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Abstracts of Scientific Documents Submitted to the Commission for the 2017 CSRS Meeting: Understand Variations in Pacific Salmon Productivity in a Changing Climate

by

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Abstracts of Scientific Documents Submitted to the Commission for the 2017 CSRS Meeting: Understand Variations in Pacific Salmon Productivity in a Changing Climate

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Keywords: status of salmon and steelhead, change, North Pacific, technologies, management, information systems, science plan

This document is a compilation of abstracts of new and revised scientific documents submitted to the Commission between adjournment of the 2016 Annual Meeting and April 28, 2017. 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 43 new documents (including two documents that were revised in 2017 before the meeting), plus two revised 2016 documents for a total of 45 documents. Including all the submitted documents (n=45), 21 documents related to status of Pacific salmon and Steelhead trout, 15 documents related to Pacific salmon and Steelhead trout in a changing North Pacific Ocean, 22 documents related to new technologies, five documents related to management system, eight documents related to integrated information system, and four related to other topics. Of the 45 documents, nine were submitted by Canada, 13 by Japan, four by Korea, nine by Russia, eight by the United States, and two 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. 736 (Rev. 2) Biostatistical Information on Salmon Catches, Escapement, Outmigrants Number and Enhancement Production in Russia in 2002

Doc. 1487 (Rev. 1) Biostatistical Information on Salmon Catches, Escapement and Enhancement Production in Russia in 2012

Doc. 1639 (Rev. 1) Proposed Otolith Marks for Brood Year 2016 Salmon in Japan

Doc. 1673 Japanese Salmon Research Under the NPAFC Science Plan 2016–2020

Doc. 1680 Trawl Survey Plans for Pacific Salmon Marine Life Period Studies in the Far Eastern Seas in 2017 by Russia

Doc. 1683 Microsatellite Identification of Sockeye Salmon Rearing in the Bering Sea During Summer 2016

Doc. 1693 Preliminary Statistics for 2016 Commercial Salmon Catches in Japan

Doc. 1694 Preliminary 2016 Salmon Enhancement Production in Japan

Doc. 1698 Japanese Bibliography in 2016 for NPAFC Science Plan

Doc. 1704 Russian Bibliography Publications Linked to the NPAFC Science Plan in 2016

Doc. 1705 United States National Research Plan 2017

Doc. 1707 Biochemical Composition and Energy Content of Salmonid Fish in the Sea of Okhotsk

Doc. 1708 Korean Salmon Catch Statistics and Hatchery Releases in 2016–2017

Doc. 1709 Korean Research Plan for Salmon in 2017

Doc. 1712 Report of the International Year of the Salmon North Pacific Steering Committee Meeting

Doc. 1714 Canadian Salmon Catch and Enhanced Salmon Production in 2015 and 2016

Doc. 1716 Summary of Non-coastal Salmon Catch Data from the North Pacific Ocean

Doc. 1721 Canadian Juvenile Salmon Surveys in 2017–2018

Doc. 1722 Fraser River Sockeye: Abundance and Productivity Trends and Forecasts

Doc. 1723 Proposed Thermal Marks for Salmon from Canada, Brood Year 2017

Doc. 1724 Biostatistical Information on Salmon Catches, Escapement and Enhancement Production in Russia in 2016

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

Doc. 1673 Japanese Salmon Research Under the NPAFC Science Plan 2016–2020

Doc. 1689 Results of 2016 Salmon Research in the Eastern Part of Okhotsk Sea by the R/V *MRTK-316*

Doc. 1692 Results of 2016 Salmon Research by the *Oshoro maru*

Doc. 1697	The Summer 2016 Japanese Salmon Research Cruise of the R/V *Hokko maru*
Doc. 1698	Japanese Bibliography in 2016 for NPAFC Science Plan
Doc. 1700	United States Cruise Plan for the Gulf of Alaska Assessment Survey for 2017
Doc. 1702	Southeast Alaska Coastal Monitoring Survey Plan for 2017
Doc. 1704	Russian Bibliography Publications Linked to the NPAFC Science Plan in 2016
Doc. 1705	United States National Research Plan 2017
Doc. 1707	Biochemical Composition and Energy Content of Salmonid Fish in the Sea of Okhotsk
Doc. 1709	Korean Research Plan for Salmon in 2017
Doc. 1712	Report of the International Year of the Salmon North Pacific Steering Committee Meeting
Doc. 1713	Climate and Density Effects on Growth of Chum Salmon in British Columbia, Canada (Extended Abstract)
Doc. 1714	Canadian Salmon Catch and Enhanced Salmon Production in 2015 and 2016
Doc. 1716	Summary of Non-coastal Salmon Catch Data from the North Pacific Ocean

3. New Technologies

Doc. 1647 (Rev. 2)	High Seas Salmonid Coded-Wire Tag Recovery Data, 2012, 2014–2015
Doc. 1673	Japanese Salmon Research Under the NPAFC Science Plan 2016–2020
Doc. 1686	Releases of Otolith Marked Salmon from Alaska in 2016
Doc. 1687	Proposed Thermal Marks for Brood Year 2017 Salmon in Alaska
Doc. 1688	Proposed Otolith Marks for Brood Year 2017 Salmon in Russia
Doc. 1690	Marked Salmon Production by the Hatcheries of Russia in 2016
Doc. 1695	Releases of Otolith Marked Salmon from Japan between Summer of 2015 and Spring of 2016
Doc. 1696	Proposed Otolith Marks for Brood Year 2017 Salmon in Japan
Doc. 1698	Japanese Bibliography in 2016 for NPAFC Science Plan
Doc. 1699	Homing Migration Route of Japanese Chum Salmon Estimated by a Data Storage Magnetic Tag
Doc. 1701	High Seas Salmonid Coded-Wire Tag Recovery Data, 2008, 2015–2016
Doc. 1703	Comparative Analysis of Microsatellite Markers on Coastal Western Alaska Chum Salmon Stocks
Doc. 1704	Russian Bibliography Publications Linked to the NPAFC Science Plan in 2016
Doc. 1705	United States National Research Plan 2017
Doc. 1706	Recoveries of High Seas Tags and Tag Releases from High Seas Research Vessel Surveys in 2016
Doc. 1707	Biochemical Composition and Energy Content of Salmonid Fish in the Sea of Okhotsk
Doc. 1709	Korean Research Plan for Salmon in 2017
Doc. 1710	Otolith Thermal Mark for Brood Year 2016 and Proposed Thermal Marks for Brood Year 2017 Chum Salmon in Korea

