	Speel Lake	Weir Count	SRA	Over	Met	Met	Met	Under	Under	Under	Met	Met	Met	No
SEAK	Sockeye	Taku River	Mark-Recapture	Professional Judgement	Over	Over	Over	Over	Over	Under	Met	Over	Over	Over	No
SEAK	Sockeye	Redoubt Lake	Weir Count	SRA	Over	Over	Over	Over	Over	Met	Met	Met	Met	Over	No
SEAK	Sockeye	Chilkat Lake	Sonar/Mark-Recapture	SRA	Met	Over	Met	Under ^h	Under	Under	Over ^a	Under	Under	Met	No
SEAK	Sockeye	Chilkoot Lake	Weir Count	SRA	Over	Met	Met	Over ^a	Met	Under	Under ^a	Met	Met	Over	No
SEAK	Sockeye	East Alsek-Doame River	Peak Aerial Survey	SRA	Over	Over	Over	Over	Over	Under	Under	Met	Over	Met	No
SEAK	Sockeye	Klukshu River	Weir Count	SRA	Over	Met	Under	Met	Met	Under	Under	Over	Over	Over	No
SEAK	Sockeye	Lost River	Foot/Boat Survey	Percentile	Over	Met	Met	Met	Under	Under	NA ^d	Met	Met	Under	No
SEAK	Sockeye	Situk River	Weir Count	SRA	Over	Met	Met	Over	Met	Under	Over	Met	Over	Met	No
Central	Chinook	Nushagak River	Sonar	SRA/Yield Analysis		Over	Over	Over	Met ^a	Over	Met	Met	Met	Over	No
Central	Chinook	Togiak River	Single Aerial Survey	Risk Analysis	NA	NS	NS	NS	NS ^b	NS	NS	NS	NS	NS	No
Central	Chinook	Naknek River	Single Aerial Survey	Risk Analysis	Over	Over	NS	NS	Met ^b	Met	Under	NS	NS	NS	No

Central	Chinook	Alagnak River	Single Aerial Survey	Risk Analysis	NA				Met	Under	Under	NS	NS	NS	No
Central	Chinook	Egegik River	Single Aerial Survey	Risk Analysis	NA				Met	Under	Under	NS	NS	NS	No
Central	Chinook	Alexander Creek	Single Aerial Survey	Percentile	Under	Met	Met	Under	Under	Under	Under	Under	Under	Under	Management
Central	Chinook	Campbell Creek	Single Foot Survey	Risk Analysis	Over	Over	eliminated			Met ^c	Met	Met	Under	NA	No
Central	Chinook	Chuitna River	Single Aerial Survey	Percentile	Met	Over	Met	Met	Under	Under	Under	Under	Under	Under	Management
Central	Chinook	Chulitna River	Single Aerial Survey	Percentile	NA	Met	Met	Met	Over	Met	Met	Under	Met	Under	No
Central	Chinook	Clear (Chunilna) Creek	Single Aerial Survey	Percentile	NS	Over	Met	Met	Met	Met	Met	Under	Under	Met	No
Central	Chinook	Crooked Creek	Weir Count	Percentile	Over	Over	Over	Met	Met	Met	Under	Met	Met	Under	No
Central	Chinook	Deshka River	Weir Count	SRA	Over	Over	Over	Over	Met	Under	Under	Met	Met	Met	No
Central	Chinook	Goose Creek	Single Aerial Survey	Percentile	Under	Met	Met	Met	Under	Under	Under	Under	Under	Under	Yield
Central	Chinook	Kenai River - Early Run	Sonar	SRA	Met	Met	Over ^d	Over	Over	Over	Over	NA	NA	NA	No
Central	Chinook	Kenai River - Late Run	Sonar	SRA	Met	Over	Met	Met	Met	Met	Under	NA	NA	NA	No
Central	Chinook	Lake Creek	Single Aerial Survey	Percentile	Over	Over	Met	Met	Met	Under	Under	Under	Met	Under	No
Central	Chinook	Lewis River	Single Aerial Survey	Percentile	Over	Over	Met	Met	Under	Under	Under	Under	Under	Under	Management
Central	Chinook	Little Susitna River	Single Aerial Survey	Percentile	Met	Met	Over	Over	Met	Met	Met	Under	Under	Met	No
Central	Chinook	Little Willow Creek	Single Aerial Survey	Percentile	Met	Over	Met	Met	Met	NC	Met	Met	Met	Met	No
Central	Chinook	Montana Creek	Single Aerial Survey	Percentile	Met	Met	Met	Met	Met	Met	Met	Under	Under	Under	No
Central	Chinook	Peters Creek	Single Aerial Survey	Percentile	Over	Over	Met	Met	Met	NC	Met	NC	Met	Under	No
Central	Chinook	Prairie Creek	Single Aerial Survey	Percentile	Met	Met	Met	Met	Met	Under	Met	Under	Under	Under	No
Central	Chinook	Sheep Creek	Single Aerial Survey	Percentile	NA	Under	Met	Under	Under	NC	Under	NC	Under	Under	No
Central	Chinook	Talachulitna River	Single Aerial Survey	Percentile	Over	Over	Met	Over	Met	Met	Met	Under	Under	Under	No
Central	Chinook	Theodore River	Single Aerial Survey	Percentile	Met	Under	Under	Met	Under	Under	Under	Under	Under	Under	Management
Central	Chinook	Willow Creek	Single Aerial Survey	Percentile	Over	Over	Met	Met	Under	Under	Under	Under	Under	Under	Yield
Central	Chinook	Anchor River	Sonar/Weir Count	SRA	Under	Over	eliminated			Met ^e	Under	Under	Under ^f	Met	No
Central	Chinook	Deep Creek	Single Aerial Survey	Percentile	Over	Over	Over	Met	Met	Under	Met	Met	Met	Met	No

Central	Chinook	Ninilchik River	Weir Count	Percentile	Under	Met	Met	Met	Met	Met ^f	Under	Met	Met	Met	No
Central	Chinook	Copper River	Mark-Recapture	Empirical Observation	Met	Met	Under	Met	Met	Met	Met	Under	Met	Met	No
Central	Chum	Nushagak River	Sonar	Risk Analysis	NA	NA	NA	NA	Under	Met	Met	Met	Met	Met	No
Central	Chum	Clearwater Creek	Peak Aerial Survey	Percentile	Under	Met	Under	Under	Met	Over	Met	Over	Over	Met	No
Central	Chum	Port Graham River	Multiple Foot Surveys	Percentile	Met	Under	Under	Met	Met	Met	Under	Under	Met	Under	No
Central	Chum	Dogfish Lagoon	Multiple Foot Surveys	Percentile	Over	Met	Under	Met	Met	Met	Met	Over	Over	Met	No
Central	Chum	Rocky River	Multiple Foot Surveys	Percentile	Over	Over	Over	Over	Met	Met	Met	Met	Met	Met	No
Central	Chum	Port Dick Creek	Multiple Aerial/Foot Surveys	Percentile	Over	Over	Over	Met	Met	Over	Over	Met	Over	Over	No
Central	Chum	Island Creek	Multiple Aerial/Foot Surveys	Percentile	Over	Met	Over	Under	Under	Met	Met	Under	Met	Met	No
Central	Chum	Big Kamishak River	Multiple Aerial Surveys	Percentile	Met	Over	Over	Over	Met	Under	Met	NS	Under	Met	No
Central	Chum	Little Kamishak River	Multiple Aerial Surveys	Percentile	Met	Over	Met	Over	Met	Met	Under	Met	Met	Over	No
Central	Chum	McNeil River	Multiple Aerial Surveys	Percentile	Over	Met	Met	Met	Met	Under ^h	Under	Under	Met	Under	No
Central	Chum	Bruin River	Multiple Aerial Surveys	Percentile	Over	Over	Over	Met	Under	Over	Met	Met	Under	Over	No
Central	Chum	Ursus Cove	Multiple Aerial Surveys	Percentile	Over	Over	Over	Over	Over	Met	Over	Over	Over	Under	No
Central	Chum	Cottonwood Creek	Multiple Aerial Surveys	Percentile	Over	Over	Over	Over	Over	Met	Over	Over	Under	Under	No
Central	Chum	Iniskin Bay	Multiple Aerial Surveys	Percentile	Over	Over	Over	Over	Under	Over	Over	Over	Under	Under	No
Central	Chum	Eastern District	Multiple Aerial Surveys	Risk Analysis	Over	Met	Met	Met ⁱ	Met	Met	Met	Met	Met	Met	No
Central	Chum	Northern District	Multiple Aerial Surveys	Risk Analysis	Met	Met	Met	Met ⁱ	Met	Met	Met	Met	Met	Under	No
Central	Chum	Coghill District	Multiple Aerial Surveys	Risk Analysis	Met	Met	Met	Met ⁱ	Met	Met	Met	Met	Met	Met	No
Central	Chum	Northwestern District	Multiple Aerial Surveys	Risk Analysis	Met	Met	Met	Met ⁱ	Met	Met	Met	Met	Met	Met	No
Central	Chum	Southeastern District	Multiple Aerial Surveys	Risk Analysis	Over	Over	Over	Met ⁱ	Met	Met	Met	Met	Met	Met	No
Central	Coho	Fish Creek (Knik)	Weir Count	Percentile	Met	Met	eliminate d	NA	NA	NA	NA	NA	Met ^c	Met	No
Central	Coho	Jim Creek	Single Foot Survey	Percentile	Over	Over	Over	Over	Over	Over	Over	Under	Under	Under	No
Central	Coho	Little Susitna River	Weir Count	Percentile	Met	Over	Met	NA	Met	Over	Under	Under	Under	Under	No

Central	Coho	Copper River Delta	Peak Aerial Survey	Percentile	Over	Over	Over	Over	Met	Over	Met	Met	Met	Met	No	
Central	Coho	Bering River	Peak Aerial Survey	Percentile	Met	Met	Over	Over	Over	Met	Met	Met	Met	Met	No	
Central	Pink	Humpy Creek	Multiple Foot Surveys	Percentile	Over	Met	Over	Met	Met	Over	Under	Met	Under	Met	No	
Central	Pink	China Poot Creek	Multiple Foot Surveys	Percentile	Met	Met	Over	Met	Met	Met	Under	Under	Met	Over	No	
Central	Pink	Tutka Creek	Multiple Foot Surveys	Percentile	Over	Over	Over	Over	Under	Met	Under	Under	Over	Met	No	
Central	Pink	Barabara Creek	Multiple Foot Surveys	Percentile	Met	Met	Over	Met	Over	Over	Met	Over	Over	Under	No	
Central	Pink	Seldovia Creek	Multiple Foot Surveys	Percentile	Met	Over	Over	Over	Over	Over	Under	Met	Over	Over	No	
Central	Pink	Port Graham River	Multiple Foot Surveys	Percentile	Met	Over	Over	Over	Over	Over	Met	Met	Over	Over	No	
Central	Pink	Port Chatham	Multiple Foot Surveys	Percentile	Over	Over	Over	Over	Met	Met	Over	Under	Met	Under	No	
Central	Pink	Windy Creek Right	Multiple Foot Surveys	Percentile	Over	Over	Over	Over	Over	Over	Over	Met	Under	Met	No	
Central	Pink	Windy Creek Left	Multiple Foot Surveys	Percentile	Over	Met	Over	Over	Met	Over	Over	Met	Met	Met	No	
Central	Pink	Rocky River	Multiple Foot Surveys	Percentile	Over	Met	Over	Over	Over	Over	Over	Met	Met	Met	No	
Central	Pink	Port Dick Creek	Multiple Aerial or Foot Surveys	Percentile	Over	Under	Over	Met	Met	Met	Met	Met	Under	Under	No	
Central	Pink	Island Creek	Multiple Aerial or Foot Surveys	Percentile	Over	Over	Met	Over	Over	Over	Over	Over	Met	Met	No	
Central	Pink	S. Nuka Island Creek	Multiple Aerial or Foot Surveys	Percentile	Over	Met	Met	Met	Met	Met	Over	NS	NS	Under	No	
Central	Pink	Desire Lake Creek	Multiple Aerial Surveys	Percentile	Over	Over	Over	Over	Met	Met	Over	Met	Under	Met	No	
Central	Pink	Bruin River	Multiple Aerial Surveys	Percentile	Met	Met	Met	Over	Over	Met	Over	Met	Under	Met	No	
Central	Pink	Sunday Creek	Multiple Aerial Surveys	Percentile	Over	Over	Over	Over	Over	Met	Over	Met	Under	Under	No	
Central	Pink	Brown's Peak Creek	Multiple Aerial Surveys	Percentile	Over	Met	Over	Over	Over	Met	Over	Met	Under	Met	No	
Central	Pink	Northern District (even year)	Multiple Aerial Surveys	Percentile	NA	NA	NA	NA	NA	NA	NA	NA	NA	Under	No	
Central	Pink	Northern District (odd year)	Multiple Aerial Surveys	Percentile	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No	
Central	Pink	Coghill District (even year)	Multiple Aerial Surveys	Percentile	NA	NA	NA	NA	NA	NA	NA	NA	NA	Over	No	
Central	Pink	Coghill District (odd year)	Multiple Aerial Surveys	Percentile	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No	
Central	Pink	Northwestern District (even year)	Multiple Aerial Surveys	Percentile	NA	NA	NA	NA	NA	NA	NA	NA	NA	Met	No	

Central	Pink	Northwestern District (odd year)	Multiple Aerial Surveys	Percentile	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No
Central	Pink	Eshamy District (even year)	Multiple Aerial Surveys	Percentile	NA	NA	NA	NA	NA	NA	NA	NA	NA	Under	No
Central	Pink	Eshamy District (odd year)	Multiple Aerial Surveys	Percentile	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No
Central	Pink	Southwestern District (even year)	Multiple Aerial Surveys	Percentile	NA	NA	NA	NA	NA	NA	NA	NA	NA	Met	No
Central	Pink	Southwestern District (odd year)	Multiple Aerial Surveys	Percentile	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No
Central	Pink	Montague District (even year)	Multiple Aerial Surveys	Percentile	NA	NA	NA	NA	NA	NA	NA	NA	NA	Met	No
Central	Pink	Montague District (odd year)	Multiple Aerial Surveys	Percentile	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No
Central	Pink	Southeastern District (even year)	Multiple Aerial Surveys	Percentile	NA	NA	NA	NA	NA	NA	NA	NA	NA	Met	No
Central	Pink	Southeastern District (odd year)	Multiple Aerial Surveys	Percentile	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No
Central	Sockeye	Kvichak River	Tower Count	SRA/Yield Analysis	Under	Under ^j	Met	Met	Met	Met	Met	Met	Met	Met	No
Central	Sockeye	Alagnak River	Tower Count	Risk Analysis	Over	Over	Over	Over	Met ^k	Met	Met	Met	Met	Met	No
Central	Sockeye	Naknek River	Tower Count	SRA/Yield Analysis	Over	Over	Over	Over	Over	Over	Met	Over	Met	Met	No
Central	Sockeye	Egegik River	Tower Count	SRA/Yield Analysis	Met	Met	Over	Over	Over	Met	Met	Met	Met	Met	No
Central	Sockeye	Ugashik River	Tower Count	SRA/Yield Analysis	Met	Met	Met	Met	Over	Met	Over	Met	Met	Met	No
Central	Sockeye	Wood River	Tower Count	SRA/Yield Analysis	Met	Over	Met	Over	Over	Over	Met	Over	Met	Met	No
Central	Sockeye	Igushik River	Tower Count	SRA/Yield Analysis	Met	Under	Over	Over	Over	Over	Over	Over	Over	Met	No
Central	Sockeye	Nushagak River	Sonar	SRA/Yield Analysis	Met	Met	Over	Met	Met	Met	Met	Met	Met	Met	No
Central	Sockeye	Togiak River	Tower Count	SRA/Yield Analysis	Over	Met	Met	Over	Met ^d	Met	Over	Met ⁱ	Met	Met	No
Central	Sockeye	Crescent River	Sonar	SRA	Over	Over	Over ^d	Over	Over	Met	NS	Over	Over	Met	No
Central	Sockeye	Fish Creek (Knik)	Weir Count	Percentile	Over	Met	Under	Met	Met	Under	Over	Over	Met	Under	No
Central	Sockeye	Kasilof River	Sonar	SRA	Over	Over	Over	Over	Over	Met	Met	Met	Met	Met	No
Central	Sockeye	Kenai River	Sonar	Brood Interaction Simulation Model	Met	Over	Over	Over	Met	Under	Under	Met	Met	Met	No

Central	Sockeye	Packers Creek	Weir Count	Percentile	NA	NS	eliminated			Met ^c	Met	NS	NA	NA	No
Central	Sockeye	Russian River - Early Run	Weir Count	Percentile	Met	Over	Over ⁱ	Over	Met	Met	Over	Met	Met	Met	No
Central	Sockeye	Russian River - Late Run	Weir Count	Percentile	Over	Met	Met ^d	Met	Met	Met	Met	Met	Met	Met	No
Central	Sockeye	Chelatna Lake	Weir Count	Percentile	NA	NA	NA	NA	NA	NA	Under	Met	Over	Met	No
Central	Sockeye	Judd Lake	Weir Count	Percentile	NA	NA	NA	NA	NA	NA	Met	Under	Met	Under	No
Central	Sockeye	Larson Lake	Weir Count	Percentile	NA	NA	NA	NA	NA	NA	Met	Met	Under	Met	No
Central	Sockeye	English Bay	Peak Aerial Survey/Weir Count	Percentile	Over	Over	Met	Over	Over	Met	Over	Met	Met	Under	No
Central	Sockeye	Delight Lake	Peak Aerial Survey/Weir Count	Percentile	NA	Met	Over	Met	Over	Over	Over	Over	Over	Met	No
Central	Sockeye	Desire Lake	Peak Aerial Survey/Weir Count	Percentile	Under	Met	Under	Over	Met	Met	Over	Under	Met	Met	No
Central	Sockeye	Bear Lake	Weir Count	Percentile	Over	Met	Over	Over	Over	Over	Over	Met	Over	Met	No
Central	Sockeye	Aialik Lake	Peak Aerial Survey	Percentile	Met	Over	Met	Met	Met	Met	Under	Met	Under	Under	No
Central	Sockeye	Mikfik Lake	Peak Aerial Survey	Percentile	Over	Over	Under	Over	Met	Under	Over	Met	Under	Under	No
Central	Sockeye	Chenik Lake	Peak Aerial Survey	Percentile	NA	Over	Over	Over	Over	Over	Over	Over	Met	Over	No
Central	Sockeye	Amakdedori Creek	Peak Aerial Survey	Percentile	Over	Over	Met	Under	Over	Over	Met	Under	Over	Under	No
Central	Sockeye	Upper Copper River	Sonar	Percentile	Met	Met	Over	Over	Over	Met	Met	Over	Over	Over ^d	No
Central	Sockeye	Copper River Delta	Peak Aerial Survey	Percentile	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	No
Central	Sockeye	Bering River	Peak Aerial Survey	Percentile	Met	Met	Met	Under	Met	Under	Under	Under	Met	Met ^d	No
Central	Sockeye	Coghill Lake	Weir Count	SRA	Over	Met	Met	Met ⁱ	Over	Met	Under	Met	Over	Over ^d	No
Central	Sockeye	Eshamy Lake	Weir Count	SRA	Met	Under	Met	Over	Under	Under	Met ^d	Met	Met	NA	No
AYK	Chinook	North (Main) Fork Goodnews River	Single Aerial Survey	Percentile	Met	Met	NS ^a	Over	NS	Met	NS	NS	Met	NS	No
AYK	Chinook	Middle Fork Goodnews River	Weir Count	SRA	Under	Met	Over ^a	Over	Over ^b	Met	Met	Met	Met	Under	No
AYK	Chinook	Kanektok River	Single Aerial Survey	Percentile	Met	Met	Over ^a	Over	NS	Met	NS	Under	NS	NA	No
AYK	Chinook	Kogrukluk River	Weir Count	Percentile	Met	Met	Over ^a	Over	Met	Met	Met	Met	Met	NA	No

AYK	Chinook	Kwethluk River	Weir Count	Percentile	Over	Over	Over	NA	Over ^c	Under	Under	Under	Under	NA	Yield	
AYK	Chinook	Tuluksak River	Weir Count	Percentile	NA				Under	Under	Under	Under	Under	Under	Yield	
AYK	Chinook	George River	Weir Count	Percentile	NA				Met	Under	Met	Under	Under	Under	Yield	
AYK	Chinook	Kisaralik River	Single Aerial Survey	Percentile	Under	Met	Over ^a	Over	Met	Met	NS	Under	NS	Met	No	
AYK	Chinook	Aniak River	Single Aerial Survey	Percentile	Met	Met	NS ^a	Over	Over	Over	NS	NS	NS	NS	No	
AYK	Chinook	Salmon River (Aniak R)	Single Aerial Survey	Percentile	Met	Met	Over ^a	NS	Over	Met	NS	NS	Under	Under	No	
AYK	Chinook	Holitna River	Single Aerial Survey	Percentile	NA	Met	Over ^a	Over	NS	Under	NS	Under	NS	NS	No	
AYK	Chinook	Cheeneetnuk River (Stony R)	Single Aerial Survey	Percentile	NA		Met	Met	NS	Under	Under	NS	Under	Under	Yield	
AYK	Chinook	Gagaryah River (Stony R)	Single Aerial Survey	Percentile	NA		Met	Met	Over	Under	Met	Under	Under	Under	No	
AYK	Chinook	Salmon River (Pitka Fork)	Single Aerial Survey	Percentile	Met	Under	Over ^a	Met	Met	Met	Met	Under	Met	Met	No	
AYK	Chinook	East Fork Andreafsky River	Weir Count	Percentile	Under	Met	Over ^a	Under	Over	Under	Under	Met ^c	Over	Met	No	
AYK	Chinook	West Fork Andreafsky River	Peak Aerial Survey	Percentile	Met	Under	Met ^a	Met	Met	NS	Over	Met	Met	NS	No	
AYK	Chinook	Anvik River	Peak Aerial Survey	Percentile	Under	Met	Over ^a	Over	Met	Under	Under	Under	Under	Under	Yield	
AYK	Chinook	Nulato River (forks combined)	Peak Aerial Survey	Percentile	NA	Met	Under ^a	Met	Over	Under	Over	Under	Met	Met	No	
AYK	Chinook	Chena River Tower	Mark-Recapture	SRA	Over	Over	NS	Met	Met	Met	Met	Under	NS	Under	No	
AYK	Chinook	Salcha River Tower	Mark-Recapture	SRA	Over	Over	Met	Over	Met	Met	Over	Met	Over	Over	No	
AYK	Chinook	Yukon Canada Mainstem	Sonar	Agreement	Met	Met	Met	Met	Met ^d	Under ^d	Met	Under ^d	Met	Under	No	
AYK	Chinook	Fish River/Boston Creek	Peak Aerial Survey	Percentile	Met	Met	Under ^e	NS	NS	NS	NS	NS	NS	NS	No	
AYK	Chinook	Kwiniuk River	Tower Count	SRA	Over	Over	Met ^f	Under	Under	Under	Met	Under	Under	Under	No	
AYK	Chinook	North River (Unalakleet R)	Tower Count	Percentile	Met	Under	Under ^b	Under	Met	Under	Met	Met	Under	Under	Yield	
AYK	Chinook	Shaktoolik River	Peak Aerial Survey	Theoretical SRA	Under	Under	Under ^f	Under	Met	NS	NS	NS	Under	NS	No	
AYK	Chinook	Unalakleet/Old Woman River	Peak Aerial Survey	Theoretical SRA	Under	Under	Under ^f	NS	Met	NS	Over	Met	Over	NA	No	
AYK	Chum	Middle Fork Goodnews River	Weir Count	Percentile	Met	Met	Met ^b	Met	Met	Met	Met	Met	Met	Under	No	

AYK	Chum	Kanektok River	Single Aerial Survey	Percentile	NA	NS	NS ^b	NS	NS	NS	NS	NS	NS	NA	No	
AYK	Chum	Kogrukluk River	Weir Count	Percentile	Under	Under	Over ^a	Over	Over	Met	Over	Over	Over	NA	No	
AYK	Chum	Aniak River	Sonar	Percentile	Met	Met	Over ^a	Over	Over ^g	Met	Met	Met	Met	NS	No	
AYK	Chum	East Fork Andreafsky River	Weir Count	SRA	Under	Under	Under	Met	Met	Under	Under	Met ^e	Met	Met	No	
AYK	Chum	Anvik River	Sonar	SRA	Under	Under	Met ^b	Met	Met	Met	Under	Met	Met	Met	No	
AYK	Chum	Yukon River Drainage	Calculated - Multiple Surveys	SRA	Over	Met	Over	Over	Over	Met	Met	Met ^f	Over	Met	No	
AYK	Chum	Tanana River	Mark-Recapture	SRA	Over	Over	Over	Over	Over	Over	Over	Over	Over	Met	No	
AYK	Chum	Delta River	Multiple Foot Surveys	Proportion of Tanana River Goal	Over	Over	Over	Over	Over	Over	Met	Over	Over	Met	No	
AYK	Chum	Upper Yukon River Tributaries	Sonar & Weir Count	SRA	Met	Met	Over	Over	Over	Met	NA	Met	Over	Over	No	
AYK	Chum	Chandalar River	Sonar	Proportion of Upper Yukon River Tributaries Goal	Over	Met	Over	Over	Over	Over	NA	Over	Over	Over	No	
AYK	Chum	Sheenjek River	Sonar	Proportion of Upper Yukon River Tributaries Goal	Under	Under	Over	Over	Met	Met	Met	Under	Met	Over	No	
AYK	Chum	Fishing Branch River (Canada)	Weir Count	Agreement	Under	Under	Over	Under	Under	Under ^d	Met	Under	Under	Met	No	
AYK	Chum	Yukon Mainstem (Canada)	Mark-Recapture	Agreement IMEG SRA	Met	Met	Met	Met	Met	Met	Met	Over ^d	Over	Over	No	
AYK	Chum	Norton Sound Subdistrict 1 Aggregate	Calculated - Multiple Surveys	SRA	Under	Met	Over	Over	Over	Met	Under	Over	Over	Over	Yield	
AYK	Chum	Nome River	Weir Count	Proportion of Aggregate Goal	Under	Met	Over ^f	Over	Over	Under	Under	Over	Met	Under	No	
AYK	Chum	Snake River	Tower/Weir Count	Proportion of Aggregate Goal	Met	Met	Over ^f	Over	Over	Under	Under	Over	Over	Under	No	
AYK	Chum	Eldorado River	Peak Aerial Survey (Expanded)	Proportion of Aggregate Goal	Under	Under	Over ^f	Over	Over	Met	Under	Over	Over	Over	No	
AYK	Chum	Niukluk River	Tower Count	Risk Analysis	NA		Under	Under	Met	Under	Under	Met ^b	Met	Under	No	
AYK	Chum	Kwiniuk River	Tower Count	SRA	Met	Under	Met	Over	Over	Under	Under	Over	Over	Under	No	
AYK	Chum	Tubutuluk River	Peak Aerial Survey (Expanded)	SRA	Under	NS	Under	NS	Under	NS	Under	Met	Met	NS	No	
AYK	Chum	Unalakleet/Old Woman River	Peak Aerial Survey	Empirical Observation	NA	NS	Under ^f	NS	Under	NS	NS	NS	NS	NS	No	
AYK	Chum	Kotzebue Sound Aggregate	Peak Aerial Survey (Expanded)	SRA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No	

AYK	Chum	Noatak and Eli Rivers	Peak Aerial Survey	Proportion of Aggregate Goal	NA	Under	NS ^f	Under	NS ^b	Over	Met	NS	NS	NS	No
AYK	Chum	Upper Kobuk w/ Selby River	Peak Aerial Survey	Proportion of Aggregate Goal	Met	Over	NS ^f	Over	NS ^b	Over	Over	NS	NS	NS	No
AYK	Chum	Salmon River	Peak Aerial Survey	Proportion of Aggregate Goal	NA	NS	NS ^f	NS	NS ^b	NS	NS	NS	NS	NS	No
AYK	Chum	Tutuksuk River	Peak Aerial Survey	Proportion of Aggregate Goal	NA	NS	Met ^f	NS	NS ^b	NS	NS	NS	NS	NS	No
AYK	Chum	Squirrel River	Peak Aerial Survey	Proportion of Aggregate Goal	NA	NS	NS ^f	NS	NS ^b	NS	NS	NS	NS	NS	No
AYK	Coho	Middle Fork Goodnews River	Weir Count	Percentile	NA		Met	Met	Met	Met	Met	Met	Met	Met	No
AYK	Coho	Kogrukluk River	Weir Count	Percentile	Met	Met	Met ^a	Met	Met	Over	Met	Met	Met	Met	No
AYK	Coho	Kwethluk River	Weir Count	Empirical Observation	NA							NA	NA	Met	No
AYK	Coho	Delta Clearwater River	Boat Survey	Percentile	Met	Met	Over ^a	Met	Met	Met	Met	Met	Met	Met	No
AYK	Coho	Kwiniuk River	Peak Aerial Survey	Theoretical SRA	Met	Met	NS ^f	NS	Over	Over	NS	Over	Over	NS	No
AYK	Coho	Niukluk River	Tower Count	Percentile	NA	Met	NS	NS	Met ^h	Over	Over	Over ^b	Met	Under	No
AYK	Coho	North River (Unalakleet R.)	Peak Aerial Survey	Theoretical SRA	NA	Over	Over ^f	NS	Over	Over	Over	NS	Met	NS	No
AYK	Pink	Nome River (odd year)	Weir Count	Empirical Observation	NA		Met		Met		Met		Met		No
AYK	Pink	Nome River (even year)	Weir Count	Empirical Observation	NA	Over	i	Met		Met		Met		Met	No
AYK	Pink	Kwiniuk River	Tower Count	Empirical Observation	Over	Over	Met ⁱ	Met	Met	Met	Met	Met	Met	Met	No
AYK	Pink	Niukluk River	Tower Count	Empirical Observation	Over	Over	Met ⁱ	Met	Met	Met	Met	Met	Met	Met	No
AYK	Pink	North River	Tower Count	Empirical Observation	Over	Over	Met ⁱ	Met	Met	Met	Met	Met	Met	Met	No
AYK	Sockeye	North (Main) Fork Goodnews River	Single Aerial Survey	Percentile	Met	Met	NS ^a	Over	NS	Over	NS	NS	Met	Met	No
AYK	Sockeye	Middle Fork Goodnews River	Weir Count	SRA	Met	Met	Over ^a	Over	Over ^b	Over	Met	Met	Under	Met	No
AYK	Sockeye	Kanektok River	Single Aerial Survey	Percentile	Met	Met	Over ^a	Over	NS	Over	NS	Met	NS	NA	No
AYK	Sockeye	Kogrukluk River	Weir Count	Percentile	NA	NA	NA	NA	NA	NA	NA	Met	Met	NA	No
AYK	Sockeye	Salmon Lake/Grand Central River	Peak Aerial Survey	Empirical Observation	Over	Over	Over ^f	Over	Over	Over	Under	Under	Met	Met	No
AYK	Sockeye	Glacial Lake	Peak Aerial Survey	Empirical Observation	Met	Met	Over ^f	Over	Met	Under	Under	Under	NS	NS	No

West	Chinook	Nelson River	Weir/Peak Aerial Survey	Spawning Habitat Model/SRA	Met	Over ^a	Over	Met	Met	Over	Under	Met	Under	Under	No	
West	Chinook	Chignik River	Weir Count	SRA	Over	Over	Over	Over	Met	Met	Met	Over	Met	Met	No	
West	Chinook	Karluk River	Weir Count	SRA	Met	Met	Met	Met	Under	Under	Under	Under	Met ^a	Met	Management	
West	Chinook	Ayakulik River	Weir Count	SRA	Over	Over	Met	Under	Met	Under	Under	Met	Met ^a	Met	No	
West	Chum	Northern District	Peak Aerial Survey	SRA	Met	Met	Under	Over	Over ^b	Met	Met	Met	Under	Met	No	
West	Chum	Northwestern District	Peak Aerial Survey	SRA	Met	Over ^a	Met	Met	Over ^b	Over	Under	Met	Met	Met	No	
West	Chum	Southeastern District	Peak Aerial Survey	Percentile	Over	Over	Over	Over	Met	Over	Met	Under	Met	Met	No	
West	Chum	South Central District	Peak Aerial Survey	Percentile	Under	Over	Over	Met	Met	Met	Under	Under	Met	Under	No	
West	Chum	Southwestern District	Peak Aerial Survey	Percentile	Met	Met	Over	Met	Over	Met	Over	Met	Met	Under	No	
West	Chum	Unimak District	Peak Aerial Survey	Risk Analysis	Under	Under ^b	Met	Met	Met ^c	Met	Met	Met	Met	Under	No	
West	Chum	Chignik Area	Peak Aerial Survey	Risk Analysis	NA	NA	NA	NA	NA	Met ^d	Met	Met	Met	Met	No	
West	Chum	Mainland District	Peak Aerial Survey	Percentile/Risk Analysis	Under	Met	Under ^e	Met	Under	Under ^f	Under	Met	Met	Met	No	
West	Chum	Kodiak Archipelago Aggregate	Peak Aerial Survey	Percentile	NA	NA	NA	NA	NA	Under ^d	Met	Met	Met	Met	No	
West	Coho	Nelson River	Peak Aerial Survey	Risk Analysis	Over	Met ^c	Met	Met	Met	Met	Met	Under	Met	Met	No	
West	Coho	Thin Point Lake	Peak Aerial Survey	Empirical Observation	Over	Met ^c	Met	Met	Met	Met	Under	NA	Under	Under	No	
West	Coho	Ilnik River	Peak Aerial Survey	Risk Analysis	Over	eliminated						Met ^g	Met	Met	No	
West	Coho	Pasagshak River	Foot Survey	Theoretical SRA	Over	Over	Over ^a	Under	Met	Over	Met	Met	Under ^c	Met	No	
West	Coho	Buskin River	Weir Count	SRA	Over	Met	Over ^a	Over	Over	Over	Over	Met	Met	Met	No	
West	Coho	Olds River	Foot Survey	Theoretical SRA	Over	Over	Over ^a	Met	Under	Under	Under	NA	Met ^c	Under	No	
West	Coho	American River	Foot Survey	Theoretical SRA	Over	Over	Under ^a	Over	Under	Met	Met	NA	Met ^c	Met	No	
West	Pink	Bechevin Bay Section (odd year)	Peak Aerial Survey	Risk Analysis	Under	^e	Met	NA	Met	NA	Met	NA	Met	NA	No	
West	Pink	Bechevin Bay Section (even year)	Peak Aerial Survey	Risk Analysis	NA	Met ^e	NA	Met	NA	Under	NA	Under	NA	Under	No	
West	Pink	South Peninsula Total (odd year)	Peak Aerial Survey	SRA	NA	^d	Over	NA	Met ^b	NA	Met	NA	Met	NA	No	
West	Pink	South Peninsula Total (even year)	Peak Aerial Survey	SRA	NA	Over ^d	NA	Met	^b	Met	NA	Under	NA	Under	No	

West	Pink	Chignik Area (odd year)	Peak Aerial Survey	Yield Analysis	NA	NA	Over ^d	NA	Over	^a	Over	NA	Over	NA	No
West	Pink	Chignik Area (even year)	Peak Aerial Survey	Yield Analysis	NA	NA	^d	Met	NA	Over ^a	NA	Met	NA	Met	No
West	Pink	Mainland District	Peak Aerial Survey	Conditional Sustained Yield Analysis	Over	Met	Met ^h	Over	Met	Under	Met	Met	Met ⁱ	Met	No
West	Pink	Kodiak Archipelago (odd year)	Peak Aerial Survey	SRA	NA	NA	Met ^d	NA	Met	NA	Met	NA	Met ⁿ	NA	No
West	Pink	Kodiak Archipelago (even year)	Peak Aerial Survey	SRA	NA	NA	NA	Over	NA	Met	NA	Met	ⁿ	Met	No
West	Sockeye	Cinder River	Peak Aerial Survey	Percentile	Over	Over	Over	Over	Over ^a	Over	Over	Over	Over	Over	No
West	Sockeye	Ilnik River	Weir Count	Percentile/Euphotic Volume Model/Zooplankton Model	Over	Over	Over	Over	Over	Met	Over	Met	Met	Over	No
West	Sockeye	Meshik River	Peak Aerial Survey	Percentile	Over	Over	Over	Over	Met ^a	Over	Over	Met ^a	Met	Met	No
West	Sockeye	Sandy River	Weir Count	Percentile	Over	Under	Over	Met	Met ^a	Under	Met	Met	Met	Under	No
West	Sockeye	Bear River Early Run	Weir Count	Spawning Habitat Model/Percentile/Euphotic Volume Model/Zooplankton Model/Lake Surface Area	Over	Over ^a	Over	Met	Met	Under	Met	Met	Met	Under	No
West	Sockeye	Bear River Late Run	Weir Count	Spawning Habitat Model/Percentile/Euphotic Volume Model/Zooplankton Model/Lake Surface Area	Over	Under ^a	Over	Met	Over	Over	Met	Met	Met	Under	No
West	Sockeye	Nelson River	Weir Count	SRA	Over	Over ^a	Over	Met	Met	Met	Met	Met	Under	Met	No
West	Sockeye	Christianson Lagoon	Peak Aerial Survey	Spawning Habitat Model	Over	Over	Over	Met	Met	Over	Met	Met	Met	Met	No
West	Sockeye	Swanson Lagoon	Peak Aerial Survey	Percentile	Over	Over	Under	Under	Met ^a	Under	Under	Under	Under	Met	Management
West	Sockeye	North Creek	Peak Aerial Survey	Percentile	Over	Over	Over	Met	Over	Over	Met	Over	Over	Over	No
West	Sockeye	Orzinski Lake	Weir Count	Percentile	Over	Over	Over	Met	Under	Over	Over	Met	Met	Met	No
West	Sockeye	Mortensen Lagoon	Peak Aerial Survey	Spawning Habitat Model/Percentile/Euphotic Volume Model/Zooplankton Model/Lake Surface Area	Over	Over	Over	Over	Met	Met	Over	Over	Under	Met	No

West	Sockeye	Thin Point Lake	Peak Aerial Survey	Spawning Habitat Model/Percentile/ Euphotic Volume Model/Zooplankton Model/Lake Surface Area	Over	Over	Met	Under	Met	Met	Over	Under	Met	Met	No
West	Sockeye	McLees Lake	Weir Count	Percentile		eliminated ⁱ						Met ^s	Met	Met	No
West	Sockeye	Chignik River Early Run	Weir Count	Yield Analysis/Euphotic Volume Model/Zooplankton Model	Met	Met	Met ^b	Met	Met	Met	Met	Over	Over	Met	No
West	Sockeye	Chignik River Late Run	Weir Count	SRA/Euphotic Volume Model/Zooplankton Model	Over	Met	Met	Over	Over	Met ^a	Met	Met	Met	Met	No
West	Sockeye	Malina Creek	Peak Aerial Survey	Percentile/ Zooplankton Model	Met	Met	Met ^a	Met	Met	Met	Met	Met	Met	Met	No
West	Sockeye	Afognak (Litnik) River	Weir Count	SRA	Under	Under	Met ^a	Met	Met	Met	Met	Over	Met	Met	No
West	Sockeye	Little River	Peak Aerial Survey	Risk Analysis	Over	Met	eliminated			Under ^j	Under	Met	Met	Met	No
West	Sockeye	Uganik Lake	Peak Aerial Survey	Percentile	Met	Over	eliminated			Met ^j	Met	Met	Met	Under	No
West	Sockeye	Karluk River Early Run	Weir Count	SRA	Over	Over	Over ^a	Met	Over	Under ^a	Under	Under	Under	Met	No
West	Sockeye	Karluk River Late Run	Weir Count	SRA	Over	Under	Over ^a	Met	Met	Under	Met	Met	Met	Met	No
West	Sockeye	Ayakulik River	Weir Count	Zooplankton Model/historical escapement		Met	Met	Under	Met	Under	Met	Met	NA	NA	No
West	Sockeye	Ayakulik River Early Run	Weir Count	Zooplankton Model/historical escapement	Under	NA	NA	NA	NA	NA	NA	NA	Met ^k	Met	No
West	Sockeye	Ayakulik River Late Run	Weir Count	Zooplankton Model/historical escapement	Under	NA	NA	NA	NA	NA	NA	NA	Met ^k	Met	No
West	Sockeye	Upper Station River Early Run	Weir Count	Percentile	Met	Met	Met ^a	Under	Met	Met	Met	Met	Met	Met	No
West	Sockeye	Upper Station River Late Run	Weir Count	SRA	Over	Met	Met ^a	Met	Met	Met	Met	Met	Under	Met	No
West	Sockeye	Frazer Lake	Weir Count	SRA	Over	Under	Met ^a	Met	Met	Met ^a	Met	Met	Met	Met	No
West	Sockeye	Saltery Lake	Weir Count	SRA	Over	Over	Met	Met	Met	Over	Over	Met	Under ^l	Met	No
West	Sockeye	Pasagshak River	Peak Aerial Survey	Percentile/Risk Analysis	Over	Over	Over ^a	Met	Over	Over	Under	Met	Met ^c	Met	No
West	Sockeye	Buskin Lake	Weir Count	Empirical Observation	Over	Over	Over	Over	Over	Under	Under	Met	Over ^m	Over	No

Footnotes by Region:**Southeast:**

Note: NA = data not available. Blank cells indicate that there was no official escapement goal for the stock in that particular year.

