

The Winter 2019 Gulf of Alaska Expedition: Studying salmon ecosystems on the high seas



Photo by Ego
3rd mate



Today's talk

- Why the expedition?
- Methods
- Initial results
 - Physical oceanography
 - Biological oceanography
 - Nekton
- Lessons
- Plans for 2021



Toba, the
ship's cat



Dick Beamish's audacious idea comes true



Privately funded by:

North Pacific Anadromous Fish Commission (NPAFC), Pacific Salmon Foundation, DFO Science Branch, Salmon Farmers Association of BC, Province of British Columbia, Pacific Salmon Commission, Harmac Canada, Port Authority of Nanaimo and private donors

Why the expedition?

Expedition goals

- Test hypothesis that adult salmon abundance is determined by the end of the first ocean winter.
- See if an international team can work effectively together to make the discoveries we need to be responsible stewards in a future of rapidly changing ocean ecosystems.



Research Teams

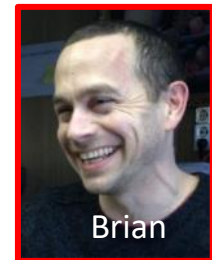
Physical/Chemical Oceanographers



Satellite
remote
sensing



Biological oceanographers

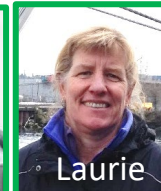
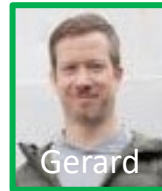
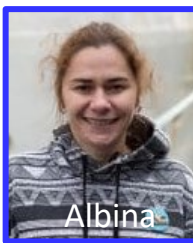
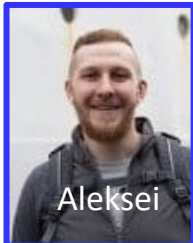


Russia

Canada

U.S.

Fish Team



Science team

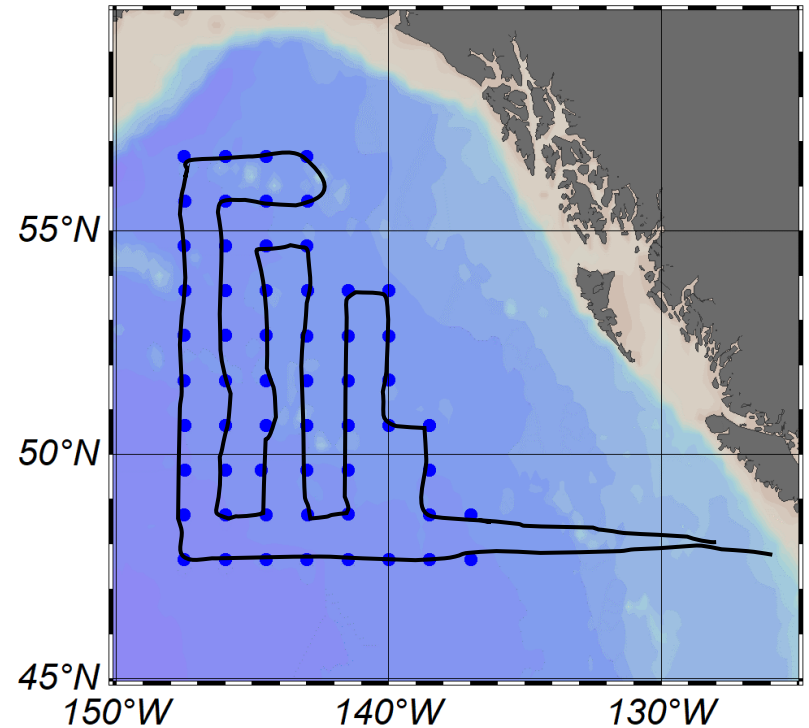
5 Countries represented: Russia, Canada, U.S., South Korea, Japan

Methods

60 stations across 10° lat x 10° long study area based on expected salmon distributions

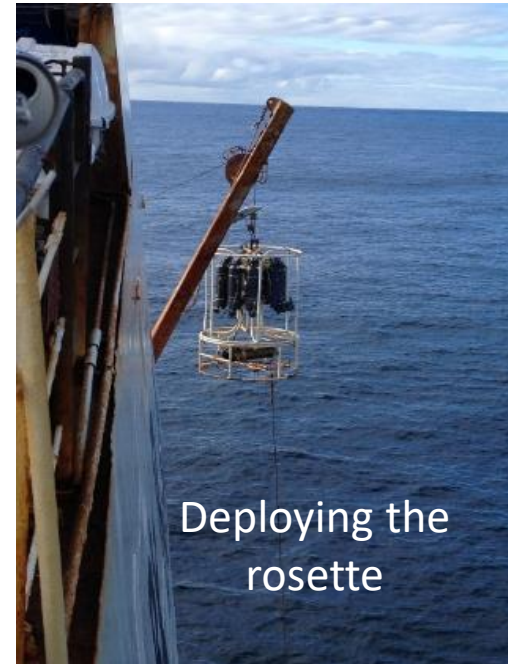
At every station did:

