

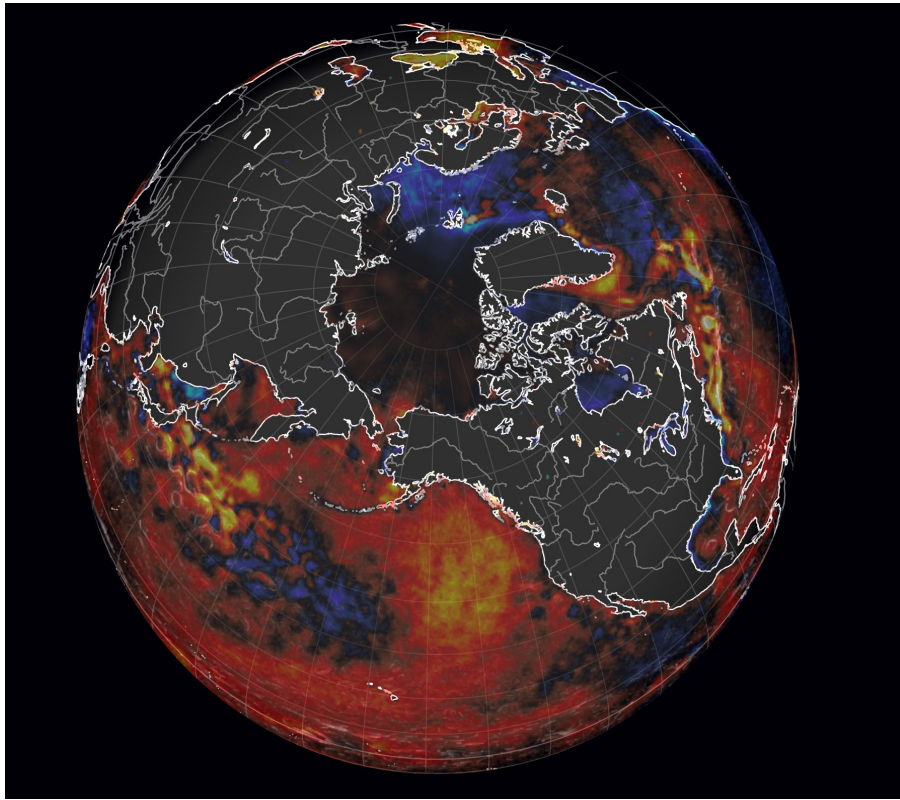
A close-up, macro photograph of salmon scales, showing their intricate, overlapping pattern in shades of blue, teal, and white. The scales are slightly out of focus, creating a soft, textured background.

# SALMON AND PEOPLE IN A CHANGING WORLD



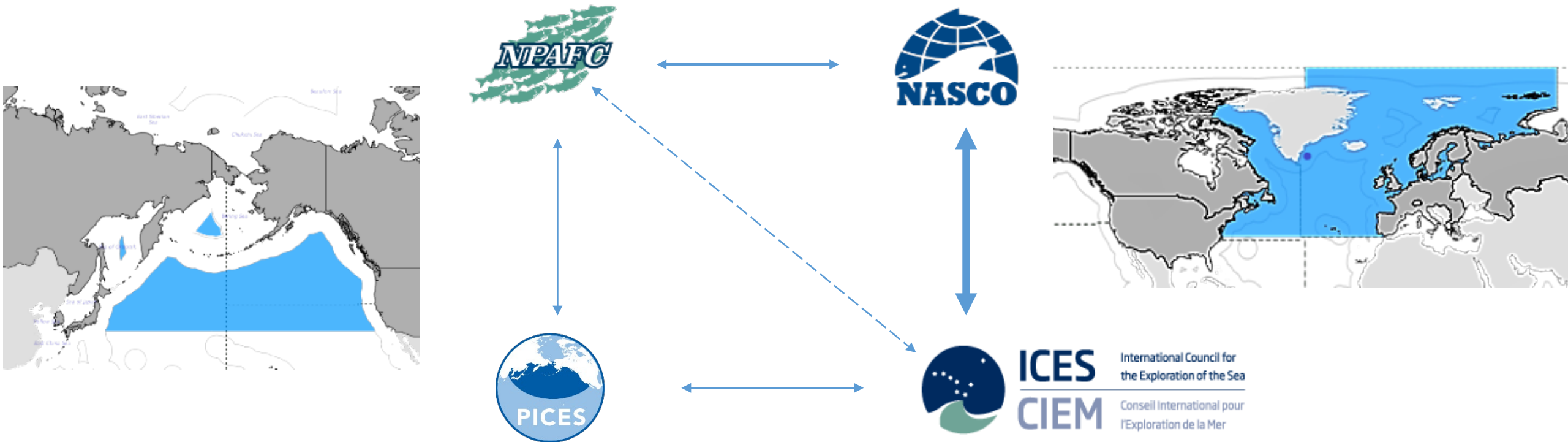
**THE INTERNATIONAL YEAR OF THE SALMON PAN PACIFIC HIGH SEAS EXPEDITION 2022: A COLLABORATIVE INTERNATIONAL APPROACH TO UNDERSTANDING HOW A RAPIDLY CHANGING OCEAN AFFECTS PACIFIC SALMON**

