

NPAFC
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Rev. _____

**Abstracts of Scientific Documents Submitted to the
Commission for the 2015 CSRS Meeting:
Forecast of Pacific Salmon Production in the Ocean
Ecosystems under Changing Climate**

by

NPAFC Secretariat

*Suite 502, 889 West Pender Street
Vancouver, BC, V6C 3B2 Canada*

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Abstracts of Scientific Documents Submitted to the Commission for the 2015 CSRS Meeting: Forecast of Pacific Salmon Production in the Ocean Ecosystems under Changing Climate

NPAFC Secretariat
Suite 502, 889 West Pender Street
Vancouver, BC, V6C 3B2 Canada

Keywords: migration, survival, climate impact, monitoring, key population, stock identification, management

This document is a compilation of abstracts of new and revised scientific documents submitted to the Commission between adjournment of the 2014 Annual Meeting and April 17, 2015. The compilation is organized into sections. The first section lists the document number and title according to six topics (Section 1). The first five topics are the five research components of the 2011-2015 NPAFC Science Plan.

- (1) migration and survival of juvenile salmon in ocean ecosystems;
- (2) climate impacts on Pacific salmon production in the Bering Sea (BASIS) and adjacent waters;
- (3) winter survival of Pacific salmon in North Pacific Ocean ecosystems;
- (4) biological monitoring of key salmon populations;
- (5) development and application of stock identification methods and models for management of Pacific salmon.

For convenience, one more topic is added:

- (6) Other topics.

Individual documents may pertain to more than one topic and, therefore, may be listed more than once.

The second section lists the document number and title according to the country that submitted the document (Section 2). Documents submitted by CSRS working groups or the Secretariat are not listed in this section. The third section lists abstracts of documents in order of document number (Section 3).

For consideration at the 2015 CSRS meeting, a total of 36 new documents (including two documents that were revised in 2015 before consideration of the Commission, and one revised 2014 document). Of the new documents that were submitted, 12 documents related to research on juvenile salmon, 12 documents related to research on climate impacts on salmon in the Bering Sea and adjacent waters, two documents related to research on salmon winter survival, 22 documents related to research on biological monitoring of key populations, 15 documents related to research on development and applications of stock identification methods and models for management, and four documents related to other topics. The number of unique new documents included four submitted by Canada, 10 by Japan, three by Korea, five by Russia, 13 by the United States, and one joint document submitted by Canada and the United States.

Section 1. Documents (number, title) Listed by Topic

1. **Migration and Survival Mechanisms of Juvenile Salmon in Ocean Ecosystems**
 - [Doc. 1554](#) Annual Survey of Juvenile Salmon, Ecologically-Related Species, and Biophysical Factors in the Marine Waters of Southeastern Alaska, May–August 2013
 - [Doc. 1555](#) Forecasting Pink Salmon Harvest in Southeast Alaska from Juvenile Salmon Abundance and Associated Biophysical Parameters: 2013 Returns and 2014 Forecast
 - [Doc. 1556](#) Southeast Alaska Coastal Monitoring (SECM) Survey Plan for 2015
 - [Doc. 1564](#) Gulf of Alaska Assessment Survey Plan for 2015
 - [Doc. 1570](#) United States Cruise Plan for Northern Bering Sea Surface Trawl Surveys, August-September 2015
 - [Doc. 1571 \(Rev. 1\)](#) Russian Bibliography of 2014 Publications Linked to the Current NPAFC Science Plan
 - [Doc. 1572](#) Trawl Survey Plans for Pacific Salmon Marine Life Period Studies in the Far Eastern Seas in Summer and Fall 2015 by Russia
 - [Doc. 1573](#) United States Cruise Plan for BASIS on the NOAA Ship *Oscar Dyson*, September-October 2015
 - [Doc. 1574](#) United States National Research Plan 2015
 - [Doc. 1578](#) Korean Research Plan for Salmon in 2015
 - [Doc. 1579](#) Otolith Thermal Mark for Brood Year 2014 and Proposed Thermal Marks for Brood Year 2015 Chum Salmon in Korea
 - [Doc. 1589](#) Canadian Juvenile Salmon Surveys in 2015-2016

