

*North
Pacific
Anadromous
Fish
Commission*



TECHNICAL REPORT 10

Story of the International Year of the Salmon: Concept to Launch

***First Scoping Workshop for the International Year of the
Salmon, Vancouver, B.C., Canada, February 17–18, 2015***

***Second Scoping Workshop for the International Year of the
Salmon, Vancouver, B.C., Canada, March 15–16, 2016***

Technical Editors: Madeline Young, Mark Saunders and Vladimir Radchenko

Vancouver, Canada

Abstract

The International Year of the Salmon (IYS) is conceived as an intensive burst of internationally coordinated, interdisciplinary, scientific research and outreach focused on salmon, and their importance to people. The IYS is a joint initiative led by the North Pacific Anadromous Fish Commission (NPAFC), the North Atlantic Salmon Conservation Organization (NASCO), and other partners. The IYS focal year will be 2019, with projects and activities starting in 2018 and continuing into 2022. Technical Report 10 includes all available NPAFC materials on IYS scoping and planning since the initiative was originally proposed to the NPAFC in 2012 up until the first meeting of the North Pacific Steering Committee, which took place on February 28 and March 1, 2017. IYS scoping began with the formation of the IYS Study Group in 2014, which held the First IYS Scoping Meeting in April 2015 to develop scientific objectives of the IYS. From the results of this meeting, the IYS Study Group developed the First Proposal for the IYS that outlined research themes. A newly formed IYS Working Group held the Second IYS Scoping Meeting in March 2016, which brought together potential partners in the IYS initiative, including NASCO, to provide input into the scoping and development of the IYS strategy and business model. NASCO Parties unanimously supported the initiative, but preferred a focus on salmon outreach rather than research. At this point in the IYS planning process, the major components of the IYS had been identified, including the purpose, themes, and duration, in addition to the need for donor and public outreach strategies, and for partners and their roles to be identified. What was most pressing was to determine how to best organize partners to finalize the IYS strategy and begin its implementation. Following the Second Scoping Meeting, the IYS Working Group developed the Outline Proposal for the IYS, which was intended to support both organizations in the implementation of the IYS in the North Pacific and the North Atlantic regions and delineated a possible governance structure for the initiative. The Outline Proposal was accepted by both NPAFC and NASCO at the Annual Meetings of both organizations in May and June 2016, respectively, officially launching the planning phase of IYS implementation. An IYS Coordinating Committee composed of six members from NPAFC and NASCO was formed in September 2016, with its top priorities to develop a document outlining IYS governance, develop an IYS brand and website, and begin planning the 2018 IYS Symposium. The IYS narrative of Technical Report 10 ends just prior to the first meeting of the North Pacific Steering Committee (NPSC); next steps included detailed planning of IYS outreach and research themes, completion of a results-based planning framework to guide planning, research, and outreach activities at the local, regional, basin and hemispheric scales, and development of an IYS funding strategy.

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List of Abbreviations

| | |
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| CSRS | North Pacific Anadromous Fish Commission Committee on Scientific Research and Statistics |
| DFO | Fisheries and Oceans Canada |
| F&A | North Pacific Anadromous Fish Commission Committee on Finance and Administration |
| ICES | International Council for Exploration of the Sea |
| IOC-UNESCO | Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization |
| IPY | International Polar Year |
| IYS | International Year of the Salmon |
| IYS-SG | International Year of the Salmon Study Group |
| IYS-WG | International Year of the Salmon Working Group |
| ICC | International Year of the Salmon Coordinating Committee |
| NGO | Non-governmental Organization |
| NPAFC | North Pacific Anadromous Fish Commission |
| NASC | International Year of the Salmon North Atlantic Steering Committee |
| NPSC | International Year of the Salmon North Pacific Steering Committee |
| NASCO | North Atlantic Salmon Conservation Organization |
| PICES | North Pacific Marine Science Organization |
| PSC | Pacific Salmon Commission |
| PSF | Pacific Salmon Foundation |
| RFMO | Regional Fisheries Management Organization |
| RSN | Regional Fishery Body Secretariat |
| SSC | International Year of the Salmon Symposium Steering Committee |
| SST | Sea Surface Temperature |

INTRODUCTION

The International Year of the Salmon (IYS) is an international initiative to raise the capacity of collaborative outreach, engagement, and research to meet the challenges of ‘Salmon and People in a Changing World’. The IYS is a joint initiative led by the North Pacific Anadromous Fish Commission (NPAFC) and the North Atlantic Salmon Conservation Organization (NASCO), with a geographic scope of the ‘salmosphere’—the current and future geographic range of salmon in the Subarctic and Arctic. The IYS focal year will be 2019, with projects and activities starting in 2018 and continuing into 2022. The aim of the initiative is to raise awareness of what humans can do to better ensure salmon and their varied habitats are conserved and restored amidst increasing environmental variability, as well as to stimulate an investment in research and leave a legacy of knowledge, data/information systems, tools, and a new generation of scientists better equipped to inform rational management of salmon. Technical Report 10 contains a review of the IYS from its origin with the initial proposal for the initiative by Richard Beamish in 2012 (referred to as the “Initial Proposal” in Technical Report 10) and its early history to the launch of the planning phase for the initiative and what can be expected in the future.

Two scoping meetings for the IYS were held to seek advice from participants in February 2015 and March 2016, respectively, and were structured as a series of facilitated discussion panels, short presentations, and group discussions. The First IYS Scoping Meeting focused on developing the scientific research themes for the initiative. Conveners of small discussion groups containing subject area experts created a detailed list of research ideas based on panel and round-table discussions reviewing current and emerging national priorities to identify knowledge gaps that could serve as scientific pillars for the IYS scientific programme. Some of these suggestions were included in the meeting report while others remained beyond further consideration. Based on the outcomes of this workshop, the IYS Study Group (IYS-SG) developed a proposal for the IYS, which, for the purposes of this technical report, will be referred to as the “First Proposal”.

The Second IYS Scoping Meeting included IYS Working Group (IYS-WG) members as well as potential partners invited to provide input into the scoping and development of the IYS strategy and business model. The main issues under consideration at the meeting were potential governance arrangements to support ongoing IYS coordination and implementation, prospective research themes, public engagement and outreach strategies, organizational capacity and support, funding strategies, and business plan development. Based on the outcome of the Second Scoping Meeting, the IYS-WG developed a new proposal (referred to as the “Outline Proposal” in Technical Report 10) to assist NPAFC and NASCO in deciding how to best move forward with the IYS initiative.

Although IYS planning and implementation has been a continuum from the outset, the process has been arbitrarily divided into stages in Technical Report 10 to highlight the significant progress that has been made since the idea for the IYS was initially proposed. Systematic review of IYS planning in this technical report is based on a diversity of available sources including NPAFC Documents, annual reports, annotated meeting agendas, and Secretariat archival electronic materials including drafts and working documents. Technical Report 10 ends with initial considerations of the IYS governance structure and formation of the IYS Coordinating Committee (ICC) and leads into the first meeting of the North Pacific Steering Committee (NPSC), which took place on February 28 and March 1, 2017, in

Richmond, Canada. Appendices of relevant documents and reference lists are included at the end of each chapter.

On behalf of NPAFC, we thank Richard Beamish for the initial idea of the IYS, Mark Saunders as Chairperson of the IYS-SG and IYS-WG, as well as IYS-SG and IYS-WG members and scoping meeting participants. We would also like to thank the Pacific Salmon Commission and Pacific Salmon Foundation for their support for the First IYS Scoping Meeting, the North Pacific Research Board and the Pacific States Marine Fisheries Commission for their support for the Second IYS Scoping Meeting, and Fisheries and Oceans Canada for their ongoing support. Material in this report is based on the personal views of the authors and does not necessarily reflect the opinions of the NPAFC or the member countries.

Madeline Young, Mark Saunders and Vladimir Radchenko
Technical Editors, NPAFC

CHAPTER 1: A YEAR FOR SALMON

The Long Term Research and Monitoring Plan for Pacific Salmon

The concept of an International Year of the Salmon (IYS) was first put forward in the NPAFC Long-term Research and Monitoring Plan (LRMP) for Pacific Salmon (*Oncorhynchus* spp.) in the North Pacific Ocean (Beamish et al. 2009). The LRMP is an international strategic plan to improve the forecast of climate change effects on all life history stages of Pacific salmon by coordinating research among Pacific salmon producing countries. Effective management of Pacific salmon requires an understanding of mechanisms controlling production in both freshwater and marine environments. Although each Pacific salmon producing country can study the resource within their own jurisdiction, research and monitoring on the high seas requires international cooperation. The plan states the importance of international cooperation to conduct large-scale oceanic studies which is considered to be more possible than ever with the availability of new technologies and emergence of a new spirit of international cooperation. Furthermore, the NPAFC—as “*a trusted organization where researchers can share their data and interpretations*”—provides an existing framework for this cooperation (Beamish et al. 2009 p. 1).

The LRMP was produced based on the consensus of an international group of scientific experts on the dynamics and population ecology of Pacific salmon. Emphasis was placed on better understanding mechanisms regulating Pacific salmon populations in ocean ecosystems in order to “*improve forecasts of marine survival, produce more accurate estimates of the timing and abundance of adults returning to coastal rivers and determine the capacity of the subarctic Pacific to produce Pacific salmon*” (Beamish et al. 2009 p. 3). Researchers identified country-specific research and long-term monitoring requirements in addition to coming to an agreement on shared key areas of interest. These shared key areas of research and monitoring included an understanding of the large mortality of juvenile Pacific salmon in the early marine period as well as winter conditions affecting brood strength, which would require comprehensive winter surveys. The necessity of conducting integrated studies including specialists in physical, chemical, and climatological processes as well as experienced modellers was specified, in addition to the importance of having a fully shared data system. Emphasis was also placed on maintaining and improving basic monitoring of Pacific salmon, specifically with respect to escapement, catch, and migration, as many long-term monitoring programmes appear to be disappearing. Access to this basic data is essential to understanding climate impacts on Pacific salmon production.

The initial IYS concept was introduced by Richard Beamish of Fisheries and Oceans Canada (emeritus). The initiative was in part intended as a way to address some of the research needs put forward in the LRMP and in general imagined as a way to alert the public and provide a framework for an integrated study of salmon, particularly in the winter (R. Beamish, pers. comm.). The concept was supported by all NPAFC member states, and in the concluding remarks of the LRMP, a request for a proposal for an IYS was put forward.

The Initial Proposal to Establish an International Year of the Salmon

In response to the request put forward in the LRMP, a proposal was made by Canada to the NPAFC in 2012 to develop an IYS (Appendix A; Beamish 2012). The Initial Proposal discussed a rationale and possible levels of research for the IYS initiative. The overall goal of an IYS stated in the Initial Proposal

was “to ensure that each Pacific salmon producing country has the information to make management decisions that optimize economic opportunities relating to Pacific salmon production while maintaining responsible stewardship” (Beamish 2012 p. 2).

As we are entering a period of increasing variability in salmon productivity due to changing aquatic environments, Beamish (2012) stressed that it is now more important than ever to be able to forecast changes in Pacific salmon abundance in order to plan for the future and minimize economic impact. Major changes in Pacific salmon production and potential factors that have affected these changes in the past were discussed as they are likely to continue to have an impact in the future. These included improved marine survival of pink salmon, declining catches of Chinook and coho salmon (particularly in the southern portion of their range), extreme variability in sockeye salmon production in the Fraser River, varying marine survival of chum salmon, large-scale sea-surface temperature trends (specifically the Pacific Decadal Oscillation), large-scale changes in wind patterns, and ecosystem regime shifts.

Funding available for salmon research has been reduced in all Pacific salmon producing countries. A major benefit of the IYS discussed in the Initial Proposal would be that all resources available could be combined and used more efficiently by participating countries. The initiative would also include large-scale ocean studies and smaller-scale freshwater studies, as well as a collaborative approach to analyze and model the data that is collected. Moreover, every country involved would be able to address their own research needs with the “*common intent to be prepared for the future and optimize economic opportunities*” (Beamish 2012 p. 15). Three levels of activity were suggested for the IYS in the Initial Proposal, the first of which was to use existing knowledge in a series of workshops, which could be supported by organizations such as the North Pacific Marine Science Organization (PICES), to predict changes in Pacific salmon productivity and to identify key research needs. This stage would be followed by a year of marine research “*that would focus on identifying the country and population-specific rearing areas in the ocean, and improving the understanding of the mechanisms that regulate brood year strength*” (Beamish 2012 p. 15). The third level discussed was to continue ocean studies for another two years and include winter surveys. A final suggestion to the NPAFC was to form a group to begin to discuss the feasibility of an IYS initiative.

The proposal to establish an IYS was officially presented to the Committee on Scientific Research Statistics (CSRS) at the 2012 Annual Meeting of the NPAFC (North Pacific Anadromous Fish Commission [NPAFC] 2012). The proposal was fully supported by the Committee, and subsequently the Commission, who agreed that the goals of the initiative were urgent due to changing conditions for salmon and that with cooperation, significant understanding could be developed to help inform management, maximize economic opportunities, and guarantee responsible stewardship. Discussion proceeded to the creation of an IYS feasibility study group. It was decided that members were to be appointed by CSRS Points of Contact and that a short, clear prospectus would need to be developed to more clearly define the objective and give a timeline. This document would then be the focus of a scoping meeting that would include government and non-government agencies as well as industry.

References

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- Beamish, R.J., B.E. Riddell, K.L. Lange, E. Farley Jr., S. Kang, T. Nagasawa, V. Radchenko, O. Temnykh, S. Urawa, T. Azumaya, R. Brodeur, R. Emmett, H. Imai, Y. Ishida, M. Kaeriyama, S. Kim, L. Klyashtorin, M. Koval, G. Kristianson, C.S. Lee, L-L. Low, I. Melnikov, J. Moss, P. Mundy, K. Myers, S. Naydenko, V. Nazarov, G. Ruggerone, J. Seeb, J. Seki, K.B. Seong, G. Smith, V. Sviridov, B. Templin, M. Trudel, V. Volobuev and S. Young. 2009. A Long-term Research and Monitoring Plan (LRMP) for Pacific salmon (*Oncorhynchus* spp.) in the North Pacific Ocean. N. Pac. Anadr. Fish Comm. Sp. Pub. 32 pp. (Available at www.npafc.org).

Appendix A

A Proposal to Establish an International Year of the Salmon

Beamish, R.J.

September 2012, *originally presented as NPAFC Doc. 1425*

Abstract

The Long-term Research and Monitoring Plan developed by the North Pacific Anadromous Fish Commission concluded that a proposal should be developed for an International Year of the Salmon. An International Year of the Salmon will allow experts from all Pacific salmon producing countries to focus on identifying the mechanisms that regulate Pacific salmon abundance and to use this understanding to maximize economic opportunities in the future while ensuring responsible stewardship. This proposal identifies some of the major climate and ocean influences on Pacific salmon production to show that there will be major changes in abundance trends in the future. It is of benefit to everyone that these changes are anticipated and not come as surprises. I suggest that the NPAFC form a group that will look at the feasibility of funding an International Year of the Salmon.

Introduction

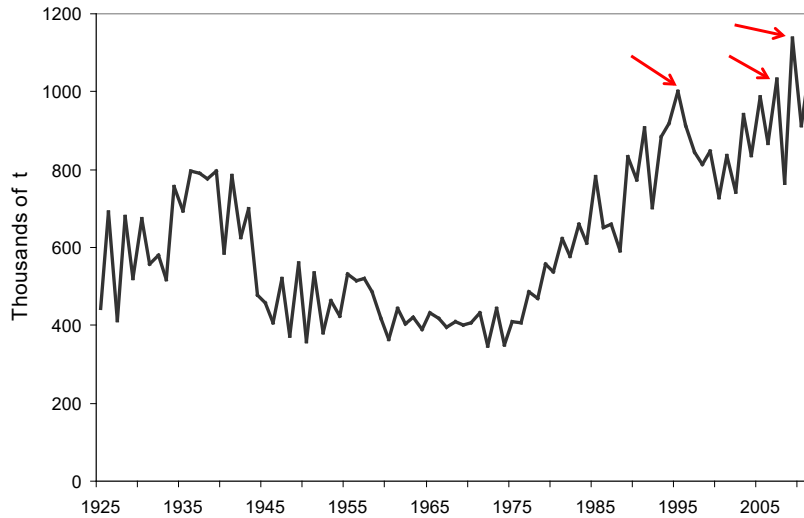
The Long-term Research and Monitoring Plan (LRMP; Beamish et al. 2009a) for Pacific salmon *Oncorhynchus* spp. that was produced and published by the North Pacific Anadromous Fish Commission concluded that a proposal for an International Year of the Salmon should be developed. Thus, this is a proposal to establish an International Year of the Salmon. The goal is to ensure that each Pacific salmon producing country has the information to make management decisions that optimize economic opportunities relating to Pacific salmon production while maintaining responsible stewardship. The trends in production and catches of Pacific salmon from around the North Pacific are a history of surprises. International fisheries science now has the ability and new technologies to reduce these surprises and minimize their economic impact. Furthermore, many researchers recognize that we are in a period of increasing variability in Pacific salmon production most likely because ocean and freshwater environments are changing. The following examples of major changes in climate and ocean environment probably will affect the abundance of Pacific salmon. An International Year of the Salmon is a practical way of using all available resources to anticipate future trends in the abundance of the various species of Pacific salmon. An International Year of the Salmon will bring experts from all countries into teams that will use existing knowledge and hopefully new information to understand the mechanisms that regulate Pacific salmon abundances and allow all countries to plan for the future.

Major Issues

The following are examples of major, natural changes that affected Pacific salmon production. It is likely that their impacts will continue. An improved understanding of the linkages between these changes and Pacific salmon production will help each country plan for the economic consequences of these changes.

The Resource

The total commercial catch of all Pacific salmon set historic high records in 1995, 2007 and 2009 (Figure A.1). The historic high catches resulted from improved marine survival and, to a lesser extent, from increases in hatchery production. However, the reasons for the improved marine survival remain to be



explained in a way that can be used to manage Pacific salmon production. An International Year of the Salmon will attempt to identify the capacity of the ocean to produce Pacific salmon.

Figure A.1. Total commercial catch of Pacific salmon by all countries in the North Pacific from 1925 to 2011 in thousands of t (2011 catches are preliminary). Arrows indicate the record high catches.

Pink salmon

The increasing catches of Pacific salmon result from the increasing production of pink salmon *O. gorbuscha*. Numerically, pink salmon in recent years represent 64.6 % of the total catch of all Pacific salmon and 45.3 % of the total catch by weight (1998–2011). From the late 1970s to the early 1990s, the rate of increase of odd- and even-year pink salmon was about the same (Figure A.2). Beginning in the early 1990s and through to the present, the average catches of even-year pink salmon have not increased but the catches of odd-year pink salmon continue to increase. There is no explanation for the different behaviour of the two lines of pink salmon but it is most important to discover the reasons.

Chinook and coho salmon

Chinook *O. tshawytscha* and coho *O. kisutch* salmon catches collectively represent only about 4% of the total catch by weight of all Pacific salmon in the North Pacific over the past 20 years (1992–2011). However, catches of Chinook and coho salmon are particularly important in the Canadian and United States fisheries. The efforts of supplementing wild production with hatchery production have not rebuilt abundances and in some fisheries hatchery fish are virtually the only fish caught. The marine survival of both of these species has declined dramatically at the southern portion of their ranges over the past 25 years. In some populations of Chinook salmon, the marine survival is now less than 0.5%. The marine survivals are so low in some populations of Chinook and coho salmon that it is not an exaggeration to consider it a crisis. Perhaps surprisingly, the total catches of Chinook salmon in all major areas throughout the North Pacific have also declined over the past 50 years (Figure A.3(a)). Catches of coho salmon have also declined in all of the major areas except in Alaska (Figure A.3(b)). The reasons for the continuing decline in catch have to be more than reduced fishing opportunities and remain to be

explained. It is particularly important to Canada and the United States to determine if the trends will continue.

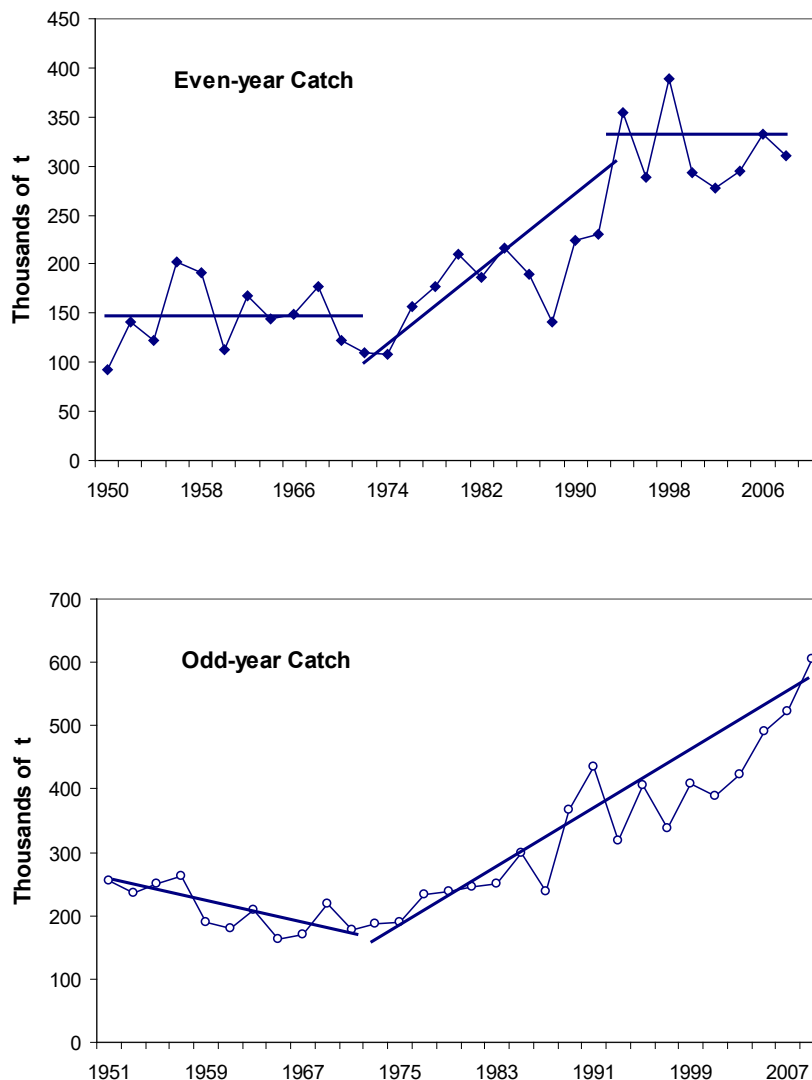


Figure A.2. Commercial catch of pink salmon in the North Pacific in even (upper panel) and odd years (lower panel) from 1950–2009. The odd-year catch continues to increase about 1990 after the average even-year catch levels off. Data from the North Pacific Anadromous Fish Commission.

Sockeye salmon

The Fraser River is a key producer of sockeye salmon *O. nerka* and the production is shared with the United States. Canada and the United States established the Pacific Salmon Commission to facilitate agreements on the catch and stewardship of Fraser River sockeye salmon as well as for other species that move in and out of the territorial waters of the two countries. There was an increasing trend of production of Fraser River sockeye salmon up to the early 1990s, followed by a decreasing trend. The decreasing trend was highlighted by an historic low return in 2009, followed by an historic high return in 2010 (Figure A.4). The extreme variability was unexpected and the extreme low resulted in Canada spending about \$27 million CAD on a judicial inquiry to determine the reason for the surprise. Canada and the United States provide funds to operate the Pacific Salmon Commission and many people participate in the proceedings of the Commission. An understanding of the mechanisms responsible for the trends and the

variation in sockeye salmon production would facilitate the work of the Commission, help the industry and assure a concerned public that sockeye salmon stewardship is in good hands.

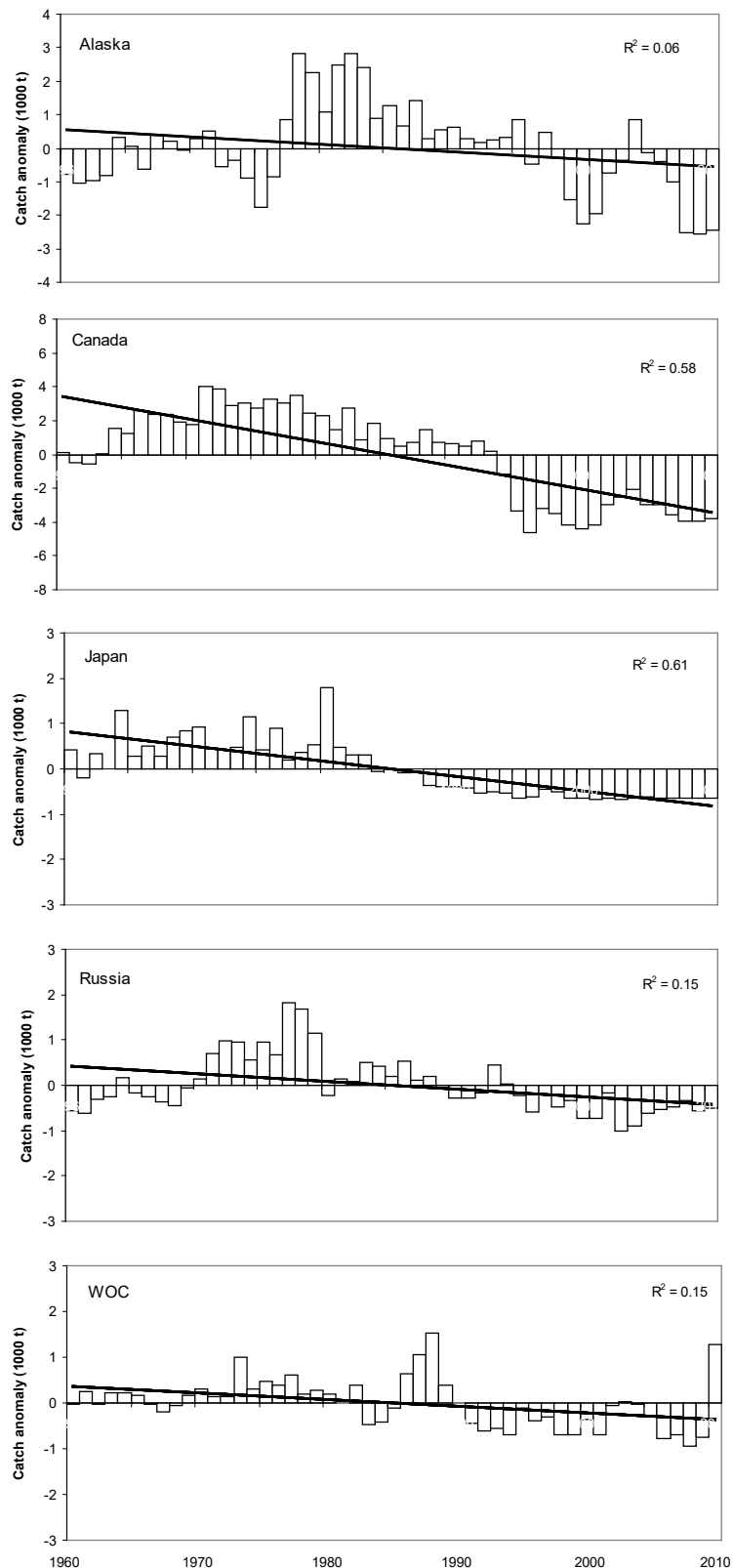


Figure A.3(a). Anomalies of catch of Chinook salmon by Alaska, Canada, Japan, Russia and Washington, Oregon and California (WOC) from 1960 to 2010 showing the declining trend in all countries beginning about 1990.

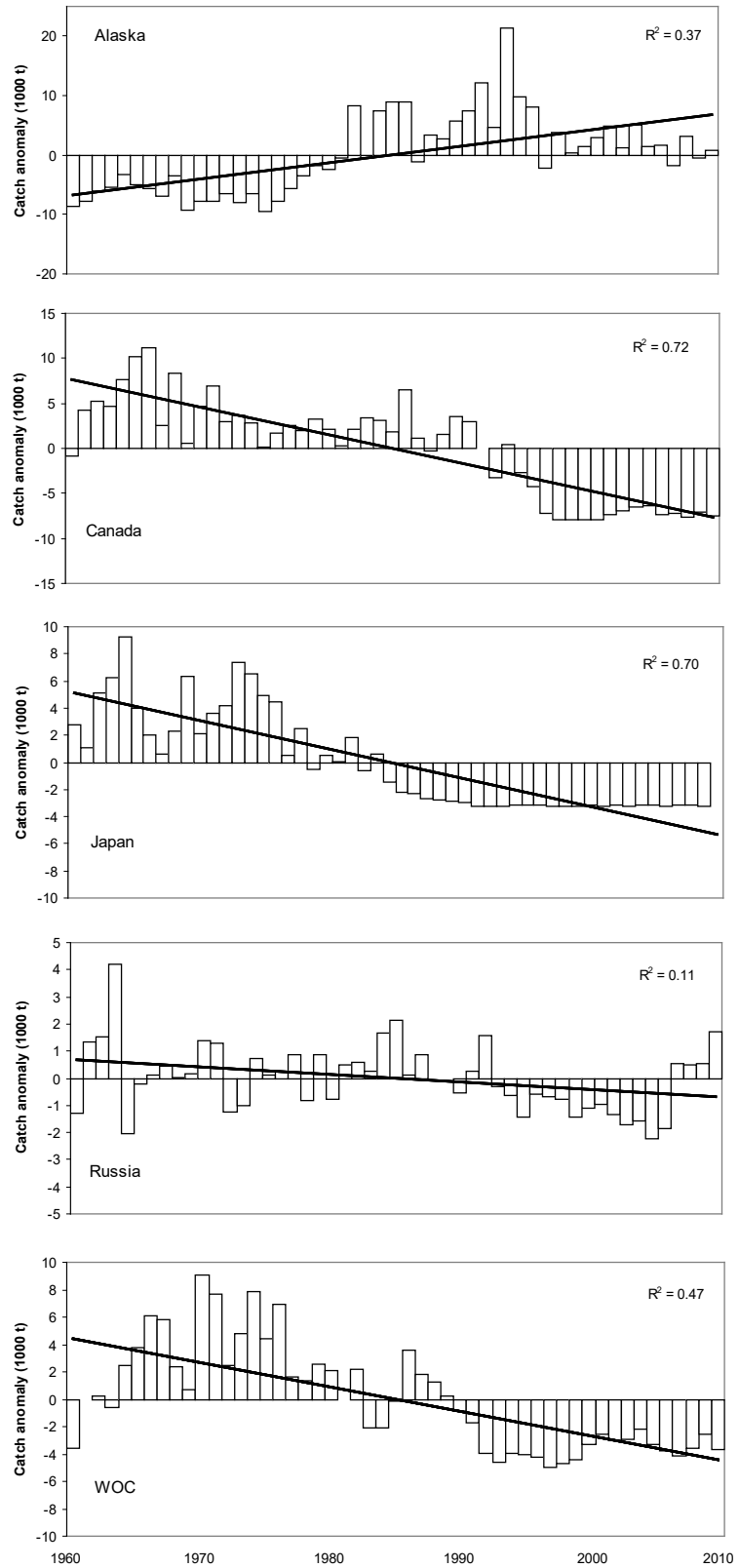


Figure A.3(b). Anomalies of catch of coho salmon by Alaska, Canada, Japan, Russia and Washington, Oregon and California (WOC) from 1960 to 2010 showing the declining trend all countries beginning about 1990, except for Alaska.

in

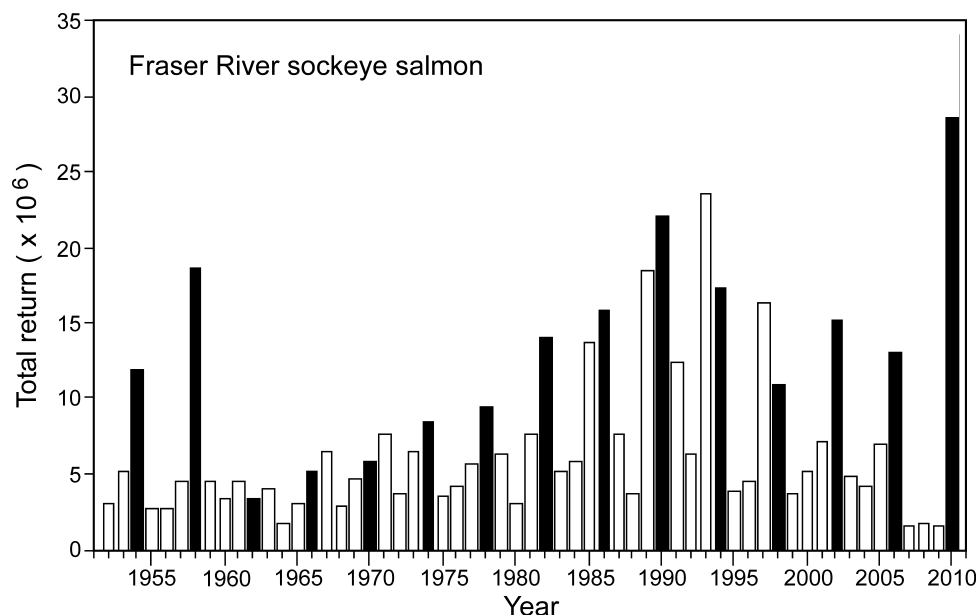


Figure A.4. Total returns of sockeye salmon to the Fraser River. Dark bars indicate those years when late-run Adams River stocks make a major contribution to the total salmon return. Return years 2007, 2008, and 2009 (brood years 2003, 2004, and 2005) were record low years. The highest recorded return was in 2010.

Chum salmon and Hatcheries

Chum salmon *O. keta* are produced in hatcheries by all countries in the North Pacific (Figure A.5). The marine survivals vary, apparently as a result of the conditions in the early marine coastal environment and as a consequence of the summer and winter rearing areas in the open ocean. It is important for all countries to understand how to optimize the early marine survival of chum salmon by designing cooperative research programmes throughout the distribution of juvenile chum salmon. It is also necessary to map the seasonal distributions of chum salmon from all countries in the open ocean to better understand the capacity of the ocean to produce chum salmon.

Pacific Decadal Oscillation

Large-scale trends in sea surface temperature in the subarctic Pacific were shown by Mantua et al. (1997) to be related to total Pacific salmon production. The major changes in the Pacific Decadal Oscillation that corresponded to major changes in Pacific salmon production trends occurred in the late 1940s, the late 1970s and about 1998 (Figures A.6, A.7, A.8). Other studies showed that there has been a general warming in the ocean habitat of Pacific salmon (Figure A.9), but it is not known if the warming trend will continue or be affected by the factors that cause the oscillations in the Pacific Decadal Oscillation. Because temperature affects the prey production for Pacific salmon as well as the amount of energy that is available for growth and storage, it is important to determine the reasons for the large-scale changes in temperature and to determine how the cyclic trend of the Pacific Decadal Oscillation will affect Pacific salmon production in the future.

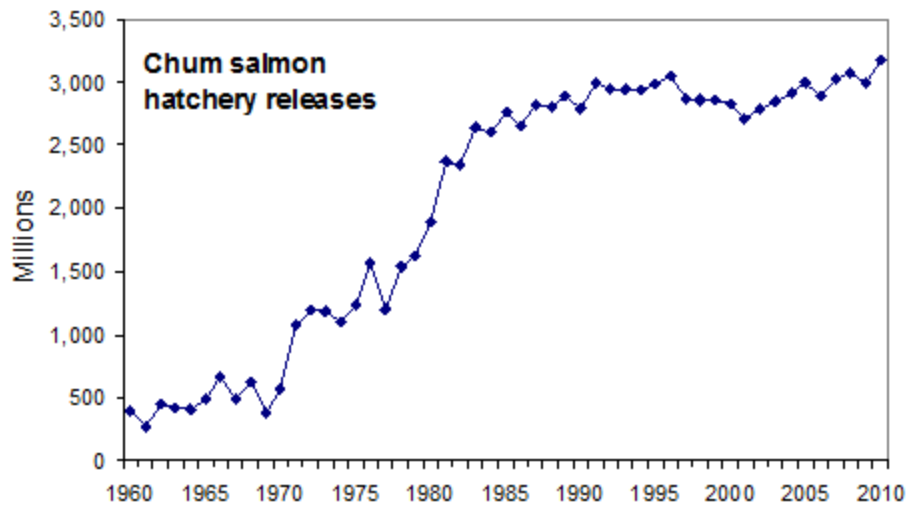


Figure A.5. Annual hatchery releases of chum salmon by all countries in the North Pacific in millions of fish.

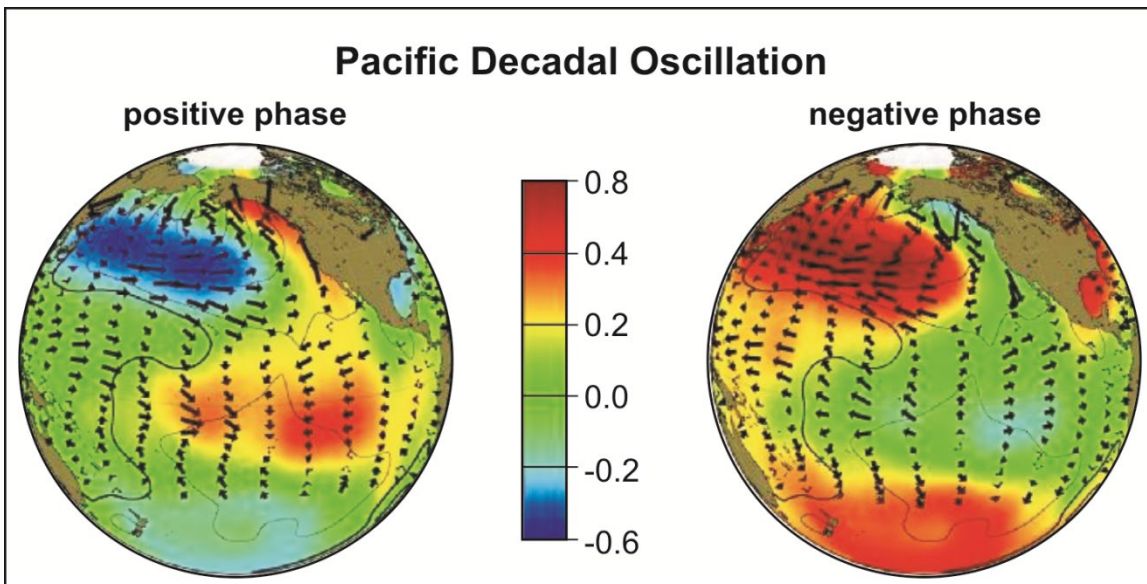


Figure A.6. Representation of the warm and cool phases of sea surface temperature anomaly in the Pacific Ocean and associated wind anomaly patterns.