# A RAPIDLY CHANGING WORLD



- Both the North Pacific and North Atlantic basins are experiencing unprecedented climate events
- Salmon and the people that rely on them have been severely impacted by the increasingly high uncertainty and variability in environmental conditions
- Since the mid-1990s we have seen declines in the productivity of salmon populations in both basins attributed mainly to decreasing marine survival
- Despite teleconnection of climate drivers across the Northern Hemisphere our scientific and management institutions remain largely disconnected and the mechanisms affecting salmon remain poorly understood

# CONNECT INSTITUTIONS



# ENHANCED PARTNERSHIP



CANADIAN  
WILDLIFE HEALTH  
COOPERATIVE



WILD  
SALMON  
CENTER



Northwest Power and  
Conservation Council



국부경대학교  
PUKYONG NOMUHYUN UNIVERSITY



FIRA  
KOREA FISHERIES  
RESOURCES AGENCY



NOAA  
FISHERIES



SFU  
SIMON FRASER  
UNIVERSITY



UAF  
UNIVERSITY OF  
ALASKA  
FAIRBANKS



NASCO



NPAFC



FIRST NATIONS  
FISHERIES COUNCIL



PICES



BC  
SALMON FARMERS  
ASSOCIATION



NORTH PACIFIC RESEARCH BOARD



OCEAN  
NETWORKS  
CANADA



UNINTERRUPTED  
a cinematic spectacle



CANADIAN FISHING COMPANY



YAKAMA NEZ PERCÉ TRIBAL  
FISHERY



ocean wise  
A SUSTAINABLE CHOICE



Hakai  
Science on the Coastal Margin



NCEAS



UBC



PACIFIC  
SALMON  
FOUNDATION



ALASKA  
DEPARTMENT OF FISH AND GAME



BRITISH  
COLUMBIA



FRA  
Fisheries Research Agency



Genome  
British Columbia



TAHPO  
UETP

BC SALMON RESTORATION  
AND INNOVATION FUND



Tula  
TULA FOUNDATION



Washington  
Department of  
FISH and  
WILDLIFE

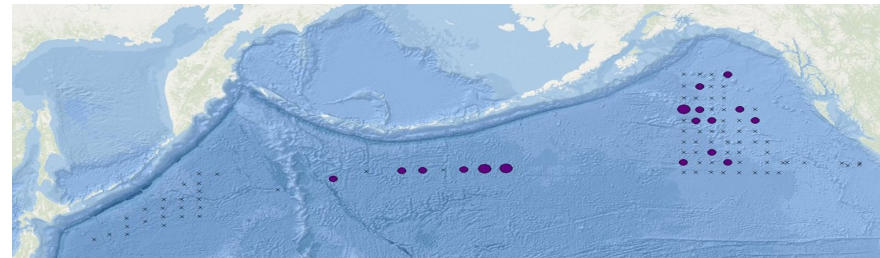
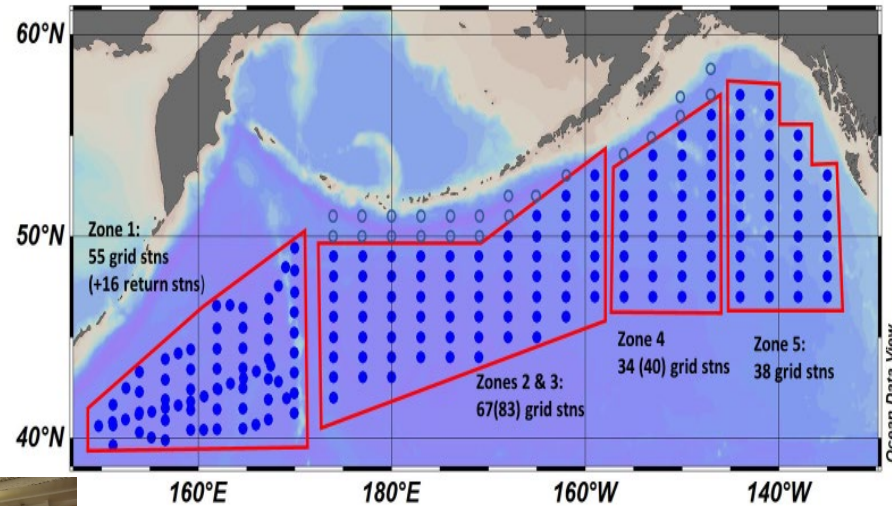


