

Gulf of Alaska Expeditions, 2019 and 2020

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PICES, 2020 Annual Meeting, Session 14 (Oct. 28, 2020)



RV Professor Kaganovsky (2019)



Pacific Legacy No. 1 (2020)



CANADIAN PROGRAM SUMMARIES



COMPILED BY
Isobel Pearsall and Brian Riddell
Pacific Salmon Foundation, 2020



Salish Sea Marine Survival Project

Strait of Georgia, Puget Sound, and Juan de Fuca Strait

<https://marinesurvivalproject.com/>

Strait of Georgia Data Centre

University of British Columbia, Sitka Foundation, and PSF

<http://sogdatacentre.ca>

SSMSP is an ecosystem-based, international science program to understand determinants of salmon production annually in the **Salish Sea**. (2014-2018) Focus on Chinook, Coho, Steelhead, and limited consideration of Sockeye salmon.

Primary Hypothesis: Critical size–critical period hypothesis (Beamish and Mahnken 2001) that suggests that Pacific salmon populations experience two size-related survival bottlenecks—one due to predation during their first marine summer *and the other due to starvation during their first marine winter—that largely regulate marine survival.*



Study Objectives in Gulf of Alaska

- **Is the first winter at sea a major determinant of salmon production?**

Fish that grow faster and quicker in the first months at sea will survive the first ocean winter better than smaller fishes, consequently ***adult salmon abundance is strongly influenced by survival of juvenile salmon at the end of the first ocean winter.***

- ***Can we improve salmon forecasts?***

Does marine research to assess environmental conditions and its impact Pacific salmon improve our ability to forecast subsequent returns to our coastal waters and communities?

Web sources/links and Contacts

1) Main websites: <https://yearofthesalmon.org/gulf-of-alaska-expedition-2/> (2019)

<https://yearofthesalmon.org/gulf-of-alaska-expedition2020/>

2) <https://npafc.org/iys/> Provides access to the initial **2020 cruise report**:

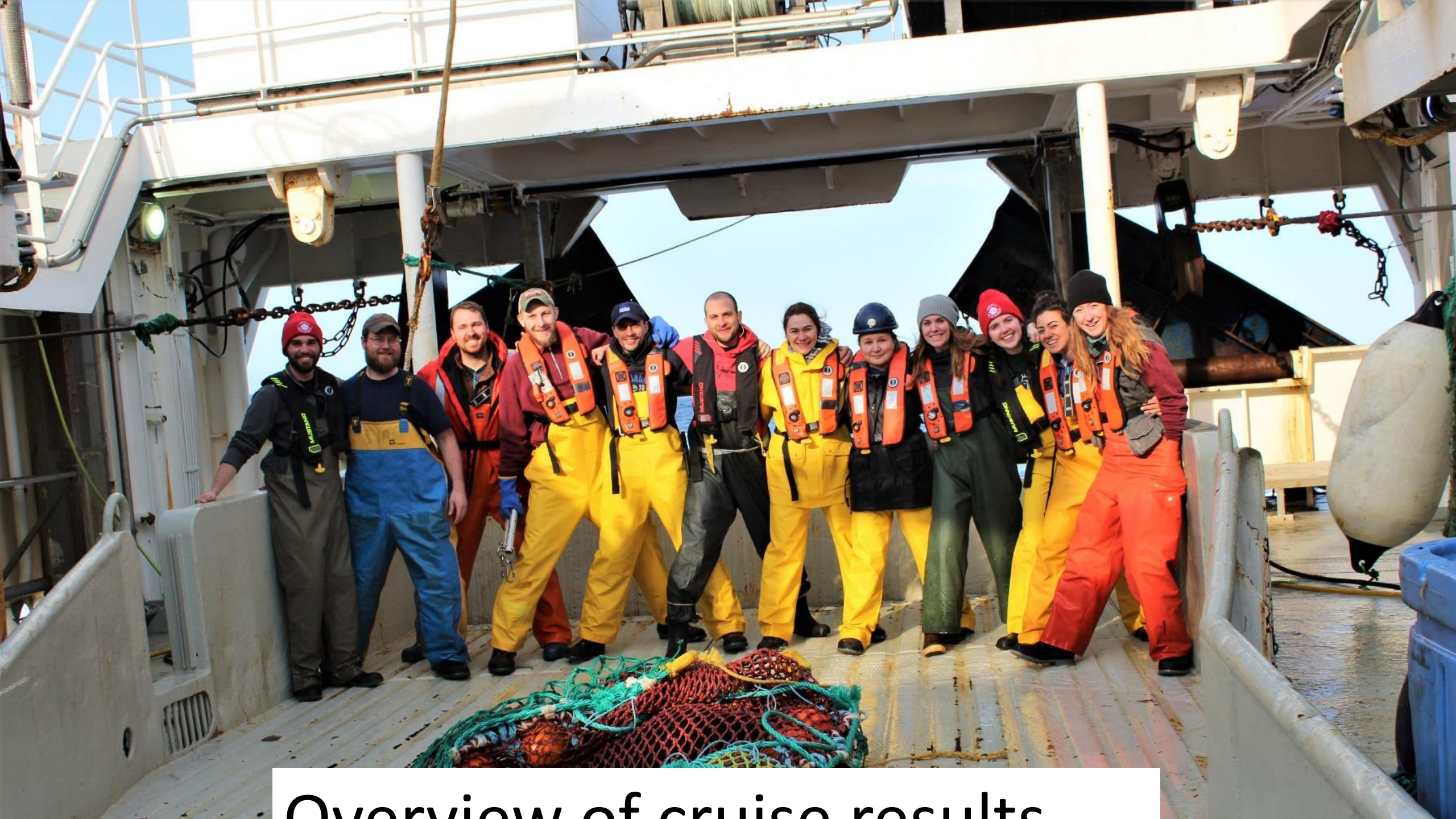
Preliminary Findings of the Second Salmon Gulf of Alaska Expedition Onboard the R/V *Pacific Legacy* March 11–April 7, 2020 as Part of the International Year of the Salmon

3) <https://npafc.org/wp-content/uploads/Public-Documents/2019/1858Prof-Kaganovskiy-Cruise-Summary.pdf>

Summary of Preliminary Findings of the International Gulf of Alaska Expedition Onboard the R/V Professor Kaganovskiy During February 16–March 18, 2019 (*website also has a very good PPT presentation*)

