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Rev.

Abstracts of Scientific Documents Submitted to the Commission for the 2018 CSRS Meeting

by

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Abstracts of Scientific Documents Submitted to the Commission for the 2018 CSRS Meeting

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Keywords: Pacific salmon, status of salmon and steelhead, North Pacific Ocean, technologies, management, information systems, NPAFC Science Plan, International Year of the Salmon (IYS)

This document is a compilation of abstracts of new and revised scientific documents submitted to the Commission between adjournment of the 2017 Annual Meeting and April 20, 2018. The compilation is organized into three sections.

Section 1 lists the document number and title according to the research themes in the NPAFC Science Plan 2016–2020 (Doc. 1665) to "understand variations in Pacific salmon productivity in a changing climate".

(1) Status of Pacific Salmon and Steelhead Trout
(2) Pacific Salmon and Steelhead Trout in a Changing North Pacific Ocean
(3) New Technologies
(4) Management Systems
(5) Integrated Information Systems

For convenience, one more topic was added:

(6) Other Topics

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

Section 2 lists the document number and title according to the country that submitted the document. Documents submitted by CSRS working groups are also listed in this section.

Section 3 lists abstracts of documents in order of document number.

Documents submitted during the specified time period include 46 new documents, and two revised documents in 2017 and 2018 before the meeting for a total of 48 documents. Including all the submitted documents (n=48), 24 documents related to status of Pacific salmon and Steelhead trout, 19 documents related to Pacific salmon and Steelhead trout in a changing North Pacific Ocean, 23 documents related to new technologies, nine documents related to management system, 11 documents related to integrated information system, and 10 related to other topics. Of the 48 documents, nine were submitted by Canada, 12 by Japan, five by Korea, six by Russia, 13 by the United States, and three by Working Groups.

Section 1. Documents (number, title) Listed by Research Themes of the NPAFC Science Plan 2016–2020

1. Status of Pacific Salmon and Steelhead Trout

Doc. 1696 (Rev. 2) Proposed Otolith Marks for Brood Year 2017 Salmon in Japan

Doc. 1739 Annual Survey of Juvenile Salmon, Ecologically-Related Species, and Biophysical Factors in the Marine Waters of Southeastern Alaska, May–August 2015

Doc. 1747 Trawl Survey Plans for Pacific Salmon Marine Life Period Studies in the Far Eastern Seas in 2018

Doc. 1749 Biostatistical Information on Salmon Catch, Escapement and Enhancement Production in Russia in 2017

Doc. 1750 Report of the 2018 International Year of the Salmon North Pacific Working Group Meeting

Doc. 1752 Microsatellite Identification of Sockeye Salmon Rearing in the South Central Bering Sea During Summer 2017

Doc. 1753 Russian Bibliography Publications Linked to the NPAFC Science Plan in 2017

Doc. 1756 United States Cruise Plan for the Southeastern Bering Sea Surface and Pelagic Trawl Survey, August–September 2018

Doc. 1761 Preliminary Statistics for 2017 Commercial Salmon Catches in Japan

Doc. 1762 Preliminary 2017 Salmon Enhancement Production in Japan

Doc. 1764 Proposed Otolith Marks for Brood Year 2018 Salmon in Japan

Doc. 1766 Japanese Bibliography in 2017 for NPAFC Science Plan

Doc. 1767 Decreasing Area of Chum Salmon (*Oncorhynchus keta*) Distribution in the North Pacific in Summer 1982–2016

Doc. 1770 Report of the 2018 International Year of the Salmon North Pacific Steering Committee Meeting

Doc. 1771 Annual Survey of Juvenile Salmon, Ecologically-Related Species, and Biophysical Factors in the Marine Waters of Southeastern Alaska, May–August 2016

Doc. 1773 Korean Salmon Catch Statistics and Hatchery Releases in 2017–2018

Doc. 1774 Korean Research Plan for Salmon in 2018

Doc. 1778 Canadian Salmon Catch and Enhanced Salmon Production in 2016 and 2017

Doc. 1779 Canadian Juvenile Salmon Surveys in 2018–2019

Doc. 1780 Proposed Thermal Marks for Salmon from Canada, Brood Year 2018

Doc. 1785 United States National Research Plan 2018

Doc. 1787 Canadian Bibliography of 2012–2018 Publications Linked to the 2016–2020 NPAFC Science Plan

Doc. 1789 Releases of Otolith Marked Salmon from Canada in 2017

Doc. 1791 Canadian Research Planned for 2018/19 Relevant to the 2016–2020 NPAFC Science Plan

2. Pacific Salmon and Steelhead Trout in a Changing North Pacific Ocean

Doc. 1740	Forecasting Pink Salmon Harvest in Southeast Alaska from Juvenile Salmon Abundance and Associated Biophysical Parameters: 2015 Returns and 2016 Forecast
Doc. 1750	Report of the 2018 International Year of the Salmon North Pacific Working Group Meeting
Doc. 1753	Russian Bibliography Publications Linked to the NPAFC Science Plan in 2017
Doc. 1756	United States Cruise Plan for the Southeastern Bering Sea Surface and Pelagic Trawl Survey, August–September 2018
Doc. 1760	Results of 2017 Salmon Research by the *Oshoro maru*
Doc. 1765	The Summer 2017 Japanese Salmon Research Cruise of the R/V *Hokko maru*
Doc. 1766	Japanese Bibliography in 2017 for NPAFC Science Plan
Doc. 1767	Decreasing Area of Chum Salmon (*Oncorhynchus keta*) Distribution in the North Pacific in Summer 1982–2016
Doc. 1770	Report of the 2018 International Year of the Salmon North Pacific Steering Committee Meeting
Doc. 1772	Forecasting Pink Salmon Harvest in Southeast Alaska from Juvenile Salmon Abundance and Associated Biophysical Parameters: 2016 Returns and 2017 Forecast
Doc. 1774	Korean Research Plan for Salmon in 2018
Doc. 1778	Canadian Salmon Catch and Enhanced Salmon Production in 2016 and 2017
Doc. 1782	Southeast Alaska Coastal Monitoring Survey Plan for 2018
Doc. 1784	United States Cruise Plan for Northern Bering Sea Surface Trawl Surveys, August–September 2018
Doc. 1785	United States National Research Plan 2018
Doc. 1787	Canadian Bibliography of 2012–2018 Publications Linked to the 2016–2020 NPAFC Science Plan
Doc. 1788	The Hakai Institute Juvenile Salmon Program: Early Life History Drivers of Marine Survival in Sockeye, Pink and Chum Salmon in British Columbia, Canada
Doc. 1790	Juvenile Salmon Migration Dynamics in the Discovery Islands and Johnstone Strait; 2015–2017
Doc. 1791	Canadian Research Planned for 2018/19 Relevant to the 2016–2020 NPAFC Science Plan

3. New Technologies

Doc. 1750	Report of the 2018 International Year of the Salmon North Pacific Working Group Meeting
Doc. 1753	Russian Bibliography Publications Linked to the NPAFC Science Plan in 2017
Doc. 1754 (Rev.1)	Proposed Thermal Marks for Brood Year 2018 Salmon in Alaska
Doc. 1755	Releases of Otolith Marked Salmon from Alaska in 2017
Doc. 1757	Progress Report: Interactive Mapping System for the INPFC/NPAFC High-Seas Salmonid Tag-Recovery Database
Doc. 1758	Recoveries of High Seas Tags and Tag Releases from High Seas Research Vessel Surveys in 2017
Doc. 1763	Releases of Otolith Marked Salmon from Japan between Summer of 2016 and Spring of 2017