- Physical/chemical oceanography
- Biological oceanography
- Fishing



Methods: Physical/Chemical oceanography

CTD/Water samples to 600 or 1000m



Methods: Biological oceanography

Juday net, 0-50, 0-200 m

Bongo (vertical) 0-250m

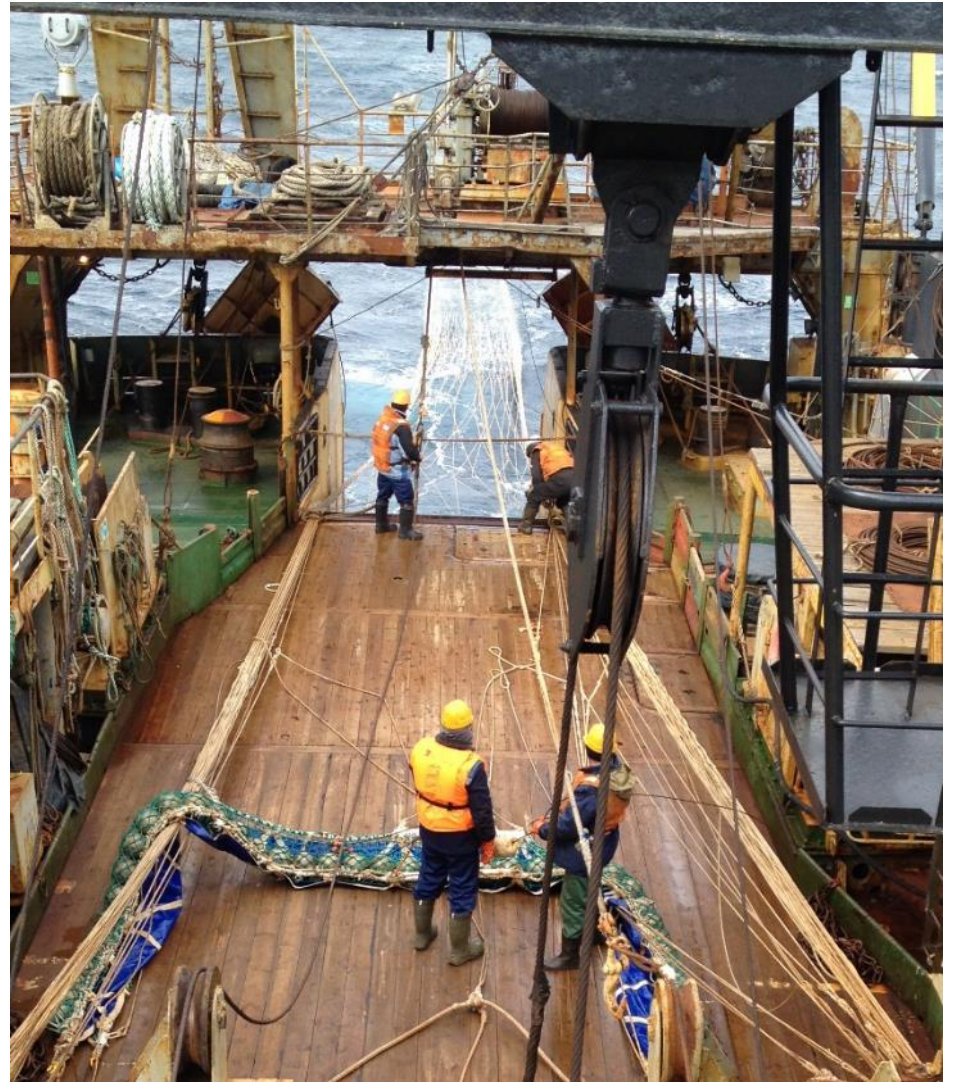


Neuston for microplastics
(Gennady Kantakov)



Methods: Fishing

Rope trawl (40m x 30m mouth) towed for 1 hour near surface



Methods: Fish processing

Everything identified, counted, measured



Chrysaora jellyfish



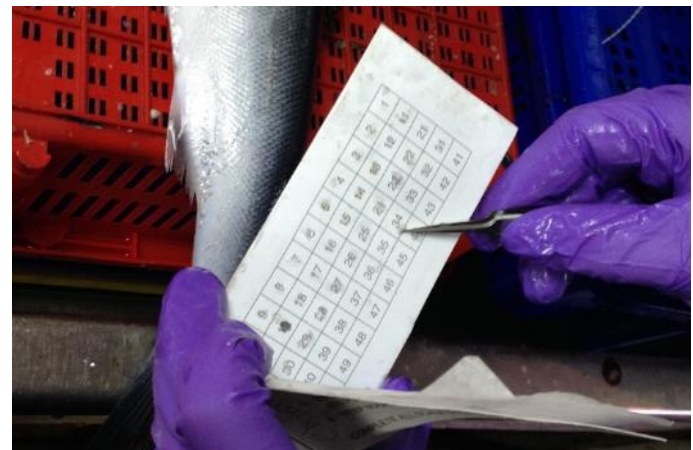
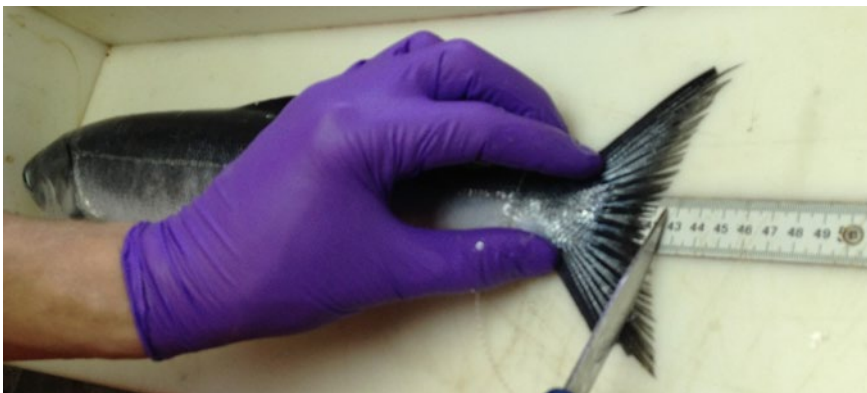
Blue lanternfish