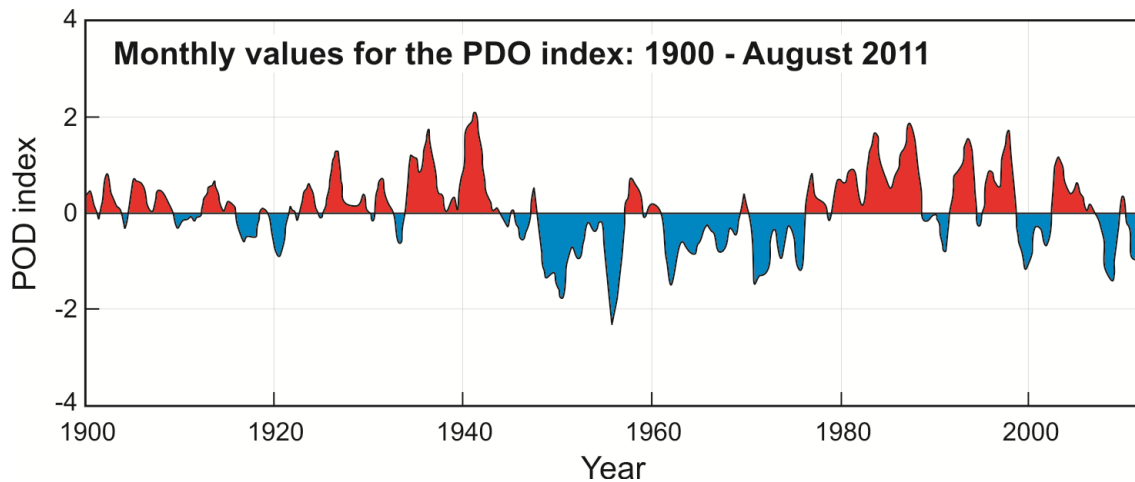


Figure A.7. Monthly values of the Pacific Decadal Oscillation (PDO) index from 1900–present. Red values are periods of warmer than normal water along the west coast of North America and correspond to the increased Pacific salmon catches in Figure A.8; blue periods correspond to periods of cooler than normal temperatures along the coast and correspond to periods of low total catch in Figure 7.

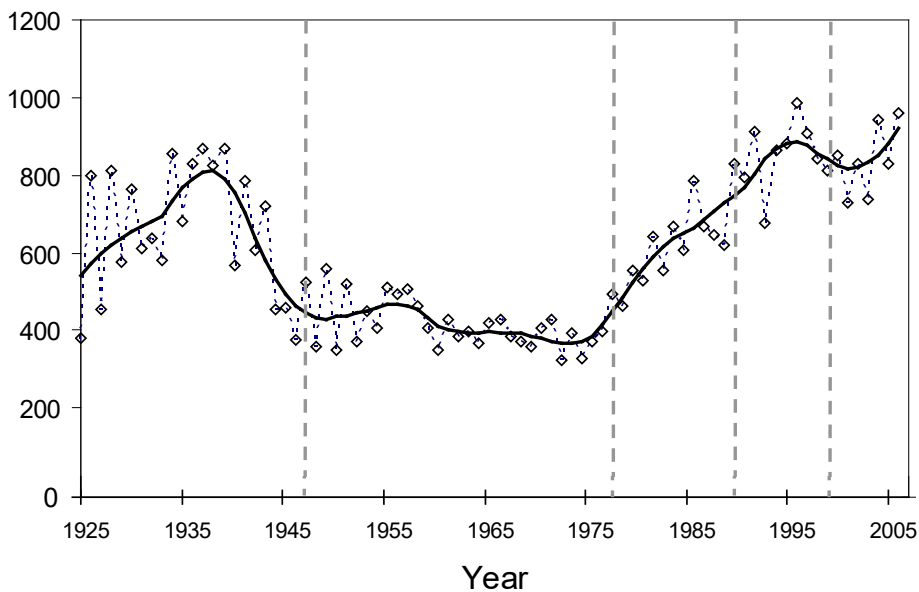


Figure A.8. Total Pacific salmon catch (dashed lines) smoothed using LOWESS (solid line) (band width, f , 0.2). Vertical dashed lines indicate regime shift years of 1947, 1977, 1989, 1998. (From Beamish et al. 2009b).

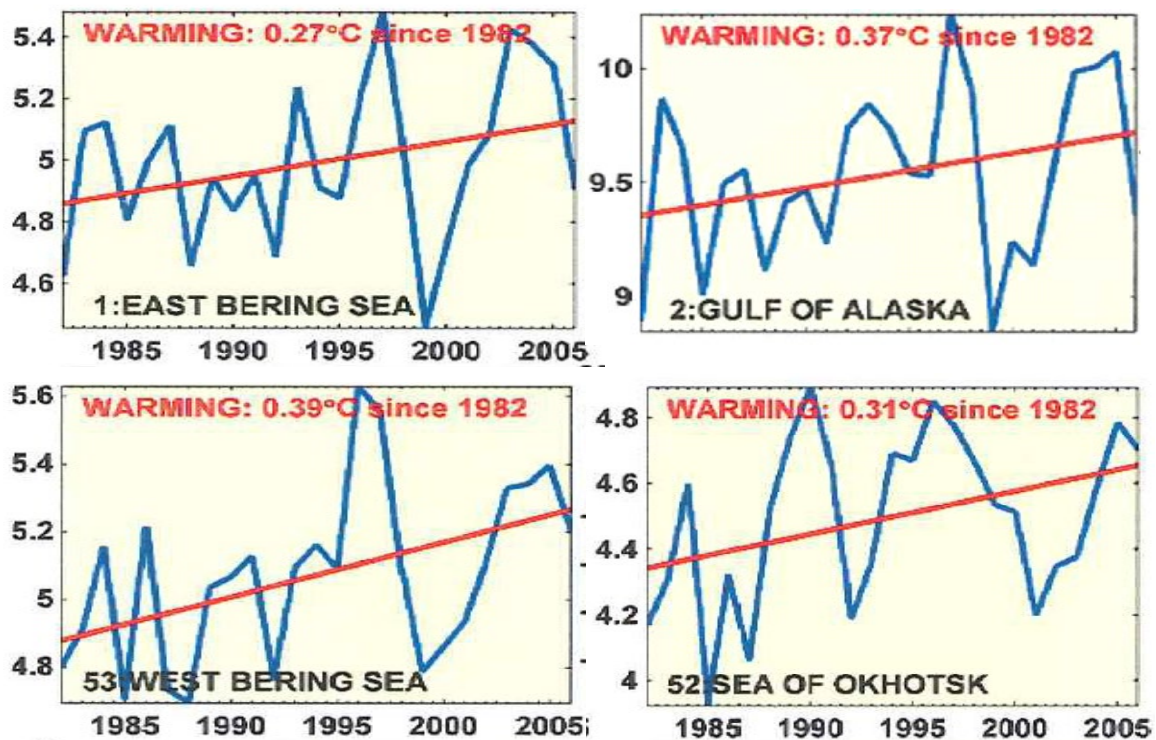


Figure A.9. Plots of sea surface temperature (°C) showing that the North Pacific Ocean has warmed from 1980 to 2005. From Sherman et al. (2009).

Indices of large-scale changes in winds

There are major cycles in the dominant direction and intensity of winds that blow across the subarctic Pacific. Indices of these winds include the Aleutian Low Pressure Index (ALPI; Beamish and Bouillon 1995) and the Pacific Circulation Index (PCI; King et al. 2006). The Aleutian Low Pressure Index is similar to the Pacific Decadal Oscillation (PDO; Figure 10), indicating that large-scale changes in winds as well as temperature affect trends in Pacific salmon production. The Pacific Circulation Index (King et al. 2006) is the Pacific counterpart of the Atmospheric Circulation Index (ACI; Klaysthorin 1998) and summarizes the annual dominant direction of the winds blowing across the subarctic Pacific (Figure A.11). The Aleutian Low Pressure Index categorizes the intensity of the winter low pressure in the area around the Aleutian Islands. The annual wind index (PCI) and the winter wind index (ALPI) are related to large-scale Pacific salmon production and both indices shift from one persistent state to another. The reasons for the shifts are not known, but it is most likely that there will be future shifts in annual wind direction (PCI) and winter wind intensity (ALPI) and these shifts will affect Pacific salmon production. An international effort to understand how the changes will affect the species-specific productivity of Pacific salmon would help explain and possibly forecast future changes to fishermen and the concerned public.

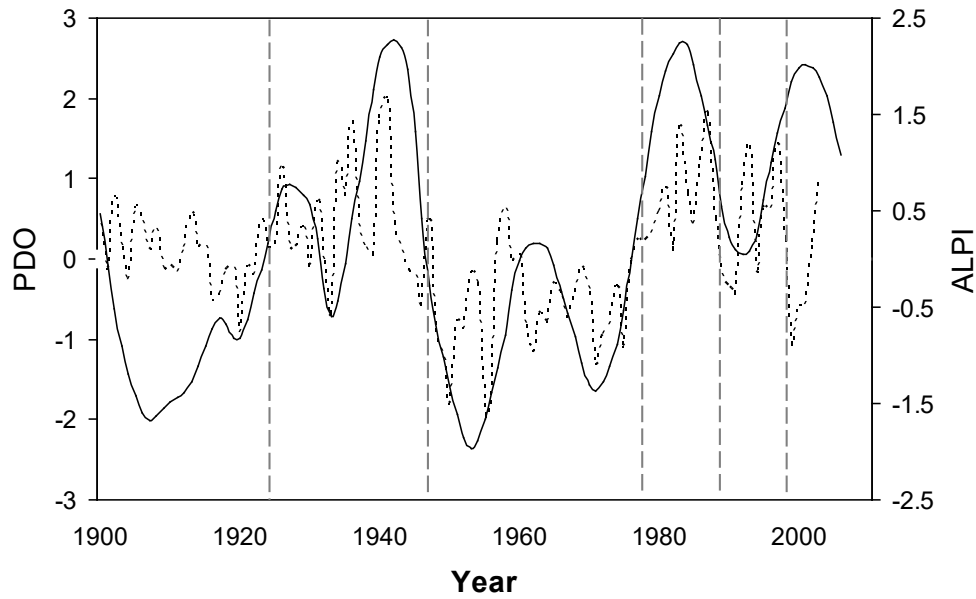


Figure A.10. The Pacific Decadal Oscillation (PDO) and Aleutian Low Pressure Index (ALPI) smoothed with LOWESS (—) (band width, f , 0.2). Vertical dashed lines indicate regime shift years. (From Beamish et al. 2009b).

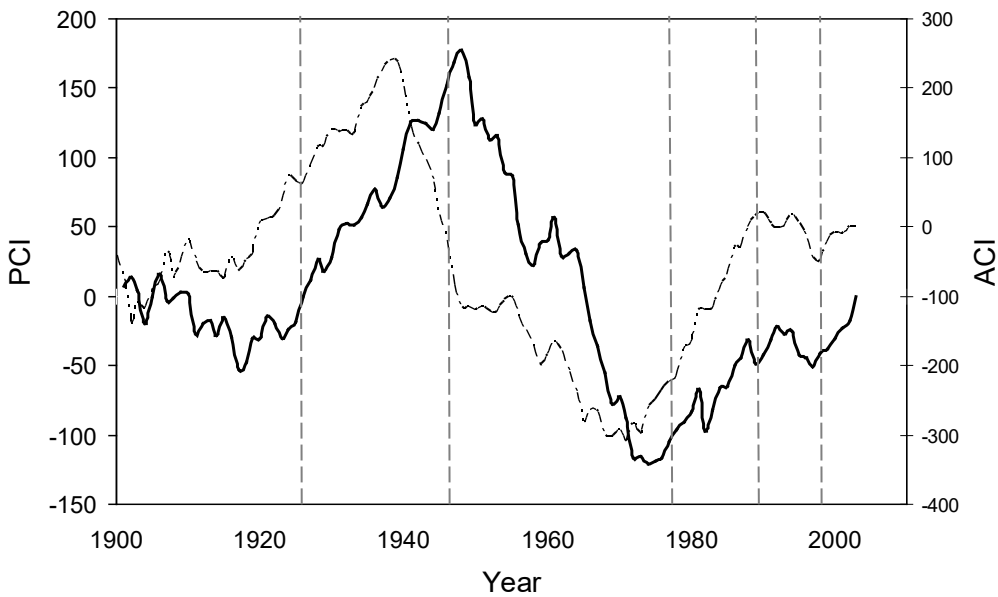


Figure A.11. The Atmospheric Circulation Index (ACI) and Pacific Circulation Index (PCI) from 1900 to 2003. Vertical lines indicate regime shift years in Figure 7 (From Beamish et al. 2009b).

1977 Regime Shift

There have been abrupt changes in the composition of ecosystems. These regime shifts have occurred on scales of about 10 years. There also are longer term shifts of about 30 years and 70 years. Recent regime shift years were 1947, 1977, 1989 and 1998 but the shift that most researchers recognize is the 1977 regime shift (Figures A.8, A.9, A.11). Regime shift years in 1947, 1989 and 1998 are associated with changing trends in Pacific salmon production but the largest change occurred in 1977. There were profound changes in the Gulf of Alaska and the Bering Sea that changed the structure of the ecosystem (Figure 12). Pacific salmon as well as Pacific halibut and other fish species increased in abundance. The reasons for the abrupt shift are unknown but it is generally accepted that the 1977 shift was not a unique event and will occur again. A reversal of the change in 1977 would have major economic impacts. A better understanding of the mechanisms that affect Pacific salmon production in the ocean will help ensure that the consequences of another major regime shift will be understood in a timely manner, allowing fisheries and hatcheries to be well managed.

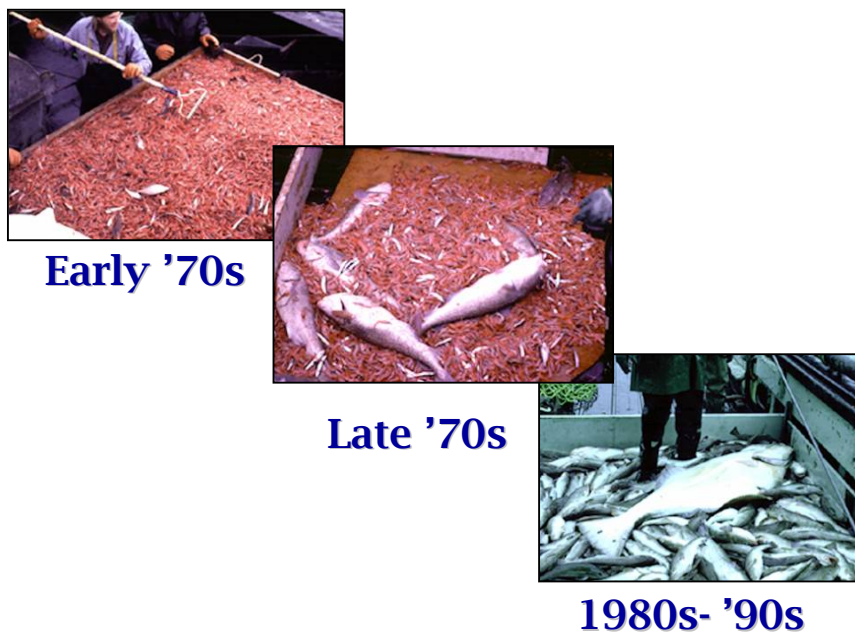


Figure A.12.

Categorization of the changes that occurred around the 1977 regime shift in the Gulf of Alaska and the Bering Sea.

(Credit: Phil Mundy and Paul Anderson, National Marine Fisheries Service)

Cost of Research

All Pacific salmon producing countries are experiencing reductions in the funding available for Pacific salmon research. There even is evidence that the number of biologists that are able and willing to study Pacific salmon on the open ocean is diminishing. A solution is to make efficient use of what is available by combining the resources available to all Pacific salmon producing countries as was done in the Bering-Aleutian Salmon International Survey (BASIS). The International Year of the Salmon could begin with a series of workshops that would focus on using existing science to determine the future abundance trends of the various species of Pacific salmon.

Benefits of an International Year of the Salmon

The major benefit of an International Year of the Salmon is the focus of resources on understanding mechanisms that regulate Pacific salmon production. The programme would include large-scale ocean studies, freshwater research and a team approach to analyzing and modelling the data. The goals would be for each Pacific salmon producing country to optimize their salmon production and improve forecasts. Each country would have specific interests, many of which were listed in the LRMP, with the common intent to be prepared for the future and optimize economic opportunities.

First Steps

I propose that the NPAFC establish a group that will consider the feasibility of an International Year of the Salmon. The feasibility group could consider three levels of activity. The simplest would be to host a series of workshops that would use existing information to forecast changes in the productivity of Pacific salmon and identify major information needs. These workshops could be jointly supported by other organizations such as PICES. A second level of involvement would add a year of marine research activities that would focus on identifying the country and population-specific rearing areas in the ocean, and improving the understanding of the mechanisms that regulate brood year strength. A third level would be to carry out the ocean studies for two years and include winter surveys.

Alaska has been a leader in supporting Pacific salmon stewardship and perhaps representatives from Alaska can agree to find the support for an initial feasibility meeting. The feasibility meeting could consider finding support from governments as well as from other groups and foundations that may be interested in a well-coordinated effort to identify the determinants of Pacific salmon production.

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CHAPTER 2: CONCEPTUALIZING THE INTERNATIONAL YEAR OF THE SALMON

The IYS Study Group

Formation of the Study Group on the International Year of the Salmon (IYS-SG) was discussed during the meeting of the Committee on Scientific Research and Statistics (CSRS) in Honolulu, Hawaii, USA, in April 2013 (NPAFC 2013). The first objective of the IYS-SG was to develop a short clear prospectus that would describe the initiative in more detail and present a possible timeline. Mark Saunders (Canada) was appointed Chairperson of the IYS-SG, and by 2014, members included Shigehiko Urawa (Japan), Ju Kyoung Kim (Korea) and Moongeun Yoon (Korea), Maxim Koval (Russia), Alex Zavolokin (Russia), Rich Lincoln (USA) and Eric Volk (USA) (International Year of the Salmon Study Group (IYS-SG) 2015b).

Following the 2013 Annual Meeting of the NPAFC, the Secretariat prepared a five-page outline to initiate discussion inside the IYS-SG, which was formed under the CSRS aegis, in January 2014 (Appendix B). This document answered some general questions regarding IYS implementation, e.g. *what are we celebrating in frame of the International Year of the Salmon?* It listed steps of preparatory phase planning including a feasibility meeting (later defined as a scoping meeting) and listed implementation details including a scientific research expedition in the NPAFC Convention Area, a major scientific symposium on status, dynamics, and factors driving production of salmon stocks, and creation of the IYS library. Social and outreach events under the IYS frame were also proposed for consideration by the IYS-SG. At this stage of IYS discussions it was also specified that the initiative would focus only on Pacific salmon and main IYS activities would be concentrated in the North Pacific, with participation generally limited to NPAFC member countries. After consultation and concurrence with the initiator of the idea, Richard Beamish, the Secretariat sent the document to the IYS-SG Chairperson, Mark Saunders, to use suggested ideas in preparation of a short clear prospectus prior to the 2014 Annual Meeting of the NPAFC.

A short prospectus was developed that outlined two phases that would be carried out under the IYS: a scoping phase and an implementation phase (Appendix C). The scoping phase would involve the development of a detailed prospectus by CSRS that would provide a more thorough description of research objectives and activities associated with cost, timeline, participants, and expected results. This phase would also include a scoping meeting, to be convened in 2014, which would involve a discussion to devise a funding strategy, with partners from government, academia, industry, businesses and NGO's. The implementation phase was to be further divided into three major components: a data collation and field collection component, an analytical component, and an outreach component. This was the first official mention of an outreach component to the IYS, with most discussion up until this point focused on research objectives. The outreach component was briefly described as engaging the scientific community as well as the public in a broad sense with respect to IYS research and findings as well as underlining Pacific salmon and steelhead conservation and cultural significance in the North Pacific Rim.

The short prospectus also included some rough details with respect to cost, duration, participants, deliverables, funding, staffing, governance, and a timeline. Total duration was expected to last three to four years with a total cost of \$2–4M CAD. Participants were expected to include scientists from

governmental organizations such as NPAFC and PICES, non-governmental organizations (NGOs), and academia, as well as representatives from First Nations groups, unions, communities, and commercial and recreational fisheries. Examples of deliverables included both primary publications and outreach material such as an IYS website and library, videos/documentaries, and popular articles. A possible governance structure of the IYS put forward in the draft prospectus included an IYS Honorary Council (senior officials, sponsors, and fundraisers) and an IYS Steering Committee and Sub-Committees (Data and Information, Research-Field, Research-Analytical, Logistics/Events, and Communications and Outreach). It was anticipated that the IYS initiative would require one to two staff, which could potentially be housed by the NPAFC Secretariat. A possible timeline was also suggested:

| | |
|---------|---|
| 2014 | Scoping meeting and a detailed prospectus completed |
| 2015 | Project initiation (confirmation of funding, establish governance bodies, develop detailed work plans and data management protocols, hiring of staff) |
| 2016/17 | Year 1 & 2 – Gulf of Alaska surveys |
| 2018/19 | Years 3 & 4 – Analyses, workshops/symposia, publications, a major scientific symposium |

At 2014 Annual Meeting of the NPAFC, the Commission agreed that the IYS-SG continue to scope the initiative and to develop an IYS proposal. The following terms of reference were provided (NPAFC 2014 p. 84).

The International Year of the Salmon (IYS) Study Group should continue to scope the initiative through a series of virtual and/or face to face meetings of interested parties and outside interests to develop an IYS proposal that will be discussed by the NPAFC at the 2015 Annual Meeting. The proposal developed by this group would address the following considerations:

1. *Scope of the Programme (Pacific-Atlantic, Farmed Salmon and other ecosystem considerations, etc.)*
Benefits of the Programme
2. *Potential for Funding and Identification of Partners (NGO's Industry, State and Federal Agencies, other RFMO's, etc.)*
3. *Communications and Outreach Strategy*
4. *Identification of Field and Analytical Research (Strategic Research Plan)*
5. *Starting Year and Duration*

The proposal was to be virtually reviewed by CSRS and undergo further review by the NPAFC at the 2015 Annual Meeting. Next steps outlined in the short prospectus were to have CSRS confirm support for the principle of the IYS as well as to convene a scoping meeting to develop a science plan for the initiative and discuss potential funding strategies. Further, the suggested start date for IYS initiative was pushed to 2016.

Initial Discussions with NASCO

In discussion of the IYS prospects at the 2014 NPAFC Annual Meeting, involvement of NASCO in future progress of the initiative was mentioned by the Secretariat. The NASCO Executive Secretary, Peter Hutchinson, had expressed a great interest in the IYS since he first became aware of the initiative in July 2013. Hutchinson shared an approach to include all salmon species in the IYS scope, most notably the ‘King of Fish’—Atlantic salmon (*Salmo salar*). The NPAFC Secretariat kept NASCO and NASCO-related NGOs updated on further IYS developments and sporadically discussed a better approach to promote the initiative with the NASCO Secretariat. Hutchinson agreed that despite the initial idea having a heavy science focus, the sponsoring of social and outreach events to raise awareness of the resource would be very important.

After receiving preliminary information on the IYS project in June 2014, the NASCO Council tasked the NASCO Secretariat to liaise with the NPAFC and report on its progress the next year. The NASCO Secretariat accepted this task as an opportunity to raise the profile of the work being done in both the North Pacific and North Atlantic to conserve and restore salmon stocks and to understand factors influencing their abundance. The NPAFC and NASCO revived regular communication and planned a face-to-face meeting to discuss details.

The First IYS Scoping Meeting

The IYS-SG and NPAFC Secretariat assembled the First IYS Scoping Meeting on February 17–18, 2015 in Vancouver, Canada, in the boardroom of the secretariat of the Pacific Salmon Commission (PSC). Participants included most members of the IYS-SG as well as scientific experts from member countries who were invited to help produce recommendations on the nature of the IYS, with particular emphasis on developing the scientific objectives. The list of participants and workshop agenda can be seen in the Report of the International Year of the Salmon Scoping Workshop (Appendix D; IYS-SG 2015b). Information was captured during a series of facilitated discussion panels, short presentations, and group discussions. Immediately following the two day meeting, the IYS-SG met to discuss all material that was presented and draft an IYS proposal with the goal of developing “*a compelling case for new coordinated research directed at key scientific issues affecting the future of salmon*” (IYS-SG 2015b p. 1). The main objectives of the workshop were as follows (IYS-SG 2015b p. 1):

1. *Develop a list of major scientific issues that will, or are likely to, affect salmon production in the foreseeable future, and around which an IYS could be developed and funded.*
2. *Identify the unknowns and scientific questions related to each issue.*
3. *Discuss the scope (spatial, temporal, species) of an IYS that will be needed to answer the questions (test the hypotheses).*

National Research Priorities

Prior to the First Scoping Meeting, the NPAFC Secretariat compiled and distributed among participants a questionnaire on national salmon research activities and priorities to facilitate identification of a prospective IYS scientific programme that would be relevant to the national priorities of each country, as well as to find common research themes and emerging issues. During the scoping meeting,

national research priorities that have emerged from research activities were also presented by a representative of each country, followed by plenary discussion. Prior to these presentations, objectives of the 2011–2015 NPAFC Science Plan (Anonymous 2010) were presented by Shigehiko Urawa. The overarching research theme of the 2011–2015 NPAFC Science Plan was “*Forecast of Pacific Salmon Production in the Ocean Ecosystems under Changing Climate*”, and included five research components (IYS-SG 2015b p. 3):

1. *Migration and Survival Mechanisms of Juvenile Salmon in the Ocean Ecosystems;*
2. *Climate Impacts on Pacific Salmon Production in the Bering Sea and Adjacent Waters;*
3. *Winter Survival of Pacific Salmon in the North Pacific Ocean Ecosystems;*
4. *Biological Monitoring of Key Salmon Populations;*
5. *Development and Applications of Stock Identification Methods and Models for Management of Pacific Salmon.*

Japanese research efforts presented at the First Scoping Meeting focused on the trend of the declining abundance of chum salmon with a temporal pattern of change that differs among three regions (Pacific, Okhotsk Sea, and Japan Sea Coasts), as well as fluctuations in age and body size of adult chum returning to spawn. National ocean salmon research priorities were presented as follows (IYS-SG 2015b p. 3):

- 1) *Juvenile salmon surveys in the coastal waters and the Okhotsk Sea to determine the survival mechanism of each regional populations,*
- 2) *Long-term monitoring of salmon and their habitats in the Bering Sea to forecast salmon production, and*
- 3) *Winter salmon surveys in the western Subarctic Pacific and the Gulf of Alaska to evaluate possible source of mortality.*

Ju Kyoung Kim, who presented results of salmon research in Korea, emphasized the importance of research and filling knowledge gaps on salmon stock abundance trends, distribution and migration of juvenile and adult salmon, climate impacts, and wild/hatchery stocks interactions. All Korean chum salmon are released from hatcheries and that adult abundance is so low that all are utilized for hatchery production.

With regards to Russian research activities discussed at the First Scoping Meeting, a significant portion focused on the early marine period of Pacific salmon; the freshwater period is well studied and currently used as the basis of forecasts. Although the early marine period is a critical period in salmon life history, these studies are difficult to conduct in eastern Russia due to the long coastlines and large number of rivers. Estuarine and inshore studies are conducted in effort to improve abundance forecasts and better understand biotic and abiotic factors affecting salmon productivity. Additionally, high seas surveys are conducted every year in the Okhotsk Sea, western Bering Sea, and Pacific Ocean in effort “*to improve forecasts of salmon abundance, to determine their biochemical composition and energetic levels,*

to understand role of Pacific salmon in marine ecosystems, to understand the carrying capacity of the North Pacific, and the determination of growth variability and its consequences for their survival” (IYS-SG 2015b p. 4). Carrying capacity was discussed as being a difficult area of research that is only beginning to be addressed in Russia. High seas information helps to improve forecasts but information on stock composition is essential as it provides regional information on abundance. Additional research activities included factors affecting mortality of salmon, including oceanography, plankton communities (food supply), predators, disease, and parasites, as well as the role of Pacific salmon in marine ecosystems under such topics as: “(1) structure and dynamics of plankton and nekton communities, (2) diets and feeding rates of salmon and other nekton species, (3) trophic status and interactions between salmon and other nekton species, and (4) dynamic of physical environment of salmon” (IYS-SG 2015b p. 4). Russian research priorities presented at the workshop were “improvements of forecasts (freshwater and marine studies), stock identification to find out stock-specific migrations and abundance, factors affecting salmon mortality, analyzing carrying capacity of the North Pacific” (IYS-SG 2015b p. 4).

In the questionnaire, Alex Zavolokin, who presented the review on Russian research activities, pointed out the importance of further studies on bacterial and viral diseases in fish as a factor of salmon mortality, seasonal and interannual dynamics of salmon energetic status estimated by stable isotope analysis of salmon diet and biochemical composition of salmon tissues, as well as development of genetic and phenotypic methods of stock identification. Considering analysis of the impact of environmental conditions, a combination of local (water temperature, stratification, distribution of eddies and fronts) and global (large-scale climate changes) approaches promises better results in the development of advanced understanding. Russian fisheries research institutions have plans to conduct these studies on a regular basis.

Research priorities of the USA presented at the scoping workshop relate back to the five research components of the 2011–2015 NPAFC Science Plan. Investigations under theme 1 (juvenile migration and survival) are conducted in the Gulf of Alaska and the eastern Bering Sea. Multiple activities under research theme 2 (climate impacts) were described, including research cruises similar to those conducted under the Bering-Aleutian Salmon International Survey program, focusing on climate and climate cycle effects on salmon populations. No research programs were being conducted under theme 3 (winter survival) at the time of the workshop. With regards to theme 4 (long-term biological monitoring), “*investigations of salmon abundance is a long-standing objective with extensive catch accounting and monitoring of escapements to several hundred systems in Alaska and the Pacific Northwest*” (IYS-SG 2015b p. 4). Research theme 5 (stock identification) was also stated as being an on-going priority “particularly with respect to method development and monitoring of fishery catch composition” (IYS-SG 2015b p. 4).

Eric Volk, from the Alaska Department of Fish and Game, emphasized in the questionnaire that planning and performance of salmon research are structured in accordance with the concept of critical life history periods. Further development of stock identification methods is critically important since enhanced stock resolution is needed to answer broad scale questions. There are crucial knowledge gaps in the current understanding of species/stock age-specific growth and maturation schedules changing in marine habitats, effects of changing primary and secondary productivity cycles under influence of changing thermal regimes and ice dynamics, and salmon forage base dynamics. Relative to a problem of

anthropogenic pollution, new research questions have been raised on the impact of micro plastic particles in the ocean on salmon and their prey.

Similarly to research objectives addressed by other Pacific salmon producing nations, there is a need in Canada to improve forecasts of hatchery and wild salmon abundances. There is also a need to describe, organize, and serve data that has been collected over the past decades. Canadian research priorities discussed at the First Scoping Meeting were highlighted by 12 research questions (IYS-SG 2015b p. 5):

- *How to develop shared data systems to enable comparisons of production and productivity of salmon populations across the North Pacific?*
- *What is the relative importance of density-dependent vs. episodic density-independent processes in regulating salmon survival?*
- *Where and when do juvenile salmon move off the continental shelf?*
- *Where do different populations of salmon migrate to in the North Pacific Ocean?*
- *What are the factors affecting the distribution of salmon in the North Pacific Ocean?*
- *What factors control the productivity of salmon prey in the North Pacific Ocean?*
- *What periods are “critical” and do they vary among species/year?*
- *How can we improve our ability to forecast salmon returns?*
- *How will salmon survivals/distributions be affected by climate change?*
- *What risks are posed to wild salmon by interactions with cultured salmon (including competitive interactions between hatchery and wild fish)? Does carrying capacity vary?*
- *Can genomics help us understand the role of pathogens and physiological condition on salmon survival?*
- *How to develop a cumulative effects approach to understand the key anthropogenic and natural factors affecting survival at each life history stage (freshwater, early marine, coastal, high seas)?*

Terry Beacham and James Irvine presented the Canadian research priorities at the meeting and especially pointed out the importance of studying climate change effects on the oceans as well as Pacific salmon adaptation capacity to new environmental conditions. In the questionnaires, they hypothesized that different migration routes and offshore rearing may account for salmon survival variation. Therefore, identification of region and time, where mortality directly correlates with subsequent returning abundance, might help to fill knowledge gaps related to salmon stock productivity, fishery forecasting and planning. The effect of increasing acidification on salmon prey and salmon growth and growth of anthropogenic noise pollution in coastal areas should be considered as notable sources of salmon habitat alteration. In a brief note regarding IYS ideas, Skip McKinnell also addressed the possible effects of ocean acidification on salmon prey organisms and how and when this may affect salmon food webs, in

addition to the possible effects of glacial erosion on productivity in salmon habitat. Beacham emphasized in a note that genomic technologies offer high resolution of stock identification. It should also provide an answer to the question of whether differential gene expression among salmon stocks may account for survival variability. Significance of interspecific and intraspecific competition for salmon body size and survival was also highlighted with a note that poor salmon nutrition might promote physiological stress.

Following the presentations by each country, integrative ways in which nation-specific research priorities could be included into the IYS initiative were suggested. These included: *“cumulative effects as a way to bring all of these questions together, life-cycle modelling as in important area of research that may address some of the issues, and data downloading to the next generation that was expanded to a need for more rapid knowledge transfer among scientific cohorts”* (IYS-SG 2015b p. 5).

A summary of the responses of the nine salmon experts who responded to the Secretariat’s questionnaire can be seen in Table 2.1. The experts mentioned anticipated changes in salmon habitat as the first priority emerging issue relevant to salmon stock conservation in 10–20 years, in addition to ocean and freshwater productivity, ocean acidification, and fish diseases. We should recognize that these matters concerned academia, civil society, the private sector, First Nations, and the community as a whole and they should be addressed in a framework of the IYS outreach programme.

Table 2.1. Prioritization of emerging issues relevant to ocean salmon in 10–20 years (A) and knowledge gaps relevant to ocean salmon research and research ideas that needs to be conducted in the next three to five years (B) based on the NPAFC Secretariat questionnaire filled by nine participants of the First IYS Scoping Meeting.

| No. | Topics A | Score* | No. | Topics B | Score* |
|-----|--------------------------------------|--------|-----|-------------------------------|--------|
| 1. | Ocean acidification | 34 | 1. | Survival | 38 |
| 2. | Changes in salmon habitat | 31 | 2. | Distribution | 34 |
| 3. | Ocean productivity | 31 | 3. | Abundance | 33 |
| 4. | Competition | 28 | 4. | Migration | 30 |
| 5. | Disease | 23 | 5. | Climate impacts | 30 |
| 6. | Freshwater productivity | 22 | 6. | Critical life history periods | 29 |
| 7. | Reduction of salmon distribution | 20 | 7. | Salmon prey | 28 |
| 8. | Domestication | 19 | 8. | Stock identification | 24 |
| 9. | Expansion of salmon distribution | 16 | 9. | Forecasting run size | 24 |
| 10. | Over-fishing | 15 | 10. | Growth | 23 |
| 11. | Salmon in polar regions | 14 | 11. | Body condition | 21 |
| 12. | Suitable salmon habitat connectivity | 11 | 12. | Hatchery/wild interactions | 20 |
| 13. | Pollution | 7 | 13. | Salmon predators | 19 |
| | | | 14. | Disease | 16 |
| | | | 15. | Behavior | 16 |
| | | | 16. | Genetics | 15 |
| | | | 17. | Competition | 15 |
| | | | 18. | Forecasting run timing | 13 |
| | | | 19. | Abiotic habitat conditions | 13 |
| | | | 20. | Genomics | 12 |
| | | | 21. | Physiology | 11 |
| | | | 22. | Pollution | 9 |

Remarks: Score is based on results of expert ranking, where 5 points were added to a set of scores for each first place, 4 points for each second place, 3 points for each third place, two points for each fourth place, and one point for each fifth place. Experts were free to list several first, second, third and other places to listed topics.

Two experts additionally proposed several topics that could not score more than 2–5 points: In section A, ocean ecosystem models, salmon hatcheries, and regulation of hatchery release numbers; in section B, stable isotope analysis and salmon in marine trophic nets.

Purpose of the IYS: A Social Benefit

The workshop progressed to a session on the purpose of the IYS, with an introduction on the origins and envisioned motivations by Richard Beamish, followed by a plenary discussion where other perspectives could be explored. The initial concept for the IYS began as an economic research programme supported by science as it was believed that political support for the initiative would have been limited otherwise (Beamish 2012). It was envisioned as a way to achieve a long-term goal of improving forecasting of changes in Pacific salmon abundance resulting from changes to climate and ocean conditions. It was also thought that it would serve to help optimize hatchery production by increased experimentation on release timings.

In addition to an economic benefit, however, a social benefit to the research initiative was brought forward during plenary discussions. An improved understanding and ability to forecast salmon abundances would initiate communication with communities that may be severely affected by declining salmon populations. Furthermore, *“linking salmon to people and culture would draw attention to an idea that the research conducted under an IYS was not simply self-serving, but for the greater goal of helping people with a strong interest in the resource”* (IYS-SG 2015b p. 5). The cultural value of salmon was also addressed, which is linked to conservation and restoration objectives of wild salmon, particularly to Indigenous Peoples and those who rely on the resource for subsistence. In some cases, the persistence of local salmon populations is very closely linked to the survival of human communities; as such, it was stated that there is a *“need for IYS science that was not based solely on economic arguments”* (IYS-SG 2015b p. 5). During final discussions on the purpose of IYS, understanding other aspects of salmon ecology unrelated to sampling to improve forecasting ability was also addressed, including studies looking into habitat, prey, and foraging behaviour.