2. **Climate Impacts on Pacific Salmon Production in the Bering Sea (BASIS) and Adjacent Waters**
 - [Doc. 1554](#) Annual Survey of Juvenile Salmon, Ecologically-Related Species, and Biophysical Factors in the Marine Waters of Southeastern Alaska, May–August 2013
 - [Doc. 1557](#) Proposed Cruise Plans of Japanese Research Vessels for Salmon in the North Pacific Ocean in 2015
 - [Doc. 1564](#) Gulf of Alaska Assessment Survey Plan for 2015
 - [Doc. 1570](#) United States Cruise Plan for Northern Bering Sea Surface Trawl Surveys, August-September 2015
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 - [Doc. 1573](#) United States Cruise Plan for BASIS on the NOAA Ship *Oscar Dyson*, September-October 2015
 - [Doc. 1574](#) United States National Research Plan 2015
 - [Doc. 1575](#) Bibliography of Sockeye, Pink, and Chum Salmon Marine Growth- and Size-at-Age Publications
 - [Doc. 1578](#) Korean Research Plan for Salmon in 2015
 - [Doc. 1583](#) The Summer 2014 Japanese Salmon Research Cruise of the R/V *Hokko maru*
 - [Doc. 1584](#) Results of 2014 Salmon Research by the *Oshoro maru*

3. **Winter Survival of Pacific Salmon in North Pacific Ocean Ecosystems**
[Doc. 1571 \(Rev. 1\)](#) Russian Bibliography of 2014 Publications Linked to the Current
 NPAFC Science Plan
[Doc. 1574](#) United States National Research Plan 2015
4. **Biological Monitoring of Key Salmon Populations**
[Doc. 1554](#) Annual Survey of Juvenile Salmon, Ecologically-Related Species,
 and Biophysical Factors in the Marine Waters of Southeastern
 Alaska, May–August 2013
[Doc. 1556](#) Southeast Alaska Coastal Monitoring (SECM) Survey Plan for 2015
[Doc. 1557](#) Proposed Cruise Plans of Japanese Research Vessels for Salmon in
 the North Pacific Ocean in 2015
[Doc. 1564](#) Gulf of Alaska Assessment Survey Plan for 2015
[Doc. 1565 \(Rev. 1\)](#) Biostatistical Information on Salmon Catches, Escapement and
 Enhancement Production in Russia in 2014
[Doc. 1570](#) United States Cruise Plan for Northern Bering Sea Surface Trawl
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[Doc. 1578](#) Korean Research Plan for Salmon in 2015
[Doc. 1580](#) Incidental Catches of Salmonids by U.S. Groundfish Fisheries in the
 Bering Sea/Aleutian Islands and the Gulf of Alaska, 1990-2014
[Doc. 1583](#) The Summer 2014 Japanese Salmon Research Cruise of the R/V
Hokko maru
[Doc. 1584](#) Results of 2014 Salmon Research by the *Oshoro maru*
[Doc. 1585](#) Preliminary Statistics for 2014 Commercial Salmon Catches in
 Japan
[Doc. 1586](#) Preliminary 2014 Salmon Enhancement Production in Japan
[Doc. 1588](#) Pacific Salmon Escapement Estimation Methods and Data for
 Alaska
[Doc. 1589](#) Canadian Juvenile Salmon Surveys in 2015-2016
[Doc. 1591](#) High Seas Salmonid Coded-Wire Tag Recovery Data, 2012-2014
[Doc. 1594](#) Provisional Abundance Estimates of Adult Hatchery and Wild Pink,
 Chum, and Sockeye Salmon by Region of the North Pacific,
 1952-2010

5. Development and Application of Stock Identification Methods and Models for Management of Pacific Salmon

- [Doc. 1517 \(Rev.1\)](#) Proposed Otolith Marks for Brood Year 2014 Salmon in Japan
[Doc. 1553](#) Marked Salmon Production by the Hatcheries of Russia in 2014
[Doc. 1555](#) Forecasting Pink Salmon Harvest in Southeast Alaska from Juvenile Salmon Abundance and Associated Biophysical Parameters: 2013 Returns and 2014 Forecast
- [Doc. 1568](#) Releases of Otolith Marked Salmon from Alaska in 2014
[Doc. 1569](#) Proposed Thermal Marks for Brood Year 2015 Salmon in Alaska
[Doc. 1571 \(Rev. 1\)](#) Russian Bibliography of 2014 Publications Linked to the Current NPAFC Science Plan
- [Doc. 1574](#) United States National Research Plan 2015
[Doc. 1576](#) Short Review of Next Generation Sequencing Software Used for Salmon Analyses - 2012-2014
- [Doc. 1578](#) Korean Research Plan for Salmon in 2015
[Doc. 1579](#) Otolith Thermal Mark for Brood Year 2014 and Proposed Thermal Marks for Brood Year 2015 Chum Salmon in Korea
- [Doc. 1582](#) Otolith Marked Salmon Released from Japan Between the Fall of 2013 and Spring of 2014
- [Doc. 1587](#) Proposed Otolith Marks for Brood Year 2015 Salmon in Japan
[Doc. 1591](#) High Seas Salmonid Coded-Wire Tag Recovery Data, 2012-2014
[Doc. 1592](#) Proposed Thermal Marks for Salmon from Canada, Brood Year 2015
- [Doc. 1593](#) SALOSIS Project: Associations Between Hydrographic Properties of the North Pacific Ocean and Salmon Catches on the High Seas Along 155°E, 175°E, and 145°W From 1988-2001