Boreal clubhook squid

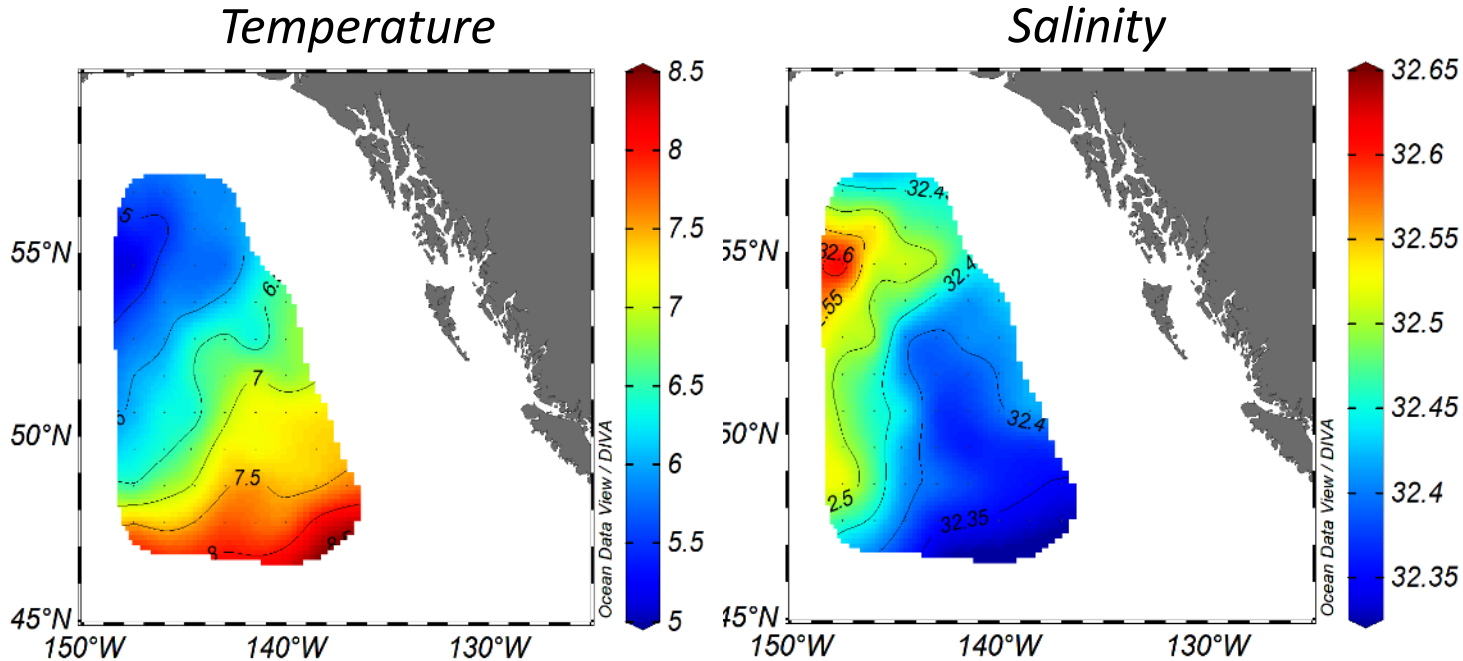
Methods: Fish processing

All Salmon had stomachs (diets), fin clips (DNA), otoliths (growth), scales (age), and muscle (lipid, biomarkers) collected



Surface temperature and salinity

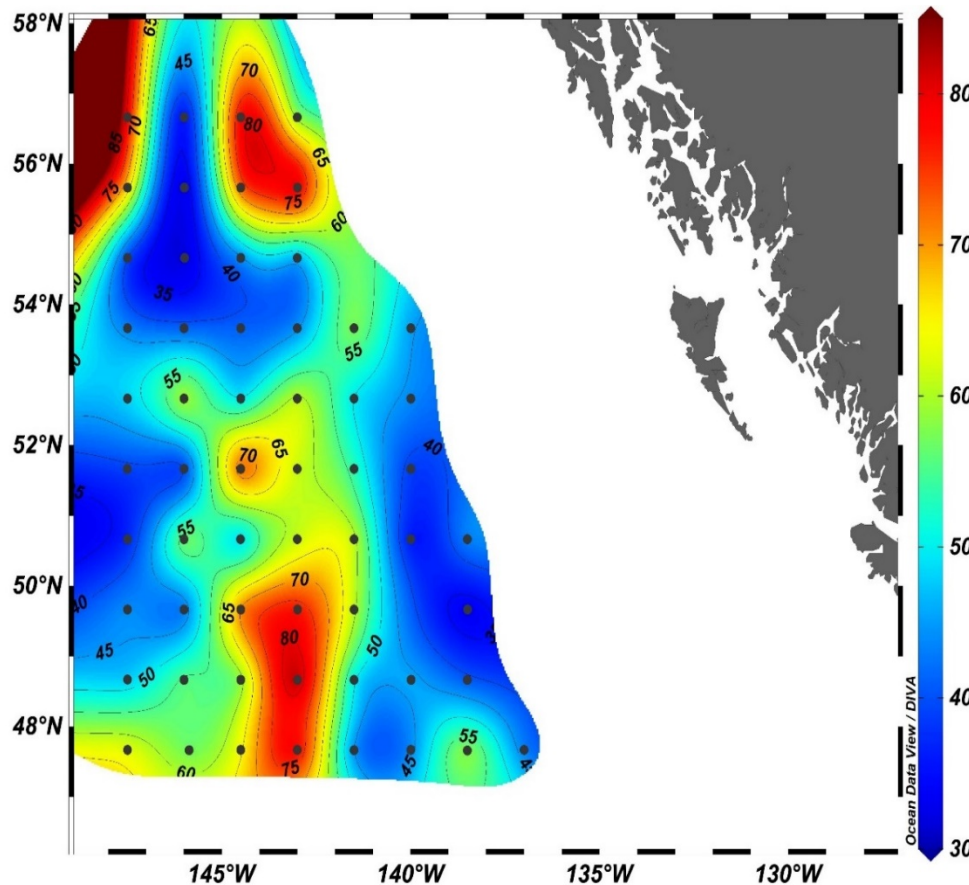
Anna Vazhova, Arkadii Ivanov, Gennady Kantakov, Igor Shurpa -Russia
Hae Kun Jung – South Korea