^a Escapement goal reevaluated, goal range changed.

^b Prior to 2009, goal was based on index count of escapements.

^c Escapement goal reevaluated, lower-bound changed.

^d Escapement goal reevaluated, upper bound eliminated, lower bound remained the same.

^e Expansion factor was removed from escapement estimates and escapement goal was reevaluated.

^f Situk River weir was pulled well before peak of pink salmon run, therefore a valid assessment of whether the goal was met is not possible.

^g Escapement goal reevaluated, odd and even-year goals replaced by single goal, goal range changed to lower-bound.

^h Prior to 2005, escapement goal was based on weir counts. After 2005, escapements and escapement goal were based on mark-recapture estimates (see DerHovanisian and Geiger 2005).

Central:

Note: NA = data not available; NC = no count; NS = no survey. There are no escapement goals for coho salmon in Bristol Bay or Lower Cook Inlet and there are no pink salmon escapement goals in Bristol Bay or Upper Cook Inlet.

^a Escapement goal reevaluated, point goal changed to a range.

^b Escapement goal reevaluated, point goal changed to a lower-bound goal.

^c Previous escapement goal reinstated.

^d Escapement goal reevaluated, goal range changed.

^e Escapement goal from 2001-2004 based on aerial surveys, escapement numbers in Table 2 are not comparable.

^f Escapement goal reevaluated, lower-bound goal changed to a range.

^g Escapement goal reevaluated, current goal based on escapement count over longer period during spawning season, escapement numbers in Table 2 are based on longer counting time.

^h Escapement goal reevaluated, escapement goal in place prior to 2002 was reinstated. Escapement goal in place from 2002 to 2007 was based on escapement estimates using a different aerial survey index expansion method (see Otis and Szarzi 2007).

ⁱ Escapement goal reevaluated, upper bound eliminated, lower bound remained the same.

^j 2004 and 2009 were identified as pre-peak/peak escapement years for Kvichak River sockeye salmon and evaluated against the 6-10 million escapement goal.

^k Escapement goal reevaluated, goal range changed to a lower bound goal.

^l Escapement goal reevaluated, goal type changed but goal range remained the same.

Arctic-Yukon-Kuskokwim:

Note: NA = data not available; NS =no survey; ND = not determined yet. There are no escapement goals for pink salmon in Kuskokwim Area and Yukon River and there are no escapement goals for sockeye salmon in Yukon River.

a Escapement goal reevaluated, lower-bound goal changed to a range.

b Escapement goal reevaluated, goal value changed.

c Previous escapement goal was based on aerial surveys, replaced with escapement goal based on weir counts. Escapements in Table 3 are weir counts.

d Escapement goal revised by The United States and Canada Yukon River Joint Technical Committee (JTC).

e Escapement goal reevaluated, goal range changed to a lower-bound goal.

f Escapement goal reevaluated, goal type changed but goal value remained the same.

g Previous escapement goal was based on Bendix and Biosonics sonar counts, replaced with escapement goal based on DIDSON sonar counts. Escapements in Table 3 are in DIDSON units (see Molyneaux & Brannian 2006).

h Prior to 2007 escapement goal was based on escapements enumerated by aerial surveys of Niukluk and Ophir rivers. Escapements in Table 3 are weir counts.

i Escapement goal reevaluated, point goal changed to a lower-bound goal.

Westward:

Note: There are no coho salmon escapement goals in Chignik Area.

^a Escapement goal reevaluated, goal range changed.

^b Escapement goal reevaluated, goal type changed but goal range remained the same.

^c Escapement goal reevaluated, upper bound eliminated, lower bound remained the same.

^d Aggregate goal established to replace individual district level goals.

^e Escapement goal reevaluated, goal range changed to a lower bound goal.

^f Escapement goal reevaluated, lower bound goal changed.

^g Goal reestablished. New analysis.

^h Separate odd and even year goals were discontinued and a single goal established.

ⁱ Escapement goal prior to elimination in 2004 was based on escapement indices enumerated by peak aerial surveys, escapements on Table 4 are weir counts.

^j Previous escapement goal reestablished.

^k Single escapement goal was changed to separate early- and late-run escapement goals.

^l Escapement goal reevaluated, upper bound of goal changed.

^m Escapement goal reevaluated, goal type and range changed.

ⁿ Single escapement goal was separated into odd- and even-year escapement goals.

*****Extra notes about the Yukon and Kuskokwim stock of concern (SOC) designations**

All rivers/tributaries within the larger Yukon River drainage are covered by the SOC designation - not just the systems that are monitored and have escapement goals. The reason behind this is that these stocks are defined by the fishery (e.g. Yukon River Chinook) and managed as aggregate stocks. Therefore, SOC designation for individual systems within these types of larger designations are somewhat immaterial because action plans that are developed to deal with the aggregate will likely include any actions that would pertain to individual systems within. However, conceivably, there could be a SOC designation for a specific river or tributary within a larger SOC designation if it was determined to be warranted and specific actions, not already addressed in the action or management plan of the larger SOC designation, could be taken. Similar to the Yukon River Chinook SOC, the Norton Sound SOC designation for Subdistricts 5 and 6 Chinook applies to all systems within the subdistricts.

Data from the Munro and Volk 2013 Report 'Summary of Pacific salmon escapement goals in Alaska with a review of escapements from 2004 to 2012' <http://www.adfg.alaska.gov/FedAidPDFs/FMS13-05.pdf> . Note some of the data in the report are considered preliminary and subject to change.

Analysis of the stocks that failed to meet their goals for a 4-5 years period.

Due to the scale and extent of salmon resources in Alaska and the difficulty in managing such a resource, escapement goal performance over one year alone may not necessarily be reflective of the true management quality and performance. Therefore, the analysis here shows the results of all the active escapement goals in Alaska over ten years to discern the ability of management to allow sufficient salmon escapement throughout the State. More specifically, when a stock does not meet escapement for a period of 4 or 5 years (described as "chronic inability"), the stock is recommended by ADFG to the BOF and placed under the Stock of Concern designation. This designation allows a stock further and more specific management measures to allow its rebuilding to sustainable levels.

If a stock chronically fails to meet escapement goals it is reported by ADFG to the Board of Fisheries (BOF) as a stock of concern and the fishery management plan is amended to protect the productivity of the stock. In addition, a specific action plan associated with the management plan is prepared for any new or expanding salmon fishery, or stock of concern. The action plans are to contain goals, measurable and implementable objectives, and provisions for fishery management actions needed to achieve rebuilding goals and objectives, performance measures appropriate for monitoring and gauging the effectiveness of the action plan and a research plan that is periodically reevaluated, as necessary, to provide information to address concerns.

Stocks of Concern

In March 2011, the BOF took action to identify five stocks of Chinook salmon and continue one stock of sockeye from Upper Cook Inlet as stocks of concern.

These include the Chuitna River, Theodore River, Lewis River, Willow and Goose Creeks, and Alexander Creek Chinook salmon stocks and Susitna River sockeye salmon (BOF Finding 2011-266-FB).

The stock of concern status of Yukon River Chinook salmon has continued through the January 2004, 2007, and 2010 board meetings. Chinook salmon escapement goals were generally met throughout the Alaska portion of the Yukon River drainage the past 5 years (2008–2012), and management actions during the fishing season appear to have contributed to success in achieving those goals. However, commercial and subsistence harvests have decreased substantially from the historical 10-year period (1989–1998) to the recent 5-year (2007–2011) average. There has been no directed commercial fishery for Chinook salmon since 2007. While run sizes showed a modest increase during the years 2003–2006, lower returns have occurred since that time despite continued conservative management strategies, and ADFG recommended continued classification of Yukon River king salmon as a stock of yield concern (Schmidt and Newland, 2012). At its January 2013 regulatory meeting, the BOF continued the classification of Yukon River king salmon as a stock of yield concern. Previous classifications of Yukon River summer and fall chum stocks as stocks of concern were discontinued in 2004 and 2007.

For Bristol Bay, the Kvichak River sockeye stock was identified by ADFG to be a stock of concern, although it achieved the minimum escapement goal for the last three years (Sand, 2012). In 2009, the Kvichak River was reclassified to a “stock of yield concern” and with continued improvements in production over the past 5 years, ADFG recommended that this sockeye stock be removed as a stock of concern in 2012 (Morstad and Brazil, 2012).

In Norton Sound, ADFG recommended the BOF continue the “stock of yield concern” classification for Norton Sound Subdistrict 1 and Subdistricts 2 and 3 chum salmon.

The BOF classified the Norton Sound Subdistrict 5 (Shaktoolik) and Subdistrict 6 (Unalakleet) Chinook salmon as a “stock of yield concern” at its January 2004 meeting, also approving an action plan developed by ADFG. The BOF continued the Subdistrict 5 and Subdistrict 6 Chinook salmon classification as a stock of yield concern in 2007, and adopted a king salmon management plan (5 AAC 04.395) in order to increase escapements and restore the stock to historical levels of abundance. In 2010, the BOF continued the stock of concern designation and modified the management plan for commercial chum and pink salmon fisheries in times of low Chinook salmon abundance. Chinook escapement goals were achieved in 2007, 2009, and 2010, but only as a result of the subsistence fishing schedule stipulated in the management plan, gillnet mesh size restrictions, and early closures to subsistence and sport fisheries. Escapement goals were not achieved in 2008 and 2012 despite similar conservation measures (Kent and Bergstrom, 2012). ADFG recommended continuing the stock of yield concern classification for these stocks. Similarly to the case of protecting Yukon River Chinook during fisheries directed at summer chum salmon, the challenge with Norton Sound Chinook management is to develop strategies to allow subsistence and commercial fisheries directed at chum and pink salmon while minimizing adverse impacts on Chinook escapement (Kent and Bergstrom, 2012).

Sockeye salmon escapements to McDonald Lake have been below the recommended escapement goal in four of the last five years, and are not anticipated to meet the escapement goal in upcoming years (Bergmann, et al, 2009). As a result, McDonald Lake sockeye salmon were identified as a candidate stock of concern in a memo to the BOF in 2008. An action plan for McDonald Lake has been approved by the BOF and is intended to rebuild the McDonald Lake sockeye

salmon run back to levels that can maintain the current escapement goal range. In 2009, the McDonald Lake sockeye stock was identified as a stock of management concern. McDonald Lake escapement was short of its goal in 2008 and 2009, but met its goal in 2010. Sockeye escapements to McDonald Lake have improved substantially over subsequent years, and the department recommended that the stock of concern designation be removed. The Hugh Smith Lake sockeye salmon run was removed from stock of concern status in 2006 as a result of improved escapements. Total adult escapements have improved steadily from a low of 1,138 in 1998 and surpassed the lower bound of the escapement goal in seven of eight years, 2003–2010 (Brunette and Piston, 2012). No additional stocks of sockeye salmon were identified in Southeast Alaska that currently meet the criteria for stocks of concern defined in the sustainable salmon fisheries policy (Heinl, Bachman and Jensen, 2011).

Swanson Lagoon sockeye was identified in early 2013 as a stock of concern after the 2012-2013 BOF regulatory cycle review of all king, sockeye, pink, coho and chum salmon stocks with escapement goals in the Alaska Peninsula/Aleutian Islands. In the past there has been little effort and minimal harvest in the Swanson Lagoon Section, and effort outside of this section is localized such that harvest of Swanson Lagoon sockeye salmon is believed unlikely. As a result of this fishing behaviour, no management actions were taken prior to 2012 in the Swanson Lagoon to address low escapement of Sockeye salmon. During 2012, the section was closed starting July 10th for the entire fishing season to protect this stock (http://www.adfg.alaska.gov/static/regulations/regprocess/fisheriesboard/pdfs//2012-2013/area-m/rcs/rc007_adfg_swanson_lagoon.pdf). Actions to constrain commercial fisheries will continue as necessary to allow sufficient escapements, most likely via issuance of Emergency Orders.

The biological escapement goal range (BEG) for Karluk River king salmon is 3,000 to 6,000 fish. In January 2011, the Board of Fisheries designated Karluk River king salmon a stock of concern. Escapements have improved slightly, meeting the goal in 2011 and 2012, due to management actions to reduce king salmon harvest in sport, commercial and subsistence fisheries. However, recent poor productivity warrants sport fishing nonretention of all king salmon, regardless of size. Emergency Order No. 2-KS-4-02-13 prohibits the retention of king salmon in the Karluk River drainage. King salmon may not be possessed or retained; king salmon caught may not be removed from the water and must be released immediately. In addition, to reduce mortality, the use of bait is prohibited in the Karluk River drainage, excluding Karluk Lake. This emergency order is effective from 12:01 a.m., Saturday, June 1 through 11:59 p.m. Thursday, July 25, 2013. Harvest opportunity may be allowed by subsequent emergency order if inseason assessment of the Karluk River king salmon run indicates the BEG will be attained (http://www.adfg.alaska.gov/static-sf/EONR/PDFs/2013/R2/EO_2-KS-4-02-13_Karluk_Nonretention.pdf).

History of stocks of concern designations

The Policy for the Management of Sustainable Salmon Fisheries (SSFP; 5 AAC 39.222, effective 2000, amended 2001) directs the Alaska Department of Fish and Game to provide the Alaska Board of Fisheries with reports on the status of salmon stocks and identify any salmon stock that present a concern. The SSFP defines three levels of concern (Yield, Management, and Conservation) with yield being the lowest level of concern and conservation the highest level of concern. Chronic inability is defined as "the continuing or anticipated inability to meet expected yields over a 4 to 5 year period."

Yield Concern

A stock of yield concern is defined as "a concern arising from a chronic inability, despite the use of specific management measures, to maintain specific yields, or harvestable surpluses, above a stock's escapement needs; a yield concern is less severe than a management concern" (5 AAC 39.222(f)(42)).

Management Concern

A stock of management concern is defined as "a concern arising from a chronic inability, despite the 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." (5 AAC 39.222(f)(21)).

Conservation Concern

A stock of conservation concern is defined as "a 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." (5 AAC 39.222(f)(6)).

Table 12. Current stocks (March 2013) designated as stocks of management or yield concern.

Stocks of <u>Management Concern</u> as of March 2013	Species	Area	Year Initiated	Year Removed
Norton Sound SD 1	chum	Norton Sound	2001	2007
Toklat River	fall chum	Yukon	2001	2004
Fishing Branch	fall chum	Yukon	2001	2004
Yukon River	summer chum	Yukon	2001	2007
Anchor River	Chinook	Cook Inlet	2001	2004
Hugh Smith Lake	sockeye	Southeast	2003	2006
Kvichak River	sockeye	Bristol Bay	2004	2007
MacDonald Lake	sockeye	Southeast	2009	2012
Karluk River	Chinook	Kodiak	2011	ongoing
Alexander River	Chinook	Cook Inlet	2011	ongoing
Theodore River	Chinook	Cook Inlet	2011	ongoing
Lewis River	Chinook	Cook Inlet	2011	ongoing
Chuitna River	Chinook	Cook Inlet	2011	ongoing
Swanson Lagoon	sockeye	Alaska Peninsula	2013	ongoing

Stocks of <i>Yield Concern</i> as of March 2013	Species	Area	Year Initiated	Year Removed
Kuskokwim River	chum	Kuskokwim	2001	2007
Kuskokwim River	Chinook	Kuskokwim	2001	2007
Kvichak River	sockeye	Bristol Bay	2001 & 2007	2004 & 2012
Yukon River	fall chum	Yukon	2001	2007
Fish Creek	sockeye	Cook Inlet	2002	2005
Norton Sound SD 2/3	chum	Norton Sound	2001	ongoing
Yukon River	Chinook	Yukon	2001	ongoing
Norton Sound SD 5/6	Chinook	Norton Sound	2004	ongoing
Norton Sound SD 1	chum	Norton Sound	2007	ongoing
Susitna River	sockeye	Cook Inlet	2008	ongoing
Willow Creek	Chinook	Cook Inlet	2011	ongoing
Goose Creek	Chinook	Cook Inlet	2011	ongoing

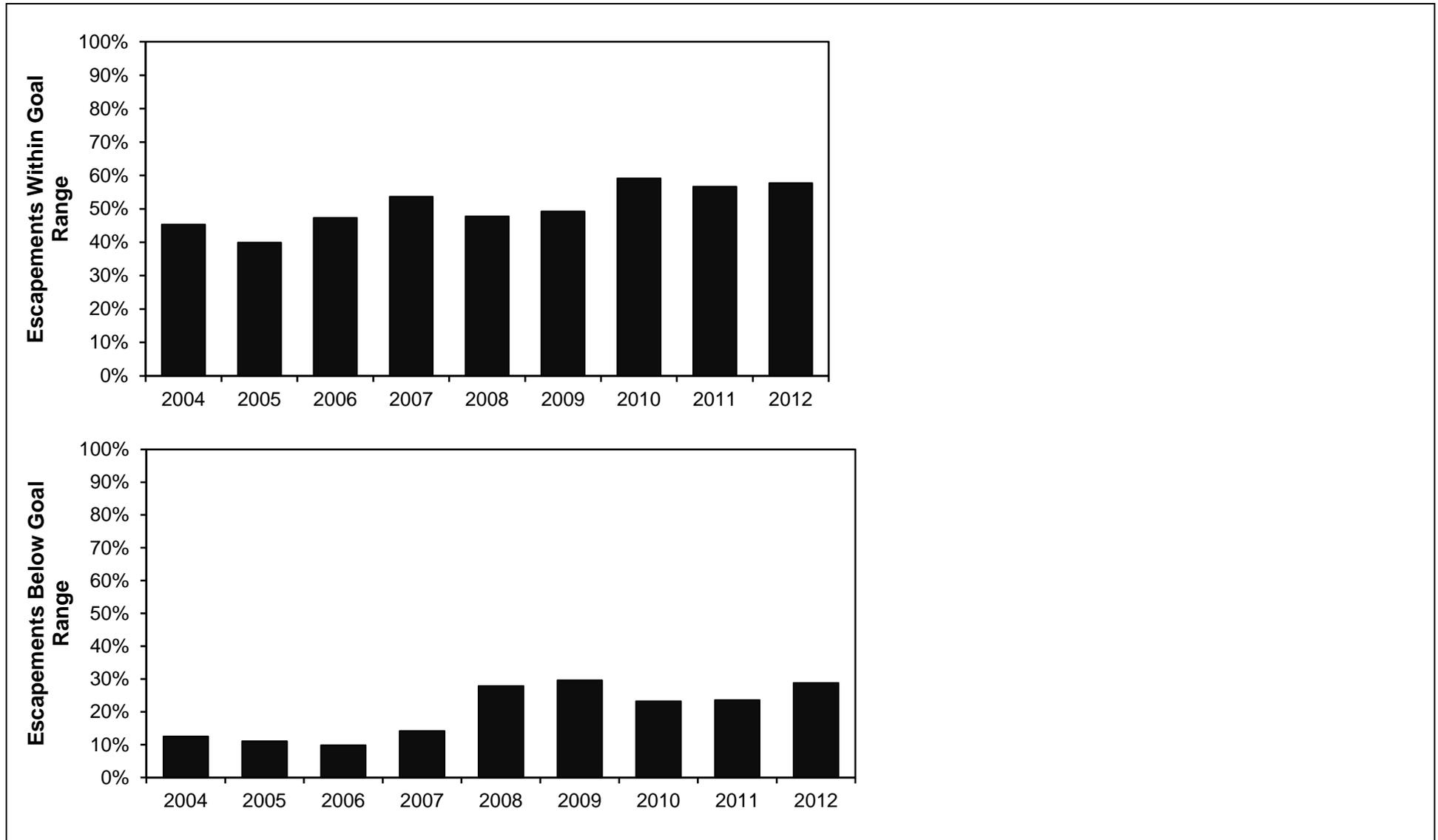
Note: SD = Subdistrict

http://www.adfg.alaska.gov/static/regulations/regprocess/fisheriesboard/pdfs//2012-2013/statewide/rcs/rc008_adfg_stocksofconcernhistory.pdf

It is clear from the tables above that stocks of concern designation and later extra management afforded to them, is able to return stocks to acceptable level of productivity (i.e. removed from stock of concern designation), and in some way allowing the rebuilding of these runs. Of the 14 stocks under management concern designation, 8 have been removed due to improved performance, while the 6 active ones have been introduced between 2011 and 2013. Of the 12 under yield concern designation, 5 have been removed due to improved performance, while the 7 active stocks have been introduced at dates spanning from 2001 to 2011. Of particular remark, 9 of 13 of the current stocks of concern are Chinook salmon stocks.

Emergency Orders

Sustained yield management of commercial salmon fisheries requires precise timing of fishery openings and closures and adjustments in gear, often with short notice, to allow or constrain the harvest of fish, ultimately assuring adequate escapement of spawning fish. Emergency Orders (EO) are widely used to open and close fisheries as needed by local area biologists. For this surveillance activity the assessment team has analyzed more than 800 emergency orders released in 2012. During the 2012 calendar year ADFG issued about 750 emergency orders to open and close commercial salmon fisheries throughout Alaska. These emergency orders can be found through the *Regulation Announcements, News Releases, and Updates for Commercial, Subsistence and Personal Use Fishing* page at the ADFG website at <http://www.adfg.alaska.gov/index.cfm?adfg=cfnews.main> . Emergency orders are a testament to the flexibility of inseason management as carried out by the Department to manage salmon using run size and timing information among other parameters. This allows for the achievement of escapement goals-based management objectives.



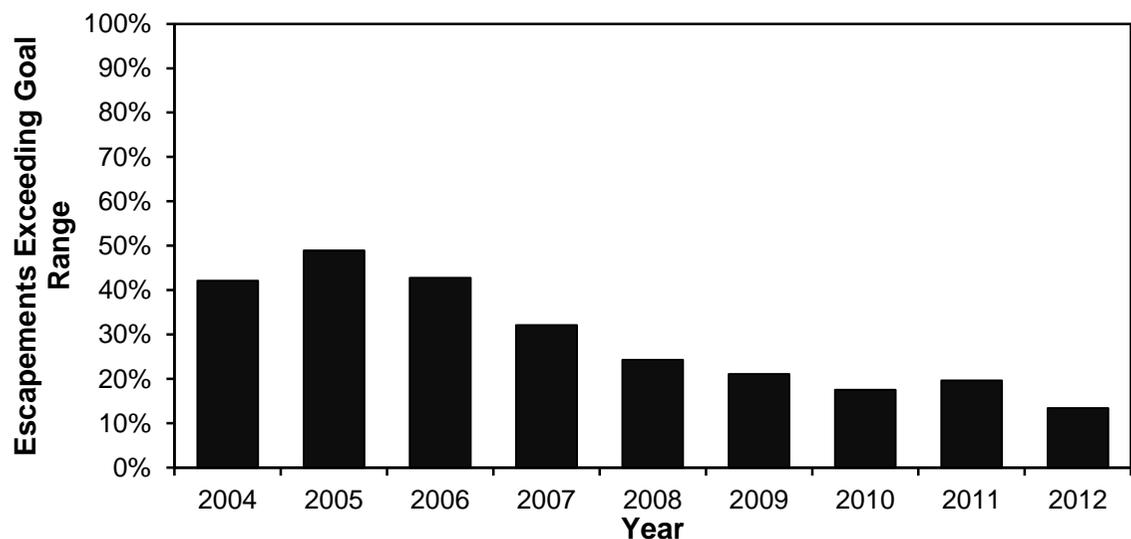


Figure 7. Statewide summary by year of percentage of escapements that upper) met the escapement goal (i.e. within goal range or above lower bound of a lower-bound SEG), middle) were below lower bound of goal, or lower) exceeded the upper bound of goal range for the years 2004 to 2012.

An increasing trend in the proportion of stocks that have not met the lower escapement goal is most evident in Chinook salmon. Increases in the proportion of Chinook stocks that have not met the lower goal has occurred in all regions. The trend is evident in all areas where Chinook salmon stocks historically were abundant (Southeast, Central, Arctic-Yukon-Koskokwim). Chum and Pink salmon in the Central Region have also shown an increasing trend in the proportion that have not met the lower escapement goal.

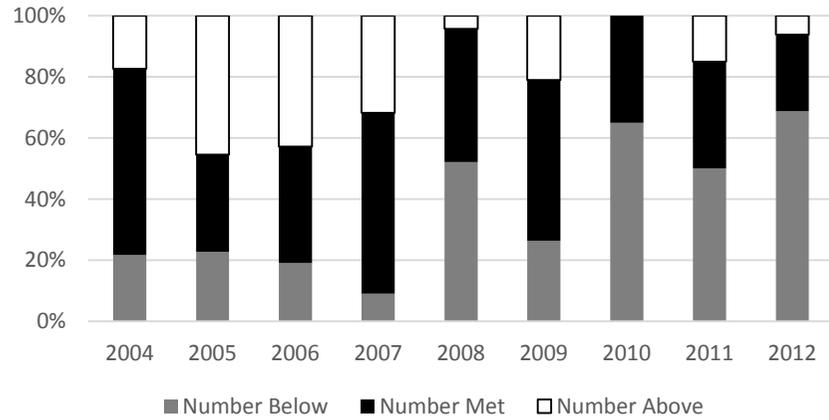
Of the 11 Chinook stocks in the Southeast Region that have escapement goals, 6 (55%) were below the goal in 2012 compared to 3 in 2011 and 1 in 2010.

Of the 22-29 Chinook stocks in the Central Region with goals, the proportion below the lower goal has been relatively high since 2007 at an average of 58% (61% in 2012 compared to 58% in 2011).

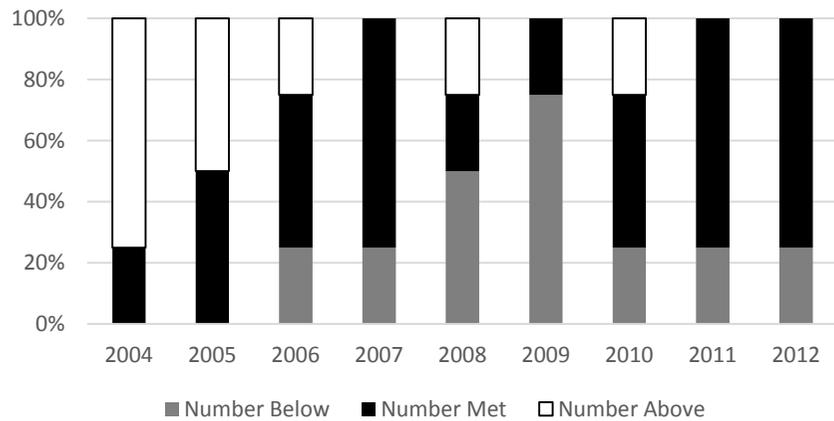
Of the 16-23 Chinook stocks in the Arctic-Yukon-Koskokwim Region 52% have been below the lower goal on average since 2007 with a record high of 69% in 2012 compared to 50% in 2011.

There are only 4 Chinook spawning systems in the Westward Region that have escapement goals and 3 have met the lower goal in the last two years.

Arctic-Yukon-Kuskokwin Chinook



Westward Chinook



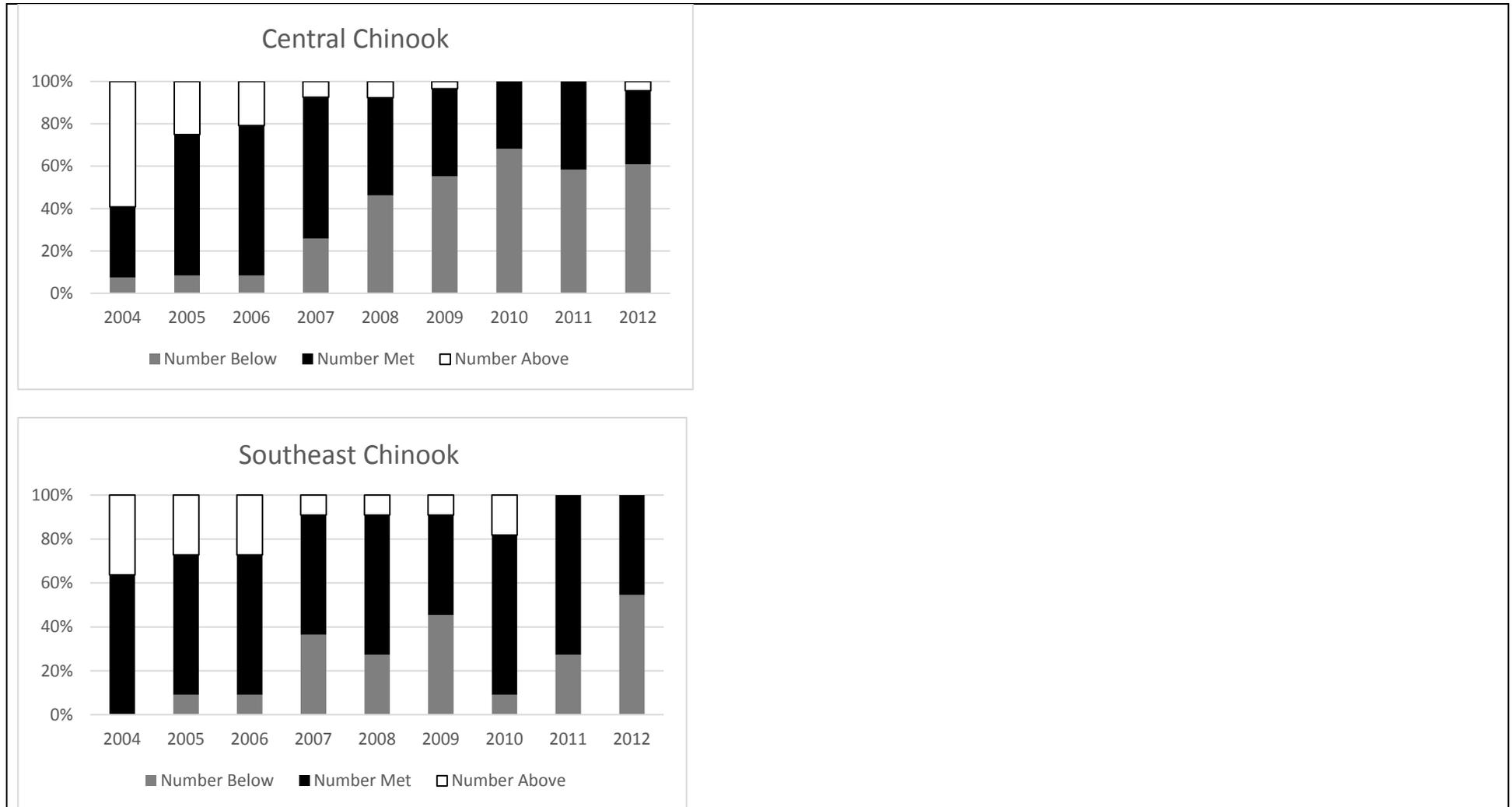


Figure 8. Summary of the four ADFG Management Region Chinook salmon escapements compared against escapement goals for the years 2004 to 2012.

Declines in the productivity and total returns of Chinook salmon have been observed since 2001 for many stocks harvested in Alaska (ADFG 2013).

http://www.adfg.alaska.gov/static/home/news/hottopics/pdfs/chinook_research_plan.pdf.

Stock recruitment analysis (SRA) for 12 Chinook stocks harvested in Alaska reveal consistent negative residuals in model Ricker fits beginning with brood year 2001. The decline is widespread throughout Alaska as well as stocks that are harvested in Alaska and that spawn in transboundary systems within Canada. For half of the stocks, recent productivity residuals are the lowest observed since data collection began in the 1970s. The decline in productivity beginning in 2001 would have begun to affect returning abundances in 2005 as age-4 Chinook. The decline would have fully affected returns by 2007 when all ages would have been affected by productivity declines. As Chinook abundance declined, fisheries management actions reduced the amount of catch taken in an attempt to meet escapement goals, however, as noted above, the decline in productivity and run abundance resulted in escapement levels below the lower range of the goals in many cases. The causes of the decline in productivity are not known and for most Chinook stocks there are insufficient data to separate freshwater and marine effects on productivity.

Alaska Chinook Stock Assessment and Research Plan (ADFG 2013)

Chinook salmon are critically important to subsistence, commercial, and sport users and to communities and economies across Alaska. Recent downturns in productivity and abundance of Chinook salmon across the state and the resulting hardships have highlighted the significant need for the ADFG to better understand and characterize the changing productivity and abundance trends for Chinook salmon and to identify actions that could be taken to lessen the hardships experienced by Alaskans that use and depend on this resource.

Overall, there is clear evidence of recent and persistent statewide declines in Chinook salmon productivity, run abundance, and inshore harvest from available stock assessment data as well as from local and traditional knowledge sources. This decline in productivity appears to have begun with the 2001 brood year and has persisted through at least the 2007 brood year, resulting in below average run abundance and harvest during 2007 through present. There is some evidence that a statewide downturn in run abundance occurred during the early to late 1970s, but this is based on incomplete information. Trends in stock specific productivity during brood years 1975 through 2000 and in run abundance during 1977 through 2006 did not appear consistent statewide, although some regional trends were apparent throughout the time series.

Fishery management has been responsive to lower run abundances by constraining significantly commercial fishing in an attempt to achieve escapement goals. Conservative management in the face of uncertainty will sustain Chinook salmon stocks by reducing the risk of overfishing and inadequate escapements, but will also increase the risk of foregone harvest opportunities that can threaten the viability of social and economic system in Alaska that are highly dependent on Chinook salmon as cultural value, subsistence and income.

To address the decline, the Department tasked a team of agency scientists and researchers with developing a comprehensive Chinook salmon research plan to address knowledge gaps and research needs. The team conducted a comprehensive review of Chinook salmon programs and developed a report entitled "Alaska Chinook Salmon Knowledge Gaps and Needs" (Gap Analysis) to identify existing knowledge gaps, identify activities that could be undertaken to narrow

those gaps, and identify the range of potential costs associated. The Department hosted the Chinook Salmon Symposium in October 2012, and invited state, federal, and academic scientists and the public, to discuss and further identify knowledge gaps and compile a list of research priorities to address specific questions informing observations of Chinook salmon abundance and productivity in Alaska. Results from the Gap Analysis, discussion at the Chinook Salmon Symposium, and comments received on the Gap Analysis were combined to develop the Chinook salmon research plan.

Documents are available online at:

http://www.adfg.alaska.gov/index.cfm?adfg=chinook_efforts_symposium.information

This project will fund activities identified as needed by the Chinook salmon research plan. The plan is structured on a stock-specific, life-history basis for 12 indicator stocks from Southeast Alaska to the Arctic-Yukon Kuskokwim, representing diverse life history and migratory characteristics across a broad geographic range. Stock assessments to be funded include, for these stocks, a complete assessment of adult escapement and stock-specific harvests in all relevant fisheries, assessment of juvenile Chinook salmon smolt, local and traditional knowledge (LTK) studies, nearshore marine surveys, and life history process studies.

The central objective of the plan implementation is to create a consistent stock assessment framework across a diversity of indicator systems in Alaska that will provide improved information for sustained yield management of Chinook salmon for a range of run sizes and productivity regimes. Linkage of improved monitoring data with process based research will provide insight into ecological and environmental mechanisms causing recent abundance declines and give managers better predictive tools.

http://www.adfg.alaska.gov/static/home/news/hottopics/pdfs/chinook_research_plan.pdf

The Chinook Stock Assessment and Research Plan (ADFG 2013) acknowledges that better information is needed from all life stages to improve forecasts of productivity and abundance. Additionally, that information would help improve escapement goal development and responsiveness of fisheries management to in-season changes in abundance and run timing to better balance the trade-offs between fishing mortality and future sustainability of Chinook stocks harvested in Alaska. The indicator stocks include the Unuk, Stikine, Taku and Chilkat rivers (Southeast Region); the Copper, Susitna and Kenai rivers (Central Region); the Karluk River on Kodiak Island, and the Chignik River on the Alaska Peninsula (westward Region); and, the Nushagak, Kuskokwim and Yukon rivers (Arctic-Yukon-Kuskokwim Region). The Research Plan recommends that stock assessment programs be implemented for each of 12 Chinook indicator stocks with the following features:

1. *Estimate annual escapement and age-size composition.*
2. *Estimate annual total harvest.*
3. *Estimate total production of adult equivalents.*
4. *Estimate the number of smolts and smolts-per-spawner from 1 above.*

5. *Estimate marine survival.*
6. *Estimate annual abundance in nearshore marine environments for forecasting.*
7. *Update and refine production models to estimate optimal escapement levels.*
8. *Provide forecasts of returns for improved management capability.*
9. *Provide adequate local traditional knowledge concerning patterns and trends.*

The Research Plan identifies several knowledge gaps, including elements of the Chinook life cycle and productivity changes, and notes that long-term study is needed to make any of the research effective. The biggest component to be funded is \$3 million for stock-specific escapement or in-river run assessments. Smolt enumeration assessments is about \$2.5 million, harvest assessments at \$1.8 million, and marine surveys and modelling at \$1.6 million. Other components are \$500,000 for long term knowledge assessments, \$700,000 for process studies, and \$500,000 for programmatic support.

This project is closely aligned with the Department's top two core services of stock assessment and harvest assessment. For 2013, the Governor of Alaska requested to the legislature \$10 million; the legislature funded \$7.5 million. As for the original research plan, another \$10 million will be requested in 2014 and then again in 2015. This is the first of a five-year \$30 million research effort.

The current \$7.5 million is in addition to the \$14.6 million ADFG typically spends each year on Chinook-related research and management. A bill was introduced into the legislature that could fund future Chinook studies. HB 49 would create an endowment that includes a fund, grant account and oversight body, all designed to benefit Chinook salmon in perpetuity. That's currently in the House fisheries committee. A similar bill was introduced last year. Progress and development resulting from this effort will be followed as the various surveillance assessments progress in time.