6. Other Topics

- [Doc. 1563](#) Cruise Plans of Japanese Research Vessels Involving Incidental Takes of Anadromous Fishes in the North Pacific Ocean in 2015
[Doc. 1566](#) Proposed Otolith Marks for Brood Year 2015 Salmon in Russia
[Doc. 1571 \(Rev. 1\)](#) Russian Bibliography of 2014 Publications Linked to the Current NPAFC Science Plan
- [Doc. 1581](#) Incidental Catches of Anadromous Fishes by Japanese Research Vessels in the North Pacific Ocean in 2014

Section 2. Documents (number, title) Listed by Country

Canada

- [Doc. 1575](#) Bibliography of Sockeye, Pink, and Chum Salmon Marine Growth- and Size-at-Age Publications
- [Doc. 1589](#) Canadian Juvenile Salmon Surveys in 2015-2016
- [Doc. 1592](#) Proposed Thermal Marks for Salmon from Canada, Brood Year 2015
- [Doc. 1593](#) SALOSIS Project: Associations Between Hydrographic Properties of the North Pacific Ocean and Salmon Catches on the High Seas Along 155°E, 175°E, and 145°W From 1988-2001

Also see below Joint Canada-United States [Doc. 1594](#)

Japan

- [Doc. 1517 \(Rev. 1\)](#) Proposed Otolith Marks for Brood Year 2014 Salmon in Japan
- [Doc. 1557](#) Proposed Cruise Plans of Japanese Research Vessels for Salmon in the North Pacific Ocean in 2015
- [Doc. 1563](#) Cruise Plans of Japanese Research Vessels Involving Incidental Takes of Anadromous Fishes in the North Pacific Ocean in 2015
- [Doc. 1581](#) Incidental Catches of Anadromous Fishes by Japanese Research Vessels in the North Pacific Ocean in 2014
- [Doc. 1582](#) Otolith Marked Salmon Released from Japan Between the Fall of 2013 and Spring of 2014
- [Doc. 1583](#) The Summer 2014 Japanese Salmon Research Cruise of the R/V *Hokko maru*
- [Doc. 1584](#) Results of 2014 Salmon Research by the *Oshoro maru*
- [Doc. 1585](#) Preliminary Statistics for 2014 Commercial Salmon Catches in Japan
- [Doc. 1586](#) Preliminary 2014 Salmon Enhancement Production in Japan
- [Doc. 1587](#) Proposed Otolith Marks for Brood Year 2015 Salmon in Japan

Republic of Korea

- [Doc. 1577](#) Korean Salmon Catch Statistics and Hatchery Releases in 2014-2015
- [Doc. 1578](#) Korean Research Plan for Salmon in 2015
- [Doc. 1579](#) Otolith Thermal Mark for Brood Year 2014 and Proposed Thermal Marks for Brood Year 2015 Chum Salmon in Korea

Russia

- [Doc. 1553](#) Marked Salmon Production by the Hatcheries of Russia in 2014
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United States

- [Doc. 1554](#) Annual Survey of Juvenile Salmon, Ecologically-Related Species, and Biophysical Factors in the Marine Waters of Southeastern Alaska, May–August 2013
- [Doc. 1555](#) Forecasting Pink Salmon Harvest in Southeast Alaska from Juvenile Salmon Abundance and Associated Biophysical Parameters: 2013 Returns and 2014 Forecast
- [Doc. 1556](#) Southeast Alaska Coastal Monitoring (SECM) Survey Plan for 2015
- [Doc. 1564](#) Gulf of Alaska Assessment Survey Plan for 2015
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- [Doc. 1570](#) United States Cruise Plan for Northern Bering Sea Surface Trawl Surveys, August-September 2015
- [Doc. 1573](#) United States Cruise Plan for BASIS on the NOAA Ship *Oscar Dyson*, September-October 2015
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- [Doc. 1576](#) Short Review of Next Generation Sequencing Software Used for Salmon Analyses - 2012-2014
- [Doc. 1580](#) Incidental Catches of Salmonids by U.S. Groundfish Fisheries in the Bering Sea/Aleutian Islands and the Gulf of Alaska, 1990-2014
- [Doc. 1588](#) Pacific Salmon Escapement Estimation Methods and Data for Alaska
- [Doc. 1591](#) High Seas Salmonid Coded-Wire Tag Recovery Data, 2012-2014