Doc. 1766 Japanese Bibliography in 2017 for NPAFC Science Plan
Doc. 1767 Decreasing Area of Chum Salmon (*Oncorhynchus keta*) Distribution in the North Pacific in Summer 1982–2016
Doc. 1768 Marked Salmon Production by the Hatcheries of Russia in 2017
Doc. 1769 Proposed Otolith Marks for Brood Year 2018 Salmon in Russia
Doc. 1770 Report of the 2018 International Year of the Salmon North Pacific Steering Committee Meeting
Doc. 1774 Korean Research Plan for Salmon in 2018
Doc. 1775 Otolith Thermal Mark for Brood Year 2017 and Proposed Thermal Marks for Brood Year 2018 Chum Salmon in Korea
Doc. 1776 Genetic Structure of Returning Chum Salmon (*Oncorhynchus keta*) Populations Inferred from 10 Microsatellite DNA Marker
Doc. 1777 Genetic Structure of Cherry Salmon (*Oncorhynchus masou*) Populations Inferred from Mitochondrial DNA Variation
Doc. 1781 High Seas Salmonid Coded-Wire Tag Recovery Data, 2016–2017
Doc. 1783 The Process of Developing Standardized Scale Age Estimation Protocols for Chinook Salmon
Doc. 1785 United States National Research Plan 2018
Doc. 1787 Canadian Bibliography of 2012–2018 Publications Linked to the 2016–2020 NPAFC Science Plan
Doc. 1788 The Hakai Institute Juvenile Salmon Program: Early Life History Drivers of Marine Survival in Sockeye, Pink and Chum Salmon in British Columbia, Canada
Doc. 1790 Juvenile Salmon Migration Dynamics in the Discovery Islands and Johnstone Strait; 2015–2017
Doc. 1791 Canadian Research Planned for 2018/19 Relevant to the 2016–2020 NPAFC Science Plan

4. Management Systems

Doc. 1750 Report of the 2018 International Year of the Salmon North Pacific Working Group Meeting
Doc. 1753 Russian Bibliography Publications Linked to the NPAFC Science Plan in 2017
Doc. 1757 Progress Report: Interactive Mapping System for the INPFC/NPAFC High-Seas Salmonid Tag-Recovery Database
Doc. 1766 Japanese Bibliography in 2017 for NPAFC Science Plan
Doc. 1770 Report of the 2018 International Year of the Salmon North Pacific Steering Committee Meeting
Doc. 1774 Korean Research Plan for Salmon in 2018
Doc. 1785 United States National Research Plan 2018
Doc. 1787 Canadian Bibliography of 2012–2018 Publications Linked to the 2016–2020 NPAFC Science Plan
Doc. 1791 Canadian Research Planned for 2018/19 Relevant to the 2016–2020 NPAFC Science Plan

5. Integrated Information Systems

Doc. 1750 Report of the 2018 International Year of the Salmon North Pacific Working Group Meeting
Doc. 1753 Russian Bibliography Publications Linked to the NPAFC Science Plan in 2017

Doc. 1757	Progress Report: Interactive Mapping System for the INPFC/NPAFC High-Seas Salmonid Tag-Recovery Database
Doc. 1758	Recoveries of High Seas Tags and Tag Releases from High Seas Research Vessel Surveys in 2017
Doc. 1766	Japanese Bibliography in 2017 for NPAFC Science Plan
Doc. 1770	Report of the 2018 International Year of the Salmon North Pacific Steering Committee Meeting
Doc. 1774	Korean Research Plan for Salmon in 2018
Doc. 1781	High Seas Salmonid Coded-Wire Tag Recovery Data, 2016–2017
Doc. 1785	United States National Research Plan 2018
Doc. 1787	Canadian Bibliography of 2012–2018 Publications Linked to the 2016–2020 NPAFC Science Plan
Doc. 1791	Canadian Research Planned for 2018/19 Relevant to the 2016–2020 NPAFC Science Plan

6. Other Topics

Doc. 1741	Proposed Cruise Plans of Japanese Research Vessels for Salmon in the North Pacific Ocean in 2018
Doc. 1742	Cruise Plans of Japanese Research Vessels Involving Incidental Takes of Anadromous Fish in the North Pacific Ocean in 2018
Doc. 1748	Cruise Plan of Russian Research Vessel *Professor Levanidov* Involving Incidental Takes of Anadromous Fish in the North Pacific Ocean in 2018
Doc. 1750	Report of the 2018 International Year of the Salmon North Pacific Working Group Meeting
Doc. 1753	Russian Bibliography Publications Linked to the NPAFC Science Plan in 2017
Doc. 1759	Incidental Catches of Anadromous Fishes by Japanese Research Vessels in the North Pacific Ocean in 2017
Doc. 1766	Japanese Bibliography in 2017 for NPAFC Science Plan
Doc. 1770	Report of the 2018 International Year of the Salmon North Pacific Steering Committee Meeting
Doc. 1774	Korean Research Plan for Salmon in 2018
Doc. 1787	Canadian Bibliography of 2012–2018 Publications Linked to the 2016–2020 NPAFC Science Plan

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

Canada

Doc. 1752	Microsatellite Identification of Sockeye Salmon Rearing in the South Central Bering Sea During Summer 2017
Doc. 1778	Canadian Salmon Catch and Enhanced Salmon Production in 2016 and 2017
Doc. 1779	Canadian Juvenile Salmon Surveys in 2018–2019
Doc. 1780	Proposed Thermal Marks for Salmon from Canada, Brood Year 2018
Doc. 1787	Canadian Bibliography of 2012–2018 Publications Linked to the 2016–2020 NPAFC Science Plan
Doc. 1788	The Hakai Institute Juvenile Salmon Program: Early Life History Drivers of Marine Survival in Sockeye, Pink and Chum Salmon in British Columbia, Canada
Doc. 1789	Releases of Otolith Marked Salmon from Canada in 2017
Doc. 1790	Juvenile Salmon Migration Dynamics in the Discovery Islands and Johnstone Strait; 2015–2017
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Japan

Doc. 1696 (Rev. 2)	Proposed Otolith Marks for Brood Year 2017 Salmon in Japan
Doc. 1741	Proposed Cruise Plans of Japanese Research Vessels for Salmon in the North Pacific Ocean in 2018
Doc. 1742	Cruise Plans of Japanese Research Vessels Involving Incidental Takes of Anadromous Fish in the North Pacific Ocean in 2018
Doc. 1759	Incidental Catches of Anadromous Fishes by Japanese Research Vessels in the North Pacific Ocean in 2017
Doc. 1760	Results of 2017 Salmon Research by the *Oshoro maru*
Doc. 1761	Preliminary Statistics for 2017 Commercial Salmon Catches in Japan
Doc. 1762	Preliminary 2017 Salmon Enhancement Production in Japan
Doc. 1763	Releases of Otolith Marked Salmon from Japan between Summer of 2016 and Spring of 2017
Doc. 1764	Proposed Otolith Marks for Brood Year 2018 Salmon in Japan
Doc. 1765	The Summer 2017 Japanese Salmon Research Cruise of the R/V *Hokko maru*
Doc. 1766	Japanese Bibliography in 2017 for NPAFC Science Plan
Doc. 1767	Decreasing Area of Chum Salmon (*Oncorhynchus keta*) Distribution in the North Pacific in Summer 1982–2016

Republic of Korea

Doc. 1773	Korean Salmon Catch Statistics and Hatchery Releases in 2017–2018
Doc. 1774	Korean Research Plan for Salmon in 2018
Doc. 1775	Otolith Thermal Mark for Brood Year 2017 and Proposed Thermal Marks for Brood Year 2018 Chum Salmon in Korea