Identification of Knowledge Gaps and Development of Research Ideas

The objective for the remainder of the first day was to develop a list of research ideas that would be required to understand factors affecting salmon production now and in the future. This detailed list would then be used on the following day to create a list of general research imperatives. This session began with an introduction by Kate Myers followed by a survey of individual opinions and group discussions. With regards to general knowledge gaps surrounding Pacific salmon research, a lack of detailed understanding of where salmon go in the ocean despite considerable attention paid to forecasting and measuring salmon productivity was discussed. The need to develop better models of where salmon go in the North Pacific was highlighted, especially considering the fact that the tools to provide this information are now available. Participants developed a list of criteria that should be considered when developing research objectives for the IYS (IYS-SG 2015b p. 6):

- *be accompanied by measurable indicators of the degree to which the objectives are met;*
- *be determined by assessing the sensitivity of simulation models to various kinds of perturbations and new research would be directed at those characteristics that have the greatest uncertainty;*
- *avoid framing outcomes as scaremongering and focus on why salmon and their ecosystems are changing;*
- *avoid biting off more than can be chewed;*
- *consider legacy and emerging issues such as human population growth, pollution, ocean acidification, offshore development;*
- *provide better information on migration, timing and distributions*
- *might focus on how humans are affecting salmon in the North Pacific;*
- *provide a better understanding of what is meant by ecosystem change;*
- *be a long-term project with short-term rewards;*
- *include a means of finding the human resources to conduct the research, given the current demographic of salmon biologists;*
- *consider whether commercial shipping might contribute to achieving IYS objectives;*
- *consider that industry will want a realistic vision of the future. It is good for business to understand future opportunities so they can adapt and benefit from this knowledge.*

It was stated that the existing framework of the NPAFC would help to undertake questions related to salmon distribution in the North Pacific as well as initiatives related to forecasting and carrying capacity. Issues that may be encountered were also discussed, however, including “*funding, optimizing the use of historical data, stock-specific distributions, and year to year variability*” (IYS-SG 2015b p.6). It was also suggested that data collection be directed at specific hypotheses and that the quantity of observations taken should be enough to improve forecasts, which themselves need to be better conceived. Another suggestion was that research questions be directed towards groups that will be utilizing the end result, specifically subsistence users and the commercial and processing sectors.

The identification of key research questions was initiated with a survey of individuals. Individuals were asked to write down three of their top research priorities which were later sorted into three categories: (1) critical questions related to specific juvenile freshwater salmon life-history phases (2) critical questions related to specific salmon marine life-history phases and (3) critical questions associated with all freshwater and marine salmon life-history phases, as well as a few cross-cutting issues. Detailed tables listing research topics under each of these three categories can be seen in the Report of the International Year of the Salmon Study Group Scoping Workshop (Appendix D; IYS-SG 2015b).

A list of potential research ideas, generated by round table and plenary discussion of knowledge gaps, can be seen below (IYS-SG 2015b pp. 6–7):

- *using societal benefits, such as examples of the NCBI/Human Genome projects that involved data intensive-data coordination activities that*

are well funded in some circles.

- *selecting an international scope that will focus on distribution of salmon at sea and distributions within national waters;*
- *testing hypotheses about winter marine survival*
- *determining the extent to which variations in ocean productivity affect salmon production;*
- *educating people about large ecological issues (examples of good models included NCEAS in California, Gulf Watch Alaska)*
- *determining spring and winter survival;*
- *understanding stock composition;*
- *understanding the carrying capacity of the ocean;*
- *understanding the effects of oceanic diseases and parasites on survival.*
- *determining the survival in coastal waters, especially where international cooperation is required to execute the research programs to achieve a better understanding.*
- *determining the consequences of future increases in Sea Surface Temperature (SST) and how it might affect inter- and intra-species competition;*
- *evaluating sibling ratio forecast models;*
- *understanding the influence of pink salmon on forecasts of abundance of other species;*
- *determining the role of hatcheries in the future of salmon survival;*
- *hatcheries can be used to understand freshwater contributions to survival by making hatchery and wild comparisons (if smolt quality is good);*
- *determining whether international regulations or guidelines are required for hatchery releases to achieve clearly articulated benefits from them. Coastal jurisdictions have different approaches to hatchery developments. The topic was seen as an important one, but with political consequences for raising it;*
- *to determine the drivers of enhancement activities. To understand their relationship with climate change, it would be appropriate to have an appropriately structured group to provide knowledge about trade-offs;*
- *determining if hatchery production affects the quality of salmon;*
- *determining the future effects of carbon pollution (ocean acidification) and its effect on salmon prey and food web structure. There are natural links to other international organizations that are studying this topic. There is variable capacity to monitor oceanic pH and most of it is occurring along coastlines.*
- *examining life-history stage transitions between freshwater and marine and other transitions;*
- *determining whether the first winter is important. Perhaps that winter*

survival is important, but factors affecting growth probably take longer.

- *differences in life-history between coasts or between oceans may provide natural experiments and large contrasts to provide some insight.*

The final task of the first day of workshop was the development of criteria for prioritization of research topics. It was thought that topics under the categories of food security benefits (communicating social implications), cultural importance, international scope, relevance to end users, feasibility (doable in 3–5 years), and high impact should be used to prioritize the research topics discussed.

Clarification of Research Objectives

Due to some uncertainty with regards to overall objectives of the IYS from the previous day, day two of the First Scoping Meeting began with the presentation of a preliminary set of research objectives that was then refined to inform group discussions later in the day. Discussion points included the following criteria and suggestions:

- The IYS needs to be a formal international cooperative that will provide a science framework for policy makers and help address food security issues across the North Pacific against the backdrop of a changing environment.
- The goal is to produce an international network of information that everyone will have access to. There must be collaboration and cooperation on an international level as well as dissemination of information and participatory engagement.
- Use of the term “variation” should be avoided as it is not appropriate framing. There is a need to do something different as research has been focused on variation for a long time. Alternatively, language such as “reducing uncertainty” and “improving confidence” should be used.
- Possible funding could come from private organizations (potential for some public funding after popularity increases), other foundations (Moore Foundation, Packard Foundation, etc.), and big corporations (specifically with respect to international shipping).
- It may be beneficial to add a technology piece to appeal to the public, particularly on salmon movement.
- Indicators of success related to broad goals must be defined.
- A children’s education/training theme could be implemented, potentially framed as a young scientist’s conference. Capacity building could be carried out at universities and aboriginal communities.

Technological Advances

New developments in technology or new applications of existing technology that could be made possible with an IYS research programme were also considered. These developments would provide significant opportunities to improve understanding of salmon biology and their interactions with the environment. Possible advances in technology that were discussed included genetic stock identification, oceanographic and biological modelling, and undersea cabled observation networks.

In the brief note regarding IYS ideas mentioned above, Skip McKinnell addressed the benefits of using new technologies in the IYS initiative. *“Decades of tagging have provided only a relatively crude understanding of where and when certain species visit different parts of the ocean. New technologies have come online that will radically change the information flow from such activities.”* McKinnell also stated that colour sensing satellites could be used to detect mesoscale structures (fronts, eddies, jets) that are generally associated with increased biological productivity. These satellites could be used to determine sampling locations to see if feeding salmon are associated with these structures.

Development of Overarching Research Priorities

Overarching research priorities were developed from the topics discussed during the previous day. Participants were divided into four break-out groups (see Appendix D) to develop a research “portfolio” that should be addressed by the IYS. In the research portfolios, groups were asked to identify indicators of success, determine a set of research priorities related to the research objectives, state the accompanying research questions, document supporting rationale for what makes each priority so compelling, and if time allowed, articulate the scope of research (e.g., species, timeframe, geographic focus).

Group 1

Research priorities:

- Winter research
 - Focus on pink, chum, and sockeye salmon, or a subset where necessary
 - High-seas coordinated sampling and region-specific programs (case studies)
 - Cross-Pacific comparisons could potentially inform about key processes
 - Stock ID with genomics
- Fraser River sockeye and Russian pink salmon as a data-rich systems (especially for stock composition)
- Build multi-stock data sets for hierarchical statistical analysis to generate key questions about processes
 - For instance, why do Alaskan pink and sockeye salmon show positive changes in recruits-per-spawner with increasing SST, whereas BC and Washington show a decrease?
 - Where are the fish during the first 9 months? What are the associated features of the ocean?
- Develop more programs to estimate abundance of seaward migrating life stages (smolts for sockeye salmon, fry for pink and chum salmon)
- Can we still get useful information from scale archives?
- Growth and survival rate differ in how rapidly we can learn about the causes of observed changes
 - Growth can be estimated much better than survival rate
 - Need both because total biomass of adults is the key end variable
- Can genomics help understand condition?
 - Must sample a large number of variables of each fish

- Current information suggests fish are “homing” to certain areas on the high seas; can they respond to climate change to move to another area?

Research questions:

- Winter research
 - Where are stocks at different times in the winter, and are they non-randomly distributed?
 - Are their locations related to oceanographic variables (e.g., sea surface temperature, currents, etc.) or are the fish in the same places across years, regardless of ocean conditions?
 - Are those locations genetically influenced?
- Which ages/places are most important for interannual variation in survival or growth? The answers would probably be specific to each regional case study.
- By what mechanism could ocean acidification affect salmon?
- How do high abundances of pink salmon affect growth and survival of sockeye salmon?
- To optimize hatcheries, are increases in hatchery releases affecting growth and survival of both wild and hatchery fish?
- Is there size-selective mortality in the winter and what is the relative importance for total recruitment?

Supporting rationale:

- How can fisheries managers make better decisions based on new information generated by IYS research?
 - Best to have causally-based explanations, not correlations
- Succinctly describe a few examples of how IYS research can be used
- Tie the results of IYS research results to projections of future states and providing a baseline for future comparisons

Group 2

Indicators of success

- Seasonal mapping and related products to support public engagement and interaction with end users
- Improved forecasting is not a proposed deliverable of IYS (likely not feasible in time frames of IYS)

Research priorities:

- Stock specific sampling of distribution and abundance in coastal and open ocean areas across seasons, accompanied by collection of environmental data with fish condition and health
- Smolt monitoring (survival and relative abundance)
- International harmonization/standardization of data collection, data management, and data sharing
- Coordinated hatchery manipulation

Group 3

Research questions:

- Spatiotemporal effects of environmental variability on salmon life stages across the North Pacific
- Develop measures of risk of salmon to environmental and humans pressures
- Develop tools for evaluating management actions to mitigate risks

Measures of success and evaluation of risk and actions:

- Engagement with stakeholders and researchers
- Determine drivers (e.g., human population growth, climate change, climate variability)
- Identify pressures related to each driver
 - Human population growth (energy demand, food needs, coastal development)
 - Climate change (SST increase, changes in habitat)
 - Climate variability (forage diversity, advection)
- Identify indicators of the state of each pressure
 - For human population growth:
 - Energy demand (number of dams, barrels of oil)
 - Food needs (area of agriculture, amount of water removal for irrigation)
 - Coastal development (number of houses, beach development)
- Evaluate Risk: build out models such as that shown by Randal to evaluate sensitivity and create measures of risk on salmon from the suite of indicators determined before
- Evaluate our capacity to mitigate risk: tune the different “boxes” of the web of indicators

Additional comments from Group 3 included the issue of food security versus salmon resource stability.

Group 4

Stock-specific distribution and abundances of salmon throughout their life-cycle:

- Collection of new distribution and abundances from research surveys
 - Apply new data for retrospective analyses of historical catches
- Marine productivity (bottom-up)
 - Do salmon cue on hydrological features and associated prey concentrations?
- Predation (top-down)
 - Is this a source significant?

Hatcheries:

- Are odd/even pink salmon different species?
 - Differential mortality
- What is optimal hatchery production in the North Pacific and where should hatcheries be located?
- What is the optimum release strategy?

Indicators of Success:

- Identify research goals and objectives on salmon that require collaboration around the North Pacific (i.e., those that can't be achieved by one country alone)
- Role in advising public/decision makers about future of salmon in a changing climate
- IYS helps introduce fisheries into the “food security” dialog
- Engagement of a broad spectrum of participants (academic, NGOs, RFMOs, industry, etc.) in an IYS framework
- Measurable/quantifiable output
- Enhanced cooperation among western Pacific producing countries.

Commonalities between research priorities expressed by participants were associated with the following topics: (IYS-SG 2015b p. 8):

- *Winter ecology*
- *Baseline information including data management and standardization*
- *Spring/summer (early ocean) mortality*
- *Ocean productivity/carrying capacity*
- *Stock interactions*
- *Run forecasting*
- *Life-history, multi-population species comparison*
- *Human impacts (hatcheries, fishing, pollution)*

Indicators of success were also identified by some participants and commonalities between groups included engagement in the IYS by a broad range of participants, as well the initiative helping to introduce fisheries managers into the “food security” dialog.

The First Proposal for the IYS

On February 19, 2015, most members of the IYS-SG met to consider material that was presented and discussed at the First IYS Scoping Meeting, make recommendations to the CSRS on the IYS initiative, and begin the process of drafting what would become the Proposal of the CSRS Study Group on International Year of the Salmon (IYS)—hereafter referred to as the ‘First Proposal’ (Appendix E; IYS-SG 2015a). IYS-SG members that were absent from the meeting included Maxim Koval and Richard Lincoln. Additional attendees, invited by the IYS-SG Chairperson, included Robie Macdonald (Emeritus, Fisheries & Oceans Canada), and consultants Skip McKinnell and Marc Nelitz.

Concept

The First Proposal defines the IYS as an intensive burst of interdisciplinary, internationally coordinated research focused on salmon and their relation to people. New technologies, new observations, and new analytical methods will be used to address “*knowledge gaps that prevent a clear understanding of the future of salmon in a rapidly changing world*” (IYS-SG 2015a p. 2). Five broad research themes were listed as follows (IYS-SG 2015a p. 2):

1. *Status of Salmon: to understand the present status of salmon and their environment.*
2. *Salmon in a changing salmosphere: to understand and quantify the effects of natural environmental variability and anthropogenic factors affecting salmon distribution and abundance and to make projections of their future changes.*
3. *New Frontiers: to develop new technologies and analytical methods to advance salmon science and to explore the uncharted regions of the salmosphere.*
4. *Human Dimension: to investigate the cultural, social, and economic elements that depend upon sustainable salmon populations.*
5. *Information Systems: to develop an integrated archive of accessible electronic data collected during the IYS and tools to support future research.*

In pursuing these research themes, the First Proposal states that the IYS aims “*to leave a legacy of new or enhanced observational systems, research networks, as well as an unprecedented degree of access to the data and information it will generate*” (IYS-SG 2015a p. 3). Outreach objectives included the goal of attracting and developing a new generation of researchers, as well as generating worldwide interest and involvement of students, the general public and decision-makers.

Rationale

A rationale for the IYS emphasized the link between the well-being of people and salmon. Salmon are of great importance ecologically, economically, socially, and culturally. They are also important source of food security and will become an even greater contributor to this emerging issue in the future. A better understanding of the future of salmon populations is needed, particularly in the face of environmental changes occurring in the salmosphere that will have an effect on salmon distribution and abundance. An understanding of how these changes will play out requires an understanding of the cumulative effects of a wide-ranging number of human and natural factors affecting salmon in order to determine what can be managed and mitigate what cannot. “*An intense burst of international research can provide the field observations to address knowledge gaps as well as the analytical tools, technologies and a new generation of scientists to facilitate the unprecedented international collaboration required to sustain salmon and people in a rapidly changing world*” (IYS-SG 2015a p. 3).

Timeframe

Due to rapid environmental change occurring in the 21st century, it is essential that the IYS is initiated as soon as possible. Current understanding of salmon in the ocean is not adequate to be able to forecast the consequences of these changes, but recent technological developments have made it possible for researchers to make significant progress in this regard. Additionally, as salmon distributions span international boundaries and large-scale processes are responsible for affecting salmon distribution and abundance, an international approach to research must be taken. Scientific expertise is also distributed among nations, and common management and research objectives foster cooperation, which also allows for costs and benefits to be shared among nations.

The timeframe for the IYS put forward in the First Proposal was to have activities develop through a planning and preliminary phase to a peak in 2018–2019, and decline over a period of 7 years. The presence of a focal year(s) provides for better planning and coordination and a focal period of two years is suggested due to anticipated changes in national budget cycles, and also allows for a comparison of even and odd years for pink salmon, the most abundant species of Pacific salmon.

Scope

The proposed geographic scope of the IYS is the salmosphere—defined as the current and future geographic range of salmon in the Subarctic and Arctic Ocean. Species to be considered under the IYS are anadromous members of the sub family Salmonidae, which include the salmons, trouts, and charrs, but exclude graylings and whitefishes. It is suggested that studies regarding farmed salmon should not be considered unless they address an interaction between wild and farmed fish. Further establishing the scope of the initiative, the First Proposal states that it was necessary to establish international partners in the Atlantic in order to create a hemispheric IYS. Many concerns facing salmon conservation and management (e.g., declining abundances and farmed and wild interactions) are common to both the Pacific and Atlantic regions and comparisons between regions would provide valuable ways of understanding ecosystem variability.

Benefits

An IYS would provide a variety of social, economic, and academic benefits through cooperative effort between nations, organizations, and individuals. Typical outputs of a large research programme would be produced, including new and improved distribution maps, better models, and linked and shared data systems. Unlike other research programmes, however, the cooperative approach of the IYS would *“produce a demand for new international standards in methods and data exchange, where none currently exist”* (IYS-SG 2015a p. 7), leading to improved collaboration, understanding, capacity, and awareness. The IYS would also provide aboriginal communities with information necessary to support their cultural practices and the food requirements of their communities. It would also result in better informed regulation and management policies for all salmon-producing countries.

Recommendations

In addition to research activities, the First Proposal states the need for a communication and engagement strategy to facilitate communication between salmon researchers and target audiences, which will include students, young scientists, indigenous peoples, salmon-dependent communities, managers, salmon fishers, seafood industry, and the general public. The initial funding objective for the IYS was to generate enough interest by developing a compelling argument presented in an attractive format with simple descriptions of the need for an IYS in order to gain support from government, as well as business and industry. Additional support and partnerships could come from associations of fish harvesters, conservation foundations, and NGOs. A complete list of potential partners can be seen in Table D.1 of the First Proposal (Appendix E), in addition to detailed descriptions of field and analytical research priorities under each of the research themes.

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Appendix B

Prepared as a discussion paper by the NPAFC Secretariat: Radchenko, V.I., N.D. Davis, and W. Morris

March, 2014

The International Year of the Salmon (Hereafter IYS)

** It should not be specified in the prospectus that the **International Year of the Salmon** programme will deal with the Pacific salmon only. However, it is likely that the main activity will be focused in the North Pacific region and participation will be generally limited to NPAFC Member countries.*

Potential questions to be addressed in the background and objectives**

*(**must be covered by prospectus)*

1. What are we celebrating in frame of the International Year of the Salmon?

An International Year of the Salmon is a practical way:

“to determine how Pacific salmon populations are regulated, and to develop models that will use climate and ocean parameters to forecast production trends of the various species of salmon” (*R. Beamish’s acceptance remarks at the 2012 PICES Annual Meeting in Hiroshima, Japan, as the recipient of the 12th annual Wooster Award*);

“of using all available resources to anticipate future trends in the abundance of the various species of Pacific salmon” (*NPAFC Doc. 1425*);

“to highlight conservation and the importance of Pacific salmon and steelhead as cultural icons across the North Pacific Rim” (*NPAFC news release of July 11, 2013*).

2. Who will declare the International Year of the Salmon?

NPAFC invites UNESCO to announce IYS and participate in its implementation in the IYS designated year(s).

3. What do we expect people to do?

There will be three components of the IYS initiative led by participating parties (= NPAFC Member countries):

- a field component (scientific expeditions),
- an analytical component (workshops and symposia), and
- a social component (outreach activities).

The field component could highlight the distribution of salmon in the North Pacific. *The analytical component* would summarize results from the field component and integrate this new information into

existing knowledge of salmon ecology. *The social component* includes outreach activities which must be attractive for business, provide advertisement opportunities, and bring outside funding for all IYS events.

4. Will this create employment?

The NPAFC Secretariat will support any activity related to the IYS. However, the IYS organizational, resource, and financial management may require a larger and separate sphere of actions than can be accommodated by the NPAFC Secretariat. The IYS steering team and working body (*ad hoc* Secretariat) must be formed and their relationships with the NPAFC Secretariat established by the Commission, depending on the scale of IYS implementation.

5. What are risks/benefits of the IYS implementation to the NPAFC?

Prospectus should include clearly stated general goal and objectives for IYS and separately identify the goal and objectives of NPAFC participation.

6. Does this movement contribute to the environment? How? Will this event make a difference to the future of salmon conservation after the IYS is completed?

The IYS implementation will contribute to the environment through its social component, outreach activities, and public participation at planned events. People will have opportunities to address questions, obtain and share information, and obtain expert reviews and opinions in matters related to salmon. From this information exchange, NPAFC and related organizations will gain an awareness of public attitudes and opinions, by which these organizations can adjust their course of future activity.

Steps of preparation

1. Prepare short clear prospectus:

Prospectus should fully describe the International Year of Salmon (*hereafter IYS*) initiative and possible timeline (**). Discussion of the first draft prospectus will be initiated at the CSRS during the 22nd Annual Meeting in Portland, Oregon, 12–16 May 2014.

The prospectus must formulate the main objectives and establish key themes to be studied, outline time schedule, describe fundraising opportunities, and generate a list of events and activities. Two parts should be described separately: (1) feasibility meeting and (2) implementation stage. The role of NPAFC and degree of involvement must be clearly identified at each stage.

CSRS has decided that the IYS initiative will include three components: First, *a field* and the second, *an analytical component*. The field component could be to look at distribution of salmon in the North Pacific.

The third component is directed at *social and outreach activities* that can be attractive for business, provide advertisement opportunities, and bring outside funding for IYS events. The importance

and relevance of all three components needs to be clearly identified and justified to attract potential donors/sponsors.

2. Pre-event activity:

- Identify/nominate a fulltime leader/initiator. Hiring the best, highly capable person is critical to the success of the project. Therefore, this will be one of the most important initial tasks.
- Establish mandates (Terms of Reference, etc.) and select the IYS steering team and working body (*ad hoc* Secretariat) and the actual or virtual IYS Headquarter.
- Two IYS working bodies may be established:
 - IYS Honorary Council (senior officials, sponsors, fundraisers, etc.);
 - *Ad hoc* IYS Secretariat and Headquarter (based in the NPAFC Secretariat with additional staff).
- At least six active committees/groups should be established to manage/coordinate the following tasks:
 - ***one to three*** implementation of components;
 - ***one*** event planning, logistics and follow-up;
 - ***one*** outreach and public relations; and
 - ***one*** fundraising.
- The leader/initiator will then:
 - hire permanent staff for positions approved by the Commission (need to be fulltime),
 - identify members/coordinators for the committees,
 - identify an initial list of donors/sponsors,
 - communicate with possible participating organizations,
 - elaborate a schedule/timetable,
 - conduct financial planning,
 - create a logo, webpage,
 - advertise the IYS programme and events on commercially distributed products: e.g., canned fish labels, fish product packages, posters, etc.

3. Feasibility meeting:

The first step is **fundraising for the feasibility meeting**.

It is crucial to find the most experienced people to raise money, facilitate the feasibility meeting, and attract key participants, i.e., industry representatives, who could be the general and primary sponsors of the meeting.

Significant promotional efforts must be undertaken ***before this meeting***.

- This would include IYS advertising in media and among fisheries businesses and associations in NPAFC Member Countries,
- Web pages would need to be created, and
- IYS news releases and advertisements would be placed in current NPAFC publications and local publications in NPAFC Member Countries through the participating authorities.
- the *ad hoc* IYS Secretariat must formulate an expected programme budget, and place and time of major events.

There are some advantages to conduct the feasibility meeting in conjunction with a large NPAFC event, such as an annual meeting or symposium.

4. Implementation stage

Ideas for events by components are as follows:

4.1. Field component, scientific and enforcement events:

4.1.1. Scientific research expedition in the NPAFC Convention Area (e.g., in the winter residence area of Pacific salmon). Envisage cooperative efforts of scientific organizations in NPAFC Member Countries and data sharing.

Cruise survey of no less than 30 days duration at sea. The approximate cost of a single ship charter is approximately **\$600,000**, and the approximate survey period would be March-April 2017. Together with scientific tasks developed by CSRS, the expedition may include an extensive tagging component with disk tags and data storage tags:

- special IYS disk tag (with IYS logo) that is widely advertised prior to the expedition. Collection of recovered tags will be organized by the NPAFC Member Countries. Each person who recovers a special IYS disk tag will be rewarded or given a commemorative prize.
- data storage tags, if these tag manufacturers will sponsor the event.

4.1.2. Joint enforcement operation (or training maneuvers) in the Convention Area.

4.1.3. National scientific research expeditions devoted to IYS, especially in new and rarely investigated survey areas. These efforts will obtain informational support from NPAFC and the IYS Headquarter. Published results of these expeditions (workshop proceedings, books, special issues of scientific journals) will be placed in the IYS library (see below).

4.2. Analysis component, scientific events:

4.2.1. A major scientific symposium on status, dynamics, and factors driving production of salmon stocks that includes IYS expedition results. (Develop a specific section associated with the IYS in the 2016–2020 NPAFC Science Plan, or develop it as a separate program.)

Approximate cost for the venue and equipment rentals for a three-day symposium will be approximately **\$110,000**. Potential timing of the symposium would be to hold it in

conjunction with the 26th NPAFC Annual Meeting in May 2018 (Russia) or the 27th NPAFC Annual Meeting in May 2019 (United States). Alternatively, it could be held independently of regular NPAFC events.

4.3. Creation of IYS library.

The IYS Library will combine monographs, collective papers, workshop proceedings, etc., related to Pacific salmon research and published in NPAFC Member Countries during the IYS (with a IYS logo) in official NPAFC languages. English summaries and translation of the title, headings, table captions, and figure legends will be requested. Internet access will be provided through the IYS website.

4.4. Social and outreach events:

4.4.1. Outreach activities will be advertised on the web, with posters, and advertisements in newspaper/magazines, etc., that are directed to academia, government offices, scientific institutes, fisheries associations, fisheries unions, coastguard stations, aquariums, ports, hatcheries, fishery plants, recreational fishers, and native groups, etc.

4.4.2. Community-focused events and activities (here are several examples):

- the IYS movie (depending from available budget, ranging from a low-cost documentary video to a computer-animated film) about salmon, their life cycle, the dangers and difficulties of living in the open ocean and migrations over many thousands of miles, etc. Estimated at approximately **\$10,000** (the same as the cost of the ENFO promotional video).
- quizzes, photo, stories, salmon recipe contests;
- activities for children at schools, aquariums, festivals, other summer outdoor events;
- educational projects at hatcheries.

4.4.3. Promotional goods.

Pins, postage stamps (e.g., issuing of postage stamps series of five stamps, each of them in one NPAFC Member Country), wall posters/calendars, commemorative album, etc.

Possible Timeline:

Feb. 2014 NPAFC Exec. Director's initial draft goes to the IYS Study Group

IYS Study Group starts drafting prospectus

May 2014 CSRS discusses Draft Prospectus

? Establish timeline

? Identify/nominate/hire a Leader

? Establish HQ (*ad hoc* Secretariat), hire permanent staff

- ? Establish 6 committees/groups
- ? Advertise, create webpage, IYS news release/ad will be placed in NPAFC publications
- ? Fundraise for the feasibility meeting
- ? Hold **Feasibility Meeting** (in conjunction with NPAFC large event?)
- ? Implement events (by components)

International Year of the Salmon

- May 2018 Hold IYS Symposium in Russia with the 26th NPAFC Annual Meeting /or
- May 2019 Hold IYS Symposium in USA with the 27th NPAFC Annual Meeting

Appendix C

The International Year of the Salmon (IYS) Short Prospectus

Compiled by the IYS Study Group: Saunders, M., S. Urawa, J.K. Kim, M. Koval, A. Zavolokin, R. Lincoln, and E. Volk.

April, 2014

Background

Pacific salmon abundances fluctuate in trends that generally have not been explained. As climate change introduces more variability into systems it is time to increase the efforts of researchers to discover the fundamental mechanisms regulating production. Salmon researchers from the Pacific rim countries of Korea, Japan, Russia, United States and Canada who meet annually through the North Pacific Anadromous Fish Commission (NPAFC) are in agreement that through an intensive, coordinated research initiative these mechanisms can be understood. This understanding will produce more accurate forecasts, stabilize fisheries management and optimize the use of hatcheries.

Objective

Conduct an international, multi-disciplinary, multi-year research initiative, entitled International Year of the Salmon to determine how Pacific salmon populations are regulated, and to develop models that will use climate and ocean parameters to forecast production trends of the various species of salmon.

IYS - Short Summary

The initiative will be conducted in two phases, *a scoping phase* and *an implementation phase*. The scoping phase will entail the development of a detailed prospectus by the NPAFC's Committee on Scientific Research and Statistics (CSRS). An initial scoping meeting will be convened by the CSRS in 2014 with researchers and representatives from government agencies, non-government organizations, academic institutions, First Nations and businesses. The detailed prospectus will provide a comprehensive description of research objectives and activities with associated costing, timelines, participants and deliverables. The scoping meeting will also include the discussion of a funding strategy.

Preliminary discussions suggest three major components of the implementation stage: First, *a data collation and field collection component* to develop integrated data bases linking salmon distribution, abundance and biology with related environmental data sets and to conduct field programs to address gaps in information regarding high seas distribution and ecology. It is anticipated that research cruises will be conducted to determine the high seas distribution of salmon populations in the Gulf of Alaska in particular during the winter months. The second, *an analytical component* to bring researchers together to jointly analyse assess and forecast the factors affecting salmon abundance and develop forecast models. This could potentially include exchanges of personnel and meetings of teams to conduct research as well as workshops and symposia. A third, *outreach component* to broadly engage the scientific community

as well as the public in our research to communicate results and highlight conservation and the importance of Pacific salmon and steelhead as cultural icons across the North Pacific Rim.

Some of the IYS details for consideration include:

Cost: to be determined but estimated to be in the range of \$2-4M (Canadian) over 4 years

Duration – 3–4 years

Participants: Scientists from NPAFC, PICES, academia and non-government organizations. Engagement of participants from unions, communities, First Nations, commercial and recreational fishers.

Deliverables: Primary publications including workshop and symposia proceedings. Outreach materials including videos/documentary, website, popular articles. IYS library

Funding: Business strategy to be part of detailed prospectus. Partners to include government, academia, industry, businesses and NGO's.

Staffing: Anticipated to require 1–2 staff, potentially housed by NPAFC secretariat to lead and administer the initiative.

Governance: IYS Honorary Council (senior officials, sponsors, fundraisers, etc), IYS Steering Committee and Sub-Committees (Data and information, Research-Field, Research-analytical, Logistics/Events, Communications and Outreach.

Timeline:

2014 – Scoping meeting completed and Detailed Prospectus

2015 – Project initiation – confirmation of funding, establish governance bodies, develop detailed workplans and data management protocols, hiring of staff.

2016 - Year 1 – Gulf of Alaska surveys

2017 - Year 2 – Gulf of Alaska surveys

2018-19 Years 3–4 – Analyses, workshops/symposia and publications. A major scientific symposium on status, dynamics, and factors driving production of salmon stocks that includes IYS expedition results.

Next Steps

- CSRS to confirm support for the concept of the IYS in principle and for convening a scoping meeting to develop a science plan for the initiative and discuss potential funding strategies.
- CSRS to develop a funding strategy for the meeting. Approximately \$30K(Can) is required to host the meeting which could be funded through contributions from the NPAFC parties, the NPAFC Research Fund, and/or potential IYS partners.

Appendix D

Report of the International Year of the Salmon Study Group Scoping Workshop

International Year of the Salmon Study Group

April 2015, originally presented as NPAFC Doc. 1602

Keywords: Vancouver, future, research, planning, proposal

Abstract

An international workshop was organized and convened in Vancouver, Canada by the Study Group on International Year of the Salmon (IYS-SG, February 17–18, 2015). It was attended by most members of the IYS-SG plus invited scientific experts from the member countries. The workshop was structured as a series of facilitated discussion panels, short presentations, and group discussions designed to inform the IYS-SG. This document is a report of the Scoping Workshop. The IYS-SG met immediately after the two-day workshop to develop a compelling case for new coordinated research directed at key scientific issues affecting the future of salmon in the form of a proposal for an International Year of the Salmon.

Background

In 2012, a proposal was made to NPAFC by Canada to establish a major research initiative around the idea of an International Year of the Salmon (Beamish 2012). Discussions ensued within the NPAFC leading to the creation of the Study Group on International Year of the Salmon (IYS-SG) in 2013. Mark Saunders (Canada) was appointed Chairperson. In 2014–2015, Study Group membership also included Shigehiko Urawa (Japan), Ju Kyoung Kim (Korea), Max Koval and Alex Zavolokin (Russia), and Rich Lincoln and Eric Volk (USA).

At the May 2014 Annual Meeting, the Commission directed the IYS-SG to further scope the initiative and provided the following Terms of Reference (Records of the 22nd Annual Meeting, p. 112):

The International Year of the Salmon (IYS) Study Group should continue to scope the initiative through a series of virtual and/or face to face meetings of interested parties and outside interests to develop an IYS proposal that will be discussed by the NPAFC at the 2015 Annual Meeting. The proposal developed by this group would address the following considerations:

- *Scope of the Programme (Pacific-Atlantic, Farmed Salmon and other ecosystem considerations, etc.)*
- *Benefits of the Program*
- *Potential for Funding and Identification of Partners (NGO's Industry, State and Federal Agencies, other RFMO's, etc.)*
- *Communications and Outreach Strategy*
- *Identification of Field and Analytical Research (Strategic Research Plan)*
- *Starting Year and Duration*

The IYS-SG convened a Scoping Workshop (February 17 – 18, 2015) in Vancouver, Canada with members of the IYS-SG and invited scientific experts from the member countries to inform development of recommendations on the nature of IYS, in particular the scientific objectives. This document is a report of the Scoping Workshop. In addition to the Study Group members, others contributed to the drafting of this report including, Skip McKinnell (Salmoforsk International), Marc Nelitz (ESSA), and Nancy Davis and Vladimir Radchenko (NPAFC Secretariat).

The IYS-SG met on February 19, 2015 to consider the information presented at the Scoping Workshop and draft the IYS proposal. The IYS proposal is in a separate report.

Motivation

Among all of the animals that serve as a source of food for humans, salmon are iconic. Their wide-ranging habit of migrating from freshwater to the ocean and back are indicators of ecological health. Salmon are highly valued culturally simply for their presence, socially as a source of food and economically as a source of wealth through fisheries and tourism. The well-being of humans and salmon are linked in coastal communities. Indigenous peoples, resource managers, fishers, processors, businesses, governments have demonstrated a need to understand what drives the variation we see in salmon abundance now and into a future with climate change.

Salmon abundance fluctuates on intra-annual to decadal scales and the causes of these variations have not yet found convincing explanations in any ocean. Climate change is expected to introduce additional variability so it is time to increase the efforts of researchers to discover the fundamental mechanisms regulating production. Facing such uncertainty, the Study Group (SG) sought advice from invited experts as it prepared to develop a new proposal for a multinational, multidisciplinary, multi-year research effort directed at critical unknowns associated with salmon production. Collectively the activities conducted within this major research programme will be known as International Year of the Salmon (IYS).

Anticipated Results

The workshop was structured as a series of facilitated discussion panels, short presentations, and group discussions designed to capture the information required to inform the IYS-SG. The IYS-SG met immediately after the two-day workshop to draft the proposal. The goal of the SG was to develop a compelling case for new coordinated research directed at key scientific issues.

Welcome & Introductions

Study Group Chairperson Mark Saunders (Canada) called the International Year of the Salmon Scoping Workshop to order at 0900, February 17, 2015. The venue for the workshop was the boardroom of the secretariat of the Pacific Salmon Commission (PSC). Its Executive Director, John Field, spoke first to welcome the participants (Table D.1) and to comment on the potential importance of this initiative. He described the history and role of the Pacific Salmon Commission (PSC) and noted the shared goals of the PSC and the NPAFC. Dr. Vladimir Radchenko, Executive Director of NPAFC, spoke next to welcome

the participants and review the charge of its Commission to the Study Group. Mr. Saunders introduced himself and described the objectives of the workshop and the workshop agenda (Table D.2). Self-introductions of the participants continued until Mr. Saunders closed the introductory session with a review of the motivation for the initiative, focusing on what research needs to be done and why. Mr. Saunders introduced the workshop facilitator, Mark Nelitz (ESSA Ltd.), who reviewed the workshop objectives and described his role as facilitator.

Objectives

The main objectives of the workshop were to:

- develop a list of major scientific issues that will, or are likely to, affect salmon production in the foreseeable future, and around which an IYS could be developed and funded.
- identify the unknowns and scientific questions related to each issue.
- discuss the scope (spatial, temporal, species) of an IYS that will be needed to answer the questions (test the hypotheses).

National Salmon Research Priorities

NPAFC Science Plan (S. Urawa, Chairperson of the CSRS Science Sub-Committee (SSC))

The Chairperson of the SSC reviewed the current 5-year NPAFC Science Plan. The NPAFC Science Plan is a long-term comprehensive guideline for cooperative research. Member countries conduct national research under the Science Plan. The plan has been revised almost every 5 years after reviews of research progress. The goal of the current 2011–2015 Science Plan is to explain the annual variation in Pacific salmon production. The overarching theme is “*Forecast of Pacific Salmon Production in the Ocean Ecosystems Under Changing Climate*”, and five research components are identified:

1. Migration and Survival Mechanisms of Juvenile Salmon in the Ocean Ecosystems;
2. Climate Impacts on Pacific Salmon Production in the Bering Sea and Adjacent Waters;
3. Winter Survival of Pacific Salmon in the North Pacific Ocean Ecosystems;
4. Biological Monitoring of Key Salmon Populations;
5. Development and Applications of Stock Identification Methods and Models for Management of Pacific Salmon.

Progress under the current Science Plan will be reviewed at NPAFC Symposium in Japan on May 17–19, 2015. He described how the IYS might contribute to or be part of the next NPAFC Science Plan.

Japan (S. Urawa)

Japanese salmon research priorities were reviewed. There is a trend of declining chum salmon abundance in Japan since 2004, but the temporal pattern of changes differs among three regions (Pacific, Okhotsk Sea and Japan Sea coasts) of northern Japan. Annual fluctuations are also observed in the age and body size of adult chum salmon returning for spawning. It is a mission for researchers to examine the mechanisms of variations in salmon abundance and body size. Respecting the seasonal migration model of Japanese chum salmon, the national proprieties of ocean salmon research are:

- 1) Juvenile salmon surveys in the coastal waters and the Okhotsk Sea to determine the survival mechanism of each regional populations,
- 2) Long-term monitoring of salmon and their habitats in the Bering Sea to forecast salmon production, and
- 3) Winter salmon surveys in the western Subarctic Pacific and the Gulf of Alaska to evaluate possible source of mortality.

One hypothesis is that the survival of juvenile chum salmon migrating from the coastal water to the Okhotsk Sea is the highest key to determine regional chum salmon returns. Juvenile salmon study in the Okhotsk Sea is very important to understand the early marine survival of chum salmon. There is another hypothesis that the body size and age of chum salmon at maturity are determined by habitat condition in the Bering Sea. Thus a long-term monitoring of salmon has been conducted in the central Bering Sea during summer since 2007. The Gulf of Alaska is an important overwintering habitat for chum salmon stocks from around the Pacific Rim. In addition, the western Subarctic Pacific is the first winter habitat for Asian chum salmon. However, it is still unknown whether the winter is a critical period for salmon in these waters.