Also see below Joint Canada-United States [Doc. 1594](#)

Joint Canada-United States

- [Doc. 1594](#) Provisional Abundance Estimates of Adult Hatchery and Wild Pink, Chum, and Sockeye Salmon by Region of the North Pacific, 1952-2010

Section 3. Document Abstracts (numerical order)

Doc. 1517 (Rev. 1) Proposed Otolith Marks for Brood Year 2014 Salmon in Japan

Yasuo Tomida, Tsutomu Ohnuki, and Shigehiko Urawa

Japan plans to mark approximately 256 million salmon of the 2014 brood year (227 million chum, 24.5 million pink, 4.2 million masu, and 150 thousand sockeye salmon) using 95 discrete thermal patterns and two ALC (alizarin complexone) patterns at 46 hatcheries. Two rings in the first band are adopted as the base mark to distinguish Japanese chum and pink salmon from other stocks.

Doc. 1553 Marked Salmon Production by the Hatcheries of Russia in 2014

Elena Akinicheva, Vladimir Volobuev, and Evgeny Fomin

At Russian hatcheries salmon marking, as in previous years, is in general directed at evaluating the dynamics of number of hatchery raised salmon returns. In the recent years the main part of the hatchery raised salmon is marked in Sakhalin and Kurils region. The marking at hatcheries is conducted by two methods: thermal and “dry”. In 2014 the share of marked salmon in Sakhalin and Kurils made up 90.5%. It is connected with the fact that the major part of the hatcheries (38) is located in Sakhalin and Kurils and only 19 are in the other regions of the Far East.

Doc. 1554 Annual Survey of Juvenile Salmon, Ecologically-Related Species, and Biophysical Factors in the Marine Waters of Southeastern Alaska, May–August 2013

Joseph A. Orsi and Emily A. Fergusson

Juvenile Pacific salmon (*Oncorhynchus* spp.), ecologically-related species, and associated biophysical data were collected from the marine waters of the northern region of southeastern Alaska (SEAK) in 2013. This annual survey, conducted by the Southeast Coastal Monitoring (SECM) project, marks 17 consecutive years of systematically monitoring how juvenile salmon utilize marine ecosystems during a period of climate change. The survey was implemented to identify the relationships between year-class strength of juvenile salmon and biophysical parameters that influence their habitat use, marine growth, prey fields, predation, and stock interactions. Thirteen stations were sampled monthly in epipelagic waters from May to August (total of 23 sampling days). Fish, zooplankton, surface water samples, and physical profile data were collected during daylight at each station using a surface rope trawl, Norpac and bongo nets, a water sampler, and a conductivity-temperature-depth profiler. Surface (3-m) temperatures and salinities ranged from approximately 7 to 16 °C and 16 to 32 PSU across inshore, strait, and coastal habitats for the four months. A total of 25,730 fish and squid, representing 27 taxa, were captured in 98 rope trawl hauls fished from June to August. Juvenile salmon comprised approximately 94% of the total fish catch with the exception of one large haul of capelin ($n = 10,452$). Juvenile pink (*O. gorbuscha*), chum (*O. keta*), sockeye (*O. nerka*), and coho (*O. kisutch*) salmon occurred in 57-84% of the hauls by month and habitat, while juvenile Chinook salmon (*O. tshawytscha*) occurred in 34% of the hauls. Abundance of juvenile salmon was moderate in 2013; peak CPUE occurred in July in strait and coastal habitats. Coded-wire tags were recovered from 20 coho salmon and 14 Chinook salmon, mainly including hatchery and wild stocks originating in SEAK and captured in strait habitat; an additional 20 adipose-clipped individuals without tags (presumably originating from the Pacific Northwest) were recovered mainly in coastal habitat. Alaska enhanced stocks comprised 59%, 19%, and < 1% of chum, sockeye, and coho salmon, respectively. Predation on juvenile salmon was observed in 3 of 11 fish species examined. The long term seasonal time series of SECM juvenile salmon stock assessment and biophysical data is used in conjunction with basin-scale ecosystem metrics to annually forecast pink salmon harvest

in SEAK. Long term seasonal monitoring of key stocks of juvenile salmon and associated ecologically-related species, including fish predators and prey, permits researchers to understand how growth, abundance, and interactions affect year-class strength of salmon during climate change in marine ecosystems.

