

Status of the IYS: Connecting Salmon and People in a Changing Salmosphere

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Since at least the 1990s, declines in salmon productivity have been detected in the Pacific and Atlantic basins due to factors such as continuing poor marine survival and increasingly uncertain and variable environmental conditions. Each of the five species of Pacific salmon and steelhead trout have different responses and are vulnerable to climate and habitat change to varying degrees. Increasing our understanding and knowledge of the mechanisms driving salmon abundance, distribution and productivity may help us predict their responses to changing climate and habitats, which in turn can inform fisheries management systems and habitat restoration efforts to ensure the resilience of salmon for years to come.

The International Year of the Salmon (IYS) is a five-year outreach and research initiative of the North Pacific Anadromous Fish Commission (NPAFC) and the North Atlantic Salmon Conservation Organization (NASCO). Countries across the Northern Hemisphere are banding together in a new partnership of governments, Indigenous Peoples, academia, NGOs, streamkeepers, and industries to drive an intense burst of outreach, research, and network connections that will establish the conditions necessary for the resilience of salmon and people in a rapidly changing world. The focal year of the IYS was 2019, but associated events began in 2018 and will continue through to 2022.

While salmon have a high degree of resilience built into their genetic make-up, increasingly extreme and highly uncertain climate conditions coupled with continuous human activity threaten their survival. The epic migrations of salmon through rivers and oceans take them across borders, languages, cultures, and economies. Saving these beautiful and influential creatures requires a uniquely large-scale solution. To support the resilience of both salmon and the people and ecosystems that depend on them, we need to collectively share and generate new knowledge, spread awareness, make timely decisions, and engage our communities wherever salmon swim.



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classical communication theory, ideology, philosophy, surveillance culture, environmental communication, decolonization theory, and Indigenous rights. Camille currently sits as the Co-chair to the IYS Theme Council Group 4—Outreach and Communication. She is also a registered 200-hour yoga and fuse teacher.

In order to achieve this, the IYS has multiple research themes to further our understanding of the mechanisms behind salmon survival and productivity, and what this means to the people, ecosystems, and habitats that rely on them. The ocean is a complex and changing environment, which complicates salmon forecasting and makes studying them a challenge. The overarching IYS Outcomes listed in Table 1 are the general goals of the IYS Initiative.

The IYS has multiple ongoing Signature Projects that tie into the Research Themes and Outcomes. The information gathered from the Signature Projects will serve as a baseline for salmon research to continue after the completion of the IYS, and the connections and partnerships established will allow for better communication within the global community of salmon and people.

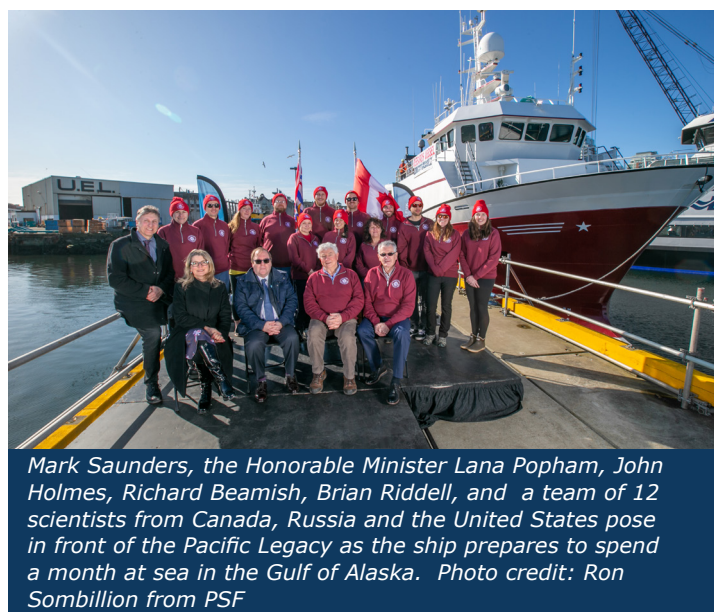
Currently, the most prominent IYS Signature Projects are the High Seas Expeditions, which

Table 1. International Year of the Salmon Research Themes.