Based on the fact that ADFG is constraining significantly commercial harvests of Chinook salmon throughout Alaska in response to the current period of low production, and considering the ADFG led *Chinook salmon stock assessment and research plan* effort and initial funding for the year 2013; the assessment team considers that this management response is appropriate for the issue at hand and in line with improving the state of affairs of Chinook salmon stocks in the A-Y-K, Westward, Central and Southeast Management Regions.

International fisheries

Yukon salmon harvest 2012 and 2013 outlook

The Joint Technical Committee (JTC) of the United States and Canada serves as a scientific advisory body to the Yukon River Panel. The JTC discusses harvest and escapement goals, management trends, postseason reviews and preseason outlooks, and results of cooperative research projects. The 2013 JTC report (<http://www.adfg.alaska.gov/FedAidPDFs/RIR.3A.2013.02.pdf>) summarizes the status of Chinook, coho and summer and fall chum salmon stocks in 2012, presents an outlook for the 2013 season, and provides data on salmon harvests in commercial, subsistence, aboriginal, personal use domestic and sports

fisheries. Recommended Yukon River escapement goals for Chinook, chum and coho salmon for 2012 remained unchanged from 2011. In response to a poor Chinook salmon run strength, the need to fulfill the Canadian border passage obligation, meet Alaska escapement needs, and provide for subsistence uses, no commercial harvest targeting Chinook salmon was allowed in 2012 in the Yukon River mainstem or in the Tanana River.

The preliminary 2012 Chinook escapement in Canada was about 33,000 fish, falling below the goal range of 42,500-55,000 fish. Preliminary harvest estimates were about 26,000 Canadian origin Chinook for subsistence in Alaska and 2,200 Chinook for Yukon Territory aboriginal fisheries. For fall chum salmon, the preliminary 2012 drainage-wide total run size estimate was 963,000 fish. The escapement goal range for chum in Canada was 70,000-104,000 fish and the preliminary 2012 fall chum salmon estimate for fall chum escapement in the Yukon River mainstem in Canada was about 138,000 fish, exceeding the upper end of the goal range. The total commercial harvest of fall chum salmon in Alaska was 289,000 fish, the largest harvest since 1995. The Alaska preliminary subsistence harvest of fall chum salmon was 94,000 fish. The Canadian commercial harvest was 3,205 fall chum salmon and the aboriginal harvest was about 4,000 fish. Recommended Yukon River escapement goals for Chinook, chum and coho salmon for 2013 remained unchanged from 2012.

Northern Transboundary Stocks

Most of the Chinook salmon harvested in the Southeast Alaska summer troll fishery are of wild stock origin. Fish of hatchery origin harvested in this fishery originate primarily from hatcheries in British Columbia, Canada, Washington, and Oregon with a relatively small number from Alaskan hatcheries. The Southeast Alaska Chinook salmon harvest is managed on an annual, all-gear harvest quota established by the United States and Canada through the PSC. The quota is now abundance-based, with increases when abundance is high, and reductions when it is low. In addition to the harvest ceiling of treaty fish, the treaty includes provisions administered by the PSC to provide for an additional harvest of Chinook salmon produced in Alaskan hatcheries (add-on). The all-gear add-on is equal to the total number of Alaskan hatchery Chinook caught, minus the pre-treaty production of Chinook salmon and a risk adjustment factor of around 4,700 fish. The hatchery add-on is calculated inseason through port sampling programs. Chinook salmon are sampled for the presence of adipose fins. The heads from fish that have missing adipose fins are then sent to the Juneau Mark, Tag and Age lab where coded-wire tags are removed from the heads and decoded. The number of Alaskan hatchery fish is then calculated by expanding the number of Alaskan hatchery-produced Chinook salmon in the sampled catch by the total catch.

The harvest of treaty Chinook salmon is limited to a specific number of fish, which varies annually according to an abundance index. The accounting of treaty Chinook harvested by trollers begins with the winter fishery and ends with the summer fishery. The winter troll fishery is managed to not exceed the guideline harvest level (GHL) of 45,000 Chinook salmon plus a number of non-Alaska hatchery-produced Chinook salmon. Fish tickets provide inseason information on harvest and effort throughout the fishery. In years when the winter fishery closed prior to April 30 because the GHL was reached (2003–2006, 2011 and 2012), daily counts from regional processors were important in tracking harvest during the final weeks of the fishery. During these years several spring fishery areas opened prior to May 1. Spring fisheries are conducted along migration routes or close to the following hatcheries and release sites: Little Port Walter Hatchery; Port Armstrong Hatchery; Macaulay Hatchery (Douglas Island Pink and Chum, Inc.); Whitman Lake Hatchery; Crystal Lake Hatchery; Neets Bay and Anita Bay release sites (Southern Southeast Regional Aquaculture Association); and Medvejie Hatchery and Hidden Falls Hatchery (Northern Southeast Aquaculture

Association). Spring troll and terminal troll fisheries target Alaska hatchery Chinook salmon, although non-Alaska hatchery Chinook are also harvested. Non-Alaska hatchery fish are counted towards the season treaty quota of Chinook salmon under the Pacific Salmon Treaty, while most of the Alaska hatchery fish are not.

ADFG management objectives for this fishery include: achieve the allowable Chinook salmon harvest; maximize the harvest of Alaska hatchery-produced Chinook salmon; manage the fishery according to the BOF Summer Salmon Troll Fishery Management Plan (5AAC 29.100); continue the coastwide natural Chinook salmon stock-rebuilding program; achieve harvest allocations among user groups as mandated by the BOF; and minimize the incidental mortality of Chinook salmon to the extent practicable. Historically, the majority of the annual troll Chinook salmon harvest is taken during the general summer opening, when salmon may be taken throughout most of the Southeast Alaska/Yakutat area, including the outside waters of the EEZ. One of the major functions of the department's troll management plan is to determine when the general summer season for Chinook salmon must be closed in order to stay within the allowable harvest. Timely tabulation of the troll catch is difficult due to the large number of fish tickets and the difficulty of receiving them from remote areas in a timely manner. A Fisheries Performance Data (FPD) program, consisting of confidential interviews with commercial trollers as they deliver catches, is used to estimate daily catch rates. The department manages the summer troll season to harvest 70% of the summer Chinook salmon troll quota in an initial opening beginning July 1. The remainder of the Chinook salmon quota for troll gear is harvested following any closure for coho salmon conservation and/or allocation in August.

The 2012 Chinook fishery was managed to achieve an all-gear harvest of 266,800 treaty Chinook salmon. The actual all-gear treaty harvest was 241,118 fish, which was 10% under the quota. The troll treaty harvest was 191,839 fish, which was 3% under the troll treaty allocation of 197,272. The purse seine harvest of 5,994 treaty Chinook was well under the allocation of 11,472 fish. The drift gillnet allocation was 7,737, of which 6,591 Chinook were harvested. Set gillnetters harvested 968 of their 1,000 fish quota and the sport harvest of 36,454 was below the allocation of 49,318 fish. For 2013, the Chinook treaty harvest quota is 176,000 fish, of which 129,862 are allocated to troll, 32,466 to sport, 7,568 to purse seine, 5,104 to drift gillnet and 1,000 to set gillnet (Skannes, Hagerman and Shaul, 2013).

For 2013, the Chinook Technical Committee of the PSC has determined that the Chinook salmon abundance index for Southeast Alaska is 1.20. This abundance index equates to an all-gear quota of 176,000 treaty Chinook salmon, which is about 90,800 fewer than the 2012 all-gear quota. According to the BOF allocation plan the troll fishery allocation of the all-gear quota is 129,862 treaty Chinook salmon, which is about 67,410 fewer than the 2012 troll treaty allocation. The quota is based on the Southeast Alaska (SEAK) abundance index from 30 stock groups that originate from the Oregon coast to Alaska. Of those, seven stocks make up the majority of the SEAK abundance index. Below-average returns are expected for six of these seven stocks in 2013. The all-gear quota for this year is 176,000 and is allocated among commercial and sport fisheries according to management plans established by the BOF in regulations 5AAC 29.060(b) and 47.055. Most Chinook salmon produced by Alaska hatcheries are not included in the abundance index and may be harvested above and beyond the treaty limit. The commercial troll fishery is allocated 80% and the recreational fishery 20% of the PST quota (after subtracting 4.3% from the total for the purse seine fishery, 2.9% for the drift gillnet fishery, and 1,000 fish for the set gillnet fishery). The pre-treaty Chinook salmon harvest and risk adjustment factor (4,700 combined) are proportionally shared between the gear groups. The summer troll treaty quota is calculated by adding the winter treaty harvest, the projected spring treaty harvest, the pre-treaty Alaska hatchery harvest of 3,700 fish, and a statistical risk factor surrounding the Alaska hatchery contribution

estimate of 1,000 fish. The resultant sum is then subtracted from the troll allocation, yielding a summer troll treaty quota. In addition, under the BOF plan, 70% of the summer quota is to be harvested during the first summer opening beginning July 1. The target harvest for the July Chinook salmon opening was 62,864 in a 6-day fishery opening.

In 2012, in addition to the coastwide treaty quota, preseason forecasts provided small allowable catches for directed fisheries of 5,890 for returns to the Stikine River and 6,700 for returns to the Taku River. However, in response to reduced returns measured inseason by stock assessment projects, directed fisheries on both rivers were curtailed and the river harvests on those transboundary rivers were minimal. There were also no directed fisheries on the transboundary Taku or Stikine rivers in 2011 due to low forecasts and returns.

In addition, ADFG has used its emergency order powers to limit harvests of Chinook salmon by sport fisheries in specific areas to increase escapements. For example, in 2012 the king salmon sport fishery in the marine waters around Petersburg and Wrangell that is managed under the Southeast Alaska King Salmon Management Plan (5 AAC 47.055), and the Stikine River King salmon Management Plan (5 AAC 47.057) was restricted to because the department's inseason estimated terminal run size of 20,950 Stikine River king salmon did not provide an allowable catch, therefore liberalized regulations implemented by Emergency Order No. 1-KS-C-05-12 were no longer justified under the provisions of the Stikine River King Salmon Management Plan. For 2013, the Stikine River Chinook preseason forecast and inseason stock assessment monitoring program that is conducted in-river, has indicated a decreased number of Chinook returning this year to the Stikine River relative to levels where sport regulations have been liberalized in other years. Given the anticipated level of run strength, and the current date (July 12) relative to the management plan's period for liberalizing regulations (May 1- July 15), there will not be any changes in regulations related to Stikine River King salmon in local marine waters around Petersburg and Wrangell for 2013.

Native Chinook salmon stocks occur throughout Southeast Alaska and Yakutat, primarily in the large mainland rivers and their tributaries. In total, 34 rivers in the region are known to produce runs of Chinook salmon. The most important are the Alsek, Taku, Stikine, Chilkat, and the Behm Canal rivers (i.e., Unuk, Chickamin, Blossom, and Keta rivers). The three major river systems (Alsek, Taku, and Stikine rivers), as well as several mid-sized systems (Unuk, Chickamin and Chilkat rivers) are transboundary rivers, originating in Canada and flowing through Alaska to the Pacific Ocean. The Pacific Salmon Commission, under the terms of the PST, addresses shared ownership and coordinated management of the Alsek, Taku, and Stikine rivers. In the Yakutat area, Chinook salmon are harvested incidentally in the set gillnet fishery for sockeye salmon. Chinook are harvested in the Situk-Ahrnklin Inlet, Alsek River, Yakutat Bay and Awe River areas. In 2011, the preseason projection for the Situk River was for a below average return and conservation measures mandated by 5AAC 30.365 were implemented. Commercial, sport and subsistence fisheries for Chinook were closed in Situk-Ahrnklin Inlet area. The preseason projection for Chinook returning to the Alsek River in 2011 was above average and the harvest of 550 fish was only 3% below the recent average of 570.

Since a Chinook salmon rebuilding program began in 1981, ADFG has annually estimated Chinook salmon escapements on 11 indicator systems. These escapements were initially measured against interim goals established prior to 1985, which in general were set as the largest escapements seen prior to 1981. As a part of the rebuilding program, ADFG conducted CWT studies and improved escapement estimation methods. The department also sampled age and sex data in the escapement in order to collect data that would, when included with escapement data, allow the use of spawner-recruit analytical methods to set

Biological Escapement Goals (BEG) to achieve maximum sustained yield. Establishment of BEG goals indicated that the Alsek, Situk, Unuk, and Keta rivers were within the ranges of desired escapement prior to the rebuilding program and only the Blossom River was below desired escapements. Prior to 2012, the four indicator systems in Behm Canal, the Unuk, Chickamin, Blossom, and Keta Rivers, had consistently been above or within escapement goal ranges dating back to 1985. Escapements to both the Blossom and Keta continued this trend, and with new BEGs established, both systems exceeded upper MSY goals in 2012. Unlike the Blossom and Keta, the escapements to the Unuk and Chickamin fell below lower limits, and were the lowest on record, dating back to 1975. Escapement values for indicator stocks in the Wrangell vicinity, the Stikine River and Andrew Creek, have been above or within their escapement goal ranges for 26 of the last 27 years and 24 of the last 27 years, respectively. While the escapement to the Stikine was within the desired goal range, Andrew Creek escapement, similar to the Unuk and the Chickamin, fell well below historic averages in 2012, and was one of the lowest returns since the Chinook rebuilding program began. With the exception of 2007, Taku River Chinook escapements have been above or within the desired ranges since 1991, with 2012 escapement surpassing the lower limit goal. For only the second time in the last 22 years, escapement to the Chilkat River was below the lower BEG, when an estimated 1,627 spawners returned in 2012. Prior to 2005, the Alsek River, one of two indicator systems near Yakutat, was consistently above or within the BEG range. Since then, the Alsek escapement values have been below the lower end goal in five of the last eight years. Although the escapement to the Situk River, the second indicator system near Yakutat, was an improvement over the record lows of 2010 and 2011, the 2012 returns still fell below the lower limit of the BEG range. In 2012, escapements generally decreased from those in 2011, with 5 of the 11 index counts above the 2011 escapement values.

Escapement to Southeast Chinook Systems											
Year	System										
	<i>Alsek</i>	<i>Taku</i>	<i>Stikine</i>	<i>Situk</i>	<i>Chilkat</i>	<i>Andrew</i>	<i>Unuk</i>	<i>Chickamin</i>	<i>Blossom</i>	<i>Keta</i>	<i>King Salmon</i>
2008	1,337	24,121	18,843	453	2,833	981	3,104	5,277	774	1,093	120
2009	6,095	22,806	11,086	902	4,429	628	3,157	2,902	370	614	109
2010	9,428	29,307	15,177	167	1,852	1,205	4,290	4,859	542	1,430	158
2011	6,668	19,682	14,569	240	2,803	936	3,272	4,052	569	671	192
2012	2,660	19,538	25,939	322	1,627	589	956	444	793	725	236
Lower Goal	5,500	19,000	14,000	450	1,850	650	1,800	2,326	150	175	120

Summary

There are currently 300 active salmon stock escapement goals throughout the state. These escapement goals cover mainly index systems but also individual streams. A variety of methods are used to develop escapement goals in Alaska. During the 2012-2013 Board of Fisheries cycle, reviews of the escapement goals were done for Bristol Bay salmon, Arctic-Yukon-Kuskokwim Region salmon and Alaska Peninsula and Aleutian Islands salmon in the Westward Region. An out-of-

cycle assessment of Late-Run Chinook Salmon in the Kenai River was also reviewed. Where escapements chronically (4-5 years) fail to meet expectations for harvestable yield or spawning escapements, the department may recommend, and the board may adopt a stock of concern designation for those underperforming salmon stocks. Stock improvement following this designation is supported by data. A review of all the latest escapements (300) throughout Alaska indicates that the majority of escapement goals have recently been met, with exceptions for Chinook salmon statewide. In response to a Statewide decline in Chinook production, ADFG has been limiting and/or closing commercial fisheries to meet escapement goals and has initiated a \$30 million research projects aimed at elucidating Chinook stock dynamics and to improve stock assessment and overall management for the species.

Additional references:

Eggers, D. M. and A. M. Carroll. 2012. Run forecasts and harvest projections for 2012 Alaska salmon fisheries and review of the 2011 season. Alaska Department of Fish and Game, Special Publication No. 12-01, Anchorage.

Eggers, D. M., C. Tide, and A. M. Carroll, editors. 2013. Run forecasts and harvest projections for 2013 Alaska salmon fisheries and review of the 2012 season. Alaska Department of Fish and Game, Special Publication No. 13-03, Anchorage.

Woods, G.F. and N.L. Zeiser. 2012. Annual management report of the 2011 Yakutat Area commercial salmon fisheries. Alaska Department of Fish and Game. Fishery Management Report No. 12-01. Anchorage.

Munro A. E. and Volk E. 2013. Summary of Pacific salmon escapement goals in Alaska with a review of escapements from 2004 to 2012. Alaska Department of Fish and Game, Division of Commercial Fisheries, Fishery Manuscript Series No. 13.05, Anchorage. Available at <http://www.adfg.alaska.gov/FedAidPDFs/FMS13-05.pdf>. Note some of the data in the report are considered preliminary and subject to change.

7. Management actions and measures for the conservation of stock and the aquatic environment shall be based on the Precautionary Approach. Where information is deficient a suitable method using risk assessment shall be adopted to take into account uncertainty.

FAO CCRF 7.5.1/7.5.4/7.5.5

FAO ECO 29.6/32

Evidence adequacy rating:

High

Medium

Low

Rating Determination:

The Policy for the Management of Sustainable Salmon Fisheries codifies the precautionary approach in State regulation of salmon fisheries and habitats. This policy states that in the face of uncertainty, salmon stocks, fisheries, artificial propagation, and essential habitats are to be managed conservatively. It also includes provisions that address the potential effects of ecological changes on sustainable harvest in the respect that salmon fisheries must be managed to provide escapements within ranges necessary to conserve and sustain salmon production and to maintain normal ecosystem functioning. Based on the statewide decrease in Chinook salmon production, ADFG is limiting commercial and sport fisheries on the species to ensure escapement goals are met, as far as possible. ADFG is also leading the Chinook salmon stock assessment and research plan effort and has obtained initial funding for the year 2013. The assessment team considers that this management response is appropriate for the issue at hand, in line with improving the state of Chinook salmon stocks in Alaska and with a precautionary approach to management. Also results of the WASSIP program have been made public in 2012, this study represents a very comprehensive program of sampling and analytical effort that has effectively reduced uncertainty in stock composition, harvest and harvest rates of sockeye and chum salmon supporting the management regulatory process in western Alaska. As for the current issues surrounding the hatchery-wild interactions, the Prince William Sound Science Center (PWSSC) has started the field work for the large scale hatchery salmon research project in late 2012. A specific schedule of tasks until 2016 has been provided by ADFG and a summary report for the 2012 activities has been published. No increase in pink or chum salmon hatchery production has been granted in PWS or SEAK in 2012. These last two items constitute the evidence supporting corrective action following the minor non-conformance issued last year under this clause. Progress is ongoing and following the agreed schedule.

The Precautionary Approach in Policy

Salmon Management

For the State of Alaska, adopted and ratified by the people almost 60 years ago, in 1956, the Constitution Article 8.4 in the state’s Constitution states “fish, forests, wildlife, grasslands, and all other replenishable resources belonging to the state shall be utilized, developed and maintained on the sustained yield principle, subject to preferences among beneficial uses”.

In State Regulation, the Policy for the Management of Sustainable Salmon Fisheries (5 AAC 39.222 (a) (1); (a) (5)(A,B),) also codifies the precautionary approach in State regulation of salmon fisheries and habitats. This policy states that 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;
- (B) a precautionary approach requires consideration of the needs of future generations and avoidance of potentially irreversible changes; prior identification of undesirable outcomes and of measures that will avoid undesirable outcomes or correct them promptly; 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; 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;
- (C) 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; a precautionary approach should be applied to the regulation of activities that affect essential salmon habitat.

Habitat/Ecosystem protection

Further, Alaska's Sustainable Salmon Policy (5 AAC 39.222) includes provisions that address the potential effects of ecological changes on sustainable harvest in the respect that salmon fisheries must be managed to provide escapements within ranges necessary to conserve and sustain salmon production and to maintain normal ecosystem functioning. Potential ecological effects on salmon stocks are incorporated in the establishment of escapement goals for each stock.

In terms of the ecological provisions set forth in the Alaska's Sustainable Salmon Policy, a list is provided:

- Maintenance of wild salmon stocks and salmon habitats at levels of resource productivity that assure sustained yields through protection of spawning, rearing, and migratory habitats;
- Maintenance of salmon habitats beyond natural perturbation and boundaries of variation.
- Preparation of scientific assessments of possible adverse ecological effects of proposed habitat alterations and the impacts of those alterations on salmon populations before approval of a proposal.
- Assessment of adverse environmental impacts on wild salmon stocks and the salmon's habitats.
- Protection of all essential salmon habitats in marine, estuarine, and freshwater ecosystems and access of salmon to these habitats. Essential habitats include spawning and incubation areas, freshwater rearing areas, estuarine and nearshore rearing areas, offshore rearing areas, and migratory pathways.
- Protection of salmon habitat in fresh water on a watershed basis, including appropriate management of riparian zones, water quality, and water quantity.
- Protection of salmon stocks within spawning, incubating, rearing, and migratory habitats.
- Assessment of degraded salmon productivity resulting from habitat loss, considered, and controlled by affected user groups, regulatory agencies, and boards when making conservation and allocation decisions.
- Assessment of effects and interactions of introduced or enhanced salmon stocks on wild salmon stocks and wild salmon stocks and fisheries on those stocks and protection from adverse impacts from artificial propagation and enhancement efforts.
- Restoration of degraded salmon spawning, incubating, rearing, and migratory habitats to natural levels of productivity.
- Establishment of ongoing monitoring activities to determine the current status of habitat

and the effectiveness of restoration activities.

- Allowance of recovery for depleted salmon or, where appropriate, active restoration and maintenance of diversity to the maximum extent possible, at the genetic, population, species, and ecosystem levels.
- Management of salmon fisheries to allow escapements within ranges necessary to conserve and sustain potential salmon production and maintain normal ecosystem functioning.
- Management of salmon escapement 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.
- Evaluation of the role of salmon in ecosystem functioning and consideration in harvest management decisions and setting of salmon escapement goals (see State of Alaska Regulation 5 AAC 39.222).

Mixed Stock Fisheries

5 AAC 39.220. Policy for the management of mixed stock salmon fisheries. In applying this statewide mixed stock salmon policy for all users, conservation of wild salmon stocks consistent with sustained yield is accorded the highest priority. Allocation of salmon resources under this policy is consistent with the subsistence preference in [AS 16.05.258](#), and the allocation criteria set out in 5 AAC [39.205](#), 5 AAC [75.017](#), and 5 AAC [77.007](#).

Also, in the absence of a regulatory management plan that otherwise allocates or restricts harvest, and when it is necessary to restrict fisheries on stocks where there are known conservation problems, the burden of conservation is shared among all fisheries in close proportion to their respective harvest on the stock of concern. The board recognized that precise sharing of conservation among fisheries is dependent on the amount of stock-specific information available.

The board's preference in assigning conservation burdens in mixed stock fisheries is through the application of specific fishery management plans set out in the regulations. A management plan incorporates conservation burden and allocation of harvest opportunity.

Most wild Alaska salmon stocks are fully allocated to fisheries capable of harvesting available surpluses. Consequently, the board restrict new or expanding mixed stock fisheries unless otherwise provided for by management plans or by application of the board's allocation criteria. Natural fluctuations in the abundance of stocks harvested in a fishery will not be the single factor that identifies a fishery as expanding or new.

Various concepts in line with the precautionary approach are also applied into the Management Plan for High Impact Emerging Fisheries (5AAC 39.210).

[http://www.legis.state.ak.us/basis/folioproxy.asp?url=http://wwwjnu01.legis.state.ak.us/cgi-bin/folioisa.dll/aac/query=\[JUMP:'5+aac+39!2E222'\]/doc/{@1}?firsthit](http://www.legis.state.ak.us/basis/folioproxy.asp?url=http://wwwjnu01.legis.state.ak.us/cgi-bin/folioisa.dll/aac/query=[JUMP:'5+aac+39!2E222']/doc/{@1}?firsthit)

Managing Salmon in Alaska

Escapement goals effectively represent reference points of the various Alaska salmon stream and index systems. Currently, (reviewing the 2012 season) there are 300 active salmon stock escapement goals throughout the state. During 2012 and early 2013, reviews of the escapement goals were done for Bristol Bay salmon, Arctic-Yukon-Kuskokwim Region salmon and Alaska Peninsula and Aleutian Islands salmon in the Westward Region. An out-of-cycle assessment of Late-Run Chinook Salmon in

the Kenai River was also reviewed.

Escapement goals are based on a number of scientific evaluation methods, founded in the sustained yield principle highlighted in the State Constitution (Article VIII, section 4) and in state statute (AS 16.05.020). Several policies in Alaska Administrative Code also provide guidance for establishing escapement goals including the policy for the management of sustainable salmon fisheries (5AAC 39.222), the policy for statewide salmon escapement goals (5 AAC 39.223) and the policy for the management of mixed stock fisheries (5 AAC 39.220). These policies provide detailed definitions of specific escapement goal types, outline the responsibilities of the ADFG and the BOF in establishing goals, and provide general direction for development and application of escapement goals in Alaska. Where escapements chronically (4-5 years) fail to meet expectations for harvestable yield or spawning escapements, the department may recommend, and the board may adopt a stock of concern designation for those underperforming salmon stocks.

The Alaska wide escapement summary (2004-2012) provided in clause 6 shows that stocks of concern are afforded additional and more conservatory management, enabling them to return these stocks to acceptable level of productivity (i.e. removed from stock of concern designation), and in some way allowing the rebuilding of these runs/stocks. Of the 14 stocks under management concern designation, 8 have been removed due to improved performance, while the 6 active ones have been introduced between 2011 and 2013. Of the 12 under yield concern designation, 5 have been removed due to improved performance, while the 7 active stocks have been introduced at dates spanning from 2001 to 2011. Of particular remark, 9 of 13 of the current stocks of concern are Chinook salmon stocks.

Chinook salmon stock assessment and research plan (ADFG 2013)

The central objective of the Chinook salmon stock assessment and research plan implementation is to create a consistent stock assessment framework across a 12 diverse indicator systems in Alaska that will provide improved information for sustained yield management of Chinook salmon for a range of run sizes and productivity regimes. Linkage of improved monitoring data with process based research will provide insight into ecological and environmental mechanisms causing recent abundance declines and give managers better predictive tools.

http://www.adfg.alaska.gov/static/home/news/hottopics/pdfs/chinook_research_plan.pdf

Based on the fact that ADFG is constraining significantly commercial harvests of Chinook salmon throughout Alaska in response to the current period of low production, and considering the ADFG led *Chinook salmon stock assessment and research plan* effort and initial funding for the year 2013; the assessment team considers that this management response is appropriate for the issue at hand, in line with improving the state of Chinook salmon stocks in the A-Y-K, Westward, Central and Southeast Management Regions, and in accordance with a precautionary approach to management.

Decreasing uncertainty in Western Alaska Fisheries management

Western Alaska Salmon Stock Identification Program (WASSIP)

ADFG announced the publication of results of the Western Alaska Salmon Stock Identification Program (WASSIP) in 2012. Results can be found in 9 reports on the ADFG website: <http://www.adfg.alaska.gov/index.cfm?adfg=wassip.tds>. This follows 8 years of a stakeholder-driven program with scientists to address long-standing questions about harvest patterns of commercial and subsistence fisheries in western Alaska. The process involved 11 signatories

representing fishing, Alaska Native and government interests that served as an Advisory Panel along with a 4-member Technical Committee.

Most of the catch of sockeye and chum salmon comes from terminal fisheries near spawning locations but mixed-stock fisheries do occur in non-terminal (non-local) areas. Uncertainty about the magnitude, frequency, location and timing of non-local harvest was the motivation for the WASSIP study. WASSIP was designed to use genetic data in mixed-stock analysis (MSA) to reduce the uncertainty. MSA has been used effectively for estimating stock composition in mixed-stock fisheries throughout the Pacific Rim.

The baseline data for sockeye comprises populations ranging along a coastline of about 6,000 km and genetic markers using single nucleotide polymorphisms (SNPs). The current WASSIP baseline for sockeye is comprised of 39,205 fish, 294 populations and 96 SNPs. This represents 10,000 additional fish and twice the number of markers compared to the previously published baseline (2010). The current WASSIP baseline for chum is comprised of 32,817 fish, 310 populations and 96 SNPs and represents an increase in the number of populations and markers reported in previous studies.

More than 225,000 samples of sockeye and chum collected from Chignik to Kotzebue over a 3 year period (2006-2008) were analyzed to determine stock-specific composition, catch and harvest rates of sockeye and chum salmon. In all, the study represents a very comprehensive program of sampling and analytical effort that has effectively reduced uncertainty in stock composition, harvest and harvest rates of sockeye and chum salmon supporting the management regulatory process in western Alaska.

Precautionary Approach in Hatcheries Practices

There are very well prescribed Statutes and laws for planning of hatchery developments (see evidence under fundamental clause 3 for evidence). In particular, there is clear policy that ensures that hatcheries are placed in areas that causes least likely risk of mixing with existing wild stocks. All hatchery release strategies are reviewed by ADFG and are ultimately under the authority of ADFG. Both economic and ecological evaluation of the release plan forms part of the decision making process. Introduction of genetic material is prohibited and hatchery stock is selected from the terminal area stock and hence, all genetic material originated from that location. Selection techniques are designed to avoid artificial reduction in genetic material – i.e. fish are selected at random and not on external trait basis (size, shape, colour etc). An extremely wide, pre-determined number of returning fish are used for stripping of ova for hatchery rearing and release. This is especially true for Pink and Chum salmon hatcheries in PWS and SEAK. Large population sizes allow for a large gene pool and decreases, over time, the likelihood of genetic loss due to inbreeding (Reference to Genetic Policy, 1985, and communications in the March site visits with the managers of DIPAC and PWSAC).

Key Aspects of Salmon Enhancement Management in Alaska

- Highest priority: protect and maintain wild salmon stocks, legal mandates that require wild stocks to be given priority in fishery management;
- Vigorous habitat protection, no dams on rivers
- Escapement-based management, no fishery targets
- Mixed stock fisheries avoided wherever possible
- Hatcheries supplement not replace wild stocks, mitigation of pressure on wild stocks.
- Annual Management Plans of all hatcheries are annually reviewed by ADFG.

Minimizing Hatchery-Wild Stock Interactions

- Comprehensive regional planning.
- Utilise conservative fish culture practices.
- A rigorous hatchery permitting process that includes genetics, pathology and fishery management reviews.
- Statewide genetics policy to guide hatchery program and practices to allow protection of wild stocks by avoiding foreseeable negative effects.
- Fish health and disease statutes (no disease has ever been introduced or amplified in the wild).
- Careful siting of hatcheries, terminal harvest areas (temporal and spatial segregation from wild stocks to minimize mixed fisheries, then harvest all the returning salmon to minimize potential breeding. Hatchery production is not approved if there is not high confidence that the resulting salmon will be fully harvested –decreasing the potential of hatchery strays).
- Hatchery brood stock diversity practices (fish selected at random and not on external trait basis such as size, colour or shape, 1 to 1 mating ratio, effective population sizes extremely large – especially true for pink and chum salmon in SEAK and PWS).
- Use of local brood sources is priority.
- Collection of broodstock for the hatcheries is stratified over spawn/run timing to maximize the heterogeneity of the gene pool.
- Mass otolith marking for real-time in-season fisheries management. All hatcheries with significant production in Southeast, Central and Westward Region (apart from Kitoy Bay and Pillar Creek hatcheries, in Kodiak) thermally mark virtually all of their releases for identification of hatchery salmon during harvest.

<http://www.springerlink.com/content/25k0146032617g38/>

<http://www.adfg.alaska.gov/static/fishing/PDFs/hatcheries/mcgeebrochure.pdf>

Clause 7. Minor Non Conformance Assigned during the 1st Surveillance Activities in 2012

In 2012, during the FAO RFM AK Salmon 1st Surveillance Activities, one minor non-conformance was assigned under Clause 7, the precautionary approach. At the time of assessment it was unclear how ADFG planned to deal with development plans and release activities (e.g. potential requests from hatchery corporations for increased pink and chum salmon productions in PWS and SEAK) in light of the fact that negative genetic interactions between hatchery and wild salmon could already be occurring, and that research results of the genetic interactions between hatchery and wild salmon following the hatchery wild salmon multigenerational study in PWS and SEAK may take considerable time to accrue. A corrective action plan from the client required the following clarifications and evidence 1) how ADFG intended to address this issue and 2) a set of specific timelines to allow for assessment during the next surveillance activities in 2013, 2014 and 2015 and the second full assessment audit in 2016, as relevant and if needed. The action plan is available in the surveillance report 1 but provided a response to these requests and agreed with the said requirements.

In simple words ADFG communicated that request for pink and chum increased capacity from hatcheries in PWS and SEAK would be reviewed with care and using a risk assessment framework, primarily to avoid risks interfering with the management of wild salmon stocks and to achieve escapement goals and orderly fisheries. Secondly they agreed to provide a set of specific timelines (regarding the progress of the large scale hatchery salmon research program) to allow for assessment during the next surveillance activities in 2013, 2014 and 2015.

Changes in Hatchery Production

Generally speaking, ADFG has been very cautious in recent years in allowing increases in capacity in the various hatchery facilities around PWS and SEAK, due to the increasing concerns about hatchery-wild salmon interactions. This is demonstrated this year in the table below.

The table below summarizes the increases in hatchery capacities that were approved in 2012. The allowed increases was essentially one in 2012 (Hidden falls coho, 0.8 million eggs). The approval for 7 million green eggs increase in Medvejie Creek was requested, reviewed and recommended in 2011, but otherwise just a housekeeping PAR to correct stated capacity was approved. Burnett Inlet too dealt with capacity of 2.0 million eggs of coho salmon from one hatchery to another one. No other increases in salmon production were allowed in other sites in Southeast or in Prince William Sound.

Region	Hatchery	Species	Change in hatchery permitted capacity via approved PAR	Total hatchery permitted capacity after approved PAR (by species)	Region-wide permitted capacity after approved PAR (by species)
Southeast	Hidden Falls	Coho salmon	0.8 million green eggs	7.7 million green eggs	39.72 million green eggs
Southeast	Medvejie Creek ¹	Chum salmon	7 million green eggs	77 million green eggs	584.80 million green eggs
Southeast	Burnett Inlet ²	Coho salmon	2.0 million green eggs	4.5 million green eggs	41.72 million green eggs

¹ Housekeeping PAR, to correct stated permitted capacity to the level previously requested, reviewed, and recommended in 2011.

² This approved PAR moved production from Whitman Lake Hatchery to Burnett Inlet Hatchery; no increase in production overall.

--- THE EVIDENCE PROVIDED ABOVE DEALS WITH ONE OF THE REQUIREMENTS OF THE 2012 CORRECTIVE ACTION PLAN ---

Salmon enhancement in Alaska and its potential effects on wild stocks

Alaska continues to approach requests for increased hatchery production by asking if an increase can be managed with consideration of potential risks to wild stocks. Alaska's modern salmon fishery enhancement program is stakeholder driven, with provisions for planning and oversight by representatives of regional user groups. Since ADFG is not comfortable directly applying research on steelhead, and other species in the Pacific Northwest or elsewhere to the unique situation in Alaska, they are expanding studies of wild and hatchery interactions to better understand those relationships as they occur in Alaska. As these studies provide results, ADFG will evaluate and decide if any modifications to the program may be warranted.

- From the beginnings of Alaska's salmon fishery enhancement program it was recognized that salmon stray and that hatchery stocks would stray; consequently, policies and regulations were adopted to mitigate concerns associated with straying.
- For the protection of wild salmon stocks, hatchery programs are required to use local stocks as the brood source and locate hatcheries away from important wild stocks. Requiring the use of only local salmon stocks means that straying hatchery fish are less likely to reduce fitness of

local populations.

- In the 1980's hatchery programs in Alaska pioneered use of otolith thermal marks for mass-marking hatchery production. Now almost 100% of all hatchery salmon in most of the state are marked. Marking programs have made possible accurate detection of hatchery-bred salmon on the spawning grounds of wild salmon.
- Straying on a sub-regional level appears to be on the order of 5 to 10% for pink and chum salmon; and less for other species. However, in a few select streams it can be over 50%.

These observations have raised several important questions:

1. Are hatchery-bred salmon interbreeding with wild salmon to the extent that fitness and productivity of these stocks are being diminished?
2. Is the annual assessment of wild stocks (which is, in large part, based on visual observation) so biased by the presence of hatchery salmon that excessive harvest of wild fish is being allowed or that escapement goals are difficult to set and difficult to assess?
3. Do density interactions diminish productivity of wild salmon?

Prince William Sound Science Center (PWSSC), in conjunction with Sitka Sound Science Center (SSSC), submitted the successful proposal and the contract was approved to conduct a portion of this project. The study was designed, and continues to be guided, by a Science Panel organized by ADFG consisting of state, federal, NGO, and academic experts on salmon biology and management, genetics, hatchery issues, and experimental statistics. In the winter of 2013, PWSSC will present the first annual report for review by the science panel and department. The science panel will continue to advise the department on how to proceed.

Written reports

Reports will be made to ADFG as described in the Request for Proposal (RFP) and posted at http://www.adfg.alaska.gov/index.cfm?adfg=fishingHatcheriesResearch.findings_updates.

Proposed reports will consist of complete description of preceding field data methods and the data collected. Reports will include any analyses that can be made with the data available up to that time. Reports will be progressive, i.e., will include all data and analyses from the beginning of the project up to the date of the report. Annual progress will be submitted in December of each year, except that the final report will be submitted in January of 2016, so that it can be reviewed by ADFG staff and then revised based on their comments prior to the March, 2016 contract end date.

Workshops

The Project Manager and one or more Project leaders will host a workshop in late November or early December of 2013 to provide ADFG staff with an in-person overview of the progress made and challenges encountered, so that mid-course adjustments can be made if necessary. As requested in the RFP, PWSSC will host a workshop in February of 2016 to summarize the data collected and the findings to that date.

Schedule

As proposed by the Prince William Sound Science Center (PWSSC), a summary of the expected timing of major activities is:

Year	Season	Activity
2012	Summer	<ul style="list-style-type: none"> • Preliminary trials of the ocean sampling • Initial reconnaissance on the 10 intensive streams to begin mapping • Collect otoliths from potential intensive streams where the stray rates are uncertain
2013	Spring	<ul style="list-style-type: none"> • Preliminary evaluation of the redd pumping techniques on one or more SEAK streams
	Summer	<ul style="list-style-type: none"> • Prince William Sound (PWS) Ocean sampling • PWS and Southeast Alaska (SEAK) streams sampling - extensive and intensive
	Winter	<ul style="list-style-type: none"> • Annual progress report and workshop
2014	Spring	<ul style="list-style-type: none"> • Intensive alevin sampling in PWS and SEAK
	Summer	<ul style="list-style-type: none"> • PWS Ocean sampling • PWS and SEAK streams sampling - extensive and intensive
	Winter	<ul style="list-style-type: none"> • Annual progress report
2015	Spring	<ul style="list-style-type: none"> • Intensive alevin sampling in PWS and SEAK
	Summer	<ul style="list-style-type: none"> • PWS and SEAK streams sampling - extensive and intensive
		<ul style="list-style-type: none"> • Annual progress report
2016	Spring	<ul style="list-style-type: none"> • Intensive alevin sampling in PWS and SEAK
	Winter	<ul style="list-style-type: none"> • Annual progress report and workshop

Although the entire project is anticipated in the RFP to extend through 2018 for the straying aspects, and through 2023, for the fitness studies, the scope of the Phase One proposal is limited to the period July 1, 2012 through March 21, 2016. The current research programme, headed by the PWSSC includes data collection for three complete annual cycles of adults in streams and their resultant offspring alevins. It also includes one preparatory season followed by two full seasons adult sampling in the ocean (because budget limitations, the third full season of ocean sampling is suggested to be funded at a later date). The work described will provide a substantial beginning to the longer term project.