Doc. 1555 Forecasting Pink Salmon Harvest in Southeast Alaska from Juvenile Salmon Abundance and Associated Biophysical Parameters: 2013 Returns and 2014 Forecast

Alex C. Wertheimer, Joseph A. Orsi, Emily A. Fergusson, and Molly V. Sturdevant

The Southeast Alaska Coastal Monitoring (SECM) project has been sampling juvenile salmon (*Oncorhynchus* spp.) and associated biophysical parameters in the northern region of Southeast Alaska (SEAK) annually since 1997 to better understand effects of environmental change on salmon production. A pragmatic application of the annual sampling effort is to forecast the abundance of adult salmon returns in subsequent years. Since 2004, peak juvenile pink salmon catch-per-unit-effort (CPUE_{cal}), adjusted for highly-correlated biophysical parameters, has been used to forecast adult pink salmon harvest (*O. gorbuscha*) in SEAK. The 2013 SEAK pink salmon harvest was an all-time record 94.7 million fish, the largest harvest since catch records were recorded dating back to 1900. The SECM forecast was for a strong harvest of 53.8 M fish, but the forecast was 43% lower than the actual record harvest. Eight of ten forecasts over the 2004-2013 period have been within 17% of the actual harvest, with an average forecast deviation of 7%. The forecast for 2013 joins the forecast of 2006 as exceptions to this degree of accuracy. In both of these years, the CPUE_{cal} model did correctly indicate the direction of the harvest trends (lower in 2006, higher in 2013), but underestimated the degree of these trends. These results show that the CPUE_{cal} information has great utility for forecasting year class strength of SEAK pink salmon, but additional information may be needed to avoid forecast “misses.” For the 2014 forecast, model selection included a review of ecosystem indicator variables and considered additional biophysical parameters to improve the simple single-parameter juvenile CPUE_{cal} forecast model. We also examined the use of a different CPUE parameter using catch per distance trawled, CPUE_{td}. The “best” forecast model for 2014 included two parameters, the Icy Strait Temperature Index (ISTI) and juvenile CPUE_{cal}. The 2014 forecast of 29.9 M fish from this model, using juvenile salmon data collected in 2013, had an 80% bootstrap confidence interval of 26-38 M fish.

Doc. 1556 Southeast Alaska Coastal Monitoring (SECM) Survey Plan for 2015

Joseph A. Orsi, Emily A. Fergusson, Ellen M. Yasumiishi, Edward V. Farley Jr., and Ron A. Heintz

This survey plan details the proposed sampling for the Southeast Coastal Monitoring (SECM) project in May, June, July, and August of 2015. A primary objective of this SECM research to study the habitat use and early marine ecology of juvenile (age-0) Pacific salmon (*Oncorhynchus* spp.) and associated epipelagic ichthyofauna in Southeast Alaska (SEAK) and in the Gulf of Alaska ecosystem. The SECM surveys have been continuous since 1997, and have provided long-term biological and oceanographic data sets associated with all five species of wild and hatchery salmon during a period of climate change. Ecosystem metrics from this SECM time series are currently used to develop pre-season forecast models for pink salmon (*O. gorbuscha*) harvest in SEAK and additionally contribute annual NOAA ecosystem consideration reports for Chinook salmon (*O. tshawytscha*), Sablefish (*Anoplopoma fimbria*), and zooplankton. The SECM project is currently supported by the Alaska Fisheries Science Center, Auke Bay Laboratories, along with supplemental funding from the Northern Fund of the Pacific Salmon Commission.

Doc. 1557

Proposed Cruise Plans of Japanese Research Vessels for Salmon in the North Pacific Ocean in 2015

Shigehiko Urawa, Shunpei Sato, and Toru Nagasawa

Two Japanese research vessels are scheduled to conduct high-seas salmon surveys. The FRA research vessel *Hokko maru* will carry out a summer monitoring survey for salmon and their habitat in the central Bering Sea. The Hokkaido University research vessel *Oshoro maru* will accomplish a salmon research in the western North Pacific Ocean in the middle May of 2015.