Doc. 1776 Genetic Structure of Returning Chum Salmon (*Oncorhynchus keta*) Populations Inferred from 10 Microsatellite DNA Marker
Doc. 1777 Genetic Structure of Cherry Salmon (*Oncorhynchus masou*) Populations Inferred from Mitochondrial DNA Variation

Russia

Doc. 1747 Trawl Survey Plans for Pacific Salmon Marine Life Period Studies in the Far Eastern Seas in 2018
Doc. 1748 Cruise Plan of Russian Research Vessel *Professor Levanidov* Involving Incidental Takes of Anadromous Fish in the North Pacific Ocean in 2018
Doc. 1749 Biostatistical Information on Salmon Catch, Escapement and Enhancement Production in Russia in 2017
Doc. 1753 Russian Bibliography Publications Linked to the NPAFC Science Plan in 2017
Doc. 1768 Marked Salmon Production by the Hatcheries of Russia in 2017
Doc. 1769 Proposed Otolith Marks for Brood Year 2018 Salmon in Russia

United States

Doc. 1739 Annual Survey of Juvenile Salmon, Ecologically-Related Species, and Biophysical Factors in the Marine Waters of Southeastern Alaska, May–August 2015
Doc. 1740 Forecasting Pink Salmon Harvest in Southeast Alaska from Juvenile Salmon Abundance and Associated Biophysical Parameters: 2015 Returns and 2016 Forecast
Doc. 1754 (Rev.1) Proposed Thermal Marks for Brood Year 2018 Salmon in Alaska
Doc. 1755 Releases of Otolith Marked Salmon from Alaska in 2017
Doc. 1756 United States Cruise Plan for the Southeastern Bering Sea Surface and Pelagic Trawl Survey, August–September 2018
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Doc. 1772 Forecasting Pink Salmon Harvest in Southeast Alaska from Juvenile Salmon Abundance and Associated Biophysical Parameters: 2016 Returns and 2017 Forecast
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Doc. 1782 Southeast Alaska Coastal Monitoring Survey Plan for 2018
Doc. 1783 The Process of Developing Standardized Scale Age Estimation Protocols for Chinook Salmon
Doc. 1784 United States Cruise Plan for Northern Bering Sea Surface Trawl Surveys, August–September 2018
Doc. 1785 United States National Research Plan 2018

CSRS Working Groups

Doc. 1750	Report of the 2018 International Year of the Salmon North Pacific Working Group Meeting
Doc. 1758	Recoveries of High Seas Tags and Tag Releases from High Seas Research Vessel Surveys in 2017
Doc. 1770	Report of the 2018 International Year of the Salmon North Pacific Steering Committee Meeting

Section 3. Document Abstracts (numerical order)

Doc. 1696 (Rev. 2) **Proposed Otolith Marks for Brood Year 2017 Salmon in Japan**

Tadayoshi Tojima, Motoyasu Kuwaki, and Shigehiko Urawa

Japan plans to mark approximately 404 million salmon of the 2017 brood year (262 million chum, 138 million pink, 3.5 million masu, and 230 thousand sockeye salmon) using 123 discrete thermal patterns and two ALC (alizarin complexone) patterns at 55 hatcheries. Two rings in the first band are adopted as the base mark to distinguish Japanese chum and pink salmon from other stocks.

Doc. 1739 **Annual Survey of Juvenile Salmon, Ecologically-Related Species, and Biophysical Factors in the Marine Waters of Southeastern Alaska, May–August 2015**

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 2015. This annual survey, conducted by the Southeast Coastal Monitoring (SECM) project, marks 19 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. Up to 13 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, bongo nets, a water sampler, and a conductivity-temperature-depth profiler. Surface (3-m) temperatures and salinities ranged from approximately 8 to 15 ºC and 15 to 32 PSU across inshore, strait, and coastal habitats for the four months. A total of 17,228 fish and squid, representing 25 taxa, were captured in 92 rope trawl hauls fished from June to August. Juvenile salmon comprised approximately 89% of the catch. Over all months and habitats, juvenile pink (*O. gorbuscha*), chum (*O. keta*), sockeye (*O. nerka*), and coho (*O. kisutch*) salmon occurred in 51–92% of the hauls, while juvenile Chinook salmon (*O. tshawytscha*) occurred in about 22% of the hauls. Abundance of juvenile salmon was low in 2015; peak CPUE occurred in June strait and coastal habitats. Coded-wire tags were recovered from 51 juvenile coho salmon and five juvenile and immature Chinook salmon, that primarily originated from hatchery and wild stocks in SEAK sampled in the strait habitat; an additional 18 adipose-clipped juvenile salmon without tags were present. The only non-Alaskan stocks were recovered off Icy Point, a juvenile Chinook salmon from the Willamette River, OR and a juvenile coho salmon from the Satsop River, Washington. Of the juvenile salmon examined for otolith marks, Alaska enhanced stocks comprised 56% of the juvenile chum (373 of 663) and 38% of the juvenile sockeye salmon (202 of 532). Of the 380 potential predators of juvenile salmon, predation on juvenile salmon was not observed in the six 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 in marine ecosystems during a period of rapid climate change.

Doc. 1740 **Forecasting Pink Salmon Harvest in Southeast Alaska from Juvenile Salmon Abundance and Associated Biophysical Parameters: 2015 Returns and 2016 Forecast**

Alex C. Wertheimer, Joseph A. Orsi, Emily A. Fergusson, and Andrew Gray

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 SECM forecast was for an excellent odd-year harvest of 54.5 M fish. However, the actual 2015 SEAK harvest was 35.1 million fish, the lowest odd-year harvest since 1997. Thus the 2015 SECM forecast was 56% over the actual harvest. Nine of 12 forecasts over 2004–2015 have been within 20% of the actual harvest, with an average forecast deviation of 9%. Most (66%) of the harvest was in northern SEAK, consistent with strong returns in more northerly regions of the Gulf of Alaska, e.g., Prince William Sound and Kodiak. For the 2016 forecast, model selection included a review of ecosystem indicator variables and consideration of additional biophysical parameters to improve the simple single-parameter juvenile CPUE forecast model. Two measures of CPUE were examined for forecast efficacy: $CPUE_{cal}$, the time series of CPUE calibrated for changes in sampling vessels; and $CPUE_{ttd}$, catch per distance trawled. An alternative model using the regression of harvest and the average ranks of select ecosystem indicators, was also considered. The "best" forecast model for 2016 included two parameters, the ecosystem rank index and a measure of May water temperatures in Icy Strait. The 2016 forecast from this model, using juvenile salmon data collected in 2015, was 30.4 M with an 80% regression model prediction interval of 16-45 M fish.

Doc. 1741 **Proposed Cruise Plans of Japanese Research Vessels for Salmon in the North Pacific Ocean in 2018**

Kengo Suzuki, Shunpei Sato, Shigehiko Urawa, and Masa-aki Fukuwaka

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 training vessel *Oshoro maru* will accomplish two salmon researches in the western North Pacific Ocean in middle May, and the North Pacific Ocean and the Bering Sea between late June and late July 2018.

Doc. 1742 **Cruise Plans of Japanese Research Vessels Involving Incidental Takes of Anadromous Fish in the North Pacific Ocean in 2018**

Japan Fisheries Research and Education Agency

Japanese research vessels (Appendix table) are scheduled to conduct ten surveys for pelagic fishes and squids in the North Pacific Ocean in 2018 (Table 1). These surveys have a possibility of incidental salmon catch during the fishing operations with driftnets or trawl net. In the case of driftnet operation, the length of driftnets will be less than 2.5 km at the sea.