TIM PLOWDEN  
PHOTOGRAPHY



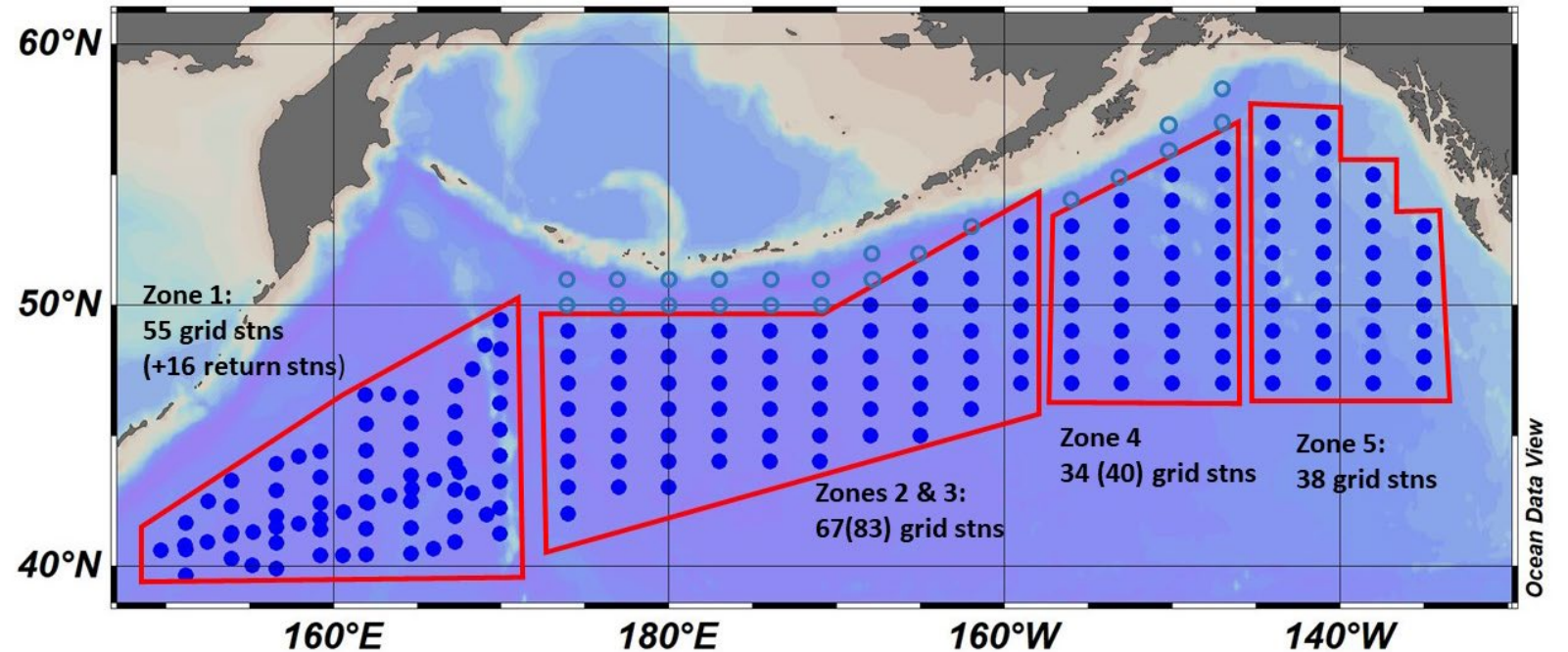
INTERNATIONAL  
YEAR OF THE SALMON

# FILLING KNOWLEDGE GAPS



# IYS 2022 PAN PACIFIC WINTER EXPEDITION

- Comprehensive ecosystem survey
- Notional support from Canada, Russia and USA
  - Zone 1 – Russia
  - Zone 2&3 – Chartered Vessel
  - Zone 4 – USA
  - Zone 5 – Canada
- Currently raising funds for charter vessel



# 2022 EXPEDITION OBJECTIVES



Demonstrate the utility of an international pan-Pacific winter ecosystem survey to understand how increasingly extreme climate variability in the North Pacific Ocean and the associated changes in the physical environment influence the abundance, distribution, migration, growth, fitness and survival of Pacific salmon and surrounding species.

