



## North Pacific Fisheries Commission

NPFC-2022-SC07-OP01

### Progress report on the 2022 IYS Winter High Seas Research Expedition

In April, the 2022 Pan-Pacific Winter High Seas Expedition ended with the maximum possible success under the circumstances. Five expedition vessels from Canada, Russia, and the United States covered more than 1.5 million km<sup>2</sup> by a regular integrated survey to study Pacific salmon distribution and winter ecology in February–April 2022. These vessels spent 182 days at sea including 96 days on survey, completed 126 survey stations, and caught 1,623 salmon, mostly sockeye (46.1%) and chum (35.5%). See the finalized survey map attached (Figure 1).

This was the first international research expedition to combine such wide geographical scope in the high seas during the least-studied winter season with such a variety of methods and approaches including sampling by trawl, gillnet, and three types of plankton nets, oceanographic and hydrochemical research, hydroacoustic monitoring, and macro- and microplastic pollution observations. Novel technologies such as gliders, environmental DNA and genetic stock identification were used to enhance research efforts. Total Expedition expenses paid by the NPAFC reached \$2,393,865.49. NPFC contributed about 2.2% of this amount. Including the NPAFC Parties' in-kind contributions, the Expedition budget totaled around \$6.9M.

In the offshore part of the Alaska Stream domain, water temperature in the surface layer varied from 4.5 to 8.2°C, in inshore part (within the U.S. EEZ) – from 3.3 to 5.6°C. Salinity at the ocean surface (SSS) varied from 32.45 to 33.39 psu. In the western Gulf of Alaska, sea surface temperatures showed a strong north-south gradient, with temperatures as low as 3.0°C in the north and slightly exceeding 9°C in the south. Surface salinity was relatively constant across the study area with a range of 32.12 – 32.79 (PSS-78). In the eastern Gulf of Alaska, observed SST ranged from 4.2 – 8.8°C. Observed SSS showed low variability, ranging from 32.18 – 32.64 (PSS-78) indicating euhaline conditions throughout the survey area.

As for the biological structure of nekton and macroplankton community of upper epipelagic layer, it was rather similar to survey areas within the Gulf of Alaska. Pacific salmon constituted 23.7%-28.6% of total catch weight. In the offshore central Pacific Ocean, Pacific salmon portion in total weight of catch grew to 41.2%, and in the Alaska Stream domain – up to 77.8%. Jellyfish contributed from 52.6% to 64.0% in three survey areas, while in the Alaska Stream domain their portion decreased below to 13.8%. Contrarily, squid portion increased from 1.6%-4.4% in three mentioned survey areas to 8.4% in waters near central part of the Aleutian Islands chain.

Two salmon sharks *Lamna ditropis* were captured, tagged by satellite tags, and successfully released. Their migration trajectories show that salmon shark overwinter at low latitudes, where they can feed upon gregarious pelagic fish including sardine, saury, and mackerel. Among other pelagic predators, ten juvenile specimens of North Pacific daggertooth *Anotopterus nikparini* were caught throughout the survey area, mainly in the Alaska Stream domain.

Mesopelagic fauna was not abundant in the upper epipelagic layer. Four species of myctophids and one bathylagid species were encountered in trawls catches. Blue lanternfish *Tarletonbeania crenularis* was sole species observed in all survey areas with its larger contribution (3.1% of the total catch weight) in the eastern Gulf of Alaska. Typical species of oceanic epipelagic domain including ragfish *Icosteus aenigmaticus*, medusafish *Icichthys lockingtoni*, and prowlfish *Zaprora silenus* met rarely in single quantities.

Anadromous three-spine stickleback *Gasterosteus aculeatus* was the most abundant non-salmon fish species with the highest catches in the eastern Gulf of Alaska (n = 3,298) and the Alaska Stream domains (n = 5,737). This species dispersed to high seas from inshore waters similarly to juvenile salmon. Three-spine stickleback outbreaks are sporadically observed in several rivers of the Kamchatka Peninsula with subsequent increase of its abundance in adjacent seas. Three vagile specimens of black rockfish *Sebastes melanops* were captured as well as in the Gulf of Alaska in winter of 2019 and 2020.

Catches of NPFC species of interest were rare due to survey limitation to northern and eastern parts of the NPAFC Convention Area. One specimen of Pacific sardine *Sardinops sagax* occurred in trawl sample at 45°N 135°W at SST = 9.33°C. Juvenile skilfish *Erilepis zonifer* was caught by gillnet in the southeastern Gulf of Alaska. There were no eDNA traces for the NPFC priority species found throughout the survey area. Despite R/V *Professor Kaganovskiy* sampled Japanese anchovy *Engraulis japonicus* (in abundance), Japanese sardine *Sardinops melanostictus*, and mackerels *Scomber japonicus* and *S. australasicus* at SST = 4-5°C in the near-coastal northwestern North Pacific in December 2021, such cold-water dwelling is likely unusual for the high seas in February-April. This information can be useful for the planning of scientific research cruises to study the NPFC priority species.

In summary, the 2022 IYS Pan-Pacific Winter High Seas Expedition collected a significant array of new information on status of epipelagic nekton communities in the northern North Pacific Ocean in winter. As the IYS prepares to sunset at the end of 2022, it is time to develop a legacy initiative. The UN Decade of Ocean Science (UNDOS) endorsed the NPAFC& PICES project titled *Basin-scale Events to Coastal Impacts (BECI): An Ocean Intelligence System for a Changing World* (see <https://beci.info/>). NPFC could consider participation in the BECI to promote understanding the impacts of climate on the ocean, pelagic food web and marine ecosystems as a whole.