- Mixed layer depth at ~100 m throughout study area
- Chemical signatures indicate warm and cool water distinct

Phytoplankton biomass (mg Chl-a.m⁻²)

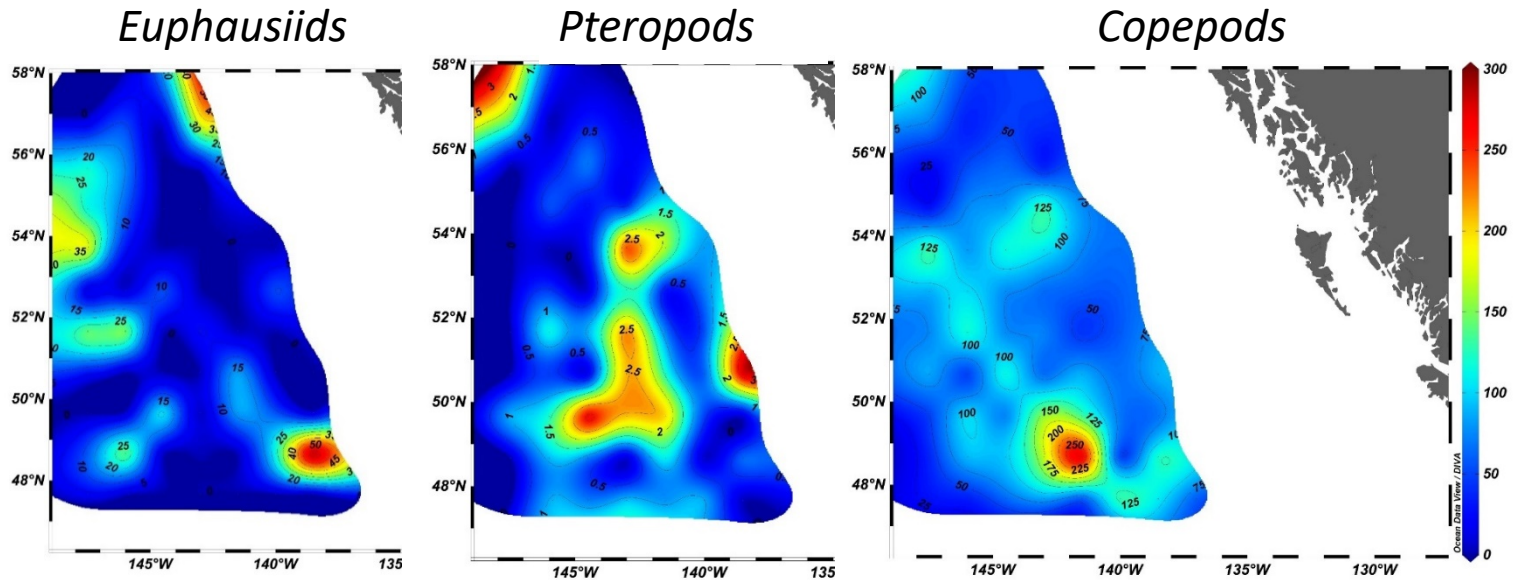
Brian Hunt and Evgeny Pakhomov – Canada
Alexander Slabinskii – Russia



- Extracted chl-a from rosette samples
- 0-150m Integrated
- West to east increase reflected seasonal biomass increase
- High biomass associated with eddies in the north

Zooplankton biomass (mg WW.m⁻³)