Doc. 1711	Genetic Structure of Returning Chum Salmon Population 2015 Inferred from Microsatellite DNA Marker
Doc. 1712	Report of the International Year of the Salmon North Pacific Steering Committee Meeting
Doc. 1717	Evaluating Models to Forecast Salmon Dynamics
Doc. 1718	Survey of Infectious Agents Detected in Juvenile Chinook and Sockeye Salmon from British Columbia and Washington

4. Management Systems

Doc. 1698	Japanese Bibliography in 2016 for NPAFC Science Plan
Doc. 1704	Russian Bibliography Publications Linked to the NPAFC Science Plan in 2016
Doc. 1705	United States National Research Plan 2017
Doc. 1709	Korean Research Plan for Salmon in 2017
Doc. 1712	Report of the International Year of the Salmon North Pacific Steering Committee Meeting

5. Integrated Information Systems

Doc. 1647 (Rev. 2)	High Seas Salmonid Coded-Wire Tag Recovery Data, 2012, 2014–2015
Doc. 1698	Japanese Bibliography in 2016 for NPAFC Science Plan
Doc. 1701	High Seas Salmonid Coded-Wire Tag Recovery Data, 2008, 2015–2016
Doc. 1704	Russian Bibliography Publications Linked to the NPAFC Science Plan in 2016
Doc. 1705	United States National Research Plan 2017
Doc. 1706	Recoveries of High Seas Tags and Tag Releases from High Seas Research Vessel Surveys in 2016
Doc. 1709	Korean Research Plan for Salmon in 2017
Doc. 1712	Report of the International Year of the Salmon North Pacific Steering Committee Meeting

6. Other Topics

Doc. 1678	Proposed Cruise Plans of Japanese Research Vessels for Salmon in the North Pacific Ocean in 2017
Doc. 1679	Cruise Plans of Japanese Research Vessels Involving Incidental Takes of Anadromous Fishes in the North Pacific Ocean in 2017
Doc. 1691	Incidental Catches of Anadromous Fishes by Japanese Research Vessels in the North Pacific Ocean in 2016
Doc. 1698	Japanese Bibliography in 2016 for NPAFC Science Plan

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

Canada

Doc. 1683	Microsatellite Identification of Sockeye Salmon Rearing in the Bering Sea During Summer 2016
Doc. 1713	Climate and Density Effects on Growth of Chum Salmon in British Columbia, Canada (Extended Abstract)
Doc. 1714	Canadian Salmon Catch and Enhanced Salmon Production in 2015 and 2016
Doc. 1716	Summary of Non-coastal Salmon Catch Data from the North Pacific Ocean
Doc. 1717	Evaluating Models to Forecast Salmon Dynamics
Doc. 1718	Survey of Infectious Agents Detected in Juvenile Chinook and Sockeye Salmon from British Columbia and Washington
Doc. 1721	Canadian Juvenile Salmon Surveys in 2017–2018
Doc. 1722	Fraser River Sockeye: Abundance and Productivity Trends and Forecasts
Doc. 1723	Proposed Thermal Marks for Salmon from Canada, Brood Year 2017

Japan

Doc. 1639 (Rev. 1)	Proposed Otolith Marks for Brood Year 2016 Salmon in Japan
Doc. 1673	Japanese Salmon Research Under the NPAFC Science Plan 2016–2020
Doc. 1678	Proposed Cruise Plans of Japanese Research Vessels for Salmon in the North Pacific Ocean in 2017
Doc. 1679	Cruise Plans of Japanese Research Vessels Involving Incidental Takes of Anadromous Fishes in the North Pacific Ocean in 2017
Doc. 1691	Incidental Catches of Anadromous Fishes by Japanese Research Vessels in the North Pacific Ocean in 2016
Doc. 1692	Results of 2016 Salmon Research by the *Oshoro maru*
Doc. 1693	Preliminary Statistics for 2016 Commercial Salmon Catches in Japan
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Doc. 1699	Homing Migration Route of Japanese Chum Salmon Estimated by a Data Storage Magnetic Tag

Republic of Korea

Doc. 1708	Korean Salmon Catch Statistics and Hatchery Releases in 2016-2017
Doc. 1709	Korean Research Plan for Salmon in 2017

Doc. 1710	Otolith Thermal Mark for Brood Year 2016 and Proposed Thermal Marks for Brood Year 2017 Chum Salmon in Korea
Doc. 1711	Genetic Structure of Returning Chum Salmon Population 2015 Inferred from Microsatellite DNA Marker