Contacts: Brian Riddell (604) 763-1899 briddell@psf.ca

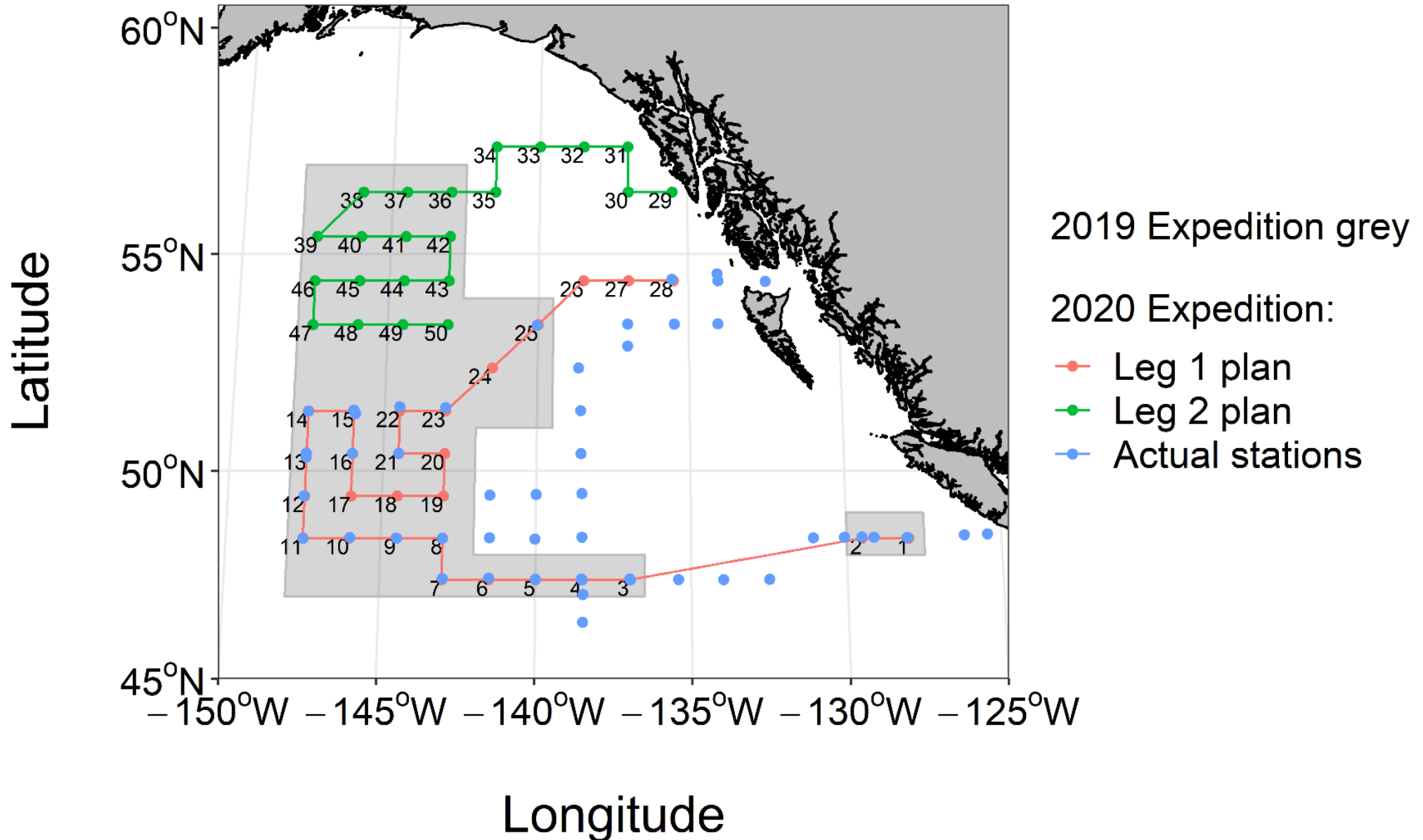
Dick Beamish (250) 758-2574 Richard.Beamish@dfo-mpo.gc.ca