The NPAFC reiterates its deep appreciation to NPFC for its invaluable contribution to the IYS Expedition budget as well as planning and information support.

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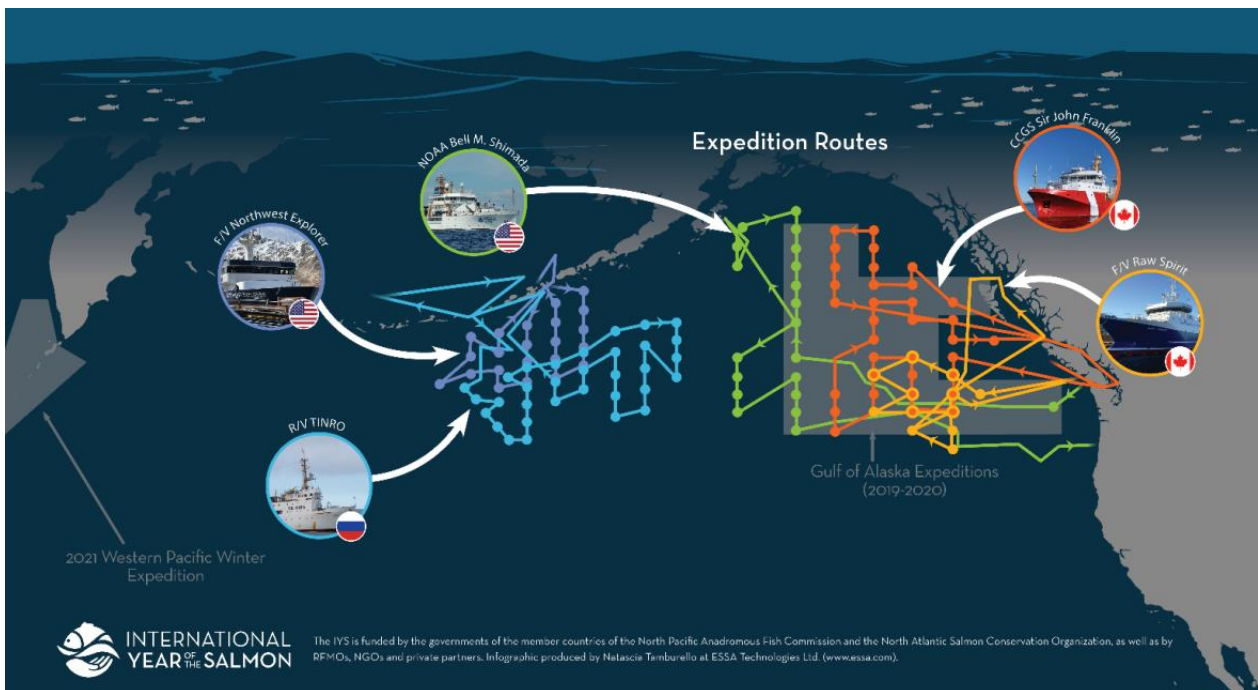


Figure 1. The 2022 IYS Pan-Pacific Winter High Seas Expedition zone map with completed vessel routes

2022 IYS Pan-Pacific Winter High Seas Expedition cruise reports:

King, J., C. Freshwater, A. Tabata, and T. Zubkowski. 2022. Preliminary findings of the International Year of the Salmon Pan-Pacific Winter High Seas Expedition onboard the CCGS Sir John Franklin during February 19–March 21, 2022. NPAFC Doc. 2048 (Rev. 1). 9 pp. Fisheries and Oceans Canada, Pacific Biological Station (Available at <https://npafc.org>).

Neville, C., R.J. Beamish, and B. Riddell. 2022. 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. NPAFC Doc. 2049. 6 pp. Fisheries and Oceans Canada, Pacific Biological Station, and Pacific Salmon Foundation (Available at <https://npafc.org>).

Murphy, J., J. Dimond, E. Price, J. Lerner, T. Sheridan, M. Baker, C. Graham, E. Farley, and M. Saunders. 2022. Preliminary findings of the International Year of the Salmon Pan-Pacific Winter High Seas Expedition onboard the F/V Northwest Explorer during April 3–17, 2022. NPAFC Doc. 2054 (Rev. 1). 29 pp. National Oceanic and Atmospheric Administration, University of British Columbia, Sheridan Consulting, LLC, North Pacific Research Board, and North Pacific Anadromous Fish Commission (Available at <https://npafc.org>).

Weitkamp, L., E. Farley, A. Andrews, A. Billings, B. Chasco, C. Deeg, I. Ekmanis, S. Garcia, B. Gray, K. Howard, C. Kovach, S. Lindley, M. Litz, R. McCabe, J. Moss, J. Murphy, D. Nicolls, A. Pinchuk, T. Rogers, K. Shedd, W. Strasburger, G. Troina, A. Wells, B. Wells, and E. Wisegarver. 2022. Preliminary findings of the International Year of the Salmon Pan Pacific Winter High Seas Expedition onboard the NOAA Ship Bell M. Shimada, February 1– March 7, 2022. NPAFC Doc. 2060. 30 pp. (Available at <https://npafc.org>).

Somov, A.A., A.A. Starovoytov, D.N. Chulchekov, K.K. Kivva, A.S. Khleborodov, V.I. Polyanichko, Y.Y. Korolev, A.O. Bezverkhnyaya, S.V. Novokreshchennykh, V.A. Soshnina, I.N. Mukhametov, V.F. Parkhomchuk, G.A. Kantakov, and E.A. Pakhomov. 2022. Preliminary findings of the International Year of the Salmon Pan-Pacific Winter High Seas Expedition onboard the R/V TINRO during March 2–20, 2022. NPAFC Doc. 2061. 25 pp. (Available at <https://npafc.org>).