Brian Hunt and Evgeny Pakhomov – Canada
Alexander Slabinskii – Russia



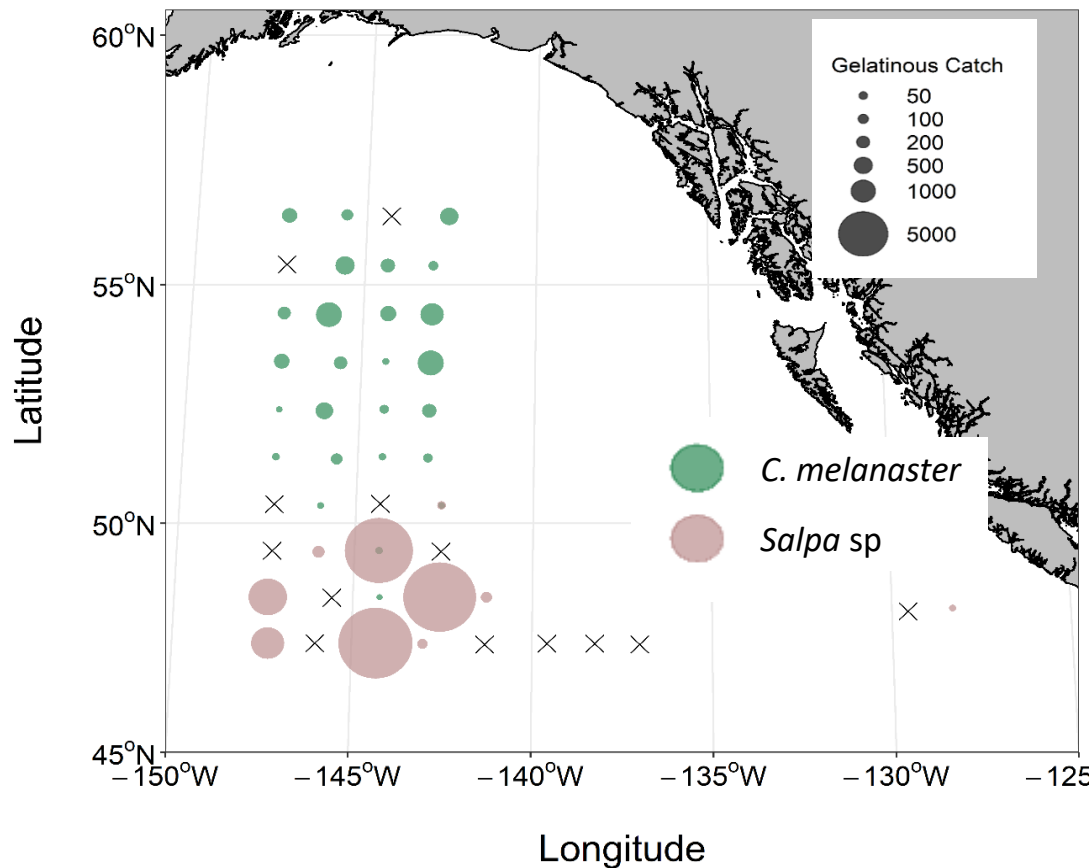
- Euphausiid biomass highest in the north and south east
- Copepod biomass highest in the south
- Pteropod biomass highest in the mid latitudes



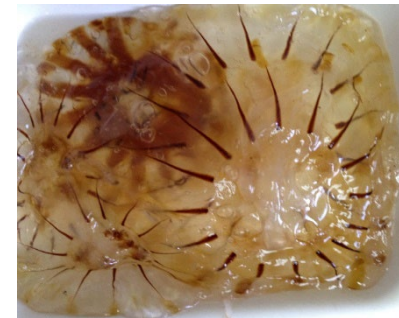
Limacina

Gelatinous species distributions: *Chrysaora melanaster* and *Salpa aspera*

Brian Hunt and Evgeny Pakhomov – Canada
Alexander Slabinskii – Russia



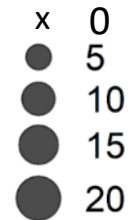
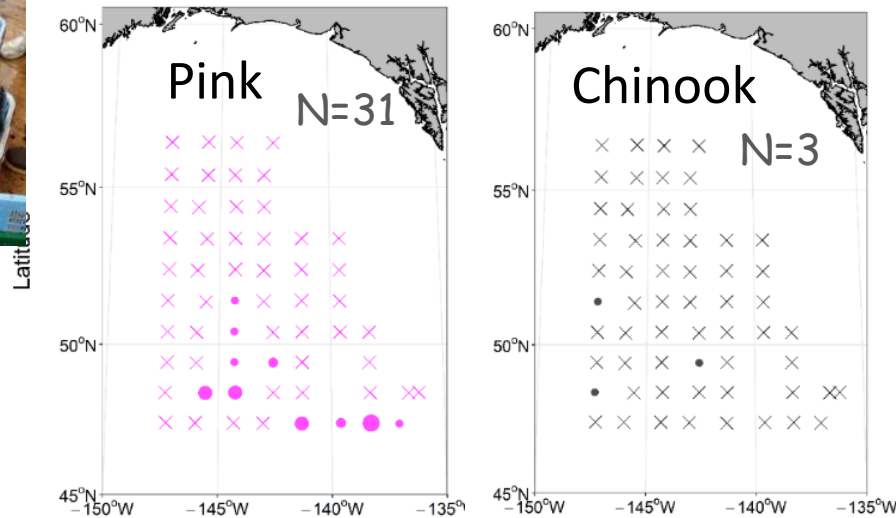
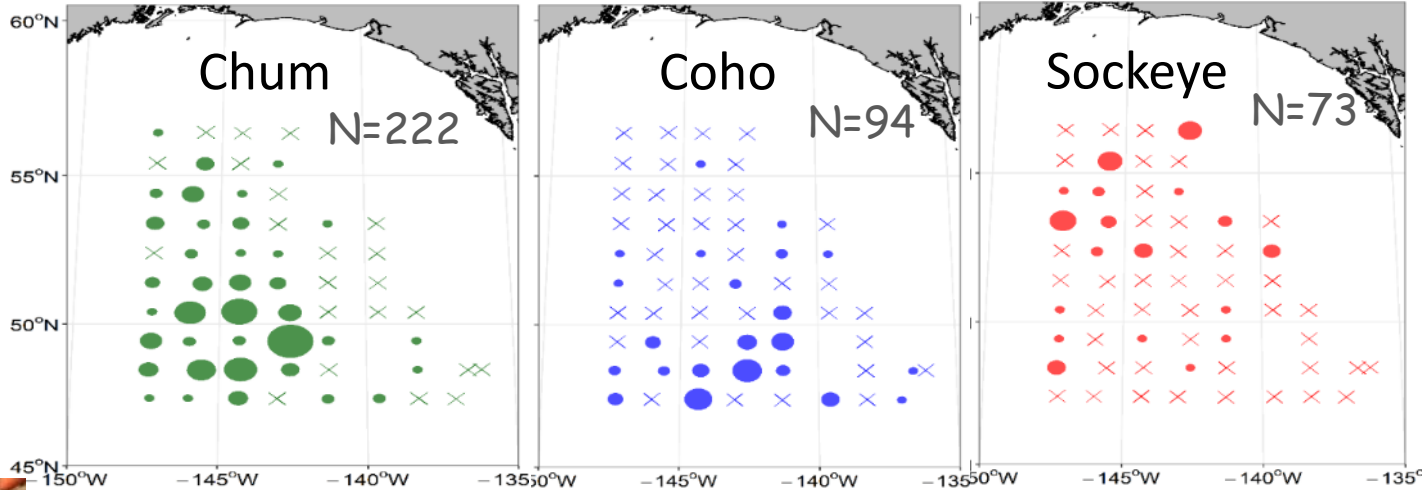
- Clear north-south segregation
- *C. melanaster* jellyfish visible in north at night in surface waters.
- Salps have low occurrence in chum salmon diet