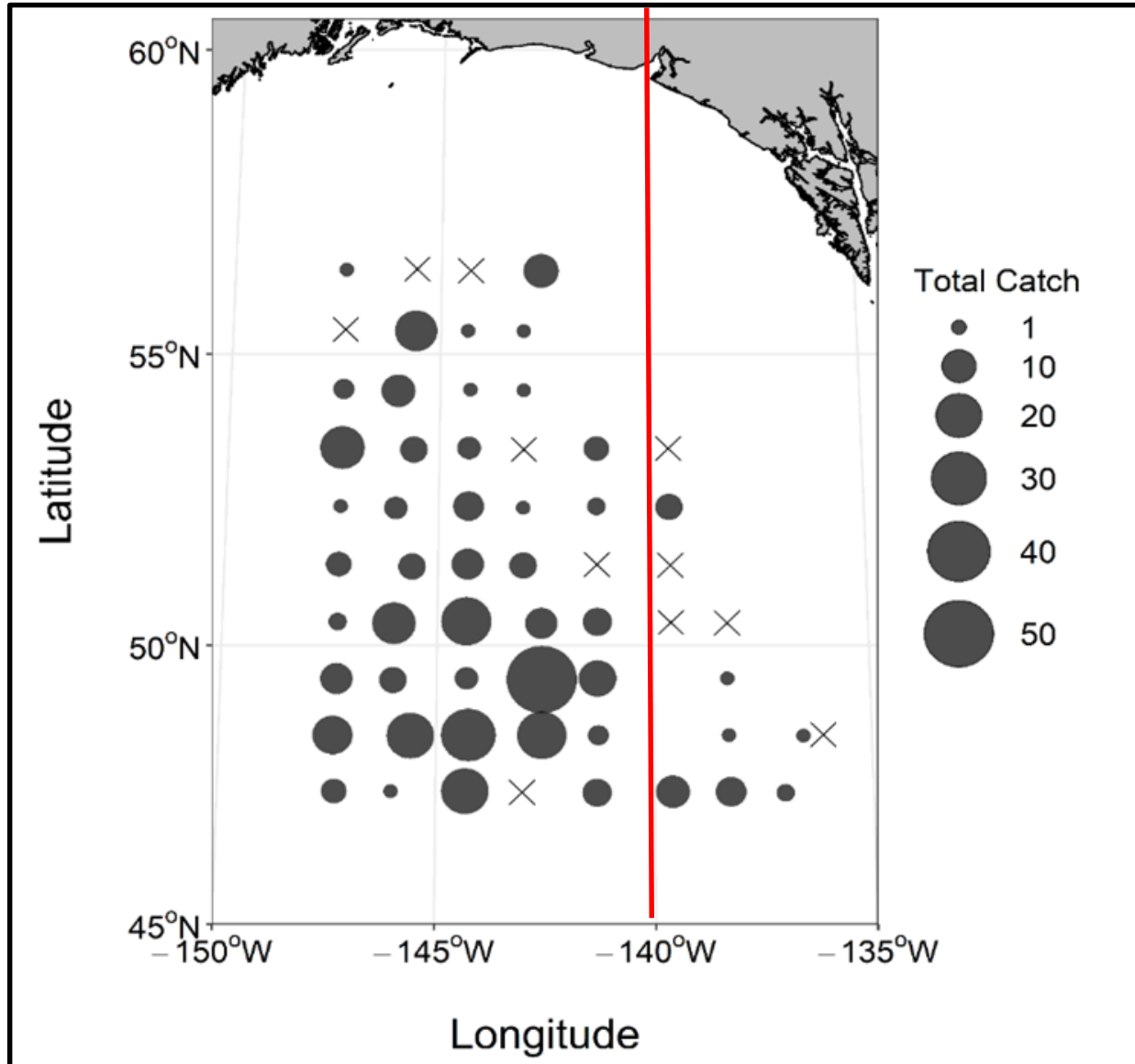
Overview of cruise results

Gulf of Alaska
2020 Cruise
plan super-
imposed over
the 2019
survey area
(**grey zone**).

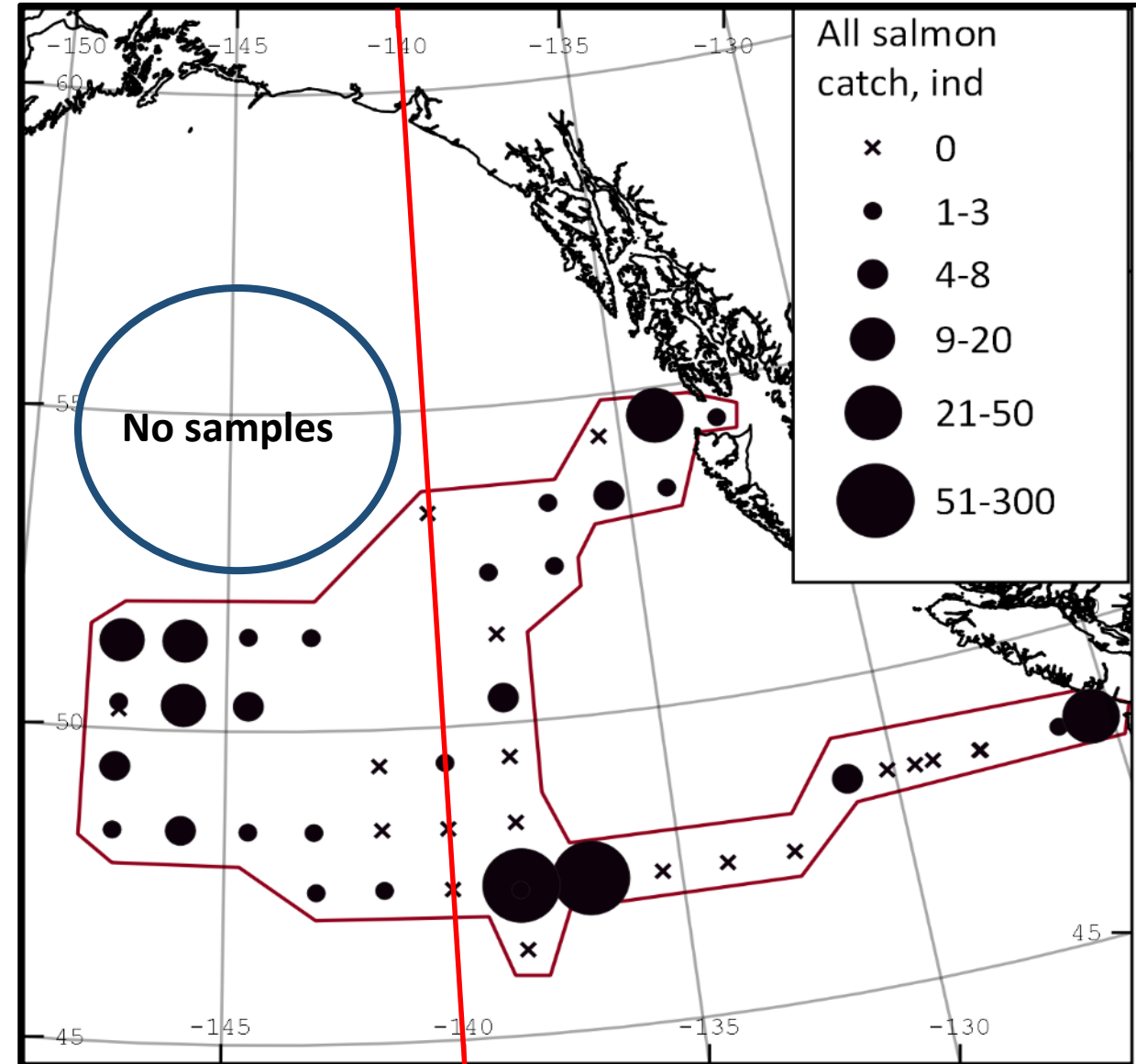
Blue circles
represent the
actual
sampling
stations
during the
2020 cruise.