IYS Outcomes	
Status of salmon	The present status of salmon and their environments is understood.
Salmon in a changing salmosphere	The effects of natural environmental variability and human factors affecting salmon distribution and abundance are understood and quantified.
New frontiers	New technologies and analytical methods are advanced and applied to salmon research. Research is carried out to fill gaps in poorly studied regions of the salmosphere.
Human dimensions	Communities, Indigenous Peoples, youth, harvesters, scientists, and resource managers across the Northern Hemisphere share knowledge and collaborate in the development of new tools and approaches to restore, manage, and sustain salmon.
Information systems	Freely available information systems contain historic and current data about salmon and their environment.
Salmon outreach and communication	People understand the value of healthy salmon populations and engage to ensure salmon and their varied habitats are conserved and restored against the backdrop of increasing environmental change.

are supported by numerous donors and include Canadian federal and provincial contributions through the BC Salmon Restoration and Innovation Fund (BC SRIF). The 2019 and 2020 GoA expeditions were privately organized by Dr. Richard Beamish and Dr. Brian Riddell while the organization and operation of the 2019 expedition was highly supported by the NPAFC Secretariat. Following the first GoA expedition in 2019, the IYS organized a session on the preliminary findings of the 2019 GoA in conjunction with the PICES Annual Meeting in October 2019. During this meeting, the IYS brought together experts from all five countries and those involved in the 2019 GoA, to discuss plans and research hypotheses for the 2020 and 2021 Expeditions. The two main hypotheses driving the 2019 and 2020 Expeditions were (1) that juvenile salmon survival is mostly determined by the end of their first winter at sea and (2) abundance at the end of the first ocean winter are an indicator of adult returns, which are anticipated in subsequent fisheries.

The 2020 GoA Expedition had a number of objectives, with the ultimate goal of identifying the mechanisms that naturally regulate salmon abundance in the ocean. On March 11, 2020, a team of 12 scientists from Canada, Russia, and the United States embarked on a month-long survey aboard the *Pacific Legacy*—a commercial fishing vessel turned into an oceanographic research vessel for the purpose of the expedition. Due to the unprecedented circumstances that took place surrounding the COVID-19 pandemic and resulting global quarantine, unique challenges were faced by our American scientists during their time at



Mark Saunders, the Honorable Minister Lana Popham, John Holmes, Richard Beamish, Brian Riddell, and a team of 12 scientists from Canada, Russia and the United States pose in front of the Pacific Legacy as the ship prepares to spend a month at sea in the Gulf of Alaska. Photo credit: Ron Sombillion from PSF

sea. In addition, the lockdowns resulting from the pandemic have slowed down data processing in labs as most of them have been closed since March. However, the 2020 GoA Expedition was successfully completed and researchers are continuing to analyze and process the data. The preliminary results have been presented, and have themselves increased our knowledge of the winter ecology of Pacific salmonids in the Gulf of Alaska.

Chief organizers of the 2020 expedition, Dr. Dick Beamish and Dr. Brian Riddell, were able to announce preliminary results from the expedition in a series of virtual press conferences put on by the International Year of the Salmon and the Pacific

Salmon Foundation. Dr. Beamish noted that in 2019, catches of Fraser River Sockeye were the lowest ever recorded, and there has been a declining trend in Pacific salmon abundance and catches in Canada overall. He showed that commercial salmon catches over the past 10 years have actually been the highest overall for all NPAFC member countries in the NPAFC database dating back to 1925. Chum salmon in Japan are produced from hatcheries, but since approximately 2004, total catches of chum salmon in Japan have decreased by about 70% despite consistent hatchery releases. Therefore, the declining trend is likely a result of changing ocean conditions, particularly around Japan. The opposite trend for pink and chum salmon in the Russian Federation has produced their highest catches in the NPAFC database dating back to 1925. These increasing trends in catches could also be related to improved ocean production as both pink and chum spend very little time in freshwater. These results show us that there are changes in the ocean that are affecting salmon production and abundance differently around the Pacific Rim.

When the 2020 area surveyed is adjusted to the 2019 area, estimates of total salmon abundances are identical, at 55 million salmon. More will be understood about the relevance of these estimates when the returns to rivers are known this year. Scientists are anxiously waiting to analyze the remaining data from the 2020 Expedition as labs are beginning to reopen from the pandemic lockdown, which will hopefully mean that more information on salmon abundance and changing ocean conditions will be provided before the multi-vessel 2021 Pan-Pacific High Seas Expedition takes off.