Chrysaora melanaster

Pacific salmon catch by species

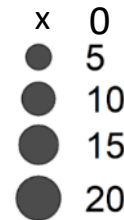
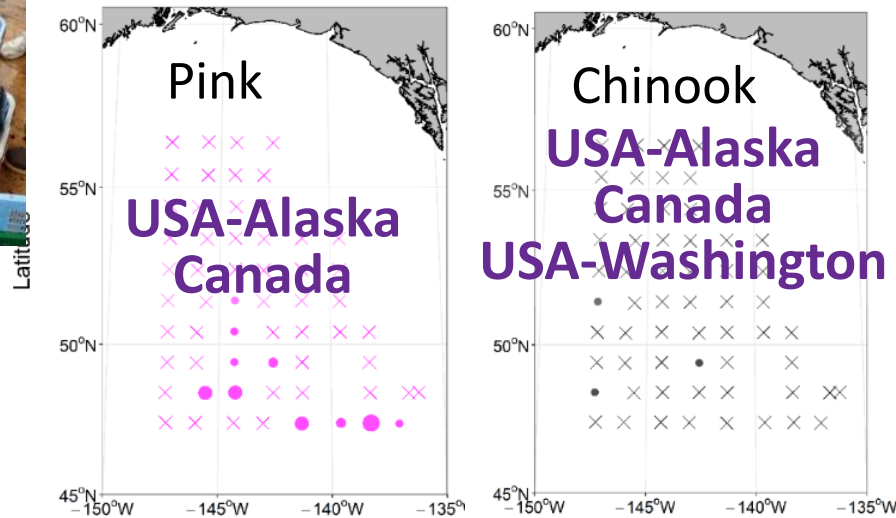
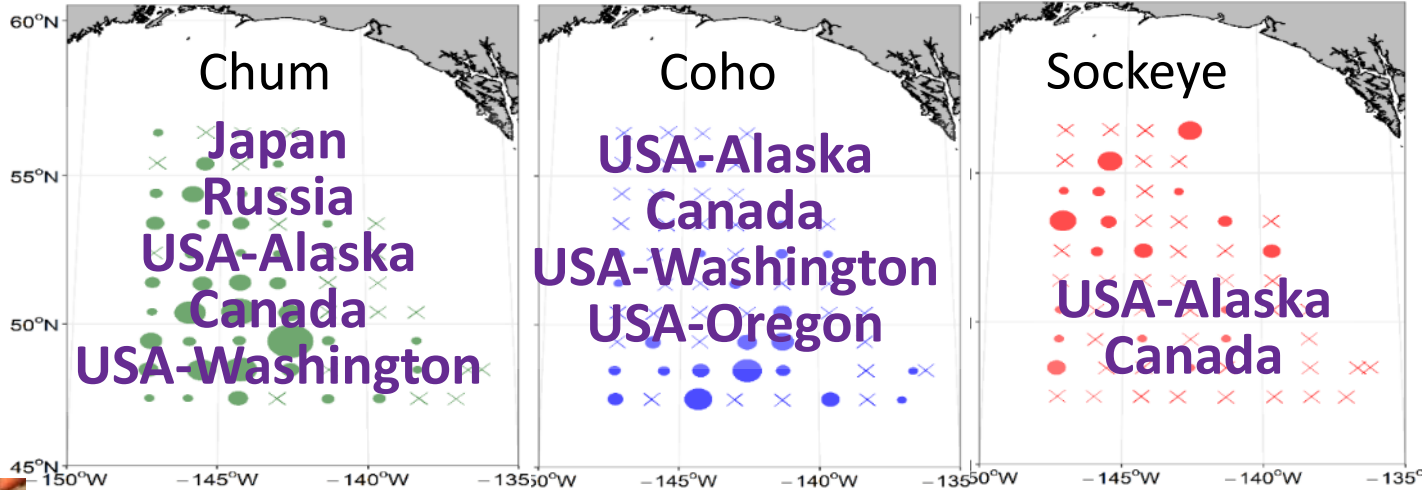
Fish team



- Clear north-south and east-west differences between species

Pacific salmon origins from genetics

Fish team cont.