A first summary report of these research activities was posted in April 2012 on the ADFG website: [Interaction of Wild and Hatchery Pink and Chum Salmon in Prince William Sound and Southeast Alaska, Annual Report 2012](#)

PWSSC 2012 Summary Report

Introduction

Prince William Sound Science Center (PWSSC) and its sub-contracting partner Sitka Sound Science Center (SSSC) are engaged in the scientific data collection and analysis services requested under the State of Alaska contract IHP-13-013 entitled "Interactions of Wild and Hatchery Pink and Chum Salmon in Prince William Sound and Southeast Alaska".

The plans and intentions of this contracted research are guided by two documents: 1) the ADFG RFP 2013-1100-1020, Dated May 7, 2012 entitled "Interactions of Wild and Hatchery Pink and Chum Salmon in Prince William Sound and Southeast Alaska and 2) the PWSSC proposal for the same project, dated June 29, 2012. The overarching purposes of this research are to: 1) further document the degree to which hatchery pink and chum salmon straying is occurring; 2) assess the range of interannual variability in the straying rates; and, 3) determine the effects of hatchery fish spawning with wild populations on the fitness of wild populations.

The information provided here has been extracted from the annual PWSSC report, essentially a summary of activities in the first, preliminary year of research - 2012. Because the starting date of the contract was somewhat delayed relative to the timing of the 2012 fish runs, the report summarizes logistical planning, as well as some preliminary field sampling and reconnaissance, in preparation for intensive field work beginning in 2013. The report also reflects some decisions made following the 2012 initial field season, and in consultation with the Science Panel in November 2012, that will affect the field approach for 2013.

This research project has been subdivided into four major activities for implementation, each with a separate project leader: ocean sampling near PWS; stream sampling in PWS; stream sampling in SEAK; and data management, analysis, and reporting. Methods and activities under each of these major subdivisions are reported in separate sections.

Summary of the PWSSC Report

Due to the late signing of the contract relative to fish run timing, work on this project was of a preliminary nature during 2012. Full implementation began in 2013. Yet, a number of things have been accomplished to set the stage for a more successful implementation of the project in 2013.

In the PWS ocean sampling portion, the PWSSC purchased an experimental gillnet, made an initial gillnet sampling run, and tested the fishing methods. This initial effort helped formulate questions for clarification by the Science Panel and for slight revision of the sampling protocol for 2013.

The PWS stream sampling effort began with an initial cruise to six candidate pink salmon pedigree study streams for initial mapping, biological sampling, and to evaluate the streams' suitability for sampling. Although a late start combined with heavy rainfall eliminated all adult spawners from the streams, PWSSC staff was able to collect map data and evaluate the streams' potential for the study. Preliminary stakes were planted at locations from where base maps were developed.

Two of the six PWS candidate streams were determined to be unsuitable for the pedigree studies. Since the cruise, the list of candidate pedigree streams has been revised. There are now 10 candidate streams, four of which have been visited and preliminarily mapped.

Four SEAK candidate chum salmon pedigree sampling streams were visited in August, 2012. Since chum spawners were available, biological attributes called for in the RFP were collected for preliminary information about the wild and hatchery populations. The staff also evaluated the streams' suitability as future pedigree study streams and collected preliminary geographical information about the streams, the extent of upstream chum access, and the areas used by chum spawners. Of the four streams visited, Swan Cove Creek and Saltery Bay Head were dropped as pedigree streams, while Fish Creek – Douglas and Sawmill Creek were retained. This was based on too low hatchery abundance observed in the Swan and Saltery Creeks, making them potentially unsuitable for fitness analysis, as well as difficulties with stream access. PWSSC is tentatively planning to add Prospect Creek and Admiralty Creek as alternate pedigree streams, pending some further investigations and approval by the Science Panel. Results of the otolith analysis in Fish and Sawmill creeks indicate suitable hatchery-wild proportions. Both of these streams provide reasonable access.

--- THE EVIDENCE PROVIDED ABOVE DEALS WITH THE SECOND REQUIREMENT OF THE 2012 CORRECTIVE ACTION PLAN ---

The minor non conformance opened last year (2012) under clause 7, on the Precautionary Approach, remains open until the next full re-assessment date (2016). The evidence available for this (2nd) surveillance activities satisfies the requirement set forth last year (check and document for increases in hatchery production, especially in PWS and SEAK; and document the yearly progress of the large scale hatchery-wild salmon interactions research program). These same items will be re-analyzed in the next (3rd) surveillance activities (2014).

Summary

The Policy for the Management of Sustainable Salmon Fisheries codifies the precautionary approach in State regulation of salmon fisheries and habitats. This policy states that in the face of uncertainty, salmon stocks, fisheries, artificial propagation, and essential habitats are to be managed conservatively. It also includes provisions that address the potential effects of ecological changes on sustainable harvest in the respect that salmon fisheries must be managed to provide escapements within ranges necessary to conserve and sustain salmon production and to maintain normal ecosystem functioning. Based on the statewide decrease in Chinook salmon production, ADFG is limiting commercial and sport fisheries on the species to ensure escapement goals are met, as far as possible. ADFG is also leading the Chinook salmon stock assessment and research plan effort and has obtained initial funding for the year 2013. The assessment team considers that this management response is appropriate for the issue at hand, in line with improving the state of Chinook salmon stocks in Alaska and with a precautionary approach to management. Also results of the WASSIP program have been made public in 2012, this study represents a very comprehensive program of

sampling and analytical effort that has effectively reduced uncertainty is stock composition, harvest and harvest rates of sockeye and chum salmon supporting the management regulatory process in western Alaska. As for the current issues surrounding the hatchery-wild interactions, the Prince William Sound Science Center (PWSSC) has started the field work for the large scale hatchery salmon research project in late 2012. A specific schedule of tasks until 2016 has been provided by ADFG and a summary report for the 2012 activities has been published. No increase in pink or chum salmon hatchery production has been granted in PWS or SEAK in 2012. These last two items constitute the evidence supporting corrective action following the minor non-conformance issued last year under this clause. Progress is ongoing and following the agreed schedule.

References

http://www.adfg.alaska.gov/index.cfm?adfg=fishingHatcheriesResearch.findings_updates
<http://pwssc.org/pwssc-studying-wild-hatchery-salmon-interactions/>
<http://www.sitkascience.org/research/chum-salmon/>
[http://www.legis.state.ak.us/basis/folioproxy.asp?url=http://www.jnu01.legis.state.ak.us/cgi-bin/folioisa.dll/aac/query=\[jump!3A!275+aac+39!2E222!27\]/doc/{@24782}?prev](http://www.legis.state.ak.us/basis/folioproxy.asp?url=http://www.jnu01.legis.state.ak.us/cgi-bin/folioisa.dll/aac/query=[jump!3A!275+aac+39!2E222!27]/doc/{@24782}?prev)
<http://www.adfg.alaska.gov/static/fishing/PDFs/hatcheries/research/pwssc4-29-13.pdf>

D. Management Measures

8. Management shall adopt and implement effective measures including; harvest control rules and technical measures applicable to sustainable utilization of the fishery and based upon verifiable evidence and advice from available scientific and objective, traditional sources.

FAO CCRF 7.1.1/7.1.2/7.1.6/7.4.1/7.6.1/7.6.9/12.3

FAO Eco 29.2/29.4/30

Evidence adequacy rating:

High

Medium

Low

Rating Determination

Escapement goals are essentially the harvest control rule used for management of Alaska salmon. Currently, there are 300 active salmon stock escapement goals throughout the state of Alaska. However, not all Alaska salmon fisheries and salmon stocks are managed with formal escapement goals, but instead, through inseason management and emergency orders. Inseason management involves opening and closing geographical areas and prosecuting (commercial, sport, subsistence) components of the fishery using emergency orders, based on run size projections, historical and contemporary escapement estimates, intensive harvest monitoring, fishing-effort monitoring, and escapement monitoring, environmental conditions, stock sampling data and any other available information. During the 2012 calendar year ADFG issued about 750 emergency orders to open and close commercial salmon fisheries in the Alaska. Fisheries regulations are published for the various areas in Alaska. These documents contain selected Alaska statutes enabling legal management of resources, statewide general provisions, management plans, gear allowances, closed and open areas, and all the other area specific provisions. These regulations may be changed inseason by emergency regulations or emergency orders at any time to allow sufficient escapements. The Alaska Commercial Fisheries Entry Commission (CFEC) issues permits and vessel licenses to qualified individuals in both limited and unlimited fisheries, and provides due process hearings and appeals for those individuals denied permits. A limited entry or interim-use permit entitles the holder to operate gear in a specific commercial fishery in accordance with BOF regulations. The term "fishery" refers to a specific combination of fishery resource(s), gear type(s), and area(s). Management measures specific to salmon hatcheries include Title 05, Fish and Game; Chapter 40: Private Non Profit Salmon Hatcheries; and Chapter 41: Transportation, Possession and Release of Live Fish; Aquatic Farming.

Commercial Fisheries Regulations

Commercial and Subsistence Fishing and Private NonProfit Salmon Hatcheries

Fisheries regulations are published for the various areas in Alaska. These documents contain selected Alaska statutes enabling legal management of resources, statewide general provisions and the area specific provisions including area description, geographical extent and position of fishing district and subdistricts, seaward boundaries of fishing districts, fishing seasons, weekly fishing periods, gear allowances in the various districts, gillnet, seine, troll, fish-wheel specifications and operations, minimum distance between units of gear, vessel and gear identification, waters closed to commercial fisheries, salmon fishermen, processor and buyer permit, reporting and landing requirements, fish size limits, river/fishery/region specific fishery management plans, salmon hatcheries management plans, salmon enhancement allocation plans etc...

The regulations as outlined in the documents below may be changed by emergency regulations or emergency orders at any time. Supplementary changes to these regulations are available at offices of the Department of Fish and Game

- [2013-2016 Alaska Peninsula, Atka-Amlia Islands, and Aleutian Islands Areas Commercial Salmon Fishing Regulations](#)
- [2012–2015 Commercial Salmon Fishing Regulations for Prince William Sound](#)
- [2012 –2015 Southeast Alaska and Yakutat Commercial Salmon Fishing Regulations](#)
- [2013-2016 Bristol Bay Commercial Salmon Fishing Regulations](#)
- [2011-2014 Chignik and Kodiak Areas Commercial Salmon Fishing Regulations](#)
- [2011-2014 Cook Inlet Area Commercial Salmon Fishing Regulations](#)

<http://www.adfg.alaska.gov/index.cfm?adfg=fishregulations.commercial>

Escapement goals and salmon management

Escapement goals are essentially the harvest control rule used for management of Alaska salmon. Currently, there are 300 active salmon stock escapement goals throughout the state of Alaska (<http://www.adfg.alaska.gov/FedAidpdfs/FMS11-06.pdf>).

- Biological Escapement Goals (BEGs) are usually established using stock-recruit information which generally requires multiple years of run reconstructions to establish. BEGs are expressed as a range based on factors such the productivity of the stock and data uncertainty.
- A Sustainable Escapement Goal (SEG) is the level of past escapement (as demonstrated by escapement counts or indices) that has resulted in sustainable yield over a 5-10 year period. SEGs are used when data are insufficient to establish a BEG, usually due to lack of stock specific harvest data. SEGs are also set as a range and take into account uncertainty of the data. Once established, ADFG attempts to manage fisheries to maintain an even distribution of escapement within the boundaries of a BEG or SEG.
- Two other, less common escapement goals are also defined in the Sustainable Salmon Policy. A Sustainable Escapement Threshold (SET) is a threshold level of escapement, below which the ability of the stock to sustain itself is jeopardized. The SET is below the lower bound of a BEG or SEG and is established when needed for salmon stocks of management or conservation concern.
- An Optimum Escapement Goal (OEG) is a specific management objective for salmon escapement that considers biological and allocative factors and may differ from BEG or SEG. An OEG may be expressed as a range but the minimum bound of an OEG will always be above the SET.

Every three years (based on the BOF schedule) each Region updates its escapement information and submits a salmon stock status report to the BOF. This report (mandated in the Policy for the Management of Sustainable Salmon Fisheries, 5AAC 39.222) reviews the status of all stocks within a management area, recommends new and modified escapement goals based on the new data that have been collected and analyzed in the past three years, defines stocks of concern, and develops management or action plans to deal with fishery management issues. State Regulation, the Policy for

the Management of Sustainable Salmon Fisheries (5 AAC 39.22), directs management measures to ensure sustainability of yield. The Policy is implemented through the various fishery management plans for different fisheries in different regions and areas of the state. The BOF's process provides a transparent, accessible route for all fishery participants and stakeholders to submit proposals and ultimately cause legitimate amendment to fishery regulations for the sustainable use of the resource through verifiable, objective based review of information, including from traditional sources.

Emergency Orders and Inseason Management

Emergency orders (EOs) have the force and effect of law after announcement by the ADFG commissioner or an authorized designee. Sustained yield management of commercial salmon fisheries requires precise timing of fishery openings and closures and adjustments in gear, often with short notice, to allow or constrain the harvest of fish, ultimately assuring adequate escapement of spawning fish. EOs are widely used to open and close fisheries as needed by local area biologists, based on information on run strength and escapement goals. For this surveillance activity the assessment team has analyzed more than 800 EOs released in 2012. During the 2012 calendar year ADFG issued about 750 EOs were used to open and close commercial salmon fisheries in the Southeast, Central, Westward and Artic-Yukon-Kuskokwim management regions.

These EOs can be found through the *Regulation Announcements, News Releases, and Updates for Commercial, Subsistence and Personal Use Fishing* page at the ADFG website at <http://www.adfg.alaska.gov/index.cfm?adfg=cfnews.main>

Emergency orders are a testament to the flexibility of inseason management as carried out by the Department to manage salmon using run size and timing information among other parameters. This allows for the achievement of escapement goals-based management objectives.

Time and area restrictions limit when and where specific fisheries occur and restrictions are also imposed by regulation on all types of fishing gear (e.g., mesh size restrictions and length of nets for gillnets, number of fishing lines, rods, and gurdies for troll gear, and mesh size, net length and depth for purse seine gear). Specific requirement for gear (i.e. gillnet length, depth, and mesh sizes) are defined for each area and in specific management plans and regulations.

Moreover, enforcement agencies spend much of their resources checking that fishing vessels at the onset of a given fishery start and finish at the established time, that the gear used is that allowed by regulation, and that reporting requirements are fulfilled, among other things. All gear types in Alaska are strictly regulated, in many cases different salmon fisheries have different gear requirements and restrictions to increase selectivity and decrease incidental non target catches (i.e. other salmon species). Types of legal gear are listed in 5AAC 39.105.

Management of AK salmon stock without formal escapement goals.

Not all Alaska salmon fisheries and salmon stocks are managed with formal escapement goals. These include stocks with low fishery impact, poor stock assessment data quality or cases where escapement goals do not affect management actions of the stock. In some cases stocks are managed wholly or partially without escapement goals. Here below some examples are provided (not a comprehensive list) for the 4 management regions of Alaska. It should not be assumed that any fishery not described below is managed by escapement goal.

Summary of Examples

Yukon & Northern

Yukon Summer Chum Salmon (No escapement goal)

There are no formal escapement goals for the majority of chum salmon stocks in the Yukon (<http://www.sf.adfg.state.ak.us/FedAidpdfs/FMS09-07.pdf>, page 12). The summer chum management plan (<http://touchngo.com/lglcntr/akstats/aac/title05/chapter005/section362.htm>) sets out management actions based on projected run sizes across the entire Yukon region. Components of the fishery (subsistence, commercial, sport, personal use) are opened/closed as follows:

- Projected run of 600,000 fish or less = all fisheries closed, except subsistence under some circumstances.
- 600,000 – 700,000 fish = all fisheries except subsistence closed, subsistence managed to achieve an escapement of 600,000.
- 700,000 – 1,000,000 fish = Subsistence fishery open and other fisheries possibly opened in geographical areas where individual escapement goals are met.
- 1,000,000+ fish = fishery opened and managed for a guideline harvest level of 400,000 - 1,200,000 fish, distributed in a prescribed manner between the various districts.

Projected run size is primarily estimated using past run size data, recognising the age classes which will dominate the run and therefore the years which are most relevant. For example, the strength of the summer chum salmon run in 2012 was projected to be dependent on production from the 2008 (age-4 fish) and 2007 (age-5 fish) escapements, as these age classes dominate the run. Both 2007 and 2008 produced runs of approximately 1.9 million fish. Combining this information with estimates of 'predicted return per spawner', ADFG predicted the summer chum run would provide a harvestable surplus of 500,000 – 1,000,000 fish.

This estimate is further updated in response to in-season indicators such as Pilot Station sonar project passage estimate, test fishing indices, age and sex composition, subsistence and commercial harvest reports, and information from escapement monitoring projects. Emergency orders and other in-season management measures are then implemented by local fishery managers to ensure the stock is not over-exploited (<http://www.adfg.alaska.gov/FedAidpdfs/FMR12-23.pdf>, p. 36).

Kuskokwim

Kuskokwim all species

In 2010 the Kuskokwim management area contained 25 escapement goals, of which 14 were for Chinook, 4 for chum, 4 for sockeye and 3 for coho (<http://www.sf.adfg.state.ak.us/FedAidpdfs/FMS09-07.pdf>, p.7).

In addition to the escapement goals (where present), the Kuskokwim salmon fisheries are managed according to the Kuskokwim River Salmon Rebuilding Management Plan (<http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter007/section365.htm>), which was introduced in 2001.

The commercial fisheries are opened when *“inseason indicators of run strength indicate a run strength that is large enough to provide for a harvestable surplus and a reasonable opportunity for*

subsistence uses". To determine what constitutes a 'reasonable opportunity', the BOF has calculated the 'amount necessary for subsistence' (ANS) for each species in the Kuskokwim area, most recently updated in 2004. The values for Kuskokwim River itself are 64,500 to 83,000 Chinook salmon, 39,500 to 75,500 chum salmon, 27,500 to 39,500 sockeye salmon, and 24,500 to 35,000 coho salmon. The ANS range for the remainder of the Kuskokwim Area is from 7,500 to 13,500 salmon (<http://www.adfg.alaska.gov/FedAidpdfs/FMR11-67.pdf>, p.7).

Other significant components of the management plan include:

- The commercial King (Chinook) fishery is closed; the GHL for incidental Chinook catch in other fisheries is 0 – 50,000 fish.
- The GHL for sockeye is 0 – 50,000 fish.

Management of those stocks without escapement goals is therefore primarily by in-season management measures instigated by managers based on all available data, including projected run size, aerial surveys, escapements in those streams which are monitored, catch and other information.

Central

Four annual management reports are published for the Central management area:

- Bristol Bay
- Upper Cook Inlet
- Lower Cook Inlet
- Prince William Sound

Escapement goals are reviewed in each of these sub-areas separately.

Bristol Bay

Bristol Bay salmon fisheries are divided into ten river systems as listed in the table below. In 2012 an escapement goal review was carried out (<http://www.adfg.alaska.gov/FedAidPDFs/FMS12-04.pdf>), the results of which are also provided in the table. Between 2006 and 2012, coho and pink salmon were managed entirely without escapement goals; since the review in 2012, escapement goals have been re-introduced in the Nushagak river system but continue to not be used elsewhere. Summary of stocks for which escapement goals are established as of the 2012 escapement review. 'X' indicates an escapement goal is established. (<http://www.adfg.alaska.gov/FedAidPDFs/FMS12-04.pdf>) NOTE: the absence of an 'X' does not indicate a fishery without an escapement goal; there are not substantial fisheries for all species in all districts.

River	Chinook	Chum	Coho	Pink	Sockeye
Alagnak	X				X
Egegik	Eliminated 2012				X
Igushik					X
Kulukak					Eliminated 2012
Kvichak					X
Naknek	X				X
Nushagak	X	X	Created 2012	Created 2012	X
Togiak	Eliminated 2012				X
Ugashik					X

Wood					X
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Bristol Bay Coho & Pink salmon (No escapement goals 2006 – 2012, outside this period escapement goals only set in Nushagak district).

A historical Coho SEG for Nushagak was dropped in 2006 by the escapement review, and a new SEG set in 2012. Between these years the stock was managed without an official escapement goal. The smaller Coho fisheries in the other Bristol Bay districts have always been managed without an escapement goal (<http://www.adfg.alaska.gov/FedAidPDFs/FMS12-04.pdf>, p. 10 & 11).

The same is true of Pink salmon, which was without escapement goal between 2006-2012 in Nushagak and permanently in the other districts. The 20-year average harvest of these species (in 2011) was 84,000 and 253,000 (even years only) respectively. The management of these stocks therefore represents a straightforward example of salmon management without escapement goals. Note that there are not necessarily substantial fisheries for these two species in all of the river systems listed above. The majority of pink salmon landings are in the Nushagak, Togiak and Naknek-Kvichak regions, with very few landings in odd years.

Coho salmon landings are more evenly spread across the districts, although the most significant landings are made in Nushagak, especially in recent years (<http://www.adfg.alaska.gov/FedAidpdfs/FMR12-21>, p76 & 77).

Nushagak District – There was very little directed effort towards Coho in 2011, with total landings of 4,613, and as an odd-numbered year there was almost no Pink salmon fishery. The 2010 Annual Management Report (<http://www.adfg.alaska.gov/FedAidpdfs/FMR11-23.pdf>) provides a better example of the management process in years where there is a substantial fishery.

The 2010 management report references the Nushagak Coho Salmon Management Plan (http://www.adfg.alaska.gov/static-sf/management_areas/PDFs/bbcohopl.pdf) which sets escapement goals and other harvest control rules for the stock.

The management plan directs ADFG to managed the fishery to achieve an escapement of 100,000 Coho, measured by sonar, by August 25th (<http://www.adfg.alaska.gov/FedAidpdfs/FMR11-23.pdf>, p. 16). The historical SEG was 50,000 – 100,000 (<http://www.adfg.alaska.gov/FedAidPDFs/FMS12-04.pdf>, p. 10).

At the time of the 2010 report the sonar station referenced in the management plan was no longer being used to monitor Coho escapement, and there was no forecast of expected run size. Based on the information provided in the 2010 AMR, there does not appear to have been any management plan or escapement target for Pink salmon in Nushagak 2006-2012.

The relevant section of the AMR describes the management of the two species as follows:
“In the fall of 2009, processors expressed interest in buying pink salmon in the Nushagak District during the 2010 season. With no escapement enumeration and uncertain participation, ADFG staff set a preliminary schedule based on stakeholder input. The preseason schedule called for commercial fishing 6 days per week for 15 hours each day. On alternate days, fishing gear would be restricted to pink salmon mesh (4.75 inches or smaller) for the conservation of coho salmon. The alternate gear openings would provide an opportunity to determine if the smaller mesh resulted in lower coho salmon catches. Fishing time would be adjusted inseason based on effort and harvest. The department’s goal was to achieve escapement for coho and pink salmon while providing a harvest opportunity for fish surplus to escapement needs. Fishing was closed in the Nushagak District on July 24 and July 25 and the transition to pink and coho salmon management occurred on

July 26. There was some concern about poor sport fishing for coho salmon in the Wood River but other reports indicated sport fishing for coho salmon was good despite high water on the Nushagak River. However, because of community concerns regarding coho salmon escapement, fishing time on unrestricted mesh days was reduced beginning July 29. With no measure of escapement available and high water preventing any meaningful aerial surveys, fishing time was reduced as the number of deliveries increased. On August 5, all future openings were restricted to 4.75 inch mesh or smaller and periods were limited to 10 hours per day. The final period occurred on August 10 for 8 hours. The total pink salmon harvest was 1.3 million fish, 26 times more than the average harvest since 1990 and more than the total pink salmon harvest in the Nushagak District in the last 20 years combined. The 69,186 coho salmon harvested in 2010 was double the latest 10-year average harvest of 39,000." (<http://www.adfg.alaska.gov/FedAidpdfs/FMR11-23.pdf>, p.16 & 17).

These fisheries were managed by in-season management measures described later in this document. Formal escapement goals for pink and coho were then assigned in 2012.

Naknek/Kvichak District – Sockeye fishery extensively managed and forecasted. There is no forecasting for Coho or Pink salmon; however the 2011 removals were very small – 633 coho salmon and no reported pink salmon (this was an odd-numbered year; Pink landings in 2010 were 8,237). Based on the AMR there does not appear to be any monitoring of pink or coho escapement or in-season management, probably due to the small numbers.

Togiak District – The 2010 AMR again provides a better explanation of the management process due to it being an even-numbered year; however even this provides limited detail. In 2010, “Coho salmon began to appear in catches in the last week of July and focus shifted [from sockeye management] to coho salmon management. Participation and harvest was at historical averages for August. A small group of permit holders continued to fish with above average coho salmon fishing into the beginning of September. Buying ceased for the season on September 3 with a cumulative coho salmon harvest of 23,730 fish.” (<http://www.adfg.alaska.gov/FedAidpdfs/FMR11-23.pdf>, p. 19).

Although the 2011 AMR reports total landings of pink salmon in 2010 to be 39,734 fish (<http://www.adfg.alaska.gov/FedAidpdfs/FMR12-21>, p. 76), the 2010 AMR does not mention Pink salmon landings in the Togiak district, nor explain the management process. Based on the AMRs, there does not appear to be an enumeration of pink or coho salmon escapement in Togiak district.

Upper Cook Inlet

There are no pink salmon stocks with an escapement goal in the Upper Cook Inlet area, and only one chum salmon escapement goal, for Clearwater Creek (http://www.susitna-watanahydro.org/wp-content/uploads/2012/05/Fair_2010_UCI_Salmon_Escpmt_Goals.pdf, p.23). The 2011 landings for the two species across the entire UCI area were:

- Pink salmon: 34,000 fish
- Chum salmon: 129,000 fish

The AMR does not specify what proportion of the chum catch was from rivers with escapement goals.

Pink salmon

With no escapement goals and no species-specific enumeration projects in place, the only data available to managers of pink salmon in the UCI are from commercial fisheries harvests, recreational fishing surveys, and some information collected at projects that are designed to enumerate other species. Commercial harvest data are the main source of population estimates, which ADFG

recognises is not a particularly effective indicator. A marine tagging project designed to estimate the total population size, escapement, and exploitation rates for coho, pink, and chum salmon returning to UCI was conducted in 2002, and estimated the exploitation rate on pink salmon by the UCI commercial fishery to range between 1% and 12%, with a point estimate of 2%, and so ADFG consider that the stock is in no danger of overfishing. The 2011 UCI harvest of pink salmon (34,000 fish) was 61% less than the 1997 – 2009 odd-year average, and the 2010 landings (292,000 fish) were 57% less than the even-year average (<http://www.adfg.alaska.gov/FedAidpdfs/FMR12-25>, p. 36).

Chum

Chum salmon management is also affected by a lack of information other than commercial catch data. There is little species-specific enumeration, and the single escapement goal for Clearwater Creek represents only a small proportion of the fishery (although this escapement goal has been met or exceeded every year since it was established in 2002). Sporadic additional data are available from aerial surveys and projects designed to monitor other species, and are used to make general conclusions about run sizes and thus population health. Chum escapements to streams throughout UCI have benefited by management actions or regulatory changes aimed principally at other species.

These actions have included:

- Significant reductions in the offshore drift gillnet and Northern District set gillnet fisheries to conserve Susitna (Yentna) River sockeye salmon
- Adoption of the Northern District Salmon Management Plan (5 AAC 21.358, <http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter021/section358.htm>), which states that its primary purpose is to minimize the harvest of coho salmon bound for the Northern District
- The lack of a directed chum salmon fishery in Chinitna Bay
- Harvest avoidance by the drift fishery as a result of lower prices being paid for chum salmon than for sockeye salmon.

The 2011 harvest of 129,000 fish was 11% greater than the short term average (2001 – 2010) but 71% less than the long-term average (1966 – 2011). Based on the 2002 tagging study mentioned in the pink salmon section above, the commercial fishing exploitation rate on chum salmon was estimated at approximately 6%, and so ADFG consider that the chum stock is in no immediate danger of overfishing (<http://www.adfg.alaska.gov/FedAidpdfs/FMR12-25>, p. 36).

Southeast

An annual management report is published summarising the entire Southeast management area, with three additional, detailed reports divided by gear type and geographical location as follows:

- Yakutat set gillnet
- Southeast & Yakutat troll
- Southeast purse seine & drift gillnet
-

Southeast & Yakutat troll

Southeast Chinook troll (partially managed by escapement goal)

NOTE: There are 11 established Chinook escapement goals in the Southeast region (according to the Alaska Pacific Salmon Escapement Goals Summary published in 2012). These are referred to in the

AMR as 'indicator systems' and appear to represent stocks within the broader quota-based management regime described below. In-season management measures are implemented similar to those in the escapement-based management in other regions, but the AMR does not include any substantial description of these (<http://www.adfg.alaska.gov/FedAidpdfs/FMR12-02>, p. 15).

The Southeast & Yakutat troll primarily targets Chinook and Coho salmon, although other species are caught incidentally. Chinook troll fisheries in the Southeast region are managed according to the Pacific Salmon Treaty (<http://www.psc.org/pubs/Treaty/Treaty.pdf>), an agreement between the USA and Canada for co-managing international salmon stocks. It is important to note that throughout the management process, Chinook are divided into two groups: treaty and non-treaty. Non-treaty individuals are primarily Alaska hatchery fish, and do not count towards the treaty quotas described below.

Chapter 3, Section 6 of the treaty states that between 2008 and 2013, selected Chinook fisheries (including the Southeast troll fishery) will be managed by Aggregate Abundance-Based Management regimes (AABM). Chapter 3, Section 6(a) defines AABM as:

"an abundance-based regime that constrains catch or total mortality to a numerical limit computed from either a preseason forecast or an in-season estimate of abundance, from which a harvest rate index can be calculated, expressed as a proportion of the 1979 to 1982 base period." (Pacific Salmon Treaty, Chapter 3, Section 6(a)).

In relation to the determining of appropriate catch levels, Chapter 3, Section 9(e) of the treaty states: *"the annual catch (or total mortality) limit applicable to each AABM fishery shall be based upon the best available pre-season predictions of abundance as determined by the CTC [Chinook Technical Committee, maintained by the USA and Canadian governments and reporting to the Pacific Salmon Commission]."* (Pacific Salmon Treaty, Chapter 3, Section 9(e)).

There are two seasons in the Chinook fishery; the winter season lasts from October to April inclusive, or until 45,000 fish are caught. The summer season runs from May to September inclusive, but may start early if the 45,000 fish quota is reached. The main difference between the seasons is that there are substantial regional closures during the winter season. 45,000 fish represents the Guideline Harvest Level (GHL) for the winter fishery, and fish tickets are monitored on a daily basis to ensure the fishery is closed upon reaching the quota.

The quota for the summer season is calculated based on pre-season estimates of abundance. An all-gear Allowable Catch (AC) is determined by the Joint Chinook Technical Committee (CTC) from the pre-season abundance indicators each spring, and is divided between the troll, net and sport fisheries according to a plan formulated by the ADFG (CTC Chinook catch and escapement report, 2011, p.3: <http://www.psc.org/pubs/TCCHINOOK12-3.pdf>).

The methodology used to estimate abundance indices is subject to annual assessment and adjustment by the CTC. This process is summarised in an annual "Exploitation Rate Analysis and Model Calibration" report (2012 report here: <http://www.psc.org/pubs/TCCHINOOK12-4.pdf>).

The relationship between abundance index and maximum all-gear catch is set out in Chapter 3, Table 1 of the treaty (p.63). Abundance indices themselves are determined using cohort analysis of release and recovery data, catch and escapement data, and other fishery dependent and independent data sources (2012 Exploitation Rate Analysis and Model Calibration, p.1: : <http://www.psc.org/pubs/TCCHINOOK12-4.pdf>).

The spring fishery (the first part of the summer season) primarily targets hatchery Chinook, although treaty fish are also captured. The spring fishery is divided into five fishing areas near hatcheries and

release sites, each of which is managed separately. Although there is no absolute quota for the spring fisheries, each area is permitted to land a limited number of treaty individuals before the area is closed. The precise number is based on the ratio of treaty to non-treaty fish harvested (<http://www.adfg.alaska.gov/FedAidpdfs/FMR12-02>, p. 4).

Spring troll areas are opened from May 1st and are either open continually or on weekly schedules. The broader summer Chinook troll fishery targets the remainder of the treaty troll quota during one or more openings. The fishery is closed when estimates of total landings reach the allowed quota (<http://www.adfg.alaska.gov/FedAidpdfs/FMR12-02>, p.5).

Table 12. Deviations between total Chinook catch and treaty quota from 1999 – 2011. Note that these values cover the entire Southeast Alaska Chinook fishery and are not limited to the troll component.

Year	Treaty Harvest	Hatchery Add-on	Terminal Exclusion	Total Harvest	Treaty Quota	Over/Under Quota
1985	268,293	6,246	0	274,539	263,000	5,293
1986	271,262	11,091	0	282,353	263,000	8,262
1987	265,323	17,095	0	282,418	263,000	2,323
1988	256,787	22,525	0	279,312	263,000	-6,213
1989	269,522	21,510	0	291,032	263,000	6,522
1990	320,996	45,873	0	366,869	302,000	18,996
1991	297,986	61,476	0	359,462	273,000	24,986
1992	221,980	36,811	0	258,791	243,000	-21,020
1993	271,193	32,910	0	304,103	263,000	8,193
1994	235,165	29,185	0	264,350	240,000	-4,835
1995	176,939	58,800	0	235,739	175,000	1,939
1996	154,997	72,599	8,663	236,259	140,000–155,000	0
1997	286,696	46,463	9,843	343,002	277,000–302,000	0
1998	243,152	25,021	2,420	270,593	260,000	-16,848
1999	198,842	47,725	4,453	251,020	184,200	14,642
2000	186,493	74,316	2,481	263,290	178,500	7,993
2001	186,919	77,287	1,528	265,734	250,300	-63,381
2002	357,133	68,164	1,237	426,534	371,900	-14,767
2003	380,152	57,228	2,056	439,436	439,613	-59,461
2004	417,019	75,955	6,295	499,268	418,342	-1,323
2005	390,470	65,294	40,875	496,639	387,403	3,067
2006	362,402	49,111	26,979	438,493	354,530	7,872
2007	328,504	69,647	8,730	406,881	259,184	69,320
2008	173,040	68,163	6,147	247,350	152,850	20,190
2009	230,401	65,189	3,869	299,459	218,789	11,612
2010	231,591	55,816	121	287,528	221,823	9,768
2011	289,980	67,225	1,147	358,352	294,800	-4,820
2001–2010 Sum:						-17,102

Summary data for Chinook in Southeast Alaska. ‘Treaty Harvest’ is the number of fish to which the treaty applied which were actually harvested; ‘Treaty Quota’ is the maximum number of fish to which the treaty applies which should have been harvested, based on the methodology described in the text. From the AMR, (<http://www.adfg.alaska.gov/FedAidpdfs/FMR12-02>, p.20).

Southeast Coho troll (partially escapement-based management)

Coho fisheries in the Southeast management area are managed to adhere to the Southeastern Alaska/Yakutat Area coho salmon fishery management plan (5 AAC 29.110, <http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter029/section110.htm>). One of the main components of the plan is a troll closure for up to seven days in late July if the total projected commercial harvest of wild coho salmon is less than 1.1 million fish. A second closure, for up to ten days, can be issued if “the number of coho salmon reaching inside waters might be inadequate to provide for spawning requirements under normal or restricted inside fisheries for coho salmon and other species”. The primary indicators for determining whether the number of salmon might be inadequate are commercial catch and CPUE data, which are compared to historical values. In addition, in-season management is supported by a range of data including wild stock and hatchery stock CWT programs, dockside sampling programs to sample the harvest for CWTs, escapement monitoring, and the troll FPD collection program, all of which have been running since the 1980’s. Finally, a model was developed in the late 1980’s to accurately project the likely total landings based on late-June harvest data.

Westward

In addition to a region-wide summary report, five detailed annual management reports are published for the Westward management area:

- North Alaska Peninsula
- South Alaska Peninsula
- Kodiak
- Aleutian & Atka-Amlia Islands
- Chignik

North Alaska Peninsula**North Alaska Peninsula Chinook, outside the Nelson River**

Total landings in 2012 across the entire North Alaska Peninsula area were 1,053 fish, significantly below the 10-year average of 5,057 per year (<http://www.adfg.alaska.gov/static/regulations/regprocess/fisheriesboard/pdfs/2012-2013/area-m/frm12-52.pdf>, p.3). Although Nelson River is the only Chinook stock with an escapement goal, escapement in other rivers is monitored and estimated, including King Salmon, Bear, and Sandy rivers (Bear River Section, weir counts); Ilnik river (weir count); Meshik River and tributaries (Inner Port Heiden Section, aerial survey); and Cinder River Section. There are only occasionally directed fisheries for Chinook, and in most years any catch is incidental in the sockeye fisheries.

South Alaska Peninsula**South Alaska peninsula Chinook**

There are no South Alaska peninsula Chinook escapement goals because there are no directed Chinook fisheries (<http://www.adfg.alaska.gov/static/regulations/regprocess/fisheriesboard/pdfs/2012-2013/area-m/fms13-01.pdf>). There are no known Chinook spawning streams in the region, and all Chinook catch is incidental (<http://www.adfg.alaska.gov/FedAidPDFs/FMR12-42.pdf>, p.11).

Kodiak**Kodiak coho (some escapement goals)**

A 2005 review of escapement goals in the Kodiak Management Area (KMA) recommended the elimination of a number of coho escapement goals due to the high level of uncertainty in the development of the goals, and the difficulty in monitoring the river systems. Of 16 SEGs in place before the review, it was recommended that 12 be eliminated, including: Saltery, Roslyn, Big Bay, Bear Creek, Portage, Pauls, Afognak, Karluk, Ayakulik, Akalura, Upper Station and Dog Salmon (<http://www.sf.adfg.state.ak.us/FedAidPDFs/fms05-05.pdf>, p.81).

The 2010 AMR confirms that the four remaining SEGs were the only ones still in place more recently (<http://www.adfg.alaska.gov/FedAidpdfs/FMR10-47.pdf>, p.20). The only established coho salmon escapement goals occur in Northeast and Eastside Kodiak districts for the following systems; American (400 fish), Olds (1000 fish), Buskin (3200 to 7200 fish) and the Pasagshak rivers (1200 fish). All systems but Olds were met. It is expected that coho salmon enter systems in the fall after weirs have been removed and aerial and foot surveys have concluded. The estimated coho salmon escapement in 2012 of 118,814 fish was above the previous 10 years average of 92,420 fish. (http://www.adfg.alaska.gov/static/fishing/PDFs/commercial/kodiak/2012_kodiak_salmon_summary.pdf)

Aleutian & Atka-Amlia islands**Aleutian Islands Chum & Coho**

The Aleutian Islands salmon fishery primarily targets pink salmon. In 2011, 235 chum and 2 coho salmon were landed. This broadly reflects the low level of fishery removals over the last 20+ years. The geography and location of the Aleutian islands makes escapement enumeration very difficult, and the majority of runs, particularly of the less commercially exploited species, are generally not monitored, although foot and aerial surveys have been conducted on occasion (<http://www.adfg.alaska.gov/FedAidpdfs/FMR12-19>, p. 3 & 4). The escapement goal review process includes monitoring of stocks without escapement goals to ensure goals are generated as appropriate, as has occurred in other regions.