Russia

Doc. 736 (Rev. 2)	Biostatistical Information on Salmon Catches, Escapement, Outmigrants Number and Enhancement Production in Russia in 2002
Doc. 1487 (Rev. 1)	Biostatistical Information on Salmon Catches, Escapement and Enhancement Production in Russia in 2012
Doc. 1680	Trawl Survey Plans for Pacific Salmon Marine Life Period Studies in the Far Eastern Seas in 2017 by Russia
Doc. 1688	Proposed Otolith Marks for Brood Year 2017 Salmon in Russia
Doc. 1689	Results of 2016 Salmon Research in the Eastern Part of Okhotsk Sea by the R/V *MRTK-316*
Doc. 1690	Marked Salmon Production by the Hatcheries of Russia in 2016
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Doc. 1707	Biochemical Composition and Energy Content of Salmonid Fish in the Sea of Okhotsk
Doc. 1724	Biostatistical Information on Salmon Catches, Escapement and Enhancement Production in Russia in 2016

United States

Doc. 1647 (Rev. 2)	High Seas Salmonid Coded-Wire Tag Recovery Data, 2012, 2014–2015
Doc. 1686	Releases of Otolith Marked Salmon from Alaska in 2016
Doc. 1687	Proposed Thermal Marks for Brood Year 2017 Salmon in Alaska
Doc. 1700	United States Cruise Plan for the Gulf of Alaska Assessment Survey for 2017
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Doc. 1702	Southeast Alaska Coastal Monitoring Survey Plan for 2017
Doc. 1703	Comparative Analysis of Microsatellite Markers on Coastal Western Alaska Chum Salmon Stocks
Doc. 1705	United States National Research Plan 2017

CSRS Working Groups

Doc. 1706	Recoveries of High Seas Tags and Tag Releases from High Seas Research Vessel Surveys in 2016
Doc. 1712	Report of the International Year of the Salmon North Pacific Steering Committee Meeting

Section 3. Document Abstracts (numerical order)

Doc. 736 (Rev. 2) **Biostatistical Information on Salmon Catches, Escapement, Outmigrants Number and Enhancement Production in Russia in 2002**

Pacific Scientific Research Fisheries Center (TINRO-Center)

Salmon catch (commercial, subsistence, and sport), average weights, and hatchery releases statistics for 2002 are clarified.

Doc. 1487 (Rev.1) **Biostatistical Information on Salmon Catches, Escapement and Enhancement Production in Russia in 2012**

N.V. Klovach, O.S. Temnykh, V.A. Shevlyakov, A.V. Bugaev, A.M. Kaev, V.V. Volobuev

Escapement statistics for 2012 is clarified

Doc. 1639 (Rev. 1) **Proposed Otolith Marks for Brood Year 2016 Salmon in Japan**

Yasuo Tomida, Shuichi Toda, and Shigehiko Urawa

Japan plans to mark approximately 277 million salmon of the 2016 brood year (243.4 million chum, 25.5 million pink, 3.4 million masu, and 150 thousand sockeye salmon) using 110 discrete thermal patterns and four ALC (alizarin complexone) patterns at 49 hatcheries. Two rings in the first band are adopted as the base mark to distinguish Japanese chum and pink salmon from other stocks.

Doc. 1647 (Rev. 2) **High Seas Salmonid Coded-Wire Tag Recovery Data, 2012, 2014–2015**

Michele M. Masuda, Emily A. Fergusson, Jamal H. Moss, Casey Debenham, Joseph A. Orsi, James M. Murphy, Vanessa J. Tuttle, and Thomas Holland

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 480 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 (NPGHOP) in 2015 (102 Chinook salmon [O. tshawytscha] and 1 coho salmon [O. kisutch]), 2) the U.S. rockfish trawl fishery in the GOA in 2015 (27 Chinook salmon), 3) U.S. trawl research in the GOA in 2014 (46 Chinook salmon and 1 coho salmon), 4) the U.S. groundfish trawl fisheries in the eastern Bering Sea-Aleutian Islands (BSAI) as sampled by observers of the NPGHOP in 2015 (10 Chinook salmon), 5) salmon excluder device testing in the BSAI in 2015 (3 Chinook salmon), 6) U.S. trawl research in the northern Bering Sea in 2012 (3 Chinook salmon), 2014 (4 Chinook salmon), and 2015 (5 Chinook salmon), 7) the U.S. at-sea Pacific hake (Merluccius productus) trawl fishery in the North Pacific Ocean off Washington and Oregon in 2014 (170 Chinook salmon and 5 coho salmon) and 2015 (49 Chinook salmon), and 8) the U.S. West Coast Catch Shares fishery off Washington, Oregon, and California in 2014 (54 Chinook salmon). No new CWT recoveries from foreign high seas research have been reported to the PSMFC/RMPC since 2010.

Doc. 1673 **Japanese Salmon Research Under the NPAFC Science Plan 2016–2020**

Fisheries Agency of Japan

The 2016-2020 NPAFC Science Plan has defined its primary goal "Understand Variations in Pacific Salmon Productivity in a Changing Climate" with five research themes aligned with the International Year of the Salmon (IYS) initiatives (IYSWG 2016, SSC 2016). These research themes are: status of Pacific salmon and steelhead trout, Pacific salmon and steelhead trout in a changing North Pacific Ocean, new technologies, management systems, and integrated information systems. It is a high priority for Japanese salmon research to explain and forecast the annual variation of salmon production, corresponding to the new Science Plan themes. Japanese research consists of three components: (1) monitoring of major salmon populations, (2) salmon studies in the ocean, and (3) development and application of techniques for studying stock-specific distribution and abundance.

Doc. 1678 **Proposed Cruise Plans of Japanese Research Vessels for Salmon in the North Pacific Ocean in 2017**

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 research 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 early August 2017.