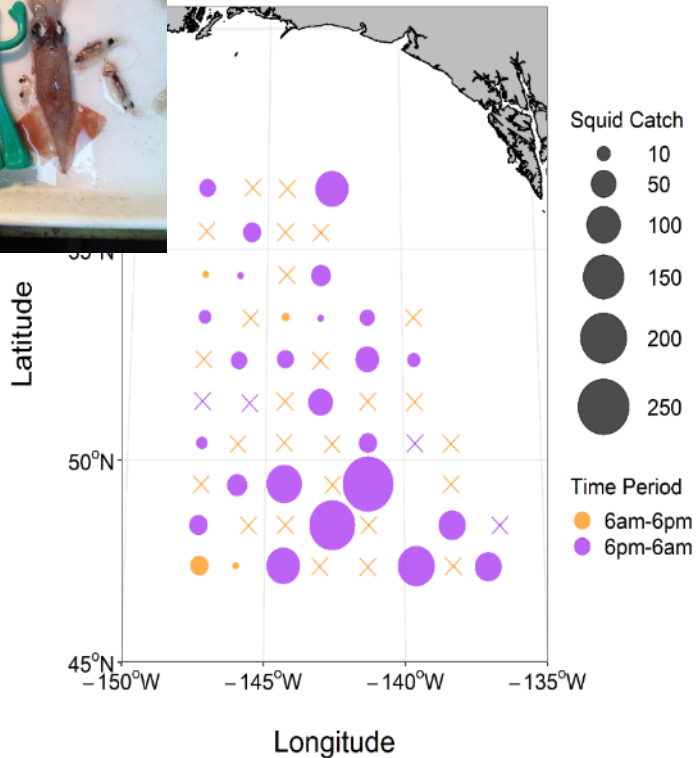
- Clear north-south and east-west differences between species

Night creatures: Squid and lanternfish

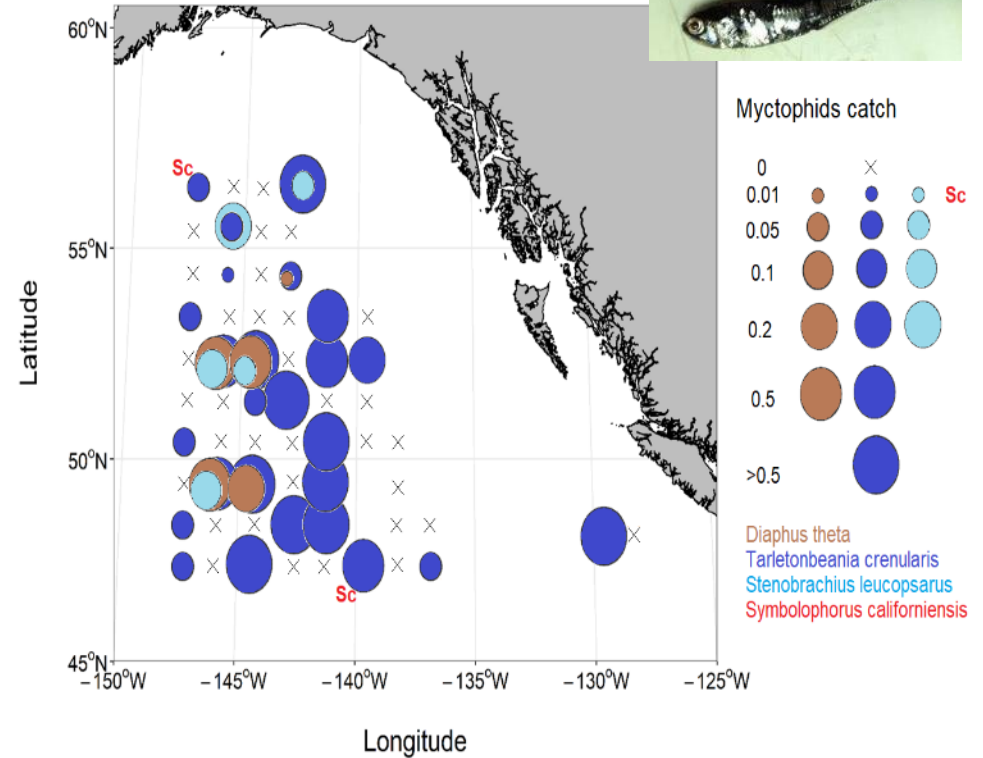
Mikhail Zuev (Russia), Svetlana Esenkulova (Canada), Vladimir Radchenko (NPAFC) and the Fish team



Gonatid squids



Lanternfishes

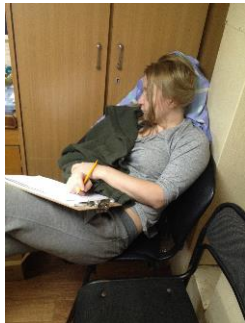
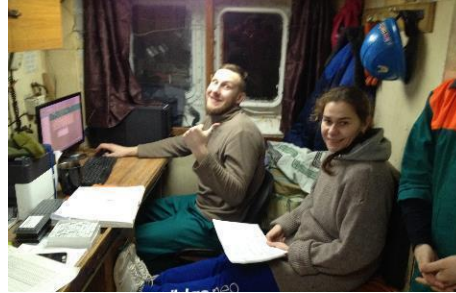