Republic of Korea (J-K. Kim)

Korean salmon research priorities were summarized and the history of releases and catches of chum salmon in Korea was reviewed. Studies are focusing on the relationship between currents and migration routes near Korea. Charter fishing vessels have been used to catch juvenile salmon out to 5 km. Long-term research is required clarify information about Korean salmon biology. Japanese research indicates that Korean chum salmon have been found in the Bering Sea. Research associated with otolith marking will continue as well as investigations on juvenile salmon and their prey around the coast of Korea. All Korean chum salmon are released from hatcheries. Adult abundance is very low so all are utilized for hatchery production. There is no information about North Korean salmon populations. Cooperative research was initiated at the beginning of the century, but was not sustained. Efforts are being made to educate the Korean public about the importance of salmon in Korean rivers.

Russian Federation (A. Zavolokin)

Russian research activities and emerging priorities in eastern Russia. The freshwater period is well studied on the main rivers and this information is used as a basis of forecasts. The early marine period is a critical period of marine life, but the long coastlines and large numbers of rivers make the studies very difficult. The main goals of estuarine and inshore surveys are intend to improve forecasts of abundance, and comprehensive studies of biotic and abiotic parameters that affect salmon production. High seas surveys are conducted in the Okhotsk Sea, western Bering Sea, and Pacific Ocean. The main goals of these surveys are: to improve forecasts of salmon abundance, to determine their biochemical composition and energetic levels, to understand role of Pacific salmon in marine ecosystems, to understand the carrying capacity of the North Pacific, and the determination of growth variability and its consequences for their survival. To improve forecasts, high seas surveys are conducted each year. Stock identification is an important component of the forecasts as it provides regional information about abundance using scale patterns, otolith marks, and genetics. Russian studies also focus on factors of salmon mortality such as predators, diseases and parasites. Another important issue is assessment of the role of Pacific salmon in marine ecosystems and its dynamic including: (1) structure and dynamics of plankton and nekton

communities, (2) diets and feeding rates of salmon and other nekton species, (3) trophic status and interactions between salmon and other nekton species, and (4) dynamic of physical environment of salmon. This ecosystem approach has been conducted in Russia for more than 30 years. Current priorities of Russian research include: improvements of forecasts (freshwater and marine studies), stock identification to find out stock-specific migrations and abundance, factors affecting salmon mortality, analyzing carrying capacity of the North Pacific.

Carrying capacity is an extremely difficult research area and Russia is only in the beginning of this kind of assessment. High seas information improves forecasts, but there is a great need for stock composition. Stock identification includes all salmon species with an emphasis on the most abundant species: pink salmon, chum salmon, and sockeye salmon. Surveys are conducted in the fall prior to maturity, giving a 1 year lead time, with follow-up surveys in the North Pacific and Bering Sea about 2–3 months before the fishery. Forecasts are not very accurate presently and that is a problem for planning fisheries. The Aniva Bay pink salmon fishery, for example, in 2006 was 6 times larger than the large run that was forecast.

United States of America (E. Volk)

Research priorities of the USA were summarized in the 2014 CSRS Report (NPAFC Doc. 1545). Research theme 1 (juvenile migration and survival) investigations take place in coastal waters of Gulf of Alaska and the eastern Bering Sea and includes repeated habitat measurements, fine scale field studies, genetic stock identification, growth, and archival tagging of mature and immature salmon. Research theme 2 (climate impacts) is investigated on BASIS-type cruises, which occur every other year in the eastern Bering Sea, focused on climate and climate cycles and their effects on various aspects of salmon production. The ADF&G is collaborating with NOAA to calibrate paired trawl surveys between the large NOAA vessel and the smaller ADFG vessel so that meaningful surveys may be conducted in the absence of the larger platform. . Survival and growth of juvenile Yukon River Chinook salmon during their early marine life is being investigated in the river prodelta, and there are hopes to keep a programme alive with the idea of developing a forecasting index. There is long-term oceanographic monitoring in Gulf of Alaska, including physical oceanography, primary/secondary productivity, forage fish species and marine mammals under the Gulfwatch Alaska program, with a planned duration of 20 years. .. Research theme 3 (winter survival) is not an active area of research in Alaska. Research theme 4 (long-term biological monitoring) investigations of salmon abundance is a long-standing objective with extensive catch accounting and monitoring of escapements to several hundred systems in Alaska and the Pacific Northwest. . Datasets are spread geographically, but may be a good resource for a variety of studies. There are many data sets that could be mined with records dating back many decades (e.g. Auke Creek has a 40-year record). An extensive CWT data resource and catch sampling programme is still providing stock-specific information for hatchery and wild salmon. Research theme 5 (stock identification) is an on-going priority, particularly with respect to method development and monitoring of fishery catch composition. In 2012, ADF&G completed one of the largest mixed-stock genetic stock identification projects ever undertaken in fisheries of western Alaska. There is a large amount of information available online for catch composition of chum and sockeye salmon in all major fisheries of Western Alaska. . Active research programs investigating effects of hatchery production on fitness of wild stocks is occurring in Alaska and the Pacific Northwest.

Canada (J. Irvine)

The salmon research priorities of Canada were summarized. There is a need to describe, organize, and serve data that were collected during the past decades. A group of international collaborators led by Shoshiro Minobe (Hokkaido University) are collecting data from all over the North Pacific to examine salinities and temperatures where salmon were/weren't caught. There is a need to improve estimates of hatchery and wild salmon abundances. A new database of recruits and spawners is being released, with new quality control filters based on a rating system that has been developed. A technical report is being published that contains the details of the procedures and the results with the data made available online. This data could be expanded to include other populations from throughout the North Pacific. There is a need to do a better job of assembling, evaluating, and distributing the data.

Twelve research questions were highlighted based on the presentations on national priorities.

- How to develop shared data systems to enable comparisons of production and productivity of salmon populations across the North Pacific?
- What is the relative importance of density-dependent vs. episodic density-independent processes in regulating salmon survival?
- Where and when do juvenile salmon move off the continental shelf?
- Where do different populations of salmon migrate to in the North Pacific Ocean?
- What are the factors affecting the distribution of salmon in the North Pacific Ocean?
- What factors control the productivity of salmon prey in the North Pacific Ocean?
- What periods are “critical” and do they vary among species/year?
- How can we improve our ability to forecast salmon returns?
- How will salmon survivals/distributions be affected by climate change?
- What risks are posed to wild salmon by interactions with cultured salmon (including competitive interactions between hatchery and wild fish)? Does carrying capacity vary?
- Can genomics help us understand the role of pathogens and physiological condition on salmon survival?
- How to develop a cumulative effects approach to understand the key anthropogenic and natural factors affecting survival at each life history stage (freshwater, early marine, coastal, high seas)?

Discussion

Suggestions were made to include topics related to these questions including: cumulative effects as a way to bring all of these questions together, life-cycle modelling as an important area of research that may address some of the issues, and data downloading to the next generation that was expanded to a need for more rapid knowledge transfer among scientific cohorts.

Purpose of the IYS (Introduction by R. Beamish)

The IYS idea was spawned as an economic programme supported by science (NPAFC Spec. Publ. No. 1). Without an economic approach, it was felt that political buy-in to the programme may be limited. Generally, the goals of an IYS were to improve long-term forecasting, motivated by changes in abundances that have been observed, and to determine their relationship to climatic and oceanic conditions in a changing world. The IYS was imagined as a way to reach this objective. It might also serve to optimize hatchery production programs by experimenting with release timing to achieve

maximum survival and to use this knowledge for the benefit of wild salmon forecasts. Improved understanding and improved ability to forecast abundances were also thought to be important for social as well as economic reasons. This knowledge would allow greater confidence to communicate the problems that are likely to arise in areas where salmon may not persist. Linking salmon to people and culture would draw attention to an idea that the research conducted under an IYS was not simply self-serving, but for the greater goal of helping people with a strong interest in the resource. An IYS may also draw attention to conservation objectives and restorations of wild populations, which in turn are linked to cultural values, especially for Indigenous Peoples. Hatcheries are more important to the economic role of salmon in recreational and commercial fisheries. Attention was drawn to the need for IYS science that was not based solely on economic arguments, and in that regard, participants were advised not to underestimate the importance of salmon to Indigenous Peoples and to those who use the resource for subsistence. The survival of human communities, in some cases, may be intimately connected to the survival of the local salmon. The discussion ended with a comment that understanding and forecasting future abundances might require that IYS research be directed more to the environment of salmon (habitat, prey, behaviour) than to the salmon themselves.

R. Peterman discussed approaches to improve understanding and measurable indicators for each of the research objectives that might be considered. Suggestions included use simulation models at the beginning and standardizing variables measured across populations.

Identifying knowledge gaps (Introduction by K. Myers)

It was noted that the freshwater life-history phase is the most critical period for salmon productivity because such large numbers of individuals are affected by small variations in survival rates. The early ocean/juvenile life-history phase is critical for ocean survival, while the high seas phase has a greater influence on migration timing and fecundity. The history of efforts to plan for salmon research was reviewed as were aspirations for new initiatives in the NPAFC Convention Area. In general, there is a lack of detailed knowledge of where salmon go in the ocean, but considerable attention is paid to measuring productivity and to forecasting. Better models are needed for where salmon are located in the North Pacific. The tools have emerged during the last 30 years to provide this information.

Discussion

Participants commented that research objectives should:

- be accompanied by measurable indicators of the degree to which the objectives are met;
- be determined by assessing the sensitivity of simulation models to various kinds of perturbations and new research would be directed at those characteristics that have the greatest uncertainty;
- avoid framing outcomes as scaremongering and focus on why salmon and their ecosystems are changing;
- avoid biting off more than can be chewed;
- consider legacy and emerging issues such as human population growth, pollution, ocean acidification, offshore development;
- provide better information on migration, timing and distributions
- might focus on how humans are affecting salmon in the North Pacific;
- provide a better understanding of what is meant by ecosystem change;

- be a long-term project with short-term rewards;
- include a means of finding the human resources to conduct the research, given the current demographic of salmon biologists;
- consider whether commercial shipping might contribute to achieving IYS objectives;
- consider that industry will want a realistic vision of the future. It is good for business to understand future opportunities so they can adapt and benefit from this knowledge.

NPAFC is well positioned to take on questions related to distribution in the North Pacific, to contribute to research initiatives in forecasting and determining carrying capacity. Issues include funding, optimizing the use of historical data, stock-specific distributions, and year to year variability. Data collection could be directed to testing specific hypothesis. The quantity of observations should be adequate to improve forecasts. The development of forecasts needs to be better conceived, and research questions need to consider what matters to the end users of the information: subsistence users and the commercial and processing sectors.

Critical Unknowns

The identification of key research questions began with a survey of participants. Topics suggested included:

- using societal benefits, such as examples of the NCBI/Human Genome projects that involved data intensive-data coordination activities that are well funded in some circles.
- Selecting an international scope that will focus on distribution of salmon at sea and distributions within national waters;
- testing hypotheses about winter marine survival
- determining the extent to which variations in ocean productivity affect salmon production;
- educating people about large ecological issues (examples of good models included NCIES in California, Gulf Watch Alaska)
- determining spring and winter survival;
- understanding stock composition;
- understanding the carrying capacity of the ocean;
- understanding the effects of oceanic diseases and parasites on survival.
- determining the survival in coastal waters, especially where international cooperation is required to execute the research programs to achieve a better understanding.
- determining the consequences of future increases in SST and how it might affect inter- and intra-species competition;
- evaluating sibling ratio forecast models;
- understanding the influence of pink salmon on forecasts of abundance of other species;
- determining the role of hatcheries in the future of salmon survival;
- hatcheries can be used to understand freshwater contributions to survival by making hatchery and wild comparisons (if smolt quality is good);
- determining whether international regulations or guidelines are required for hatchery releases to achieve clearly articulated benefits from them. Coastal jurisdictions have different approaches to hatchery developments. The topic was seen as an important one, but with political consequences for raising it;
- to determine the drivers of enhancement activities. To understand their relationship with climate change, it would be appropriate to have an appropriately structured group to provide knowledge about trade-offs;

- determining if hatchery production affects the quality of salmon;
- determining the future effects of carbon pollution (ocean acidification) and its effect on salmon prey and foodweb structure. There are natural links to other international organizations that are studying this topic. There is variable capacity to monitor oceanic pH and most of it is occurring along coastlines.
- examining life-history stage transitions between freshwater and marine and other transitions;
- determining whether the first winter is important. Perhaps that winter survival is important, but factors affecting growth probably take longer.
- differences in life-history between coasts or between oceans may provide natural experiments and large contrasts to provide some insight.

Criteria for Setting Priority among Proposals

Proposals should describe the benefit of the new knowledge, noting that the timeframes will differ among clients. Some criteria included:

- food security (communicating the social implications)
- cultural importance
- international scope
- relevance to end users
- feasibility (do-able in 3–5 years)
- impact

Research Topics

Participants were subdivided in 4 breakout groups to take the information developed on the first day and condense and refine the list of issues created on the first day. These issues were used to develop a research “portfolio” that IYS should address. Each portfolio should include information on: (1) a set of research priorities related to the research objectives, (2) the accompanying research questions, (3) supporting rationale for what makes each priority so compelling, and as time allows (4) the scope of research (e.g., species, time horizon, geographic focus).

The views expressed by individuals were consolidated around the following research topics:

- Winter ecology
- Baseline information including data management and standardization
- Spring/summer (early ocean) mortality
- Ocean productivity /carrying capacity
- Stock interactions
- Run forecasting
- Life-history, multi-population species comparison
- Human impacts (hatcheries, fishing, pollution)

Panel on Technological Advances

New tools and developing technologies are providing remarkable opportunities to improve understanding of the biology of salmon and their environments. Examples are genetic stock identification, satellite

remote sensing (ocean colour, altimetry, temperature), drifting ocean profilers, undersea cabled networks, earth system models, etc. Some are yet to be developed. An IYS could provide an opportunity for significant new developments in technology or new applications of existing technologies directed at understanding salmon biology.

Advances in Genetic Stock Identification (T. Beacham)

Analysis of protein variation (allozyme) was the first technique used to examine genetic differences among populations. It was used from the 1960s to the early 1990s, but was replaced by genotyping which examined DNA variation directly. Two main classes of DNA variants developed: microsatellites and single nucleotide polymorphisms (SNPs). The key reaction that allowed the technique to develop was polymerase chain reaction (PCR). SNP variation is determined by direct DNA sequencing of specific amplicons. Amplicons are specific sections of DNA that are known to contain SNPs and which are amplified by PCR primers. This technology has allowed for highly multiplexed PCR reactions, where up to 500 individual reactions on 1,000–2,000 individuals are genotyped per chip. It has lowered the “per fish” cost of genotyping compared to existing alternatives.

Oceanographic and biological models (H. Batchelder and B. Wells)

Ocean circulation models such as ROMS (Regional Ocean Modelling System) can be coupled with biological productivity models (e.g. NEMURO and COSINE) to capture the magnitude of ecosystem variability in open ocean and coastal environments. When verified against observations, these bio-physical models can be powerful tools for studying the relationship between salmon distribution, migration, and survival. They can be used to fill in the gaps between observations and can be used to explore match-mismatches between biology and oceanic productivity. Models can be used to quantify functional relationships between salmon in their environment. Studying salmon in bio-physical models can lead to better hypotheses that direct new observations toward critical unknowns.

Individual-Based Models (IBMs) are used within bio-physical models to simulate how salmon interact with their oceanic environment. Using reasonable assumptions about prey and temperature, a bioenergetics model reproduced the observed growth patterns of coho salmon in 2000 and 2002 in the California Current (GLOBEC Program, Figure 1). Coho salmon growth was positive in all simulations, even at low prey densities, implying that fish mortality may be determined by predation rather than ocean productivity. Random foraging by juvenile coho salmon was sufficient to sustain basic fish metabolism and allow moderate growth, however the final size range is below observed values based on random foraging. Optimal foraging enabled final coho salmon size distributions to be closer to what was observed.

Undersea cabled observation networks (A. Sastri)

During the past decade, Canada made significant investments into new technology that provides continuous streams of data from the ocean through undersea cabled observatories. Electrical power is delivered to nodes of co-located instruments. Communications to/from the instruments are possible with high resolution data being provided in real-time. A sophisticated data infrastructure has been developed to suit multiple types of very high resolution data, along with sophisticated data archiving capability.

Why Improve Understanding of Variation in Salmon Abundance

Improved understanding of the causes of variations in abundance of salmon to a level that will allow for better forecasts of future variations in abundance is related to issues of:

- food security where salmon is a dietary staple,
- economic security where participants in industries related to salmon are forewarned with sufficient time to mitigate the consequences of changes in abundance,
- provide improved short term forecasts of abundance and, potentially, behaviour of salmon.

Table D.1. Participants at the International Year of the Salmon Scoping Workshop. The “member” role indicates Study Group members who attended the scoping meeting, February 17–18, 2015, Vancouver.

| Name | Country | Role | Agency | Breakout Group |
|--------------------|----------------|-------------|-------------------------------|-----------------------|
| Mark Saunders | Canada | Member | DFO | 1 |
| Alex Zavolokin | Russia | Member | TINRO-Center | 1 |
| Terry Beacham | Canada | Participant | DFO | 1 |
| Randall Peterman | Canada | Participant | SFU (emeritus) | 1 |
| Mike Lapointe | PSC | Participant | PSC | 1 |
| Kate Myers | United States | Participant | UW (retired) | 1 |
| Vladimir Radchenko | NPAFC | Organizer | NPAFC | 1 |
| Eric Volk | United States | Member | Alaska Dept. of Fish & Game | 2 |
| Marc Nelitz | Canada | Organizer | Essa Ltd. | 2 |
| Dan Selbie | Canada | Participant | DFO | 2 |
| Hal Batchelder | PICES | Participant | PICES | 2 |
| Steve Latham | PSC | Participant | Pacific Salmon Commission | 2 |
| Greg Ruggerone | United States | Participant | Natural Resources Consultants | 2 |
| Nancy Davis | NPAFC | Organizer | NPAFC | 2 |
| Shigehiko Urawa | Japan | Member | Fisheries Research Agency | 3 |
| Jim Irvine | Canada | Participant | DFO | 3 |
| Stewart Johnson | Canada | Participant | DFO | 3 |
| Brian Riddell | Canada | Participant | Pacific Salmon Foundation | 3 |
| Francis Juanes | Canada | Participant | University of Victoria | 3 |
| Brian Wells | United States | Participant | NOAA/NMFS | 3 |
| Ju Kyung Kim | Korea | Member | FIRA | 4 |
| Dick Beamish | Canada | Participant | DFO (emeritus) | 4 |
| Ian Perry | Canada | Participant | DFO | 4 |
| John Field | PSC | Participant | Pacific Salmon Commission | 4 |
| Akash Sastri | Canada | Participant | University of Victoria | 4 |
| Skip McKinnell | Canada | Organizer | Salmoforsk International | 4 |

Table D.2. Agenda of the International Year of the Salmon Scoping Workshop (February 17–18, 2015, Vancouver).

February 17—DAY ONE: The main goal for today is to create a detailed list of research ideas/issues/questions based on a panel discussion reviewing current and emerging national priorities and the participants identifying knowledge gaps in round table discussions.

0900 Welcomes (Radchenko, Field, Saunders)

0915 Introduction of participants (Saunders)

0930 Workshop objectives and organization (Saunders/Nelitz)

0945 **NPAFC Science Plan – current and emerging national priorities:** Panel Discussion (IYS Study Group members: Saunders, Urawa, Kim, Zavolokin, Volk)

NPAFC has a long history of developing and implementing science plans. One member of the panel (Urawa) will briefly summarize the current NPAFC science plan. A representative from each member country will then briefly highlight the national priorities that have emerged from research activities that have already occurred. This summary is intended to help clarify the context for IYS to ensure it is consistent with the emerging national priorities of member countries, rather than provide a detailed summary of research activities of member nations.

1115 **Purpose of IYS – What are the problems IYS should address?** Introduction (Beamish) and Plenary Discussion

The session will begin with a brief introduction on the origins of IYS and its envisioned motivations. There will then be time to explore perspectives of others through plenary discussion.

1300 **Identifying knowledge gaps – What new knowledge is required** Presentation (Myers), Silent Generation, Round Table, and Plenary Discussions

The remainder of the day is dedicated to developing ideas for new research required to understand the factors affecting salmon production now and in the future. The objective for the day is to create a list of research ideas, developed from individual opinions and discussion that will serve as the basis of developing general research imperatives on Day 2.

- What are the big unknowns that demand attention?
- What has changed and what is changing?
- What can be done to provide fishery managers and regulators with better advice?

Each participant will be asked to write down their top 3 research priorities or specific research questions that address these motivating questions and then briefly elaborate on one of them.

1530 **Identifying knowledge gaps – continued** Round Table and Plenary Discussion

1630 Daily wrap-up, assignments (Saunders/Nelitz)

1700 Adjourn

February 18—DAY TWO: The main goal for day two is to distill a compelling list of overarching research priorities from the detailed list of ideas developed on Day 1. The day will begin with a review and discussion of preliminary research objectives. Breakout groups will then be convened to condense and refine the list of issues from the previous day with each group reporting out in plenary. A short panel discussion on new and emerging technologies will be provided in the afternoon. Concluding discussion at the end of the day will touch on related issues such as when, how, and what scope, in addition to opportunities for capacity building, and previous experience with large research programs. At the end of the day, the Study Group hopes to have enough information to create a proposal for an IYS.

0900 Introduction to Day 2 (Saunders/Nelitz)

0915 **Research objectives** Plenary Discussion

Based on a request for clarity from the previous day, a preliminary set of research objectives will be presented and refined to inform breakout group and plenary discussions throughout the day.

1030 **Technological Advances (Ocean Observing, Genomics, Modelling, etc.)** Panel Discussion (Sastri, Beacham, Batchelder, Wells)

New tools and developing technologies are providing remarkable opportunities to improve understanding of the biology of salmon and their environments. Examples are genetic stock identification, satellite remote sensing (ocean colour, altimetry, temperature), drifting ocean profilers, undersea cabled networks, earth system models, etc. Some are yet to be developed. An IYS could provide an opportunity for significant new developments in technology directed at understanding salmon biology. Does this inform development of scientific objective/research themes/activities?

1300 **Major scientific issues and key questions** Breakout Group Discussion

Participants will be subdivided in 4 breakout groups. The goal of each group is to use the research objectives to condense and refine the list of issues created on Day 1. These issues will be used to develop a research “portfolio” that IYS should address. Each portfolio should include information on: (1) a set of research priorities related to the research objectives, (2) the accompanying research questions, (3) supporting rationale for what makes each priority so compelling, and as time allows (4) the scope of research (e.g., species, time horizon, geographic focus).

1445 **Major scientific issues and key questions** Plenary Discussion (Saunders/Nelitz)

In plenary, a representative from each group will describe the results of their group discussion and present their list of priorities. Results will be compared and discussed to identify commonalities and areas of divergence with the goal of developing general agreement on the most compelling issues and key questions.

1645 Wrap-up, next steps, and closing (Saunders)

Table D.3. Critical questions related to specific juvenile freshwater salmon life-history phases identified at the IYS Scoping Meeting.

| Eggs/alevin (incubation/emergence) | Fry/parr (juvenile rearing) | Smolt (emigration/estuary) |
|--|---|---|
| <ul style="list-style-type: none"> • Role of synoptic processes (e.g. climate change & phenology) on egg incubation & emergence and therefore total productivity (poor data representation) • Flow (climate change, inter-annual variability) • Temperature (bioenergetics) • Prey base • Predation | <p>Preferred prey is not sufficient. Can abundance be experimentally adjusted to determine effects on survival and growth? (Steve Latham)</p> | <ul style="list-style-type: none"> • Overwinter and outmigration survival of parr/smolts • Species comparisons to understand factors regulating species that are doing poorly (e.g., pink and chum vs. Chinook) (Stewart Johnson) • Effects on survival of smolt size and condition • Prey availability. How to assess? How will it change? • Outmigration predation • Channelization • Timing match/mis-match • Bottom-up (environmental) processes drive annual deviations in production. (Brian Riddell) • Climate change, change in ocean current • How stable are relative stock abundances after sampled life history stages, and can these be used to update forecasts of abundance based on the earliest-returning stocks? (e.g. is just post-smolt) (Steve Latham) • Habitat use, growth, survival, behavior in the context of climate change and other cumulative impacts (Francis Juanes) • Effects of climate change on the distribution and production of juvenile salmon, especially in the Okhotsk Sea (Shigehiko Urawa). Future SST increase in Okhotsk Sea may cause: <ul style="list-style-type: none"> • Reduction of salmon distribution space • Increase of inter or intra-specific competition • Reduction of individual growth |

| Eggs/alevin (incubation/emergence) | Fry/parr (juvenile rearing) | Smolt (emigration/estuary) |
|---------------------------------------|--------------------------------|---|
| | | <ul style="list-style-type: none"> • Increasing mortality the following winter • Possibility of negative process should be evaluated by an international cooperative program. |

Table D.4. Critical questions related to specific salmon marine life-history phases identified at the IYS Scoping Meeting.

| Immature (coastal migration) | Adult (ocean rearing/migration) | Spawners |
|---|--|---|
| <ul style="list-style-type: none"> • Do stocks with different survival rates migrate at different times, have different migration routes and rear in different ocean areas? (Terry Beacham) • Where and when does mortality occur that is significantly related to returning adult abundance? (Terry Beacham) • Carrying capacity-density dependent effects on growth (and survival?) • Variability in adult returns is controlled by survival during the period when first enter marine environment, so consider the type, abundance, seasonality, aggregation of prey of ocean entry salmon (Hal Batchelder) • Rapid growth reduces probability of predation and starvation, therefore; simulation results of juvenile salmon feeding and growth in coastal systems are extremely sensitive to assumptions about level of optimal foraging (vs. random foraging); need better information about salmon foraging behavior (Hal Batchelder) • Prey availability • HTL predation • Rearing area/distribution • Overall impact of period on cohort strength • Climate change effects on distribution and amount of salmon “habitat” • Validate (experiments) early marine (6-10 week) mortality rates determine production (species specific) (Brian Riddell) • Overwinter (first winter) distribution and fitness (Brian Riddell) • Migration routes, drivers of mortality, distribution in first winter, role of individual variation • Where are the fish and when are | <ul style="list-style-type: none"> • How much ocean acidification will affect survival rates of juvenile salmon (Randall M. Peterman) • Marine survival (from juveniles to adult recruits) specifically first 9-12 months at sea (Randall M. Peterman) • What is the relative importance to population dynamics of the reduced body size that is associated with greater abundance of salmon in the ocean? (Randall M. Peterman) • Salmon ocean distribution. How consistent is it between years? What does the distribution tell us about the environment? • How are Columbia R sockeye distributed in the North Pacific? (Skip McKinnell) • Climate effects on distribution, maturation, and growth • Mixed stock analysis • Where are the fish and when are they there (i.e., to identify physical and biological conditions that support the growth and body size of returning salmon stocks, assumes high seas regions govern return body size of stocks) (Ian Perry) | <ul style="list-style-type: none"> • How significant is the effect of stress during spawning migration on egg/fry/smolt quality? • Spawner-recruit variability and covariates |

| Immature (coastal migration) | Adult (ocean rearing/migration) | Spawners |
|---|--|-----------------|
| they there? i.e., to identify physical and biological conditions that support the survival of salmon stocks (assumes coastal and shelf regions govern survival and therefore stock abundance) (Ian Perry) | | |

Table D.5. Critical questions associated with all freshwater and marine salmon life-history phases identified at the IYS Scoping Meeting.

| All Freshwater | All Marine |
|---|---|
| <ul style="list-style-type: none"> • Hatchery smolt quality when compared to wild and variability over time (e.g., Is there a relationship between hatchery production levels and quality?) • Cumulative effects (Ian Perry) • What is the distribution of salmon food abundance and nutritional value relative to the distribution of salmon in spacetime and relative to the more easily remotely measured biophysical parameters? (Steve Latham) • Can we measure this in a way that provides a baseline for future comparison (as well as something that allows us to extend the present baseline backward in time)? (Steve Latham) • Stock identification is important. GSI is a good tool. Otolith marking is now also a good tool to identify hatchery origins of salmon in the ocean. (Shigehiko Urawa) • Landscape processes (nutrient) driving freshwater aquatic productivity. Calcium-phosphorus limitation linked to climate change. Match/mismatch. (Mark Saunders) • Freshwater productivity because it affects abundance of seaward migrating juveniles. (Randall M. Peterman) | <ul style="list-style-type: none"> • Natural mortality sources and drivers: is there anything other than predation, parasites, and diseases? What is a scope of such hidden sources of natural mortality? • Marine survival exhibits long-term change while salmon year class live for 2-5 years. We observed the large-scale changes of salmon species productivity and related them to some physical factors dynamics. Re-analysis of such dependencies could be useful. • Stock identification of Fraser River sockeye in the Gulf of Alaska (Terry Beacham) • Causes of mortality in the ocean • What is the relationship between ocean productivity and salmon production? (Skip McKinnell) • Influence of food quality on survival and growth, especially for juveniles in coastal and shelf regions, i.e., it is likely that prey abundance and biomass are not the only determining (prey) factors (Ian Perry) • Salmon abundance, distribution, and migration routes in winter, prey abundance and distribution in winter, salmon predator abundance and distribution in winter, and salmon habitat (ocean conditions) in winter (Kate Myers) • What kills salmon? Predators? Who are they? Growth/predator interaction? Starvation? • Disease/growth/predation interactions? (Greg Ruggerone) • Winter mortality at critical period. Does this simply growth related mortality? If predators are key, why increase predators during /after winter? (Greg Ruggerone) • How much mortality during early marine vs. middle /late marine? Variability? Why no delay in maturation if |

| All Freshwater | All Marine |
|----------------|---|
| | <p>late marine mortality is low? (Greg Ruggerone)</p> <ul style="list-style-type: none"> • Salmon species interactions. Implications for hatchery management. (Greg Ruggerone) • Factors affecting salmon production in winter and spring: prey, predators, diseases, parasites? • Stock-specific composition, distribution and migrations and interactions between different stocks during marine life • Assessment of the carrying capacity of the North Pacific for Pacific salmon, and its dynamics • Quantifying disease, prey, identifying predators. Behavioural responses to environmental change. (Francis Juanes) • Factors limiting primary production > suitable salmon prey. Is it all about iron? • Winter ocean distribution • Behavioural changes under changing climate, e.g., will salmon go deeper to retain their preferred temperatures? (Ian Perry) • What will be the impact of climate change on suitability of North Pacific habitat for productivity of Pacific salmon? |

Cross-cutting issues in Tables D.3–D.5

- Life cycle approaches (Brian Wells)
- Sensitivity analyses
- What does improved forecasting mean to end users of our information? What do we think we will deliver? What is the question? What is the metric, what is the path?
- Based on current assessment capacity/ability – how much change needs to occur in order to be recognized? (Stewart Johnson)
- Need environmental (temp, oxygen, food) at locations where and when salmon are and where salmon are not. Applies to all life stages but more critical to younger life stages. (Hal Batchelder)
- Improve communication
- Monitoring of selected populations for abundance by life history stage (Mark Saunders)
- Cumulative effects models across all life history stages (Mark Saunders)
- Stage specific abundance, survival, and growth estimates (Kate Myers)

Appendix E

Proposal for an International Year of the Salmon

International Year of the Salmon Study Group

15 April 2015, originally presented as NPAFC Doc. 1609, Appendix 7

Background

The North Pacific Anadromous Fish Commission (NPAFC) has endorsed in principle the concept of an International Year of the Salmon (IYS) initiative. At the May 2014 Annual Meeting the Commission directed the Committee on Scientific Research and Statistics (CSRS) Study Group on International Year of the Salmon (IYS-SG) to further scope the initiative and provided the following Terms of Reference (Records of the 22nd Annual Meeting, p. 112):

The International Year of the Salmon (IYS) Study Group should continue to scope the initiative through a series of virtual and/or face to face meetings of interested parties and outside interests to develop an IYS proposal that will be discussed by the NPAFC at the 2015 Annual Meeting. The proposal developed by this group would address the following considerations:

- *Scope of the Programme (Pacific-Atlantic, Farmed Salmon and other ecosystem considerations, etc.)*
- *Benefits of the Program*
- *Potential for Funding and Identification of Partners (NGO's Industry, State and Federal Agencies, other RFMO's, etc.)*
- *Communications and Outreach Strategy*
- *Identification of Field and Analytical Research (Strategic Research Plan)*
- *Starting Year and Duration*

The IYS-SG convened a Scoping Workshop (February 17–18, 2015) in Vancouver, Canada with members of the IYS-SG and invited scientific experts from the member countries. The main objectives of the workshop were to:

- Develop a list of major scientific issues that will, or are likely to, affect salmon production in the foreseeable future, and around which an IYS could be developed and funded.
- Identify the unknowns and scientific questions related to each issue.
- Discuss the scope (spatial, temporal, species) of an IYS that will be needed to answer the questions (test the hypotheses).

A report of the International Year of the Salmon Scoping Workshop was prepared by the Chair of the Study Group and is available from the NPAFC Secretariat.

The IYS-SG met at the NPAFC Secretariat on February 19, 2015 to consider what had been presented and discussed at the workshop and to develop recommendations (below) on the IYS initiative for the CSRS. Drs. Koval and Lincoln were unable to attend. At the invitation of the Chairman, the IYS-SG meeting was

attended by Drs. Robie Macdonald (Emeritus, Fisheries & Oceans Canada), and consultants Dr. Skip McKinnell and Mr. Marc Nelitz.

Concept of the International Year of the Salmon

The International Year of the Salmon (2018–2019) is an intensive burst of internationally coordinated, interdisciplinary, stimulating scientific research focused on salmon, and their relation to people. New technologies, new observations and new analytical methods, some developed exclusively during the IYS, will be focused on knowledge gaps that prevent a clear understanding of the future of salmon in a rapidly changing world.

Concept of the International Year of the Salmon (continued)

Research themes

The IYS will be seeking First Proposals under five broad scientific themes:

1. *Status of Salmon:* to understand the present status of salmon and their environment.
2. *Salmon in a changing salmosphere¹:* to understand and quantify the effects of natural environmental variability and anthropogenic factors affecting salmon distribution and abundance and to make projections of their future changes.
3. *New Frontiers:* to develop new technologies and analytical methods to advance salmon science and to explore the uncharted regions of the salmosphere.
4. *Human Dimension:* to investigate the cultural, social, and economic elements that depend upon sustainable salmon populations.
5. *Information Systems:* to develop an integrated archive of accessible electronic data collected during the IYS and tools to support future research.

In pursuing these themes, the IYS will seek to develop and utilize new technological capabilities to make major advances in knowledge and understanding. It will leave a legacy of new or enhanced observational systems, research networks, as well as an unprecedented degree of access to the data and information it will generate. Key objectives are to attract and develop the next generation of researchers and to engage the interest and involvement of students, the general public, and decision-makers worldwide.

Rationale

IYS is an international research effort to understand the future of salmon. Salmon are iconic indicators of ecological health and the state of the human environment. For many, salmon are a source of food and economic security through fisheries or tourism. For indigenous peoples, salmon have an important connection with social and ceremonial traditions. Food security is an emerging issue and salmon will be important contributors to that security in the future. The well-being of people and salmon are linked.

1 The current and future geographic range of salmon in the Subarctic and Arctic.

Resource managers, fishers, processors, businesses, and governments need a better understanding of the future of salmon populations. Environmental changes are occurring in the salmosphere that will affect salmon distribution and abundance. Increases and decreases in abundance are likely to occur in the 21st century but at present, there is insufficient knowledge to understand how the changes will play out. New insights will require an understanding of the cumulative effects of a broad array of human and natural factors affecting salmon in order to manage what can be controlled and to mitigate what cannot.

An intense burst of international research can provide the field observations to address knowledge gaps as well as the analytical tools technologies and a new generation of scientists to facilitate the unprecedented international collaboration required to sustain salmon and people in a rapidly changing world.

Why now?

- The 21st century will be a time of rapid environmental change because of increasing quantities of greenhouse gases, carbon pollution, the shrinking of glaciers and sea level rise, increasing ocean stratification and many other related phenomena.
- *Status quo* is not a reasonable expectation for the future, and the current understanding of salmon in the ocean is insufficient to make reliable forecasts of the consequences of such major changes.
- Technological developments during the past decade now make it possible for quantum leaps in understanding many aspects of the life of salmon in the ocean.
 - New kinds of tags can be attached to salmon at sea to provide a detailed record of the environment that a salmon experiences.
 - Developments in genetic stock identification now make it possible to identify the origin of salmon in ways that were never possible when the baseline information was collected decades ago.
 - New data-integrating ocean models are now providing high resolution images (nowcasts) of potential productivity hot spots and migration corridors that can be linked to the data on ocean habitat provided by tags
 - IPCC-class climate models can be coupled to new information on distribution and migration to project salmon futures under various climate change scenarios.
 - The timescale for preparations allows advances in technology and logistics to be exploited to address new issues and to access new areas
- There is a pressing need to capture contemporary information on change and to understand the effects of this change on salmon and our human well-being.

Why call it a 'Year'?

- While the activities will grow through a planning and preliminary sampling phase to a peak in 2018–2019, then decline over a total period of 7 years, a clear idea of the target year(s) provides for better planning and coordination.
- A period of 2 years allows for anticipated differences in national budget cycles, but in the Pacific it also allows for a comparison of odd and even cycle years of the most abundant species (pink salmon).
- The geophysical research community has led the way in demonstrating the benefits of having a “year” as a call to action.

Why international?

- Salmon have passports, but they do not know which one they carry.
- Salmon travel widely, crossing international boundaries with impunity.
- Scientific expertise is distributed among nations.
- Many processes that affect salmon distribution and survival are large-scale.
- The broad salmosphere is effectively a laboratory to determine factors that affect abundance and distribution through comparative studies.
- Common objectives foster cooperation.
- Costs and benefits are shared among nations.

Major Recommendations

A.1 – An International Year of the Salmon programme be established as an intense, forward-looking, international, collaborative research programme directed at filling critical knowledge gaps, developing analytical tools and training a new generation of scientists to understand salmon and their future.

A.2 – The theme of the IYS is *Salmon and People in a Changing World* to focus on the intimate nature of the relationship between salmon and people and their joint future.

A.3 – The geographic scope of the IYS be defined broadly as the salmosphere because similar issues affect all northern seas to varying degrees.

A.4 – The thematic scope of the IYS be focused on issues that affect salmon distribution and abundance, and how these changes are expected to affect people.