Doc. 1747 **Trawl Survey Plans for Pacific Salmon Marine Life Period Studies in the Far Eastern Seas in 2018**

Alexander N. Starovoytov and Olga S. Temnykh

Two Russian research vessels are scheduled to conduct salmon surveys in summer and fall 2018. R/V *Professor Kaganovsky* will carry out a summer monitoring survey in the Pacific waters off Kuril Islands in June-July. The primary objectives are to collect biological information on plankton and nekton communities, and describe the physical and biological oceanographic conditions in this region. The major purpose of these studies is the estimation of anadromous

Pacific salmon abundance and biomass for short-term forecasting of their returns and possible catches on the coasts of the Sea of Okhotsk.
Two Russian research vessels *Professor Levanidov* and *Professor Kaganovsky* will carry out salmon surveys in fall 2018 in the southern Okhotsk Sea. The major purpose of these studies is the estimation of Pacific salmon juvenile's abundance for forecasting of their returns and possible catch in the next years. A similar salmon survey will be performed by R/V *Professor Levanidov* in the western part of the Bering Sea in September.

Doc. 1748 **Cruise Plan of Russian Research Vessel *Professor Levanidov* Involving Incidental Takes of Anadromous Fish in the North Pacific Ocean in 2018**

Alexander N. Starovoytov and Olga S. Temnykh

One Russian research vessel is scheduled to conduct epipelagic trawl survey in summer–fall in 2018. R/V *Professor Levanidov* will carry out a summer monitoring survey in the Pacific waters off Kuril Islands in August–September. The primary objectives are to collect biological information on plankton and nekton communities and describe the physical and biological oceanographic conditions in these regions. The major purpose of these studies is the estimation of Pacific mackerel, Japanese pilchard, mature and immature Pacific salmon and other nekton species abundance and biomass.

Doc. 1749 **Biostatistical Information on Salmon Catch, Escapement and Enhancement Production in Russia in 2017**

Klovach N.V., Temnykh O.S., Shevlyakov V.A., Lysenko A.V., Golub E.V., Burlak O.V., Shevlyakov E.A., Kaev A.M., Golovanov I.S.

Salmon catch (commercial, subsistence, and sport catch), average weights, hatchery releases, and escapement statistics for 2017 are provided.

Doc. 1750 **Report of the 2018 International Year of the Salmon North Pacific Working Group Meeting**

International Year of the Salmon Working Group

The International Year of the Salmon Working Group (IYS-WG) met on February 5 & 8, 2018, first at the Pacific Salmon Commission (February 5) and then at the Blue Horizon Hotel (February 8), both in Vancouver, BC, Canada. The purpose of the first day of the meeting (February 5) was to plan for the IYS high seas cruise that is scheduled to occur in 2019. The purpose of the second day (February 8) was to consider the progress made during the North Pacific Steering Committee (NPSC) Meeting held during the previous two days (February 6–7) and to determine the next steps of the IYS-WG with respect to the development of IYS research and outreach plans that reflect NPAFC priorities.

Doc. 1752 **Microsatellite Identification of Sockeye Salmon Rearing in the South Central Bering Sea During Summer 2017**

Terry D. Beacham, Colin Wallace, and Shunpei Sato

Stock composition of sockeye salmon (*Oncorhynchus nerka*) caught in the southern central Bering Sea during a Japanese research cruise in the summer of 2017 was estimated through an analysis of microsatellite variation. Variation at 14 microsatellites was analyzed for immature sockeye salmon, and a 415-population baseline spanning Japan, Russia, Alaska, Canada, and Washington State was used to determine the stock composition of the fish sampled. Alaskan-origin sockeye salmon were the most abundant in the catch of immature individuals, comprising 82.0% of all sockeye salmon caught, with the catch dominated by sockeye salmon of Bristol Bay origin (69.0%). Canadian-origin salmon accounted for an average of 14.6% of the catch, while Russian-origin sockeye salmon accounted for 2.5% of the catch, with 535 individuals of the catch

genotyped. The research surveys have potentially provided an early indication that the return of Fraser River sockeye salmon in 2018 may rival or exceed that observed in 2010.

Doc. 1753 **Russian Bibliography Publications Linked to the NPAFC Science Plan in 2017**

A.N. Kanzeparova, O.S. Temnykh, V.A. Shevlyakov, A.V. Bugaev, N.V. Klovach, V.V. Volobuev, E.V. Golub, V.I. Ostrovsky

The current bibliography lists original papers published in 2017 by Russian scientists and their collaborators relevant to the 2017–2020 NPAFC Science Plan as well as other salmon studies. The bibliography lists 85 papers, corresponding mainly to the 3 key research components of the NPAFC Science Plan: 1) Status of Pacific Salmon and Steelhead Trout; 2) Pacific Salmon and Steelhead Trout in a Changing North Pacific Ocean; 3) New Technologies. Publications are listed in alphabetic order, because most of them are relevant to several components. The references are given with abstracts if papers included abstracts in English. Otherwise, they are listed without abstracts.

Doc. 1754 (Rev. 1) **Proposed Thermal Marks for Brood Year 2018 Salmon in Alaska**

Dion S. Oxman

In Alaska, mass-marking of salmon using otolith thermal marking is an effective research and management tool applicable to a variety of situations. For brood year 2018, approximately 62 million sockeye, 940 million pink salmon, 710 million chum, 9 million coho, and 9 million Chinook salmon will be marked at 26 different hatcheries using 107 thermal marks, four dry marks, and one strontium mark.

Doc. 1755 **Releases of Otolith Marked Salmon from Alaska in 2017**

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 2017. It includes five species of salmon from brood years 2015 through 2016. Release numbers, mark patterns, and release locations are summarized.

Doc. 1756 **United States Cruise Plan for the Southeastern Bering Sea Surface and Pelagic Trawl Survey, August–September 2018**

Alexander G. III Andrews and Elizabeth C. Siddon

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 2018. 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. 1757 **Progress Report: Interactive Mapping System for the INPFC/NPAFC High-Seas Salmonid Tag-Recovery Database**

Sabrina J. Larsen and Dion S. Oxman

Corresponding to the 2016–2020 NPAFC Science Plan and the International Year of the Salmon initiative that identifies Integrated Information Systems as a research theme, the Alaska Department of Fish and Game Mark, Tag, and Age Laboratory in collaboration with the Working Group of Salmon Marking is developing an online Interactive Mapping System for the effective use of the INPFC/NPAFC High-Seas Salmonid Tag-Recovery Database. By providing a dynamic display of information, the IMS helps users visualize and understand the ocean distribution and movement patterns of Pacific salmon and steelhead trout through geographical representation of

tag recovery data. Users can employ interactive tools to display tag recovery data (by species, age class, maturity, origin, and season), and compare tag recoveries to environmental data (sea surface temperature, chlorophyll) within the IMS.

Doc. 1758 **Recoveries of High Seas Tags and Tag Releases from High Seas Research Vessel Surveys in 2017**

Working Group on Salmon Marking

In late July and early August 2017, tagging operations were conducted by the Japanese R/V *Hokko maru*, and 48 chum salmon and six sockeye salmon were released with tags in the Bering Sea. Among them, seven chum salmon were equipped with DST magnetic tag. Other tagging experiments were conducted by US scientists, in which 40 Chinook salmon were tagged with PSATs and released in Kachemak Bay near the Kenai Peninsula (n=20), Alaska in March 2017 and Unalaska Bay in the Aleutian Islands (n=20) in October–November 2017. Although no recovery of disc and DST magnetic tags released in the summer Bering Sea was reported in 2017, archived tag data were retrieved via the Argos satellite system from 19 PSATs that were attached to Chinook salmon in Kachemak Bay. The remaining 20 PSATs deployed in Unalaska Bay are still attached to free swimming Chinook salmon.