Doc. 1679 **Cruise Plans of Japanese Research Vessels Involving Incidental Takes of Anadromous Fishes in the North Pacific Ocean in 2017**

Japan Fisheries Research and Education Agency

Japanese research vessels (Appendix table) are scheduled to conduct nine surveys for pelagic fishes and squids in the North Pacific Ocean in 2017 (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. 1680 **Trawl Survey Plans for Pacific Salmon Marine Life Period Studies in the Far Eastern Seas in 2017 by Russia**

Olga S. Temnykh and Alexander N. Starovoytov

Two Russian research vessels are scheduled to conduct salmon surveys in summer and fall 2017. 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. R/V "*TINRO*" and R/V "*Professor Kaganovsky*" will operate respectively in the western Bering sea and in the southern Okhotsk Sea. The major purpose of these studies is the estimation of catadromous Pacific salmon abundance for forecasting of their returns and possible catch in the next years.

Doc. 1683 **Microsatellite Identification of Sockeye Salmon Rearing in the Bering Sea During Summer 2016**

Terry D. Beacham, Colin Wallace, Shunpei Sato, and Shigehiko Urawa

Stock composition of Sockeye Salmon (Oncorhynchus nerka) caught in the southern central Bering Sea during a Japanese research cruise in the summer of 2016 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 85.3% of all Sockeye Salmon caught, with the catch dominated by Sockeye Salmon of Bristol Bay origin (80.0%). Canadian-origin salmon accounted for an average of 3.3% of the catch, while Russian-origin Sockeye Salmon accounted for 11.3% of the catch, with 382 individuals of the catch genotyped.

Doc. 1686 **Releases of Otolith Marked Salmon from Alaska in 2016**
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 2016. It includes five species of salmon from brood years 2014 through 2016. Release numbers, mark patterns, and release locations are summarized.

Doc. 1687 **Proposed Thermal Marks for Brood Year 2017 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 2017, approximately 65 million sockeye, 942 million pink salmon, 740 million chum, 13 million Coho, and 9 million Chinook salmon will be marked at 26 different hatcheries using 101 thermal marks, three dry marks, and one strontium mark.

Doc. 1688 **Proposed Otolith Marks for Brood Year 2017 Salmon in Russia**
Elena Akinicheva, Vladimir Volobuev, Alexey Yamborko, and Maksim Myakishev

Mass-marking of juvenile Pacific salmon is an effective tool for fish origin identification at all stages of their life. In Russia, otolith-marking is used to obtain information on proportion of hatchery-reared fish in their commercial returns. Occurrence of marks on otoliths makes it possible to identify salmon from different hatcheries that is the most important thing for fish farmers. Besides, in Russia the researches on differentiation of hatchery and wild stocks salmon during their early sea life period have been conducted. This allows receiving information on distribution, movements and abundance of young salmon in the sea, and identifying salmon from different reproductive zones (Kamchatka, Sakhalin, Magadan, and Khabarovsk regions). Finding of marked salmon during their ocean feeding period allow us to define areas of distribution and to know more about migrations of the wild salmon.

Doc. 1689 **Results of 2016 Salmon Research in the Eastern Part of Okhotsk Sea by the R/V *MRTK-316***
Anton V. Klimov, Victor G. Erokhin, and Alexander V. Bugaev

The analysis brought new information on Pacific salmon biology. One phase of mass migration of pink and chum salmon under-yearlings from the coastal area was revealed in July 21-30, 2016. Surveys in earlier dates in all years before (during the 1st or 2nd decades of July) revealed sporadic representatives of both mentioned species. Additional surveys in the last half of August usually do not demonstrate many pink or chum salmon individuals in the waters between the shore and 155° E and southward from 54°N. Hence, the migration of pink and chum salmon under-yearlings from the shore with their simultaneous drift with geostrophic surface currents northward is shorter, less than one month in mentioned waters, and takes place from mid July to mid August.

Doc. 1690 **Marked Salmon Production by the Hatcheries of Russia in 2016**

Elena Akinicheva, Vladimir Volobuev, Alexey Yamborko, and Maksim Myakishev

In Russia, the main aim of the hatcheries salmon marking, as in the preceding years, is to evaluate numbers of hatchery-reared salmon returns. In recent years, the basic part of salmon juveniles have been reared and marked at Sakhalin. Two methods were used for hatcheries marking: thermal and "dry". In 2016, the percentage of marked salmon juveniles in Sakhalin region was 81.7%. This has happened because the majority of hatcheries (38) are located at Sakhalin and only 19 hatcheries in other regions of the Russian Far East.

Doc. 1691 **Incidental Catches of Anadromous Fishes by Japanese Research Vessels in the North Pacific Ocean in 2016**

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 2016). A total of 563 salmon including 351 chum, 108 pink, one sockeye, 98 coho, four Chinook salmon, and one steelhead trout was incidentally caught during the research surveys between May and October 2016 (Table 1).

Doc. 1692 **Results of 2016 Salmon Research by the *Oshoro maru***

Naoki Hoshi, Keiichiro Sakaoka, Yoshiyuki Kajiwara, Maki Ohwada, Taichi Sato, Keiri Imai, 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 47°N 160°E). The survey was conducted during the Cruise #025 in May, and the Cruise #026-Leg2 June to July 2016.

Eleven oceanographic observations and three drift gillnet surveys were conducted along the 155°E during the Cruise #025 in May. The Polar Front was observed in the vicinity of 44°N which were shifted north than the location in previous years and the Subarctic Boundary was located in the north side of 41°N also shifted north rather than last year. A total of 474 salmonids was caught by gillnet surveys, including 439 Pink, 32 Chum, two Steelhead and one Sockeye salmon. Pink salmon was the dominant species. The fork lengths (F.L.) of chum salmon collected by C-gear gillnet ranged between 454-586 mm F.L., and those of pink salmon ranged between 300-430 mm F.L., 90.6% 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 hook-and-line gear samplings were conducted during the Cruise #026-Leg2. Almost all of caught by these gears were Pink salmon. A total of eight Chum, and 237 Pink salmon were collected during the Cruise #026-Leg2.