A.5 – The temporal scope of IYS be 7 years duration with two years (2018–2019) reserved for intensive coordinated field study, primarily in the oceans.

Recommendations about implementation

B.1 – The NPAFC Secretariat determine the core membership of partners in the IYS by communicating with relevant regional organizations.

B.2 – A Second Scoping Meeting for the IYS with core partners be convened to refine the approach proposed by NPAFC. A scheme for the international governance of the IYS is an expected outcome.

B.3 – The science of the IYS be led by an IYS Scientific Steering Committee that will be formed to provide overall scientific direction for the program. Membership will be based on relevant expertise and determined by regional science and conservation organizations that have committed to supporting IYS goals. Regional science panels will likely be needed to provide leadership and coordination within regions. The IYS-SSC will identify the number of regions.

B.4 – The IYS research programme be developed from an international *Call for Pre-proposals* to the scientific community to conduct IYS-related research. The call will be developed by the IYS-SSC according to broad objectives outlined in B.3 and research themes identified below. The IYS-SSC will use these to develop a detailed IYS research plan and to request full proposals of researchers whose

research projects are consistent with the IYS detailed plan. A primary function of the IYS-SSC is to ensure optimal use of resources and consistency of research projects with IYS objectives.

B.5 – An International Project Office be established to provide oversight, planning, administrative services, and to support the IYS-SSC and Regional Science Panels.

B.6 – National funding commitments to IYS are to be determined as early as possible to attract good project proposals (proposals to who?), and to attract researchers and students to the program.

B.7 – A press release about IYS be prepared and released at an appropriate time to be determined by the Secretariat, and that such communications be managed by the NPAFC Secretariat until such time as this function is transferred to the International Project Office.

1. Scope of the Program

The IYS-SG discussed the geographic scale, duration, and themes of an IYS. The “salmon” of the IYS are the anadromous members of the sub-family Salmonidae, which includes the salmon, trouts, and charrs, but excludes the whitefishes and graylings.

The IYS-SG noted that Atlantic salmon are found in the North Pacific Ocean and Bering Sea and Pacific salmon are found in watersheds draining into the Atlantic Ocean, and both are found in the southern hemisphere as a result of introductions. Range expansions by species of Pacific salmon into the Arctic are uncertain at this time, although chum salmon are endemic to the McKenzie River. Atlantic salmon are endemic to the European part of the Arctic.

The IYS-SG felt that international partners in the Atlantic, with mandates aligned to those of NPAFC, should be invited to participate in the IYS. Many pressing issues in salmon conservation and management, such as declining abundances, and farmed and wild salmon interactions are common to the Atlantic and Pacific oceans. Regional comparisons in large-scale programs such as GLOBEC have been a productive means of understanding marine ecosystem variability. Preliminary communications between organizations in Atlantic and Pacific researchers on the idea of developing a hemispheric IYS have suggested that the invitations would be welcome.

Self-sustaining populations of salmonids in the southern hemisphere are a consequence of intentional introductions more than 100 years ago, or escapes from salmon farms in recent decades. Inter-comparisons of these populations with the original donor stocks have provided new insights into their biology, their strategies for adaptation, and evolutionary trajectory. To the extent that new research on salmon in the southern hemisphere addresses the fundamental key questions of the IYS, such projects will be considered as any other.

The annual production of farmed salmon exceeds that of the wild salmon catch in many regions of the salmosphere. The IYS will not consider First Proposals directed at farmed salmon production, but will consider proposals that address the interactions of wild and farmed salmon.

The IYS is a tremendous opportunity for the international research community to:

- conduct collaborative scientific research on key unknowns about salmon
- advance understanding of salmon ecology during the whole life cycle including freshwater and

marine periods; specifically:

- to discover stock-specific information about seasonal migration, distribution, and abundance of salmon throughout the oceans.
- to learn more about key factors of salmon mortality at each stage of their life cycle, especially during early ocean life and winter periods.
- to gain new knowledge on oceanic conditions in remote areas
- enhance capacity for salmon science with new observational systems, tools, and research networks
- strengthen international cooperation
- train the next generation of researchers
- provide unprecedented access to data and information
- capture the interest of the public and showcase science and technology.

2. Benefits of the Programme

Charles Darwin did not set sail on the *Beagle* in 1831 with an intention of making observations to support one of the greatest ideas ever to emerge from science. Rather, he wrote what might have been expected at the outset, a book describing *The Voyage of the Beagle* that was published in 1839. He returned to England with specimens, descriptions, maps, and drawings, but the greatest success of that voyage was an unintended outcome, a theory of evolution by natural selection. The primary lesson to be learned from Darwin's experience is that confronting historical data and new observations with prepared minds has a potential to lead to remarkable outcomes.

Major international research programs always produce a mixture of social, economic, and academic benefits in varying proportion. Some programs have immediate benefit while some benefits emerge more gradually. Regardless, the key feature of all of them is the cooperative effort by nations, organizations, and individuals to remove some veil of human ignorance by undertaking a shared voyage of discovery.

IYS research will produce outputs that are typical (e.g., new field observations leading to new maps of the distributions of individual salmon populations, better models, linked and shared databases housed on data servers). The cooperative approach will produce new international standards in methods and data exchange, where none currently exist. These outputs are expected to have an impact in some specific ways (e.g., improved collaboration, understanding, capacity, awareness).

Salmon return home to their natal streams, so people tend to have greater interest in “their” salmon, not all salmon. Individual populations face different threats and potentially different futures, depending on where they are located and where they go. The intensive burst of field effort will help to fill the considerable gaps in understanding of salmon in under-studied regions of their ocean residence. Better knowledge of their distributions and migrations in the ocean will improve advice to different stakeholders on the fate of their salmon and allow these stakeholders to make decisions that affect their lives and livelihoods. Indigenous peoples will have the information needed to support their cultural practices and provide food for their communities. Better information will facilitate pre-season forecasts of abundance and timing by scientists, and a better understanding of the fate of salmon in the 21st century will allow harvesters and processors to plan business investments. National and international governing agencies can improve enforceable regulations/management policies. This understanding will inform fisheries management as well as resource management more broadly during a period of anticipated rapid climatic change during the 21st century.

The IYS legacy is expected to be:

6. A comprehensive international network of data and information needed for ongoing research and to form the baseline for study of climate change effects on salmon.
7. New tools, technologies and analytical methods that draw on the data and can be applied on international and local scales.
8. A new generation of enthusiastic scientists trained to work with these data and tools with personal connections to the international science community needed to collaborate and build on the work of the IYS.
9. Improved intra- and international collaboration (among institutes, agencies, and countries).
10. Improved high seas fisheries enforcement through improved understanding and tools to predict the ocean distribution of salmon.
11. It is foreseen that science in many disciplines in the post-IYS era will be vastly strengthened and improved.
12. Fresh ideas seeded by examination of existing and new data will drive enlightened researchers to new discoveries.

Social and economic benefits of IYS include:

- greater awareness and appreciation of the connection of salmon and people, the importance of salmon, their stewardship, and links to climate and culture.
- People will be inspired to affect positive change, either individually or collectively, to sustain salmon and their ecosystems.
- Better long-term and short-term forecasts of salmon returns will improve the economic performance of fisheries.
- Identification of current and future factors affecting salmon productivity, whether natural or anthropogenic, will inform mitigation strategies to sustain salmon.
- Economic returns from hatcheries can be optimized.
- The role of salmon as a key component of food security will be understood.
- Across borders, stakeholders, indigenous peoples, and the public are engaged on similar salmon issues such as food security, cultural identity, and economic benefits.
- Recognition and fostering of common threads among diverse salmon-dependent communities provides an anchor for why the science is important and why people should care about salmon.

The kinds of benefits that will accrue from the IYS can be classified into a few general categories but the primary benefits are better understanding of the present to inform a new understanding of the future.

Improved understanding of:

- seasonal distributions, migration routes, and abundances of salmon populations will facilitate:
 - better salmon research and management
 - updating outdated baseline information and set a new standard for future comparisons
 - knowing the key factors causing mortality at each stage of the salmon life cycle
 - development of more accurate models for long-term and short-term forecast of salmon returns
 - knowing how, when, and where wild and hatchery salmon interact
- how to modify hatchery practices to optimize marine survival of salmon to foster sustainable food sources for people

- the effects on salmon of changing nutrient and water quality of the North Pacific Ocean
- the cumulative effects of multiple stressors on salmon
- biological and oceanographic factors which govern or limit production of salmon species in oceanic ecosystems
- the impacts of climate change on salmon

Better cooperation and communication through:

- new shared databases
- improved intra- and international collaboration (between institutes, agencies and countries)
- engaging a new generation of people in salmon studies and conservation
- raising awareness of salmon research and conservation
- engaging stakeholders and public across national borders focused on similar salmon issues such as food security, cultural identity, and economic benefits
- recognizing and fostering of a common message among diverse salmon-dependent communities provides an anchor for why the science is important and why people should care about salmon and salmon conservation
- engaging business and industry in developing new technology.

NPAFC will gain an awareness of public attitudes and opinions which will guide the Commission in their future activities.

- IYS scientific activities will help to resolve key scientific questions that are relevant to the NPAFC Science Plan. They will identify potential projects or activities that are most likely to lead to progress in understanding unexplained variability in salmon abundance, migration, growth, and survival.
- IYS will provide improved advice to fisheries management during what is anticipated to be a period of rapid climatic change during the 21st century. Stepping away from routine monitoring of salmon populations to re-examine accumulated scientific materials and data should reveal potential challenges to salmon stock sustainability before problems become clinically significant.
- NPAFC should expect a multiplier effect in its efforts to support anadromous stock conservation in the North Pacific Ocean through widespread advertisements of IYS events on the web and the print media.

3. Potential for Funding and Identification of Partners

Recognizing that major international research programs are funded largely by national resources, with variable levels of interest and investment in programs, and with different national administrative procedures among nations, the approach taken by the IYS-SG was to develop a compelling argument for the IYS and to present it in an attractive format with simple descriptions of the need for an IYS.

If the IYS can generate enough interest as a whole, support could come from government as well as business and industry in the form of technology development (e.g. new tags for migration studies, greater levels of automation in salmon science, other ideas may emerge) or ships of opportunity. There are potential partnerships and support from associations of harvesters, foundations with interests in fish conservation, and non-governmental organizations which need fresh ideas for their conservation activities. Crowd sourcing/funding is a new approach to fundraising that will be investigated.

An incomplete list, focusing on the North Pacific region, is attached to indicate examples of the broad range of potential IYS partners (Table E.1).

4. Communications and Outreach Strategy

It is important to develop a strategy to engage people early in the development and throughout the program. Each day, individuals from all walks of life are making decisions that affect salmon or their habitat. These ought to be informed decisions so it is important to encourage communications among “salmon people” to foster a shared commitment and responsibility for salmon sustainability throughout the salmosphere. The IYS will ultimately include a comprehensive Communications and Engagement Plan that facilitates two-way communication between researchers and target audiences that include:

- kindergarten, primary, secondary and post-secondary students and their teachers
- new researchers and their professors
- indigenous peoples
- communities with salmon
- resource managers
- the general public and their day to day decisions that affect salmon
- salmon fishers
- salmon industry

Rapidly evolving web-based media and communications technologies will enable an unprecedented ability to communicate, interact, and contribute directly through citizen science.

5. Field and Analytical Research

IYS research will comprise physical, chemical, biological, engineering, and social studies addressing five research themes conducted over a seven-year period. A two-year period of fund-raising, proposal selection, preparation and planning will be followed by an intensive two-year field study phase and three subsequent years of analysis, major symposia, and publication. The broad scope of physical, biological, and social science requires the engagement of the broad community including government, university, NGO, private sector, and citizen scientists. Projects will be developed from calls for proposals for each research theme. The preliminary five broad scientific themes identified by the IYS-SG based on the initial Scoping Meeting are listed below.

Theme 1. Status of Salmon: to understand the present status of salmon and their environment

- Seasonal distribution and abundance of major salmon populations.
 - Winter- A major knowledge gap is the nature of seasonal spatial transitions from autumn through the first and subsequent winters to spring in the open ocean. Variation in survival during the first winter at sea has been hypothesized to have a major role in determining the numbers of adults that return to spawn.
 - Migration- How salmon migrate at sea has inspired many hypotheses, but there is no consensus about how it operates.
 - Ocean entry- Juvenile abundance at ocean entry is a parameter that is critical to understanding and quantifying mortality at sea, but it is rarely measured.
- Growth and survival of salmon
 - Carrying capacity- Understanding and quantifying current and future limits to salmon

production. The ability of an ocean to produce salmon is not constant, and for the most part, the limits are not known. A general concern is that competition among different salmon populations will lead to lower growth and survival at high abundances, especially during periods of lower biological productivity.

- Density-dependence- There is a need to understand how salmon growth and survival are affected by salmon abundance. High abundance in salmon populations is generally considered to be a desirable property. Indeed, consistent abundances have allowed salmon to become a staple food. What are the benefits and costs associated with high abundances?
- Optima- There is a need to understand the interplay of ecological, biological, and economic factors affecting salmon. New research under the IYS could resolve some of the unknowns about oceanic limits to production, and the general role of salmon in the ocean foodweb. Where limits are not yet evident, IYS could provide advice that would lead to better marine survivals and better hatchery practices. What level of production can be achieved without compromising the sustainability of the resource?
- Salmon health- Understanding the effects of pathogens and stressors on the growth and survival of salmon in the wild.
- Cumulative effects- How does the accumulation of individual non-lethal stressors affect the ultimate survival of salmon?
- Freshwater landscapes - Understanding the status of freshwater ecosystems and the effect of changing habitat on salmon abundance
- Regional inter-comparisons- A powerful technique for understanding variability in one population is to compare its variability with another on scales from watersheds to hemispheres.

Theme 2. Salmon in a changing salmosphere: to understand and quantify the effects of natural environmental variability and anthropogenic factors affecting salmon and to make projections of future changes

- Retrospective studies
 - Historical surveys of salmon on the high seas and in coastal waters have produced rich collections of data and samples that are under-utilized. Scale samples that were deposited in archives decades ago can now provide records of individual fish age and growth and with the advent of DNA-based stock-identification, the identity of individual salmon can be determined for some species.
- Climate change in the salmosphere
 - Earth System Models- To understand the range of possibilities about the future of the world's salmon populations, it will be necessary to understand how the salmosphere will change under different climate scenarios. The output of the models must coincide with the temporal and spatial scales of variability experienced by salmon.
- Salmon futures
 - Future salmon distributions- How is salmon distribution determined at present and how will the anticipated changes affect future spatial distributions?
 - Salmon productivity- How does energy flow to salmon and how will it in the future?
 - Policy and management- How will salmon adapt to a changing world?

Theme 3. New Frontiers: to develop new technologies to advance salmon science

- Technological advances
 - Stock identification- The ability to understand stock-specific distributions of salmon requires the development of new markers for species (e.g. pink salmon) where there is considerable genetic similarity among populations.
 - Genomics- Genomic technology allows for the rapid assessment of the physiological condition of salmon and helps to identify the cause.
 - Marking- expand mass marking (e.g. otoliths) to identify hatchery salmon in the ocean
 - Salmon observation systems- Long migrations beneath the water surface to remote locations make salmon difficult animals to observe. Improved tagging and tracking technologies are needed to understand stock-specific patterns of migration and survival.
 - Standard methods- Standard methods have been developed in salmon biology. New tools and methods will require new standards or intercalibrations to make data comparable across platforms.
 - Biophysical models- Linking salmon to biophysical models is an emerging technique for studying variability in growth and survival of salmon and may lead to better forecasts of abundance.

Theme 4. Human Dimension: to investigate the cultural, social, and ecological processes that jointly shape the sustainability of people and salmon in the salmosphere.

Salmon and humans co-exist in socio-ecological systems where ecological (or ‘natural’) systems and human (cultural, social, economic, socio-political, ethical, and management) systems are dimensions of a greater whole.

- Develop the role of salmon in food security.
- How do changes in the health of salmon populations affect place-based human societies?
- Develop and apply analytical methods to examine what has occurred and conditional predictions of what is likely to occur under anticipated future conditions in social-ecological systems where salmon and humans interact.
- Understand the relationship between salmon and indigenous peoples.
- Create a mechanism for an international exchange of indigenous knowledge, traditions and experience relating to salmon.

Theme 5. Information systems

The ability to share information and collaborate advances almost daily. A modern web-based framework to rapidly access data and collaborate will be one of the most important legacies of the IYS.

- Data archaeology- In some jurisdictions, the baseline information about salmon in the sea is more than 50 years old. Readily available historical data on salmon and their environment will ensure an adequate basis of comparison with IYS data.
- Data servers- The data collected during the IYS will serve as a basis for future comparisons. It will require management and distribution.

6. Starting Year and Duration

The IYS is envisaged as a multiyear programme with the largest investments occurring during two years of intensive field work involving the coordinated efforts of multiple vessels. A proposed seven year timeline is presented in Table E.2 with the intensive field years in 2018 and 2019. Very few resources will

be required beyond 2019, but large international programs have found that it is important to plan for five or more years to ensure that projects are completed, results communicated, and data archived.

Table E.1. Preliminary list of IYS potential partners.

| Country | Organization Name | Website | Mission |
|---|-----------------------------------|------------------------------------|--|
| Type of Organization: Conservation-non-profits | | | |
| Canada | Pacific Salmon Foundation | www.psf.ca | Provide thoughtful leadership in the conservation, restoration and enhancement of Pacific salmon and their ecosystems. |
| Canada | Raincoast Conservation Foundation | www.raincoast.org | Use rigorous, peer-reviewed science and grassroots activism to further our conservation objectives. This approach ‘informed advocacy’ and it is unique amongst conservation efforts. Investigate to understand coastal species and processes; inform by bringing science to decision makers and communities; inspire action to protect wildlife and their wilderness habitats |
| Canada | Pacific Wild | pacificwild.org | Defend wildlife and their habitat on Canada’s Pacific coast by developing and implementing solution-based conservation strategies |
| Canada | David Suzuki Foundation | www.davidsuzuki.org | The mission is to protect the diversity of nature and our quality of life, now and for the future. |
| Canada and US (Nanaimo and Snohomish) | Sustainable Fisheries Foundation | sustainablefisheriesfoundation.org | A non-profit organization dedicated to the protection, enhancement, and wise use of fisheries resources and their habitats. Our mission is to promote a balanced approach to fisheries management – one based on sound ecological and economic principles – to ensure that fish populations, and the ecosystems they depend on, remain viable, productive, and accessible to future generations. |
| US | Save our wild salmon | www.wildsalmon.org | A nationwide coalition of conservation organizations, commercial and sport fishing associations, businesses, river groups, and taxpayer advocates working collectively to restore self-sustaining, abundant, and harvestable populations of wild salmon and steelhead to rivers, streams and oceans of the Pacific Salmon states. |
| US | Long Live The Kings | www.lltk.org | Committed to restoring wild salmon and steelhead to the waters of the Pacific Northwest |
| US | Bering Sea Fishermen’s | www.bsfaak.org | Gives the subsistence and commercial fishermen a voice in the sustainability and development of Bering Sea and western |

| | | | |
|---|---|--|---|
| | Association | | Alaska fishery resources |
| US | North Pacific Research Board | www.nprb.org | Committed to building a clear understanding of the North Pacific, Bering Sea and Arctic Ocean Ecosystems that enables effective management and sustainable use |
| US & Canada | The Nature Conservancy | www.natureconservancy.ca www.nature.org | Conserve lands and water |
| US | Gordon and Betty Moore Foundation | www.moore.org | Wild Salmon Ecosystems Initiative. Working with partners across the North Pacific to ensure that these salmon ecosystems remain healthy. Specific strategies include the following: Maintain healthy habitat in key watersheds; Ensure sustainable management of salmon fisheries; Promote natural resource use practices that are compatible with maintaining healthy salmon systems |
| US | Wild Salmon Center | wildsalmoncenter.org | Promote the conservation and sustainable use of wild salmon ecosystems across the Pacific Rim. Identify science-based solutions to sustain wild salmonids and the human communities and livelihoods that depend on them. |
| Fishermen's organizations | | | |
| Canada | The Steelhead Society of British Columbia | www.steelheadsociety.org | Charitable non-profit river conservation organization. The Society has evolved to advocate for the health of all wild salmonids and wild rivers in BC. |
| Other organizations | | | |
| Canada | Vancouver Aquarium | www.vanaqua.org | Protecting our oceans |
| US | Seattle Aquarium | www.seattleaquarium.org | Hands-on marine experiences and conservation education |
| US | Pacific Seafood Processors Association | www.pspafish.net | A nonprofit seafood industry trade association. Its corporate members are major seafood processing companies with operations in Alaska and Washington |
| Inter-governmental organizations | | | |
| Can-US | Pacific Salmon Commission | www.psc.org | Shared responsibility to act with wisdom and ensure their migrations continue, by managing for rich harvests, while allowing the salmon to return in abundance to the rivers of their birth. |

| | | | |
|----------------------------------|-------|---------------|---|
| Can-Jpn- China-Rus- Kor-US | PICES | www.pices.int | Promote and coordinate marine research in the northern North Pacific and adjacent seas. |
| many | NASCO | www.nasco.int | Conserving and restoring wild Atlantic salmon |

Tribal entities

| | | | |
|--------|---|--------------|---|
| US | Northwest Indian Fisheries Commission | | |
| US | Columbia River Inter-Tribal Fish Commission | | |
| Canada | Fraser River Aboriginal Fisheries Secretariat | www.frafs.ca | The Secretariat provides communications and biological support services to First Nations, and coordinates the <i>Forum on Conservation and Harvest Planning for Fraser Salmon</i> and the <i>Fraser Salmon Roadmap (Fraser Salmon Management Agreement)</i> processes. As the numbers of meetings and workshops increase in response to a multitude of initiatives and issues surrounding the management of Fraser River salmon, the Secretariat also plays a key role in coordinating and supporting these initiatives by arranging venues and associated services for both First Nations and DFO. |
| Canada | Skeena Fisheries Commission | | |
| Canada | First Nations Fisheries Council | | |

| Country | Organization Name | Website |
|--|--------------------------------|-------------------------|
| Universities & Institutions | | |
| Canada | University of British Columbia | |
| Canada | Simon Fraser University | |
| Canada | Vancouver Island University | |
| Canada | Thompson River University | |
| Canada | UVIC | |
| Japan | Hokkaido University | |
| Russia | Far-Eastern Federal University | www.dvfu.ru/en/web/fevu |
| US | University of Washington | |
| US | University of Alaska | |
| US | Oregon State University | |

| | | |
|--------------------|--|--|
| US | University of Oregon | |
| US | Sea Grant | |
| Governments | | |
| Canada | Fisheries and Oceans Canada | |
| Canada | B.C. Ministry of Forests, Land & Natural Resource Operations | |
| Japan | Japan Fisheries Agency | |
| Japan | Fisheries Research Agency | |
| Japan | Salmon and Freshwater Fisheries Research Institute | |
| Korea | Korea Fisheries Resources Agency | |
| Russia | Federal Agency for Fishery | www.fish.gov.ru |
| Russia | Academy of Sciences | www.ras.ru |
| US | Alaska Department of Fish and Game | |
| US | Oregon Department of Fish and Wildlife | |
| US | California Department of fish and Game | |
| US | US Army Corps of Engineers | |
| US | National Marine Fisheries Service | |
| US | Fish and Wildlife Service | |
| US | Washington Department of Fish and Game | |

Table E.2. Proposed IYS timeline.

| Year | Science | Resources/Partnerships | Communication and Engagement |
|---------------|--|--|---|
| 2015 and 2016 | <ul style="list-style-type: none"> Determine core members of research partnership Conduct 2nd IYS Scoping Meeting with all partners Establish IYS-SSC Establish an International Project Office (perhaps interim) Convene IYS-SSC meeting in conjunction with IYS Workshop Issue Call for Pre-proposals Issue Call for Proposals Data policy and management | <ul style="list-style-type: none"> Develop IYS promotional material Obtain seed funding Identify patron and sponsors Identify contributors/donors Develop governmental proposals Secure research funding | <ul style="list-style-type: none"> Press release Invitations to potential partners Distribution of promotional materials |
| 2017 | <ul style="list-style-type: none"> Student recruitment Retrospective studies Data archaeological projects Cruise planning and coordination | | |
| 2018 | <ul style="list-style-type: none"> Primary field season Analysis IYS post-season workshop Cruise planning and coordination | <ul style="list-style-type: none"> Major expenditures Ships at sea | |
| 2019 | <ul style="list-style-type: none"> Primary field season Analysis IYS post-season workshop | <ul style="list-style-type: none"> Major expenditures Ships at sea | |
| 2020 | <ul style="list-style-type: none"> Analysis and writing. Establish permanent IYS data archive | | |
| 2021 | Dénouement Symposium | | |
| 2022 | Journal Issue | | |

CHAPTER 3: SUPPORT FOR THE INTERNATIONAL YEAR OF THE SALMON

Formation of the IYS Working Group

The First Proposal of the IYS-SG was presented to the Commission at the 2015 Annual Meeting of the NPAFC in Kobe, Japan, by Mark Saunders (NPAFC 2015). All parties praised the excellent work of the IYS-SG—particularly in the development of the IYS science priorities—and it was at this point where the NPAFC became fully supportive of the IYS initiative. The importance of engaging and securing the commitment of partners as well as external funding due to the limited resources of the NPAFC was emphasized. These issues, as well as the need to further define the geographic scope and governance of the initiative, were referred to CSRS.

A suggestion was made to CSRS to create a formal IYS Working Group (IYS-WG) to continue the scoping and implementation of the IYS initiative. CSRS agreed to disband the IYS-SG and the IYS-WG was formed, with members including Mark Saunders (Canada, Chairperson), Ju Kyoung Kim and Do Hyun Lee (Korea), Shigehiko Urawa (Japan), Alex Zavolokin (Russia), and Ed Farley and Eric Volk (US). The IYS-WG received \$50,000 CAD to conduct a Second Scoping Meeting including core partners to refine the approach of the initiative prior to the 2016 Annual Meeting of the NPAFC. The expected outcome of this Second Scoping Meeting was to include a more detailed scheme for research, international governance of the IYS, and a business plan. NASCO was identified as a likely core partner in the IYS initiative implementation.

A Summary Description of the International Year of the Salmon (IYS) as proposed by the North Pacific Anadromous Fish Commission was written by Mark Saunders, Chairperson of the IYS-WG, in July of 2015. This document includes a summarized description of the IYS up until this point of the IYS planning process, including sections on background, concept, scope, timeline, funding and partnership, and next steps. This document is included as Appendix F at the end of this chapter.

Commitment from the NASCO and Exploration of Other Partnerships

Following the 2015 Annual Meeting of the NPAFC, NASCO committed to engage with the NPAFC in the development of its role as a partner with the IYS. Several weeks after the meeting, IYS-WG Chair Mark Saunders delivered a summary and presentation on developments of the IYS initiative at the NASCO Council at its 32nd Annual Meeting in Happy Valley-Goose Bay, Canada. Upon completion of the presentation, the NASCO Council asked “*the NASCO Secretary to liaise with NPAFC on arrangements for an IYS and to consider NASCO’s possible involvement in, and contributions to, such an initiative*” (see M. Saunders’ article in the NPAFC Newsletter #38, p. 19–20).

Since July 4, 2015, NASCO Executive Secretary, Peter Hutchinson, and Head of the US delegation to NASCO, Daniel Morris, joined an informal “small organizational group” to formalize the arrangements between the two commissions. Several conference calls were conducted in the course of making Second IYS Scoping Meeting preparations. From March 15–16, 2016, the NASCO delegation participated in the Second Scoping Meeting with presentations on their SALSEA ocean studies, further

plans in the development of salmon telemetry tagging networks, and their vision of the IYS initiative implementation.

Among other international organizations, the NPAFC Secretariat sent an invitation to the Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO) Executive Secretary, Vladimir Ryabinin, to join the IYS initiative as one of the core partners in October 2015. The IYS scope, objectives, and timing were described based on the First Proposal of the IYS-SG adopted by the Commission. In his response, Ryabinin informed the Secretariat that, while IOC does find the IYS initiative very worthwhile, it did not fall within the IOC focus or mandate. However, he asked that the IOC be kept on the list of addresses to which results of the IYS Scoping Meeting will be sent.

In 2015, NPAFC informed the international fisheries management society on planning of the IYS initiative implementation launch. Upon the invitation of the Regional Fishery Body Secretariat's Network (RSN), Mark Saunders and Nancy Davis wrote a brief article "*NPAFC: International Year of the Salmon—Envisioning a New Initiative*" on the Commission's major project for the RSN Newsletter No. 12 issued in October 2015 (see <http://www.fao.org/fishery/rsn/newsletter/en>).

The Second IYS Scoping Meeting

Prior to the Second Scoping Meeting, the NPAFC had endorsed in principle the concept of the IYS and had provisionally identified the scope, time frame, and key research themes. The newly formed IYS-WG was tasked by the Commission to identify potential partners, develop a business plan, and further define North Pacific research activities. After months of consultations between NASCO and NPAFC, NASCO agreed to participate in the Second Scoping Meeting and provided the Commission with constructive suggestions for the development of the IYS. A briefing note on the IYS initiative was written to incorporate views of NASCO into recommendations on how the IYS could be organized, as well as to set out objectives and approach for the Second Scoping Meeting (Appendix G).

Suggestions from NASCO largely focused on increasing the business and outreach strategy of the IYS initiative. One example included holding a focal year concentrated on outreach before the period of intensive research in order to raise awareness of the issues facing salmon and assist in fundraising for new research. It was also suggested that the scope of the initiative be finalized before bringing in other core partners. A conference call was held between IYS-WG Chairperson Mark Saunders, NPAFC representatives, NPAFC Secretariat staff, NASCO Secretary Peter Hutchinson, and NASCO Commissioner Dan Morris to discuss NASCO involvement in the scoping meeting. The approach suggested by NASCO was well-received by NPAFC representatives and was provided in the briefing note for further consideration of the IYS-WG.

The briefing note outlined a number of strategic considerations to provide a more complete perspective on the pressures and opportunities that should be anticipated in moving forward with the initiative. In order to gain support, identifying organizations and governments with interest and capacity to participate in a large-scale multi-year endeavour was essential, as well as matching IYS outcomes to the interests of potential donors and partners. Further informing the public on the challenges facing salmon was another way of gaining support, while also ensuring the IYS is seen as relevant to people outside the science community. Additionally, due to the dedicated effort required to run the initiative over several years, there was a need to define and secure organizational governance for the initiative.

These considerations reinforced the requirement for a progressive and phased approach to the IYS that had been outlined in the First Proposal. Some suggested changes mainly involved the business and outreach strategy of the initiative and thus did not change the fundamental concept of the IYS.

The initial focus would entail developing the IYS strategy to address the key strategic considerations noted above, identifying its core partners, seeking their views and support, and outlining and adopting an effective public engagement and donor approach. This would provide a solid foundation for the subsequent official launch of the IYS and its research and field component which would be concluded by reporting out on its outcomes and outlining the benefits and legacy of the IYS (p. 2).

Based on the new considerations listed above, the suggestion for the broad objective of the Second Scoping Meeting was to focus on reviewing, refining and building support for the IYS implementation strategy, and thus be a more formative process than originally intended. It was suggested that the workshop involve a more focused group of core partners with the following suggested actions (p. 4):

1. developing a public engagement and outreach approach;
2. identifying and securing organization capacity and support;
3. developing a funding strategy; and
4. developing and agreeing to a business plan.

At the point of the Second IYS Scoping Meeting, NPAFC had already invested three to four years in the initiative beginning with the Initial Proposal by Richard Beamish in 2012. The First IYS Scoping Meeting, held in February 2015, had been a major success through the development of the science portion of the initiative. The purpose of the Second Scoping Meeting, held in Vancouver, Canada, on March 15–16, 2016, was to bring together potential partners in the IYS initiative to provide input into the scoping and development of the IYS strategy and business model. Participants included IYS-WG members and other invitees; a complete list of participants is included in the Report of the International Year of the Salmon 2016 Scoping Workshop (Appendix H; IYS-WG 2016b). Specific objectives were as follows (IYS-WG 2016b p. 2):

- *develop a common understanding of the IYS initiative, scope, and purpose*
- *elaborate on, and further develop, the major components of the IYS strategy*
- *identify actions needed and next steps to create a comprehensive IYS strategy.*

The workshop began with a few introductory presentations, followed by numerous plenary and breakout group discussions. *“Much of the discussion centred on the scope of the IYS and how its approach could be made more relevant to partners and potential donors, what components, such as communication and public outreach strategies, were necessary and what governance structure best accommodated the diverse organizations who may be part of the initiative”* (IYS-WG 2016b p. 1). Immediately following the workshop, the IYS-WG met to develop a proposed implementation strategy, including outcomes, decisions, and next steps.

NASCO Perspectives

At the beginning of the workshop, a presentation was given by the Secretary of NASCO, Peter Hutchinson, on the status of Atlantic salmon and issues facing management of the species, in addition to the views of NASCO parties on the IYS initiative. There have been dramatic declines of Atlantic salmon in recent decades and declining adult returns have remained low despite significant fisheries restrictions. Low marine survival in the first and second years at sea is thought to be constraining abundance of the species. With respect to the IYS, there was unanimous support for the initiative among NASCO parties and core partners. Instead of a focal year concentrated on research, however, NASCO parties preferred a clearly defined year focused on outreach as a “call to action” to raise awareness of the challenges and opportunities facing salmon and in support of fundraising for further research. It was stated that a focus on outreach should not take away from the need for new research or enhanced cooperation among scientists.

Potential Key Partners and Donors

Participants were divided into breakout groups to create a list of key partners and donors along with their interests related to salmon. A summary of the results can be seen in Table 3.1. A large number of donors were identified but fewer partners were discussed. With that being said, it was clear that a customized approach should be taken when approaching donors/partners and that “*any outreach should be funnelled, streamlined, and focused*” (IYS-WG 2016b p. 6).

Table 3.1. Potential partner/donor categories and examples of their interests related to salmon.

| Partner/Donor Category | Example Interests/Considerations |
|--------------------------------------|--|
| Major foundations | Differs depending on foundation, but some examples: <ul style="list-style-type: none">- Education- Community outreach- Technology |
| Government/National Science Agencies | <ul style="list-style-type: none">- Require long lead times- Land based research (provincial agencies)- Climate change |
| Private companies/industry | <ul style="list-style-type: none">- Social licence- Brand alignment with conservation issues- Getting results that provide direction |
| International science committees | <ul style="list-style-type: none">- Research |
| Universities | <ul style="list-style-type: none">- Can likely provide in-kind support- Research- Brand affiliation- Recruitment |
| Purchasers/consumers | <ul style="list-style-type: none">- Want to be better informed- Want improved understanding |
| Food distributors | <ul style="list-style-type: none">- Social licence- Public health |
| Treaty-related | <ul style="list-style-type: none">- Understanding salmon dynamics- Support for fisheries management |
| First Nations | <ul style="list-style-type: none">- Salmon as cultural foundation- Sharing knowledge |

Further Consideration of Research Themes

The IYS was originally proposed to include five research themes. With the potential expansion of the initiative into the Atlantic Ocean, as well as the broader interests of the meeting participants, it was necessary to determine whether the proposed research themes captured their interests. Participants were divided into five breakout groups under each of the research themes and asked to answer the following questions:

1. Consider the current theme and its subthemes: are there any missing subthemes?
2. Is there a different way we want to frame this research theme to better resonate with donors and partners and their interests?
3. In implementing this theme, what are the results or outcomes that will be important for decision-makers?
4. Considering the five themes identified, are we missing any themes?

Overall, there was broad support for all five research themes among workshop participants, although a few refinements were suggested. Group 1 discussed the research theme ‘Status of Salmon’ and developed a list of considerations for possible subthemes, reported to the plenary by Jim Irvine (IYS-WG 2016b p. 7):

- *scale (spatial and temporal), which ranges from taxonomic species in the North Pacific to Conservation Units; ties into the international aspect of salmon management*
- *information needed, varies depending on scale sources, could add local knowledge*
- *data quality, western science vs. aboriginal traditional and local knowledge*
- *forecasting*
- *hatchery production is an important issue, including effects on wild salmon and uses of hatcheries*

Follow-up discussions included a suggestion that the Atlas of Pacific Salmon—an exceptional communication tool originally published by the Wild Salmon Center that describes the status of salmon in watersheds around the Pacific Rim—could be updated as an outreach activity of the IYS. This suggestion was brought forward by numerous groups. To include a broader reach, it could be linked with similar activities underway in Alaska and the Atlantic region, and also include reports on new and exciting research on salmon navigation.

Under the ‘Human Dimension’ research theme, *“the original IYS proposal offered to investigate cultural, social, and economic elements that depend on sustainable salmon populations”* (IYS-WG 2016b p.7). During the plenary discussion, it was suggested that this wording needed to be changed as the term “investigate” did not adequately capture the research need required under this theme. Group 2 discussed a possible refinement of this approach with the following subthemes, presented to the plenary by Mark Saunders (IYS-WG 2016b p. 7):

- *understanding socio-economic and cultural impacts of changing salmon distribution, abundance and productivity*
- *addressing the role of salmon in food security*
- *engaging community in research and resulting societal choices and trade-offs*
- *addressing root causes of social, political, technical, and management challenges, that when solved, will greatly enhance the probability of salmon sustainability*
- *investigating long-term challenges to salmon dependent communities*
- *exploring options for maintaining access to salmon resources through changes in salmon productivity*

While discussing the Human Dimension theme, group 2 addressed the benefits of connecting people across large geographic scales, including the breadth of knowledge that can be gained from comparing management strategies across regions. There will be a common need for new fisheries management strategies across the entire range of salmon as a result of climate change. Building connections across the salmosphere will also assist in developing a relevant and focused IYS programme and potentially a “salmon nation” of people ready to protect salmon resources. Challenges affecting salmon are related to decisions that affect people’s lives and in this way, the social and economic “value” of salmon should be considered in the arguments for an IYS, as well as engaging the public in the development of the IYS research themes. A suggestion was also made for the development of a tool kit for communities dependent on salmon, in order to help them make the best possible decisions in the face of change.