Doc. 1759 **Incidental Catches of Anadromous Fishes by Japanese Research Vessels in the North Pacific Ocean in 2017**

Kengo Suzuki and Shigehiko Urawa

Japanese research vessels conducted scientific fishing operations to assess stock status of Pacific saury, and other pelagic fishes and squids using surface and midwater trawls, and drift gillnets in the western and central North Pacific Ocean (Japan Fisheries Research and Education Agency 2017). A total of 388 salmon including 139 chum, 92 pink, 119 coho, two Chinook salmon, and 36 steelhead trout was incidentally caught during the research surveys between June and October 2017 (Table 1).

Doc. 1760 **Results of 2017 Salmon Research by the *Oshoro maru***

Taichi Sato, Keiichiro Sakaoka, Yoshiyuki Kajiwara, Keiri Imai, Naoki Hoshi, Maki Ohwada, Yuta Inagaki, 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) and Bering Sea. The survey was conducted during the Cruise #039 in May, and the Cruise #040-Leg2, 4 from June to July 2017.

Oceanographic observations and drift gillnet surveys were conducted along the 155°E during the Cruise #039. No significant shift from the last year was confirmed for the Polar Front observed in the vicinity of 44°N.

A total of 1,945 salmonids was caught by gillnet surveys, including 1,896 Pink, 49 Chum salmons. Other species such as Steelhead and Sockeye salmon were not caught this year by the gillnet surveys. The fork lengths (F.L.) of chum salmon collected by C-gear gillnet ranged between 272-551 mm F.L., and those of pink salmon ranged between 322-495 mm F.L., 100% of Pink salmons caught along 155°E were adult fish.

To collect salmon samples extensively and to collect fresh salmon blood, otoliths and various tissues, three hook-and-line gear samplings and a surface long-line sampling were conducted during the Cruise #040-Leg2, 4 as well as the Cruise #039. The dominant species caught by these gears during the Cruise #040 were pink salmon (61 pink, 18 sockeye, 6 chum, 3 coho and 1 Chinook salmon).

Doc. 1761 **Preliminary Statistics for 2017 Commercial Salmon Catches in Japan**

Yukihiro Hirabayashi and Toshihiko Saito

The commercial catches in coastal and offshore areas of Japan in 2017 totaled 22.2 million fish (70.9 thousand metric tonnes), including 20.4 million chum (67.6 thousand metric tonnes) and 1.8 million pink (2.6 thousand metric tonnes) salmon (Tables 1, 2). The official specific statistics data may be available by the end of March 2019.

Doc. 1762 **Preliminary 2017 Salmon Enhancement Production in Japan**

Hiroaki Fukuzawa and Yukihiro Hirabayashi

Four species of anadromous Pacific salmon (chum, pink, masu, and sockeye) are currently enhanced in Japan. A total of 1,760 million fry, juveniles and smolts were released from Japanese hatcheries in 2017 (Tables 1 and 2). Number of chum salmon fry released in the spring of 2017 was approximately 1,630 million fish. Japanese hatcheries also released 121 million pink salmon fry, 8,986 thousand masu salmon fry, juveniles and smolts, and 82 thousand sockeye salmon fry and smolts in the spring and fall of 2017.

In 2017, the number of adult salmon captured in rivers along the Japanese coasts was 2,762 thousand fish (Table 3), which corresponded to 8,992 metric tonnes in weight (Table 4). The dominant and second dominant species were chum and pink salmon, contributing 93.2% and 6.7% 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 3.4 thousand fish. Anadromous sockeye salmon were caught in two rivers along the Pacific coast of Hokkaido, where the number of catches was 381 fish.

Doc. 1763 **Releases of Otolith Marked Salmon from Japan between Summer of 2016 and Spring of 2017**

Tadayoshi Tojima, Motoyasu Kuwaki, and Shigehiko Urawa

This document provided information of Japanese otolith mark releases, including release site, date, number, and mark patterns with images. From November 2016 to June 2017, approximately 244 million chum, 28.8 million pink, and 2.6 million masu salmon, 24 thousand sockeye salmon (2016 brood year) with thermal marks or ALC (alizarin complexone) patterns were released or stocked in Japan. In addition, 374 thousand masu salmon smolts and 58 thousand sockeye salmon smolts (2015 brood year) with thermal marks were released in the spring of 2017. In the summer and fall of 2016, 418 thousand masu salmon juveniles (2015 brood year) with thermal marks were also released. Two thermal rings as base mark were adopted to distinguish Japanese chum and pink salmon from other stocks. The data are uploaded to the database on the website of NPAFC Working Group on Salmon Marking (http://wgosm.npafc.org/).

Doc. 1764 **Proposed Otolith Marks for Brood Year 2018 Salmon in Japan**

Tadayoshi Tojima, Motoyasu Kuwaki, and Shigehiko Urawa

Japan plans to mark approximately 377 million salmon of the 2018 brood year (235 million chum, 138 million pink, 3.6 million masu, and 150 thousand sockeye salmon) using 122 discrete thermal patterns and two ALC (alizarin complexone) patterns at 55 hatcheries. Two rings in the first band are adopted as the base mark to distinguish Japanese chum and pink salmon from other stocks.

Doc. 1765 **The Summer 2017 Japanese Salmon Research Cruise of the R/V *Hokko maru***

Kentaro Honda, Shunpei Sato, Tomoki Sato, Azusa Yoshida, Tomoki Yamanaka, and Kengo Suzuki

A summer high-seas research cruise to investigate the biology of Pacific salmon was conducted from July 24 to August 2 in the Bering Sea aboard the Japanese research vessel *Hokko maru*. Research cruise activities included the collection of data on oceanography, zooplankton, micronekton, salmonids, and other organisms. In addition, seawater samples were collected for environmental DNA analysis. A total of 4,065 salmonids were caught by surface trawls (excluding a test trawl) and angling at 17 monitoring stations. Chum salmon was the most abundant species (n = 3,112, 76.6%), followed by sockeye salmon (n = 846, 20.8%), pink salmon (n = 58, 1.43%), Chinook salmon (n = 38, 0.93%), coho salmon (n = 9, 0.22%), and Dolly Varden (n = 2, 0.05%). Salmonids were measured with respect to fork length and body and gonad weights by sex, and the scales were removed for age determination. Isotope, genetic, otolith, stomach, and seawater samples were obtained for future study. A total of six sockeye salmon and 48 chum salmon were tagged with disk tags and were released in the Bering Sea. Among them, seven large chum salmon were released with an archival tag. Age-specific catch per unit effort by surface trawl and annual mean body weight of each ocean age of chum salmon during 2007–2017 are documented here.

Doc. 1766 **Japanese Bibliography in 2017 for NPAFC Science Plan**
Shunpei Sato, Masa-aki Fukuwaka, and Shigehiko Urawa

This bibliography listed original papers and documents published in 2017 by Japanese scientists and/or their collaborators to review Japanese national researches for the 2016–2020 NPAFC Science Plan. The bibliography includes 33 articles with abstracts, corresponding to five research themes of the NPAFC Science Plan.

Doc. 1767 **Decreasing Area of Chum Salmon (*Oncorhynchus keta*) Distribution in the North Pacific in Summer 1982–2016**
Tomonori Azumaya, Ekuo Sato, and Shigehiko Urawa

The area of chum salmon (*Oncorhynchus keta*) distribution in the North Pacific in summer from 1982 to 2016 was annually estimated using sea surface temperature (SST). Long term trends of SST in the North Pacific in summer were positive except for the United States west coast area. The maximum positive trend was about 0.07°C/year. In summer, SST in the whole North Pacific, except for the United States west coast, was warming so that the southern limit of chum salmon distribution has shifted northward. The interannual change in area of chum salmon distribution in summer had a statistically significant negative trend ($P<0.01$) which was about -30,000 km^2/year to -40,000 km^2/year. It is found that the area of chum salmon distribution in the North Pacific in summer has decreased approximately 10% during the last 35 years.