Doc. 1693 **Preliminary Statistics for 2016 Commercial Salmon Catches in Japan**

Yukihiro Hirabayashi and Toshihiko Saito

The commercial catches in coastal and offshore areas of Japan in 2016 totaled 38.4 million fish (111 thousand metric tons), including 29.3 million chum (96 thousand metric tons) and 9.2 million pink (14 thousand metric tons) salmon (Tables 1, 2). The official specific statistics data may be available by the end of March 2018.

Doc. 1694 **Preliminary 2016 Salmon Enhancement Production in Japan**

Hiroaki Fukuzawa and Yukihiro Hirabayashi

Four species of anadromous Pacific salmon (chum, pink, masu, and sockeye salmon) are currently enhanced in Japan. A total of 1,898 million fry, juveniles and smolts were released from Japanese hatcheries in 2016 (Tables 1 and 2). Number of chum salmon fry released in the spring of 2016 was approximately 1,767 million fish. Japanese hatcheries also released 123 million pink salmon fry, 7,694 thousand masu salmon fry, juveniles and smolts, and 73 thousand sockeye salmon fry and smolts in the spring and fall of 2016.
In 2016, the number of adult salmon captured in rivers along the Japanese coasts was 3,976 thousand fish (Table 3), which corresponded to 11,642 metric tonnes in weight (Table 4). The dominant and second dominant species were chum and pink salmon, contributing 80.8% and 19.0% 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 6.9 thousand fish. Anadromous sockeye salmon were caught in three rivers along the Pacific coast of Hokkaido, where the number of catches was 268 fish.

Doc. 1695 **Releases of Otolith Marked Salmon from Japan between Summer of 2015 and Spring of 2016**

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 2015 to July 2016, approximately 256.1 million chum, 30.4 million pink, and 1.7 million masu salmon (2015 brood year) with thermal marks or ALC (alizarin complexone) patterns were released or stocked in Japan. In addition, 335 thousand masu salmon smolts and 73 thousand sockeye salmon smolts (2014 brood year) with thermal marks were released in the spring of 2016. In the summer and fall of 2015, 420 thousand masu salmon juveniles and 40 thousand sockeye salmon juveniles (2014 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. 1696 **Proposed Otolith Marks for Brood Year 2017 Salmon in Japan**

Tadayoshi Tojima, Motoyasu Kuwaki, and Shigehiko Urawa

Japan plans to mark approximately 277 million salmon of the 2017 brood year (243.1 million chum, 29.5 million pink, 4.0 million masu, and 150 thousand sockeye salmon) using 108 discrete thermal patterns and two ALC (alizarin complexone) patterns at 48 hatcheries. Two rings in the first band are adopted as the base mark to distinguish Japanese chum and pink salmon from other stocks.

Doc. 1697 **The Summer 2016 Japanese Salmon Research Cruise of the R/V *Hokko maru***

Kentaro Honda, Shunpei Sato, Tomoki Sato, Takumi Morishita, Masahiro Ogawa, and Kengo Suzuki

A summer high-seas research cruise to investigate the biology of Pacific salmon was conducted during August 4–10 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 2,124 salmonids were caught by surface trawls and angling at 13 monitoring stations. Chum salmon was the most abundant species (79.8%), followed by sockeye salmon (18.5%), Chinook salmon (1.60%), and pink salmon (0.09%). 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. There were 12 chum salmon tagged with disk tags and released in the Bering Sea. Among them, two 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 2007–2016 are documented here.

Doc. 1698 **Japanese Bibliography in 2016 for NPAFC Science Plan**

Shunpei Sato, Masa-aki Fukuwaka, and Shigehiko Urawa

This bibliography listed original papers and documents published in 2016 by Japanese scientists and/or their collaborators to review Japanese national researches for the 2016-2020 NPAFC Science Plan. The bibliography includes 32 articles with abstracts, corresponding to five research themes of the NPAFC Science Plan.

Doc. 1699 **Homing Migration Route of Japanese Chum Salmon Estimated by a Data Storage Magnetic Tag**

Tomonori Azumaya, Shunpei Sato, Shigehiko Urawa, and Toru Nagasawa

Archival tagging operations of chum salmon (Oncorhynchus keta), which record the geomagnetic intensity and inclination fields, were carried out in the Bering Sea in 2012. Data storage tags were attached to the body of chum salmon on board the research ship. Tagged chum salmon was recaptured near the coast of Hokkaido, Japan in 2012. The tags stored temperature, depth, geomagnetic intensity, inclination, compass heading vector and tilt of the fish during the homing migration. Data by archival tag on chum salmon indicated it moved from the Bering Sea to the coast of Japan in 74 days. To determine the ocean location of tagged fish after release, we estimated the homing migration route using a progressive vector which is the product of the swimming speed and compass heading vector of the tag. It was found that the estimated homing migration route was approximately along the isoline of the magnetic intensity at the recapture site. Simple homing migration model reproduced the homing migration route in the open sea. From these results it was found that although both the geomagnetic intensity and inclination play more important roles on homing migration of chum salmon, with the effect of geomagnetic intensity for the homing migration in the open sea was larger than the geomagnetic inclination.

Doc. 1700 **United States Cruise Plan for the Gulf of Alaska Assessment Survey for 2017**

Wesley W. Strasburger and Jamal H. Moss

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 2017. The goal of this work will be to provide key ecological data on pelagic ecosystems, examine oceanographic transport mechanisms, measure lower trophic level production, and quantify age-0 marine fish and juvenile salmon distribution and ecology. Additionally, the pilot age-0 sablefish survey conducted during August of 2016 will be repeated as an extension of the Gulf of Alaska Assessment Survey during August of 2017.