2019 Salmon catch distribution

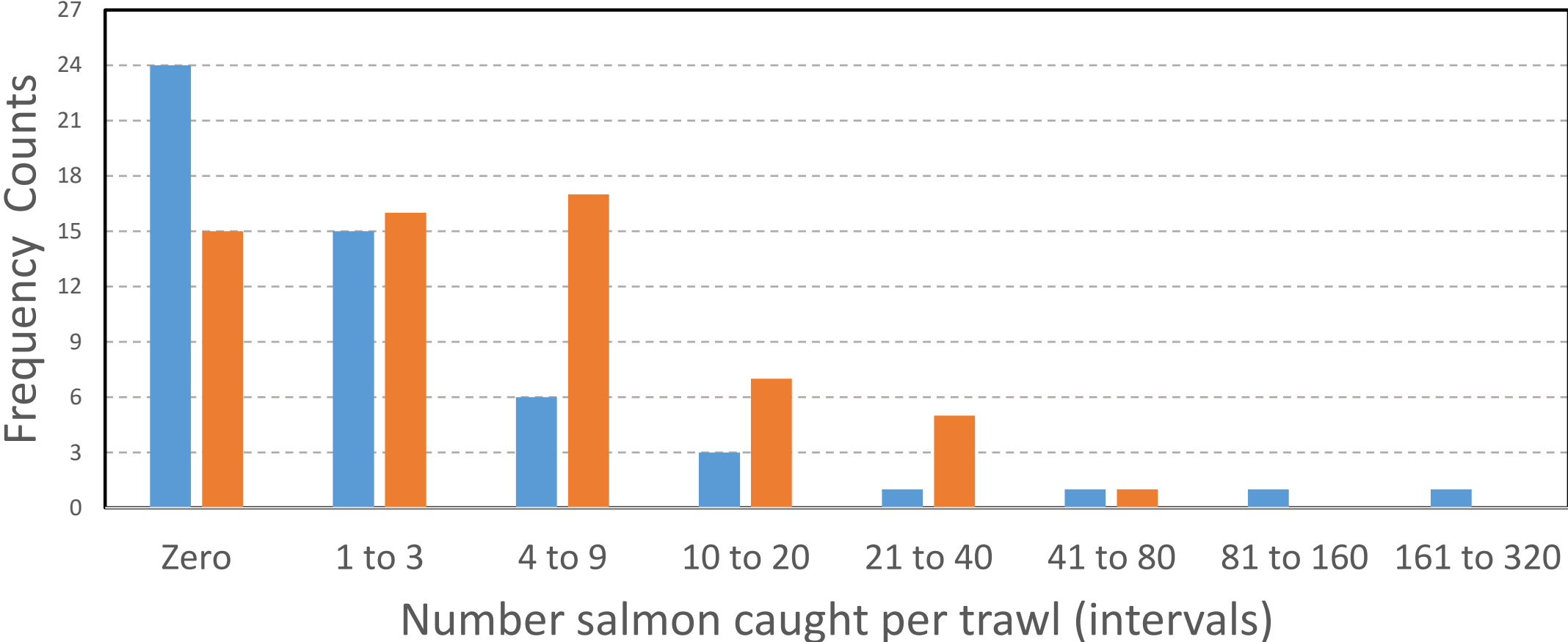


2020 Salmon catch distribution



Distribution of salmon catches by trawl set

■ 2020 (52 trawls) ■ 2019 (61 trawls)



Comparison of Salmon Catches
between years ...



2020-06-08

Year	2019	2020
Trawl sets:	58	52
Salmon catches:		
Chum	222	234
Pink	30	136
Sockeye	68	51
Coho	94	118
Chinook	3	26
Steelhead	0	1
Total	417	566
<i>Estimated total abundance in Millions</i>	55.00	51.30

Comparison

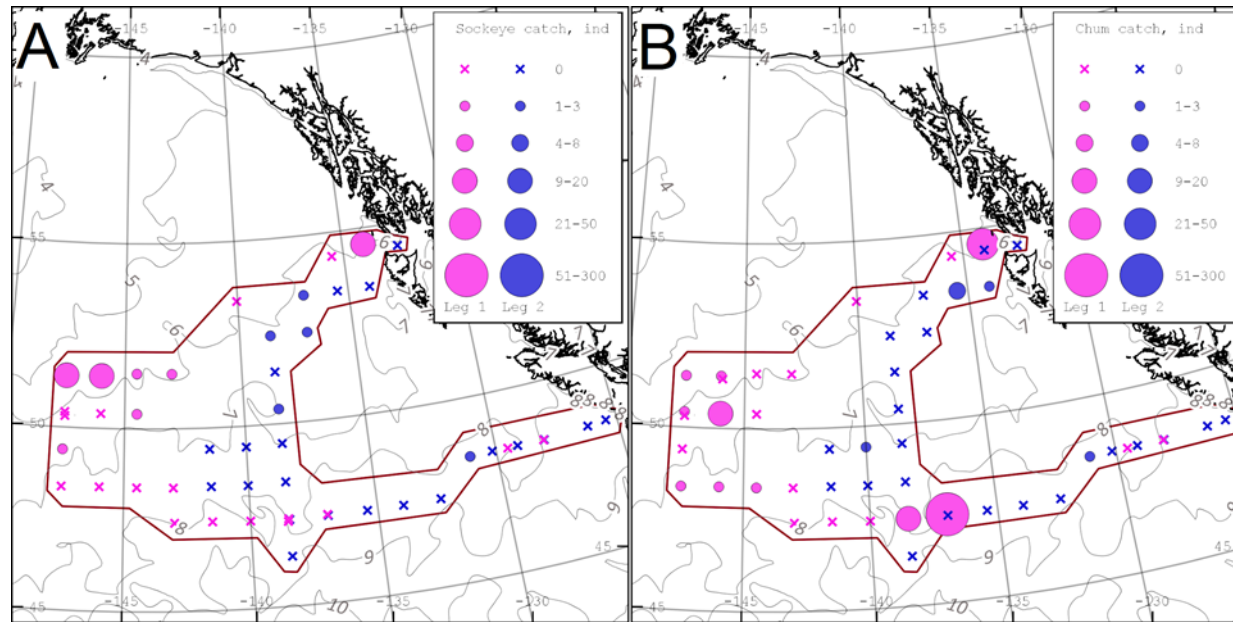
2019 Cruise

2020 Cruise

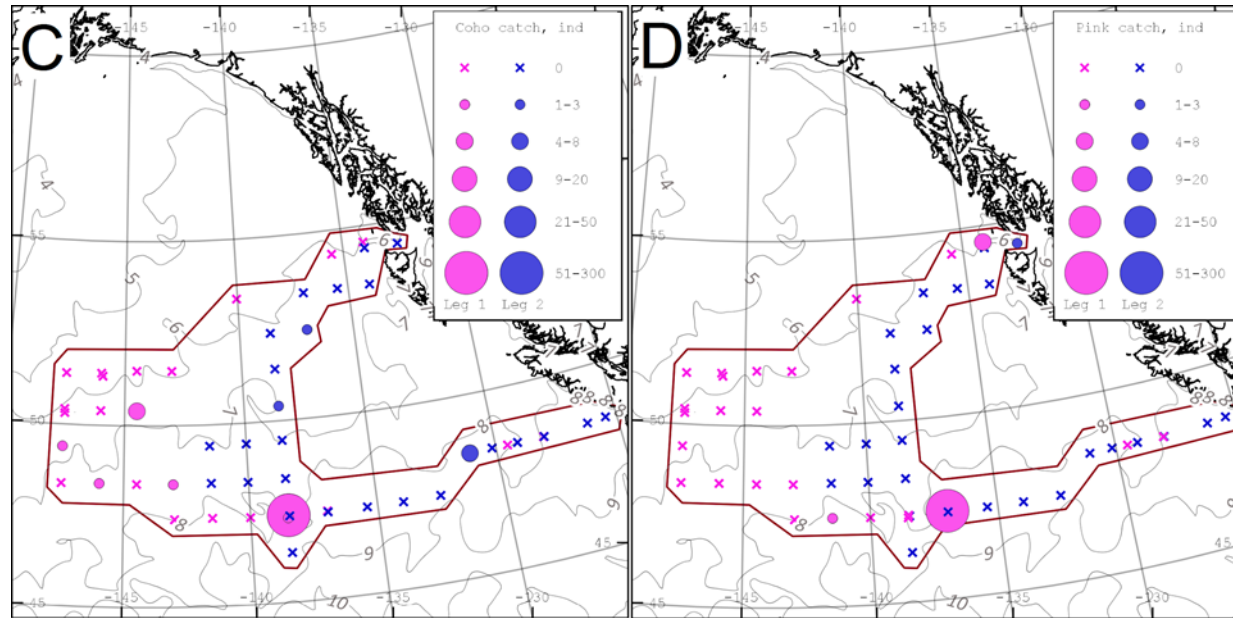
Survey dates	Feb. 16 - March 18	March 11 - April 7
Vessel	Professor Kaganovskiy 62m x 13.8m, 2062 t	Pacific Legacy No. 1 37m x 10m, 600 t
Trawl Net (speed)	40m x 30m (4.5 knot)	40m x 30m (5 knot)
Net liner mesh	10 mm	3 mm
Number of stations sampled	58	52
Surface area sampled (km. sq.)	698,000	648,000
Number of salmon caught	432	566
% trawl samples with salmon	83%	53%
Estimated total abundance of Pacific salmon (numbers)	55.0 million	51.3 million
Oceanographic samples	SeaBird 911 CTD plus turbidity, fluorescence and oxygen to 600m or 1,000m @ 1 m/sec; plus water sampling.	SeaBird 19 CTD plus fluorescence and oxygen to 300m @ 1 m/sec; plus water sampling.
Zooplankton	Juday net, Bongo net, <i>HydroBios</i> sampling	Juday and Bongo net sampling