Doc. 1768 **Marked Salmon Production by the Hatcheries of Russia in 2017**
Elena Akinicheva, Vladimir Volobuev, Aleksey Yamborko, and Maksim Myakishev

As in the preceding years, the main aim of the hatcheries salmon marking in Russia is to evaluate numbers of hatchery-reared salmon returns. In recent years the basic part of juvenile salmon has been reared and marked at Sakhalin. Two methods were used for hatcheries marking: thermal (Munk et al., 1993) and "dry" (Safronenkov et al., 1999). In 2017, the percentage of marked salmon juveniles in Sakhalin region was 80.3% of the total Russian release of marked juveniles. This is caused by the location of hatcheries, a large number of which (38) are located at Sakhalin and only 19 hatcheries in other regions of the Russian Far East.

Doc. 1769 **Proposed Otolith Marks for Brood Year 2018 Salmon in Russia**
Elena Akinicheva, Vladimir Volobuev, Aleksey Yamborko, and Maksim Myakishev

Otolith marking of salmon of 2018 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 69% of salmon hatcheries. Salmon will be marked at 28 hatcheries. Totally 34 otolith marks will be used.

Doc. 1770 **Report of the 2018 International Year of the Salmon North Pacific Steering Committee Meeting**

International Year of the Salmon Working Group

This report documents the proceedings of the 2018 meeting of the North Pacific Steering Committee (NPSC) that took place from February 6–7 in Vancouver, Canada, to provide direction regarding the implementation of the International Year of the Salmon (IYS). The NPSC is one of two basin-scale Steering Committees that provide direction to an IYS Coordinating Committee (CC) that in turn considers issues related to overall implementation of the IYS at the hemispheric scale. This was the second meeting of the NPSC. The agenda was supported by detailed discussion documents on overarching issues of concern to be considered at meetings of all three committees that were held over a two-week period in late January/early February 2018. These documents were developed at a Technical Meeting of a subset of CC members NPAFC Secretariat staff in December 2017.

The meeting highlighted continued support for the IYS. There was acknowledgement that the focus of the past year had been on building effective working relationships, and that a concerted effort will now be needed to meet our tight timeline for implementation. Through a series of breakout groups, plenary discussions, and some featured presentations from IYS partner organizations, NPSC participants made progress toward IYS implementation. Participants provided direction on IYS communication and outreach plans, including the website, key messages, social media, opening events/activities, and an outreach planning workshop. There were presentations on proposed IYS signature projects and participants provided feedback on research planning under the IYS themes. The NPSC agreed to move ahead with the Japanese delegation's proposal of Theme Counsel Groups to be inclusive and efficient in planning IYS activities. There was also discussion about the current budget and funding strategies, and participants agreed that the NPSC needed to move forward quickly with targeted fundraising.

Doc. 1771 **Annual Survey of Juvenile Salmon, Ecologically-Related Species, and Biophysical Factors in the Marine Waters of Southeastern Alaska, May–August 2016**

Emily A. Fergusson, Jordan Watson, Andrew Gray, and Jim Murphy

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 2016. This annual survey, conducted by the Southeast Coastal Monitoring (SECM) project, marks 20 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. Up to 13 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, bongo nets, a water sampler, and a conductivity-temperature-depth profiler. Surface (3-m) temperatures and salinities ranged from approximately 9 to 16 ºC and 16 to 32 PSU across inshore, strait, and coastal habitats for the four months. Integrated (top 20-m) temperatures and salinities ranged from approximately 8 to 15 ºC and 24 to 31 PSU, notably the warmest 20-m integrated temperatures recorded by the

SECM project. A total of 72,073 fish and squid, representing 27 taxa, were captured in 89 rope trawl hauls fished from June to August. Juvenile salmon comprised approximately 49% of the catch. For all months and habitats, juvenile pink (*O. gorbuscha*), chum (*O. keta*), sockeye (*O. nerka*), and coho (*O. kisutch*) salmon occurred in 58-87% of the hauls, while juvenile Chinook salmon (*O. tshawytscha*) occurred in about 18% of the hauls. Abundance of juvenile salmon was high in 2016; peak CPUE occurred in June strait and coastal habitats. Coded-wire tags were recovered from 28 juvenile coho, that primarily originated from hatchery and wild stocks in SEAK sampled in the strait habitat; an additional 17 adipose-clipped juvenile coho and Chinook salmon without tags were present. The only non-Alaskan stocks were juvenile coho salmon recovered off Icy Point, one from the Solduc River, WA and the other from the Methow River, Washington. Of the juvenile salmon examined for otolith marks, Alaska enhanced stocks comprised 69% of the juvenile chum (503 of 726) and 18% of the juvenile sockeye salmon (107 of 489). Of the 96 potential predators of juvenile salmon, predation on juvenile salmon was observed in three of eight 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 in marine ecosystems during a period of rapid climate change.

Doc. 1772 **Forecasting Pink Salmon Harvest in Southeast Alaska from Juvenile Salmon Abundance and Associated Biophysical Parameters: 2016 Returns and 2017 Forecast**

Alex C. Wertheimer, Joseph A. Orsi, Emily A. Fergusson, and James M. Murphy

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 2016 SEAK harvest was 18.4 million fish, the lowest even-year harvest since 2008. The SECM forecast was for a relatively strong harvest of 30.4 M fish, but ended up 65% higher than the actual harvest. The harvest was within the 80% prediction interval of the forecast, however. This is the fourth of 13 forecasts from 2004-2016 that have deviated more than 20% from the actual harvest. The poorer than expected returns of pink salmon in SEAK was consistent with poor pink salmon harvests for Alaska in general. Statewide harvest of pink salmon totaled 39 M fish, the lowest in 40 years. Most (89%) of the harvest was in southern SEAK, suggesting adverse ocean conditions had more affected on more northern and western pink salmon stocks entering the Gulf of Alaska. For the 2017 forecast, model selection included a review of ecosystem indicator variables and consideration of additional biophysical parameters to improve the simple single-parameter juvenile CPUE forecast model. Two measures of CPUE were examined for forecast efficacy: $CPUE_{cal}$, the time series of CPUE calibrated for changes in sampling vessels; and $CPUE_{ttd}$, catch per distance trawled. An alternative model using the regression of harvest and the average ranks of select ecosystem indicators, was also considered. The "best" forecast model for 2017 included two parameters, the $CPUE_{cal}$ and an index of spring/summer water temperatures in Icy Strait. The 2017 forecast from this model, using juvenile salmon data collected in 2016, was 46.2 M with an 80% bootstrap prediction interval of 28–64 M fish.

Doc. 1773 **Korean Salmon Catch Statistics and Hatchery Releases in 2017–2018**

Do Hyun Lee, Chung Il Lee, and Na Ri Kim

Total catch of chum salmon was 56,620 fish or 182.2 metric tons in 2017. The total fries of chum salmon released was 10,710 thousand fish in 2018 (2017 brood).

Doc. 1774 **Korean Research Plan for Salmon in 2018**

Cheul Ho Lee, Do Hyun Lee, and Ju Kyoung Kim

Salmon are political resources due to the characteristics of transboundary distribution and economic importance. The interest in chum salmon biology in Korea has been much increased since the establishment of the Inland Living Resources Center (former name: 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. More than 10 million fry salmon have been released every year since the 2000s. On the other hand, 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 country, the conspicuous increase in research funding was not achieved. Oceanic environment has been rapidly altered by climate change during the last a few decades and ocean ecosystems including salmon populations will be changed under the global warming situation. Especially, a special attention is needed for stocks in southern boundary of distribution such as Korean chum salmon.