Doc. 1701 **High Seas Salmonid Coded-Wire Tag Recovery Data, 2008, 2015–2016**

Michele M. Masuda, Emily A. Fergusson, Jamal H. Moss, Casey Debenham, Joseph A. Orsi, Wesley W. Strasburger, Vanessa J. Tuttle, and Thomas Holland

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 133 CWT salmonids not previously reported to the PSMFC/RMPC. These CWTs were recovered from 1) the U.S. rockfish trawl fishery in the Gulf of Alaska (GOA) in 2016 (23 Chinook salmon [O. tshawytscha]), 2) U.S. trawl research in the GOA in 2015 (25 Chinook salmon and 9 coho salmon [O. kisutch]), 3) salmon excluder device testing in the Bering Sea-Aletuian Islands in 2016 (5 Chinook salmon), 4) the U.S. at-sea Pacific hake (Merluccius productus) trawl fishery in the North Pacific Ocean off Washington and Oregon in 2008 (3 additional Chinook salmon not previously reported) and 2016 (65 Chinook salmon), 5) 2016 winter pollock trawl survey (2 Chinook salmon), and 6) 2015 Japanese high seas research in the Bering Sea (1 Chinook salmon).

Doc. 1702 **Southeast Alaska Coastal Monitoring Survey Plan for 2017**

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 in May, June, July, and August of 2017. 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. 1703 **Comparative Analysis of Microsatellite Markers on Coastal Western Alaska Chum Salmon Stocks**

Jacqueline A. Whittle, Christine M. Kondzela, and Jeffrey R. Guyon

Chum salmon (Oncorhynchus keta) populations from five reporting groups in coastal Western Alaska were genotyped for 11 new microsatellite markers and 25 existing microsatellite markers to determine if discrimination among these reporting groups was possible, and if a larger number of markers could improve stock discrimination. G-test and FST values for the two panels were similar, with highly significant differences between the majority of population pairs. Stock aggregation results from principal component analyses and phylogenetic trees were nearly identical for the two panels. Baseline 100% simulation analyses indicated that the addition of the 11 new genetic markers slightly increased the ability to distinguish reporting groups in mixed-stock applications.

Doc. 1704 **Russian Bibliography Publications Linked to the NPAFC Science Plan in 2016**

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 2016 by Russian scientists and their collaborators relevant to the 2016-2020 NPAFC Science Plan as well as other salmon studies. The bibliography lists 48 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. Each publication is listed under one research component, although some 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. 1705 **United States National Research Plan 2017**

Auke Bay Laboratories

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. In order to improve monitoring and enforcement efforts, the North Pacific Anadromous Fish Commission (NPAFC) scientists developed BASIS (Bering-Aleutian Salmon International Survey) during 2002, a comprehensive survey of the Bering Sea epipelagic ecosystem. The NPAFC, BASIS working group completed the research after a successful 10-year program, and the working group was disbanded during 2015. The US modified the acronym during 2016 (Bering Arctic Subarctic Integrated Surveys) to describe the current integrated ecosystem research in Alaska's Large Marine Ecosystems.

Doc. 1706 **Recoveries of High Seas Tags and Tag Releases from High Seas Research Vessel Surveys in 2016**

The Working Group on Salmon Marking (WGSM)

In August 2016, tagging operations were conducted by the Japanese R/V *Hokko maru*, and 12 chum salmon were released with tags in the Bering Sea. Among them, two chum salmon were equipped with DST magnetic tag. In March 2016, another tagging experiment was conducted by US scientists, and 20 Chinook salmon were tagged with PSATs and released along the Gulf of Alaska coast (59ºN, 151ºW) off the Kenai Peninsula, central Alaska. A high-seas tag released in the Bering Sea on August 3rd, 2013 was reported from a chum salmon caught in the Okhotsk Sea coast, Hokkaido, Japan on November 4, 2013. In addition, archival tag data were retrieved via data communication through the Argos satellite system from all 20 PSATs that were attached to Chinook salmon.

Doc. 1707 **Biochemical Composition and Energy Content of Salmonid Fish in the Sea of Okhotsk**

I.V. Melnikov, K.M. Gorbatenko, and V.I. Radchenko

The main bioenergetic parameters of Pacific salmon are estimated in this study. Juvenile salmon demonstrate maximum fat accumulation rates at the end of feeding migrations in the Sea of Okhotsk in October-November. That makes possible its successful overwintering in the Pacific Ocean. In the Sea of Okhotsk, juvenile pink salmon gain 532 kcal or 27% of the total amount of energy accumulated during marine life period before returning to the sea basin. In the north-western Pacific Ocean, pink salmon, without ranking by sex, gain 1442 kcal in average or 73% of the total accumulated energy for that period. Juvenile chum salmon gain 492 kcal in the Sea of Okhotsk that is 11% of the total energy accumulated during marine life period. Mature chum without ranking by age and sex gain 4,071 kcal in the northwestern Pacific Ocean in average, or 89% of the total accumulated energy in marine life period.

Doc. 1708 **Korean Salmon Catch Statistics and Hatchery Releases in 2016–2017**

Kwan Eui Hong, Cheul Ho Lee, and Do Hyun Lee

Total catch of chum salmon was 85,206 fish or 256.5 metric tons in 2016. The total fries of chum salmon released was 18,157 thousand fish in 2017 (2016 brood).

Doc. 1709 **Korean Research Plan for Salmon in 2017**

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 was much increased since the establishment of the Inland Living Resources Center (Yangyang Salmon Station formerly) of Korea Fisheries Resources Agency 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, 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.