# 2022 EXPEDITION OBJECTIVES

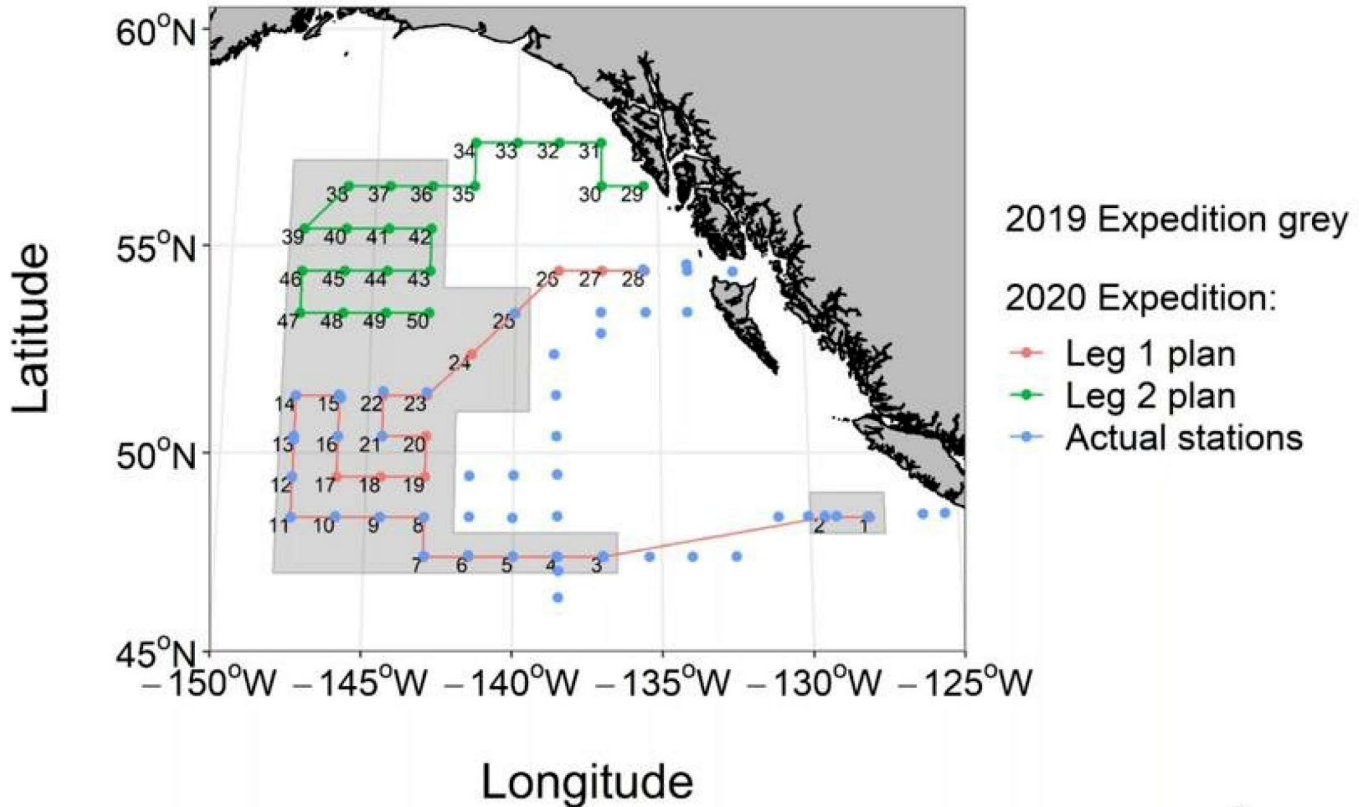


1. Determine species and stock-specific ocean distributions and relative abundances, and condition of juvenile, immature/mature Pacific salmon within the study area, and factors/mechanisms controlling them.
2. Document the spatial and temporal variation in physical and biological oceanographic conditions
3. Document the distribution, condition, and standing stocks of zooplankton, and nekton that serve as the prey base for Pacific salmon and associated marine fishes
4. Demonstrate the ability to effectively collaborate across the five NPAFC parties and our partners to conduct integrated ecosystem research that will support the sustainable management of salmon in a rapidly changing North Pacific Ocean.