Doc. 1775 **Otolith Thermal Mark for Brood Year 2017 and Proposed Thermal Marks for Brood Year 2018 Chum Salmon in Korea**

Ju Kyoung Kim, Chan Hyeok Jeon, and Seung Min Yoon

Korea released 7.6 million and 5.0 million thermal marked chum salmon in March 2017 and 2018, respectively. The marks were 3,2,1H (7.0 million), 3,4,2H (0.6 million) for 2017 (2016 BY) and 3,3nH (5.0 million) for 2018 (2017BY). Korea will mark approximately 5.0 million chum salmon in BY 2018, which cover about 50–60% of release of BY 2018 chum salmon at the Namdae River. Chum salmon will be marked at another hatchery (Yangyang Hatchery) using one thermal mark.

Doc. 1776 **Genetic Structure of Returning Chum Salmon (*Oncorhynchus keta*) Populations Inferred from 10 Microsatellite DNA Marker**

Sang Gyu Kim and Eun Ah Kim

Genetic structure of chum salmon (*Oncorhynchus keta*) was examined in a total of 1,208 samples collected from thirteen geographical groups by using 10 microsatellite DNA markers.

In Asia populations included five localities (the Myeongpa River, the Buk River, the Namdae River, the Yeongok River and the Taehwa River) on the east side of the Korean Peninsula and two localities (the Kushiro and the Tokushibetsu River) on the Hokkaido Island of Japan. In North America populations included six localities on the Alaska (Holokuk and Wells River) with United States (the Green River and the Hoodsport), and two localities of Canada (the Conurna and the Nimpkish River).

The results of genetic diversity analysis are shown in Table 1. The mean Na (number of alleles) ranged from 16.70 (the Wells River) to 23.60 (the Tokushibetsu River). The H_O (observed heterozygosity) and H_E (expected heterozygosity) per populations ranged from 0.686 (Wells River) to 0.780 (the Conurna River) and from 0.765 (the Wells River) to 0.836 (the Kushiro River), respectively. In addition, the mean PIC (polymorphism information content) index ranged from 0.747 (the Wells River) to 0.822 (the Kushiro River). In conclusion, the Wells River population showed lower than genetic diversity from between thirteen populations.

Doc. 1777 **Genetic Structure of Cherry Salmon (*Oncorhynchus masou*) Populations Inferred from Mitochondrial DNA Variation**

Sang Gyu Kim and Eun Ah Kim

Genetic structure of cherry salmon (*Onchorhynchus masou*) populations was examined by analyzing NADH dehydrogenase subunit 5 gene (553bp) of 364 individuals collected from 6 geographical groups: one localities (Gangwondo Gosung) on the demilitarized zone of the South Korea, four localities (the Shiribetsu River, the Shari River, the Ichani River and the Tokushibetsu River) on the Hokkaido Island, Japan and one locality on Russia. 11 haplotypes were defined. Haplotype and nucleotide diversities were greater in the populations in Japan and South Korea than in those in Russia. The most populations showed genetic differentiation ranged from 0.0677 to 0.0415($P< 0.05$) between geographical populations, respectively. However, the Tokushibetsu river and the Shari river populations showed no genetic differentiation ($P < 0.05$).

Doc. 1778 **Canadian Salmon Catch and Enhanced Salmon Production in 2016 and 2017**

Mary E. Thiess, Joan Bateman, Jason Parsley and Shelee Hamilton

This document reports final catch estimates for 2016 and preliminary catch estimates for 2017 for the six major salmon species in British Columbia (B.C.) and Yukon fisheries. Catch is reported for commercial fisheries (numbers and total weight) in tidal waters, and recreational (numbers only) and aboriginal fisheries (numbers only) in tidal and non-tidal waters. Catches include non-Canadian origin fish caught in B.C. and exclude Canadian origin fish caught in fisheries outside B.C. This document also summarizes release information for salmon including steelhead trout from Fisheries and Oceans Canada (DFO) and Freshwater Fisheries Society of BC enhancement facilities in BC in 2016 and 2017.

Doc. 1779 **Canadian Juvenile Salmon Surveys in 2018–2019**

Chrys-Ellen M. Neville and Jackie R. King

This document provides information on the juvenile salmon research surveys planned in both offshore and inshore areas of the North Pacific Ocean by Canada for fiscal year 2018–2019. The inshore program will conduct sampling in the Salish Sea (encompassing the Strait of Georgia and Puget Sound) whereas the offshore program will conduct sampling along of the continental shelf surrounding Vancouver Island (mid-summer) and on the continental shelf in southern Queen Charlotte Sound, into Queen Charlotte Strait and through Johnstone Strait (early summer and fall). These surveys are both part of long-term research programs that were initiated in 1997–1998, however in 2017 the offshore program began integrating with other pelagic research programs to develop a synoptic pelagic survey on the continental shelf off the west coast of Vancouver Island. This integrated survey will continue in 2018. In addition, in 2018 Canada will extend sampling in inside waters in early summer to include waters of Johnstone Strait and Queen Charlotte Strait.

Doc. 1780 **Proposed Thermal Marks for Salmon from Canada, Brood Year 2018**

Jeff Till

Thermal marking continues to play an important role for both stock, hatchery, and fisheries management and research in Canada. Canada plans to thermally mark approximately 73 million Pacific salmon for release in 2019/20. Thermal marking will include 63 thermal marks applied at 17 hatcheries with marked salmon released at 54 locations. The plan is similar to the 2017 brood year marking plan, fish planned for release in 2018/19 (DiNovo and Luedke 2017).

Doc. 1781 **High Seas Salmonid Coded-Wire Tag Recovery Data, 2016–2017**

Michele M. Masuda, Emily A. Fergusson, and Jamal H. Moss

Information on high seas recoveries of salmonids (*Oncorhynchus* spp.) tagged with coded-wire tags (CWTs) has been reported annually to the International North Pacific Fisheries Commission (1981–1992) and to the North Pacific Anadromous Fish Commission (1993–present). Data from these CWT recoveries are also reported to the Regional Mark Processing Center (RMPC, http://www.rmpc.org) of the Pacific States Marine Fisheries Commission (PSMFC) for inclusion in their Regional Mark Information System database. This document lists recovery data for 299 CWT salmonids not previously reported to the PSMFC/RMPC. These CWTs were recovered from 1) the U.S. groundfish trawl fisheries in the Gulf of Alaska (GOA) as sampled by observers of the North Pacific Groundfish and Halibut Observer Program (Observer Program) in 2016 (234 Chinook salmon [*O. tshawytscha*]), 2) the U.S. rockfish trawl fishery in the central GOA in 2017 (14 Chinook salmon), 3) U.S. trawl research in the GOA in 2016 (17 Chinook salmon and four coho salmon [*O. kisutch*]), 4) the U.S. groundfish trawl fisheries in the eastern Bering Sea-Aleutian Islands (BSAI) as sampled by observers of the Observer Program in 2016 (28 Chinook salmon), and 5) the U.S. groundfish trawl fisheries in the eastern BSAI as sampled in the SeaShare Donation Program in 2017 (two Chinook salmon).

