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Preliminary Summary of Information Collected during the Gillnet and Longline Survey Onboard the F/V *Raw Spirit* from February 25–March 25, 2022 as Part of the 2022 International Year of the Salmon

by

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Abstract

The 2022 International Year of the Salmon Pan-Pacific Winter High Seas Expedition was developed from the original proposal submitted to the NPAFC in 2012 (Beamish 2012) and the initial two winter surveys conducted in the GOA in 2019 and 2020 (NPAFC 2019, Beamish and Riddell 2020). The original proposal and the first two surveys highlighted the importance of identifying the mechanisms that regulate Pacific salmon abundance, how changes in climate could result in major abundance changes in the future and how working in the Pacific in the winter could provide new and important information to help us test hypothesis on mechanisms regulating survival. The gillnet and longline survey using the charter vessel, the F/V *Raw Spirit*, was the third privately financed and organized expedition to study the factors affecting the survival of Pacific salmon in the Gulf of Alaska in the winter. This third expedition used gillnets and longlines to capture Pacific salmon as a way to compare catches with trawl gear that was being fished by other vessels in the 2022 Pan-Pacific Expedition and specifically with the Canadian research vessel, *Sir John Franklin*. The catches from the gillnets and longlines will also be compared with the major international studies from the 1960s to 1990s that used similar gear. This 2022 expedition covered the southeastern portion of the Gulf of Alaska between February 25 and March 25, 2022. A research team of 8 researchers including two commercial fishermen from Canada participated on the F/V *Raw Spirit*. Chrys Neville of Fisheries and Oceans Canada was the Chief Scientist on the vessel. Funding for this portion of the 2022 Expedition was raised and secured by R.J. Beamish and B. Riddell. In total, 202 salmon were caught during the gillnet and longline survey, including 30 chum salmon (*Onchorhynchus keta*), 51 coho salmon (*O. kisutch*), 53 sockeye salmon (*O. nerka*), 10 pink salmon (*O. gorbuscha*), one Chinook salmon (*O. tshawytscha*), 57 steelhead trout (*O. mykiss*). Information from the survey is currently being analyzed. This report provides an overview of the samples collected by the F/V *Raw Spirit* and some preliminary results from the survey.

Keywords: Pacific salmon, North Pacific Ocean, winter salmon ecology, surface gillnet, surface longline

Introduction

The 2022 International Year of the Salmon Pan-Pacific Winter High Seas Expedition was an international effort coordinated by NPAFC to study the winter distribution of Pacific salmon across the North Pacific and to demonstrate the importance of working as international teams of researchers to understand the factors that affect the survival of Pacific salmon. The surveys were built and designed after the successful expeditions in 2019 and 2020 that were organized and deployed by R.J. Beamish and B. Riddell (NPAFC Secretariat 2018, Beamish and Riddell 2019, Pakhomov et al. 2019, Somov et al. 2020). The 2022 Expedition was expanded to include multiple vessels and is the largest ever multinational survey to study salmon in the North Pacific Ocean during the winter.

Significant resources around the Pacific have been invested to understand factors that determine salmon productivity and marine distributions. However, the mechanisms regulating marine survival have not been identified and science is not able to explain the overall increasing abundance of salmon in the North Pacific since the 1970s, the decline in the proportion of these salmon returning to Canada, Japan and the southern US, or the increased variability in returns (Beamish 2022). The IYS 2019 and 2020 expeditions provided new information on the winter period for Pacific salmon in the eastern Pacific. The NPAFC/IYS survey in 2022 expanded the recent survey area to provide additional information from over a broader region of the North Pacific.

The 2022 gillnet and longline survey was designed to address some key objectives (Riddell et al. 2022).

1. Compare catches using gillnet and longline gear with catches from trawls to determine how to interpret the trawl catches relative to total abundances of Pacific salmon in the Gulf of Alaska in the winter.
2. Collect data and biological samples for Pacific salmon stock identification, age determination, growth rates, condition and diet.
3. Collect scales from the area of a fish that allows reliable estimates of growth during the winter and prior to the winter that will help test the hypothesis that winter is a period of minimal growth and only the fastest growing juveniles survive the first ocean winter.
4. Determine if there are relatively few predators within the distribution of Pacific salmon.
5. Use the data collected, along with data collected by researchers on the four other research ships, to develop methods to identify the reasons for the recent collapse of the salmon fisheries in British Columbia and provide advance information about the abundances of Pacific salmon returning to BC rivers.