Highlights from discussions within group 3 regarding the research theme ‘Salmon in a Changing Salmosphere’ were presented to the plenary by Kim Hyatt. The group did not develop any new subthemes but suggested that the effects of environmental variability and anthropogenic factors on biological traits of salmon should be considered in addition to the effects of these factors on salmon distribution and abundance. Biological traits could provide clues as to what may be driving any observed changes in salmon distribution and abundance. Other discussion points included the need for full suites of new models based on new observations, as well as the requirement for support systems for the IYS to consider data standards, data assembly, and data exchange. Issues of range expansion into the Arctic were also addressed, in addition to possible changes to Arctic charr populations, which ties into food security issues in the high Arctic. Additionally, there were some differing opinions among group members about whether the priority of the initiative should focus on open ocean research or look into cumulative outcomes across all life stage of Pacific salmon. Potential outcomes of the IYS were also discussed, including (IYS-WG 2016b p. 8):

- *improved forecasting*
- *improved planning given environmental uncertainties to improve the probabilities of success of hatcheries and/or spawning channels for example*
- *understanding of temporal and spatial risks in a changing salmosphere*
- *high social/cultural values of Atlantic salmon is something that IYS could inform by improving assessments of restoration possibilities. This might be an example of basin-specific differences in priorities*

- *different perspectives were expressed on the value of experimenting with hatchery production*

Highlights of the discussion from group 4 regarding the theme ‘Information Systems’ were presented by Nancy Davis (IYS-WG 2016b pp. 8–9):

- *A strong suggestion was NOT to develop a whole new database system but instead to integrate IYS data products with existing data systems.*
- *A working group could investigate which data systems would be the most appropriate places to house IYS data and, depending on the type of IYS data to be archived, this could be in several different existing data systems. The best practices established by these existing data systems would then become the best practices used for developing IYS data sets.*
- *The starting point would be to know stakeholders interests and then design the data to be generated, making this a customer-oriented process.*
- *Handling the data and information systems component of research generally requires more time and effort than originally estimated. Approximately 20% of the budget may be a reasonable estimate needed for this theme.*

Group 5 considered the theme ‘New Technologies’. Topics raised during the group discussion were presented by Marc Trudel (IYS-WG 2016b p. 9):

- *new developments in genomics*
- *new types of tags*
- *the value of including salmon as components of ecosystem models*
- *new models are needed that will utilize data from ocean observing systems; satellites and gliders*
- *applying new technologies in novel ways to longstanding problems in salmon research*
- *adopting techniques currently developed for brain science to questions about salmon migration*
- *stop doing activities that are not generating new information*

A Year of Outreach

The second day of the meeting began with more breakout group discussions—this time regarding a year of outreach. Prior to involvement with NASCO, outreach was not a top priority in IYS discussions. It was the strong view of NASCO, however, that IYS outreach would be an opportunity to gain awareness for issues facing salmon as well as support for salmon conservation and restoration and new research to partition mortality at sea. In light of this, each group was asked to consider the following questions:

1. What are the main objectives and outcomes needed to ensure a successful year at sea?
2. Who needs to be engaged and who engages them?

3. How do we effectively outreach to interested groups? (Considering the practicalities, what are some of the key messages? What are some of the media vehicles?)
4. What is the ideal timeframe for the outreach, and when should it begin? Why?
5. What are the main barriers that we will likely face in raising funds for the IYS? How can we adjust to overcome these barriers?

Group leaders presented the highlights of each discussion to the plenary and a number of common themes emerged (IYS-WG 2016b p. 13):

- *the idea of framing the joint future of salmon and people in light of climate change*
- *a need to articulate a realistic, yet optimistic message*
- *how to measure whether the IYS was successful*
- *nuanced communication strategies for different audiences will likely be needed.*
- *a need for a logo/theme to be attached to something concrete*
- *there was unanimity that some dedicated communications support will be required*
- *finally, IYS scope was flagged as an issue (thematic, geographic, etc.) that will require more attention from the architects of the IYS. It can be quite narrow if focused on something like high seas research, or it can be something more universal about research in the salmosphere. At present there is no convergence of views in the room on whether to adopt the broad or narrow views.*
- *IYS needs a balance of projects and activities that is international and inclusive on one end of the spectrum and programs with a more narrow focus on the other.*

Governance and Capacity to Undertake the IYS

At this point in the planning process of the IYS, the major components of the IYS had been identified, including the purpose, themes, and duration of the initiative, in addition to the need for donor and public outreach strategies, and the need for partners and their roles to be identified. What was most pressing was to determine how to best organize partners in order to finalize the IYS strategy and begin its implementation. As the IYS-WG Chairperson, Mark Saunders made a presentation on issues surrounding governance and capacity to undertake an IYS. IYS governance must “*ensure effective coordination and continuity over the IYS time frame and bring coherence to an international endeavour*” (IYS-WG 2016b p. 13). It is also necessary for “*the governance structure to define who is involved, their roles and responsibilities and what process will be used to interact, identify actions, make decisions (as necessary) and communicate effectively*”. Participants of the workshop were asked to consider:

- *the makeup of IYS Partners and their roles in IYS*
- *respecting the interests and needs of the diversity of organizations that may be involved in IYS*
- *potential differences in IYS approach and scope between oceans*
- *what level of (in)flexibility is appropriate during the research phase,*

- *deviations from themes, IYS approvals process*
- *centralized or distributed coordination*
- *ensuring that capacity and resources are available for IYS oversight and coordination*

The need for dedicated capacity to implement the IYS was reiterated throughout the meeting. Multiple suggestions were made to have an international overarching or steering committee that would include science and non-science experts. In addition, there could be regional sub-committees which would require a communication system to be able to exchange information. Suggestions were also made for working groups to be established to address different components of the IYS (e.g., outreach, research themes, and international collaboration). Moreover, it was necessary to define the scale of activities that would be appropriate at different levels. There was a specific suggestion to divide objectives into three scales: international, basin-specific, and party-specific. The need to for a programme champion was also brought forward by multiple participants—someone excited and committed to follow through the next steps of the implementation process. Overall, it was determined that a governance structure needed to be flexible and be able to address the wide range of mandates and roles of organizations that will be a part of the IYS while also providing a focused direction for the IYS approach.

The Outline Proposal for the IYS

A meeting of the IYS-WG and other invited guests (including representatives from NPAFC and NASCO) was held following the Second Scoping Meeting on March 17, 2016, in order to develop an ‘Outline Proposal for an International Year of the Salmon’ (Appendix I; IYS-WG 2016). This new proposal differed from the First Proposal that had been previously presented to NASCO by NPAFC, as its intention was to support both organizations in the implementation of the IYS initiative in the North Pacific and the North Atlantic regions, and potentially the Arctic and Baltic regions. To differentiate this proposal from the First Proposal of the IYS-SG, it will be referred to as the ‘Outline Proposal’ for the duration of Technical Report 10.

Rationale, Vision, and Aims

The Outline Proposal reiterates the overall reasoning behind the need for an IYS put forward in the First Proposal, expanding this discussion to the North Atlantic and Baltic Sea regions and the benefits that will be felt by salmon-dependent communities throughout the salmosphere as a result of the initiative. In addition to stimulating an investment in salmon research, the IYS seeks to raise awareness of what humans can do to better insure salmon and their varied habitats are conserved and restored against a backdrop of increasing environmental variability—and thus, the theme of the IYS remains ‘Salmon and People in a Changing World’. The proposed aims of the IYS put forward in the Outline Proposal included (IYS-SG 2016a pp. 1–2):

- *improve scientific understanding and public and political awareness of the factors driving salmon abundance, the environmental and anthropogenic challenges facing salmon and the measures being taken to mitigate these;*
- *generate further support for strategies to conserve, restore and rationally manage salmon;*

- *develop a legacy of collaboration among organisations and researchers across disciplines in countries throughout the salmosphere;*
- *inspire and support a new generation of researchers and managers;*
- *improve understanding and awareness of the ecological, social, cultural and economic values of salmon; and*
- *engender a call to action to support research and conservation of salmon and their supporting environment throughout the salmosphere.*

Themes

All proposed research themes of the IYS in the Outline Proposal remain unchanged from the First Proposal, except for the subtheme of the ‘Human Dimension’ research theme, which was changed from “*to investigate the cultural, social, and economic elements that depend upon sustainable salmon populations*” (IYS-SG 2015a p. 3) in the First Proposal to “*to improve the resilience of people and salmon through the collection and collaboration of salmon-dependent communities, indigenous people, youth, harvesters and resource managers across the salmosphere*” (IYS-WG 2016b p. 2) in the Outline Proposal. The Outline Proposal also proposed core outreach, engagement and education themes for the IYS, which are adaptable in scale and include “*improving public and political awareness of the status of salmon stocks and their cultural, social and economic importance and of the challenges they face from major environmental changes and a variety of anthropogenic factors*” (p. 2).

Timeframe

The IYS-WG proposes three phases to the IYS initiative: planning (2016–2017), launch (2018), and implement and report on new research (2018–2022). In comparison to the original suggestion of a two-year focal period concentrated on research, the Outline Proposal suggests a single focal year involving a significant outreach and communication initiative to raise awareness of the challenges facing salmon and gather support for the initiative. This focal year would be followed by a longer period of data collection, data analysis and publication, concluding with a *dénouement* symposium to share findings, review accomplishments, and consider whether coordination should continue at the salmosphere level. Throughout all phases, the IYS brand and organisational and communication structure will persist, but the nature and scope of activities will be at the discretion of regional/RMFO and party/jurisdiction levels. The suggested focal year of the IYS is 2018, with the possibility of postponing it to 2019 with an opening symposium in late 2018 if the timeframe is not deemed feasible.

Scope

With respect to focal species of the IYS, Atlantic salmon (*Salmo salar*) will be the focus of North Atlantic and Baltic research and outreach, while Pacific salmon, including pink salmon (*Oncorhynchus gorbuscha*), chum salmon (*O. keta*), sockeye salmon (*O. nerka*), coho salmon (*O. kisutch*), Chinook salmon (*O. tshawytscha*), cherry salmon (*O. masou*) and steelhead trout (*O. mykiss*), will be the focus of these activities in the North Pacific. As lead organizations, it will be the responsibility of NPAFC and NASCO to expand the scope to cover other species (e.g., charr and trout) or non-anadromous members of

the focal species. Involvement of the Arctic and Baltic regions in the IYS will depend on the liaison of the lead organizations with different organizations within these regions.

Governance

One of the most important outcomes of the meeting of the IYS-WG following the Second Scoping Meeting was the delineation of a possible governance structure for the IYS. There is a need for the IYS governance to be inclusive, flexible and supportive and it will depend on a range of partners to be successful. As a result of different outreach and research priorities across the salmosphere, three levels of governance were suggested for the IYS in the Outline Proposal: the salmosphere level (IYS Coordinating Committee), the regional/RFMO level (IYS Regional Steering Committees), and the party/jurisdiction specific level (Individual Parties/jurisdictions, NGOs, and core partners). It was anticipated that most of the IYS activities would occur at the regional/RFMO and party/jurisdictional levels and coordination with regards to a wide range of objectives will be required between all levels of IYS governance.

The IYS-WG envisioned the IYS Coordinating Committee to be comprised of appointed representatives from lead organizations that would work via correspondence whenever possible, perhaps meet face-to-face on an annual basis, and report back to the lead organizations on their progress. Suggestions for activities that would occur at the salmosphere level included:

- Developing an IYS brand and website;
- Developing and distributing IYS newsletters, posters, brochures, and other material concerning IYS activities at the salmosphere level;
- Defining broad outreach principles;
- Developing criteria for research and other activities seeking IYS endorsement;
- Reviewing First Proposals
- Identifying research priorities at the salmosphere level and coordination of any research programs implemented (recognizing that most research activities will occur at the regional/RFMO or party/jurisdiction level);
- Coordinating fundraising activities in support of IYS Coordinating Committee functions;
- Organizing the international IYS symposium through a dedicated Symposium Steering Committee; and
- Establishing of a hub for information sharing.

The Outline Proposal envisioned the Symposium Steering Committee as a separate entity with appointed representatives from the lead organizations that would be responsible for planning, organizing, and running the international symposium to launch the IYS. Responsibilities would include determining a date and venue, developing the programme and objectives, including inviting keynote speakers and soliciting contributed papers, establishing a web page for registrations, seeking sponsors and supporters as well as handling all other financial matters, and making arrangements for publication of the proceedings.

At the regional/RFMO level, the Outline Proposal specified that there would be Regional Steering Committees on both the Pacific and Atlantic sides, led by NPAFC and NASCO, respectively, and supported by the secretariats of each lead organization. The regional Steering Committees would provide the means for cooperation between lead organizations and core partners, coordinate activities

being undertaken at the regional level, and share information with the Coordinating Committee. Specific activities carried out at the regional/RMFO level would include

- Engaging core partners;
- Resolving species, life stages, and geographical areas to be included in the IYS in addition to the focal species already listed;
- Identifying research priorities and development of research plans;
- Establishing of a hub for compilation and sharing of information on IYS activities; and
- Coordinating fundraising activities in support of the IYS Regional Steering Committee functions.

At the party/jurisdiction specific level, which would include individual parties/jurisdictions, NGOs and core partners, activities would potentially include conducting the primary IYS functions of research and engagement, seeking and distributing funding, organizing or supporting regional symposia or workshops and other events, and engaging with First Nations.

Initial Budgetary Considerations

The Outline Proposal anticipated that the initial activities of the IYS would require a small centralized budget that would be shared by the two lead organizations (and possibly core partners and external sources). With that being said, the proposed governance structure of the IYS was designed for regional implementation that would be adaptable in the scale and nature of the activities undertaken; thus, further consideration of budgetary issues would primarily be the responsibility of the Regional Steering Committees. The Coordinating Committee, would, however, be involved in the case of activities being undertaken at the salmosphere level, and these costs would be shared equally among the lead organizations.

The Outline Proposal stated that the most immediate need was to approve funding for the initial planning stages of the IYS that would be carried out in 2016 and 2017. This was to be agreed upon in the respective annual meetings of both lead organizations in 2016. While the funding strategy could raise funds externally in addition to using Commission funds, the Outline Proposal suggested that NPAFC and NASCO make budgetary provisions for IYS brand and web development (which would require professional expertise) and towards the 2018 symposium. Additionally, DFO recognized the potential of the initiative and a Canadian Partnership Fund proposal was funded to facilitate internal coordination between NPAFC and NASCO towards planning for the IYS. Clarification on future expenditure past 2018 (e.g. the need for regional coordinators or an IYS project officer) was suggested to occur well before the 2017 annual meetings of both lead organizations.

Next steps outlined in the Outline Proposal included its consideration for endorsement by both the NPAFC and NASCO at their respective 2016 annual meetings, as well as further consideration of core partners. The need for representatives to be appointed to the IYS Coordinating Committee, the Regional Steering Committees, and the Symposium Steering Committee was also outlined by the Outline Proposal.

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Appendix F

Summary Description of the International Year of the Salmon (IYS) as proposed by the North Pacific Anadromous Fish Commission

Mark Saunders, Chairperson, NPAFC Working Group on the International Year of the Salmon

July 2015

Background

The North Pacific Anadromous Fish Commission (NPAFC) has endorsed in principle the concept of an International Year of the Salmon (IYS) initiative. At their May 2014 annual meeting the Commission formed a Study Group on International Year of the Salmon (IYS-SG) to scope the initiative. The Study Group convened a Scoping Workshop (February 17–18, 2015) in Vancouver, Canada with members of the IYS-SG and invited scientific experts from the member countries and developed a report describing the IYS in more detail with particular focus on the scientific rationale.

At the 2015 Annual Meeting the report was accepted by the Commission and a formal NPAFC Working Group established to continue the scoping and implementation of the IYS. The Working Group received Can \$50K to conduct a Second Scoping Meeting for the IYS with core partners to refine the approach. The expected outcomes are to include a more detailed scheme for the research, international governance of the IYS and a business plan. What follows is a current description of the IYS initiative.

Concept of the International Year of the Salmon

The International Year of the Salmon is an intensive burst of internationally coordinated, interdisciplinary, stimulating scientific research focused on salmon, and their relation to people. New technologies, new observations and new analytical methods, some developed exclusively during the IYS, will be focused on gaps in knowledge that prevent the clear and timely understanding of the future of salmon in a rapidly changing world.

The ability to provide timely advice to resource managers and society in general is not adequate to meet the frequency and intensity of environmental change we are experiencing. The current pace of research is too slow in the face of this change and it requires this burst of activity to develop new tools, a coordinated approach to their development and application and field observations to close information gaps.

Scope of the IYS

The “salmon” of the IYS are the anadromous members of the sub-family Salmoninae, which includes the salmon, trouts, and char, but excludes the whitefishes and graylings. Geographically the scope is the Salmosphere – Pacific, Arctic, and Atlantic Ocean. Research in the southern hemisphere as it pertains to

salmon research in the northern hemisphere will be considered. Farmed and wild salmon interactions are to be considered.

The IYS will support research under five broad scientific themes:

1. Status of Salmon: to understand the present status of salmon and their environment.
2. Salmon in a changing salmosphere²: to understand and quantify the effects of natural environmental variability and anthropogenic factors affecting salmon distribution and abundance and to make projections of their future changes.
3. New Frontiers: to develop new technologies and analytical methods to advance salmon science and to explore the uncharted regions of the salmosphere.
6. Human Dimension: to investigate the cultural, social, and economic elements that depend upon sustainable salmon populations.
7. Information Systems: to develop an integrated archive of accessible electronic data collected during the IYS and tools to support future research.

Examples of studies include:

- Winter distribution in the first and second summers in the open ocean
- Limitations of productivity in the open ocean
- Comparative studies across the salmosphere to understand what is driving variability
- Application of climate forcing models up to higher trophic levels and salmon to project changes in the ecosystem and salmon
- Application of new tagging technology to understand salmon migrations
- Application of genomic technologies to understand the factors affecting salmon
- The role of salmon in food security
- The impact of salmon distributional changes on communities and fishing sectors.

Timeline

A two-year period of fund-raising, preparation and planning (2015 and 2016) will be followed by an intensive two-year field study phase (2018 and 2019) and three subsequent years of analysis, major symposia, and publication (2020 through 2022).

Funding and Partnership

The IYS seeks to generate funding support from government, academia, business/industry and non-governmental organizations. There are potential partnerships and support from associations of harvesters, foundations with interests in fish conservation, and non-governmental organizations which need fresh ideas for their conservation activities. The North Atlantic Salmon Conservation Organization (NASCO),

2 The current and future geographic range of salmon in the Subarctic and Arctic.

an international Commission with government and extensive NGO participation from Canada, US and the European Union has committed to engaging with the NPAFC to develop its role as a partner in the IYS.

Next Steps

The NPAFC Secretariat will determine the core membership of partners in the IYS by communicating with relevant regional organizations.

The Working Group on IYS will conduct a Second Scoping Meeting for the IYS in early 2016 with core partners to refine the approach including a more detailed scheme for the research, international governance of the IYS and a business plan are the expected outcomes.

Appendix G

Briefing Note on International Year of the Salmon Initiative Second Scoping Meeting March 2016

Compiled by the IYS Working Group: Saunders, M., S. Urawa, J.K. Kim, D.H. Lee, A. Zavolokin, E. Farley, and E. Volk.

January 19, 2016

Introduction and Purpose

The North Pacific Anadromous Fish Commission (NPAFC) has endorsed in principle the concept of an International Year of the Salmon (IYS) initiative, and has provisionally identified its scope, time frame, and key salmon research themes. The Commission has tasked the IYS Working Group with further scoping the potential partners, business plan, and North Pacific science activities. One of the IYS key partners, the North Atlantic Salmon Conservation Organization (NASCO) was engaged at their annual meeting in June of 2015. NASCO signalled interest in the IYS at that time and after consultations held over the past five months with the parties, NASCO has agreed to participate in the scoping meeting in March 2016 and provided a number of positive suggested changes to the IYS.

The purpose of this note is to provide recommendations on how the IYS initiative could be organized, taking into account the views of NASCO, and set out what the objectives and approach to a March 2016 workshop to further develop the IYS initiative.

Background

The NPAFC is proposing that the IYS be an intensive (2018–2019) burst of internationally coordinated, interdisciplinary, stimulating scientific research focused on salmon, and their relation to people. The total seven year time frame would include planning in 2016, start-up in 2017, a peak of research designated as the Year of the Salmon in 2018/19 with research completed, and written up and legacy infrastructure in place by 2022. Geographically the scope under consideration is the salmosphere—Pacific, Arctic, and Atlantic Oceans. The IYS proposal would support research under five broad scientific themes: status of salmon, salmon in a changing salmosphere, new frontiers, human dimension, and information systems and envisages working with key partners to further develop the initiative.

NASCO suggested, among other points, that rather than holding the named Year of the Salmon in the year of peak research, that the IYS provide a Year of the Salmon at the beginning with a focus on public outreach and engagement to raise awareness of the challenges facing salmon and to assist in fund raising for new research. They further suggested that the nature and scope of the IYS be resolved before finalizing its core partners. The Chair of the IYS Group, Mr. Doug Mecum, NPAFC Commission representative and Secretariat staff held a conference call with the NASCO Secretary Dr. Peter Hutchinson and Mr. Dan Morris, NASCO Commissioner (head of US delegation) to discuss NASCO involvement in the Scoping Meeting. NPAFC representatives felt the approach has merit and is providing more detail here for consideration by the NPAFC Working Group.

A scoping workshop in March 2016 that potentially would invite a broad cross section of interested parties to further develop the IYS initiative is in the planning stages. The initial plan for the workshop was to prepare a more detailed scheme for research and international governance of the IYS and to develop a business plan. However, given the early thoughts on the IYS initiative noted above, the objectives and approach to the workshop are re-examined below.

Strategic Considerations

A number of strategic considerations influencing the development of a IYS strategy are described below. A few of these issues were flagged in recent discussions on the IYS proposal and others have been added to provide a fuller perspective on the pressures and opportunities that can be anticipated in moving forward with the IYS.

The IYS is an important initiative that will require diverse partners to ensure its effective implementation. A key requirement will be to explore the support for the IYS and identify those organizations and governments whose interests and capacity to participate in a multi-year endeavour will make them obvious partners. Along these lines, careful attention will need to be paid to those groups, who may have an interest in salmon but are unable to commit to a long term process.

Matching IYS outcomes to the interests of potential partners and donors will be key. In Canada, as an example, the new federal government has emphasized the importance of climate change in its direction and policies. Shaping the IYS research in a manner that supports this direction will be helpful when pursuing the support of the federal government. Partners and other participants in the IYS can be expected to have similar views on the need for matching the IYS themes and outputs to their various interests and those of potential donors.

Although public interest in salmon appears wide spread, knowledge of the issues facing salmon, at best, is uneven. Strong arguments have been made that efforts to sensitize and further inform the public on the challenges facing salmon can be highly beneficial in gaining support for the IYS initiative. Efforts in this area will be varied and likely will need to be customized to the requirements of the IYS partners.

With the above in mind, ensuring that the IYS is seen as relevant to others particularly outside of the science community is another requirement. Careful attention will need to be paid to its research themes and how these connect with others such as local groups and communities who may play an instrumental role in bringing support to the IYS.

Managing the IYS will require dedicated effort over several years. This raises the question on the adequacy of the capacity of the organizations leading its implementation and the level of coordination to support the international scope of the initiative. Attention to organizational governance and resources will need to be respectively defined and secured.

Given complexity of the initiative and the need for the identification of funding sources to complete a business plan, the current timeline proposed is likely overly optimistic. An International Year of the Salmon identified at the beginning of the initiative with outreach and a call-to-action to engage potential funders may be more realistic in terms of timing and likelihood of success.

Proposed Phased Approach

The above considerations reinforce the perspective that a progressive and phased approach to the IYS initiative is warranted as noted in the provisional NPAFC proposal. The initial focus would entail developing the IYS strategy to address the key strategic considerations noted above, identifying its core partners, seeking their views and support, and outlining and adopting an effective public engagement and donor approach. This would provide a solid foundation for the subsequent official launch of the IYS and its research and field component which would be concluded by reporting out on its outcomes and outlining the benefits and legacy of the IYS.

To this end, three phases are identified (the elements are arranged in another form in attachment 1):

- **Phase 1:** The preparation phase (2016 and 2017) would focus on the setting the stage for IYS and would comprise developing and confirming a comprehensive IYS strategy (scope, themes, funding requirements, governance arrangements) that is supported by its key partners. This phase would include developing and implementing a public outreach and engagement approach and would include preparing and executing a funding strategy with the aim to produce a business plan in 2017 describing how IYS will unfold, what its key actions will be, who will participate and with what budget.
- **Phase 2:** The implementation phase (2018, 2019, 2020) would envisage launching the IYS with announcements and a major international symposium in 2018 in which the key partners and interests would gather to consider challenges and research opportunities and potentially declare agreement on adopting a coordinated international arrangement that would share information and results. This phase will be centred on the research portion of the IYS and call for projects would be expected to be announced in 2018 with the decisions on projects announced in time for the projects to be underway and completed in 2019 and 2020.
- **Phase 3:** The reporting phase (2021, 2022) would outline the progress and legacy of the initiative. Through announcements, publications, a further major international symposium, bringing partners and interests together; the results, highlights, and ongoing benefits of the initiative would be outlined.

These changes mainly address the business and outreach strategy and do not change the fundamental concept of the IYS and are within the Terms of Reference for the Working Group and the Commission's instructions related to the March 2016 scoping meeting.

March 2016 Scoping Workshop

In terms of the March 2016 workshop, given the strategic considerations and the phased approach noted above for the IYS, the broad aim of this workshop should be on reviewing, refining, and building support for the IYS implementation strategy. The workshop should be a more formative process than originally intended, and involve participants who would be key in delivering on an international initiative. This suggests that a more focussed group of core partners able to "brainstorm" ideas and potential refinements to the IYS would be appropriate.

More specifically, attention on the development of the IYS implementation strategy should include seeking views on its themes, phases and timelines; further identifying partners and considering how other interested organizations and groups may be effectively engaged; and outlining possible governance

arrangements and capacity requirements. Actions from this workshop could lead to establishing processes and working committees for follow-up:

- (1) developing a public engagement and outreach approach;
- (2) identifying and securing organization capacity and support;
- (3) developing a funding strategy; and
- (4) developing and agreeing to a business plan.

A DRAFT detailed annotated agenda is attached. It is not for circulation to participants. It has been designed to meet the objectives above. Note that the meeting will be two full days with all participants and the third day will be a meeting of the IYS Working Group with our NASCO colleagues.

An updated list of participants is below in attachment 3. We are focussed on getting key partners to the table as well as representative experts from research themes.

Direction Sought and Next Steps

- Please provide comments on the overall approach, agenda, and list of participants by the close of business by Tuesday January 26.
- Comments will be addressed and letters of invitation to participants will go out by January 29.
- The IYS Working Group Chair, Doug Mecum, Peter Hutchinson (NASCO Secretary), Dan Morris (US NASCO Head of Delegation), Secretariat staff, and contracted facilitators Paul Sprout and Andrew Stegemann will continue to work through details of agenda development and engaging participants. The IYS Working Group Chair will update the IYS Working Group weekly and seek input on any decisions as required.
- The IYS Working Group chair has been working with Ed Farley, Jim Irvine, and Marc Trudel to begin scoping research in the North Pacific that could be considered as part of IYS. Notes will be circulated shortly and input sought from the Working Group.
- Over the next month the Working Group will be asked to develop further ideas regarding the research themes: status of salmon and salmon in the salmosphere.

Appendix H

Report of the International Year of the Salmon 2016 Scoping Workshop

International Year of the Salmon Working Group

April 2016, *originally presented as NPAFC Doc. 1658*

Keywords: Vancouver, future, research, planning, proposal

Abstract

Following an international scoping workshop in 2015, an International Year of the Salmon (IYS) proposal was developed by the NPAFC IYS Study Group (IYS-SG), endorsed by its Committee on Scientific Research and Statistics (CSRS) and approved by the NPAFC Commission as an intensive burst of internationally coordinated, interdisciplinary, scientific research and outreach focused on salmon and their relation to people. New technologies, observations, analytical methods and analyses will address knowledge gaps that prevent a clear understanding of the future of salmon in a rapidly changing world. The IYS proposal anticipated a broadly inclusive research programme of 7 years duration, beginning in 2017 with two years (2018/19) for a period of peak research and outreach activity. The IYS-SG proposal anticipated interest and participation in the concept from beyond the Pacific Ocean so a Second Scoping Meeting was organized in 2016 by the International Year of the Salmon Working Group (IYS-WG). It was asked to explore greater participation by potential partners and funders and to revise the IYS strategy accordingly.

The Second Scoping Meeting was organized and convened in Vancouver, Canada on March 15 and 16, 2016. Total attendance by members of the IYS-WG-WG and invitees was 51. The workshop featured a limited number of introductory presentations followed by extensive plenary and breakout group discussions. The substantive results of the workshop described in this report underscored the support for the IYS, particularly its broad direction, milestones and research themes. Much of the discussion centred on the scope of the IYS and how its approach could be made more relevant to partners and potential donors, what components; such as communication and public outreach strategies were necessary and what governance structure best accommodated the diverse organizations who may be part of the initiative. The results were used by the IYS-WG to develop an implementation strategy and the outcome and decisions are described in a separate report.

Background

In 2012, a proposal was made to NPAFC by Canada to establish a major research initiative based on the idea of an International Year of the Salmon (Beamish 2012). Discussions ensued within the NPAFC leading to the creation of the International Year of the Salmon Study Group (IYS-SG) in 2013. The Study Group organized a scoping workshop on February 17–18, 2015 in Vancouver, Canada to develop the research themes for the IYS (IYS-SG 2015a). An IYS-SG meeting followed immediately after the workshop where the IYS-SG developed a compelling argument for the IYS. It was supported by a number of recommendations that were later endorsed by the CSRS (IYS-SG 2015b) and presented to the Commission at its Annual Meeting in Kobe, Japan, in May 2015.

The IYS proposal was well received by the Commission. It noted that external funding would be needed and that the IYS must be fiscally prudent. Concern was expressed by the Commission that given the ambitious schedule, it may not be possible to redirect current research on such short notice. The Commission identified a need to further refine the research activities that will be undertaken. In response, CSRS formed a working group (IYS-WG) to clarify the potential core IYS partners, to develop an agenda for a Second Scoping Meeting and to report back to the Commission at its Annual Meeting in 2016.

This document is the report of the 2016 IYS Scoping Workshop. IYS-WG members are Mark Saunders (Chairperson), Shunpei Sato, Shigehiko Urawa, Ju Kyoung Kim, Do Hyun Lee, Igor Melnikov, Ed Farley, and Eric Volk. In addition to the Study Group members, others contributed to the drafting of this report including: Skip McKinnell (rapporteur), Paul Sprout (facilitator), and Nancy Davis and Vladimir Radchenko (NPAFC Secretariat).

Welcome & Introductions

IYS-WG Chairperson Mark Saunders (Canada) called the Scoping Workshop to order at 9 am on March 15, 2016, at the Metropolitan Hotel in Vancouver, BC, Canada. Welcome addresses were made by Debora Sparrow (Musqueam First Nation), Carmel Lowe (Regional Director of Science, DFO Pacific Region), and Vladimir Radchenko (Executive Director, NPAFC). The meeting was attended by a total of 51 people including the IYS-WG and invitees (Table H.1). Mark Saunders described the objectives of the workshop (Table H.2), followed by self-introductions of the participants.

Facilitators

The meeting was professionally facilitated by Paul Sprout (former NPAFC representative and former Regional Director-General, DFO Pacific Region) and Andrew Stegemann who began the workshop by reviewing its objectives, the principles for discussion, their roles in the process, and the meeting logistics.

Objectives

The purpose of the 2016 IYS scoping meeting (hereafter, the workshop) was to bring potential partners together who could provide advice to refine the IYS scope, to develop the IYS strategy, and the IYS business model. Results of the workshop assisted the IYS-WG in its creation of a comprehensive strategy for the IYS, including next steps. The specific goals of the workshop were to:

- develop a common understanding of the IYS initiative, scope, and purpose
- elaborate on, and further develop, the major components of the IYS strategy
- identify actions needed and next steps to create a comprehensive IYS strategy

Determining Timeframe and Milestones

After the introductory remarks, workshop participants were asked to provide feedback and comments on the concept, timeframe, and milestones presented. There was overall agreement with the phases as they were proposed with some specific comments from participants, which included:

- whether a two-year period of intensive research activity was sufficient to achieve the goals of the program

- the need for simple, public based communications/outreach to begin sooner than 2018
- how to maintain flexibility as funding opportunities and schedules will differ among nations
- a need to include climate change explicitly and to consider our need to respond nimbly in the future

NASCO and NPAFC Perspectives

Peter Hutchinson (Secretary, North Atlantic Salmon Conservation Organization, NASCO) started the workshop with a presentation on the status Atlantic salmon and the issues facing management of this species. He noted that the decline in abundance in recent decades was striking for multi-sea-winter stocks, particularly those in southern parts of the species range and that some stocks are critically endangered. On the other hand, there have been some notable success stories where habitat has been improved, e.g. by liming acidified rivers in Norway, and in England and Wales where there are more rivers with salmon spawning than there have been for over 100 years, primarily due to water quality improvements following the decline of heavy industry. Nevertheless, in its advice to NASCO, the International Council for the Exploration of the Sea (ICES) has advised that marine survival indices, although variable, remain low and a declining trend in adult returns has persisted despite significant fishery reductions (Figure 1). Low marine survival in the first and second years at sea are constraining the abundance of Atlantic salmon.

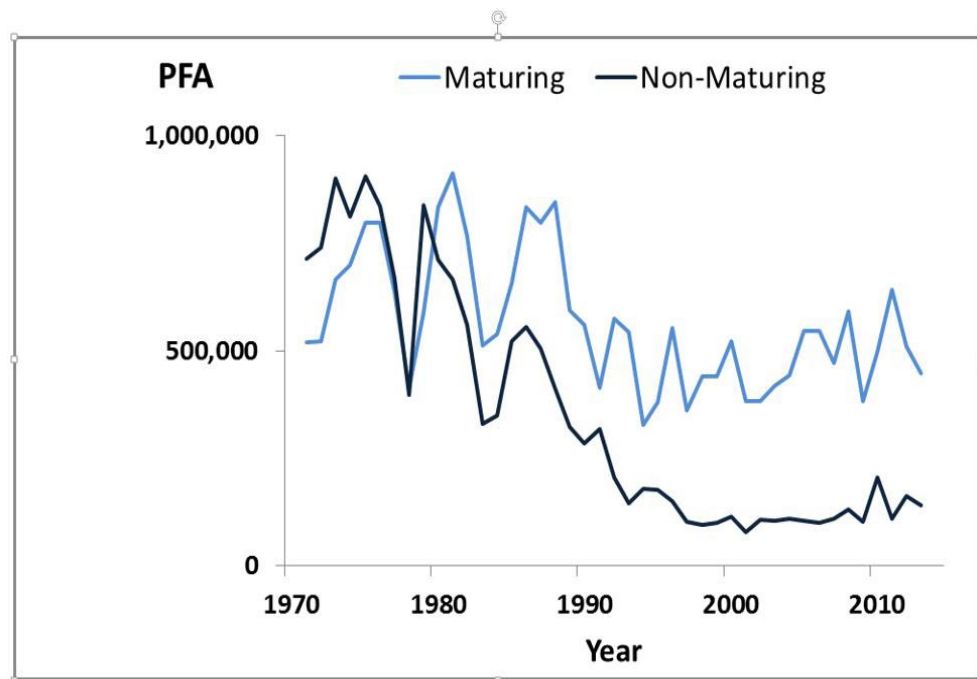


Figure H.1. Pre-fishery abundance (numbers) of immature and maturing Atlantic salmon in the North Atlantic from 1960 to 2014. Figure provided by the NASCO Secretariat.

There was unanimous support for an IYS among NASCO Parties and its accredited NGOs. NASCO Parties favour a clearly defined, one year initiative focused on outreach to raise awareness of the challenges and opportunities facing salmon, to support fund-raising for important new research, and to include a major international symposium. The theme proposed by IYS-SG of *Salmon and People in a Changing World* captures the need for a major outreach programme and further research.

Outreach initiatives that may be possible during the IYS are:

- creating exhibits e.g., at natural history museums, aquaria etc.
- liaising with international fisheries organizations to include themes and sessions relating to salmon in their annual conferences during the IYS
- developing curriculum packs for schools
- developing an IYS website or web pages
- eliciting declarations relating to commitments to salmon conservation and research by legislative bodies of Parties/jurisdictions
- producing information packs or templates to be adapted by Parties/jurisdictions on specific issues

The list is not exhaustive and would be tailored to the situation in individual Parties/jurisdictions.

The research arm of NASCO is the International Atlantic Salmon Research Board. The Board's current research priorities are to undertake studies to determine where mortality of Atlantic salmon occurs along their migration routes by conducting local collaborative telemetry projects and international telemetry projects.

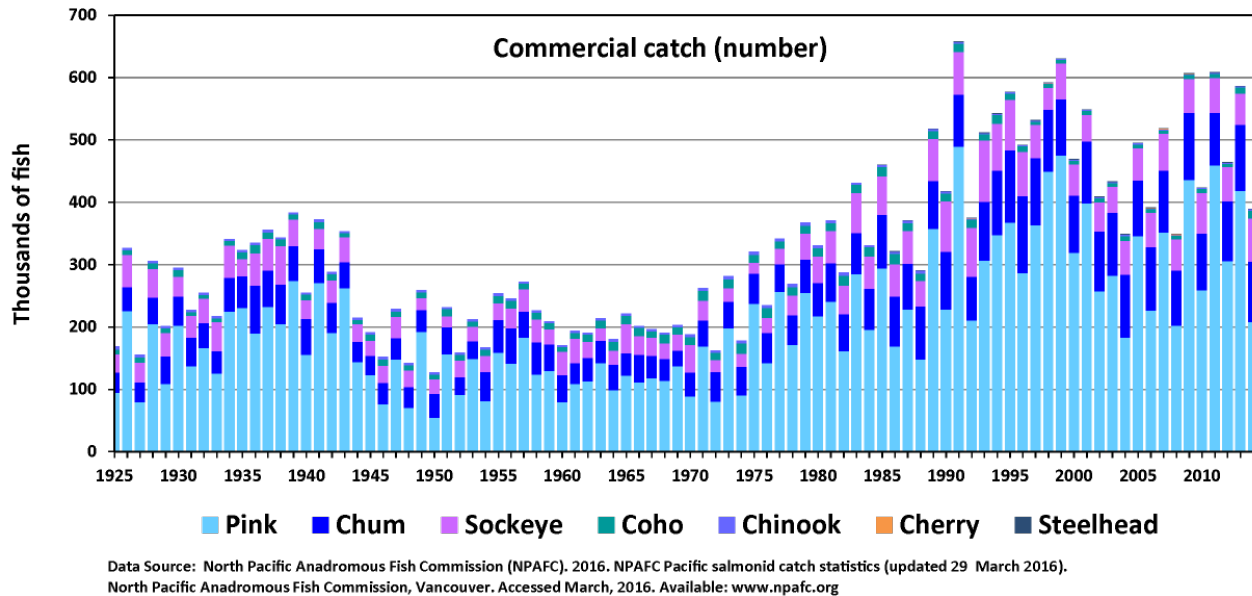


Figure H.2. History of total commercial catch (number) in the North Pacific by species.