Doc. 1563

Cruise Plans of Japanese Research Vessels Involving Incidental Takes of Anadromous Fishes in the North Pacific Ocean in 2015

Fisheries Research Agency

Japanese research vessels are scheduled to conduct 15 high-seas surveys for pelagic fishes and squids in the North Pacific Ocean in 2015. These surveys have a possibility of incidental salmon catch during the fishing operations with driftnets, trawl or saury dip-net. In the case of driftnet operation, the length of driftnets will be less than 2.5 km at the sea.

Doc. 1564

Gulf of Alaska Assessment Survey Plan for 2015

Jamal H. Moss, Wesley W. Strasburger, and Casey W. Debenham

Scientists from the National Marine Fisheries Service (NMFS) will conduct a fisheries oceanographic survey within the southeastern region of the Gulf of Alaska (GOA) during summer of 2015 to provide key ecological data on the pelagic ecosystem, examine oceanographic transport mechanisms, lower trophic level production, age-0 marine fish distribution and energetic status, and juvenile salmon distribution and energetic status. Primary objectives of the survey will be to: (1) collect biological information on ecologically important marine fish and salmon and (2) describe the physical and biological conditions of the GOA.

Doc. 1565 (Rev. 1)

Biostatistical Information on Salmon Catches, Escapement and Enhancement Production in Russia in 2014

Nataliya V. Klovach, Olga S. Temnykh, V.A. Shevlyakov, Elena V. Golub, Albina N. Kanzeparova, Eugeny A. Shevlyakov, Alexander M. Kaev, and Vladimir V. Volobuev

Salmon catch (commercial, subsistence, and sport), average weights, hatchery releases, and escapement statistics for 2014 are presented.

Doc. 1566

Proposed Otolith Marks for Brood Year 2015 Salmon in Russia

Elena Akinicheva, Juliya Batyuk, Vladimir Volobuev, and Evgeny Fomin

Otolith marking of salmon of 2015 brood year will be conducted in five regions of the Far East: Kamchatka, Magadan, Sakhalin, Khabarovsk and Kuril regions. Marking will be carried out using two methods: thermal and “dry”. Their application will be determined by the possibilities and specificity of water supply of incubated embryos at hatcheries of the Far East. The dominating method of marking will be a “dry” one – it will be used on the 75% of salmon hatcheries. Salmon will be marked at 30 hatcheries. Totally 39 otolith marks will be used.

Doc. 1568

Releases of Otolith Marked Salmon from Alaska in 2014

Dion S. Oxman

In Alaska, mass-marking of salmon using otolith thermal marking is an effective research and management tool for a variety of situations. This document reports the otolith mark patterns applied to hatchery-raised salmon stocks released in Alaska during 2014. It includes five species

Doc. 1573

**United States Cruise Plan for BASIS on the NOAA Ship
Oscar Dyson, September-October**

Alex Andrews

This cruise plan outlines the dates, locations, and activities of a fisheries oceanographic survey conducted in the southeastern Bering Sea during late summer and fall 2015. This survey is in part a continuation of the Bering Aleutian Salmon International Survey (BASIS). The primary objectives are to collect biological information on important fish species and describe the physical and biological oceanographic conditions in the southeastern Bering Sea.

Doc. 1574

United States National Research Plan 2015

Auke Bay Laboratories

The United States identified the following research plans that reflect the five research components identified under the NPAFC Science Plan for 2011-2015 “Forecast of Pacific Salmon Production in the Ocean Ecosystems under Changing Climate”. (1) Migration and survival mechanisms of juvenile salmon in ocean ecosystems; (2) Climate impacts on salmon production in the Bering Sea and adjacent waters (BASIS); (3) Winter survival of Pacific salmon in Pacific Ocean ecosystems; (4) Biological monitoring of key salmon populations; (5) Development and applications of stock identification methods and models for management of Pacific salmon.

Doc. 1575

**Bibliography of Sockeye, Pink, and Chum Salmon Marine
Growth- and Size-at-Age Publications**

Athena D. Ogden and James R. Irvine

We provide a list of documents, with abstracts (when available) that use time series of annual growth or size-at-age for marine age classes of sockeye, pink and chum salmon, focusing on time series that exceeded ten years. Our documents are mainly peer-reviewed journals and NPAFC/INPFC documents, but include a small number of publications from other sources. Section 1 assembles articles that review salmon marine growth- or size-at-age. Section 2 lists articles with length or weight time series of return-at-age or catch-at-age. Section 3 lists methodological papers for quantifying growth increments. Section 4, our focus, assembles articles that provide indices of marine growth for at least one age class; all of these studies were based on size estimates from scale annuli measurements. Readers are encouraged to advise us of relevant documents not included in this bibliography.