Distribution by species,
2020 example ...

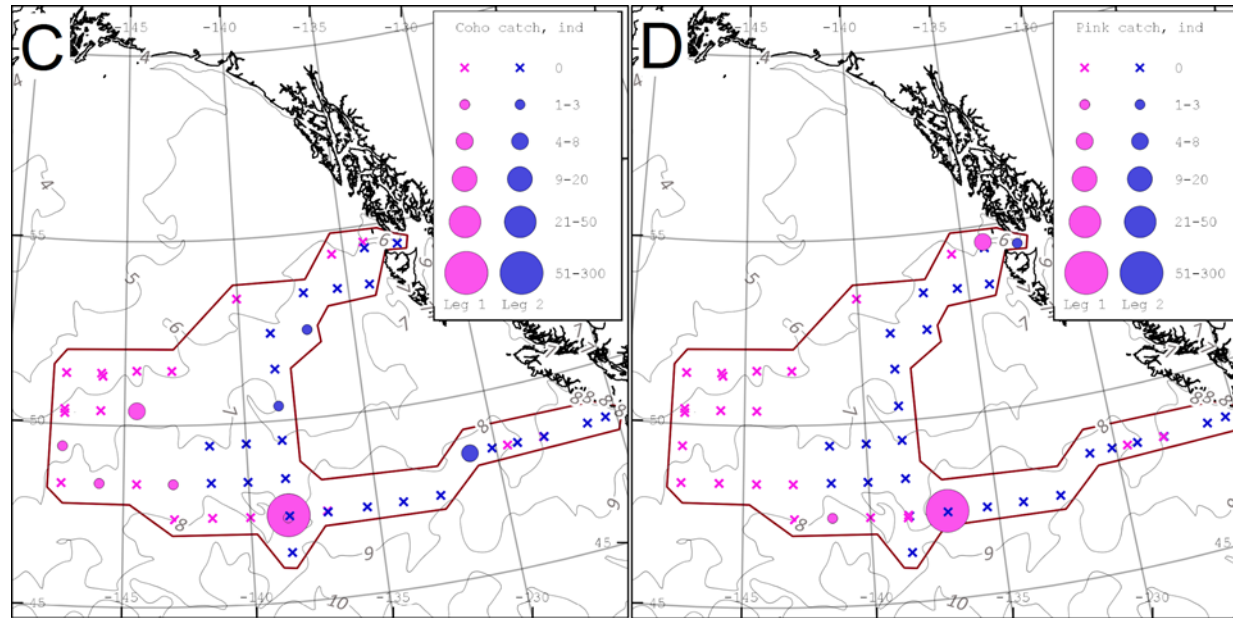
Sockeye
50% at
Stations
16 & 17



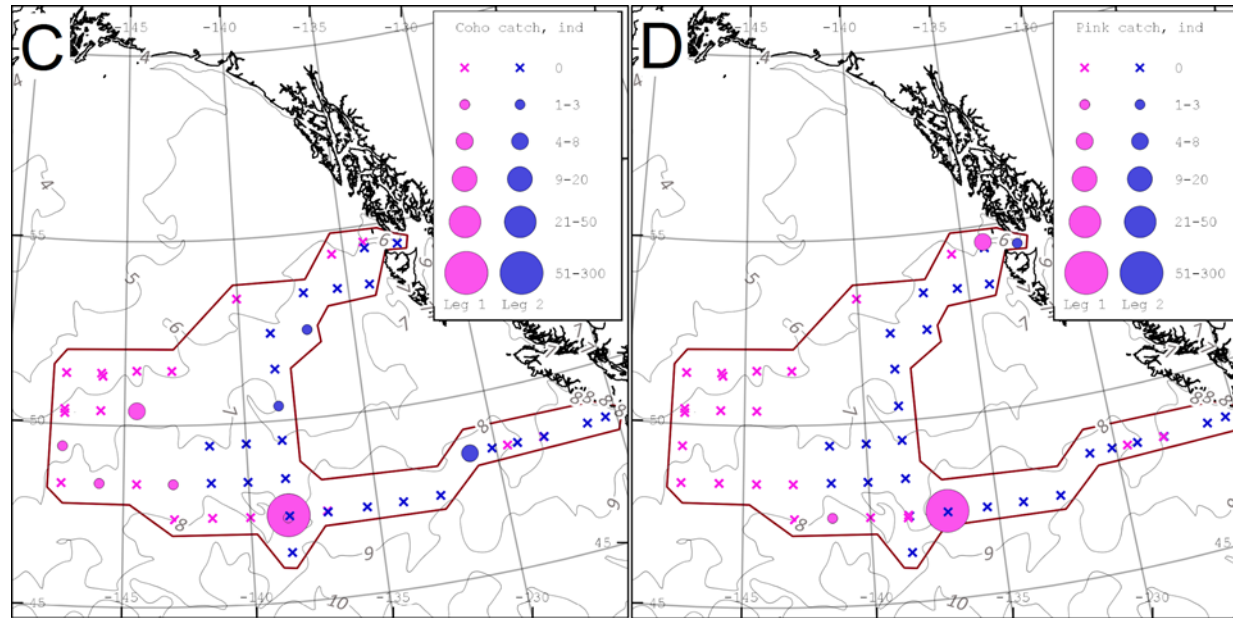
Chum
70% at
Station 3



Coho
83% at
Station 4



Pink
93% catch
at Station 3

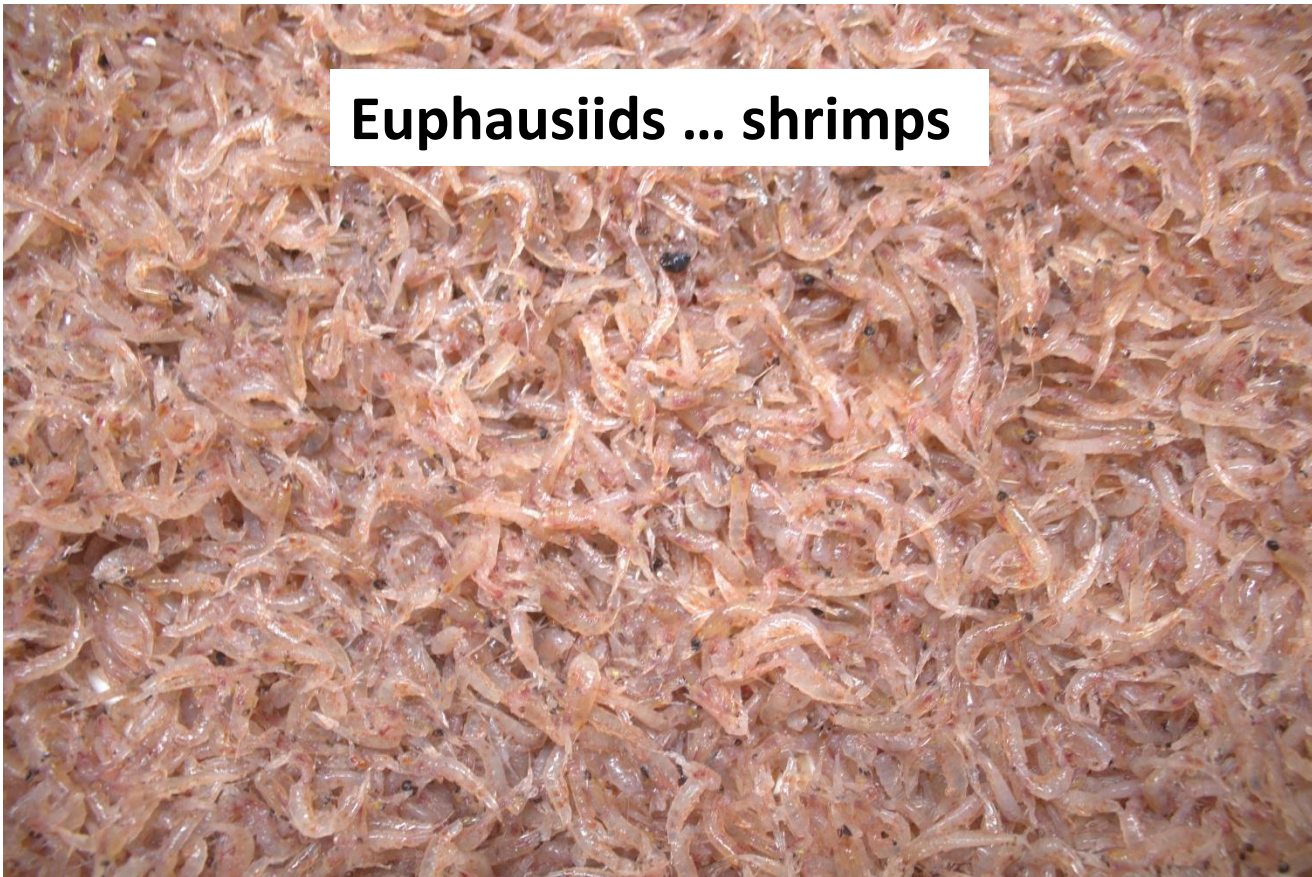


North Pacific Chum salmon caught during the 2019 and 2020 surveys

Year	Chum stock identification by Regions around the North Pacific					
	Japan	Russia	Yukon R.	Alaska, non-Yukon	B.C.	Washington
2019	22.0%	20.2%	5.0%	32.6%	16.6%	3.7%
2020	9.4%	3.8%	0.9%	18.4%	58.0%	9.4%

Total age of fish	2019 Chum	Preliminary 2020
1 (< 35cm)	15.60%	46.20%
2	25.70%	7.60%
3	44.60%	25.20%
4	14%	15.10%
5	0.01%	5.90%