In the North Pacific, the total abundance of salmon has been higher than the long-term average in recent decades, largely because of greater abundances of pink and chum salmon in the western North Pacific (Figure 2). The total, however, does not reflect the trends in all regions. In British Columbia, Washington, Oregon, and California, for example, average abundances of coho salmon and Chinook salmon have been lower than the long-term average for several decades and many populations in the region have been designated as threatened or endangered. As the causes are poorly understood, concerns for the future of salmon populations have increased.

The IYS-WG Chairperson reviewed the IYS initiative and its history for the participants before describing the work required during the next few months and the role of the workshop in this process. The primary need is to prepare reports and recommendations for the annual meetings of NPAFC (May) and NASCO (June). Those reports must:

- outline the nature, scope, and timing of the proposed IYS initiative,
- describe the IYS Implementation Strategy including a business model,
- include recommendations on governance, funding, and capacity requirements for the planning phase.

Key Partners and Donors

Discussion leaders were identified for each breakout group (named below in parentheses). They reported to the plenary session on the results of their groups' deliberations. Without repeating points raised by previous groups, the unique responses of each group, in order of presentation at the plenary, are summarized in point form. After each presentation, any follow-up discussion points raised in plenary are noted.

Group 5 (Jim Irvine)

- two potential kinds of funding seem possible: impulse donors versus sustainable donors
- impulse funding was defined as a large sum donated once
- a Moore Foundation representative was part of the group and suggested there may be some legacy funds to support IYS
- communications industry
- fishing industry could contribute both boats and time
- donors suggested by the group included Oregon Stream, Applied Technology, Kramer Fish Sciences, Stream of Dreams, Mural Society, and BC Hydro

Group 4 (Kim Hyatt) – Major categories of donors were discussed:

- national science agencies subscribing to IYS
- obtaining funding for international collaboration on common problems is a more difficult challenge
- industry partners might include:
 - wild capture fishing industries
 - energy producers and petroleum product transportation industries; because of their extensive use of salmon and fish habitat, they will be part of the problem unless they become part of the solution

- wild/farmed salmon producers (corporate donors and partners can also make in-kind contributions); with access to farm production data and life-history data
- International Arctic Science Council (IASC) as a partner to include Arctic salmonid ecosystems
- provincial/state agencies; their interests are served if land/freshwater habitats are included in IYS
- major foundations (Moore is moving away from wild salmon research but it has made substantial investments in wild salmon that they are unlikely to walk away from)
- outreach activities should be in parallel with science programme development
- universities would likely be in-kind contributors (using NSERC or NSF, for example)
- a brief discussion of priorities concluded that different donors may be interested in different phases of the IYS

Group 3 (Marc Trudel)

Many topics raised by Group 4 were also discussed in this group. The novel contributions of this group are:

- to develop strategies to attract funding (e.g. a high profile patron might be desirable)
- the need to identify 4 or 5 key funders to provide seed funding (sponsors might place their logos on IYS programme materials)
- Schmidt Foundation (has both funding and a vessel)
- in-kind contributions may be possible (e.g. ships of opportunity – shipping companies)

Group 2 (Nancy Davis)

- foundations to approach include Moore, Meyer, Tides Canada, Tides US, Tula, Crabtree, PSF
- corporate sponsors could include: oil, energy, forestry, utilities: Irving, BC Hydro
- salmon buyers/consumers (Costco, Walmart)
- governmental funding (Genomics agencies in Canada, DFO, NOAA)
- treaty (Pacific Salmon Commission endowment funds, Atlantic Salmon Conservation Fund)

Follow-up: Government science funding agencies should be the highest priority. Foundations act as individuals and what may suit one might not suit another. Each donor/partner should have an approach tailored to their perceived needs. Donors that are currently known are probably already overcommitted.

Group 1 (Mark Saunders)

- US Tribes, Alaska aquaculture associations, BC freshwater fisheries, U.S. Forests, Suzuki Foundation, (data partnerships)
- be sensitive to competition among donors so the approach needs to be coordinated
- there was a desire to stay in the northern hemisphere
- recognition that there are European analogues to the North American agencies that are being identified
- salmon fatigue needs to be recognized
- Whole Foods, Packard, MBARI (Monterey Bay Aquarium Research Institute)

Follow-up: Seeking additional millions for salmon from legislators requires a sensitive approach that recognizes existing investments.

Facilitator Synthesis

While the groups identified a number of donors, usually in categories, few partners were noted. Notwithstanding this, it was clear that when approaching donors/partners, that a customized approach was needed and that any outreach should be funnelled, streamlined, and focused. In considering the partners and donors, it was also useful to consider their interests, which are outlined broadly as follows:

| Partner/Donor | Example Interests/Considerations |
|--|--|
| Major donors (e.g. Moore's legacy fund, Schmitt Foundation, Tula, Meyer, Tides Canada, etc) | Differs depending on foundation, but some examples: <ul style="list-style-type: none">- Education- Community outreach- Technology |
| Government/ National Science Agencies (e.g. NSERC, provincial agencies, DFO, NOAA, etc) | <ul style="list-style-type: none">- Require long lead times- Land based research (provincial agencies)- Climate change |
| Private companies/industry | <ul style="list-style-type: none">- Social licence- Brand alignment with conservation issues- Getting results that provide direction |
| International Arctic Science Committee | <ul style="list-style-type: none">- Research |
| Universities | <ul style="list-style-type: none">- Can likely provide in-kind support- Research- Brand affiliation- Recruitment |
| Purchasers/ consumers | <ul style="list-style-type: none">- Want to be better informed- Want improved understanding |
| Food Distribution (e.g. Costco, Whole Foods, etc) | <ul style="list-style-type: none">- Social licence- Public health |
| Treaty related (e.g. Pacific Salmon Treaty) | <ul style="list-style-type: none">- Understanding salmon dynamics- Support for fisheries management |
| First Nations (e.g. US Tribes, Canadian First Nations) | <ul style="list-style-type: none">- Salmon as cultural foundation- Sharing knowledge- Long-term sustainability |

Research Themes

The IYS was proposed originally to include five overarching research themes. Meeting participants were split into five groups, based primarily on personal interest, and each group reviewed and discussed one theme. Considering the potential expansion of IYS to the Atlantic Ocean, and the broader interests of the participants at the workshop, there was a need to determine whether the themes were adequate to capture their interests. The discussion leaders of each group reported back to the plenary and the highlights are reported here.

Group 1 - Status of Salmon (Jim Irvine)

The group identified topics that could be appropriate as sub-themes. They included:

- scale (spatial and temporal), which ranges from taxonomic species in the North Pacific to Conservation Units; ties into the international aspect of salmon management
- information needed, varies depending on scale sources, could add local knowledge
- data quality, western science vs. aboriginal traditional and local knowledge
- forecasting
- hatchery production is an important issue, including effects on wild salmon and uses of hatcheries

Follow-up: The outreach activities could include an update of the Atlas of Pacific Salmon that was published by the Wild Salmon Center. It is an excellent communication tool that describes the status of salmon in various watersheds around the Pacific Rim. It could be linked with similar activities that are currently underway in the Atlantic and in Alaska. It might also include reports on new, exciting research on where salmon go and how they navigate. The atlas could be an early IYS product that would feed into future work and be a legacy activity for IYS. A comprehensive data and information system could provide the basic information for the atlas. NASCO has established a web-based database of salmon rivers (approximately 2,500 rivers) with an indication of stock status, main impact factors and river characteristics and the information can be displayed on interactive maps. The intention is to develop a 'State of the Salmon' report once revised stock classification categories are agreed. This report could be a very important contribution to the IYS.

Group 2 – Human Dimension (Mark Saunders)

Salmon connect ecosystems, economies, cultures, and traditions throughout the salmosphere. The original IYS proposal offered to investigate cultural, social, and economic elements that depend on sustainable salmon populations. This might be refined to the following research sub-themes:

13. understanding socio-economic and cultural impacts of changing salmon distribution, abundance and productivity
14. addressing the role of salmon in food security
15. engaging community in research and resulting societal choices and trade-offs
16. addressing root causes of social, political, technical, and management challenges, that when solved, will greatly enhance the probability of salmon sustainability
17. investigating long-term challenges to salmon dependent communities
18. exploring options for maintaining access to salmon resources through changes in salmon productivity

The value of considering a large geographic scale is its ability to connect people (people, educators, indigenous peoples, managers).

- there will be a need for new strategies for fisheries management, within the context of climate change
- How do management strategies vary among countries? Perhaps by sharing experiences through existing NASCO and NPAFC organizations, we can we learn. Can we learn by comparing systems from different regions?
- challenges in maintaining salmon are generally related to decisions that affect peoples' lives
- can we develop a tool kit for communities to make the best possible decisions in the face of change?
- how can the public be engaged in the development of the research agendas? Address the causes of declining abundance in the salmosphere

- the IYS programme needs to be relevant and focused throughout the salmosphere
- the value (social and economic) of the fishery should be considered in arguments about the need for an IYS. There may be a need to update the importance of fisheries to society.
- notion of a “salmon nation” at the ready to protect the resource

Follow-up: This theme/goal needs to be reframed in terms of connectivity objectives because, for example, the word “investigate” in the IYS proposal did not capture the research need. A question was raised about how children would be engaged in the IYS.

Group 3 – Salmon in a changing salmosphere (Kim Hyatt)

- no new themes were raised by the group but there was a suggestion that biological traits be included in addition to distribution and abundance. Biological traits can provide clues to drivers that might explain the distribution and abundance.
- most bottom-up models of ecosystem function do not get to fish, whereas top-down models do not capture ecosystem variability. Entire suites of new models should be an important part of an IYS. New observations will be required to ground truth the new models. High precision data would be represented by only a small percentage of the tens of thousands of salmon populations that exist and that will not change.
- comparative studies generally lead to new insights
- support systems for an IYS need to consider data assembly, data standards, data exchange
- scaling up of regional models and downscaling of large-scale models will be required
- there were different views in the group about whether the open ocean should be the priority or whether the mission should be looking at cumulative outcomes across all stages of a salmon life history. There are varying degrees of difficulty depending on whether the scale is large or more focused.
- range expansions into the Arctic will be an issue
- Arctic charr populations may change substantially as a consequence of climate change. How can that change be accommodated? This ties into food security issues in the high Arctic.

Outcomes of IYS might include:

- improved forecasting
- improved planning given environmental uncertainties to improve the probabilities of success of hatcheries and/or spawning channels for example
- understanding of temporal and spatial risks in a changing salmosphere
- high social/cultural values of Atlantic salmon is something that IYS could inform by improving assessments of restoration possibilities. This might be an example of basin-specific differences in priorities.
- different perspectives were expressed on the value of experimenting with hatchery production

Follow-up: There was a suggestion made to frame the IYS objectives within a broader ecosystem concept with the idea that there would be benefits from studying salmon and their entire ecosystems. This was countered by concern that a broad ecosystem perspective could dilute the focus of the IYS and limit fundraising opportunities by having objectives that are too diffuse.

Group 4 – Information Systems (Nancy Davis)

- A strong suggestion was NOT to develop a whole new database system but instead to integrate

IYS data products with existing data systems

- A working group could investigate which data systems would be the most appropriate places to house IYS data and, depending on the type of IYS data to be archived, this could be in several different existing data systems. The best practices established by these existing data systems would then become the best practices used for developing IYS data sets.
- The starting point would be to know stakeholders interests and then design the data to be generated, making this a customer-oriented process
- Handling the data and information systems component of research generally requires more time and effort than originally estimated. Approximately 20% of the budget may be a reasonable estimate needed for this theme.

Follow-up: There may be a need to concentrate data efforts on high-value high-reward products such as the atlas.

Group 5 – New Technologies (Marc Trudel)

No new themes for the IYS were proposed but topics that were raised in the group included:

- new developments in genomics
- new types of tags
- the value of including salmon as components of ecosystem models
- new models are needed that will utilize data from ocean observing systems; satellites and gliders
- applying new technologies in novel ways to longstanding problems in salmon research
- adopting techniques currently developed for brain science to questions about salmon migration
- stop doing activities that are not generating new information

Discussion: The group felt that a targeted approach to donors/partners will be required to link their interests with the IYS. Some feasibility studies could be implemented immediately to show that the work can be done. Options included one cruise in one ocean to three cruises in three oceans with communicators on board.

Day 1 – Facilitator's Review

Paul Sprout began the second day summarizing Day 1. He reflected first on the welcome by Debora Sparrow who emphasized the importance of salmon to the Musqueam people and to others in the region. Ms. Sparrow advised that solutions to the challenges facing salmon should engage people in their local communities and be seen as meaningful to them. Mr. Sprout suggested that this perspective provided important guidance to the IYS, and resonated with its proposed research themes.

Mr. Sprout referred briefly to the presentations on setting the stage for further developing the IYS which included presentations by Peter Hutchinson on NASCO, a potential Atlantic partner in the IYS, and Mark Saunders' remarks on behalf of NPAFC on the broad IYS components, milestones and timelines. The NASCO presentation, which outlined the role and mandate of the Atlantic organization, also highlighted the challenges affecting Atlantic salmon conservation. The facilitator observed that the presentation underscored the requirement for a IYS approach to be flexible and able to accommodate the diverse organizational mandates, various regional contexts and different salmon issues and needs that may comprise the IYS. The NPAFC presentation, and the subsequent plenary discussion, confirmed that there was broad interest in the IYS and support for its structure but more discussion was required on its specific

elements. Several participants, when discussing the role of salmon in the environment, expressed the view that salmon were integrators of freshwater and marine ecosystems but also integrated people and nature.

On the topic of donors and partners, Mr. Sprout noted the suggestion from several of the groups to better understand the interests of potential donors and ensure that IYS was seen as relevant and connected with the goals of these organizations. Given the concerns with donor fatigue (e.g., large number of funding proposals and little resources or capacity for donors to take on new funding requests) flagged in the discussions, the facilitator referred to the advice from several participants that the IYS donor approach needed to be carefully considered and mindful of the capacity and time required to effectively engage donors. Mr. Sprout observed that discussion on donors did not lead to specific recommendations on potential donors but tended to describe classes of donors. He noted, as well, that there was little advice on potential partners.

Regarding the five research themes reviewed in Day 1, Mr. Sprout observed that there was broad support for the themes, although refinements were suggested. He noted the advice by some that a comprehensive data policy and communications strategy should precede the IYS and should follow through the more intensive research phases. Mr. Sprout commented that demonstration projects had been proposed as a way to promote IYS and begin IYS implementation efforts early and that the results from these projects should be used to assist in encouraging broader involvement and support for IYS. Along these lines, the idea of committing to prepare a revised Salmon Atlas, advanced by several of the groups, was seen as a tangible and important product that would bring additional credibility and support for the IYS. Lastly, Mr. Sprout noted the views of several participants who encouraged IYS to be nimble and able to respond or adjust to new funding opportunities that may arise quickly.

Finally, Mr. Sprout referred to the visit by participants to the Vancouver Aquarium at the end of Day 1 and the interest of the Aquarium in supporting the IYS. He observed the importance of raising public awareness on IYS, and its connection to salmon, that had been flagged by participants and how this may be greatly aided by working with organizations, such as Aquariums and others. The facilitator noted that the Aquarium visit was a good introduction to tackling a key component of the IYS and that was to develop a public outreach and engagement strategy.

Year of Outreach

NASCO views the IYS outreach as an opportunity to raise awareness and understanding of the issues facing salmon in support of salmon conservation and restoration and of new research to partition mortality at sea. In that light, workshop participants were divided into breakout groups to discuss the following topics related to outreach:

- the main objectives and outcomes needed to ensure a successful year of outreach
- who needs to be engaged, who engages them and how
- how to effectively outreach to interested groups
- timeframe for outreach
- barriers to fundraising and how to overcome them

Group 1 (Jim Irvine)

Objectives and outcomes

- the group identified different target audiences and approaches: public, scientific community, donors and partners, First Nations
- all need to be involved in articulating the objectives and it should occur early in the process
- donors need to be sold on the opportunities provided by an IYS
- ways of branding the initiative will be important, established early and continued through the IYS program
- convince the public that climate change is upon us with implications for salmon populations
- Terry Fox initiative is a good example of fundraising in research; examining this approach might provide some valuable lessons
- involve professional groups with expertise

Engagement

- the Pacific salmon atlas update was held up as a good example of a product that could engage the public
- a workshop or symposium is needed for scientists to articulate the scientific objectives, and ensure young scientists are involved
- some donors may want only a loose association with IYS while others may want a more hands-on approach and wish to be actively involved in some aspect of IYS

Timeframe

- IYS has already begun. Begin with outreach aimed at donors/partners. Divide IYS into stages (e.g., planning, coordinated field programs, post-field programs, outreach, and a legacy of IYS)
- A linear timeline may not be the right model because of potential loops and feedbacks

Barriers

- donor's salmon fatigue and funding shortages are hurdles
- Public is much more focused on climate change, ecosystem changes, and their potential effects on salmon. Incorporate these concepts in IYS communication materials.

Group 2 (Kim Hyatt)

Objectives and outcomes

- generate broad support for IYS
- inform the audience about the history of what was, what is now, and what their future will be. There is a great deal of interest in what science can say about a future that will be different from today.

Engagement

- engage the next generation of scientists in climate change and ecosystem impacts research
- solicit dollars and build a business plan to achieve the objectives
- donors may wish to shape the nature of the IYS program

- crowdsourcing is a novel approach
- government agencies need to push forward on an outreach agenda
- an alternative is NGOs which more often than not, have a wealth of experience. NASCO, for example, has a network of 35 accredited NGOs that make a valuable contribution to all aspects of its work and that could be key partners in outreach activities around the North Atlantic.
- there is a need to decide what message is going out; it will be important to get something that will grab attention

Outreach

- international, national, and regional outreach (i.e. not local) is the appropriate scale for outreach initiatives
- essential that someone is responsible for outreach (organizations or individuals) but funding is needed
- Census of Marine Life was a successful example of a focused research programme of limited duration
- tailoring the outreach activities will be needed; for example, the significance of whether salmon are produced in hatcheries or wild will differ among regions
- credibly forecasting the fate of salmon could augment a salmon atlas if it lays out likely futures in addition to the present status. The linkages between salmon and people are likely to change with new populations appearing and marginal ones disappearing.

Timeframe

- this is a perpetual process needing a multiyear strategy
- efforts to have a focused single year of outreach are consistent with an ongoing need for promotion.

Barriers

- donor fatigue and competition for a limited pool of funds
- not knowing the committed individuals and organizations
- achieving proper message clarity and focus

Follow-up: The atlas was seen as a great idea. IYS should have a programme that aligns with the positive things that smaller initiatives are doing and have done. Therefore, some sensitivity to existing research initiatives is required.

Group 3 (Marc Trudel)

Objectives and outcomes

- the group discussion began with calls for a focused programme and the highest likelihood of success and international cooperation and collaboration is probably on the high seas. There are many initiatives in coastal waters but not so much on the high seas. Salmon as ocean integrators was seen as an attractive hook.

Engagement

- engage politicians in the cause of high seas research was seen as a desirable approach to securing funding under IYS
- convey the impacts of climate change on salmon populations
- need for new management strategies in the face of changing climate
- celebrating the innate value of salmon in the IYS by creating memorable experiences
- IYS as a call for action
- need broad base support

Outreach

- use conduits or intermediaries (journalists) to reach the public
- use social media

Timeframe

- as soon as possible!

Follow-up: There is a need for positive stories about salmon to be part of the communication strategy. Should the IYS ignore freshwater habitat? Some species will be excluded by the choice of high seas as the focus.

Group 4 (Nancy Davis)

Engagement

- buy-in by science leaders – get a clear IYS message to them (Royal societies, professional organizations). This might be done by a call for pre-proposals
- government – a working group is needed that would have a portfolio to approach organizations
- public – needs a clear message that continues throughout the IYS, with a fully developed story, by social and traditional media. Should be flexible because of variable timelines of projects. Salmon have an ecological role as an integrator (freshwater and marine); tracking can be visually displayed and easily understood.

Barriers

- need a catch phrase that inspires action (e.g. the poles are melting)

Group 5 (Mark Saunders)

Engagement

- NGOs, etc. can amplify the IYS message.
- academics – perhaps an annual science forum
- engagement of youth
- Stream of Dreams as a small example

- celebrate the successes
- community science participation

Outreach

- need a good communications strategy that is targeted to achieve success in IYS, rather than general topics about salmon. Sell the IYS, not the animals.
- difficult to discuss outreach when the scope of IYS has not been finalized.
- not enough detail to sell the program.
- how does understanding salmon improve lives?
- Clearly spell out how IYS will make things different in 5 years for people, industries, First Nation etc.
- use a “Day in the Life” model to tell stories about salmon
- the written word is becoming less important

Timeframe

- need people paid who can move the programme forward

Follow-up: The broad scope of an IYS can be overwhelming. Perhaps some demonstration projects could be used to demonstrate an integrated view to the world.

Facilitators Review

Common themes emerged among the groups including:

- the idea of framing the joint future of salmon and people in light of climate change
- a need to articulate a realistic, yet optimistic message
- how to measure whether the IYS was successful
- nuanced communication strategies for different audiences will likely be needed.
- a need for a logo/theme to be attached to something concrete
- there was unanimity that some dedicated communications support will be required
- finally, IYS scope was flagged as an issue (thematic, geographic, etc.) that will require more attention from the architects of the IYS. It can be quite narrow if focused on something like high seas research, or it can be something more universal about research in the salmosphere. At present there is no convergence of views in the room on whether to adopt the broad or narrow views.
- IYS needs a balance of projects and activities that is international and inclusive on one end of the spectrum and programs with a more narrow focus on the other.

Governance/Capacity

The IYS-WG Chairperson made a presentation on the issues surrounding governance and capacity to undertake an IYS. The context for the discussion was:

- the major components of IYS have been identified, including its purpose, themes, duration, need for donor and public outreach strategies, and a need for partners and roles to be confirmed
- what remains is how best to organize partners to finalize the IYS strategy and begin its

implementation

- governance must insure effective coordination and continuity over the IYS time frame and bring coherence to an international endeavour
- the governance structure should define who is involved, their roles and responsibilities and what process will be used to interact, identify actions, make decisions (as necessary) and communicate effectively

Considerations for discussion among workshop participants included:

- the makeup of IYS Partners and their roles in IYS
- respecting the interests and needs of the diversity of organizations that may be involved in IYS
- potential differences in IYS approach and scope between oceans
- what level of (in)flexibility is appropriate during the research phase, deviations from themes, IYS approvals process
- centralized or distributed coordination
- ensuring that capacity and resources are available for IYS oversight and coordination

One possible direction proposed was to establish an IYS Steering Committee to decide on the final strategy and make decisions as necessary. Issues included:

- who should part of this?
- what is its role?
- how and when does it interact and communicate its decisions and actions?
- identify working committees where further work is required to prepare strategy and seek endorsement by the IYS Steering Committee and potentially to set up working groups to complete work required
- tracking progress and reporting regularly to partners

David Carlson (Director of World Climate Research Program) described governance during the International Polar Year. IPY did not have a detailed science plan. Backed by the support of the World Meteorological Organization and the International Council of Scientific Unions, the IPY was developed to make major advances, leave a legacy of capacity, inspire a new generation, and to engage the public. These are very similar to what the IYS imagines it will be. There were existing international polar research organizations in the northern and southern hemisphere that did not communicate well, if at all, and there was no mandate or capacity for this to occur. An initial decision of the IPY planning group was not to map existing research activities under an IPY umbrella. “Projects” were used as the mechanism to get new science done and to develop new associations. The planning group decided on 11 criteria for branding an activity as an IPY project:

- address one or both polar regions and its global relevance
- had the potential to make significant advances within one or more of the IPY themes
- represented an intensive, time-limited burst of activities that occurred within the period of the IPY
- contributed to international cooperation and collaboration
- logistically and technically feasible within the IPY timeframe
- avoided duplication or disruption of established activities (established IPY as something new)
- open and timely access to data

- ethically and environmentally sensitive
- logistically efficient
- explicitly includes young scientists
- engages in outreach activities

IPY Outcome: After this set of criteria was agreed by the IPY planners, a call for 2-page pre-proposals was sent out and over 1200 were received, many of which had overlapping goals. International Project Office was created to organize these into fewer projects by merging like-minded initiatives. Once all of the matches had been identified, fund-raising for a project was undertaken independently by the proponents. Eventually, 170 projects got funded through national science agencies. The International Project Office did not fund any activities; all were funded nationally, primarily by governmental agencies. The IPY became the 170 projects that were funded by agencies. About 80–85% were funded. Each project had two leaders, a data function, and outreach activities. The International Project Office simply coordinated things through communication with the project leaders. The IPY logo was not licensed; it was open access for use by organizations (NGOs, museums, schools) that supported the goals of the IYS. The IPY would not have worked without a central coordinating office. IPY was a very flat structure with a coordinating function at the centre. Most of IPY research played out in the 2007–09 period. Some projects were early (some already underway before IPY) and some were late. It is almost impossible to get international projects to start and end on the same dates.

Follow-up: How did the International Project Office get its funds to run the coordinating office? Did NGOs engage in IPY? There was a huge influx of organizations to the program.

What structure makes sense for an IYS?

In plenary, the participants were asked to provide their views on an appropriate structure for IYS.

Suggestion 1: Establish an overarching committee with science/non-science expertise. Under this might be regional sub-committees for the three nodes representing different regions.

Suggestion 2: The precursor of what became Ocean Networks Canada recognized that oceanographic research was expensive because of the need for ship time. The original participants met to discuss their interests in monitoring and research without ships. A key feature in running these projects is cooperation; quasi-independent groups were established in the Atlantic and Pacific. There was a need to have a substantial communications budget to allow scientists in both oceans to exchange information.

Suggestion 3: There is a need to consider the nature of the governance objectives and what will be gained from governance. We certainly need rigorous science programs, but the specifics are likely place dependent. It would be useful to bin the objectives into three scales: International/overarching, basin specific and then party specific. Under ‘international’ would fall things like a steering committee to provide a cohesive message and to be a hub for compiling and sharing information and to create inclusive (not stifling) objectives such as brand, messaging and outreach along with the coordination of science. Under ‘basin’ would fall the basin NGO’s, the status of salmon by basin, and the more basin specific research objectives and projects. Under ‘party specific’ would fall the regional examples such as recognizing that, e.g. NE USA is very different from other areas. Here you would determine what other

species you may include like trout. Here would also fall local outreach and first nations engagement, and other very place specific items.

Suggestion 4: The basic model of IPY relied on national science foundations, whereas IYS is anticipating donors. NPAFC and PICES have secretariats with the capacity to act for the benefit of IYS whereas a Steering Committee is a different species with responsibilities in many places. There is a need for dedicated capacity to implement the IYS.

Suggestion 5: Early career scientists should be included in governance. It also needs to include the Arctic.

Suggestion 6: IPY had 3 subcommittees:

- education and outreach subcommittee
- data subcommittees
- satellites observations subcommittee

Suggestion 7: The IPY model is good model but so was the Census of Marine Life. It had a secretariat, a steering committee, and a data committee.

Suggestion 8: The IPY model seems good but it contrasts with an alternative that might have more government involvement. Is IYS to be an NPAFC initiative or a broad international program?

Suggestion 9: If we followed the IPY model with the existing research themes, it would have to begin immediately to meet the timeline.

Suggestion 10: Governance in the Pacific should be more like the Salish Sea Project. There would be no need for a request for proposals because the leaders would identify the research gaps. That requires a steering committee, perhaps without an administrative function, that determines where and what research needs to be done.

Suggestion 12: If someone is going to receive money from donors for a research program, there will be a need for a responsible financial board.

Discussion: Define scales of activities that are appropriate at different levels.

Next Steps

A topic that arose repeatedly during the workshop was that of capacity. Who is to do the work that is needed to implement the IYS? While the broader issues of governance and staffing were to be a subject of further discussion by the IYS-WG and partners, there were some immediate tasks to undertake:

- revise the Research Themes
- develop public engagement strategies that are sensitive to different organizations and timelines
- develop a donor strategy that respects differences in organizations / partners
- identify partners

Following a period of pairwise discussions among participants, suggestions were made by each pair about the work required to ensure a successful IYS? Responses are listed below:

Suggestion 1: The first WG must define the scope of IYS in broad terms, identify the knowledge gaps. In the Pacific, the NPAFC office should have a new person hired; there needs to be a programme champion (someone excited and committed and young enough to follow through), a steering committee is needed that is international covering all oceans, there should be a science oversight committee to participate in review of science programs, coordinate vessel activity, each country reports to the steering committee and national implementation teams.

Suggestion 2: Ensure that IYS is linked with international research on climate change

Suggestion 3: Highest order decision needs to demonstrate that the whole is greater than the sum of the parts that would not occur without IYS. Governance follows from the mission. All major aspects of the IYS programme require working groups (among nations).

Suggestion 4: A group will be needed to identify where to focus, to identify where the information gaps are currently. An overall scientific committee will be critical to this.

Suggestion 5: The initial next steps require a champion. NPAFC has been the champion and it needs to continue with increasing energy. An expression of concept is required to allow people to sign onto the IYS. Could be NGOs, governments, individuals, etc. What does it cost? Initially, there is a need for basic start up that may not be so pricey.

Suggestion 6: Bottom-up versus top-down approaches have been described by participants. If IYS has a clear mission then top-down approach is preferred. IYS must find its own funds. NPAFC office has no capacity to take on a coordinating role so an International Project Office should be established.

Suggestion 7: Identifying potentials for ship time should be a priority for a group. Canvas the broader research community. There is a need to coordinate with ICES and PICES at the higher level. Data gathering strategies need to be established early.

Suggestion 8: The IPY success was impressive. A steering committee would be the next step after NPAFC and NASCO endorse the IYS in the spring. A steering committee should identify costs of an International Project Office. A working group could look at outreach activities. A working group might define project criteria that builds on the research themes.

Suggestion 9: At least three working groups could be established: one to frame the IYS package, one to work on scientific knowns and unknowns, and one to focus on international collaboration.

Suggestion 10: Every component of IYS could use a working group. They need to be directed at specific questions. There is a need to have an easy answer when someone asks what the IYS hopes to accomplish.

Suggestion 11: Start with national members of a working group. A technical secretariat will be needed to take care of business.

Facilitators review

Paul Sprout briefly provided some concluding comments observing the key questions on scope, governance and capacity that had been flagged in the preceding discussions. He underscored the need for the architects of the IYS to reflect on how a governance structure could be flexible and able to address the

differing mandates and roles of organizations that may be part of the IYS while still providing sufficient common direction to ensure that the IYS approach was coherent

Final remarks (Chairperson)

The NPAFC Working Group was thanked for their hard work in preparing for the workshop, NASCO and Peter Hutchinson have engaged in the development, the Secretariat of the NPAFC, facilitators were skillful in getting ideas out of the participants, the rapporteur who will assemble the record of the meeting, David Carlson for sharing the IPY experience, the Aquarium staff for hosting the reception and supporting the IYS. This workshop was a major leap forward in developing the for the Working Group meeting. All of the participants were thanked and the meeting concluded.

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Table H.1. Participants at the International Year of the Salmon Scoping Workshop March 15–16, 2016, listed in alphabetical order of the last name.

| | Name | Role | Organization | Country |
|---|-------------------|-------------|--|-------------|
| 1 | Dick Beamish | Participant | Pacific Biological Station, Fisheries and Oceans Canada | Canada |
| 2 | David Carlson | Participant | World Climate Research Programme (WCRP) | Switzerland |
| 3 | Villy Christensen | Participant | Institute for the Oceans and Fisheries, University of British Columbia | Canada |
| 4 | Nancy Davis | Organizer | North Pacific Anadromous Fish Commission (NPAFC) | Canada |
| 5 | Andrew Day | Participant | Coastal Ocean Research Institute, Vancouver Aquarium Marine Science Centre | Canada |
| 6 | Karen Dunmall | Participant | Fisheries and Oceans Canada, University of | Canada |

| Manitoba, Salmon in the Canadian Arctic | | | | |
|---|------------------|----------------|--|----------------|
| 7 | John Field | Participant | Pacific Salmon Commission (PSC) | Canada |
| 8 | Randy Fisher | Participant | Pacific States Marine Fisheries Commission (PSMFC) | USA |
| 9 | Rupert Gale | Participant | The Ritchie Foundation | Canada |
| 10 | Joel Harding | Participant | InStream Fisheries Research | Canada |
| 11 | Brian Hunt | Participant | Hakai Institute/University of British Columbia, Department of Earth, Ocean, and Atmospheric Sciences | Canada |
| 12 | Peter Hutchinson | Participant | North Atlantic Salmon Conservation Organization (NASCO) | United Kingdom |
| 13 | Kim Hyatt | Participant | Pacific Biological Station, Fisheries and Oceans Canada | Canada |
| 14 | Jim Irvine | Participant | Pacific Biological Station, Fisheries and Oceans Canada | Canada |
| 15 | Minho Kang | Organizer | North Pacific Anadromous Fish Commission (NPAFC) | Canada |
| 16 | Gennady Kantakov | Participant | Far Eastern Ecological Center, Ltd. | Russia |
| 17 | Sara LaBorde | Participant | Wild Salmon Center | USA |
| 18 | Do Hyun Lee | IYS WG Member | Inland Life Resources Center, Korea Fisheries Resources Agency (FIRA) | Korea |
| 19 | Carmel Lowe | Participant | Fisheries and Oceans Canada | Canada |
| 20 | Deana Machin | Participant | First Nations Fisheries Council of British Columbia | Canada |
| 21 | John Madden | Participant | | Canada |
| 22 | Mike Matylewich | Participant | Columbia River Inter-Tribal Fish Commission | USA |
| 23 | Skip McKinnell | IYS Rapporteur | Salmoforsk International Environmental Consulting | Canada |

| | | | | |
|----|----------------------------|------------------------------|---|--------|
| 24 | Megan McPhee | Participant | School of Fisheries and Ocean Sciences, University of Alaska Fairbanks | USA |
| 25 | Doug Mecum | IYS WG Member from F&A | Alaska Region (F/AK), National Marine Fisheries Service | USA |
| 26 | Igor Melnikov | IYS WG Member | Pacific Scientific Research Fisheries Center (TINRO-Center) | Russia |
| 27 | Kristi Miller- Saunders | Participant | Pacific Biological Station, Fisheries and Oceans Canada | Canada |
| 28 | Yasuyuki Miyakoshi | Participant | Salmon and Freshwater Fisheries Research Institute, Hokkaido Research Organization | Japan |
| 29 | Kate Moran | Participant | Ocean Networks Canada | Canada |
| 30 | Dan Morris | Participant | (GARFO) National Marine Fisheries Service | USA |
| 31 | Evgeny Pakhomov | Participant | University of British Columbia, Institute for the Oceans and Fisheries/Dept. of Earth, Ocean and Atmospheric Sciences | Canada |
| 32 | Eric Peterson | Participant | Tula Foundation | Canada |
| 33 | Vladimir Radchenko | Organizer | North Pacific Anadromous Fish Commission (NPAFC) | Canada |
| 34 | Laura Richards | Participant | North Pacific Marine Science Organization (PICES) | Canada |
| 35 | Brian Riddell | Participant | Pacific Salmon Foundation | Canada |
| 36 | Rachael Ritchie | Participant | Genome British Columbia | Canada |
| 37 | Akash Sastri | Participant | Ocean Networks Canada | Canada |
| 38 | Shunpei Sato | IYS WG Member | Hokkaido National Fisheries Research Institute, Fisheries Research Agency | Japan |
| 39 | Mark Saunders | IYS WG Chairperson | Pacific Biological Station, Fisheries and Oceans Canada | Canada |
| 40 | Sue Scott | Participant | Atlantic Salmon Federation | Canada |
| 41 | Matthew Sloat | Participant | Wild Salmon Center | USA |

| | | | | |
|----|------------------|-------------------------|---|--------|
| 42 | Gary Smith | Participant | Smith and Stark LLC | USA |
| 43 | Paul Sprout | IYS Business Consultant | | Canada |
| 44 | Andrew Stegemann | IYS Meeting Facilitator | | Canada |
| 45 | Greg Taylor | Participant | Fish First Consulting | Canada |
| 46 | Terry Tebb | Participant | Pacific Salmon Foundation | Canada |
| 47 | Marc Trudel | Participant | Pacific Biological Station, Fisheries and Oceans Canada | Canada |
| 48 | Hiroshi Ueda | Participant | Graduate School of Environmental Science, Hokkaido University | Japan |
| 49 | Shigehiko Urawa | IYS WG Member | Hokkaido National Fisheries Research Institute, Fisheries Research Agency | Japan |
| 50 | Eric Volk | IYS WG Member | Commercial Fisheries Division, Alaska Department of Fish and Game | USA |
| 51 | Fred Whoriskey | Participant | Ocean Tracking Network, Dalhousie University | Canada |

Table H.2. Agenda of the International Year of the Salmon Scoping Workshop 2016 (March 15-16, 2016, Vancouver).

DAY ONE

9:00 – 9:45 Agenda Review & Introductions

- ☐ NPAFC welcome: Mark Saunders
- ☐ First Nations welcome: Debora Sparrow
- ☐ Welcome from Fisheries and Oceans Canada: Carmel Lowe
- ☐ Role of the facilitators
- ☐ Review of meeting logistics, objectives, day one agenda, scope of discussion, ground rules

9:45 – 10:25 Setting the Stage

- ☐ NASCO presentation: introduction to NASCO and their interests in the IYS
- ☐ NPAFC presentation on the proposed concept of the IYS initiative

10:25 – 10:45 Determining timeframe and milestones

- ☐ Participant feedback on the proposed concept of the IYS initiative

11:00 – 12:15 Key partners and Donors

- ☐ Breakout groups: Group work to create a list of key partners and donors, and to identify each partner/donor's interest as it relates to salmon

1:15 – 3:15 Research themes

- ☐ Breakout groups: Group work (one group for each of the five research themes) to answer the following questions:

1. Consider the current theme and its subthemes: are there any missing subthemes?
2. Is there a different way we want to frame this research theme to better resonate with donors and partners and their interests?
3. In implementing this theme, what are the results or outcomes that will be important for decision-makers?
4. Considering the five themes identified, are we missing any themes?

3:15 – 4:00 Research theme report back to the plenary

- ☐ Plenary: presentation of findings

DAY TWO

9:00 – 9:30 Agenda Review & Day One Overview

- ☐ NPAFC welcome: Mark Saunders
- ☐ Overview of day one and review of day two agenda

9:30 – 11:00 Year of Outreach

- ☐ Breakout groups answer the following questions:
 1. What are the main objectives and outcomes needed to ensure a successful year of outreach?
 2. Who needs to be engaged and who engages them? (That is, who does the engaging, and who do they engage?)
 3. How do we effectively outreach to interested groups? (Considering the practicalities, what are some of the key messages? What are some of the media vehicles)?
 4. What is the ideal timeframe for the outreach, and when should it begin? Why?
 5. What are the main barriers that we will likely face in raising funds for the International Year of the Salmon? How can we adjust to overcome these barriers?