Doc. 1576

**Short Review of Next Generation Sequencing Software Used
for Salmon Analyses - 2012-2014**

Jeffrey R. Guyon

Next generation DNA sequencing (NGS) methodologies have enabled the sequencing of massive amounts of DNA at low costs. The use of this technique for the genetic analysis of Pacific salmon is becoming more common. This is a short review of some of the software used in recent papers and contains a small example analysis using steelhead RNA-seq data. This review is provided to help share statistical techniques for analysis of genetic data on high seas anadromous stocks.

Doc. 1577

**Korean Salmon Catch Statistics and Hatchery Releases
in 2014-2015**

Kwan Eui Hong, Ju Kyoung Kim, and Do Hyeon Lee

Total catch of chum salmon was 144,341 fish or 411.3 metric tons in 2014. The total number of chum salmon fry released was 27,670 thousand fish in 2015 (2014 brood).

Doc. 1578

Korean Research Plan for Salmon in 2015

Kwan Eui Hong, Ju Kyoung Kim, and Do Hyeon Lee

Salmon are political resources due to the characteristics of transboundary distribution and economic importance. The interest in chum salmon biology in Korea was much increased since the establishment of the Yangyang Salmon Station of Korea Fisheries Resources Agency in the 1980s. The enhancement program of chum salmon has been expanded thereafter, so that chum salmon were transplanted 18 streams in the coast of the Korean Peninsula. On the other hand, however, the ecological research on salmon species was very limited until recently due to the lack of research program. Though the involvement to the North Pacific Anadromous Fisheries Commission (NPAFC) requires scientific investigation on salmon research of each member nation, the conspicuous increase in research funding was not achieved. Oceanic environments have been rapidly altered by climate change during the last a few decades and ocean ecosystems including salmon populations will be modified under the global warming situation. Especially, a special intention is needed for stocks in southern boundary of distribution such as Korean chum salmon. Research will be conducted to reveal the mechanisms of mass mortality of chum salmon during their early life in rivers and coastal areas in conjunction with the fluctuation of return rates. Climate change effects on salmon distribution, migration route, and abundance will be investigated. Otolith thermal marking on Korea chum salmon will be carried out to provide information about growth, survival during the early ocean life stage, and hatchery origins from 2014 release (2013 brood). For the stock identification, we will develop new multiplex PCR set using microsatellite loci of chum salmon to investigate genetic variation and population structure of Korean populations. Genetic structure of non-anadromous and anadromous cherry salmon populations will be investigated using mitochondrial DNA to collect baseline data for the strategy of conservation and management.

Doc. 1579

Otolith Thermal Mark for Brood Year 2014 and Proposed Thermal Marks for Brood Year 2015 Chum Salmon in Korea

Kwan Eui Hong, Ju Kyoung Kim, and Seung Min Yoon

Korea released 6.2 million and 7.0 million thermal marked chum salmon in March 2014 and 2015, respectively. The marks were 3,2,1H (6.0 million), 3,4,2H (0.2 million) for 2014 (2013BY) and 3,3nH (6.0 million), 3,1,4nH (1.0 million) for 2015 (2014BY). We will mark approximately 7.5 million chum salmon in BY 2015, which covers about 50% ~60% of release of BY 2015 chum salmon at Namdae-cheon and Wangpi-cheon (river). Chum salmon will be marked at 2 different hatcheries (Yangyang Hatchery and Uljin Hatchery) using 2 thermal marks.

Doc. 1580

Incidental Catches of Salmonids by U.S. Groundfish Fisheries in the Bering Sea/Aleutian Islands and the Gulf of Alaska, 1990-2014

Gwynne M. Schnaittacher and Renold E. Narita

This report presents the estimated incidental catches and average weights of Pacific salmonids in U.S. groundfish fisheries off Alaska from 1977 through 2014. Estimated annual incidental salmon catches (all species combined) in 2014, were 242,224 salmon in the Bering Sea/Aleutian Islands (BSAI) and 18,822 salmon in the Gulf of Alaska (GOA).