Doc. 1782 **Southeast Alaska Coastal Monitoring Survey Plan for 2018**

James M. Murphy, Emily A. Fergusson, Jordan T. Watson, and Andrew K. Gray

This survey plan details the proposed sampling for the Southeast Coastal Monitoring (SECM) project during 2018. The primary objective of SECM research is to evaluate the status of the pelagic ecosystem including juvenile salmon (*Oncorhynchus* spp.) and other pelagic fish species in the northern region of Southeast Alaska. SECM surveys are conducted in support of Gulf of Alaska ecosystem assessments, research on the marine ecology of salmon and other pelagic fish resources in SEAK, and harvest forecast models for pink salmon (*O. gorbuscha*). SECM surveys will occur during monthly intervals from May to August, 2018 (Tables 1 and 2) within Southeast Alaska. Sampling will include surface trawl (Nordic 264) sampling for epi-pelagic fish, bongo net sampling for zooplankton, and CTD sampling for oceanographic data (Figure 1). Funding support for the 2018 survey is provided by the Northern Fund of the Pacific Salmon Commission and will be staffed by scientists from the Alaska Fisheries Science Center and the Alaska Department of Fish and Game.

Doc. 1783 **The Process of Developing Standardized Scale Age Estimation Protocols for Chinook Salmon**

Beverly A. Agler, Lorna I. Wilson, and Rich Brenner

Sustainable fisheries management of salmon populations includes estimating the age of returning fish, and these ages are typically obtained from scale patterns. Although regional offices within the Alaska Department of Fish and Game (ADF&G) have developed scale age estimation methods, these procedures are often undocumented or not updated, which may lead to inconsistent age estimates and increased variability within and among regional offices. Because the amount of variability is unknown, this could have negative impacts on salmon management. To improve the quality of scale age data, ADF&G, at the behest of the U.S. Chinook Technical Committee of the Pacific Salmon Commission, began comparing procedures used to estimate age of Chinook salmon in the Pacific Northwest and Alaska to determine whether they could be standardized. To accomplish this, ADF&G held a workshop to compare techniques for age estimation from scales, identify major challenges, and develop common terms. During this workshop, challenges to scale age estimation were documented, and participants concluded that procedures could be standardized over a broad geographic area.

As a result of the workshop, ADF&G began a comparison of the variability of Chinook salmon scale age estimates across Alaska. Once completed, these data will allow us to quantify the variability of age estimates and examine the effects of this variability on management parameters.

Ultimately, these efforts will contribute to more consistent scale age estimates through the development a standardized protocol and image library. In addition, insights gained from these initiatives can be used to develop standardized scale age estimation protocols and to increase communication among readers around the Pacific Rim.

Doc. 1784 **United States Cruise Plan for Northern Bering Sea Surface Trawl Surveys, August–September 2018**

Kristin Cieciel and Edward Farley

This survey plan details the proposed sampling of juvenile salmon and forge fish in the northern Bering Sea in August-September 2018. This represents a project that includes participation from the Alaska Department of Fish and Game (ADF&G), US Fish and Wildlife, and the Alaska Fisheries Science Center, Auke Bay Laboratories (ABL). This project builds upon prior surveys conducted in the northern Bering Sea and led by ABL.

Doc. 1785 **United States National Research Plan 2018**

National Oceanic and Atmospheric Administration

The United States identified the following research plans that reflect the five research components identified under the NPAFC Science Plan for 2016–2020 (NPAFC Doc. 1665): 1) Status of Pacific salmon and steelhead trout; 2) Pacific salmon and steelhead trout in a changing North Pacific Ocean; 3) New technologies; 4) Management systems; 5) Integrated information systems. The US refers to the Bering Arctic Subarctic Integrated Surveys (BASIS) throughout the document.

Doc. 1787 **Canadian Bibliography of 2012–2018 Publications Linked to the 2016–2020 NPAFC Science Plan**

J.R. Irvine, T. Beacham, M. Trudel, C. Neville, K. Dunmall, and S.C.H. Grant

The current bibliography lists publications in primary scientific journals and other documents published during 2012–2018 by Fisheries and Oceans Canada scientists and their collaborators relevant to the 2016–2020 NPAFC Science Plan. The bibliography lists 112 publications, many with abstracts, corresponding to three of the key research components of the NPAFC Science Plan.

Doc. 1788 **The Hakai Institute Juvenile Salmon Program: Early Life History Drivers of Marine Survival in Sockeye, Pink and Chum Salmon in British Columbia, Canada**

Brian P.V. Hunt, Brett T. Johnson, Sean C. Godwin, Martin Krkosek, Evgeny A. Pakhomov, Luke A. Rogers

The Hakai Institute Juvenile Salmon program is an ongoing initiative that was established in 2015 in partnership with the University of British Columbia, University of Toronto, Simon Fraser University and Salmon Coast Field Station. This program researches the early life history of juvenile salmon in coastal British Columbia. Primary research objectives are determining: 1) Migration timing rates and routes; 2) Migration habitat, including physical and chemical oceanographic conditions, and availability of plankton prey; 3) The impacts of prey phenology, quantity and quality on juvenile salmon growth and condition; 4) Species and stock specific feeding biology and competitive interactions; 5) Pathogen and parasite infection dynamics; and 6) Mortality estimates. The program targets Fraser River sockeye, and pink and chum salmon, but additionally provides information on coho, Chinook and herring through incidental capture. The field program operates between May and July during the peak of the juvenile sockeye outward migration. Purse seine and oceanographic sampling is conducted in the northern Strait of Georgia / Discovery Islands region (~ 220 km from the Fraser River mouth) and the Johnstone Strait /

Queen Charlotte Strait region (~ 180 km from the northern Strait of Georgia. As such, this program informs early life history across two critical legs of the Fraser salmon northward migration.

Doc. 1789 **Releases of Otolith Marked Salmon from Canada in 2017**

Jeff Till

Thermal mass marking of salmon has, for a number of years, played an important role in stock, hatchery, and both fisheries and research management within Canada. This document follows up on two previous documents outlining Canada's thermal marking proposals for brood years 2015 and 2016 (DiNovo and Luedke, 2015 and 2016). It summarizes all thermally marked salmonids released from BC hatcheries in 2017 by species, hatch mark, facility, release location and release number.

Doc. 1790 **Juvenile Salmon Migration Dynamics in the Discovery Islands and Johnstone Strait; 2015–2017**

Brett T. Johnson, Julian C.L. Gan, Carly V. Janusson, Brian P.V. Hunt

The majority of out-migrating juvenile Fraser River salmon (*Oncorhynchus spp.*) pass northwest through the Strait of Georgia, the Discovery Islands, and Johnstone Strait. The Discovery Islands to Johnstone Strait leg of the migration is a region of poor survival for sockeye salmon (*Oncorhynchus nerka)* relative to the Strait of Georgia. High resolution spatiotemporal measurements of migration timing and abundance of juvenile sockeye salmon and the relative species composition of co-migrating juvenile salmon are needed to understand the factors influencing early marine survival through this region. Here we report on migration dynamics in the Discovery Islands to Johnstone Strait region based on purse seine data collected by the Hakai Institute Juvenile Salmon Program from 2015–2017. The peak migration period in the Discovery Islands in which 50 % of sockeye passed through occurred between May 25 and June 4 and in Johnstone Strait between May 30 and June 12. Peak abundance was observed earlier than normal in 2015 and 2016, likely due to anomalously warm winter and spring weather. Sockeye migrated at 2.0 $BL \bullet s^{-1}$ between the Discovery Islands and Johnstone Strait based on the peak migration date in each region, faster than the 1.1 $BL \bullet s^{-1}$ observed in the Strait of Georgia. Sockeye abundance was much lower in 2017 compared to 2015 and 2016. Species composition was dominated by sockeye in 2015 and 2016, and by chum *(Oncorhynchus keta)* in 2017.

Doc. 1791 **Canadian Research Planned for 2018/19 Relevant to the 2016–2020 NPAFC Science Plan**

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This document summarises Canada's scientific research activities in relation to the 2016–2020 NPAFC Science Plan. The focus is on research activities planned by Canada during 2018/19 that are relevant to the Science Plan.