# 2019 AND 2020 GULF OF ALASKA EXPEDITIONS

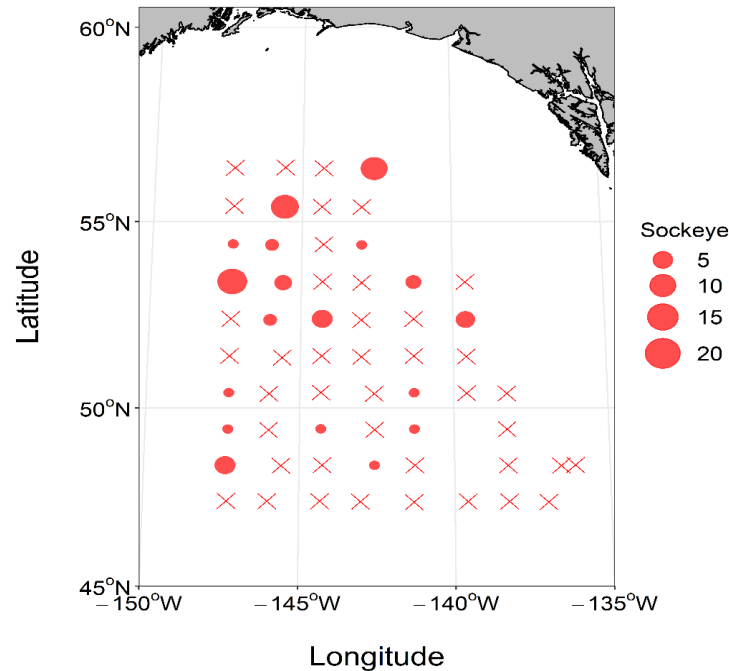
- Organized by Dr. Dick Beamish and Dr. Brian Riddell (PSF) with support from the NPAFC Secretariat with a combination and government, NGOs, and private sector funding
- Proof of concept for the 2022 Expedition
- Teams of scientists from Canada, Japan, the Republic of Korea, Russia, and the USA spent a month in the Gulf of Alaska in winter performing ecosystem surveys
- Test key the hypothesis that factors affecting return abundance have mostly occurred by the end of the first ocean winter



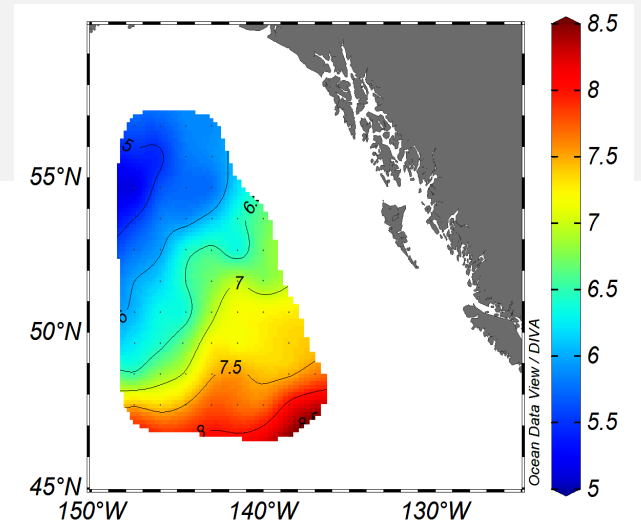
# WHAT WE LEARNED IN 2019 & 2020

- Distribution primarily in cooler waters of northern portion of study area
- Distribution overlap with localized concentrations of euphausiids in the north and south. This prey group represented over 70% of diet by volume in this northern portion of study region