This is a preliminary report of the results from the 2022 IYS Expedition onboard the F/V *Raw Spirit*. More detailed reports will be completed before the end of 2022.

Materials and Methods

The *FV Raw Spirit* fished gillnet and longline gear rather than a surface fishing trawl net. The survey area was the same region being fished by the CCG *Sir John Franklin* in the eastern Gulf of Alaska (Figure 1. Riddell et al. 2022). The fishing period was February 25 to March 25, 2022.

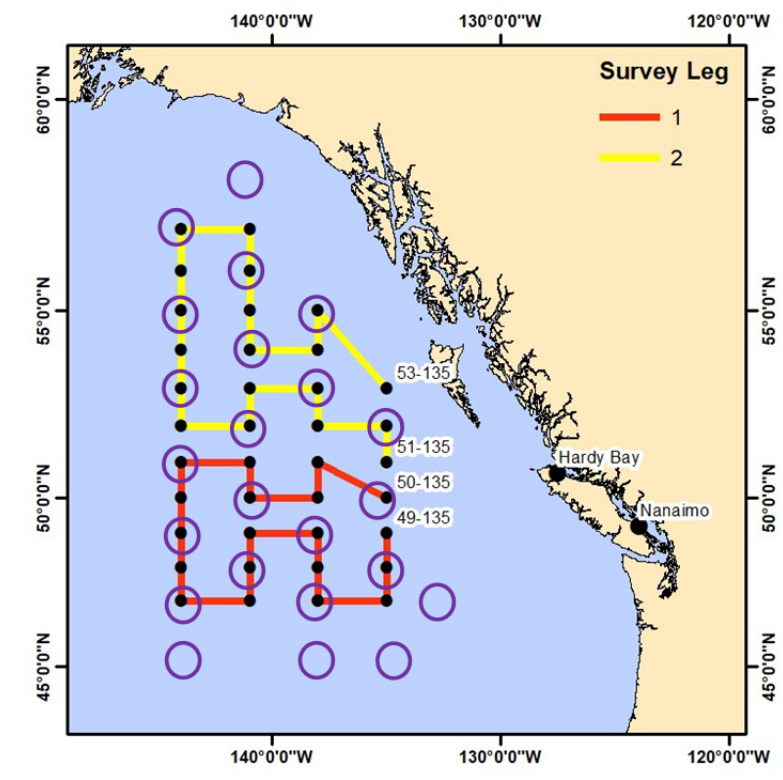


Figure 1 Set locations for the *Sir John Franklin*. Circles are possible gillnet and longline locations dependent on locations the *Sir John Franklin* fishes at night and on weather conditions.

This survey was supported by funding secured by R.J. Beamish and B. Riddell from multiple sources including the Great Pacific Foundation, the Pacific Salmon Foundation, BC Northern Development and Innovation, Central Coast First Nation Alliance, the BC Salmon Restoration and Innovation Fund (Project 2020_238), 18 Canadian and US fishing interests, and Parkland Fuels. The F.V. Raw Spirit was chartered from the Independent Seafood Canada Corporation, Port Alberni, B.C. The project was administered through the Pacific Salmon Foundation, Vancouver, BC. Chrys Neville of the Department of Fisheries and Oceans Canada was the Chief Scientist for this survey. The science team included seven additional researchers from Canada. Two of the researchers were commercial fishermen with expertise building and fishing longlines.

The detailed sampling protocols are outlined in Riddell et al. 2022. The typical survey stations consisted of

1. Deployment of one or two surface gillnets (each 2.4 km). Each net consists of 3 tans (50m panel) each of variable mesh sizes (48, 55, 63, 72, 82, 93, 106, 121, 138,

and 157 mm) combined with 9 panels of ‘commercial’ gillnets (115 mm mesh size) at each end of net.

2. Deployment of one or two surface longlines (1.5km). Hooks on 1m leads with spacing approximately 3m apart. Bait used combination of anchovy, herring and squid.
3. Each gillnet and longline deployed was monitored via satellite communication buoys (MetOcean Stokes drifters¹) and lights.
4. CTD casts to 350m
5. eDNA sample from 5m
6. Vertical Bongo net to 350 m
7. Observations of marine mammal and seabirds
8. Ocean plastic monitoring by GoPro mounted on port railing during daylight hours.

For additional details on the protocols used, please refer to Riddell et al. 2022.