In-Season Management

Whether managed by escapement goal or not, salmon fisheries in Alaska are subject to in-season management measures designed to achieve the goals of the various applicable over-arching management documents, including:

- the Policy for the Management of Mixed Stock Salmon Fisheries (Mixed Stock Policy: 5 AAC 39.220, <http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter039/section220.htm>);
- Policy for the Management of Sustainable Salmon Fisheries (Sustainable Salmon Policy: 5 AAC 39.222, http://www.housemajority.org/coms/jcis/pdfs/Sustainable_Salmon_Fisheries_Policy.pdf);
- and Policy for Statewide Salmon Escapement Goals (Escapement Goal Policy: 5 AAC 39.223 <http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter039/section223.htm>).

At the most basic level, in-season management involves local fishery managers utilising the most up-to-date fishery data, combined with their own expert knowledge and experience, to make immediate and ongoing management decisions and ensure the sustainability of the various stocks.

Generally managers are assigned escapement goals for a sub region or index stock, with less formal harvest guidelines for each of the stocks. Harvests are monitored through a "fish ticket" system. A formal fish ticket is required by law at the time of each ex-vessel sale. The fish tickets are entered into a computer-based fish system so that cumulative catch can be estimated up to the minute. Through this system, the cumulative catch can be forecasted to the end of the season, as a function of increased or decreased fishing effort. Fishing effort can also be computed through the fish tickets system. Additionally, fishing effort -- and the spatial distribution of fishing effort -- is monitored by occasional aerial overflights of the fishery by fishery managers. In practice, this involves opening and closing geographical areas and prosecuting (i.e. commercial, sport, subsistence) components of the fishery using emergency orders, based on run size projections, historical and contemporary escapement estimates, intensive harvest monitoring, fishing-effort monitoring, and escapement monitoring, environmental conditions, stock sampling data and any other available information.

Index streams tend to be large streams with good visual access. On aerial overflights, managers record their impression of the number of pink salmon staging near spawning areas and the number of pink salmon present in the spawning areas. These impressions are combined into an index of escapement, and ADFG maintains a computer system so that managers can view values of these indices, by date, for each fishery historic record. This system allows managers to forecast year-end values of the indices as a function of fishing effort. Managers can control fishing effort by "emergency orders." The season begins with a series of scheduled fishing periods and closed periods defined for specific fishing areas or districts. If managers want to increase fishing effort they can extend the time of a fishing period or add additional fishing periods. Similarly, on short notice, managers can eliminate fishing periods. In some cases they can add to or restrict the size of fishing areas to fine tune the effort exerted on different stocks and substocks. Managers have a very wide latitude to control fishing effort during the season, and they are evaluated based on their ability to permit orderly fisheries and to have the escapement indices fall within pre-season escapement goal ranges, which are specified in regulations. Notably, preseason forecasts have very little to do with the management of these fisheries, and the preseason forecasts only affect the fishing intensity very early in the season, before many fish are present. This style of management is almost entirely based on measured and observed harvest and a measured and observed proxy for escapement.

In addition to the generalised policies listed above, the majority of salmon fisheries are subject to local management plans or policies which further inform and guide the ability of managers to achieve their objectives for the fisheries. The following are stock-specific examples of in-season management to illustrate how the process functions in practice.

Yukon Fall Chum Salmon (managed by escapement goal)

Run size is estimated in a pre-season Outlook & Management Plans document using estimates of escapements from previous years as shown in the table below. Estimated 'return per spawner' combined with the relative contributions of relevant year classes are used to produce an estimated total returns range. The fall chum run is an example of a stock for which there is a lot of information; for less well-understood stocks similar estimates of expected return are made based on whatever data are available (see 2012 Outlook & Management Plans document <http://www.adfg.alaska.gov/FedAidpdfs/RIR.3A.2012.04.pdf>).

Table 13. Forecasted 2012 total run size of fall chum salmon based on parent year escapement for each brood year and predicted return per spawner (R/S) rates, Yukon River 2006-2009.

Brood Year	Escapement	Estimated Production (R/S)	Estimated Production	Contribution Based on Age	Current Return
2006	880,503	0.89	783,648	1.0%	11,333
2007	910,883	1.44	1,311,672	32.3%	360,160
2008	687,153	1.66	1,141,261	65.2%	725,909
2009	482,411	1.98	957,148	1.5%	16,357
Total expected run (unadjusted)					1,114,000
Total 2012 run size expressed as a range based on the forecasted vs. observed returns from 1987 to 2011 (80% CI):					986,000 to 1,200,000

From the 2012 Fisheries Outlook and Management Strategies, Yukon Management Area
<http://www.adfg.alaska.gov/FedAidpdfs/RIR.3A.2012.04.pdf>.

“Based on the forecast, it is anticipated that escapement goals will be met while providing normal subsistence fishing activities. Commercial harvest, depending on run size, could range from 500,000 to 700,000 fall chum salmon. Commercial harvestable surpluses will have to be determined in-season and opportunity provided where commercial ventures exist.

Management decisions made early in the fall season are based primarily on the preseason projection. The preseason projection, made in early July, refines the preseason forecast. The projection will be based on the 2012 summer chum salmon run size and historical relationship between summer and fall chum salmon runs. As the fall chum salmon run approaches the first quarter point (late July-early August), management decisions will start incorporating abundance and run timing information from the Pilot Station sonar project and the drift gillnet test fisheries located at Emmonak and Mountain Village, as well as fishing reports from local fishermen.” (pp. 5&6, <http://www.adfg.alaska.gov/FedAidpdfs/RIR.3A.2012.04.pdf>).

Initial inseason management decisions are also informed by the performance of the summer chum fishery (primarily sonar-based abundance estimates). Management then continues using in-season monitoring projects distributed throughout the river system upstream. The over-arching theory is to monitor performance at each project and compare it to historical data to determine how successful the return is at that point. For example:

“Information from Rapids test fish project (14 years of data) indicated the run in 2010 was half of average and up to 7 days later than normal. Escapement information from tributaries came in late because of run timing but it was determined inseason that most of the goals would be achieved with concerns primarily for the weak Porcupine River components (Sheenjok and Fishing Branch rivers).” (<http://www.adfg.alaska.gov/FedAidpdfs/FMR12-23.pdf> p. 58)

North Alaska Peninsula

A summary of in-season management is provided in the North Alaska Peninsula AMR (<http://www.adfg.alaska.gov/static/regulations/regprocess/fisheriesboard/pdfs/2012-2013/area-m/frm12-52.pdf>, p. 2):

“While the earliest opening dates are established by regulation and modified by emergency orders, actual fishing time in North Alaska Peninsula fisheries is based on inseason evaluation of local stock abundance and escapement objectives. Sockeye salmon are the primary species targeted for harvest, and Nelson and Bear rivers are the largest sockeye salmon producing systems. Between June 1 and September 15, within the Nelson Lagoon to Port Heiden region, management emphasis is on five sockeye salmon systems: Nelson, Bear, Sandy, Ilnik, and Meshik rivers (Murphy and Wilburn 2012). Alaska Department of Fish and Game (ADFG) operates weir camps on the Nelson, Bear, Sandy, and Ilnik rivers that provide daily escapement counts used to manage commercial fisheries. Aerial surveys from a fixed wing aircraft are used to enumerate salmon in other systems that do not have weirs.”

Table 13. Examples of emergency orders issued in the North Alaska Peninsula salmon fisheries 2012. There were a total of 35 such orders issued during the 2012 fishery (between June 17th and September 4th). From the 2012 AMR,

Emergency Order #	Issued:	Effective:	Action Taken:
Port Moller - 1	8:00 p.m. June 17	6:00 a.m. June 18	Closure: The Port Moller Bight and Bear River sections will close to commercial salmon fishing until further notice.
Port Moller - 2	8:00 p.m. June 19	12:01 a.m. June 20	Closure: The Ilnik, Outer Port Heiden and Three Hills sections will remain closed to commercial salmon fishing until further notice.
Port Moller - 3	8:00 p.m. June 24	6:00 a.m. June 25	Closure: The Nelson Lagoon Section will remained closed to commercial salmon fishing from 6:00a.m. June 25 until further notice.
Port Moller - 4	9:00 a.m. June 26	6:00 a.m. June 28	Fishing Period: The Outer Port Heiden Section will open to commercial salmon fishing from 6:00 a.m. June 28 until 6:00 p.m. June 30.
Port Moller - 5	9:15 a.m. June 28	3:00 p.m. June 28	Fishing Period: The Nelson Lagoon Section will open to commercial salmon fishing from 3:00 p.m. June 28 until 6:00 p.m. June 30.
Port Moller - 6	9:00 a.m. June 30	6:00 p.m. June 30	Fishing Period: The Nelson Lagoon Section will remain open to commercial salmon fishing from 6:00 p.m. June 30 until 12:00 midnight July 5.
Port Moller - 7	3:00 p.m. July 1	6:00 a.m. July 2	Fishing Period: A portion of the Bear River Section northeast from a line at bearing 280° perpendicular to the beach at the southern 1,000 yd. Bear River regulatory marker to Cape Seniavin will be closed until further notice. The Bear River portion southwest of the same line as well as the Port Moller Bight and Ilnik sections, will open to commercial fishing at 6:00 a.m. July 2 until 6:00 p.m. July 4. The Three Hills Section will remain closed as per previous news release.

<http://www.adfg.alaska.gov/static/regulations/regprocess/fisheriesboard/pdfs/2012-2013/area-m/frm12-52.pdf>, p.80)

(AYK)

Kuskokwim AMR, 2010: <http://www.adfg.alaska.gov/FedAidpdfs/FMR11-67.pdf>

Norton sound, Port Clarence and Kotzebue AMR, 2011:

<http://www.adfg.alaska.gov/FedAidpdfs/FMR11-23.pdf>

Yukon and Northern AMR, 2010 (published May 2012):

<http://www.adfg.alaska.gov/FedAidpdfs/FMR12-23.pdf>

2010 AYK escapement goal recommendations: <http://www.sf.adfg.state.ak.us/FedAidpdfs/FMS09-07.pdf>

Yukon river summer chum management plan:

<http://touchngo.com/lglcntr/akstats/aac/title05/chapter005/section362.htm>

2012 Yukon salmon fishery outlook and management strategies:

<http://www.adfg.alaska.gov/FedAidpdfs/RIR.3A.2012.04.pdf>

2012 Norton Sound salmon fishery outlook and management strategies:

<http://www.adfg.alaska.gov/FedAidpdfs/RIR.3A.2012.03.pdf>

Kuskokwim River Salmon Rebuilding Management Plan:

<http://www.touchngo.com/IglcNtr/akstats/aac/title05/chapter007/section365.htm>

(Central)

Bristol Bay AMR, 2011: <http://www.adfg.alaska.gov/FedAidpdfs/FMR12-21>

Upper Cook Inlet AMR, 2011: <http://www.adfg.alaska.gov/FedAidpdfs/FMR12-25>

Lower Cook Inlet AMR, 2011: <http://www.adfg.alaska.gov/FedAidpdfs/FMR12-30.pdf>

Prince William Sound AMR, 2011 (includes Copper River):

<http://www.adfg.alaska.gov/FedAidpdfs/SP11-12.pdf>

2012 Bristol Bay management outlook:

http://www.adfg.alaska.gov/static/fishing/PDFs/commercial/2012_bristolbay_salmon_outlook.pdf

Review of Bristol Bay escapement goals, 2012: <http://www.adfg.alaska.gov/FedAidPDFs/FMS12-04.pdf>

Nushagak River coho salmon management plan: http://www.adfg.alaska.gov/static-sf/management_areas/PDFs/bbcohopl.pdf

Upper Cook Inlet escapement goal review, 2011: http://www.susitna-watanahydro.org/wp-content/uploads/2012/05/Fair_2010_UCI_Salmon_Escpmt_Goals.pdf

(Southeast)

Southeast & Yakutat Overview AMR, 2012: <http://www.adfg.alaska.gov/FedAidPDFs/FMR13-03.pdf>

Yakutat set gillnet AMR, 2011: <http://www.adfg.alaska.gov/FedAidpdfs/FMR12-01.pdf>

Southeast & Yakutat troll AMR, 2011: <http://www.adfg.alaska.gov/FedAidpdfs/FMR12-02>

Southeast Purse Seine & Drift Gillnet AMR, 2011: <http://www.adfg.alaska.gov/FedAidpdfs/FMR12-03>

Pacific Salmon Treaty: <http://www.psc.org/pubs/Treaty/Treaty.pdf>

Joint Chinook Technical Committee (CTC) publications:

http://www.psc.org/publications_tech_techcommitteereport.htm#TCCHINOOK

CTC Chinook catch and escapement report, 2011: <http://www.psc.org/pubs/TCCHINOOK12-3.pdf>

CTC Exploitation Rate Analysis and Model Calibration report, 2012:

<http://www.psc.org/pubs/TCCHINOOK12-4.pdf>

(Westward)

North Alaska Peninsula AMR, 2012:

<http://www.adfg.alaska.gov/static/regulations/regprocess/fisheriesboard/pdfs/2012-2013/area-m/frm12-52.pdf>

South Alaska Peninsula AMR, 2012: <http://www.adfg.alaska.gov/FedAidPDFs/FMR12-42.pdf>

Kodiak AMR, 2010: <http://www.adfg.alaska.gov/FedAidpdfs/FMR10-47.pdf>

Aleutian & Atka-Amlia Islands AMR, 2011: <http://www.adfg.alaska.gov/FedAidpdfs/FMR12-19>

Chignik AMR, 2011: <http://www.adfg.alaska.gov/FedAidpdfs/FMR12-18>

Alaska Peninsula, Aleutian Islands & Atka-Amlia Islands summary AMR, 2011:

<http://www.adfg.alaska.gov/FedAidpdfs/FMR12-26>

Review of Chignik escapement goals, 2005: <http://www.sf.adfg.state.ak.us/FedAidPDFs/fms05-06.pdf>

Review of Kodiak escapement goals, 2005: <http://www.sf.adfg.state.ak.us/FedAidPDFs/fms05-05.pdf>

Escapement goal review, Peninsula & AI, 2012 (not used in 2012 AMR):

<http://www.adfg.alaska.gov/static/regulations/regprocess/fisheriesboard/pdfs/2012-2013/area-m/fms13-01.pdf>

Escapement goal review, Peninsula & AI, 2010: <http://www.adfg.alaska.gov/FedAidpdfs/FMS09-09.pdf>

Regulation of salmon fishing opportunities in Alaska

The Alaska Commercial Fisheries Entry Commission (CFEC) issues permits and vessel licenses to qualified individuals in both limited and unlimited fisheries, and provides due process hearings and appeals for those individuals denied permits. The CFEC issues three basic types of permits: limited entry permits, interim-use permits, and vessel permits. Limited entry permits are the permanent permits issued for limited fisheries. Limited entry permits must be renewed annually and most can be transferred to another person after initial issuance (e.g., sold, or inherited). Interim-use permits are issued annually for all commercial fisheries not under entry limitation, and to applicants waiting to find out if they qualify for permanent permits.

A limited entry or interim-use permit entitles the holder to operate gear in a specific commercial fishery in accordance with BOF regulations. The term “fishery” refers to a specific combination of fishery resource(s), gear type(s), and area(s). For example, Southeast salmon trolling, Cook Inlet salmon drift gillnetting and Chignik salmon seining are distinct fisheries, requiring separate permits. Permits for some species other than salmon are issued on a statewide basis; however, most are valid only for specific areas of the state (e.g., Southeast, Cook Inlet or Bristol Bay). This “right to fish” is embodied in the permit card that is issued annually.

<http://www.cfec.state.ak.us/>

http://www.cfec.state.ak.us/Publications/what_is_cfec.pdf

Management measures for private non-profit salmon hatcheries

Management measures specific to salmon hatcheries include Title 05, Fish and Game; Chapter 40: Private Non Profit Salmon Hatcheries; and Chapter 41: Transportation, Possession and Release of Live Fish; Aquatic Farming.

A key concept behind development of policies for salmon hatcheries in Alaska was the comprehensive regional planning process. This involved formation of regional planning teams consisting of scientists and fishery managers from ADFG and other state agencies, along with scientists from universities, federal agencies, commercial and recreational fishery groups, regional aquaculture associations, and local community representatives. Planning teams developed comprehensive regional plans that determined the location of hatcheries with consideration given to terminal harvest areas that would allow targeting of hatchery fish while minimizing impact on wild stocks. Other aspects of comprehensive planning included the permitted capacity of each species to be raised in individual hatcheries, origins of broodstocks used, and proximity of hatcheries to wild stocks. Because the Alaska program was developed to enhance the salmon fishery and not mitigate for lost habitat, or help rebuild wild runs with infusions of hatchery fish, the siting of hatcheries became of paramount importance.

In order to minimize potential negative impacts of hatchery salmon, hatcheries were located on streams or rivers with no major runs of wild salmon, conversely, most hatcheries are located on non-anadromous water sources at or near tidewater and some distance from important wild stocks. Other key planning and policy issues included development of conservative fish culture practices, statewide genetics and fish health policies, and use of innovative technologies. Conservative fish culture practices included use of hatchery broodstock originating from local regional wild stocks and restricting the use of a particular broodstock to a limited number of hatcheries. These practices and other policies are encoded in the statewide genetics policy and fish health policies (Heard 2011).

All hatchery release strategies are reviewed by ADFG and are ultimately approved under the

authority of ADFG. Both economic and ecological evaluation of the release plan forms part of the decision making process. Introduction of genetic material is prohibited and hatchery stock is selected from the terminal area stock and hence, all genetic material originated from that location. Selection techniques are designed to avoid artificial reduction in genetic material – i.e. fish are selected at random and not on external trait basis (size, shape, colour etc). An extremely wide, pre-determined number of returning fish are used for stripping of ova for hatchery rearing and release (Reference to Genetic Policy, 1985).

Key Aspects of Salmon Enhancement Management in Alaska

- Highest priority: protect and maintain wild salmon stocks, legal mandates that require wild stocks to be given priority in fishery management;
- Vigorous habitat protection, no dams on rivers
- Escapement-based management, no fishery targets
- Mixed stock fisheries avoided wherever possible
- Hatcheries supplement not replace wild stocks, mitigation of pressure on wild stocks.
- Annual Management Plans of all hatcheries are annually reviewed by ADFG.

Minimizing Hatchery-Wild Stock Interactions

- Comprehensive regional planning.
- Utilise conservative fish culture practices.
- A rigorous hatchery permitting process that includes genetics, pathology and fishery management reviews.
- Statewide genetics policy to guide hatchery program and practices to allow protection of wild stocks by avoiding foreseeable negative effects.
- Fish health and disease statutes (no disease has ever been introduced or amplified in the wild).
- Careful siting of hatcheries, terminal harvest areas (temporal and spatial segregation from wild stocks to minimize mixed fisheries, then harvest all the returning salmon to minimize potential breeding. Hatchery production is not approved if there is not high confidence that the resulting salmon will be fully harvested –decreasing the potential of hatchery strays).
- Hatchery brood stock diversity practices (fish selected at random and not on external trait basis such as size, colour or shape, 1 to 1 mating ratio, effective population sizes extremely large – especially true for pink and chum salmon in SEAK and PWS).
- Use of local brood sources is priority.
- Collection of broodstock for the hatcheries is stratified over spawn/run timing to maximize the heterogeneity of the gene pool.
- Mass otolith marking for real-time in-season fisheries management. All hatcheries in Southeast, Central and Westward Region (apart from Kitoy Bay and Pillar Creek hatcheries) in Kodiak thermally mark virtually all of their releases for identification of hatchery salmon during harvest.

Each hatchery is required to complete an annual report containing information on hatchery returns, numbers of eggs taken, and numbers of fry or smolt released, by species and stock, in accordance with their approved permits.

<http://www.springerlink.com/content/25k01460326l7g38/>

<http://www.touchngo.com/iglcnt/akstats/aac/title05/chapter040.htm>

<http://www.touchngo.com/iglcnt/akstats/aac/title05/chapter041.htm>

Summary

Escapement goals are essentially the harvest control rule used for management of Alaska salmon. Currently, there are 300 active salmon stock escapement goals throughout the state of Alaska. However, not all Alaska salmon fisheries and salmon stocks are managed with formal escapement goals, but instead, through inseason management and emergency orders. Inseason management involves opening and closing geographical areas and prosecuting (commercial, sport, subsistence) components of the fishery using emergency orders, based on run size projections, historical and contemporary escapement estimates, intensive harvest monitoring, fishing-effort monitoring, and escapement monitoring, environmental conditions, stock sampling data and any other available information. During the 2012 calendar year ADFG issued about 750 emergency orders to open and close commercial salmon fisheries in the Alaska. Fisheries regulations are published for the various areas in Alaska. These documents contain selected Alaska statutes enabling legal management of resources, statewide general provisions, management plans, gear allowances, closed and open areas, and all the other area specific provisions. These regulations may be changed inseason by emergency regulations or emergency orders at any time to allow sufficient escapements. The Alaska Commercial Fisheries Entry Commission (CFEC) issues permits and vessel licenses to qualified individuals in both limited and unlimited fisheries, and provides due process hearings and appeals for those individuals denied permits. A limited entry or interim-use permit entitles the holder to operate gear in a specific commercial fishery in accordance with BOF regulations. The term "fishery" refers to a specific combination of fishery resource(s), gear type(s), and area(s). Management measures specific to salmon hatcheries include Title 05, Fish and Game; Chapter 40: Private Non Profit Salmon Hatcheries; and Chapter 41: Transportation, Possession and Release of Live Fish; Aquatic Farming

9. There shall be defined management measures designed to maintain stocks at levels capable of producing maximum sustainable levels.

*FAO CCRF 7.1.8/7.6.3/7.6.6/8.4.5/8.4.6/8.5.1/8.5.3/8.5.4/8.11.1/12.10
FAO Eco 29.2bis*

Evidence adequacy rating:

High

Medium

Low

Rating Determination:

There are defined management measures designed to maintain stocks at levels capable of producing maximum sustainable levels. Escapement goals (BEGs, SEGs, OEGs and SETs) aim at allowing sufficient salmon to escape and spawn in their relative natal rivers, and enable them to produce, over the long term, maximum sustainable levels. The commercial Alaska salmon fisheries are limited entry fisheries. The CFEC manages the entry program by issuing permits and vessel licenses. Stocks that are deemed below the escapement goals are classified as: yield, management, or chronic inability concern. For stocks of concern, action plans dealing with their recovery are prepared and applied.

In the early 1970s, the Alaska government realized that the state’s salmon resources could not produce livelihoods for an increasing and unlimited number of fishermen and still be managed for maximum sustained yield. Legislation was passed in 1973 to establish a “limited entry” system to allow the state to limit the number of participants in a specific fishery. State statute AS 16.43.140 states, “after January 1, 1974, a person may not operate gear in the commercial taking of fishery resources without a valid entry permit or a valid interim-use permit issued by the commission.” The Alaska Commercial Fisheries Entry Commission (CFEC) issues permits and vessel licenses to qualified individuals in both limited and unlimited fisheries, and provides due process hearings and appeals for those individuals denied permits <http://www.cfec.state.ak.us/>.

CFEC issues three basic types of permits: limited entry permits, interim-use permits, and vessel permits. Limited entry permits are the permanent permits issued for limited fisheries. Limited entry permits must be renewed annually and most can be transferred to another person after initial issuance (e.g., sold, or inherited). Interim-use permits are issued annually for all commercial fisheries not under entry limitation, and to applicants waiting to find out if they qualify for permanent permits. Vessel permits (in contrast to vessel licenses) are issued annually for vessels qualified to participate in the Bering Sea hair crab or weathervane scallop fisheries http://www.cfec.state.ak.us/Publications/what_is_cfec.pdf.

A limited entry or interim-use permit entitles the holder to operate gear in a specific commercial fishery in accordance with BOF regulations. The term “fishery” refers to a specific combination of fishery resource(s), gear type(s), and area(s). For example, Southeast salmon trolling, Cook Inlet salmon drift gillnetting and Chignik salmon seining are distinct fisheries, requiring separate permits. Permits for some species other than salmon are issued on a statewide basis; however, most are valid only for specific areas of the state (e.g., Southeast, Cook Inlet or Bristol Bay). This “right to fish” is embodied in a permit card that is issued annually.

Since statehood, ADFG has compiled databases on salmon runs for each of the 5 species and within the Regions and Districts of Alaska. Alaska has a large and ongoing fishery monitoring and stock assessment program to obtain the extensive scientific information necessary to establish new escapement goals, modify existing escapement goals, and provide other scientific information that allows fisheries to be managed to achieve escapement goals or other benchmarks (such as harvest quotas or allocations). Details about these are provided in more detail in clause 4-5-6.

Escapement goals are the key management references for production of maximum sustainable levels as data and knowledge allows.

Biological Escapement Goal (BEG): 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 goal or in-river run goal has been adopted; BEG will be developed from the best 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 the BEG (5 AAC 39.222(f)).

Sustainable Escapement Goal (SEG): 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 due to the absence of a stock specific catch estimate; the SEG is the primary management objective for the escapement, unless an optimal escapement goal or inriver run goal has been adopted by the board, and will be developed from the best biological information; the SEG will be determined by the department and will be stated as a range that takes into account data uncertainty; the department will seek to maintain escapements within the bounds of the SEG (5 AAC 39.222(f)).

Optimal Escapement Goal (OEG): 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 Sustainable Escapement Threshold (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 (5 AAC 39.222(f)).

Inriver Goal: A specific management objective for salmon stocks that are subject to harvest upstream of 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; (5 AAC 39.222(f)).

Stocks below escapement goals are classified as:

- **Yield Concern:** results from a chronic inability to maintain yields or harvestable surplus above escapement needs.
- **Management Concern:** results from a chronic inability to maintain escapements within the bounds of a BEG, SEG, or OEG.
- **Conservation Concern:** results from a chronic inability to maintain escapements above a sustainable escapement threshold (SET).
- **Chronic inability** - continuing or anticipated inability to meet escapement threshold (goals) over 4-5 year period (generation time of most spp.) despite use of specific management measures.

For stocks of concern, action plans dealing with their recovery are prepared and applied. The Policy for the Management of Sustainable Salmon Fisheries (5 AAC 39.222) directs ADFG to report to the BOF on the status of salmon stocks and to identify specific stocks that represent a concern based on yield, management, or conservation. Generally, review teams comprised of staff from the Commercial and Sport Fish Divisions examine escapement goals by region and report potential

problems with stocks to the BOF at regularly scheduled meetings.

The overall salmon harvest levels in Alaska have remained fairly constant since the 90s. This can be seen in the figure here below.

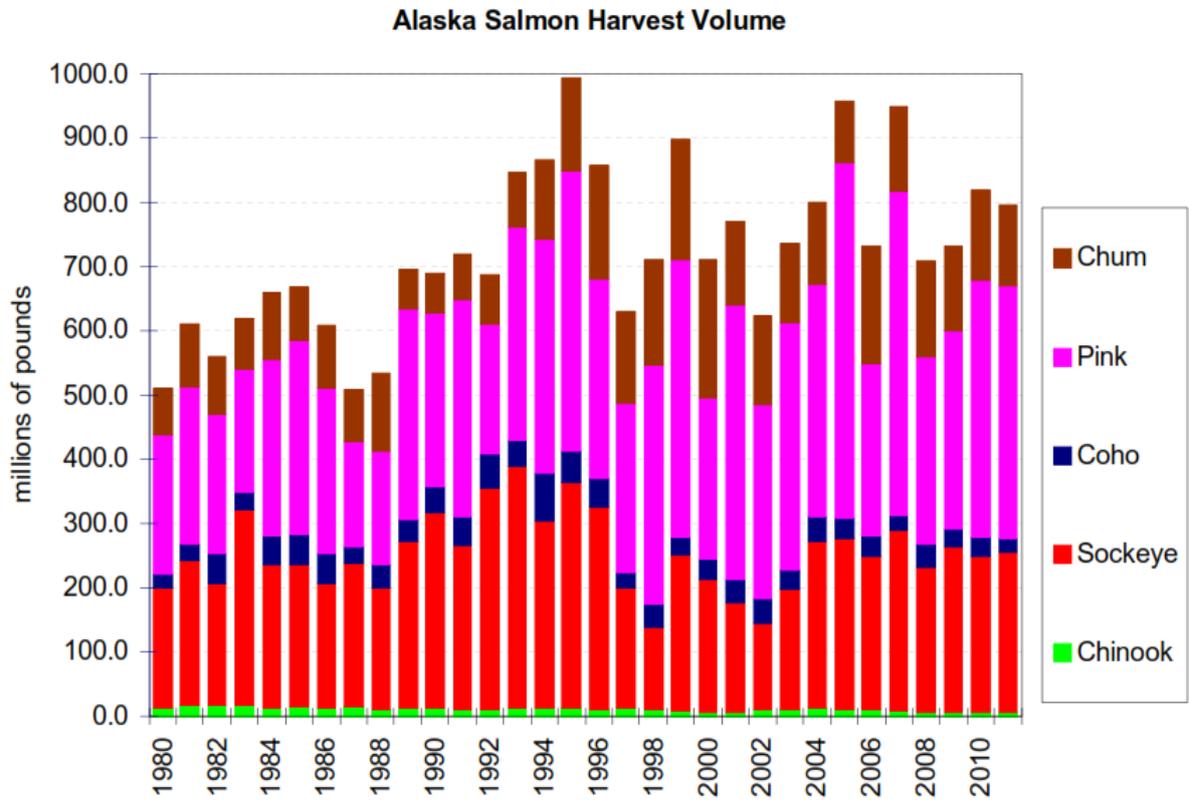


Figure 9. Alaska salmon harvest volume by species from 1980 to 2012.

<http://www.adfg.alaska.gov/FedAidpdfs/FMS11-06.pdf>

<http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter039.htm>

http://www.adfg.alaska.gov/static/fishing/PDFs/commercial/gk_trends_4-12-12.pdf

<p>10. Fishing operations shall be carried out by fishers with appropriate standards of competence in accordance with international standards and guidelines and regulations.</p>		
<p><i>FAO CCRF 8.1.7/8.1.10/8.2.4/8.4.5</i></p>		
<p>Evidence adequacy rating:</p>		
<p><input checked="" type="checkbox"/> High</p>	<p>Medium</p>	<p>Low</p>
<p>Rating Determination:</p> <p><i>Fishing operations are carried out by fishers with appropriate standards of competence in accordance with international standards and guidelines and regulations. Training programs for fishermen are widely available throughout Alaska.</i></p> <p>The State of Alaska, Department of Labor & Workforce Development (ADLWD) includes AVTEC (formerly called Alaska Vocational Training & Education Center, now called Alaska’s Institute of Technology). One of AVTEC’s main divisions is the Alaska Maritime Training Center. The goal of the Alaska Maritime Training Center is to promote safe marine operations by effectively preparing captains and crew members for employment in the Alaskan maritime industry.</p> <p>The Alaska Maritime Training Center is a United States Coast Guard (USCG) approved training facility located in Seward, Alaska, and offers USCG/STCW-compliant maritime training (STCW is the international Standards of Training, Certification, & Watchkeeping). In addition to the standard courses offered, customized training is available to meet the specific needs of maritime companies. Courses are delivered through the use of their world class ship simulator, state of the art computer based navigational laboratory, and modern classrooms equipped with the latest instructional delivery technologies.</p> <p>The Center’s mission is to provide Alaskans with the skills and technical knowledge to enable them to be productive in Alaska’s continually evolving maritime industry. Supplemental to their on-campus classroom training, the Alaska Maritime Training Center has a partnership with the Maritime Learning System to provide mariners with online training for entry-level USCG Licenses, endorsements, and renewals.</p> <p>The University of Alaska Sea Grant Marine Advisory Program (MAP) provides education and training in several sectors, including fisheries management, in the forms of seminars and workshops. In addition, MAP conducts sessions of their Alaska Young Fishermen’s Summit (AYFS). Each Summit is an intense, 2/3-day course in all aspects of Alaska fisheries, from fisheries management & regulation, to seafood markets & marketing. The target audience for these Summits is young Alaskans from coastal communities. The 2012 AYFS was held Feb. 13 and 14 in Juneau, and the 2013 AYFS will be held in December in Anchorage. The two-day conference aimed at providing crucial training and networking opportunities for fishermen entering the business or wishing to take a leadership role in their industry. The event took advantage of the Juneau location by introducing participants to the legislative process, and introducing the fish caucus of the legislature to the issues and concerns of Alaska’s emerging fishermen.</p> <p>The Alaska Fisheries Business Assistance Project, Fishbiz, is a seafood business training and educational program for Alaska’s seafood industry participants and dependent coastal communities. Fishbiz services focus on education, research and extension, and offers educational workshops, seminars, manuals and industry updates.</p> <p>The University of Alaska Sea Grant Marine Advisory Program collected input in an online survey for 10 weeks in early 2011 of commercial fishing captains and crew, retired fishermen, people</p>		

interested in becoming a fisherman, and those supporting the commercial fishing industry with their goods and services, including scientists and educators. The purpose of this survey was to understand if a formal University-sponsored training program in commercial fisheries would be of value and, if so, what subjects would be most important to offer. MAP reached survey respondents through various media outlets and direct email lists. 185 people throughout Alaska, from various fisheries, participated in the survey. Seventy-nine percent of respondents had attended workshops and/or training related to fishing and 88% responded that this had helped their fishing careers. Fifty-two percent also believed the University of Alaska should offer a formal training program in commercial fisheries; while 34% said "don't know" and 14% said "no."

The respondents also indicated that important classes would include: *Marine safety, Marine navigation and seamanship, and Seafood handling and quality, Vessel maintenance and repair, Understanding regulatory processes & fisheries management and Maritime law.*

Moreover, 77% of total respondents "strongly or somewhat agree" that a *formal training program would make an inexperienced individual a better fisherman.* Thirty-nine percent of respondents elaborated on this point and emphasized that all training is helpful, not necessarily a formal training program, and specified the need for hands-on learning and fishing experience.

By law (Alaska Statutes, or AS), all Alaska salmon fishing vessels are required to be licensed by the State of Alaska, and to display their permanent vessel license plate.

The fishing gear itself must be marked in accordance with state regulations (Alaska Administrative Code, or AAC), which are specific to each fishing region. Also, there are region-specific regulations which require how salmon fishing vessels must display their names and permit numbers.

Sources of evidence –

AS 16.05.510. Unlicensed vessel unlawful

AS 16.05.520. Number plate

5 AAC 06.334. Identification of gear

AAC 06.343. Vessel identification

<http://www.avtec.edu/AMTC.htm>

<http://www.stcw.org/>

<http://seagrant.uaf.edu/map/>

<http://seagrant.uaf.edu/map/fishbiz/index.php>

<http://seagrant.uaf.edu/map/fishbiz/trainingsurvey/formaltrngsurvey.pdf>

<http://www.sfos.uaf.edu/fitc/academicprograms/>

Personnel Resources

- * 97 commissioned AWT Troopers
- * 89 certified commissioned boat operators
- * Commissioned boat operators pass certification exams
- * 21 Public Safety Technician II - Conduct dockside boardings of federal fisheries vessels under agreement with National Marine Fisheries
- * 16 Public Safety Technician I – seasonal technicians that assist troopers with vessel operations and maintenance
- * 14 Boat Operators – civilian employees permanently assigned to operations of larger vessels between 42 ft and 156 ft
- * Civilian captains and mates are all Coast Guard licensed

Vessel Resources

- * 45 vessels in total that are used for commercial fisheries enforcement
- * Vessels range in size from 18 ft day skiffs to a 156 ft high seas enforcement vessel
- * 156 ft vessel stationed in Dutch Harbor, 121 ft vessel and 65 ft vessel stationed in Kodiak, 69 ft vessel stationed in Ketchikan and 42 ft vessel stationed in Cordova
- * Various 26 ft – 33 ft medium vessels stationed throughout Southeast Alaska, Prince William Sound, Kenai Peninsula, Kodiak Island and the Alaska Peninsula that are used for multi-day commercial fisheries patrols
- * Larger vessels (42 ft -156 ft) fully equipped with pot pulling capabilities

Aircraft Resources

- * 22 Piper PA-18 Super Cubs, 10 on floats
- * 6 Cessna 185, 3 on floats
- * 1 Cessna 206
- * 2 Cessna 208 Caravans
- * 1 Beechcraft King Air equipped with infra-red photo equipment
- * 3 Robinson R-44 helicopters, 2 on floats
- * 1 turbine helicopter equipped with infra-red photo equipment

Patrol Missions

- * In-river gill net salmon fisheries using smaller vessels, aircraft and land based viewing operations using photo equipment
- * Near coastal gill net and seine salmon and herring fisheries using all sizes of vessels, aircraft and land based viewing operations using photo equipment
- * Near coastal shrimp and crab (Dungeness, king and tanner) pot fisheries using aircraft, medium and large vessels.
- * Off shore crab (king and tanner) fisheries using large vessels and infra-red equipped twin engine aircraft
- * Off shore ground fish (halibut, pacific cod etc.) longline and pot fisheries using larger vessels and infra-red equipped twin engine aircraft
- * Off shore trawl fisheries using large vessels and infra-red equipped twin engine aircraft
- * Southeast Alaska salmon troll fisheries using all sizes of vessels and aircraft
- * Herring pound fisheries using mostly medium sized vessels
- * Rock fish jigging fisheries using any vessel class
- * Dive fisheries (sea cucumber, sea urchin) fisheries

Patrol Information

- * well over 1,100 days at sea scheduled per year for medium and larger vessels (does not include

use of day skiffs)

- * Larger vessels travel throughout the state on extended patrols up to a month long
 - * Medium sized vessels patrol up to a week at a time
 - * Calendar year 2005 had nearly 400 commercial fishing violations charged resulting in over \$750,000 in fines in addition to nets, pots and other equipment being forfeited
 - * Vessels used in committing the most egregious offenses are sometimes seized and forfeited to the state
- * Patrols are often conducted in conjunction with NMFS and USCG

Similarly to ADFG Area Biologists, the presence of Wildlife Troopers in all major and many minor communities in the state provides them almost immediate opportunity to monitor fishing activities across the state. ADFG and AWT inspect the catch and landing records of both harvesters and processors, and monitor the fishing permits required of harvesters and their crew members.

The U.S. Coast Guard (USCG) also enforces boating safety laws and fishing vessels are often under surveillance by AWT and the USCG during fishing operations. The US Forest Service and USFWS enforcement also work with AWT on the enforcement of fish and game regulations (both state and federal) on federal public land. USCG and AWT enforcement efforts are generally focused on violations that would do harm to the resource or those that create an unfair economic advantage to the violator. Trends in the incidence of these types of violations are monitored closely. The objective of regulatory enforcement is to ensure compliance. The cooperation of the public and fishing industry is further cultivated through programs such as AWT's Fish and Wildlife Safeguard program, which encourages the reporting of fish and wildlife violations and increases the outreach of enforcement agencies <http://www.dps.state.ak.us/AWT/safeguard.aspx>.