11:15 – 12:00 Year of Outreach Summaries

- ☐ Breakout facilitators recount their group's notes.

1:00 – 1:30 Proposed Capacity/ Governance Arrangements

- ☐ Presentation on the proposed governance arrangement for the IYS and the needed capacity for a successful IYS initiative: Mark Saunders

1:30 – 2:00 Capacity/ Governance feedback

- ☐ Participant feedback on the proposed capacity/ governance arrangements

2:00 – 2:45 Working Group Identification

- ☐ Participants answer: What work is needed to ensure a successful IYS initiative and will require a working group to ensure it's completed?

2:45 – 3:00 Wrap up & Next Steps

Appendix I

Outline Proposal for an International Year of the Salmon (IYS): ‘Salmon and People in a Changing World’

International Year of the Salmon Working Group

May 2016, originally presented as NPAFC Doc. 1663.

This proposal was developed at a meeting of an International Year of the Salmon (IYS) Working Group convened by NPAFC and comprising representatives of NPAFC and NASCO. The meeting was held in Vancouver, Canada on 17 March 2016. The proposal is intended to support NPAFC and NASCO in deciding how best to take forward the exciting prospect of an international focus on salmon and their importance to people in the North Pacific and North Atlantic Oceans and potentially also the Baltic and Arctic regions. While NPAFC and NASCO and several of their core partners have endorsed the concept of an IYS in principle, this proposal differs somewhat from an earlier proposal considered by NPAFC and presented to NASCO.

1. Rationale

Salmon are an important biological and economic resource throughout their range, including in the North Pacific and North Atlantic Oceans and the Baltic Sea (collectively referred to as the ‘salmosphere’). They face many challenges and uncertainties not least those associated with climate change. There is a need to advance understanding and awareness of the issues facing salmon around the salmosphere, and their implications for communities that benefit from the resource, through implementation of a programme of new research, collaboration and outreach.

2. Vision

The overall theme of the International Year of the Salmon (IYS) is ‘Salmon and people in a changing world’. The extraordinary life history of salmon exposes them to many environmental and anthropogenic factors influencing their health and abundance. The IYS seeks to raise awareness of what humans can do to better ensure salmon and their varied habitats are conserved and restored. Increasingly the pace of our scientific efforts to understand the factors affecting salmon under a changing climate is not rapid enough to effectively support the management of salmon and allow us to realize the important social and economic benefits that salmon provide now and into the future. Therefore the IYS also seeks to stimulate an investment in research which will leave a legacy of knowledge, data/information systems, tools and a new generation of scientists equipped to provide timely advice that will inform the conservation, restoration and rational management of salmon.

The proposed aims of the IYS are to:

- improve scientific understanding and public and political awareness of the factors driving salmon abundance, the environmental and anthropogenic challenges facing salmon and the measures being taken to mitigate these;
- generate further support for strategies to conserve, restore and rationally manage salmon;

- develop a legacy of collaboration among organisations and researchers across disciplines in countries throughout the salmosphere;
- inspire and support a new generation of researchers and managers;
- improve understanding and awareness of the ecological, social, cultural and economic values of salmon; and
- engender a call to action to support research and conservation of salmon and their supporting environment throughout the salmosphere.

3. Themes

The proposed core outreach, engagement, and education themes for the IYS include improving public and political awareness of the status of salmon stocks and their cultural, social and economic importance and of the challenges they face from major environmental changes and a variety of anthropogenic factors. The outreach and education initiatives could be adapted in scale to address these ideas across the salmosphere, in the individual jurisdictions and even in communities adjoining salmon rivers.

The proposed research themes for the IYS are as follows:

- *Status of Salmon*: to understand the present status of salmon and their environments;
- *Salmon in a changing salmosphere*: to understand and quantify the effects of natural environmental variability and anthropogenic factors affecting salmon distribution and abundance and to make projections of their future changes;
- *New Frontiers*: to develop new technologies and analytical methods to advance salmon science and to explore the uncharted regions of the salmosphere;
- *Human Dimension*: to improve the resilience of people and salmon through the connection and collaboration of salmon-dependent communities, indigenous peoples, youth, harvesters and resource managers across the salmosphere;
- *Information Systems*: to develop an integrated archive of accessible electronic data collected during the IYS and tools to support future research.

4. Timing

It is proposed that the focus of the IYS will be during a single year when there will be special emphasis on salmon throughout the salmosphere, comprising concerted and coordinated public outreach, engagement and education activities to increase awareness and understanding of the issues facing salmon and in support of fundraising for research. Any programme of research requires extensive planning, funding, data collection and analysis before the findings can be disseminated; this process will take many years. Throughout this period, the IYS brand and organisational/communication structure will persist. The nature and scope of the activities undertaken will, however, be largely a matter for decision at regional/RFMO and party/jurisdiction levels. The IYS initiative will, therefore, comprise three phases (planning, launch and research) with the intention that the IYS focal year will be held in 2018. These phases are as follows:

Planning (2016 – 2017): develop an IYS brand, website, brochures, posters newsletters and other materials; develop an outreach approach and communications strategy; confirm research themes, identify research priorities and develop research plans; develop criteria for IYS endorsement of First Proposals;

identify and engage core partners; agree the governance model and appoint members of Committees; identify capacity requirements; develop a fund-raising strategy; and further develop and refine budgets.

Launch (2018): launch the IYS focal year, possibly during 2018, by convening an international symposium focusing on the state of the salmosphere and to facilitate the development of a legacy of improved collaboration among organisations and scientists throughout the salmosphere; initiate a significant outreach and communications initiative to raise awareness of the values of salmon, the uncertainties and challenges facing salmon and the measures being taken to conserve, restore and rationally manage them and in support of fund-raising for new research to better understand the future of salmon in a rapidly changing salmosphere. Outreach activities could include exhibits at museums and aquaria; themes and sessions related to the IYS at the annual meetings of international fisheries organizations and regional science societies; symposia and workshops; development of educational materials for schools; development of IYS webpages and newsletters; IYS Declarations in the legislative bodies of the Parties to NASCO and NPAFC and core partners; preparation of a State of the Salmon report (reports) or an Atlas (Atlases) of salmon distribution and abundance.

Implement and report on new research (2018 – 2022): conduct research; analyse and publish results; and disseminate findings through convening an international dénouement symposium to review the accomplishments of IYS, to share findings, and to consider whether coordination at the salmosphere-level should continue. Local symposia or workshops with IYS endorsement might also be organised. Research priorities would be resolved at the regional (e.g. Pacific, Atlantic and Baltic) level but new and ongoing First Proposals could seek IYS endorsement. There would be a need to maintain a level of outreach activities during the implementation of the IYS research.

5. Scope

All life history stages of salmon of the sub-family Salmoninae to reflect the different mandates of the partner organisations. In the case of the North Atlantic and Baltic, the IYS would focus on Atlantic salmon (*Salmo salar*) while in the North Pacific it would cover Pink salmon (*Oncorhynchus gorbuscha*), Chum salmon (*O. keta*), Sockeye salmon (*O. nerka*), Coho salmon (*O. kisutch*), Chinook salmon (*O. tshawytscha*), Cherry salmon (*O. masou*) and Steelhead trout (*O. mykiss*). Each lead organisation (i.e. NPAFC and NASCO) would resolve if it wishes to expand this scope to cover other species (e.g. char and trout) or non-anadromous forms of the species listed above in its own research plan, outreach plan, and other IYS activities. The lead organisations would also liaise with organizations dealing with the Arctic and Baltic to seek their involvement in the IYS.

6. Governance

The governance of the IYS needs to be inclusive, flexible and supportive and its success will depend on the involvement of a wide range of partners. It is recognised that there may be different issues affecting salmon around the salmosphere, different research priorities and a different focus of activities in different regions. The IYS will be adaptable in scale depending on funding received and support for regional/RFMO and party/jurisdiction specific initiatives. The governance structure may need to be reviewed occasionally for its adequacy and effectiveness, depending on how the initiatives develop. It is anticipated that most of the IYS activities will be undertaken at the regional/RFMO and party/jurisdiction levels and there will be a range of objectives that will need to be coordinated at different levels

(salmosphere, regional/RFMO (i.e. North Pacific, North Atlantic and Baltic) and within individual Parties/jurisdictions) (see attached organizational chart on page 9). The Baltic could have a separate Steering Committee but there is no RFMO for the Baltic and the advice of the EU and Russia would need to be sought on an appropriate approach for implementing the IYS in that region (either a separate Regional Steering Committee or jointly with the Atlantic through NASCO). There may also be benefits from involving organisations concerned with the Arctic region. The objectives at different levels of governance are as follows:

Activities applying throughout the salmosphere (IYS Coordinating Committee):

- Develop an IYS brand (logo, slogan and messages) and guidelines for its use;
- Develop, maintain and possibly host IYS web pages, possibly including templates for use by participants in the IYS;
- Develop and distribute newsletters, posters, brochures and other materials concerning IYS activities at a salmosphere level;
- Define broad outreach principles;
- Develop criteria for IYS endorsement of research and review First Proposals and other activities seeking IYS endorsement;
- Identify research priorities at a salmosphere level and coordinate any research programmes implemented, recognising that most IYS research is expected to be at regional/RFMO or party/jurisdiction levels;
- Coordinate fundraising activities in support of the IYS Coordinating Committee functions;
- Organise the IYS international symposia through dedicated Symposia Steering Committees; and
- Establish a hub for compilation and sharing of information on IYS activities.

Regional/RFMO level (IYS Regional Steering Committees):

- Engage core partners;
- Resolve species, life stages and geographical areas to be included in the IYS in addition to those listed under section 5 above;
- Identify research priorities and develop research plans;
- Develop outreach activities, target audiences and messages;
- Establish a hub for compilation and sharing of information on IYS activities; and
- Coordinate fund-raising in support of the IYS Regional Steering Committee functions.

Party/jurisdiction specific level (Individual Parties/jurisdictions, NGOs and core partners):

- Conduct the primary IYS functions of research and public engagement, informed by IYS core principles and branding;
- Seek and disburse funding e.g. to State/Provincial/Local governments and RFMOs;
- Undertake outreach activities;
- Organise or support regional symposia and workshops or other events; and
- Engage with First Nations.

It is envisaged that the IYS Coordinating Committee would comprise nominated representatives appointed by the lead organisations that would undertake activities at the salmosphere level such as: development of an IYS logo, slogan and web page; organise symposia through a separate Symposium

Steering Committee; identify data needs and research priorities across the salmosphere and coordinate activities undertaken across more than one region in the salmosphere; and review and endorse First Proposals conducted at a regional or party/jurisdiction level. The Committee would work wherever possible by correspondence but would need to meet perhaps on an annual basis and would report back to the lead organisations on its work. There would likely be the need for professional support in developing the IYS brand materials, including the web page, logo and slogan, and possibly in support of regional activities. The Symposium Steering Committee for the international symposium planned for the IYS launch would need to commence its work no later than the autumn of 2016 if a symposium is to be held to mark the launch of the IYS in 2018.

There would be Regional Steering Committees in the North Pacific, North Atlantic and possibly the Baltic, led by NPAFC in the Pacific and NASCO in the Atlantic and supported by the Secretariats of those organisations. These Committees would provide the fora for cooperation between the lead organizations and core partners and propose outreach activities. They would coordinate the activities being undertaken in their regions and share information with the overall IYS Coordinating Committee. It would also be a matter for those Regional Committees to identify research gaps and priorities, seek funding, organise calls for First Proposals and disburse sums raised noting that NASCO has already established its International Atlantic Salmon Research Board (and Scientific Advisory Group) for this purpose. If this proposal is accepted, it is suggested that the Steering Committees be established at the 2016 annual meetings of NPAFC and NASCO with a view to commencing their work at the earliest opportunity thereafter, including further consideration of budgetary needs.

7. Initial budgetary considerations

NPAFC and NASCO provide adequate and appropriate fora for developing and advancing the basic concept of the IYS among their member parties and core partners and would be the lead organisations. It is anticipated that a relatively small centralised budget, shared by the two lead organizations (and possibly their core partners and external sources), would be required to support initial activities but the IYS governance structure proposed allows for regional implementation that would be adaptable in terms of nature and scale of the activities undertaken. If NPAFC and NASCO agree at their 2016 annual meetings to proceed with an IYS there will be a need for further consideration of budgetary issues. This would predominantly be a task at the Regional/RFMO level, through the IYS Regional Steering Committees, but would involve the Coordinating Committee in the case of activities applying throughout the salmosphere. Further consultation should occur well in advance of the 2017 annual meetings of the lead organizations to clarify anticipated future expenditure (2018-), e.g. the need for regional coordinators or an IYS project officer.

The most immediate need is to approve funding to support the initial planning stage of the IYS activities (2016 and 2017). Given the budgeting cycles of both organizations, initial funding for the planning stage will need to be agreed at the 2016 meetings. While the funding strategy could include Commission funds or funds raised externally, it is recommended that NPAFC and NASCO make budgetary provision to allow for the development of the IYS brand and towards the cost of the 2018 symposium. It is recognised that the NASCO budget has already been agreed for the calendar year 2016 so, if funds cannot be found from within that budget, then the earliest a contribution could be made to the IYS would be 2017 unless external funds could be raised.

As previously noted the main planning activities for 2016 and 2017 are as follows:

- complete and implement the IYS governance model and appoint members of the IYS Coordinating Committee, Regional/RFMO IYS Steering Committee and Symposium Steering Committee;
- identify and engage core partners;
- identify capacity requirements in the NPAFC and NASCO Secretariats; develop a fund-raising strategy; and prepare budgets;
- develop an IYS brand, website, brochures, posters newsletters and other materials;
- develop an outreach approach and communications strategy;
- develop criteria for IYS endorsement of First Proposals;
- plan 2018 Symposium; and
- confirm research themes, identify research priorities and develop research plans;

It is anticipated that many of these initial planning activities could be undertaken without the need for specific budget provision using existing resources within the Secretariats and that some of the work would be undertaken by correspondence. However, initial funding will be needed in 2016 and/or 2017 with regard to the 2018 symposium and developing the IYS brand. A strategy for communications and fundraising for activities at a salmosphere level may also be required and the Working Group discussed some options. The costs of any activities at a salmosphere level should be shared equally among the lead organisations.

Professional support, such as marketing expertise, will be required, e.g. for the development of an IYS brand and webpages to ensure a uniform identity across all participating parties and organisations. A request for proposals to provide the services may be needed to make a reliable cost estimate but a figure of £30,000 (CAN\$56,000), shared between the lead organisations, might be required in 2017.

One major activity will be to convene an international symposium to launch the focal year of the IYS in 2018. It is suggested that a budget of around £40,000 (CAN\$75,000), shared between lead organisations, might be required. As costs may be incurred in advance of the symposium (e.g. deposit for symposium venue), it is recommended that budgetary provision be made by NPAFC and NASCO in 2017. Additional funding would be expected to be raised from registration fees and sponsorship.

Activities at a regional level would be a matter for the Steering Committees to resolve but given budget cycles it is recommended that initial funds be provided to support those activities. An initial budget of £25,000 (CAN\$47,000) for each of the lead organisations might be appropriate but would need to be reviewed as the IYS activities develop. There may be a need for additional capacity within the NPAFC and NASCO Secretariats to be resolved once the nature and scope of the IYS are agreed.

Thus, it is proposed that both NPAFC and NASCO make base budget provision of £60,000 (CAN\$112,000) in 2017. This sum is seen as modest given the perceived benefits of the IYS to the lead organisations and others.

It should be recognised that within each region, implementation of the IYS may be managed differently. A large portion of the coordination effort in the North Atlantic is expected to be undertaken by the NASCO Secretariat and the participation of NASCO Parties in the IYS Regional Steering Committee and the Symposium Steering Committee should not require financial assistance through the NASCO budget. This may be handled differently in the North Pacific where funding may be required for these activities.

8. Next Steps

It is recognised that while both NPAFC and NASCO, and several core partners, have endorsed the concept of an IYS in principle, this revised proposal differs somewhat in nature and scope from earlier proposals. The first step will be for NPAFC and NASCO to consider this proposal with a view to its endorsement at their 2016 Annual Meetings (NPAFC: 16–20 May; NASCO: 7–10 June). There should be a media release, developed by NASCO and NPAFC jointly, individually or a combination of both, immediately after the endorsement by both organisations.

NASCO and NPAFC have already identified core partners but this will need further consideration. With regard to the Arctic, the NASCO Secretariat should consult with the Arctic Council Secretariat, Tromsø, Norway and the NPAFC Secretariat should consult relevant agencies. The NASCO Secretariat should consult the EU and the Russian Federation about possible involvement from the Baltic.

It is recognised that there is very limited time in which to prepare for the IYS if the focal year is to be held in 2018, depending on whether or not the proposal is acceptable to both organisations at their annual meetings. If further work is required before adoption of the proposal, then 2019 might be a more realistic option for the focal year (although the launch symposium might still be scheduled for the last quarter of 2018).

If the IYS is endorsed at the 2016 annual meetings of NPAFC and NASCO, there will be a need to appoint representatives to serve on the Coordinating Committee, the regional Steering Committees and the Symposium Steering Committee and for these committees to start work in the autumn of 2016. There is urgency about this if the IYS focal year and symposium are to be held in 2018. The tasks and composition of these Committees might be as follows:

Coordinating Committee

Activities: As detailed in section 6 above and such other tasks as may be identified by the lead organisations.

Composition: Not more than four appointed representative from each lead organisation, including a representative of the Secretariats of each lead organisation. The Committee should appoint one Co-chairperson from among the representatives of each of the two lead organizations. It would be desirable to have both managers and scientists involved and ideally representatives with experience of outreach initiatives. Additional expertise could be co-opted to the Coordinating Committee as required depending on the nature and scope of the IYS.

Symposium Steering Committee

Activities: Plan for, organise and run the international IYS symposium to launch the IYS. This will involve: agreeing on dates and venue; developing objectives and the programme, including inviting keynote speakers and soliciting contributed papers; establishing a web page for registrations; seeking sponsors and supporters; dealing with all financial matters; and making arrangements for publication of the proceedings (in this regard ICES has indicated that a symposium issue of the ICES Journal of Marine Science may be an option). It is envisaged that a joint symposium account will be needed and that depending on the venue of the symposium this be held by either NPAFC or NASCO.

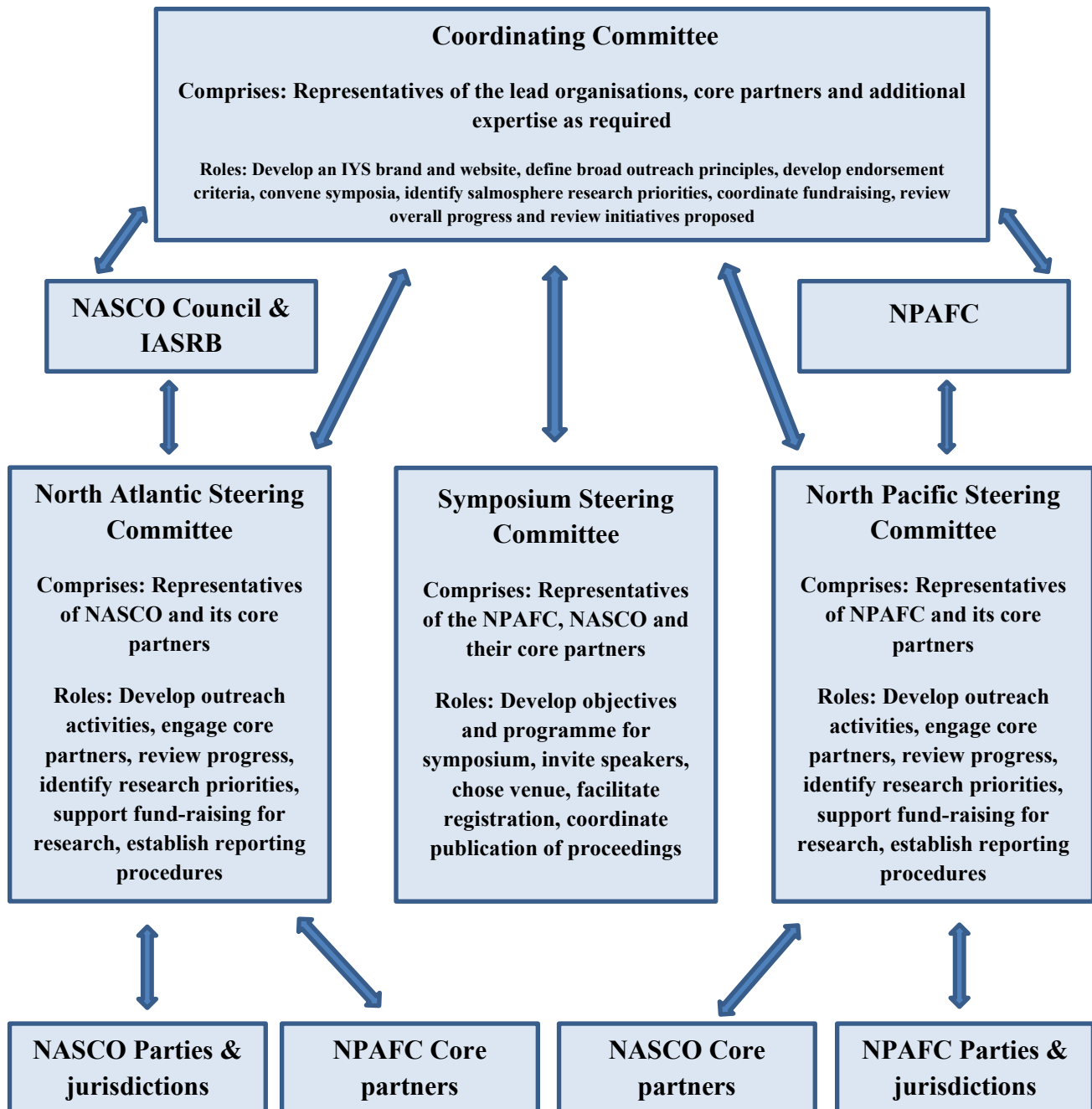
Composition: Not more than three representatives from each lead organisation, including one representative of the Secretariats of each lead organisation, and one representatives from any co-convening organisation. It would be desirable to have both managers and scientists involved with subject matter representatives for each research theme. Additional expertise could be co-opted to the Steering Committee as required depending on the nature and scope of the IYS.

Regional Steering Committees

Activities: As detailed in section 6 above and such other tasks as may be identified by the lead organisations.

Composition: One representative from each Party from the lead organisation, a representative of the Secretariat from the lead organisation and invited representatives from core partners. It would be desirable to have both managers and scientists involved and ideally representatives with experience of outreach initiatives and additional experts, as needed, to support IYS functions.

Proposed IYS Governance Model



CHAPTER 4: LAUNCH OF THE PLANNING PHASE OF THE INTERNATIONAL YEAR OF THE SALMON

NPAFC Endorses the Planning Phase of the IYS

Significant progress was made during the Second Scoping Meeting concerning plans for the implementation of the IYS initiative, particularly with respect to developing a funding strategy and engaging potential partners, as well as delineating a possible governance structure. The Outline Proposal was accepted by the Commission at the 2016 Annual Meeting of the NPAFC held in Busan, Republic of Korea, from May 16–20, 2016. All Parties praised the work of the IYW-WG in providing such a comprehensive analysis of the Second Scoping Meeting. Still, further work was needed to consider the budget, governance approach, and development of a framework for future IYS activities.

During the 2016 Annual Meeting of the NPAFC, IYS-WG members met to discuss several points related to the IYS. Participants included Mark Saunders (Chairperson, Canada), Marc Trudel (Canada), Igor Melnikov (Russia), Shigehiko Urawa (Japan) and Shunpei Sato (Japan), Ju Kyoung Kim (Korea), Do Hyun Lee (Korea), Ed Farley (United States) and Dion Oxman (United States). Discussion points encompassed adoption of the IYS-WG Terms of Reference (Appendix J), IYS governance, the 2018 IYS Symposium, and funding requests. Regarding IYS governance, it was decided that membership in the Coordinating Committee would be limited to a small number of NPAFC representatives and that the North Pacific Steering Committee would be larger—including IYS-WG members and partners. With respect to the 2018 Symposium, it was noted that the location should be a somewhere central (possibly North America) and that cost to the NPAFC should be minimized by procuring sponsorship and charging a registration fee. Additionally, it was decided that a request for funding would be sent to F&A to cover the costs of logo, branding and website development, support for North Pacific IYS research planning and coordinating meetings, and the 2018 IYS Symposium. Parties were also encouraged to gain external funding.

Alignment with the 2016–2020 NPAFC Science Plan

The proposed scientific programme for the IYS (2016–2022) was highly praised by all Parties of the Commission and is considered to be a very high-quality and thorough research programme. The new 2016–2020 NPAFC Science Plan, which was also approved at the 2016 Annual Meeting of the NPAFC, has an overlapping timeframe with the IYS and explicitly links IYS research themes to NPAFC Science Plan themes and research activities of the CSRS Working Groups. Similar to research objectives of the IYS, the primary goal of the NPAFC Science Plan is to understand variations in Pacific salmon productivity in a changing climate. The NPAFC Plan also recognizes it is now more important than ever to promote collaborative research on an international scale to provide better scientific information on the ecological mechanisms regulating the distribution and abundance of anadromous populations and climate impacts in North Pacific marine ecosystems. Due to several key differences, however, the research themes of the 2016–2010 NPAFC Science Plan are not in complete alignment with the IYS themes. For example, the IYS has a proposed extended geographic range of research, which, in addition to the Pacific Ocean includes the Atlantic Ocean, Baltic Sea and the Arctic Ocean. In addition, the IYS proposes an increased focus on people compared to the 2016–2010 NPAFC Science Plan.

NASCO Accepts the IYS Outline Proposal

The IYS Outline Proposal was presented to NASCO by Dan Morris, the head of the US Delegation to NASCO, at the Thirty-Third Annual Meeting of the Council, held in Bad Neuenahr-Ahrweiler, Germany, from June 6–10, 2016 (North Atlantic Salmon Conservation Organization [NASCO] 2016). The NASCO Council acknowledged that the IYS would provide an exceptional opportunity to raise awareness of the environmental and human-caused factors affecting salmon and the measures being taken to mitigate these. The Outline Proposal was broadly accepted by the Council, considering a few points of clarification. Firstly, due to the significant amount of planning required for the IYS and the need for coordination at different jurisdictional levels, the Council wished to designate 2019 as the focal year of the initiative, with the IYS International Symposium planned for the autumn of 2018. Additionally, NASCO wished to clarify that the work of the Coordinating Committee would be conducted in agreement with recommendations of the Regional Steering Committees. Furthermore, the Council agreed to contribute £60,000 for an IYS Special Fund to be spent in accordance with a spending plan developed by the Council and agreed to by the Parties. Dan Morris was asked to chair the North Atlantic Steering Committee, with other representatives to be included from NASCO Parties and NGOs. Moreover, NASCO representatives on the IYS International Symposium Steering Committee would include the NASCO Secretary, a scientific representative nominated by the European Union, and a manager nominated from Canada. NASCO representatives on the Coordinating Committee would initially include Dan Morris and the Secretary, with further participation considered at a later stage. Overall, the Council noted that the success of the initiative would depend on participation, support, and cooperation between a wide range of partners and therefore, the approach would need to be flexible, inclusive, and adaptive. With the approval of the Outline Proposal by both NPAFC and NASCO in May and June, 2016, respectively, the planning phase of IYS implementation was officially launched.

The First Meeting of the IYS North Atlantic Steering Committee (NASC) was held in London, England, on November 2–3, 2016. Several topics were discussed at the meeting including IYS governance, recommendations for IYS activities in the North Atlantic region, development of a an IYS spending plan, the IYS Symposium, and recommendations for activities to be carried out by the IYS Coordinating Committee.

Formation of the IYS Coordinating Committee

In September 2016, NASCO and NPAFC formed the IYS Coordinating Committee (ICC), consisting of six members: Carmel Lowe (NPAFC), Dan Morris (NASCO, Co-Chair), Doug Mecum (NPAFC), Mark Saunders (NPAFC, Co-Chair), Peter Hutchinson (NASCO), and Vladimir Radchenko (NPAFC). The first and second meetings of the ICC were conducted via conference calls, on October 6 and 26, 2016, respectively, and covered numerous topics including branding and identify design, governance, the opening symposium, and timing of major IYS events. Due to the considerable undertaking of planning and executing a major scientific symposium, the ICC decided to hold the IYS Symposium in the fall of 2018 and officially push the IYS focal years to 2019, resulting in the following new timeline (with outreach to be conducted during every phase):

| | |
|-------------|--|
| 2016–2018 | Setting the stage: planning, coordinating, enlisting partners and contributors |
| 2018 | IYS symposium |
| 2019 | IYS focal year: field seasons, new data collection |
| 2020–2022 | Wrap-up: final analyses, publication, concluding symposium |

IYS Governance

One of the top priorities of the ICC was to finalize the IYS governance model. After prolonged discussions, a distributed governance structure was agreed to by NPAFC and NASCO, consisting of the ICC, two Regional Steering Committees (the North Pacific and North Atlantic Steering Committees, NPSC and NASC, respectively), and a Symposium Steering Committee (SSC). The ICC would be responsible for coordinating the planning, implementation, and administration of the IYS and reviewing its progress at the salmosphere level. Most IYS activities would likely occur at the Regional/RFMO and Party/jurisdiction level, and would be the responsibility of the Regional Steering Committees. There will, however, be a range of objectives that would need to be coordinated at and among different levels and between or within individual Parties/jurisdictions. The ICC would undertake activities at the salmosphere level, such as development of an IYS brand/website and endorsement criteria; in conducting its work, however, the ICC would be required to consult the Regional Steering Committees. The ICC agreed that it would be helpful for the Regional Steering Committees to provide their advice to the ICC as a variety of options for the ICC to consider when taking its decisions. It was also noted that membership to the ICC should be kept small, with representatives exclusively from NPAFC and NASCO, in order to allow its effective functioning. Additional expertise could be co-opted as needed for specific tasks. A draft governance document was drafted by the ICC and was to be reviewed during the first meeting of the North Pacific Steering Committee (NPSC), which was set to take place on February 28 and March 1, 2017, in Richmond, BC.

2018 IYS Symposium

The overall aim of the 2018 IYS Symposium would be to kick-off the IYS by providing a hemispheric-wide review of the current state of salmon and an appraisal of what knowledge is needed to better protect and manage salmon in the future. With the proposed date for the IYS Symposium in the fall of 2018, it was agreed by the ICC that planning should commence immediately. The planning and execution of a major scientific symposium is a considerable undertaking with some activities, particularly securing a facility for hosting the symposium, requiring a very long lead time. As the SSC will be responsible for the coordinating preparations for the 2018 IYS Symposium, the ICC agreed that NPAFC and NASCO would be asked to name their representatives for the SSC in order to commence the planning effort.

IYS Branding and Identify Design

Another top priority of the ICC was to develop a brand for the IYS, including a logo and a website. To begin this process, a creative brief for the IYS was developed by NPAFC Secretariat staff, which after some minor revisions, was accepted by the ICC (Appendix K). The creative brief is a written summary of the IYS, including themes and visions of the initiative, intended to be used by a design company to create the identity design for the initiative—translating the IYS vision into graphic elements, brand standards, website, and printed materials. The creative brief is presented in two major sections. The first section puts forward language expressing qualities of the IYS to which we might aspire, including the IYS theme, keywords, vision, scope, target audiences, objective, and tone. The remainder of the document outlines specific elements to be incorporated into the IYS logo and brand standards package. Specific requirements and desired elements of the website were to be provided at a later date as it was decided that the first step in the identity design process would be to develop the logo and brand standards.

Looking to the future

Following the initial meetings of the ICC in October 2016, further work was conducted towards development of the IYS logo and brand, as well as development of the IYS governance and terms of reference document. Recognizing the need for dedicated staff to continue work towards planning for IYS implementation, Mark Saunders assumed the position as full-time IYS Coordinator, contracted by the NPAFC Secretariat through Canada's Partnership Fund. The IYS project began to gain recognition as an important initiative outside NPAFC and NASCO. A good working relationship was developed with the University of British Columbia and George Iwama was appointed as a liaison between the university and the NPAFC regarding IYS matters. Additionally, DFO convened a three-day workshop in January 2017, Vancouver, Canada, to establish a national network of salmon researchers with emphasis on IYS planning priorities. IYS representatives were also invited to give presentations at numerous meetings, including the National Center for Ecological Analysis and Synthesis seminar (Santa Barbara, California, February 13, 2017), the Ocean Research in Canada Alliance meeting (Ottawa, February 21 and 22, 2017), the Canada-USA Sockeye Enhancement workshop (Harrison Hot Springs, B.C., February 20–23, 2017), as well as numerous meetings with potential partner organizations. Additionally, presentations were planned at the 18th Salmon Ocean Ecology Meeting (Seattle, WA, March 21–23, 2017), the Transboundary Collections Symposium at the Washington-British Columbia American Fisheries Society Meeting (Spokane, WA, April 10–13, 2017), and the Arctic Encounter Symposium (Seattle, WA, April 13–14, 2017).

Considerable work has been done to lay the foundation of the IYS since the idea was first proposed by Canada in 2012. The IYS narrative of Technical Report 10 ends just prior to the first meeting of the NPSC, which was set to take place on February 28 and March 1, 2017, in Richmond, BC, with the goal of bringing together government, academic, NGO, First Nations, and industry partners to further engage in planning towards the implementation of the IYS. Next steps following the first meeting of the NPSC include planning the 2018 IYS Event/Symposium, development of an IYS website and brand, implementation of a SharePoint web-based environment for communication and coordination of committees and working groups, detailed planning of outreach and research themes, as well as completion of a results-based planning framework to guide planning, research, and outreach activities at the local, regional, basin and hemispheric scales, and development of a funding strategy and business model. Although considerable work remains towards implementation of the initiative, the IYS continues to gain momentum as an important international initiative that is uniquely collaborative in nature, and as such, is poised to have a significant impact in raising the capacity of outreach and research on salmon and people in a rapidly changing world.

References

North Atlantic Salmon Conservation Organization (NASCO). 2016. Decisions of the Council concerning the International Year of the Salmon (Section 5.2 of the Report of the Thirty-Third Annual Meeting of the Council). (Available at <http://www.nasco.int>).

Appendix J

International Year of the Salmon Working Group (IYS WG) Terms of Reference

The working group is composed of one or more members from each Party, and subject to approval by the CSRS. The CSRS designates one official chairperson who shall preside over the working group and act as the primary representative for the working group. The working group will report annually to CSRS on progress of its work that will include proposed changes in membership.

The primary goal of the IYS WG is to coordinate the planning and implementation of the North Pacific elements of the International Year of the Salmon initiative.

Subject to approval by CSRS:

The IYS WG shall:

- Participate in the IYS Coordinating Committee and Symposium Steering Committee;
- With assistance from the NPAFC Secretariat, develop and coordinate the North Pacific Steering Committee for the IYS including the following: Develop outreach activities, engage core partners, review progress, identify research priorities, support fund-raising for research, and establish reporting procedures;
- Draft an annual work plan for planning, outreach and research activities including IYS activities of CSRS Working Groups;
- In the final year of the IYS initiative prepare a synthesis and review of all aspects of the IYS initiative.

Appendix K

DRAFT Creative Brief for the International Year of the Salmon (IYS)

Prepared as a working document by the NPAFC Secretariat: Davis, N.D., J. Chang, H. Belongilot, M. Young, and W. Stanbury

The International Year of the Salmon

The IYS is a new initiative for a collaborative, international framework to raise the capacity of outreach, engagement and research to meet the challenges salmon and people face in a rapidly changing world.

IYS overall theme

Rallying people for salmon in a changing world.

Target audiences

As an outreach initiative, the widest audience is people in the Northern Hemisphere that may not directly rely on salmon resources and therefore may not have an interest in the status of wild salmon populations or understand the importance of the resource ecologically, socially, culturally, or economically. Other target audiences include groups that have an interest in the status of wild salmon and may wish to become involved in the initiative in either an outreach or research capacity. These groups include Indigenous peoples, conservation groups, government agencies, universities, aquariums, commercial fishers, sport fishers/outdoor recreation groups, scientists and seafood industries.

IYS keywords

Salmon, people, outreach, research, science, collaboration, international, engagement, integration, urgency, strategy, safeguarding, conservation, restoration, connectivity, climate change, recovery, healthy environments, future generations, stewardship, awareness.

IYS vision

Salmon have an extraordinary life history that puts them at risk from a number of environmental and human-caused factors. Through outreach efforts, the IYS seeks to raise awareness of what people can do to better ensure salmon and their varied habitats are conserved and restored against the backdrop of increasing environmental variability. The IYS also seeks to stimulate new investment in research and outreach to leave a legacy of data, knowledge and tools that equip a new generation of people better equipped to inform the conservation, restoration, and rational management of salmon. The enduring presence of salmon in our rivers, coastal waters and the high seas will be the most obvious and compelling indicator of a healthy relationship between people, salmon and the environment.

IYS scope

At the largest geographic scale, the IYS will cover the entire range of salmon in the Northern Hemisphere. Outreach and research will occur mainly at the basin (Pacific, Atlantic, Arctic, and Baltic) and jurisdictional level but also at the hemispherical scale. Focal species will be Pacific salmon (pink, chum, sockeye, coho, Chinook, and cherry salmon and steelhead) in the North Pacific and Atlantic salmon in the North Atlantic and Baltic.

Identity design project objective

The objective is to generate strong interest, widespread support, and cohesion for the IYS, and to compel target audiences to participate in the IYS. Target audiences will feel they have the capability to positively affect the future of wild salmon.

Tone

International, clean, and modern

Identity design project

To establish the “look and feel” of the IYS and create a logo and brand standards taking into account the options below:

- Logo:
 - Includes text “International Year of the Salmon”
 - Conveys salmon, people, and a hemispheric scope, and other keywords
 - Unique from NPAFC, NASCO, key partner’s, and previous “International Year of the X” logos
 - Not to be confused with other existing international organisations (*e.g.* FAO, UNICEF, UN)
 - Designed to be flexible for a variety of applications (*e.g.*, colour b&w, web and print applications)
- Brand Standards
 - Guidelines for logo use
 - Typography
 - Colour palette (international, contemporary colours)
 - Photography guidelines [subjects are inclusive; no models; real working people]
 - Stationary (business cards, letterheads, and envelopes → easily downloadable and available in black and white for printing purposes)
 - Banners for meetings
 - Templates (*e.g.* PowerPoint, brochures, posters)