Euphausiids ... shrimps

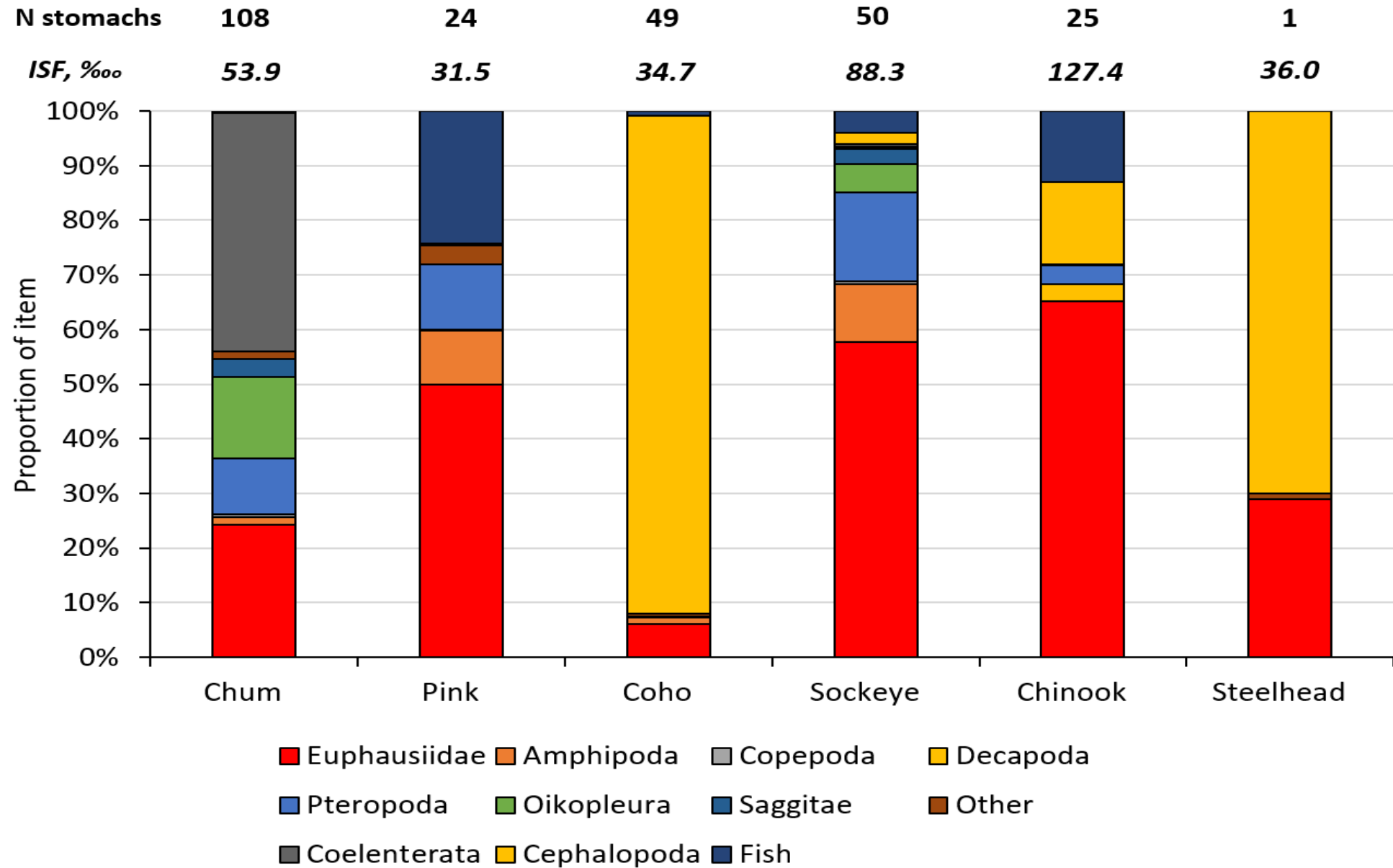


bovealis



Cephalopod ... squids

Figure 8. Preliminary results of onboard diet analysis of Pacific salmon species caught in the Gulf of Alaska, 2020



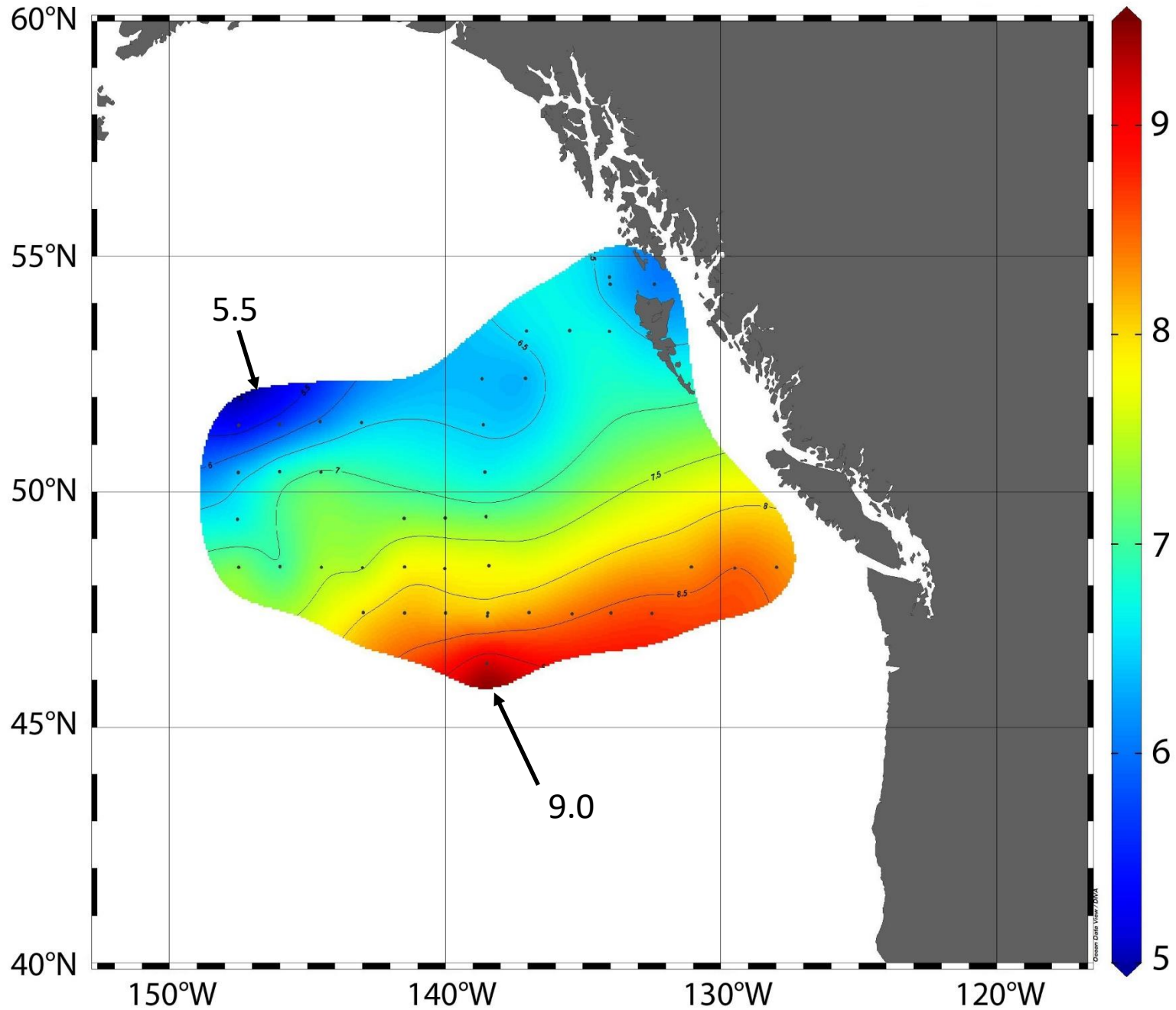
Oceanographic sampling



Surface Temperature (°C)

Upper Mixed Layer Temperature (~110-120m)

The average sea surface temperatures were 0.33 °C cooler in 2020 than during 2019.



A measure of ocean productivity within the 2020 survey area.