12. There shall be a framework for sanctions for violations and illegal activities of adequate severity to support compliance and discourage violations.

FAO CCRF 7.7.2/8.2.7

Evidence adequacy rating:

High

Medium

Low

Rating determination

Alaska salmon management is supported by a framework for sanctions for violations and illegal activities of adequate severity to support compliance and discourage violations. Salmon management is entrusted to ADFG, pursuant to Alaska Statutes Title 16 (AS16) and Alaska Administrative Code Title 5 (5AAC). These laws and regulations are enforced by the Alaska Department of Public Safety, Alaska State Troopers, Division of Wildlife Troopers (AWT) who is the State enforcement agency with 0-3 nautical miles jurisdiction. AWT coordinates with, and is supported when required, by law enforcement personnel from USCG and NMFS Office of Law Enforcement (OLE). The US Forest Service and the US Fish and Wildlife Service also work with AWT on the enforcement of fish and game regulations (both state and federal) on federal public land.

Alaska’s salmon fisheries are managed by ADFG, pursuant to Alaska Statutes Title 16 (AS16) and Alaska Administrative Code Title 5 (5AAC). These laws and regulations are enforced by the Alaska Department of Public Safety, Alaska State Troopers, Division of Wildlife Troopers (AWT). AWT coordinates with, and is supported when required, by law enforcement personnel from USCG and NMFS Office of Law Enforcement (OLE). US Forest Service and USFWS enforcement also work with AWT on the enforcement of fish and game regulations (both state and federal) on federal public land. The framework for sanction and violations specific to the salmon fisheries is shown below.

Alaska Statutes, Title 16, Chapter 16.43. Article 08. POINT SYSTEM FOR COMMERCIAL FISHING VIOLATIONS IN SALMON FISHERIES.

- Section 16.43.850. Point system.
- Section 16.43.855. Assessment of points.
- Section 16.43.860. Suspension.
- Section 16.43.870. Notice and appeal.
- Section 16.43.880. Required notice to commission.
- Section 16.43.895. Definitions for AS 16.43.850 - 16.43.895.
- Section 16.43.901. Vessel permits. [Repealed, Sec. 5 ch. 126 SLA 1996].

Section 16.43.850. Point System.

For the purpose of identifying frequent violators of commercial fishing laws in salmon fisheries, the commission shall adopt regulations establishing a uniform system for the suspension of commercial salmon fishing privileges by assigning demerit points for convictions for violations of commercial fishing laws in salmon fisheries that are reported to the commission under AS 16.43.880. The commission shall assess demerit points against a permit holder for each violation of commercial fishing laws in a salmon fishery in accordance with (b) and (c) of this section. The commission shall assess points against a permit holder for the salmon fishery in which the violation of commercial fishing laws occurred.

(b) The commission shall assess demerit points against a permit holder for a conviction of a violation of commercial fishing laws in a salmon fishery under AS 16.05.722, 16.05.723, 16.05.831; AS 16.10.055, 16.10.070 - 16.10.090, 16.10.100, 16.10.110, 16.10.120, 16.10.200 - 16.10.220, and 16.10.760 - 16.10.790 for the following violations in accordance with this schedule:

- (1) fishing in closed waters 6 points;
- (2) fishing during closed season or period 6 points;
- (3) fishing with more than the legal amount of gear 4 points;
- (4) fishing with gear not allowed in fishery 6 points;
- (5) fishing before expiration of transfer period 6 points;
- (6) interfering with commercial fishing gear 4 points;
- (7) fishing with more than the legal amount of gear on vessel 4 points;
- (8) improper operation of fishing gear 4 points;
- (9) permit holder not present when required 4 points;
- (10) fishing with underlength or overlength vessel 6 points;
- (11) wanton waste of fishery resources 4 points.

(c) Notwithstanding (b) of this section, if a permit holder's first conviction of a violation of commercial fishing laws in a salmon fishery in a 36-month period is a conviction under AS 16.05.722, the number of demerit points assessed against the permit holder for the violation must be one-half of the points assessed for the violation under (b) of this section.

(d) The commission shall suspend a permit holder's commercial salmon fishing privileges for a salmon fishery for a period of

(1) one year if the permit holder accumulates 12 or more points during any consecutive 36-month period as a result of convictions for violations of commercial fishing laws in the salmon fishery;

(2) two years if the permit holder accumulates 16 or more points during any consecutive 36-month period as a result of convictions for violations of commercial fishing laws in the salmon fishery;

(3) three years if the permit holder accumulates 18 or more points during any consecutive 36-month period as a result of convictions for violations of commercial fishing laws in the salmon fishery.

Here below are presented some of the statutes that enable the government to fine, imprison, and confiscate equipment for violations and restrict an individual's right to fish if convicted of a violation.

- AS 16.05.165. Form and issuance of citations
- AS 16.05.170 Power to execute warrant
- AS 16.05.180 Power to search without warrant
- AS 16.05.190 Seizure and disposition of equipment
- AS 16.05.195 Forfeiture of equipment
- AS 16.05.332 Wildlife Violator Compact
- AS.16.05.410 Revocation of license
- AS 16.05.710 Suspension of Commercial License and Entry Permit
- AS 16.05.722 Strict liability commercial fishing penalties
- AS 16.05.723 Misdemeanor commercial fishing penalties
- AS 16.05.896 Penalty for causing material damage
- AS 16.05.901 Penalty for violations of AS 16.05.871 – AS 16.05.896.
- AS 16.05.030 Penalty for violation of 16.10.010-16.10.050
- AS 16.10.090 Penalty for violation of AS 16.10.090
- AS 16.10.220 Penalty for violation of AS 16.10-200-16.1-.210

AS 16.10.790 Fines

AS 16.40.290 Penalty

AS 16.34.850-895 Point system for commercial fishing violations in salmon fisheries

AS 16.43.960 Commission revocation or suspension of permits

AS 16.43.970 Penalties

Regulations and violations relating to 5 AAC 95.011

5 AAC 95.011: *The Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes*, and its companion Atlas are the means by which ADFG specifies water bodies considered important for use by anadromous fish in accordance with AS 16.05.871. The Atlas and Catalog are adopted by reference under 5 AAC 95.011 (a) of the Alaska Administrative Code. Permit application procedures, definitions, and other information contained in the introductions of the Atlas and Catalog are also adopted by reference under 5 AAC 95.011 (b).

PENALTIES

AS 12.55.035 specifies the fines for various offenses. Possible fines for a Class A misdemeanor resulting from a conviction for violating AS 16.05.871 – .896 include:

- If a defendant is not an organization: A fine of up to \$10,000.
- If the defendant is an organization: Maximum fines of up to \$500,000; or three times the pecuniary gain realized by the defendant; or three times the pecuniary damage or loss caused by the defendant to another, or to the property of another, as a result of the offense.

In addition to these fines, convicted defendants are liable for the cost of restoring the stream to its original condition (AS 16.05.881), may receive up to one year in prison, and may be subject to civil fines or penalties. Please refer to the complete current text of AS 16.05.871 - .901, AS 12.55.035 and 12.55.135 and 5 AAC 95.011 for detailed information.

sources of evidence –

Alaska Statutes Title 16 (laws)

Alaska Administrative Code Title 5 (regulations)

<http://www.cf.adfg.state.ak.us/>

<http://www.dps.state.ak.us/awt/>

<http://www.nmfs.noaa.gov/ole/>

<http://www.uscg.mil/d17/>

<http://codes.lp.findlaw.com/akstatutes/16/16.43./08>

http://www.adfg.alaska.gov/static-sf/AWC/PDFs/awc_pn_intro.pdf

F. Serious Impacts of the Fishery on the Ecosystem

<p>13. Considerations of fishery interactions and effects on the ecosystem shall be based on best available science, local knowledge where it can be objectively verified and using a risk based management approach for determining most probable adverse impacts. Adverse impacts of the fishery on the ecosystem shall be appropriately assessed and effectively addressed.</p> <p style="text-align: right;"><i>FAO CCRF 7.2.3/8.4.7/8.4.8/12.11 Eco 29.3/31</i></p>			
<p>Evidence adequacy rating:</p> <table style="width: 100%; border: none;"> <tr> <td style="text-align: center; width: 33%;"><input checked="" type="checkbox"/> High</td> <td style="text-align: center; width: 33%;">Medium</td> <td style="text-align: center; width: 33%;">Low</td> </tr> </table>	<input checked="" type="checkbox"/> High	Medium	Low
<input checked="" type="checkbox"/> High	Medium	Low	
<p>Rating Determination:</p> <p><i>Alaska’s Sustainable Salmon Policy includes provisions addressing the potential effects of ecological changes/perturbations on sustainably allowable harvest in that salmon fisheries shall be managed to allow escapements within ranges necessary to conserve and sustain potential salmon production and maintain normal ecosystem functioning. Bycatch of non-targeted species is not a major issue in most Alaska salmon fisheries. Most non-targeted fish harvested in salmon fisheries are other species of salmon and are reported on fish tickets. Salmon bycatch in the groundfish fisheries in the Bering Sea Aleutian Islands and the Gulf of Alaska are formally managed by the NPFMC with regulations implemented by the NMFS. Gear used for commercial catches of Alaska salmon are not considered deleterious to physical habitats as they do not interact directly with it (unlike bottom trawl, dredges and pot gear as used in other fisheries). Takes of endangered species, e.g. Chinook from the Columbia River system, are regulated (e.g. Pacific Salmon Treaty regulations). One potential negative ecological effect of the salmon fishery is represented by the dynamics surrounding the ecological and genetic interactions between wild and hatchery salmon. The PWSSC has initiated in the late summer of 2012 a large scale multi-generation research program to elucidate and address the issue of interactions of wild and hatchery pink and chum salmon in Prince William Sound and Southeast Alaska. Their contract for phase one of the project is running until 2016.</i></p> <p>Habitat/Ecosystem protection policy</p> <p>For the State of Alaska, Article 8.4 in the state’s Constitution states “fish, forests, wildlife, grasslands, and all other replenishable resources belonging to the state shall be utilized, developed and maintained on the sustained yield principle, subject to preferences among beneficial uses”. Further, Alaska’s Sustainable Salmon Policy (5 AAC 39.222) includes provisions that address the potential effects of ecological changes on sustainable harvest in the respect that salmon fisheries must be managed to provide escapements within ranges necessary to conserve and sustain salmon production and to maintain normal ecosystem functioning. Potential ecological effects on salmon stocks are incorporated in the establishment of escapement goals for each stock.</p> <p>In terms of the provision set forth in the Alaska’s Sustainable Salmon Policy, a list is provided:</p> <ul style="list-style-type: none"> • Maintenance of wild salmon stocks and salmon habitats at levels of resource productivity that assure sustained yields through protection of spawning, rearing, and migratory habitats; • Maintenance of salmon habitats beyond natural perturbation and boundaries of variation. 			

- Preparation of scientific assessments of possible adverse ecological effects of proposed habitat alterations and the impacts of those alterations on salmon populations before approval of a proposal.
- Assessment of adverse environmental impacts on wild salmon stocks and the salmon's habitats.
- Protection of all essential salmon habitats in marine, estuarine, and freshwater ecosystems and access of salmon to these habitats. Essential habitats include spawning and incubation areas, freshwater rearing areas, estuarine and nearshore rearing areas, offshore rearing areas, and migratory pathways.
- Protection of salmon habitat in fresh water on a watershed basis, including appropriate management of riparian zones, water quality, and water quantity.
- Protection of salmon stocks within spawning, incubating, rearing, and migratory habitats.
- Assessment of degraded salmon productivity resulting from habitat loss, considered, and controlled by affected user groups, regulatory agencies, and boards when making conservation and allocation decisions.
- Assessment of effects and interactions of introduced or enhanced salmon stocks on wild salmon stocks and wild salmon stocks and fisheries on those stocks and protection from adverse impacts from artificial propagation and enhancement efforts.
- Restoration of degraded salmon spawning, incubating, rearing, and migratory habitats to natural levels of productivity.
- Establishment of ongoing monitoring activities to determine the current status of habitat and the effectiveness of restoration activities.
- Allowance of recovery for depleted salmon or, where appropriate, active restoration and maintenance of diversity to the maximum extent possible, at the genetic, population, species, and ecosystem levels.
- Management of salmon fisheries to allow escapements within ranges necessary to conserve and sustain potential salmon production and maintain normal ecosystem functioning.
- Management of salmon escapement 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.
- Evaluation of the role of salmon in ecosystem functioning and consideration in harvest management decisions and setting of salmon escapement goals (see State of Alaska Regulation 5 AAC 39.222).

This regulation requires ADFG to provide the BOF with reports on the status of salmon stocks, and, in turn, requires the BOF to develop or amend salmon fishery management plans to address any concerns that have been raised. ADFG and the BOF are also required to develop action plans for new or expanding fisheries or for stocks of concern that contain measurable and implementable objectives and performance measures for monitoring the effectiveness of the plans. This process takes place in routine fashion at regularly scheduled BOF meetings. The allowable harvest in each year is set based on fish in excess of the escapement goal.

If a stock chronically fails to meet escapement goals it is reported by ADFG to the Board of Fisheries (BOF) as a stock of concern and the fishery management plan is amended to protect the productivity of the stock. In addition, a specific action plan associated with the management plan is prepared for any new or expanding salmon fishery, or stock of concern. The action plans are to contain goals, measurable and implementable objectives, and provisions for fishery management actions needed to achieve rebuilding goals and objectives, performance measures appropriate for monitoring and gauging the effectiveness of the action

plan and a research plan that is periodically reevaluated, as necessary, to provide information to address concerns.

Fishing gear habitat interaction and issues

Introduction of new gear types or fishing methods into Alaska salmon fisheries is rare or simply does not occur. State statutes and regulations define acceptable gear and its specifications. These include gillnet, purse seine, troll (and fishwheel in the AYK Region). Any change in gear specifications requires regulatory action by the BOF. Under these restrictions, while fishing gear, methods and means, through time, may have become marginally more technologically and operationally efficient, harvest rates are controlled by biological limitations, and because fishing gear does not generally contact the bottom, salmon fishing operations are not considered to result in habitat disturbance on fisheries ecosystems.

Habitat in Alaska

The Alaska Department of Fish and Game preserves the health and viability of Alaska's fish and wildlife populations by protecting the lands and waters these species depend upon for their survival and reproductive success. The Department conducts research on watersheds, active mining sites, fire-impacted woodlands, anadromous fish streams, and coastal and marine environments throughout Alaska in an effort to document and mitigate human-related impacts, changes in habitat, and species abundance. Salmon habitat in Alaska, contrary to other States including California, Oregon and Washington, is believed to be in pristine conditions, largely due to the aggressive policies for habitat protection and the importance of the salmon resources in this State.

The Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes and its associated Atlas (the Catalog and Atlas, respectively) currently contain over 17,000 streams, rivers or lakes around the state which have been specified as being important for the spawning, rearing or migration of anadromous fish. Based upon thorough surveys of a few drainages it is believed that this number represents less than 50% of the streams, rivers and lakes actually used by anadromous species. It is estimated that at least an additional 20,000 or more anadromous water bodies have not been identified or specified under AS 16.05.871(a).

The Catalog and Atlas are important because they specify which streams, rivers and lakes are important to anadromous fish species and therefore afforded protection under the Anadromous Fish Act AS 16.05.871. The Anadromous Fish Act requires that an individual or governmental agency provide prior notification and obtain approval from the Alaska Department of Fish and Game, Division of Habitat (Habitat) "to construct a hydraulic project or use, divert, obstruct, pollute, or change the natural flow or bed" of a specified anadromous waterbody or "to use wheeled, tracked, or excavating equipment or log-dragging equipment in the bed" of a specified anadromous waterbody. All activities within or across a specified anadromous waterbody and all instream activities affecting a specified anadromous waterbody require approval. A person who violates AS 16.05.871 - 16.05.896 is guilty of a class A misdemeanor.

Water bodies that are not "specified" within the Catalog and Atlas are not afforded that protection. Protection of these specified water bodies is addressed by other sections of AS 16.05.871, which requires persons or governmental agencies to submit plans and specifications to ADFG and receive written approval in the form of a Fish Habitat Permit prior to beginning the proposed use, construction or activity that would take place in specified water bodies.

More detailed information about AS 16.05.871, the types of activities requiring permits, and permit application procedures are available here <http://www.adfg.alaska.gov/index.cfm?adfg=fishpassage.regulations>. To be protected under AS 16.05.871, water bodies must be documented as supporting some life function of an anadromous fish species (salmon, trout, char, whitefish, sturgeon, etc.) Anadromous fish must have been seen or collected and identified by a qualified observer. Most nominations come from Department of Fish and Game fisheries biologists. Others are received from private individuals, companies and biologists from other state and federal agencies (<http://www.adfg.alaska.gov/sf/SARR/AWC/>).

Bycatch issues

Salmon bycatch in other fisheries

The United States is a member of the North Pacific Anadromous Fish Commission (NPAFC), established in 1993, which has eliminated directed fishing on anadromous fishes and limits bycatch of anadromous fishes in the North Pacific (<http://www.npafc.org/new/index.html>).

In addition, the North Pacific Fisheries Management Council (NPFMC) has adopted measures to control bycatch of salmon in groundfish trawl fisheries in the Bering Sea Aleutian Islands and the Gulf of Alaska. Salmon are listed as prohibited species in groundfish management plans, meaning they cannot be retained and sold. Prohibited species caps on the groundfish fisheries off Alaska are designed to close a given fishery when the PSC cap is reached. Monitoring of PSC is paramount in the extensive groundfish observer programme and a priority of enforcement agencies such as the USCG. (<http://alaskafisheries.noaa.gov/npfmc/>).

Salmon that originated in Alaska, primarily Chinook and chum salmon, are caught incidentally in groundfish fisheries off Alaska. Salmon bycatch in trawl fisheries for pollock in the Bering Sea and Gulf of Alaska are monitored by National Marine Fisheries service (NMFS) with an onboard observer program. NMFS found that most (about 85%) of the Chinook salmon bycatch from the Bering Sea and Aleutians (BSAI) ground fish fisheries occurred in the Bering Sea Pollock fishery.

Catch limits and incentives to reduce bycatch were implemented in 2011 under Amendment 91 to the Fishery Management Plan for Groundfish in the BSAI. NMFS states “Amendment 91 is an innovative approach to managing Chinook salmon bycatch in the BSAI pollock fishery that combines a limit on the amount of Chinook salmon that may be caught incidentally with incentive plan agreements and performance standards. The program was designed to minimize bycatch to the extent practicable in all years, and prevent bycatch from reaching the limit in most years, while providing the pollock fleet with the flexibility to harvest the total allowable catch” (<https://alaskafisheries.noaa.gov/sustainablefisheries/bycatch/default.htm>).

In 2012, NMFS implemented Amendment 93 in the GOA to further limit the amount of Chinook salmon caught in the pollock fishery. Amendment 93 established separate catch limits for Chinook salmon in the Central and Western GOA that, if the applicable catch limit is reached, would cause NMFS to close the directed pollock fishery in the Central or Western areas of the GOA. This action would also require retention of salmon by all vessels in the Central and Western GOA pollock fisheries until the catch is delivered to a processing facility where an observer would be given an opportunity to count the number of salmon and to collect scientific data or biological samples from them (<http://www.fakr.noaa.gov/sustainablefisheries/>).

NMFS is also considering measures to minimize chum salmon bycatch in the Bering Sea pollock

fishery because of potential negative impacts on salmon stocks in general, and on western Alaska salmon stocks in particular. A significant portion of the chum salmon (20-34%) and Chinook salmon (56%) bycatch from trawl fisheries are fish that originate from western Alaska. NMFS hosted a workshop in Seattle on May 16, 2013, to obtain input from owners and operators of AFA catcher vessels and shoreside processors who participate in the Bering Sea pollock fishery. This workshop was designed to discuss accurate accounting of Chinook salmon bycatch <https://alaskafisheries.noaa.gov/sustainablefisheries/bycatch/default.htm>.

In state-managed fisheries, ADFG has implemented significant restrictions on chum and Chinook salmon fisheries in areas of western Alaska in response to declining returns, and reducing the trawl bycatch is part of the ongoing effort to help restore these stocks. In areas managed by ADFG, groundfish harvesters are required to keep on board, or at a shoreside processing plant, all salmon harvested as bycatch in trawl fisheries in order for them to be sampled by ADFG personnel (5AAC 39.166).

Bycatch in the directed salmon fisheries

Bycatch of non-targeted species is not a major issue in most Alaska salmon fisheries and generally considered negligible. Operation of all salmon fishing gear (purse seines, gillnets, and troll gear) is required to minimize incidental harvest of non-target species, mostly other salmon. Time and area restrictions limit when and where specific fisheries occur and restrictions are also imposed by regulation on all types of fishing gear (e.g., mesh size restrictions and length of nets for gillnets, number of fishing lines, rods, and gurdies for troll gear, and mesh size, net length and depth for purse seine gear).

Specific regulations also exist pertaining to bycatch of non-target species. For example, for the troll fishery in the state waters of the Eastern Gulf of Alaska, all groundfish incidentally taken by hand and power troll gear may be legally taken and possessed, but with numerous restrictions (5 AAC 28.171). Commercial salmon trollers may take unlimited numbers of incidentally taken groundfish in Southeast Alaska except for limitations on demersal shelf rockfish, spiny dogfish, lingcod and halibut as percentages of the salmon harvested. Aside from the troll fishery in SEAK non salmon bycatch maybe retained as personal use. Personal use fish cannot be sold, eliminating the incentive for significant amounts of such catches.

The SEAK troll fishery incidentally harvests State managed groundfish species; including lingcod, black rockfish, dark rockfish, blue rockfish, and demersal shelf rockfish (DSR). The seven species of rockfish in the DSR assemblage are yelloweye, quillback, canary, rosethorn, copper, china, and tiger rockfish. Bycatch allowances for federal waters are the same as in state waters only for the state managed groundfish species.

For federally managed groundfish species, trollers are restricted to a federal retainable percentage found at <http://www.fakr.noaa.gov/rr/tables/tab10.pdf>. In the East Area, all groundfish incidentally taken by hand and power troll gear being operated to take salmon (consistent with applicable laws and regulations) can be legally taken and possessed with the following restrictions:

- The bycatch allowance for DSR is limited to 10 percent of the round weight of all salmon on board the vessel. All DSR in excess of 10 percent must be weighed and reported as bycatch overage on an ADFG fish ticket. DSR bycatch overages must be reported on fish tickets but may be kept for a person's own use.
- Lingcod may be taken as bycatch in the commercial salmon troll fishery only from May 16 through November 30.

- Lingcod must measure at least 27 inches from the tip of the snout to the tip of the tail, or 20.5 inches from the front of the dorsal fin to the tip of the tail.

Lingcod harvest allocations for the troll fishery are set by the Lingcod Management Area and area closures will occur as allocations are taken. Inseason closures are announced by news release and marine radio broadcast.

Halibut incidentally taken during an open commercial halibut season by power and hand troll gear being operated for salmon consistent with applicable state laws and regulations are legally taken and possessed. Commercial halibut may be legally retained only by IFQ permit holders during the open season for halibut. Trollers making an IFQ halibut landing of 500 pounds or less of IFQ weight are exempted from the three hour Prior Notice of Landing if landed concurrently with a legal landing of salmon. Halibut taken incidentally during the troll fishery is reported on an ADFG fish ticket using the CFEC salmon permit.

Trollers are allowed to longline for groundfish and troll for salmon on the same trip as long as fish are not onboard the vessel in an area closed to commercial fishing or closed to retention of that species and the fisher has both a commercial salmon permit and the appropriate commercial longline permit. A vessel may not participate in a directed fishery for groundfish with dinglebar troll or mechanical jig gear if they have commercial salmon on board. A vessel fishing for groundfish with dinglebar troll gear must display the letter “D” and a vessel fishing for groundfish with mechanical jiggging machines must display the letter “M” at all times when fishing with or transporting fish taken with dinglebar troll gear or mechanical jiggging machines.

A person may not operate a vessel that is displaying one of these letters when the vessel is being used to fish for salmon. The State reports the amount and type of groundfish harvested incidentally in the SEAK troll fishery in the SE region groundfish report prepared for the Board on a 3-year cycle. In general, all harvest information on bycatch in the commercial troll fishery comes from catch reported on fish tickets. Lingcod and black rockfish, both state managed species, make up the primary bycatch in the commercial troll fishery. Reported harvest of groundfish bycatch from EEZ waters, is small when compared to bycatch totals from all of Southeast Alaska (see table below reporting all groundfish species (round pounds) reported on salmon troll fish tickets for EEZ waters only, 2005-2010.).

SPECIES	2005	2006	2007	2008	2009	2010
Black rockfish	2,049	2,690	1,144	2,217	550	167
Bocaccio rockfish			26			48
Canary rockfish	8		13	11		
Dusky rockfish	5	581	59			
General shark	29					
Lingcod greenling	2,701	8,322	10,569	6,241	8,047	7,308
Quillback rockfish		6	3	89	7	42
Redstripe rockfish			11			
rockfish, dusky				10	696	684
Rougheye rockfish			6			
Salmon shark				111		
Silvergray rockfish	108	63	36	50	84	20
Widow rockfish				39		
Yelloweye rockfish	54	208	413	64	282	191
Yellowtail rockfish	40	22	65	38	5	
Total	4,994	11,892	12,345	8,869	9,670	8,460

Bycatch in the East Area occurs during the months of July, August, and September when the summer troll season is open. Unreported harvest and discard-at-sea mortality is not estimated,

but is thought to be low.

<https://alaskafisheries.noaa.gov/npfmc/PDFdocuments/fmp/Salmon/SalmonFMP1011.pdf>

Commercial fishers are allowed to longline for groundfish and troll for salmon on the same trip as long as commercial fishing for any of the species found on the vessel is not prohibited and the fisher has all appropriate fishing permits (Skannes and Hagerman, 2013). Most non-targeted fish harvested in salmon fisheries are other species of salmon that are required to be reported on fish tickets. Alaska fishing regulations, fishery management plans, and inseason management actions are designed to minimize the harvest of non target species, where they occur. The upper Cook Inlet gillnet fishery, for example, targets sockeye, pink, and chum salmon, but coho salmon are also caught in this fishery. In this respect, the Cook Inlet Northern District Salmon Management Plan (5AAC 21.358) provides a series of regulatory measures to minimize harvest of coho salmon bound for the northern district of upper Cook Inlet.

(<http://www.adfg.alaska.gov/static/regulations/fishregulations/pdfs/commercial/CI-2011-14.pdf>).

Endangered, threatened, protected species

No species or stocks of salmon in Alaska are classified as endangered or threatened under US federal law, or State law ([AS 16.20.190](#)). Instead, fish stocks in Alaska are categorized as stocks of concern. A review of this was provided in detail under Clause 6 of this report. However, the southeast troll fishery is estimated to take a small number of Chinook salmon belonging to threatened or endangered stocks from the Columbia and other salmon from other river systems (US and Canada). The harvest of those fish is regulated under treaty with Canada by the 2009 Pacific Salmon Agreement (see http://www.psc.org/about_treaty.htm).

Under the treaty an annual quota of Chinook salmon is set for the Alaska fishery which is designed to conserve all Pacific coast wild stocks of Chinook salmon. The 2012 Chinook fishery was managed to achieve an all-gear harvest of 266,800 treaty Chinook salmon. The actual all-gear treaty harvest was 241,118 fish, which was 10% under the quota. The troll treaty harvest was 191,839 fish, which was 3% under the troll treaty allocation of 197,272. The purse seine harvest of 5,994 treaty Chinook was well under the allocation of 11,472 fish. The drift gillnet allocation was 7,737, of which 6,591 Chinook were harvested. Set gillnetters harvested 968 of their 1,000 fish quota and the sport harvest of 36,454 was below the allocation of 49,318 fish. For 2013, the Chinook treaty harvest quota is 176,000 fish, of which 129,862 are allocated to troll, 32,466 to sport, 7,568 to purse seine, 5,104 to drift gillnet and 1,000 to set gillnet (Skannes, Hagerman and Shaul, 2013). The management of the troll fishery is based on that annual harvest quota through inseason opening and closure of the fishery. The annual harvest of different Chinook stocks is estimated from the recovery of coded wire tags implanted in representative index stocks in the region of the threatened or endangered stocks (described at <http://www.psc.org/pubs/CWT/EPfinalreport.pdf>).

Marine Mammals

Marine mammals in Alaska are protected by the Marine Mammal Protection Act (MMPA). The MMPA prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S (<http://www.nmfs.noaa.gov/pr/laws/mmpa/>). General interaction with marine mammals in the Alaska salmon fisheries is limited and not considered to be of significant negative impact.

The NOAA List of Fisheries (LOF) classifies U.S. commercial fisheries into one of three Categories according to the level of incidental mortality or serious injury of marine mammals:

- **I, frequent** incidental mortality or serious injury of marine mammals,
- **II, occasional** incidental mortality or serious injury of marine mammals,
- **III, remote likelihood of/no known** incidental mortality or serious injury of marine mammals.

The Marine Mammal Protection Act (MMPA) mandates that each fishery be classified by the level of serious injury and mortality of marine mammals that occurs incidental to each fishery is reported in the annual Marine Mammal Stock Assessment Reports for each stock.

Fishers participating in a Category I or II fishery are required to accommodate an observer onboard their vessel(s) upon request (50 CFR 229.7). Fishers participating in a Category I or II fishery are required to comply with any applicable take reduction plans. NMFS may develop and implement take reduction plans for any Category I or II fishery that interacts with a strategic stock. No category I salmon fisheries are present in Alaska.

Data are available on marine mammal interactions for several salmon fisheries throughout Alaska:

AK Bristol Bay Salmon Drift Gillnet Fishery, category II. Current list of marine mammal species/stocks injured/killed: Beluga whale, Bristol Bay; Gray whale, Eastern North Pacific; Harbor seal, Bering Sea; Northern fur seal, North Pacific; Pacific white-sided dolphin, Central North Pacific; Spotted seal, AK; Steller sea lion, Western U.S.

Basis for original classification on the LOF: This fishery was categorized as a Category II based on logbook data. Observer coverage was inadequate to determine mortality and serious injury levels of marine mammal stocks across all fisheries, but available data suggested that, if observer data were available, serious injury and mortality levels may have been greater than the Potential Biological Removal (PBR) levels for each stock with which this fishery interacts. Also, known mortality and serious injury was greater than 1% of PBR for harbor seal (Bering Sea stock) and beluga whale (Bristol Bay stock).

AK Bristol Bay Salmon Set Gillnet Fishery, category II. Current list of marine mammal species/stocks injured/killed: Beluga whale, Bristol Bay; Gray whale, Eastern North Pacific; Harbor seal, Bering Sea; Northern fur seal, North Pacific; Spotted seal, AK.

Basis for original classification on the LOF: This fishery was categorized as a Category II based on analogy to other set gillnet fisheries. Observer coverage was inadequate to determine if serious injury and mortality levels in this fishery were greater than 1% of a marine mammal stock's Potential Biological Removal (PBR) level, but it was assumed to be similar to marine mammal serious injury and mortality levels incidental to other AK set gillnet fisheries. Also, logbook data showed that the total mortality and serious injury of beluga whales (Bristol Bay stock) was 0.5 animals/year, or 2% of PBR.

AK Kodiak Salmon Set Gillnet Fishery, Category II. Current list of marine mammal species/stocks injured/killed (a (1) indicates those stocks driving the fishery's classification): Harbor porpoise, GOA (1) ; Harbor seal, GOA; Sea otter, Southwest AK; Steller sea lion, Western U.S.

Basis for original classification on the LOF: This fishery was categorized as a Category II based on logbook data. The total mortality and serious injury of harbor porpoise (GOA stock) was 4 animals/year, or 1.6% of PBR.

AK Kodiak Salmon Purse Seine Fishery, Category II. Current list of marine mammal species/stocks injured/killed (a (1) indicates those stocks driving the fishery's classification): Humpback whale, Central North Pacific (1).

Basis for original classification on the LOF: This fishery was categorized as a Category II based on a single, documented mortality of a humpback whale (Central North Pacific), in 2005. This single event translated to an annual average mortality of 0.2 animals/year, or 1.55% of PBR (PBR=12.9).

AK Cook Inlet Salmon Set Gillnet Fishery, Category II. Current list of marine mammal species/stocks injured/killed (a (1) indicates those stocks driving the fishery's classification): Beluga whale, Cook Inlet; Dall's porpoise, AK; Harbor porpoise, Gulf of Alaska (GOA); Harbor seal, GOA; Humpback Whale (Central North Pacific)(1) ; Steller sea lion, Western U.S

Basis for current classification on the LOF: The total annual mortality and serious injury of humpback whales (Central North Pacific stock) in this fishery is greater than 1% and less than 50% of the stock's Potential Biological Removal (PBR) level.

AK Cook Inlet Salmon Drift Gillnet Fishery, Category II. Current list of marine mammal species/stocks injured/killed (a (1) indicates those stocks driving the fishery's classification): Beluga whale, Cook Inlet; Dall's porpoise, AK; Harbor porpoise, GOA (1) ; Harbor seal, GOA; Steller sea lion, Western U.S.

Basis for current classification on the LOF: The total annual mortality and serious injury of harbor porpoise (Gulf of Alaska [GOA] stock) in this fishery is greater than 1% and less than 50% of the stock's Potential Biological Removal (PBR) level.

AK Cook Inlet Salmon Purse Seine Fishery, category II. Current list of marine mammal species/stocks injured/killed (a (1) indicates those stocks driving the fishery's classification): Humpback whale, Central North Pacific (1).

Basis for original classification on the LOF: This fishery was categorized as a Category II based on a single, documented mortality of a humpback whale (Central North Pacific stock), in 2005. This single event translated to an annual average mortality of 0.2 animals/year, or 1.55% of PBR (PBR=12.9).

AK Peninsula/Aleutian Islands Salmon Drift Gillnet Fishery Category II. Current list of marine mammal species/stocks injured/killed: Dall's porpoise, AK; Harbor seal, GOA; Harbor porpoise, Gulf of Alaska (GOA); Northern fur seal, North Pacific.

Basis for original classification on the LOF: This fishery was categorized as a Category II by analogy with other category II AK drift gillnet fisheries, and because of inadequate observer data since 1991. The low levels of observer coverage across all fisheries were inadequate to determine mortality and serious injury levels of marine mammals across all fisheries, but available data suggested that mortality and serious injury may have exceeded 10% of the Potential Biological Removal (PBR) level for some stocks. Known Dall's porpoise mortality and serious injury was 28 animals/year, or 1.8% of PBR (PBR=1,556). Also, level of harbor porpoise take documented in logbooks was more than 10% across all fisheries, and because logbook reports represent an underestimate of total take, the total impact to harbor porpoises may be more than 1% in this fishery.

AK Peninsula/Aleutian Islands Salmon Set Gillnet Fishery, category II. Current list of marine mammal species/stocks injured/killed: Harbor porpoise, Bering Sea; Steller sea lion, Western U.S.

Basis for current classification on the LOF: Based on analogy to other Category II AK set gillnet fisheries.

AK Prince William Sound Salmon Drift Gillnet Fishery, category II. Current list of marine mammal species/stocks injured/killed (a (1) indicates those stocks driving the fishery's classification): Dall's porpoise, AK; Harbor porpoise, GOA (1) ; Harbor seal, GOA; Northern fur seal, North Pacific; Pacific white-sided dolphin, Central North Pacific; Sea otter, AK; Steller sea lion, Western U.S.

Basis for current classification on the LOF: The total annual mortality and serious injury of harbor porpoise (Gulf of Alaska [GOA] stock) and Steller sea lion (Western U.S. stock) in this fishery is greater than 1% and less than 50% of the stocks' Potential Biological Removal (PBR) level.

AK Southeast Salmon Drift Gillnet Fishery, category II. Current list of marine mammal species/stocks injured/killed (a (1) indicates those stocks driving the fishery's classification): Dall's porpoise, AK; Harbor porpoise, Southeast AK; Harbor seal, Southeast, AK; Humpback whale, Central North Pacific (1) ; Pacific white-sided dolphin, central North Pacific; Steller sea lion, Eastern U.S.

Basis for original classification on the LOF: This fishery was categorized as a Category II because observer and stranding data indicated that mortality and serious injury of harbor porpoise (Southeast AK) was 3 animals/year, or 1.3% of PBR (PBR=231); and serious injury and mortality of humpback whale (Central North Pacific) was 0.13 animals/year, or 4.6% PBR (PBR=2.8). Also, Category III reports from fishermen indicated that mortalities of both species occurred prior to 1994.

AK Yakutat Salmon Set Gillnet Fishery, category II. Current list of marine mammal species/stocks injured/killed: Gray Whale, Eastern North Pacific; Harbor seal, Southeast AK; Humpback whale, Central North Pacific (Southeast AK).

Basis for original classification on the LOF: This fishery was categorized as a Category II based on analogy with other gillnet fisheries because observer coverage was inadequate. Logbook data showed the total known mortality and serious injury for harbor seals across all fisheries did not exceed 10% of the Potential Biological Removal (PBR) level, but low levels of observer coverage were inadequate and data suggests take levels may be exceed 10%. The known mortality and serious injury of harbor seals (Southeast AK) in this fishery was 30 animals/year, or 1.5% of PBR (PBR=2,000).

Other category III (remote likelihood of/no known incidental mortality or serious injury of marine mammals) fisheries in Alaska exist, but have not been listed here. These are available at the final 2020 NOAA List of Fisheries at the following url: <http://www.nmfs.noaa.gov/pr/interactions/lof/> ; <http://www.nmfs.noaa.gov/pr/interactions/lof/final2012.htm#table1>

Marine Birds

Observers employed in the marine mammal program also collect valuable data on marine bird interactions. Birds are protected under the Migratory Bird Act (MBA) and the Endangered Species Act (ESA) covers those animals that may be threatened or Endangered to extinction. The most noted examples in Alaska include the Steller sea lion and the short tailed albatross. CITES also offers further protection to such animals.

Records of birds interaction assessment exist are available for Kodiak and Southeast Alaska salmon fisheries. A small number of birds including a Kittlitz's murrelet, four marbled murrelets, a murrelet of unknown species, an Arctic loon, two red-throated loons, a common

murre, and two Long-tailed duck ducks were recorded in the Yakutat set net fishery. For all birds and murrelets the usual approximate 95% confidence limits from ratio estimation were used, giving limits for SI/M takes of 125 to 485 for all birds in 2007, 26 to 328 for murrelets in 2007, 39 to 234 for all birds in 2008, and 5 to 137 for murrelets in 2008.

<http://alaskafisheries.noaa.gov/protectedresources/observers/bycatch/yakutat07-08.pdf>

In the Kodiak set net salmon fishery birds interactions with salmon fisheries have also been recorded. For example, in 2005, these included pelagic cormorants, 178.0 (62.5); harlequin ducks, 19.7(19.0); pigeon guillemots, 117.6 (46.4); marbled murrelets, 142.6 (67.4); Kittlitz's murrelets, 18.1 (16.8), common murre, 483.5 (156.2); thick-billed murre, 19.7 (19.3); tufted puffins, 95.9(41.4); white-winged scoters, 21.5(21.1); and other species of birds, 1096.6 (195.4). All of the birds observed to be taken were released dead.

http://alaskafisheries.noaa.gov/protectedresources/observers/bycatch/kodiakreport02_05.pdf

Habitat issues

Impacts to fish habitat from fishing activities in Alaska are considered minimal to none. Fishing gear types (e.g. purse seine, gill net, troll, fish wheel) and the manner in which they operate have been developed over time to selectively target specific species of salmon. The gear is generally environmentally safe (not lost, not unattended, not in contact with the bottom, etc.). ADFG has conducted studies on the selectivity of certain gears for size and species of fish (Quang and Geiger, 2002), as well as mortality of fish caught and released for troll and sport gears. In a study of hooking mortality on Chinook salmon in the Kenai River, Bendock and Alexandersdottir (1992) found an average of 7.6% mortality, most of which occurred within 72 hours of initial capture. ADFG recommends anglers avoid catching unwanted rockfish because they often sustain barotrauma from inflated swim bladders and also recommends use of deepwater release devices to free these fish.