The IYS Pan Pacific Winter Expedition of 2021 is an IYS Signature Project that will send out multiple vessels to the North Pacific Ocean to survey Pacific

salmon in the high seas. This project builds on the 2019 and 2020 GoA Expeditions. Along with increasing our understanding of the mechanisms driving Pacific salmon survival and productivity, these surveys will provide information on Pacific salmon distribution and abundance. The NPAFC member countries (Canada, Japan, the Republic of Korea, the Russian Federation, and the United States) are working collaboratively around the Pacific Rim to ensure a successful Expedition with the greatest surface area possible to be covered by multiple vessels sampling simultaneously.

Another IYS Signature Project is the Likely Suspects Framework (LSF). The Likely Suspects Framework takes a general approach to estimating the numbers of fish associated with each life-history stage for a population of salmon and identifying the candidate mortality factors (the Likely Suspects) within an overall spatio-temporal framework (the Likely Suspects Framework), which covers the freshwater migration and marine phases of the salmon life cycle.

To further develop the LSF, a series of virtual workshops funded by the Pacific Salmon Commission (PSC) termed 'Salmonscape' will be held during the winter and spring of 2020–2021. The IYS is working on conducting a series of virtual workshops that will guide the development of this initiative. Topic sessions include:

- Review of methods including life history models, risk assessment frameworks, Likely Suspects Framework, Ecosystem models, and Individual-based models.
- Recommendation for an integrated life history-based approach to assessing and modelling the factors affecting survival.



IYS North Pacific Steering Committee and IYS Working Group meetings on February 25–28, 2020, in Vancouver, BC. Photo credit: NPAFC Secretariat



Aleksey Somov and Albina Kazneparova conduct on-board survey research during the 2020 Gulf of Alaska Expedition. Photo credit: Svetlana Esenkulova

- Development of management case-use studies. Managers will be engaged in the development of these case-use studies. An example would be a scenario considering the management of a stock where enhanced hatchery production is being considered as an approach to sustaining a population or a fishery.
- Approaches to data synthesis to support case-use studies.

The IYS Team is submitting a BC SRIF proposal to implement two management case-use studies during 2021/2022. At the conclusion, an overview paper will be produced to describe the approach and recommend best practices for broad implementation.

One of the most significant impediments to international research efforts to understand the mechanisms driving changes in salmon productivity is the lack of readily accessible and standardized data for salmon populations and their ecosystems. The IYS is working with partners like the Hakai Institute, the National Center for Ecosystem Analysis and Synthesis in Santa Barbara California, and the Atlantic Salmon Trust to develop solutions. A graph database is being considered as the ultimate tool to house and discover data. The Hakai Institute is developing a data management plan for high seas expedition data using Global Ocean Observing Systems (GOOS) Protocols. This system will contain standardized, open-access data from all IYS Expeditions (2019, 2020, and 2021), along with providing information that can be used in the Likely Suspects Framework. This information can then be utilized by research and management communities.

The IYS has committed to increasing its outreach and communications strategy to include the IYS research objectives and signature projects into its dominant narrative. The IYS has increased its online presence and has collaborated with various salmon organizations in the online public sphere to expand knowledge networks on social media platforms. Our outreach online has expanded our networks and connections, and given us an opportunity to share, promote, and learn about salmon-related events around the North Pacific. In addition, the IYS has been steadily upgrading its website by updating signature projects and events, writing articles, and sharing narratives. The ultimate goal is to have a broad knowledge hub of IYS signature projects, events, research efforts, partnerships, and connections available online. Our outreach and communication also includes hosting in-person and virtual media events for our signature projects, the most notable being the events at the launch and arrival of the High Seas Expeditions. The 2021 Pan-Pacific High Seas Expedition launch will be our biggest event yet, with effective media event planning, strategic ship to shore communications, and a plan to share updates from the expedition to our networks and the scientific community.

Despite the COVID-19 pandemic, the IYS is forging ahead with determination and urgency. Over the last several months, the IYS has been able to bring together partners from across the Northern Hemisphere and has made great strides in advancing the IYS Signature Projects. The IYS continues to build international collaborations to advance all IYS outcomes and is looking forward to developing other projects related to these outcomes in its final two years of outreach.



The IYS team from left to right: Camille Jasinski, Stephanie Taylor, Mark Saunders, Moronke Harris, and Laura Tessier at the 2020 Gulf of Alaska Expedition Launch in Victoria, BC, Canada.