Preliminary Findings

These are preliminary results only. Due to multiple gear types and mesh sizes of gillnets, further analysis is required before release of more detailed results. As part of the objectives of this survey, future analysis will include comparison with INPFC historic longline and gillnet surveys as well as with a comparison with the CCG *Sir John Franklin* trawl catches in 2022. This report provides a summary of total salmon catches and information on other species encountered or observed during the survey.

The first leg of the survey targeted the southern part of the survey area (Figure 2). The weather during this leg was good with seas consistently less than two meters during fishing operations. Both gillnets and longlines were fished at most stations. Additionally, as planned, fishing south of the survey grid was accomplished. These sets were primarily to look for pink salmon which were only encountered in small numbers by both Canadian and US trawl vessels. The second leg of the survey was scheduled to be conducted in the norther region of the survey area (Figure 1). However, very poor weather (seas > 5m) made this impossible and the vessel returned to the southern region to do additional work. Seas during the second leg were regularly over 3m and reduced fishing opportunities, especially for the gillnet which required seas less than 3m for effective fishing. Soak times of gear were modified to take advantage of weather windows.

In total 16 stations were fished and 19 gillnet sets and 17 longline sets were completed. A total, 202 salmon were sampled during the gillnet and longline survey, including 30 chum salmon (*Onchorhynchus keta*), 51 coho salmon (*O. kisutch*), 53 sockeye salmon (*O. nerka*), 10 pink salmon (*O. gorbuscha*), one Chinook salmon (*O. tshawytscha*), 57 steelhead trout (*O. mykiss*).

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Based on length frequency data, mixed age-classes were observed for the salmon that spend one or more winters at sea. Non salmon catch included boreal clubhook squid (*Onychoteuthis borealijaponica*), black rockfish (*Sebastes melanops*), spiny dogfish (*Squalus acanthias*), longnose lancetfish (*Alepisaurus ferox*), and juvenile skilfish (*Erilepis zonifer*). Two salmon sharks (*Lamna ditropis*), two dall's porpoise (*Phocoenoides dalli*) and a fur seal (*Callorhinus ursinus*) were caught in the gillnets and/or buoy lines. None of these were landed. There was minimal interaction with marine birds. Two puffins (*Fratercula corniculata*, *F. cirrhata*) were caught in gear and perished. One Laysan albatross (*Phoebastria immutabilis*) that was tangled in gear while feeding on a salmon in the net, was released successfully. The survey did encounter a rare booby (either Nazca (*Sula granti*) or Masked (*S. dactylatra*)) that landed on the deck of the ship during a storm. The observation of this bird is of note as rare for this area.

CTD casts and eDNA water samples were collected at every station. Plankton collection by bongo net could not be completed at four of the stations due to high wind.

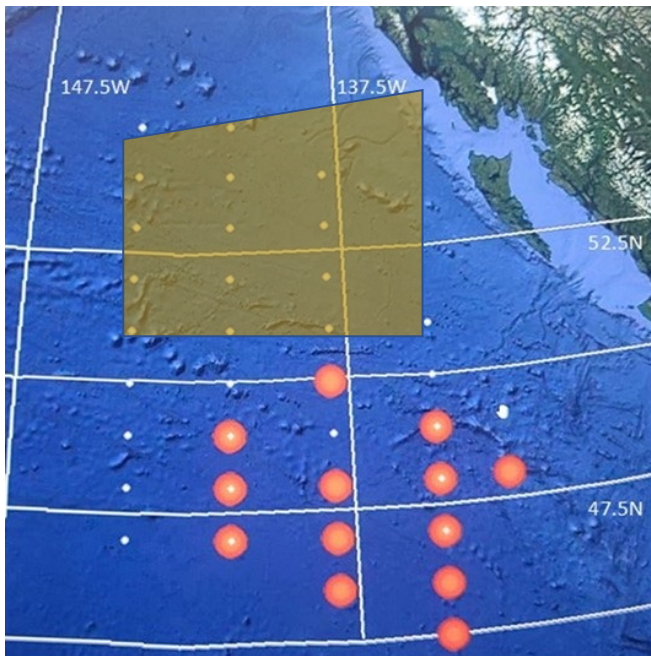


Figure 2. Map of study area and F/V *Raw Spirit* station. Dots indicate location of *Sir John Franklin* stations scheduled to be fished. Circles indicate stations fished by gillnet/longline. Brown polygon is northern region of study area was not fished by gillnet/longline vessel due to poor weather.

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