Commercial troll fisheries in Southeast Alaska are allowed by regulation to retain only individuals larger than 711 mm; smaller individuals must be released. Encounters with sublegal-sized Chinook are not recorded and the subsequent mortality is unknown. During the 1998–2003 summer troll fisheries, studies were conducted to estimate the rate at which sublegal-sized Chinook salmon were incidentally caught (Templin, et al, 2012). As part of these studies tissue samples were taken from sublegal-sized individuals for mixed stock analyses using genetic information. The stock composition indicated sublegal Chinook from Upper Columbia River, Southern Southeast Alaska, and Strait of Georgia were consistently the largest contributors.

Federal research and programs in support of Alaska salmon management

The North Pacific Fish Anadromous Commission (NPAFC), made up of representatives from Canada, Japan, Korea, Russia, and the United States (including Alaska), serves as a forum for promoting the conservation of anadromous fishes and ecologically-related species, including marine mammals, sea birds, and non-anadromous fish, in the high seas area of the North Pacific Ocean that are beyond national boundaries. The NPAFC coordinates high seas fishery enforcement activities by member countries because directed fishing for salmonids is prohibited in the area and agreements have been made to minimize the incidental take of salmonids in other area fisheries. The NPAFC's scientific research focuses on trends in marine production of salmon stocks, their population structure and diversity in marine ecosystems of

the North Pacific, and climate change impacts. http://www.npafc.org/new/science_plan.html.

ADFG participates with federal, state and international agencies and institutions in numerous research and monitoring programs that assess physical, chemical, biological, economic and social parameters of the coastal area. One of the functions of the NPAFC is to coordinate the collection, exchange, and analysis of scientific data regarding anadromous fishes and other ecologically-related species. The NPAFC's scientific research focuses on trends in marine production of salmon stocks, their population structure and diversity in marine ecosystems of the North Pacific, and impacts from climate change. Genetic and otolith marking techniques developed by the member states of NPAFC are used to identify the origins of stocks of salmon that intermix in the Pacific Ocean.

ADFG and various federal agencies participate with numerous organizations that seek information about the ecosystem and the status and management of salmon fisheries. Examples include: the North Pacific Research Board (NPRB) (<http://www.nprb.org/index.html>) which distributes monies from the earnings of the Environmental Improvement and Restoration Fund (ERIF), created by congress and derived from the Dinkum Sands case; the Bering Sea Integrated Ecosystem Research Program (<http://bsierp.nprb.org/>) which is a partnership between the North Pacific Research Board and the National Science Foundation that funds research and ecosystem modeling to understand the impacts of climate change and sea ice cover on the eastern Bering Sea ecosystem; the Gulf of Alaska Integrated Ecosystem Research Project (<http://gulfofalaska.nprb.org/>) is a program of the NPRB that seeks to understand how environmental and anthropogenic processes, including climate change, affect trophic levels and dynamic linkages among trophic levels, with emphasis on fish and fisheries, marine mammals, and seabirds within the Gulf of Alaska; The Wild Salmon Center (<http://www.wildsalmoncenter.org/>) works to protect the best remaining wild salmon ecosystems across the Pacific Rim; The Pacific States Marine Fisheries Commission (<http://www.psmfc.org/>) coordinates research activities, monitors fishing activities, and collects and maintains databases on salmon, steelhead and other marine fish occurring off the coast of California, Oregon, Washington, Idaho, and Alaska; The Pacific Coastal Salmon Recovery Fund (http://www.nwr.noaa.gov/protected_species/salmon_steelhead/recovery_planning_and_implementation/pacific_coastal_salmon_recovery_fund.html) was established by Congress in FY 2000 to provide project funding to states and tribes of the Pacific Coast Region to protect, restore, and conserve Pacific salmon and steelhead populations and their habitats; and The Saltonstall-Kennedy grant program for fisheries research and development (http://www.nmfs.noaa.gov/mb/financial_services/skhome.htm) which is a competitive grant program administered by NMFS to provide grants or cooperative agreements for fisheries research and development.

The Alaska Fisheries Science Centre (NOAA) conducts research on marine ecology of juvenile salmon, on stock assessment and enhancement of salmonids and on other fishes in Southeast Alaska and other parts of North Pacific Ocean marine ecosystems. Some of this work is based at the Ted Stevens Marine Research Institute in Juneau, AK. Studies focus on stewardship and management of salmon as indicator species in ecosystem fluctuations in support of NOAA Fisheries goals and international obligations including the Pacific Salmon Treaty (PST), North Pacific Anadromous Fish Commission (NPAFC), and Global Ocean Ecosystems Dynamics (GLOBEC).

Alaska has more than 50% of the U.S. coastline and leads the Nation in fish habitat area and value of fish harvested, yet large gaps exist in knowledge of Essential Fish Habitat (EFH) in

Alaska. Major research is needed to identify habitats that contribute most to the survival, growth, and productivity of managed fish and shellfish species; and to determine how to best manage and protect these habitats from human disturbance and environmental change. Project selection for EFH research is based on research priorities from the EFH Research Implementation Plan for Alaska. Around \$450,000 is spent on about ten EFH research projects each year. Project results are described in annual reports and the peer-reviewed literature. Study results contribute to existing Essential Fish Habitat data sets (<http://www.afsc.noaa.gov/HEPR/efh.htm>). All federal agencies must consult with NMFS regarding any action they authorize, fund, or undertake that may adversely affect EFH, and NMFS must provide conservation recommendations to federal and state agencies regarding any action that would adversely affect EFH. All significant permits and actions are subject to the Environmental Impact Statement (EIS) process, which not only requires thorough review by scientists and agencies, but also mandates thorough and comprehensive public information and transparency.

In 2005 the North Pacific Fishery Management Council (NPFMC) identified the entire U.S. Exclusive Economic Zone (EEZ; 200-nautical miles from shore) as essential fish habitat (EFH) for each of the five species of Pacific salmon. In order to better define EFH within the U.S. EEZ for Pacific salmon found in Alaska, Echave et al (2012) analyzed the influence of sea surface salinity (SSS), sea surface temperature (SST), and bottom depth on the distribution of Pacific salmon. By calculating and mapping the coincidence of the 95% range of each environmental variable (SSS, SST, depth) for each of the five species at each maturity stage, updated EFH descriptions were used by these authors to reduce the area of designated EFH for Pacific salmon by 71.3% on average. Juvenile salmon EFH generally consists of the water over the continental shelf within the Bering Sea extending north to the Chukchi Sea, and over the continental shelf throughout the Gulf of Alaska and within the inside waters of the Alexander Archipelago. Immature and mature Pacific salmon EFH includes nearshore and oceanic waters, often extending well beyond the shelf break, with fewer areas within the inside waters of the Alexander Archipelago and Prince William Sound. According to Echave, et al (2012), this was the first time that salmon data sets from multiple surveys, agencies, and years have been accumulated and formatted for Pacific salmon distribution and habitat analysis. This study summarizes catches of more than 420,000 Pacific salmon sampled during 5,280 surface trawl and purse seine events in the Alaska EEZ from 1964 to 2009. Distribution was plotted for each salmon species and life history within the Alaska EEZ.

Wild-hatchery salmon interactions

Recent studies have determined that large numbers of hatchery-origin salmon are present on the spawning grounds of wild salmon in some areas of Alaska, particularly PWS and Southeast (Brenner, et al., 2012, Piston and Heintz, 2012a, Piston and Heintz, 2012b). These studies were enabled by the incorporation of otolith thermal marks into mass-marking programs at most hatcheries that make possible the detection of hatchery-origin salmon in streams. With the possible exception of Kitoi Bay and Pillar Creek hatchery in the Kodiak region and the Tutka Lagoon Hatchery in Cook Inlet, juvenile pink and chum salmon produced from all major hatcheries in Alaska are being thermally marked to allow differentiation from wild fish wherever they are found. Issues surrounding hatcheries in PWS and Southeast will eventually be raised in the other areas of Alaska that have large-scale hatchery production.

Currently, the majority of studies that suggest a reduction in fitness of wild salmonids due to interbreeding of hatchery and wild fish have been with species that require a year or more of rearing in freshwater, including steelhead, coho and Chinook (Chilcote et al., 2011; Naish et al.,

2007). Tallman and Healy (1994) found geneflow in wild chum salmon to be much lower than expected based on observed straying and suggested that the stray fish were less successful at reproducing. Berejikian et al., (2009) did not find a significant difference in reproductive success between wild and hatchery-origin chum salmon. However, their study had low statistical power to detect such differences. A study by Dann, et al. (2010) on outbreeding depression in Alaskan coho salmon found no loss of fitness after two generations; however, as with Berejikian, et al. (2009) the statistical power of this study was low. One of the challenges for ADFG will be to develop escapement goals for salmon that account for any effects from straying of hatchery-origin fish into streams containing wild fish. Grant (2012) provided an extensive literature review of interactions between wild and hatchery-produced salmonids and suggested the health of wild salmon in Alaska should be a concern in light of the magnitude of hatchery production there. His review focused on fitness of populations of wild fish that have been impacted by fish of hatchery-origin. The main concern with wild-hatchery interactions is the effect that strays from hatcheries have on wild fish, primarily from interbreeding. Grant (2012) maintains that wild salmon populations are adapted to environmental conditions in streams, rearing areas, and the ocean while hatchery-produced fish are intentionally or unintentionally selected against traits that enhance fitness in natural environments. Hatchery selection may favor traits that enhance survival in a hatchery but are maladaptive in the wild and, in the hatchery environment; natural selective pressure may be relaxed so that non-adaptive traits increase in frequency. Grant (2012) states that a growing body of evidence, both empirical and theoretical, indicates that hatchery practices almost always result in genetic changes, life-history shifts and behavioral changes that affect survival and that persistent straying of hatchery fish into wild populations will eventually lead to complete replacement of wild individuals with hatchery-origin descendants. His conclusion is that the results of the numerous studies he has reviewed show that inevitable changes to hatchery populations will result in alteration of the fitness of wild populations from intermixing and interbreeding on the spawning grounds. However, he does say this conclusion would be strengthened by controlled, generational experiments with Alaskan salmon populations.

Research Program to Address Interactions of Wild and Hatchery Pink and Chum Salmon in Prince William Sound and Southeast Alaska

The scale of the hatchery program in Alaska (particularly for pink salmon in PWS and for chum salmon in Southeast Alaska and PWS) has raised concerns that hatchery-produced fish may be detrimentally impacting the productivity and sustainability of wild stocks of salmon. Risks posed to natural stocks from hatchery production, including genetic impacts from interbreeding, disease transmission, ecological impacts from competition and overharvest mortality, have been recognized and reported for many years (see Brenner et al., 2012; Grant, 2012; Araki and Schmid, 2010 for reviews). While the various ADFG hatchery policies and fishery management strategies already implemented may have reduced the risk to wild stocks, the magnitude of production from the Alaskan salmon enhancement program makes it likely that wild stocks are being impacted by hatchery-origin fish to an as yet undetermined degree. Current controlled, generational experiments with Alaskan pink and chum salmon populations in PWS and SEAK are ongoing. More details about this issue and the steps taken to address it are provided in the next Clause 14, dealing with Enhancement Activities.

Summary

Alaska's Sustainable Salmon Policy includes provisions addressing the potential effects of ecological changes/perturbations on sustainably allowable harvest in that salmon fisheries shall be managed to allow escapements within ranges necessary to conserve and sustain

potential salmon production and maintain normal ecosystem functioning. Bycatch of non-targeted species is not a major issue in most Alaska salmon fisheries. Most non-targeted fish harvested in salmon fisheries are other species of salmon and are reported on fish tickets. Salmon bycatch in the groundfish fisheries in the Bering Sea Aleutian Islands and the Gulf of Alaska are formally managed by the NPFMC with regulations implemented by the NMFS. Gear used for commercial catches of Alaska salmon are not considered deleterious to physical habitats as they do not interact directly with it (unlike bottom trawl, dredges and pot gear as used in other fisheries). Takes of endangered species, e.g. Chinook from the Columbia River system, are regulated (e.g. Pacific Salmon Treaty regulations). One potential negative ecological effect of the salmon fishery is represented by the dynamics surrounding the ecological and genetic interactions between wild and hatchery salmon. The PWSSC has initiated in the late summer of 2012 a large scale multi-generation research program to elucidate and address the issue of interactions of wild and hatchery pink and chum salmon in Prince William Sound and Southeast Alaska. Their contract for phase one of the project is running until 2016.

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14. Where fisheries enhancement is utilized, environmental assessment and monitoring shall consider genetic diversity and ecosystem integrity.

FAO CCRF 9.1.2/9.1.3/9.1.4/9.1.5/9.3.1/9.3.5

Evidence adequacy rating:

High

Medium

Low

Rating Determination

The Alaska enhancement program was designed with care, including a comprehensive regional planning process, to avoid the pitfalls experienced in the Pacific Northwest’s hatchery programs. In contrast to these, which were built to replace wild production that was diminished or even extirpated by widespread habitat degradation and damming of many major salmon-producing rivers, the Alaskan hatchery program was developed to supplement and enhance fisheries that historically depend on wild production. Other aspects of this comprehensive planning process included the permitted capacity of each species to be raised in individual hatcheries, the use of broodstocks of local origin, and distance of hatcheries to wild stocks. Because the Alaska program was developed to enhance the salmon fishery and not mitigate for lost habitat, or help rebuild wild runs with infusions of hatchery fish, the siting of hatcheries became of paramount importance. Introduction of genetic material is prohibited and hatchery stock is selected from the terminal area stock and hence, all genetic material originates from that location. Selection techniques are designed to avoid artificial reduction in genetic material – i.e. fish are selected at random and not on external trait basis (size, shape, colour etc). An extremely wide, pre-determined number of returning fish are used for stripping of ova for hatchery rearing and release, this especially true for pink and chum salmon in PWS and SEAK. Despite that, there have been a number of studies showing hatchery salmon is straying into wild streams in Prince William Sound and Southeast Alaska. Furthermore, a suite of other studies points to potential ecological and genetic negative effects to wild salmon resulting from hatchery-wild salmon interactions. However many of these studies are not specific to pink and chum salmon and reflect other effects caused by hatchery Programs radically different from the one in Alaska. To elucidate these potential issues, a large scale multi – generation hatchery wild salmon interaction study funded by state and industry in 2012 is currently ongoing. This should clearly reveal the scale of pink and chum straying in PWS and SEAK, the degree of interbreeding and introgression, and the relative genetic/fitness evaluation resulting from these interactions. No clear evidence of the potential negative effects (i.e. interbreeding with wild salmon, genetic dilution, decreased fitness) is yet available. However the Assessment Team is aware that a peer reviewed paper (Jasper et al. in press) on the subject should be published and become available sometime after September or October 2013. This clause will be re-evaluated accordingly in light of this new evidence as soon as this peer reviewed paper becomes published.

Salmon Enhancement in Alaska

The hatchery program in Alaska was initiated in the early 1970’s to contribute to the rehabilitation of the state’s depleted and depressed salmon fisheries. It was intended that wild stocks of salmon would be protected from adverse impacts through the development of permitting processes that included genetics, pathology and fisheries management reviews, policies that required hatcheries to be located away from significant wild stocks, use of local brood stock sources, a wild stock priority in fisheries management, and options to require marking of hatchery salmon and special studies on hatchery/wild stock interactions (McGee, 2004).

A key concept behind development of policies for salmon hatcheries in Alaska was the comprehensive regional planning process. This involved formation of regional planning teams consisting of scientists and fishery managers from ADFG and other state agencies, along with scientists from universities, federal agencies, commercial and recreational fishery groups, regional

aquaculture associations, and local community representatives. Planning teams developed comprehensive regional plans that determined the location of hatcheries with consideration given to terminal harvest areas that would allow targeting of hatchery fish while minimizing impact on wild stocks. Other aspects of comprehensive planning included the permitted capacity of each species to be raised in individual hatcheries, the use of broodstocks of local origin, and distance of hatcheries to wild stocks. Because the Alaska program was developed to enhance the salmon fishery and not mitigate for lost habitat, or help rebuild wild runs with infusions of hatchery fish, the siting of hatcheries became of paramount importance.

In order to minimize potential negative impacts of hatchery salmon, no hatcheries are located on streams or rivers with major runs of wild salmon, conversely, most hatcheries are located on non-anadromous water sources at or near tidewater and some distance from important wild stocks. Other key planning and policy issues included development of conservative fish culture practices, statewide genetics and fish health policies, and use of innovative technologies. Conservative fish culture practices included use of hatchery broodstock originating from local regional wild stocks and restricting the use of a particular broodstock to a limited number of hatcheries. These practices and other policies are encoded in the statewide genetics policy and fish health policies (Heard 2011).

All hatchery release strategies are reviewed by ADFG and are ultimately under the authority of ADFG. Both economic and ecological evaluation of the release plan forms part of the decision making process. Introduction of genetic material is prohibited and hatchery stock is selected from the terminal area stock and hence, all genetic material originated from that location. Selection techniques are designed to avoid artificial reduction in genetic material – i.e. fish are selected at random and not on external trait basis (size, shape, colour etc). An extremely wide, pre-determined number of returning fish are used for stripping of ova for hatchery rearing and release (Reference to Genetic Policy, 1985).

Key Aspects of Salmon Enhancement Management in Alaska

- Highest priority: protect and maintain wild salmon stocks, legal mandates that require wild stocks to be given priority in fishery management.
- Vigorous habitat protection, no dams on rivers.
- Escapement-based management, no fishery targets.
- Mixed stock fisheries avoided wherever possible.
- Hatcheries supplement not replace wild stocks, mitigation of pressure on wild stocks.
- Annual Management Plans of all hatcheries are annually reviewed by ADFG.

Minimizing Hatchery-Wild Stock Interactions

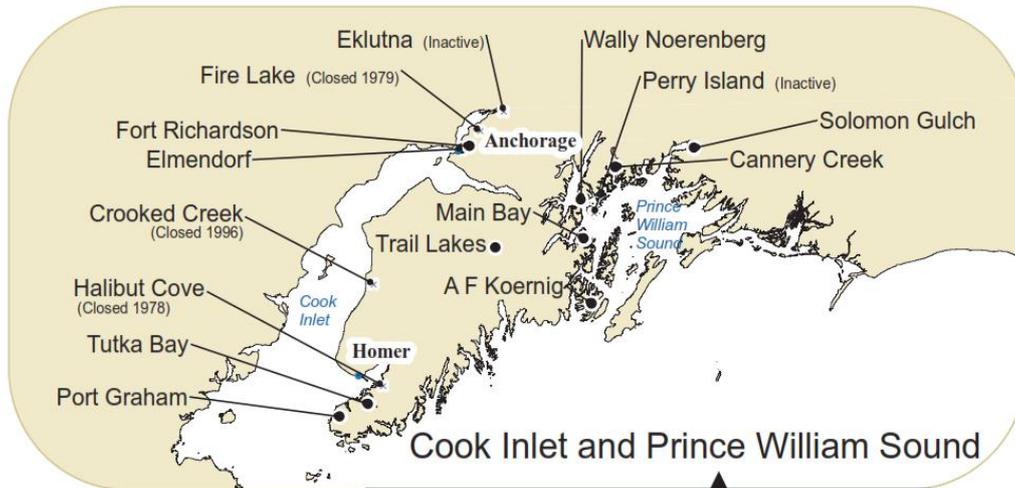
- Comprehensive regional planning.
- Utilise conservative fish culture practices.
- A rigorous hatchery permitting process that includes genetics, pathology and fishery management reviews.
- Statewide genetics policy to guide hatchery program and practices to allow protection of wild stocks by avoiding foreseeable negative effects.
- Fish health and disease statutes (no disease has ever been introduced or amplified in the wild).
- Careful siting of hatcheries, terminal harvest areas (temporal and spatial segregation from wild stocks to minimize mixed fisheries, then harvest all the returning salmon to minimize potential breeding. Hatchery production is not approved if there is not high confidence that the resulting salmon will be fully harvested – decreasing the potential of hatchery strays).

- Hatchery brood stock diversity practices (fish selected at random and not on external trait basis such as size, colour or shape, 1 to 1 mating ratio, effective population sizes extremely large – especially true for pink and chum salmon in SEAK and PWS).
- Use of local brood sources is priority.
- Collection of broodstock for the hatcheries is stratified over spawn/run timing to maximize the heterogeneity of the gene pool.
- Mass otolith marking for real-time in-season fisheries management. All hatcheries with significant production in Southeast, Central and Westward Region (apart from Kitoi Bay and Pillar Creek hatcheries, in Kodiak) thermally mark virtually all of their releases for identification of hatchery salmon during harvest.

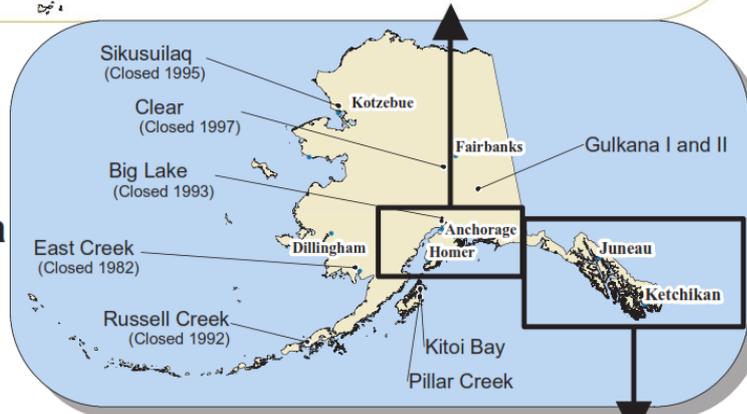
Each hatchery is required to complete an annual report containing information on hatchery returns, numbers of eggs taken, and numbers of fry or smolt released, by species and stock, in accordance with their approved permits.

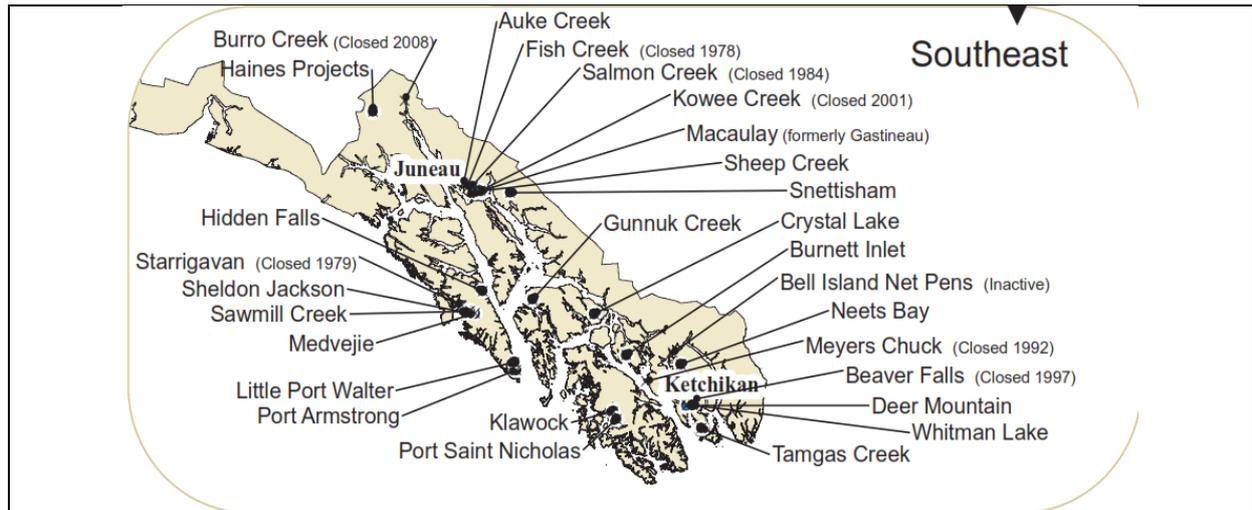
<http://www.springerlink.com/content/25k01460326l7g38/>

Hatchery management plans ensure hatchery operations are consistent with departmental policies, regulations, and fishery management plans. Prior to approval, all fish and egg transport permits are reviewed to make sure they are consistent with approved plans and policies. Hatcheries are also subject to biennial pathology inspections to maintain fish health at acceptable levels. Although some interactions between hatchery salmon and wild salmon are unavoidable including increasing concerns over straying of hatchery fish into wild salmon streams, obvious adverse impacts from hatcheries on production of wild salmon populations in Alaska are not readily evident. Large scale studies are currently underway to identify confidently the straying rates of pink and chum salmon in PWS and SEAK and the potential level of introgression and fitness of hatchery-wild salmon F1 generation.



Locations of Hatcheries within Alaska





In contrast to the mitigation hatcheries of the Pacific Northwest, which were built to replace wild production that was diminished or even extirpated by widespread habitat degradation and damming of many major salmon-producing rivers, the Alaskan hatchery program was developed to supplement and enhance fisheries that historically depend on wild production (McGee, 2004).

The policies and procedures established by ADFG at the onset of the Alaskan hatchery program were intended to avoid some of the detrimental impacts observed with Pacific Northwest hatchery programs. These policies have been generally successful for over three decades by preventing introductions of exotic stocks of fish and fish pathogens and allowing increased harvest of salmon while attempting to minimize the risk to wild stocks.

Generally speaking, all hatchery broodstock comes from returning salmon. One exception occurs at the Gulkana facility for sockeye salmon enhancement in PWS. Gulkana sockeye broodstock is strongly Integrated because PWSAC has observed the proportion of otolith marks (in this case chemical marks, not thermal marks) in the sockeye broodstock to be pretty low, i.e. near half. There is also evidence that relatively few fish stray away from the Gulkana project to wild-spawning populations. In the Gulkana sockeye broodstock there is evidence of a large portion of wild-spawned fish each year and there is scant evidence of hatchery-spawned fish among wild spawners.

In a recent study by Bidlack and McCall (2009), they collected 426 readable otoliths from six sites in sub-drainages of the upper Copper River to document any occurrence of strontium-marked sockeye salmon from the Gulkana Hatchery that had strayed into and died in wild salmon spawning streams. A microscopic analysis of recovered otoliths from spawned-out carcasses revealed no evidence of hatchery-marked fish in surveyed wild salmon streams and lakes (Bidlack and McCall 2009 <http://www.ccrks.org/wp/wp-content/uploads/Upriver-Sockeye-Straying-Report-10-13-09.pdf>).

In Southeast Alaska, the majority of Chinook, coho, sockeye and pink salmon harvested in common property fisheries are from wild stocks (Vercesi, 2013). However, a high proportion of the chum salmon harvested in this region are of hatchery origin (e.g., for 2012 83.5%). Much of the commercial harvest of chum salmon is taken in terminal/special harvest areas where the catch of wild stocks is minimized. However, the available data on wild and hatchery stock composition of fisheries that harvest both hatchery and wild stocks simultaneously may be insufficient to determine that over-harvest of wild stocks does not occur.

Recent studies have determined that large numbers of hatchery-origin salmon are present on the spawning grounds of wild salmon in some areas of Alaska, particularly PWS and Southeast (Brenner, et al., 2012, Piston and Heintz, 2012 a and b). These studies were enabled by the incorporation of

otolith thermal marks into mass-marking programs at most hatcheries that make possible the detection of hatchery-origin salmon in streams. With the exception of hatcheries in the Kodiak region, juvenile salmon produced from all major hatcheries in Alaska are being marked to allow differentiation from wild fish wherever they are found. Issues surrounding hatcheries in PWS and Southeast will eventually be raised in other areas of Alaska that have large-scale hatchery production, including Kodiak and Cook Inlet.

Kodiak hatcheries (Pillar creek, Kitoi Bay) are not currently required by ADFG to mass mark the fish they produce. ADFG staff instead performs scale patterns analysis to verify the provenience of the salmon. To date, the relatively discrete scale of the hatchery operations in Kodiak and the absence of evidence for straying salmon have seemingly influenced ADFG to not require mass marking of hatchery salmon produced in the Kodiak Region.

Hatchery Production in 2012

The contribution of hatchery produced salmon to Alaska fisheries in 2012 was as follow.

Southeast: Returning hatchery-produced salmon accounted for 27% of the salmon in the commercial CPF; 84% of the chum, 27% of the coho, 21% of the Chinook, 12% of the Sockeye, and 1% of the pink salmon can be attributed to fisheries enhancement projects. The harvest of hatchery produced salmon contributed an estimated \$72 million, or 42% of the exvessel value of salmon in the commercial CPF. In Southeast, the majority of the non-commercial common property fisheries (CPF) contribution was coho salmon, with an estimated 49 thousand fish harvested.

Prince William Sound: An estimated 25 million salmon returned from hatchery releases, accounting for an estimated 80% of the total number of salmon in the commercial CPH; 88% of the chum, 84% of the pink, 44% of the sockeye, and 5% of the coho salmon in the commercial CPH were hatchery-produced fish. In addition, hatchery produced salmon contributed an estimated \$71 million, or 63%, of the exvessel value of salmon in the commercial CPH. Sockeye salmon were the bulk of the non-commercial CPF harvest, with an estimated 136,000 fish harvested in the PWS area.

Cook Inlet: The fisheries enhancement program accounted less than 1% of the sockeye salmon in the commercial CPH and contributed an estimated \$196,000 or 0.5%, of the exvessel value of salmon in the commercial CPH. Cook Inlet area non-commercial CPF harvest of 44,000 fish was dominated by coho salmon, with estimates of over 28,000 hatchery produced fish harvested.

Kodiak: Hatcheries in the salmon fisheries enhancement program accounted for 12.5% of the total number of salmon in the commercial CPH; 25% of the chum, 22% of the coho, 14% of the sockeye, and 12% for the pink salmon in the commercial CPH were hatchery produced fish. Additionally, the fisheries enhancement program contributed an estimated \$6 million, or 13% of the exvessel value of salmon in the commercial CPH. An estimated 8,000 hatchery produced coho salmon were harvested in the non-commercial CPF.

(Vercessi 2013 available at <http://www.adfg.alaska.gov/FedAidPDFs/FMR13-05.pdf>)

Recent publications on the hatchery-wild salmon interaction

Currently, the majority of studies that suggest a reduction in fitness of wild salmonids due to interbreeding of hatchery and wild fish have been with species that require a year or more of rearing

in freshwater, including steelhead, coho and Chinook (Chilcote et al., 2011; Naish et al., 2007).

Recent studies (2012/2013) in Prince William Sound and Southeast Alaska

SEAK straying (Piston and Heidl 2012)

From 2008 to 2010 Piston and Heidl (2012a) collected otoliths from chum salmon (*Oncorhynchus cheta*) at wild stock index streams throughout Southeast Alaska to document the presence and distribution of stray hatchery fish. Summer chum salmon index streams in Southeast Alaska are grouped into aggregates of streams in three broad Subregions – Southern Southeast (SSE), Northern Southeast Inside (NSEI), and Northern Southeast Outside (NSEO).

Samples of greater than 50 fish were collected from 5 of 13 index streams in the SSE Subregion, 5 of 5 index streams in the NSEO Subregion, and 23 of 63 index streams in the NSEI Subregion. The proportion of hatchery fish was greater than 5% in 21 of 33 index streams: 2 of 5 in the SSE Subregion, 1 of 5 in NSEO Subregion, and 18 of 23 in the NSEI Subregion. The highest proportion of hatchery strays were found in streams located within 50 km of hatchery releases sites.

The authors observed significant year to year variations in the proportion of hatchery fish in four of nine streams that were sampled in multiple years. In the NSEI Subregion, they detected proportions of stray hatchery fish in excess of 5% at the majority of index streams. The overall estimated proportion of hatchery fish in the NSEI Subregion escapement index in 2010 was 13.5% (80% CI=12.5%-14.4%). In all three years the estimated overall proportion of hatchery strays in the NSEO Subregion was less than 2%.

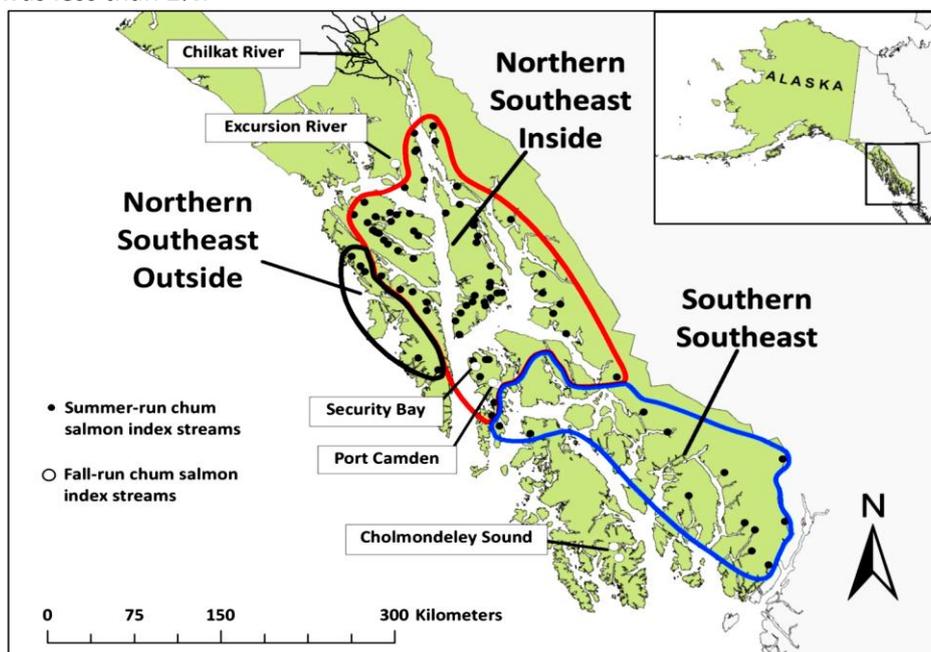


Figure 10. ADFG summer and fall-run chum salmon index streams in Southeast Alaska.

In 2011 Piston and Heidl (2012b) collected otoliths from chum salmon at wild stock index streams in the NSEI Region of Southeast Alaska to document the presence and distribution of stray hatchery fish in the escapement index for the Subregion. Sixteen of the 63 index streams were randomly selected for sampling and collections of otoliths at each stream, designed to be representative of the entire escapement. Samples of greater than 50 fish were obtained from 14 of 16 streams and hatchery fish were detected in 12 of those streams. The overall estimated proportion of hatchery fish in the NSEI

escapement index in 2011 was 9.8% (95% CI=8.9%-10.7%), which was lower than the 2010 estimate of 13.5%, and the difference was statistically significant. The authors observed considerable year to year variation in five of the streams sampled in prior years. The proportion of hatchery strays in all samples collected from 2008 and 2011 decreased as distance from release sites increased and the proportions were generally highest at streams located within 50 km of the nearest hatchery release site. The authors calculated that modification of summer chum salmon escapement indices to account for the proportion of hatchery strays observed would result in little or no change to current escapement goals due to the method used to establish goals.

PWS straying (Brenner et al. 2012)

Surveys of pink (*Oncorhynchus gorbuscha*), chum (*O. keta*) and sockeye (*O. nerka*) salmon in wild salmon spawning locations in Prince William Sound (PWS), Alaska since 1997 show a wide range of hatchery straying. The analysis of thermally marked otoliths collected from carcasses indicate that 0–98% of pink salmon, 0–63% of chum salmon and 0–93% of sockeye salmon in spawning areas are hatchery fish, producing an unknown number of hatchery-wild hybrids.

Streams within 20 km of hatcheries generally contained the highest proportions of hatchery-origin pink salmon. Their estimates suggest from 0-98% of the pink salmon in some streams were from hatcheries. Before late August, as much as 0-63% of the chum salmon sampled in some streams were from hatcheries; however, after late August no stream had more than 20%. For sockeye salmon, the Eshamy River had the highest numbers of hatchery-origin fish sampled (22%). For streams without documented populations of sockeye, 29 of 44 carcasses sampled (66%) were of hatchery origin. Conversely, the remaining 44% may have been strays from wild stocks.

Most spawning locations sampled (77%) had hatchery pink salmon from three or more hatcheries, and 51% had annual escapements consisting of more than 10% hatchery pink salmon during at least one of the years surveyed. An exponential decay model of the percentage of hatchery pink salmon strays with distance from hatcheries indicated that streams throughout PWS contain more than 10% hatchery pink salmon. Pink salmon in PWS are intertidal spawners and that intertidal populations show less genetic difference from one another than do spawners from upstream locations indicating greater straying and more gene flow among populations of this species.

The prevalence of hatchery pink salmon strays in streams increased throughout the spawning season, while the prevalence of hatchery chum salmon decreased. The level of hatchery salmon strays in many areas of PWS are beyond all proposed thresholds (2–10%), which confounds wild salmon escapement goals and may harm the productivity, genetic diversity and fitness of wild salmon in this region.

PWS chum genetic introgression (Jasper et al. in press)

Jasper, et al. (in press) compared genetic population structures of four stocks of wild PWS chum salmon, specifically from Siwash Creek, Wells River, Constantine and Beartrap Creek using material from old archived scale samples (pre-hatchery establishment) and contemporary genetic samples from hatchery chum salmon from the Wally Noerenberg Hatchery (WNH) at Esther Lake. During the 1990's, population structure among chum salmon populations in PWS was detected using allozyme data. Jasper et al. proposed to examine population structure among 4 populations distributed in PWS from archival scale samples taken before the hatchery program was established and from contemporary samples screened for 188 SNP loci.

Preliminary results suggest that structure among chum salmon populations prior to the establishment of the hatchery program was similar in depth to that observed in other places of similar scale. This structure is still present in contemporary populations, however the authors found a temporal shift toward hatchery allele frequencies in some wild chum populations. Other wild stocks did not show as much evidence of genetic introgression even though hatchery-origin strays have been documented in those streams. The authors hypothesize that some populations resist introgression because of differences in spawning timing, other behavioral differences such as poor homing ability, or failure to successfully hybridize. Furthermore, populations geographically closest to hatcheries seem to have become more similar to the hatchery population than populations more distant from the hatcheries, a pattern consistent with hatchery straying observations.

<https://afs.confex.com/afs/2012/webprogram/Paper10948.html>

<http://pinkandchum.psc.org/Presentation/Habicht.pdf>

Jasper, J., C. Habicht, S. Moffitt, R. Brenner, J. Marsh, B. Lewis, E. Fox, Z. Grauvogel, S. Rogers, and W.S. Grant. (in Press) Source-sink estimates of genetic introgression show influence of hatchery strays on wild chum salmon populations in Prince Williams Sound, Alaska. PLOS One.

Another study by Tallman and Healy (1994) found gene flow in wild chum salmon to be much lower than expected based on observed straying and suggested that the stray fish were less successful at reproducing. Berejikian et al., (2009) did not find a significant difference in reproductive success between wild and hatchery-origin chum salmon. However, their study had low statistical power to detect such differences.

Grant 2012, adaptive consequences of hatchery-wild salmon interactions

About 31% of salmon harvested in Alaska comes from the hatchery production of hundreds of millions of pink and chum salmon and smaller numbers of sockeye, Chinook, and coho salmon. The numbers of hatchery-reared juveniles released in some areas are greater than the numbers of juveniles from wild populations. However, very little is known about the effects of hatchery fish on wild populations in Alaska.