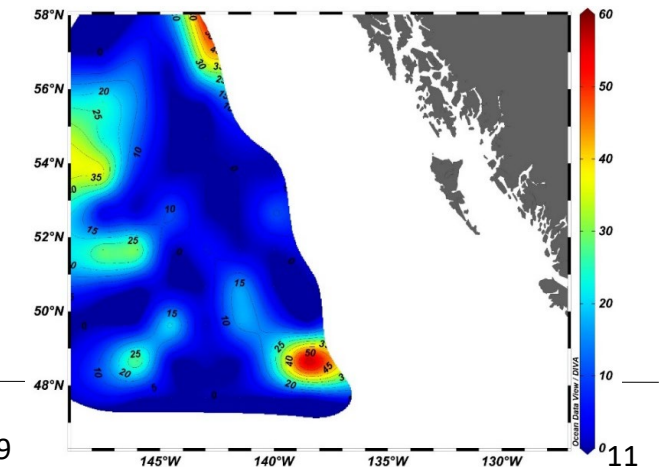
## Sockeye Salmon



## Temperature



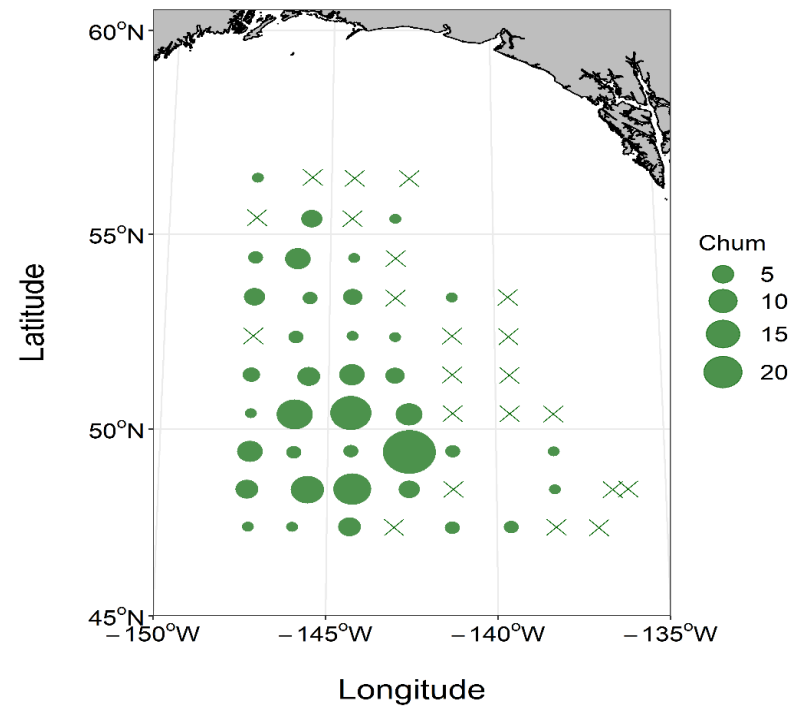
## Euphausiids



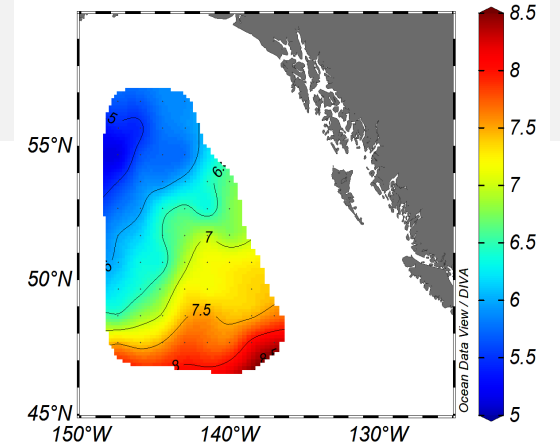
# WHAT WE LEARNED IN 2019 & 2020

- Highest catches in southern portion of study area but found in both warm and cool waters.
- Lowest condition and one of highest empty stomachs observed for salmon
- Possible overlap with squid distribution but not eating squid