Doc. 1710 **Otolith Thermal Mark for Brood Year 2016 and Proposed Thermal Marks for Brood Year 2017 Chum Salmon in Korea**

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

Korea released 8.0 million and 7.6 million thermal marked chum salmon in March 2016 and 2017, respectively. The marks were 3,1,2H(7.0million), 4n,2,3H(1.0 million) for 2016(2015BY) and 3,2,1H(7.0million), 3,4,2H(0.6 million) for 2017(2016BY). We will mark approximately 8.0 million chum salmon in BY 2017, which covers about 50% ~60% of release of BY 2017 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 mark.

Doc. 1711 **Genetic Structure of Returning Chum Salmon Population 2015 Inferred from Microsatellite DNA Marker**

Sang Gyu Kim and Eun Ah Kim

The population structure of chum salmon was examined in a total of 730 samples collected from nine geographical groups: five localities (Myeongpa River, Namdae River, Yeongok River, Wangpi River and Taehwa River) on the east side of the Korean Peninsula, two localities (Tokachi River and Chitose River) on the Hokkaido Island, Japan, one locality (Solomon River) on the Alaska, United States and one locality (East Alsek River) on the Canada, by using 10 microsatellite DNA marker. Each populations clearly separated clusters for Nei's genetic distance on the nation but differentiation test between all pairs of samples were not significant.

Doc. 1712 **Report of the International Year of the Salmon North Pacific Steering Committee Meeting**

International Year of the Salmon Working Group, Committee on Scientific Research and Statistics (CSRS)

The following outlines the key results from the meeting of the North Pacific Steering Committee (NPSC) on February 28 and March 1, 2017, to discuss the International Year of the Salmon (IYS). The IYS is an intensive burst of internationally coordinated, interdisciplinary, scientific research and outreach focused on salmon, and their importance to people conceived to address the needs of salmon in a period of unprecedented environmental uncertainty and social and economic change. New technologies, better shared knowledge, improved analyses, and more effective outreach/communication and timely management decisions are needed to sustain salmon to the greatest degree possible in a rapidly changing world. The IYS is a seven-year initiative that began in 2016 with four phases covering planning (with a kick-off Event/Symposium in 2018), research, outreach, and analysis and reporting.

The IYS initiative follows from a proposal prepared by an IYS Working Group (IYS-WG), the NPAFC and the North Atlantic Salmon Conservation Organization (NASCO), and approved by the two Regional Fisheries Management Organizations at their respective 2016 Annual Meetings. A subsequent meeting of the IYS Coordinating Committee, involving members from both Regional Fisheries Management Organisations, established terms of reference for Steering Committees to oversee activities in the Pacific and Atlantic. The NPSC meeting was organized and hosted by the NPAFC and convened in Richmond, Canada and its 43 participants comprised a wide spectrum of interests from the North Pacific. The meeting's purpose was to further plan the IYS, and its approach featured a number of presentations on key topics followed by extensive plenary discussions.

The results of the meeting, described in this report, underscore broad support for the IYS. In terms of governance, it was proposed that there should be a 12–15 person NPSC with representation from the NPAFC member countries, indigenous peoples and core partners, as well as lead subject matter experts from the six IYS themes. Allowances should be made for creating a smaller executive group and creating a broader North Pacific IYS network. There was overall support for the funding strategy, which proposed distinguishing between funding strategies for immediate short term (e.g., symposium, website, branding, and planning) and long term activities (e.g., projects, meetings, reporting). This included setting up an administrative secretariat for the North Pacific and potentially the Coordinating Committee. With regards to IYS planning, there was support for adopting a results-based planning approach, as well as a strong recommendation to develop an IYS problem statement. Additionally, planning for IYS activities should pursue a catalytic role to stimulate and encourage new research ideas. Finally, the participants supported an IYS symposium launch in the fall of 2018 which did not conflict with other major meetings such as PICES, and preferred that this take place in North America with Vancouver and Kamloops as top choices. London was also being put forward as a possible location for the symposium by the Atlantic region, with some support from meeting participants.

Doc. 1713 **Climate and Density Effects on Growth of Chum Salmon in British Columbia, Canada (Extended Abstract)**

Allan J. Debertin, James R. Irvine, Carrie A. Holt, Gladys Oka, Marc Trudel

This study provides evidence for climate and competition effects on the body growth of a southern British Columbia population of chum salmon (Oncorhynchus keta) using 39 years of scale growth measurements. Growth at all ages was reduced when the biomass of North American chum, sockeye (O. nerka) and pink salmon (O. gorbuscha) was greatest. When North Pacific Gyre Oscillation (NPGO) was positive, indicating increased primary productivity, growth at all ages was greater. Climate variation affected the strength of density-dependent competition. Density-dependent effects on growth were strongest when NPGO became more positive and Pacific Decadal Oscillation more negative (indicating cooler conditions). Southern British Columbia chum salmon are likely to exhibit continued reduction in growth at age due to increased ocean temperatures driven by climate change and high aggregate salmon biomass.

Doc. 1714 **Canadian Salmon Catch and Enhanced Salmon Production in 2015 and 2016**

Arlene Tompkins, Peter Hall, Joan Bateman, and Shelee Hamilton

This document reports final catch estimates for 2015, preliminary catch estimates for 2016 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 2015 and 2016.

Doc. 1716 **Summary of Non-coastal Salmon Catch Data from the North Pacific Ocean**

James R. Irvine

This document presents seasonal summaries of salmon catches from throughout the north Pacific. Data were assembled by an ad hoc committee, augmented as needed by country specific experts. Only data from beyond 22km of any coast line were included. Sampling took place during 1955-2014 and included catches from 32,355 sampling events (sets). Chum and pink salmon were the most frequently caught species; significant numbers of sockeye, coho and chinook salmon and steelhead were also caught. Preliminary data summaries are provided for seven regions separately for spring, summer, fall, and winter. These data will useful to compare with results from future sampling planned as part of the International Year of the Salmon, and provide a basis for the application of climate downscaling models to predict salmon abundance and distribution under various climate forecasting scenarios.