Numerous studies show a complex relationship between the genetic architecture of a population and its environment. Adaptive responses to nature and anthropogenic selection can be influenced by variation at a single gene, or more often, by the additive effects of several genes. Studies of salmonids in other areas show that hatchery practices can lead to the loss of genetic diversity, to shifts in adult run timing and earlier maturity, to increases in parasite load, to increases in straying, to altered levels of boldness and dominance, to shifts in juvenile out-migration timing, and to changes in growth.

Controlled experiments across generations show, and theory predicts, that the loss of adaptive fitness in hatchery salmon, relative to fitness in wild salmon, can occur on a remarkably short time scale. All of these changes can influence survival and impose selective regimes that influence genetically based adaptive traits. The preservation of adaptive potential in wild populations is an important buffer against diseases and climate variability and, hence, should be considered in planning hatchery production levels and release locations. The protection of wild populations is the foundation for achieving sustained harvests of salmon in Alaska.

Protecting wild populations of Pacific salmon in Alaska from the detrimental effects of wild-hatchery interactions is important for several reasons. The preservation of genetic variability among wild populations, and not just within populations, is important to the survival of regional populations and

future broodstock availability. Second, genetic variability underpins physiological and behavioral responses to environmental variables that challenge fry in freshwater habitats and juveniles and adults in the marine realm. Selection from these challenges changes constantly because of human activities and swings in climate. Climate influences patterns of precipitation, which affect salmon fry production in freshwater and ocean nutrient cycles, which influence growth and survival in marine waters. Third, adaptive variation among populations may be essential for the regional persistence of populations. The abundances of local populations may change considerably, even though regional abundances remain constant.

The concern over hatchery-wild interactions is centered on the effects that hatchery-reared strays have on wild populations. These concerns are focused on ecological mechanisms that ultimately reduce the abundances of wild populations when fish compete for mates or for nesting sites. Most interactions between wild and hatchery-reared fish have the potential to influence the demography or genetics of wild populations. First, competition from hatchery fish can lead to the loss of genetic diversity in a wild population by reducing its effective population size. Second, mating between hatchery and wild fish can also lead to the loss of adaptive fitness in wild populations, especially when hatchery fish come from cultured populations that have diverged substantially from wild populations. First-generation hybrids between hatchery and wild fish may represent a loss of productivity in the short term, and genetic introgression can produce a shift in adaptive potential that reduces the long term viability of a wild population.

The table below, extracted from Grant (2012) shows some examples of adaptations and effects of hatchery practices and hatchery strays on Pacific salmon and other salmonids.

Table 13. Examples of adaptations and effects of hatchery practices and hatchery strays on Pacific salmon and other salmonids. The literature on this topic is abundant, and the information on these topics reported in the table is not comprehensive. Note that species: 1 = pink salmon, 2 = chum salmon, 3 = coho salmon, 4 = Chinook salmon, 5 = sockeye salmon, 6 = masu salmon, 7 = rainbow/steelhead trout, 8 = cutthroat trout, 9 = Atlantic salmon, 10 = brown trout, 11 = lake trout, 12 = brook trout. Table extracted from: W. S. Grant. 2012. Understanding the adaptive consequences of hatchery-wild interactions in Alaska salmon *Environ Biol Fish*, 94:325–342.

Trait	Results	Species ^a	Reference
Environmental adaptations in salmonids			
Population structure	Neutral genetic markers generally show significant divergence between populations, which reflects homing, local adaptation, and ancestral divergence	All	e.g. Seeb et al. (1999); Waples et al. (2001); and many others
Local adaptation	Hybrids between distant populations had reduced survival over controlled matings within populations. Demonstrates outbreeding depression from disruption of epistatic gene interactions	3	Gilk et al. (2004)
	Adaptive differences in morphology, growth, and timing of migration in juveniles response to water flow and temperature	9	Riddell and Leggett (1981)
Behavior	Inherited differences in agonistic behavior between wild juveniles from different streams	3	Rosenau and McPhail (1987)
	Innate ability to migrate appropriately upstream or downstream to feeding areas after emergence from gravel	5,7,8	Raleigh (1971)
Temperature adaptation	Abnormal embryo development in thermally stressed eggs	3	Campbell et al. (1998)
	Genotype-temperature interactions influences juvenile traits in pink and chum salmon	1,2	Beacham (1988)

Run timing	Complex interaction between arrival in spawning area and size; early arrival allowed choice of nest	1	Dickerson et al. (2002, 2005)
	Seasonal temperature cycles influence migration into freshwater	1,5	Hodgson and Quinn (2002); McGregor et al. (1998); Smoker et al. (1998)
Hatchery practices			
Loss of genetic diversity	Sperm competition from mixing of milt leads to smaller effective broodstock size for a given number of fish	All	Withler (1988); Hoysak et al. (2004); Campton (2004); Wedekind et al. (2007)
	Small effective broodstock size	8,9	Allendorf and Phelps (1980); Ryman and Ståhl (1980); Verspoor (1988); Norris et al. (1999)
Broodstock selection	Inbred fish showed less resistance to pathogens than individuals	4	Arkush et al. (2002)
	Reduced differentiation among hatcheries, relative to wild populations	10	Garcia-Marin et al. (1991)
Artificial mating	Artificial random mating prevents mate choice and to loss of fitness	All	Berejikian et al. (2000); Hankin et al. (2009)
	Random hatchery matings select for earlier maturity in Chinook salmon	4	Hankin et al. (2009)
	Artificially bred Atlantic salmon had four times higher parasite loads than fish from naturally matings	9	Consuegra and Garcia de Leaniz (2008)
Timing of egg take	Selection of eggs from one part of run can shift run timing of adults	3,4	Quinn et al. (2002); Ford et al. (2006)
Timing of fry release	Smots released in winter tended to stray the most	9	Hansen and Jonsson (1991)
Behavior	Small 2.2% advantage of wild fry over first-generation hatchery fry in avoidance of predation	4	Fritts et al. (2007)
Hatchery-reared fish released into the wild			
Growth rate	Lower growth rates in hatchery-reared fish released into the wild	7,9,12	Reisenbichler and McIntyre (1977); Lachance and Magnan (1990); Finstad and Heggberget (1993); Hesthagen et al. (1999)
	Hatchery supplementation led to smaller naturally spawning males	4	Unwin and Glova (1997)
Behavior	Hatchery juveniles failed to establish feeding territories, fed less and used less efficient feeding strategies than wild fish	10	Bachman (1984)
	Hatchery juveniles were more aggressive, spent less time foraging and more time in fast flowing water than wild fish	8	Mesa (1991)
	Captive or hatchery-bred salmon were more aggressive than wild-bred fish	3,9	Swain and Riddell (1990); Blanchet et al. (2008)
	Hatchery domestication promotes boldness in brown trout	10	Sunderström et al. (2004)
Survival	Lower survival in hatchery-reared fish released into the wild	7	Reisenbichler and McIntyre (1977); Reisenbichler and Rubin (1999)
	Decline in fitness relative to wild fish the longer a broodstock is cultivated in a hatchery	7	Araki et al. (2007b)
	Offspring of hatchery spawners produced only 10-20% surviving offspring of wild spawners	7	Chilcote et al. (1986); Campton et al. (1991)
Age at maturity	Hatchery-reared fish mature more rapidly in the wild	7	Leider et al. (1986)
	Hatchery supplementation led to earlier male maturity (jacks)	4	Unwin and Glova (1997)

Homing	Homing to hatchery of origin, rather than to location of release site	7	Hayes et al. (2004)
	Hatchery fish strayed more than wild fish	4,9	Jonsson et al. (1991); McIsaac and Quinn (1988); Quinn et al. (1991)
Reproductive success	No difference in stray rate between hatchery and wild salmon	3	Labelle (1992)
	Hatchery fish reproducing in the wild had lower lifetime reproductive success than wild fish	3	Thériault et al. (2011)
Run timing	Shift of run timing in hatchery and straying led to shift to earlier run timing in natural population	3	Ford et al. (2006)
	Wild fish returned to freshwater earlier than hatchery fish	9	Jonsson et al. (1991)
Wild population abundance	Hatchery supplementation led to depressed recruitment of replacement of large proportion of wild populations with fish of hatchery origin	4,9	Unwin and Glova (1997); McGinnity et al. (2009)
Hatchery-reared and wild fish studied in common hatchery environment			
Growth rate	Hatchery fish grow more rapidly than wild fish reared in a hatchery	12	Vincent (1960); Dwyer and Piper (1984); Fleming et al. (2002)
Egg size	Wild fish had larger eggs	11	McDermid et al. (2010)
Egg development	Egg survival better in wild fish	11	McDermid et al. (2010)
Fry growth and development early growth rate	Fewer deformities in wild fish	11	McDermid et al. (2010)
	Wild fish grew more rapidly	11	McDermid et al. (2010)
Behavior	Hatchery and hatchery × wild hybrids showed higher levels of agonistic behavior than wild fish	4	Wessel et al. (2006)
	Hatchery juveniles dominant over wild juveniles	9	Metcalf et al. (2003)
Life-time survival	Reduced survival of hatchery offspring relative to offspring from wild parents	4	Kostow (2004)

^a Species: 1 = pink salmon, 2 = chum salmon, 3 = coho salmon, 4 = Chinook salmon, 5 = sockeye salmon, 6 = masu salmon, 7 = rainbow/steelhead trout, 8 = cutthroat trout, 9 = Atlantic salmon, 10 = brown trout, 11 = lake trout, 12 = brook trout

Overall, the evidence highlights that, for the studies referenced in the table above, hatchery culture reduces the fitness of hatchery-reared fish, relative to wild fish, and second that straying of hatchery fish into wild populations can lower the fitnesses of these populations. Without question, adaptations to seasonal and annual environmental cycles allow Pacific salmon to successfully complete their life history cycles in freshwater, estuarine, and marine habitats. Several experimental studies show that numerous ecological and life-history variables, such as run timing, nest building, mating behavior, egg size, fry emergence, and juvenile behavior, are closely tied to environmental variables by selection, which shape adaptive responses that affect survival and, hence, fitness of wild fish. These finely tuned adaptations can be disrupted by hybridization with genetically altered hatchery fish.

Evidence for understanding the effects of hatchery strays on wild populations in Alaska comes from studies of Pacific salmon and other salmonids in a variety of regional settings and from theoretical considerations. It may be argued that these results are not entirely applicable to Pacific salmon populations in Alaska, because of environmental differences between regions, because of life-history differences between species, and because many models for investigating the effects of straying were constructed to address conservation concerns of threatened populations and not the management of large populations. However, the results of the numerous studies reported in the table above show that artificial culture inevitably changes the genetic architectures of hatchery-reared fish. When these fish stray into streams and rivers, they can alter the fitnesses of wild populations through ecological interactions and hybridization. The full application of these conclusions for salmon populations in Alaska will be strengthened by the controlled, generational experimental studies currently ongoing in PWS and SEAK, with pink and chum salmon respectively.

Changes in Hatchery Production, 2012

Generally speaking, ADFG has been very cautious in recent years in allowing increases in capacity in the various hatchery facilities around PWS and SEAK, due to the increasing concerns about hatchery-wild salmon interactions and the uncertainties surrounding the subject. This has been demonstrated this year in the table below.

The table below summarizes the increases in hatchery capacities that were approved in 2012. The allowed increases was essentially only one in 2012 - Hidden falls coho, for 0.8 million eggs. The approval for 7 million green chum salmon eggs increase in Medvejie Creek was requested, reviewed and recommended in 2011, but otherwise just an housekeeping PAR to correct stated capacity. Burnett Inlet too dealt with capacity of 2.0 million eggs of coho salmon from one hatchery to another one. No other increases in salmon production were allowed in other sites in Southeast or in Prince William Sound.

Region	Hatchery	Species	Change in hatchery permitted capacity via approved PAR	Total hatchery permitted capacity after approved PAR (by species)	Region-wide permitted capacity after approved PAR (by species)
Southeast	Hidden Falls	Coho salmon	0.8 million green eggs	7.7 million green eggs	39.72 million green eggs
Southeast	Medvejie Creek ¹	Chum salmon	7 million green eggs	77 million green eggs	584.80 million green eggs
Southeast	Burnett Inlet ²	Coho salmon	2.0 million green eggs	4.5 million green eggs	41.72 million green eggs

¹ Housekeeping PAR, to correct stated permitted capacity to the level previously requested, reviewed, and recommended in 2011.

² This approved PAR moved production from Whitman Lake Hatchery to Burnett Inlet Hatchery; no increase in production overall.

Salmon enhancement in Alaska and its potential effects on wild stocks

Alaska continues to approach requests for increased hatchery production by asking if an increase can be managed with consideration of potential risks to wild stocks. Alaska's modern salmon fishery enhancement program is stakeholder driven, with provisions for planning and oversight by representatives of regional user groups. Since ADFG is not comfortable directly applying research on steelhead, and other species in the Pacific Northwest or elsewhere to the unique situation in Alaska, they are expanding studies of wild and hatchery interactions to better understand those relationships as they occur in Alaska. As these studies provide results, ADFG will evaluate and decide if any modifications to the program may be warranted.

- From the beginnings of Alaska’s salmon fishery enhancement program it was recognized that salmon stray and that hatchery stocks would stray; consequently, policies and regulations were adopted to mitigate concerns associated with straying.
- For the protection of wild salmon stocks, hatchery programs are required to use local stocks as the brood source and locate hatcheries away from important wild stocks. Requiring the use of only local salmon stocks means that straying hatchery fish are less likely to reduce fitness of local populations.
- In the 1980's hatchery programs in Alaska pioneered use of otolith thermal marks for mass-

marking hatchery production. Now almost 100% of all hatchery salmon in most of the state are marked. Marking programs have made possible accurate detection of hatchery-bred salmon on the spawning grounds of wild salmon.

- Straying on a sub-regional level appears to be on the order of 5 to 10% for pink and chum salmon; and less for other species. However, in a few select streams it can be over 50%.

These observations have raised several important questions:

1. Are hatchery-bred salmon interbreeding with wild salmon to the extent that fitness and productivity of these stocks are being diminished?
2. Is the annual assessment of wild stocks (which is, in large part, based on visual observation) so biased by the presence of hatchery salmon that excessive harvest of wild fish is being allowed or that escapement goals are difficult to set and difficult to assess?
3. Do density interactions diminish productivity of wild salmon?

Prince William Sound Science Center (PWSSC), in conjunction with Sitka Sound Science Center (SSSC), submitted the successful proposal and the contract was approved to conduct a portion of this project. Work on this project began in the summer of 2012. In the winter of 2013, PWSSC will present the first annual report for review by the science panel and department. The science panel will continue to advise the department on how to proceed.

Written reports

Reports will be made to ADFG as described in the Request for Proposal (RFP) and posted at http://www.adfg.alaska.gov/index.cfm?adfg=fishingHatcheriesResearch.findings_updates.

Proposed reports will consist of complete description of preceding field data methods and the data collected. Reports will include any analyses that can be made with the data available up to that time. Reports will be progressive, i.e., will include all data and analyses from the beginning of the project up to the date of the report. Annual progress will be submitted in December of each year, except that the final report will be submitted in January of 2016, so that it can be reviewed by ADFG staff and then revised based on their comments prior to the March, 2016 contract end date.

Workshops

The Project Manager and one or more Project leaders will host a workshop in late November or early December of 2013 to provide ADFG staff with an in-person overview of the progress made and challenges encountered, so that mid-course adjustments can be made if necessary. As requested in the RFP, PWSSC will host a workshop in February of 2016 to summarize the data collected and the findings to that date.

Schedule

As proposed by the Prince William Sound Science Center (PWSSC), a summary of the expected timing of major activities is:

Year	Season	Activity
2012	Summer	<ul style="list-style-type: none"> • Preliminary trials of the ocean sampling • Initial reconnaissance on the 10 intensive streams to begin mapping • Collect otoliths from potential intensive streams where the stray rates are uncertain
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	Winter	<ul style="list-style-type: none"> • Annual progress report and workshop
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	Summer	<ul style="list-style-type: none"> • PWS Ocean sampling • PWS and SEAK streams sampling - extensive and intensive
	Winter	<ul style="list-style-type: none"> • Annual progress report
2015	Spring	<ul style="list-style-type: none"> • Intensive alevin sampling in PWS and SEAK
	Summer	<ul style="list-style-type: none"> • PWS and SEAK streams sampling - extensive and intensive
2016	Spring	<ul style="list-style-type: none"> • Intensive alevin sampling in PWS and SEAK
	Winter	<ul style="list-style-type: none"> • Annual progress report and workshop

Although the entire project is anticipated in the RFP to extend through 2018 for the straying aspects, and through 2023, for the fitness studies, the scope of the Phase One proposal is limited to the period July 1, 2012 through March 21, 2016. The current research programme, headed by the PWSSC includes data collection for three complete annual cycles of adults in streams and their resultant

offspring alevins. It also includes one preparatory season followed by two full seasons adult sampling in the ocean (because budget limitations, the third full season of ocean sampling is suggested to be funded at a later date). The work described will provide a substantial beginning to the longer term project.

A first summary report of these research activities was posted in April 2012 on the ADFG website: [Interaction of Wild and Hatchery Pink and Chum Salmon in Prince William Sound and Southeast Alaska, Annual Report 2012](#)

PWSSC 2012 Summary Report

Introduction

Prince William Sound Science Center (PWSSC) and its sub-contracting partner Sitka Sound Science Center (SSSC) are engaged in the scientific data collection and analysis services requested under the State of Alaska contract IHP-13-013 entitled "Interactions of Wild and Hatchery Pink and Chum Salmon in Prince William Sound and Southeast Alaska".

The plans and intentions of this contracted research are guided by two documents: 1) the ADFG RFP 2013-1100-1020, Dated May 7, 2012 entitled "Interactions of Wild and Hatchery Pink and Chum Salmon in Prince William Sound and Southeast Alaska and 2) the PWSSC proposal for the same project, dated June 29, 2012. The overarching purposes of this research are to: 1) further document the degree to which hatchery pink and chum salmon straying is occurring; 2) assess the range of interannual variability in the straying rates; and, 3) determine the effects of hatchery fish spawning with wild populations on the fitness of wild populations.

The information provided here has been extracted from the annual PWSSC report, essentially a summary of activities in the first, preliminary year of research - 2012. Because the starting date of the contract was somewhat delayed relative to the timing of the 2012 fish runs, the report summarizes logistical planning, as well as some preliminary field sampling and reconnaissance, in preparation for intensive field work beginning in 2013. The report also reflects some decisions made following the 2012 initial field season, and in consultation with the Science Panel in November 2012, that will affect the field approach for 2013.

This research project has been subdivided into four major activities for implementation, each with a separate project leader: ocean sampling near PWS; stream sampling in PWS; stream sampling in SEAK; and data management, analysis, and reporting. Methods and activities under each of these major subdivisions are reported in separate sections.

Summary of the PWSSC Report

Due to the late signing of the contract relative to fish run timing, work on this project was of a preliminary nature during 2012. Full implementation began in 2013. Yet, a number of things have been accomplished to set the stage for a more successful implementation of the project in 2013.

In the PWS ocean sampling portion, the PWSSC purchased an experimental gillnet, made an initial gillnet sampling run, and tested the fishing methods. This initial effort helped formulate questions for clarification by the Science Panel and for slight revision of the sampling protocol for 2013.

The PWS stream sampling effort began with an initial cruise to six candidate pink salmon pedigree study streams for initial mapping, biological sampling, and to evaluate the streams' suitability for sampling. Although a late start combined with heavy rainfall eliminated all adult spawners from the

streams, PWSSC staff was able to collect map data and evaluate the streams' potential for the study. Preliminary stakes were planted at locations from where base maps were developed.

Two of the six PWS candidate streams were determined to be unsuitable for the pedigree studies. Since the cruise, the list of candidate pedigree streams has been revised. There are now 10 candidate streams, four of which have been visited and preliminarily mapped.

Four SEAK candidate chum salmon pedigree sampling streams were visited in August, 2012. Since chum spawners were available, biological attributes called for in the RFP were collected for preliminary information about the wild and hatchery populations. The staff also evaluated the streams' suitability as future pedigree study streams and collected preliminary geographical information about the streams, the extent of upstream chum access, and the areas used by chum spawners. Of the four streams visited, Swan Cove Creek and Saltery Bay Head were dropped as pedigree streams, while Fish Creek – Douglas and Sawmill Creek were retained. This was based on too low hatchery abundance observed in the Swan and Saltery Creeks, making them potentially unsuitable for fitness analysis, as well as difficulties with stream access. PWSSC is tentatively planning to add Prospect Creek and Admiralty Creek as alternate pedigree streams, pending some further investigations and approval by the Science Panel. Results of the otolith analysis in Fish and Sawmill creeks indicate suitable hatchery-wild proportions. Both of these streams provide reasonable access.

Summary

The Alaska enhancement program was designed with care, including a comprehensive regional planning process, to avoid the pitfalls experienced in the Pacific Northwest's hatchery programs. In contrast to these, which were built to replace wild production that was diminished or even extirpated by widespread habitat degradation and damming of many major salmon-producing rivers, the Alaskan hatchery program was developed to supplement and enhance fisheries that historically depend on wild production. Other aspects of this comprehensive planning process included the permitted capacity of each species to be raised in individual hatcheries, the use of broodstocks of local origin, and distance of hatcheries to wild stocks. Because the Alaska program was developed to enhance the salmon fishery and not mitigate for lost habitat, or help rebuild wild runs with infusions of hatchery fish, the siting of hatcheries became of paramount importance. Introduction of genetic material is prohibited and hatchery stock is selected from the terminal area stock and hence, all genetic material originates from that location. Selection techniques are designed to avoid artificial reduction in genetic material – i.e. fish are selected at random and not on external trait basis (size, shape, colour etc). An extremely wide, pre-determined number of returning fish are used for stripping of ova for hatchery rearing and release, this especially true for pink and chum salmon in PWS and SEAK. Despite that, there have been a number of studies showing hatchery salmon are straying into wild streams in Prince William Sound and Southeast Alaska. Furthermore, a suite of other studies points to potential ecological and genetic negative effects to wild salmon resulting from hatchery-wild salmon interactions. However many of these studies are not specific to pink and chum salmon and reflect other effects caused by hatchery Programs radically different from the one in Alaska. To elucidate these potential issues, a large scale multi – generation hatchery wild salmon interaction study funded by state and industry in 2012 is currently ongoing. This should clearly reveal the scale of pink and chum straying in PWS and SEAK, the degree of interbreeding and introgression, and the relative genetic/fitness evaluation resulting from these interactions. No clear evidence of the potential negative effects (i.e. interbreeding with wild salmon, genetic dilution, decreased fitness) is yet available. However the Assessment Team is aware that a peer reviewed paper (Jasper et al. in press) on the subject should be published and become available around September or October 2013. This clause will be re-evaluated accordingly in light of this new evidence as soon as this peer reviewed paper becomes published.

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8. Performance specific to agreed corrective action plans

Clause 7. Minor Non Conformance Assigned during the 1st Surveillance Activities in 2012

In 2012, during the FAO RFM AK Salmon 1st Surveillance Activities, one minor non-conformance was assigned under Clause 7, the precautionary approach. At the time of assessment it was unclear how ADFG planned to deal with development plans and release activities (e.g. potential requests from hatchery corporations for increased pink and chum salmon productions in PWS and SEAK) in light of the fact that negative genetic interactions between hatchery and wild salmon could already be occurring, and that research results of the genetic interactions between hatchery and wild salmon following the hatchery-wild salmon multigenerational study in PWS and SEAK may take considerable time to accrue. A corrective action plan from the client required the following clarifications and evidence 1) how ADFG intended to address this issue and 2) a set of specific timelines to allow for assessment during the next surveillance activities in 2013, 2014 and 2015 and the second full assessment audit in 2016, as relevant and if needed. The action plan is available in the surveillance report 1 but provided a response to this requests and agreed with the said requirements.

In simple words ADFG communicated that request for pink and chum increased capacity from hatcheries in PWS and SEAK would be reviewed on a case by case merit and using a risk assessment framework, primarily to avoid risks and interference with the management of wild salmon stocks and to achieve escapement goals and orderly fisheries. Secondly they agreed to provide a set of specific timelines (regarding the progress of the large scale hatchery salmon research program) to allow for assessment during the next surveillance activities in 2013, 2014 and 2015.

Changes in Hatchery Production

Generally speaking, ADFG has been very cautious in recent years in allowing increases in capacity in the various hatchery facilities around PWS and SEAK, due to the increasing concerns about hatchery-wild salmon interactions. The table below summarizes the increases in hatchery capacities that were approved in 2012. The allowed increases was essentially one in 2012 (Hidden falls coho, 0.8 million eggs). The approval for 7 million green eggs increase in Medvejie Creek was requested, reviewed and recommended in 2011, but otherwise just a housekeeping PAR to correct stated capacity was approved. Burnett Inlet too dealt with capacity of 2.0 million eggs of coho salmon from one hatchery to another one. No other increases in salmon production were allowed in other sites in Southeast or in Prince William Sound.

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--- THE EVIDENCE PROVIDED ABOVE DEALS WITH ONE OF THE REQUIREMENTS OF THE 2012 CORRECTIVE ACTION PLAN ---

Salmon enhancement in Alaska and its potential effects on wild stocks

Prince William Sound Science Center (PWSSC), in conjunction with Sitka Sound Science Center (SSSC), submitted the successful proposal and the contract was approved to conduct a portion of this large scale multi-generation hatchery-wild research project. In the winter of 2013, PWSSC will present the first annual report for review by the science panel and department. The science panel will continue to advise the department on how to proceed.

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	Winter	<ul style="list-style-type: none"> • Annual progress report and workshop
2014	Spring	<ul style="list-style-type: none"> • Intensive alevin sampling in PWS and SEAK
	Summer	<ul style="list-style-type: none"> • PWS Ocean sampling • PWS and SEAK streams sampling - extensive and intensive
	Winter	<ul style="list-style-type: none"> • Annual progress report
2015	Spring	<ul style="list-style-type: none"> • Intensive alevin sampling in PWS and SEAK
	Summer	<ul style="list-style-type: none"> • PWS and SEAK streams sampling - extensive and intensive
		<ul style="list-style-type: none"> • Annual progress report
2016	Spring	<ul style="list-style-type: none"> • Intensive alevin sampling in PWS and SEAK
	Winter	<ul style="list-style-type: none"> • Annual progress report and workshop

Although the entire project is anticipated in the RFP to extend through 2018 for the straying aspects, and through 2023, for the fitness studies, the scope of the Phase One proposal is limited to the period July 1, 2012 through March 21, 2016. The current research programme, headed by the PWSSC includes data collection for three complete annual cycles of adults in streams and their

resultant offspring alevins. It also includes one preparatory season followed by two full seasons adult sampling in the ocean (because budget limitations, the third full season of ocean sampling is suggested to be funded at a later date). The work described will provide a substantial beginning to the longer term project.

A first summary report of these research activities was posted in April 2012 on the ADFG website: [Interaction of Wild and Hatchery Pink and Chum Salmon in Prince William Sound and Southeast Alaska, Annual Report 2012](#)

PWSSC 2012 Summary Report

Introduction

Prince William Sound Science Center (PWSSC) and its sub-contracting partner Sitka Sound Science Center (SSSC) are engaged in the scientific data collection and analysis services requested under the State of Alaska contract IHP-13-013 entitled "Interactions of Wild and Hatchery Pink and Chum Salmon in Prince William Sound and Southeast Alaska".

The plans and intentions of this contracted research are guided by two documents: 1) the ADFG RFP 2013-1100-1020, Dated May 7, 2012 entitled "Interactions of Wild and Hatchery Pink and Chum Salmon in Prince William Sound and Southeast Alaska and 2) the PWSSC proposal for the same project, dated June 29, 2012. The overarching purposes of this research are to: 1) further document the degree to which hatchery pink and chum salmon straying is occurring; 2) assess the range of interannual variability in the straying rates; and, 3) determine the effects of hatchery fish spawning with wild populations on the fitness of wild populations.

The information provided here has been extracted from the annual PWSSC report, essentially a summary of activities in the first, preliminary year of research - 2012. Because the starting date of the contract was somewhat delayed relative to the timing of the 2012 fish runs, the report summarizes logistical planning, as well as some preliminary field sampling and reconnaissance, in preparation for intensive field work beginning in 2013. The report also reflects some decisions made following the 2012 initial field season, and in consultation with the Science Panel in November 2012, that will affect the field approach for 2013.

This research project has been subdivided into four major activities for implementation, each with a separate project leader: ocean sampling near PWS; stream sampling in PWS; stream sampling in SEAK; and data management, analysis, and reporting. Methods and activities under each of these major subdivisions are reported in separate sections.

Summary of the PWSSC Report

Due to the late signing of the contract relative to fish run timing, work on this project was of a preliminary nature during 2012. Full implementation began in 2013. Yet, a number of things have been accomplished to set the stage for a more successful implementation of the project in 2013.

In the PWS ocean sampling portion, the PWSSC purchased an experimental gillnet, made an initial gillnet sampling run, and tested the fishing methods. This initial effort helped formulate questions for clarification by the Science Panel and for slight revision of the sampling protocol for 2013.

The PWS stream sampling effort began with an initial cruise to six candidate pink salmon pedigree study streams for initial mapping, biological sampling, and to evaluate the streams' suitability for sampling. Although a late start combined with heavy rainfall eliminated all adult spawners from the streams, PWSSC staff was able to collect map data and evaluate the streams' potential for the study. Preliminary stakes were planted at locations from where base maps were developed.

Two of the six PWS candidate streams were determined to be unsuitable for the pedigree studies. Since the cruise, the list of candidate pedigree streams has been revised. There are now 10 candidate streams, four of which have been visited and preliminarily mapped.

Four SEAK candidate chum salmon pedigree sampling streams were visited in August, 2012. Since chum spawners were available, biological attributes called for in the RFP were collected for preliminary information about the wild and hatchery populations. The staff also evaluated the streams' suitability as future pedigree study streams and collected preliminary geographical information about the streams, the extent of upstream chum access, and the areas used by chum spawners. Of the four streams visited, Swan Cove Creek and Saltery Bay Head were dropped as pedigree streams, while Fish Creek – Douglas and Sawmill Creek were retained. This was based on too low hatchery abundance observed in the Swan and Saltery Creeks, making them potentially unsuitable for fitness analysis, as well as difficulties with stream access. PWSSC is tentatively planning to add Prospect Creek and Admiralty Creek as alternate pedigree streams, pending some further investigations and approval by the Science Panel. Results of the otolith analysis in Fish and Sawmill creeks indicate suitable hatchery-wild proportions. Both of these streams provide reasonable access.

--- THE EVIDENCE PROVIDED ABOVE DEALS WITH THE SECOND REQUIREMENT OF THE 2012 CORRECTIVE ACTION PLAN ---

The minor non conformance assigned last year (2012) under clause 7, on the Precautionary Approach, remains open until the next full re-assessment date (2016). The evidence available for this (2nd) surveillance activities satisfies the requirement set forth last year (check and document for increases in hatchery production, especially in PWS and SEAK; and document the yearly progress of the large scale hatchery-wild salmon interactions research program). These same items will be re-analyzed in the next (3rd) surveillance activities (2014).

9. Unclosed, new non conformances and new corrective action plans

No new non conformances have been assigned during the FAO RFM AK salmon 2nd surveillance activities (2013). However a new interim review of clause 14 is planned for September/October 2013 due to a new peer reviewed paper on PWS chum salmon introgression, which should be published at about that time. Clause 14 will be reviewed and re-scored as appropriate.

The minor non-conformance assigned last year is still open, but progressing satisfactorily and as agreed in the corrective action plan received, reviewed and agreed upon in 2012.

10. Surveillance Actions

Prior to the next surveillance assessment (No. 3 in 2014) clause 14 will be reevaluated in light of the findings of the Jasper et al. paper currently in press and in the process of being published. This should be sometime after September/October 2013.

Referring to the active minor non conformance raised in 2012, satisfactory information has been provided for this year (2013). Please see the details in the information provided in clause 7 (and also 14). In 2016, this will be fully re-evaluated as part of the second full re-assessment activities. The assessment team will review this information at each surveillance assessment as shown below:

Open minor non conformance	Year and assessment	Corrective action	Status
Clause 7, relating to the precautionary approach	Surveillance 1, 2012	1) The interim progress towards the completion of the 5 year hatchery salmon research study and; 2) Hatchery corporations permit alteration requests (if any) and their treatment by ADFG.	Non Conformance Assigned. Corrective Action received, reviewed and accepted.
Clause 7, relating to the precautionary approach	Surveillance 2, 2013	1) The interim progress towards the completion of the 5 year hatchery salmon research study and; 2) Hatchery corporations permit alteration requests (if any) and their treatment by ADFG.	All required evidence received. Progressing successfully as for agreed timeline.
Clause 7, relating to the precautionary approach	Surveillance 3, 2014	1) The interim progress towards the completion of the 5 year hatchery salmon research study and; 2) Hatchery corporations permit alteration requests (if any) and their treatment by ADFG.	N/A
Clause 7, relating to the precautionary approach	Surveillance 4, 2015	1) The interim progress towards the completion of the 5 year hatchery salmon research study and; 2) Hatchery corporations permit alteration requests (if any) and their treatment by ADFG.	N/A

11. Client signed acceptance of the action plan

Following the evidence provided by ADFG, ASMI will provide (in 2013, 2014, 2015 and 2016 if necessary) the following to GT, in relation to the corrective action plan to resolve the non-conformance found in the 1st FAO RFM AK salmon surveillance assessment (2012).

- 1) **Interim progress information or report (as available) towards the completion of the 5 year hatchery salmon research study (i.e. progress report during the next surveillance activities in 2013, 2014 and 2015 and the second full assessment audit in 2016).**
- 2) **List of hatchery corporation permit alteration requests received by ADFG and their treatment and decision (i.e. granted/declined and rationale for such decision).**

12. Recommendation and Determination

On concluding this report and 2nd surveillance activity, the Assessment Team recommends that continued Certification under the FAO-Based Responsible Fisheries Management Certification Program is granted to the U.S.A. Alaska commercial salmon [all pacific salmon species: Chinook (*Oncorhynchus tshawytscha*); sockeye (*Oncorhynchus nerka*); coho (*Oncorhynchus kisutch*); pink (*Oncorhynchus gorbuscha*); and chum (*Oncorhynchus keta*)] fisheries, employing troll, purse seine, drift gillnet, set gillnet gear (and fish wheel in Upper Yukon River only), in the four administrative Regions of Alaska principally managed by the Alaska Department of Fish and Game (ADFG).

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ADFG: Alaska Department of Fish & Game

NOAA: National Oceanic and Atmospheric Administration

NMFS: National Marine Fisheries Service

Appendix 1 (Assessment Team Details)

Based on the technical expertise required to carry out the above fishery assessment, Global Trust Certification Ltd. is pleased to confirm the surveillance assessment team members for this fishery as follows.

Steven McGee (Assessor)

Steve McGee received a B.Sc. in biological sciences from the University of Alaska in 1975 and a M.Sc. in parasitology from the University of Saskatchewan in 1978. He worked as a marine research assistant for the Institute of Marine Science in Fairbanks Alaska from 1979 to 1982, after which he went to work for the Alaska Department of Fish and Game FRED Division as a fishery biologist. Mr. McGee then spent 22 years with ADFG as the fishery biologist responsible for the private non-profit hatchery program. He supervised eight employees and managed a budget of approximately \$0.5 million annually. Major duties included review of all new hatchery permit applications and hatchery management plans, collection and analysis of hatchery production data, and supervision of the state's mariculture program. From 2004 to 2006, Mr. McGee served as an invasive species biologist in the ADFG invasive species program investigating invasive species infestations and analyzing large vessel arrivals and ballast water discharge in Alaska as a possible mechanism for introducing invasive species to Alaska.

Al Cass (Assessor)

Al Cass is a retired fisheries biologist with a 35 year career with Fisheries and Oceans Canada (DFO). His area of expertise is stock assessment, population dynamics and management. Mr. Cass holds a BSc. in Zoology from the University of British Columbia and a MSc from Royal Roads University in Management and the Environment. While at DFO his work has been diverse in nature but has had a primary focus on Pacific salmon and the impacts of fishery exploitation. He has lead stock assessment and research programmes on salmon in British Columbia, and has collaborated extensively with colleagues in DFO, academia and other non-government organizations. Most recently, Mr. Cass participated as the lead DFO scientist in the development of modeling approaches for assessing alternative harvest control rules including management reference points for Fraser River sockeye salmon. He has published over 30 scientific papers in the primary literature as well as numerous reports and research documents. Mr. Cass also headed the DFO science peer-review process from 2002 to 2009. Before retirement Mr. Cass was the science representative on the DFO Team assigned to the Commission of Inquiry into the Decline of Sockeye Salmon in the Fraser River.

Dr. Geraldine Criquet (Assessor)

Géraldine Criquet holds a PhD in Marine Ecology (École Pratique des Hautes Études, France) which focused on coral reef fisheries management, Marine Protected Areas and fish ecology. She has also been involved during 2 years in stock assessments of pelagic resources in the Biscay Gulf, collaborating with IFREMER. She worked 2 years for the Institut de Recherche pour le Développement (IRD) at Reunion Island for studying fish target species growth and connectivity between fish populations in the Indian Ocean using otolith analysis. She served as Consultant for FAO on a Mediterranean Fisheries Program (COPEMED) and developed and implemented during 2 years a monitoring program of catches and fishing effort in the Marine Natural Reserve of Cerbère-Banyuls (France). Geraldine has joined Global trust Certification in mid 2012 as Fisheries Assessment Officer and is involved in FAO RFM and MSC fisheries assessments.

Dave Garforth (Assessor)

Dave Garforth, BSc, HDip. (Applied Science), MSc has been involved in fisheries and aquatic resources for over 20 years. Currently, managing Global Trust FAO based Fishery Certification Program, with experience in the application of ISO/IEC Guide 65 based seafood certification systems and a professional background in numerous fishery assessments. Previous professional background includes; Development Officer in the Irish Sea Fisheries Board, supply chain and trade experience at Pan European Fish Auctions, the control and enforcement of fisheries regulations as a UK Fishery Officer. Dave is also a lead, third party IRCA approved auditor.

Vito Ciccio Romito (Lead Assessor)

Vito Ciccio Romito holds a BSc in Ecology and an MSc in Tropical Coastal Management (Newcastle University, United Kingdom). His BSc studies focused on bycatch, discards, benthic impact of commercial fishing gear and relative technical solutions, after which he spent a year in Tanzania as a Marine Research officer at Mafia Island Marine Park carrying out biodiversity assessments and monitoring studies of coral reef, mangrove and seagrass ecosystems. Subsequently, for his MSc, he worked on fisheries assessment techniques, ecological dynamics of overexploited tropical marine ecosystems, and evaluation of low trophic aquaculture as a support to artisanal reef fisheries. Since 2010, he has been fully involved through Global Trust with the FAO-based RFM Assessment and Certification program covering the Alaska commercial salmon, halibut, sablefish, pollock, crab and cod fisheries as well Icelandic cod, saithe, haddock and redfish fisheries. Vito is also a lead, third party IRCA approved auditor.

Appendix 2 (Information Submitted by Stakeholders)

The technical information here provided have been submitted by various stakeholders and considered by the assessment team as part of the evidence for this report.

No Information has been submitted by stakeholders in 2013.