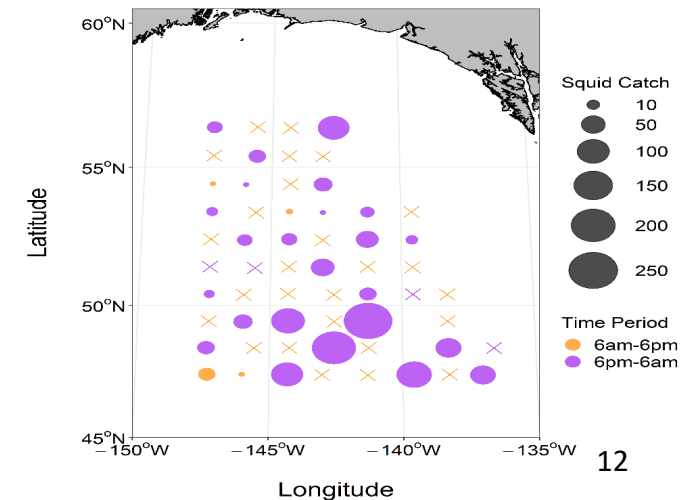
## Chum Salmon



## Temperature

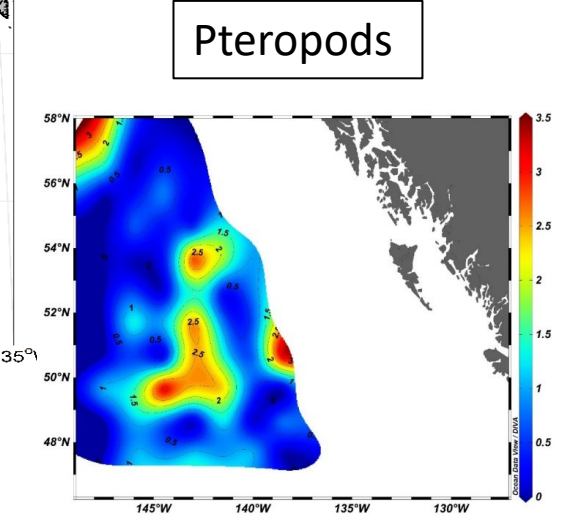
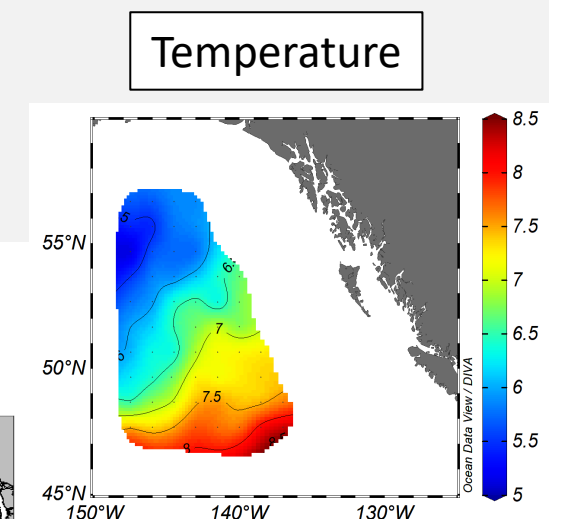
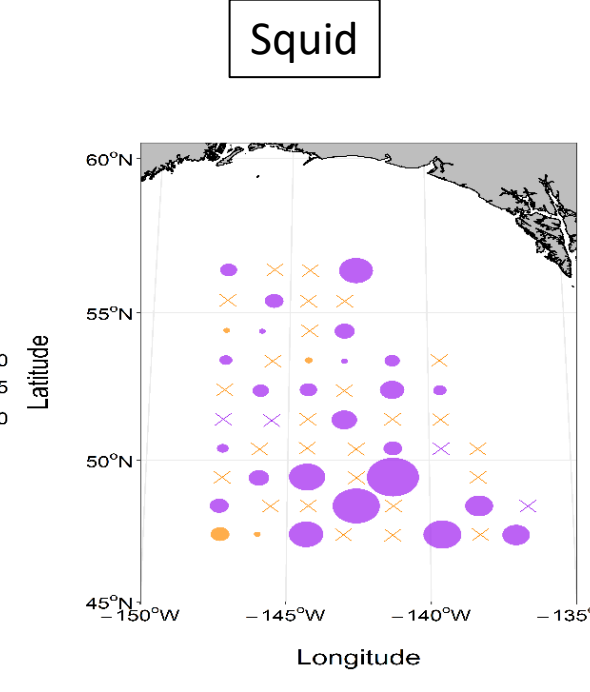
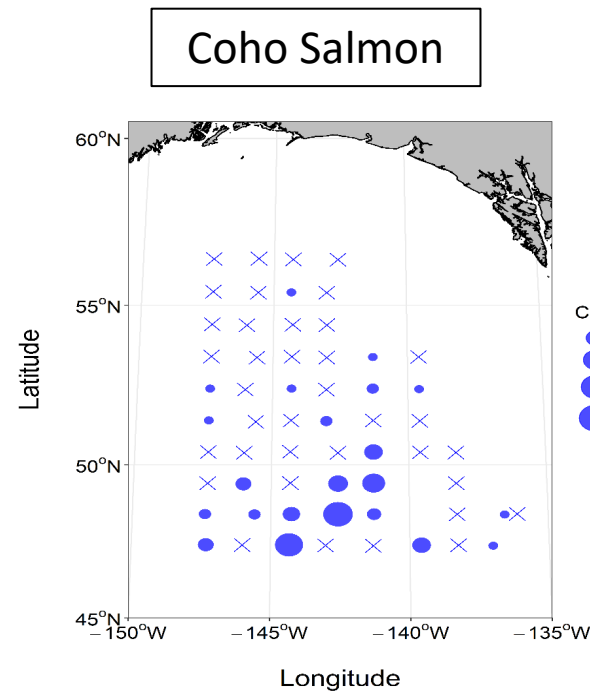


## Squid



# WHAT WE LEARNED IN 2019 & 2020

- Distribution in warmer waters of the SE quadrant of survey area.
- Distribution overlap with Pteropods. This prey group represented over 50% of diet by volume in the southern portion of study region