Lessons learned

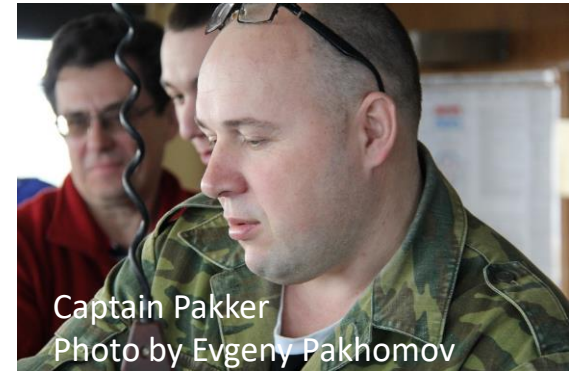


- Winter surveys in the Gulf of Alaska are possible.
- International collaboration works (and is fun)!
- Holistic study essential to understanding
 - Physical oceanogr → Biological oceanogr → Nekton
- Salmon distribution differed substantially with some species showing potential links to environmental conditions
 - Sockeye and cool water
 - Pink and Coho in warmer water
- Many more results to come.....

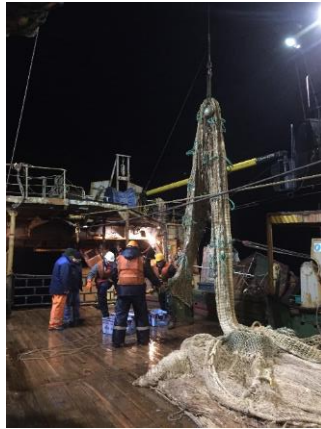
Fantastic teamwork!



Deepest gratitude to the sponsors! And to the Prof. Kaganovsky crew, officers, mechanics and Captain Alexander Pakker !!!

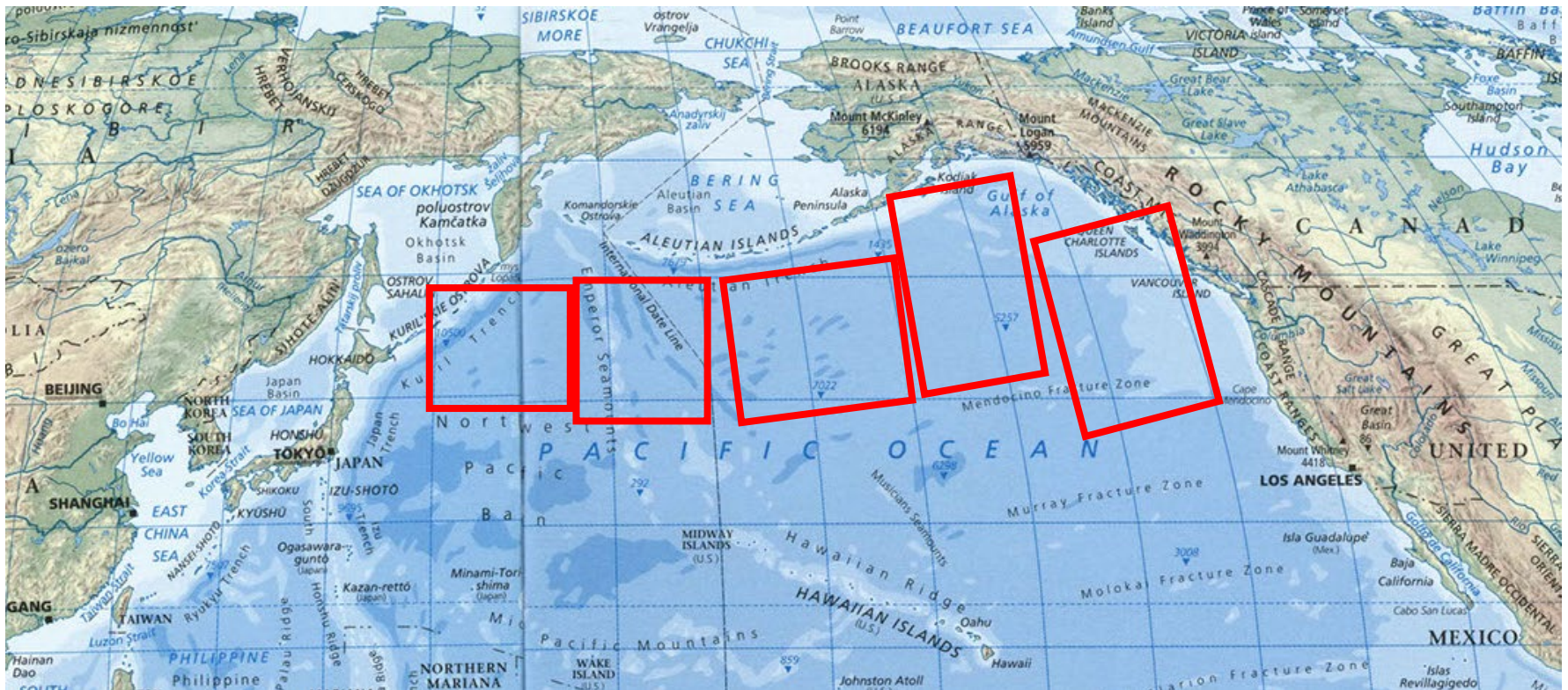


Captain Pakker
Photo by Evgeny Pakhomov



Planning for joint surveys in 2021

Simultaneous surveys by US, Canada, Russia, Japan, and Korea
Winter 2021



Questions?

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