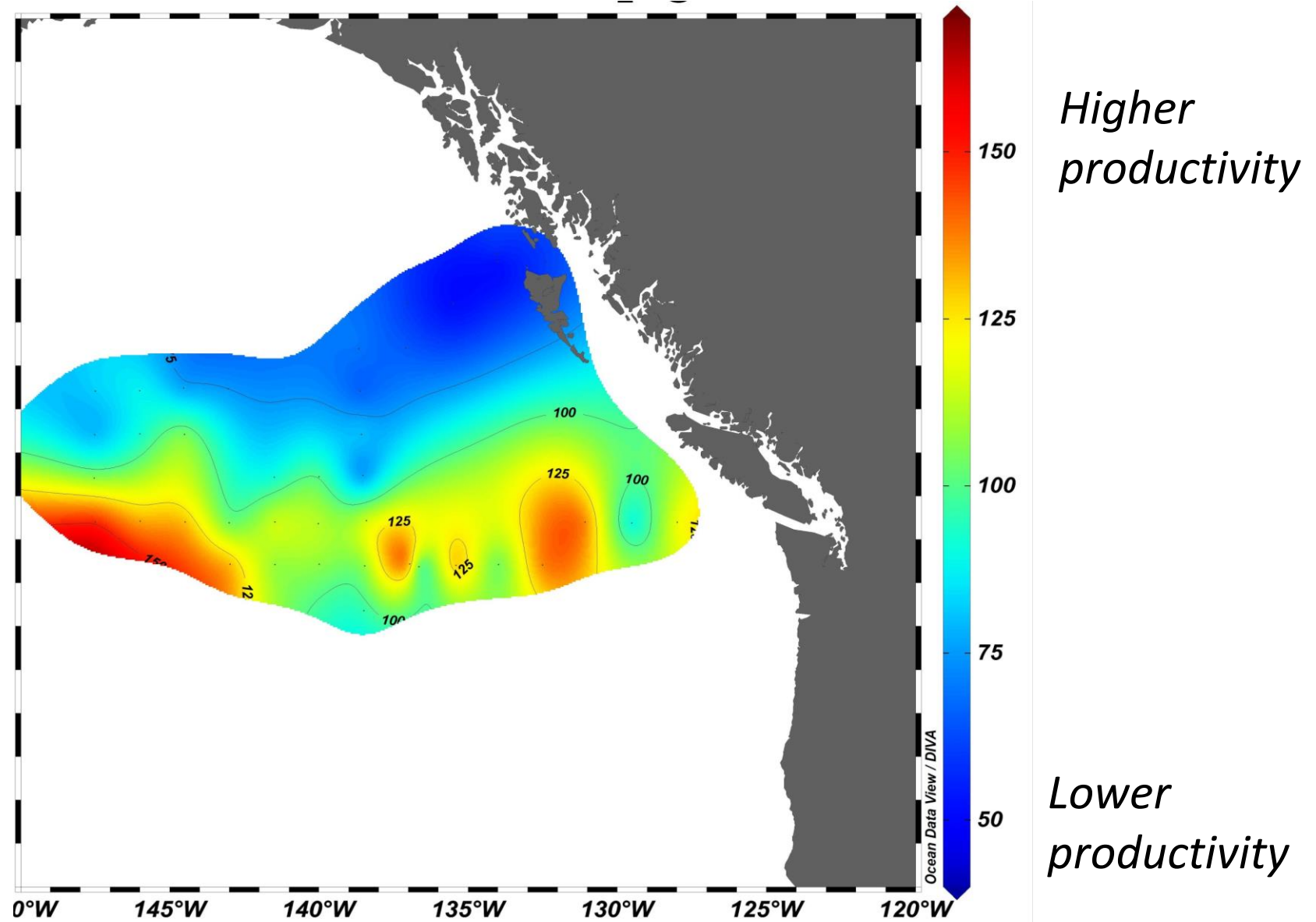


Figure 21. Chlorophyll a biomass (mg.m⁻²) integrated between 0-100 m (right) within study area, March – April 2020 (page 38)

Summary comments ...

- *Have we advanced the hypothesis on regulation of annual production of Pacific salmon.* YES, but we can not yet conclude that winter conditions determine adult abundance. Most of our 'data' remains to be analyzed/reviewed ... [looking forward to session reports.](#)
- *Can we improve salmon forecasts?* We believe this can be accomplished but will require additional years of effort and more survey effort than a single vessel in millions of sq. km. of ocean. But, the 2020 results indicate a 'Patchy' distribution of salmon and, in both years, the species are not evenly mixed (indicates a challenging set of conditions for survey coverage).

Next steps ...

1. Virtual workshop to review 2019 and 2020 expedition results (April 2021?) ... provides an opportunity for input to the International Year of the Salmon cruises in March 2022.

2. In March 2022, cruises for the International Year of the Salmon has the potential for 5 vessels to simultaneously survey the distribution and condition of salmon across the Pacific Ocean. We have submitted a proposal for gillnet sampling to compare with trawl catches during these surveys.

3. New 'Climate, Ocean, and Salmon' project in early stage of development. Target initiation in summer 2022. A multi-year study focused on climate effects in the North Pacific salmon ecosystem, with secondary objective for design of forecasting methods.

<i>Item</i>	<i>Analysis</i>	<i>Country and lab</i>
<i>Stock ID</i>	DNA analysis to assign stock of origin	Coho, chinook, chum and sockeye – Canada. Pink salmon - TBD
<i>Salmon Condition</i>	Energy density, fats and fatty acids, stable isotopes on muscle, liver and gonads	US – NOAA (Farley), Canada – DFO (Neville), UBC (Hunt)
<i>Fish health</i>	Analysis of salmon tissues including examination of parasites	Canada – DFO (Deeg, Miller-Saunders, Johnson, Jones, Garver)
<i>Diet</i>	Additional analysis of salmon gut including stable isotopes and fatty acids	Canada – UBC US – NOAA (Farley)
<i>Early Marine Growth of salmon</i>	Examination of early marine growth of fish caught	Canada – DFO (Neville et al) US – NOAA (Farley, Weitkamp)
<i>Thermal marks on salmon otoliths</i>	Identifying thermal marks on otoliths. Identifies hatchery origin and validates age	US-NOAA (Farley et al) Japan (chum)
<i>Go-Pro Camera net analysis</i>	Analysis of salmon behaviour in trawl net	Canada – DFO (Neville)
<i>Trophic relationship in bi-catch</i>	Stable Isotope analysis	UBC (Hunt)
<i>e-DNA</i>	Environmental DNA analysis of water samples	Canada – DFO (Deeg and Miller-Saunders)
<i>Plankton analysis</i>	Identification of species and estimation of volume of plankton from Bongo nets	Canada – UBC (Hunt)
<i>Hydroacoustic recording</i>	Acoustic recording throughout survey for presence of fish biomass and water variations	Canada – DFO (Gautier)
<i>Water chemistry</i>	Analysis of water samples collected.	2019 – Russia. 2020 – Canada