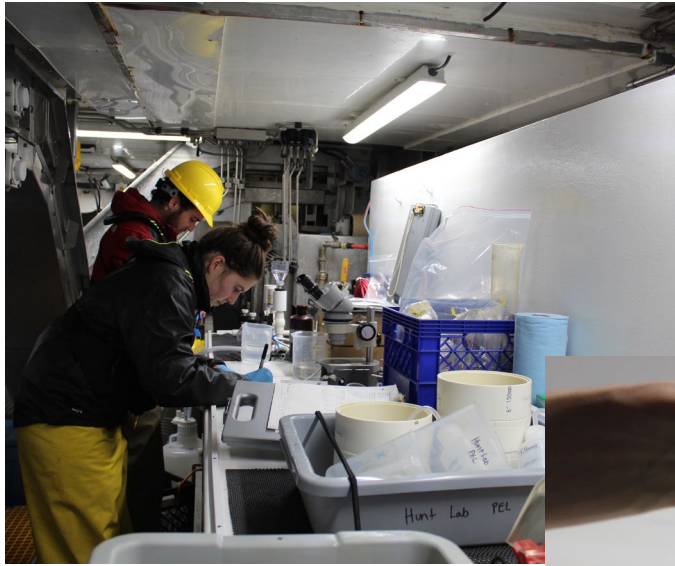


# 2022 HIGH SEAS PAN-PACIFIC WINTER EXPEDITION

- We are currently in the process of convening groups of experts in the following areas of study
  - Physical oceanography
  - Chemical oceanography
  - Biological oceanography
  - Acoustics
  - Modelling
  - Salmon feeding ecology and energetics
  - Salmon distribution, abundance, and migration
  - Salmon genomics and stock ID
  - Microplastics



# NEW FRONTIERS



The 2022 Expedition is an opportunity to test multiple emerging technologies:

- Salmon stock IDs
- eDNA
- Autonomous Vehicles & Remote Sensing
- Genomic assessment of health

# DATA MOBILIZATION



- Access to data for salmon and their associated ecosystems remains one of the most serious impediments to science and management
- Solution lies in standardized data vocabularies/schema and repositories to meet FAIR principles (data are Findable Accessible-Interoperable and Reusable)
- Working with Hakai Institute and NCEAS to develop GOOS compliant system to "federate" expedition data across countries. NPAFC Data Standardization Study Group has been formed. Discussions with ICES and PICES pending.
- Exploring use of Graph Database systems as a structure to facilitate easy discovery of data and synthesis by scientists and machines

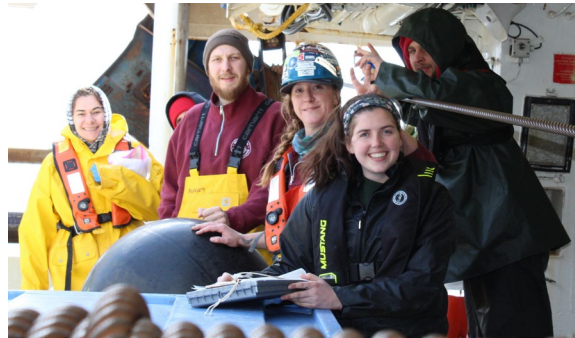
# OUTCOMES



- A collaborative interdisciplinary approach to monitoring and understanding the mechanisms affecting salmon and the surrounding species
- Standardized and integrated data are available to all interested parties
- A nimble enforcement and fisheries management system informed by timely science that addresses changing conditions in the open ocean and coastal systems
- New technologies, methods, ideas, and approaches are more rapidly and efficiently developed and applied to gaps in our understanding



# SUPPORTING YOUNG SCIENTISTS



# OUTREACH AND EDUCATION



- Development of a comprehensive communications plan
- Live streaming with the ships while at sea
- Documentary – in discussion with Explorer's Club & Discovery Channel
- Carrying journalists on vessels

# PICES-NPAFC & THE DECADE OF OCEAN SCIENCE: BASIS FOR COLLABORATION



## PICES – FUTURE PHASE 3

- Social-Ecological-Environmental approach
- Trans-disciplinary, solutions oriented
- Enhanced communication and Early Career Ocean Professional development

## DECADE OF OCEAN SCIENCE

- Predicted ocean – sustainable observing system and improved understanding and forecasts
- Healthy and resilient ocean
- Sustainably harvested and productive ocean
- Partnerships
- Transparent and accessible (data/knowledge) ocean
- Capacity Development and Technology Transfer
- Engaging and inspiring ocean

# QUESTIONS?

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