Annual estimated numbers of Chinook salmon (*Oncorhynchus tshawytscha*) incidentally caught in the U.S. groundfish fisheries in the BSAI, have ranged from 8,223 (year 2000) to 129,568 (year 2007) and the annual average weight has ranged from 2.60 kg in 2011 to 5.21 kg in 1995. Annual estimated numbers of non-Chinook salmon have ranged from 14,423 in 2010 to 709,387 in 2005. Chum salmon (*O. keta*) typically account for over 95% of the non-Chinook salmon catch. The annual average chum salmon weight has ranged from 2.07 kg in 1993 to 3.43 kg in 1995.

hundred chum salmon and nine Chinook salmon were tagged with disk tags and released in the Bering Sea. Among the tagged fish, 18 large chum salmon and seven large Chinook salmon were equipped with DST magnetic tags and pop-up satellite archival tags, respectively.

Doc. 1584

Results of 2014 Salmon Research by the *Oshoro maru*

*Naoki Hoshi, Keiichiro Sakaoka, Takuzo Abe, Maki Ohwada,
Keiri Imai, and Shogo Takagi*

In order to accumulate oceanographic and biological data (including salmonids) and to clarify the oceanic structure and marine ecosystem, the T/V *Oshoro maru* conducted oceanographic observations and fishing surveys in the western North Pacific (along the 155°E longitude line). The survey was conducted during the Cruise #269 in May 2013.

Twelve oceanographic observations and one drift gillnet survey were conducted along the 155°E during the Cruise #269 in May. The Polar Front was observed in the vicinity of 43°N which were shifted south slightly and not clear than the location in previous years. A total of 515 salmonids was caught by gillnet surveys, including 488 pink and 27 chum salmon. Pink salmon was the dominant species. The fork lengths (F.L.) of chum salmon collected by C-gear gillnet ranged between 474-648 mm F.L., and those of pink salmon ranged between 297-470 mm FL; 88.6% of chum salmon caught along 155°E were adult fish.

To collect salmon samples extensively and to collect fresh salmon blood and various tissues, three surface long-line and three hook-and-line gear samplings were conducted during the Cruise #269. Almost all of caught by these gears were pink salmon but restricted the north point (OSSL1401), caught one sockeye salmon and chum salmon was the dominant species. A total of one sockeye, fourteen chum, and 48 pink salmon were collected during the Cruise #269.

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Preliminary Statistics for 2014 Commercial Salmon Catches in Japan

Yukihiro Hirabayashi, Toshihiko Saito, and Toru Nagasawa

The commercial catches in coastal and offshore areas of Japan in 2014 totaled 43.3 million fish (144 thousand metric tons), including 40.9 million chum (140 thousand metric tons) and 2.4 million pink (three thousand metric tons) salmon. The official specific statistics data may be available by the end of March 2016.

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Preliminary 2014 Salmon Enhancement Production in Japan

Ayumi Nakashima and Yukihiro Hirabayashi

Four species of anadromous Pacific salmon (chum, pink, masu, and sockeye salmon) are currently enhanced in Japan. A total of 1,903 million fry, juveniles and smolts were released from Japanese hatcheries in 2014. Number of chum salmon fry released in the spring of 2014 was approximately 1,768 million fish. Japanese hatcheries also released approximately 123 million pink salmon fry, 11,944 thousand masu salmon fry, juveniles and smolts, and 194 thousand sockeye salmon fry and smolts in the spring and fall of 2014.

In 2014, the number of adult salmon captured in rivers along the Japanese coasts was 4,402 thousand fish, which corresponded to 15,022 metric tonnes in weight. The dominant and second dominant species were chum and pink salmon, contributing 93.8% and 6.0% in numbers of all salmon captured in rivers, respectively. Adult masu salmon occur in rivers of both Hokkaido and Honshu, but number of catches was not available in Honshu. The number of adult masu salmon caught in rivers of Hokkaido was approximately 5.7 thousand fish. Anadromous sockeye salmon were caught in three rivers along the Pacific coast of Hokkaido, where the number of catches was 273 fish.

quality and methodology are briefly discussed. We encourage NPAFC member nations to examine these data and the methods used to generate them with a view to generating revised estimates before the next annual meeting. If consensus on abundance estimates in numbers of hatchery and wild salmon can be reached, we recommend that numbers be converted to biomass in order to better understand the role of individual species in the ecosystem. Ultimately, it would be useful for member nations to report estimates of hatchery and wild salmon abundance, including escapement and catch, annually.