Doc. 1717 **Evaluating Models to Forecast Salmon Dynamics**

M.J.P. Folkes, R.E. Thomson, and R.A.S. Hourston

Management of the Fraser River sockeye fishery includes a pre-season planning component that relies on the forecast of three variables that represent characteristics of the returning adult run: recruitment, migration timing to local waters, and migration entry route relative to Vancouver Island (as defined by the Northern Diversion Rate). In this paper, we evaluate the two components related to forecasting the homing migration of adult Fraser sockeye (return timing and diversion rate). We summarize key findings of this model search, performance analysis, and selection process.

Doc. 1718 **Survey of Infectious Agents Detected in Juvenile Chinook and Sockeye Salmon from British Columbia and Washington**

Kristina M. Miller, Shaorong Li, Tobi Ming, Karia Kaukinen, Norma Ginther, David A. Patterson, and Marc Trudel

The contribution of infectious diseases to annual variations in salmon survival in the ocean is poorly understood, largely owing to the inability to observe mortality. We developed a novel microfluidics quantitative PCR system to survey 46 infectious agents (viruses, bacteria, fungal and protozoan parasites), known or suspected to cause disease in salmon worldwide, in 96 samples at once. The platform was applied to juvenile Sockeye (Oncorhynchus nerka) and Chinook (O. tshawytscha) Salmon sampled in southern British Columbia from 2008-2013. Twenty-one infectious agents were detected at a prevalence greater than 1% in ocean-migrating Chinook Salmon, and 17 in Sockeye Salmon. Among species, the most commonly observed agents were the bacterium Candidatis Branchiomonas cysticola, parasites Myxobolus arcticus, Paranucleospora theridion, and Parvicapsula minibicornis, and erythrocytic necrosis virus.

Doc. 1721 **Canadian Juvenile Salmon Surveys in 2017–2018**

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 2017-2018. The inshore program will conduct sampling in the Salish Sea (encompassing the Strait of Georgia and Puget Sound) whereas the offshore/west coast program will conduct sampling along and off the west coast of Vancouver Island (summer) and central coast (fall). These surveys are both part of long-term research programs that were initiated in 1997-1998, however in 2017 the offshore program will begin integrating with other pelagic research programs to develop a synoptic pelagic

survey on the continental shelf off the west coast of Vancouver Island. In addition, Canada will conduct up to two additional research projects in nearshore waters: 1) purse seine surveys in Cowichan Bay and off Big Qualicum River on the east coast of Vancouver Island as part of a study examining factors contributing to mortality of juvenile Chinook salmon in southern British Columbia (May to August); and 2) monthly mid-water trawl surveys in Howe Sound to describe the nearshore habitat distribution (< 30 m), prey selection and diet overlap of juvenile salmon from April to September.

Doc. 1722 **Fraser River Sockeye: Abundance and Productivity Trends and Forecasts**

Sue C.H. Grant, Bronwyn L. MacDonald, and Catherine G.J. Michielsens

Fraser sockeye salmon total returns have varied substantially over time. In the past decade, overall returns improved on the current large cycle year (2010 and 2014) compared to previous decades but declined on the other cycles. In 2016, returns (853,000) were the lowest on the 100+ year record for the Fraser Sockeye aggregate. Marine and freshwater factors both contribute to the variability in returns. Chilko is the only sockeye salmon stock where total survival can consistently be partitioned into freshwater and marine survival over a long time series. This stock also contributes significant proportions to the total returns in most years. In the past decade, Chilko sockeye have generally exhibited average to above average freshwater survival, compared to the previous period in the 1990's where freshwater survival had been below average. Marine survival on the other hand has not improved to the same extent since the decline in the 1990s and remained predominantly below average in the last decade. In the 2015 and 2016 return years, poor marine survival drove the poor returns for Chilko sockeye. In the past few years (second half of 2013 to 2016), warmer ocean temperature anomalies (the 'warm blob') occurred in the Northeast Pacific Ocean. Broadly, both marine and freshwater conditions were generally warmer than average during this period. Although these warm conditions coincided with particularly poor marine survival for Chilko Sockeye, and poor productivity for similar summer-run (based on adult sockeye migration timing in the Fraser River) stocks, productivity of other stocks has been variable. Median predictions of Fraser Sockeye returns in 2017 (4.4 million) are expected to be below the cycle average (8.4 million), due to warmer temperatures that may influence particularly the more abundant summer run stocks, including Chilko sockeye.

Doc. 1723 **Proposed Thermal Marks for Salmon from Canada, Brood Year 2017**

Susan DiNovo and Wilf Luedke

Thermal marking continues to play an important role for both research and fisheries management in Canada. Canada plans to thermally mark approximately 65 million Pacific salmon for release in 2018/19. Thermal marking will include 73 thermal marks applied at 17 hatcheries with marked salmon released at 45 locations. The plan is similar to the 2016 brood year marking plan, fish planned for release in 2017/18 (DiNovo et al. 2016).

Doc. 1724 **Biostatistical Information on Salmon Catches, Escapement and Enhancement Production in Russia in 2016**

Klovach N.V., Temnykh O.S., Shevlyakov V.A., Golub E.V., Zolotukhin S.F., Shevlyakov E.A., Romasenko L.V., and Volobuev V.V.

Salmon catch (commercial, subsistence, and sport), average weights, hatchery release and escapement statistics for 2016 are presented.
