Comparative oceanographic conditions during the International Gulf of Alaska Expedition 2019 and 2020

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Gennady Kantakov,
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Natalie Mahara,
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Vladimir Radchenko,
Igor Shurpa,
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Anna Vazhova,
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Charles Waters,
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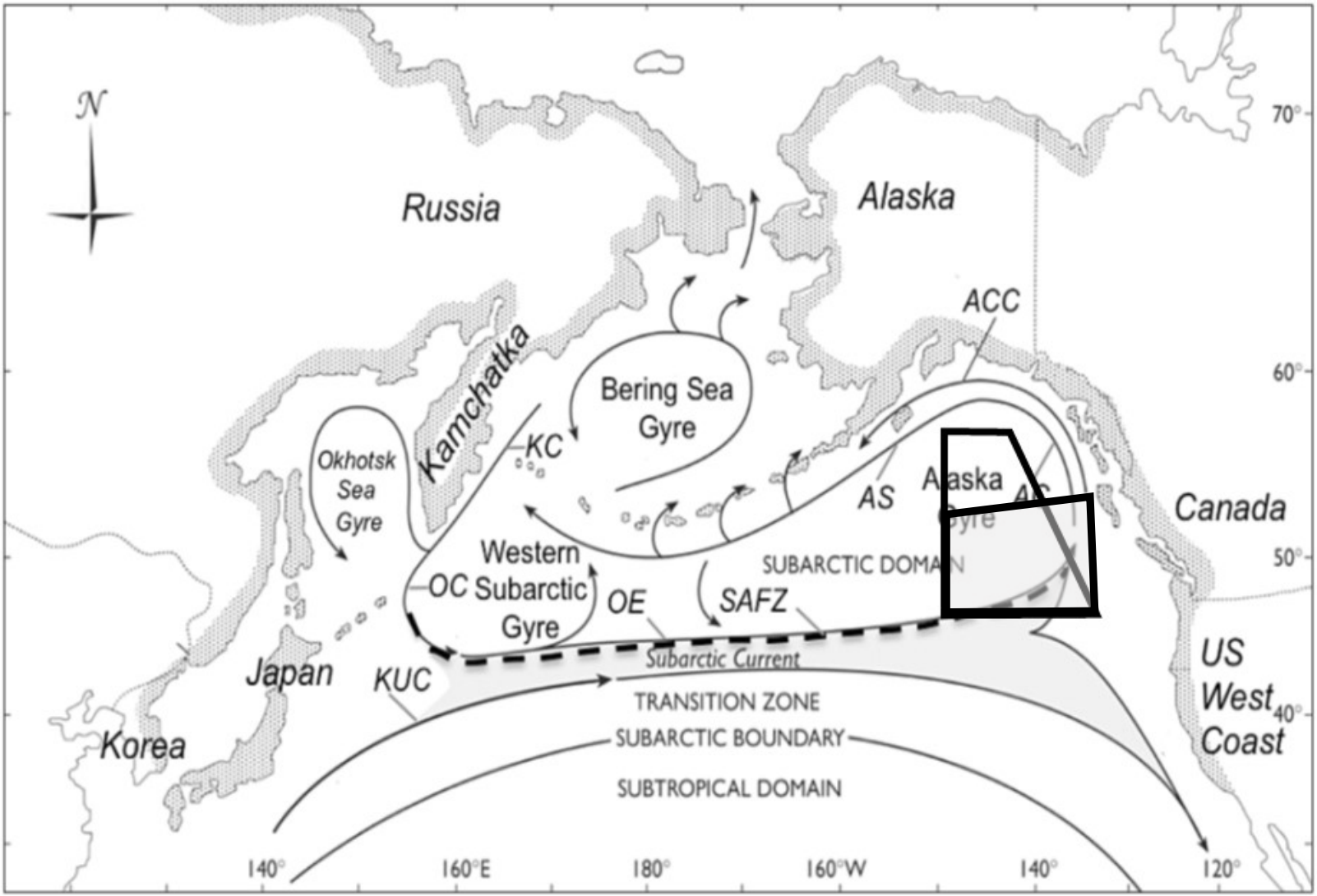
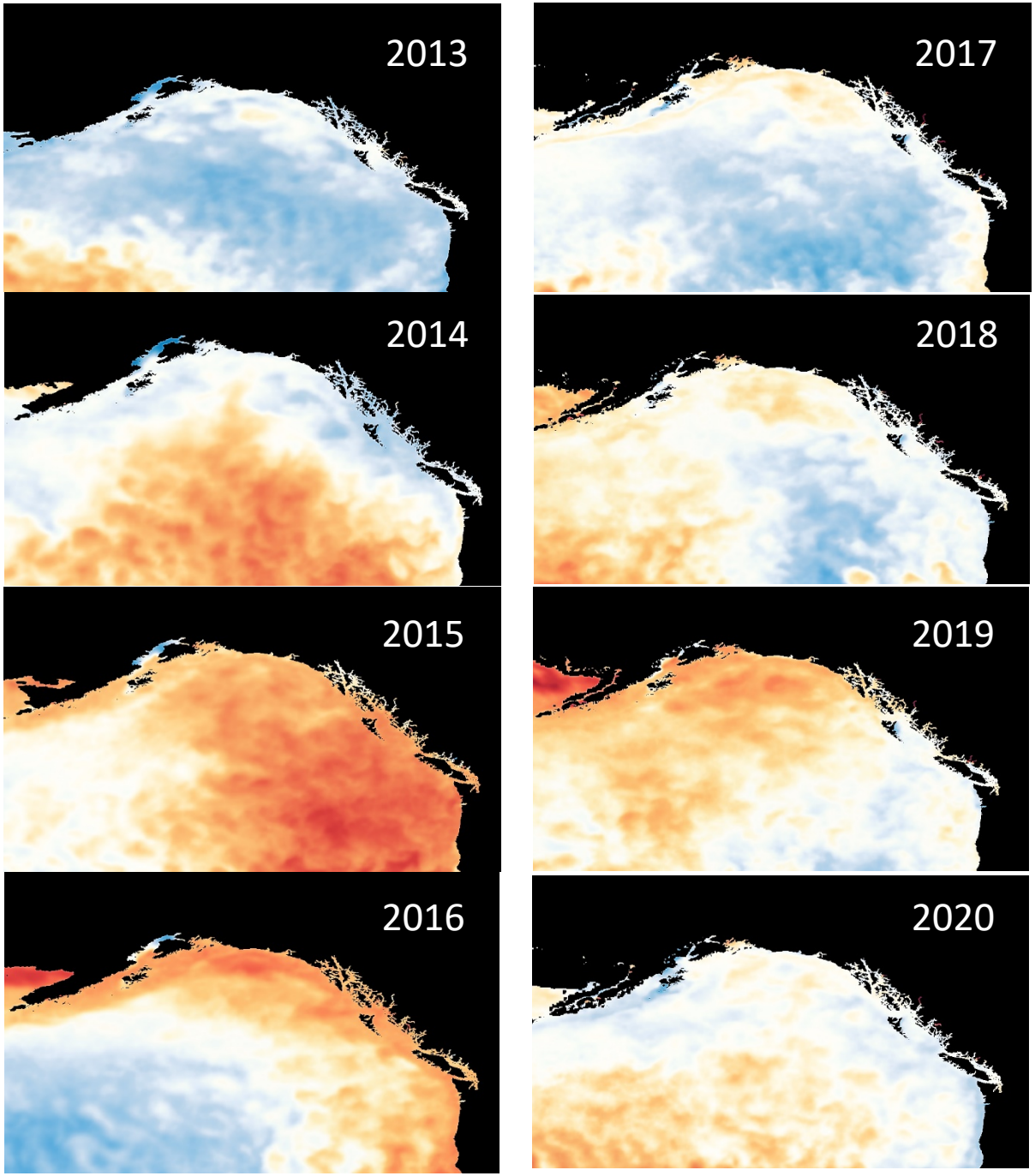
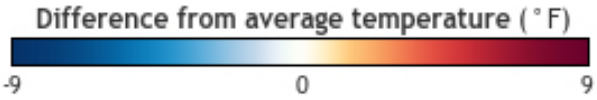
Mikhail Zuev


N
Russia
Alaska
Kamchatka
ACC
Bering Sea
Gyre
KC
Okhotsk
Sea
Gyre
AS
Alaska
Gyre
Canada
Western
Subarctic
Gyre
OC
OE
SAFZ
SUBARCTIC DOMAIN
Subarctic Current
Japan
KUC
TRANSITION ZONE
SUBARCTIC BOUNDARY
Korea
SUBTROPICAL DOMAIN
US
West
Coast
70°
60°
50°
40°
140°
160°E
180°
160°W
140°
120°

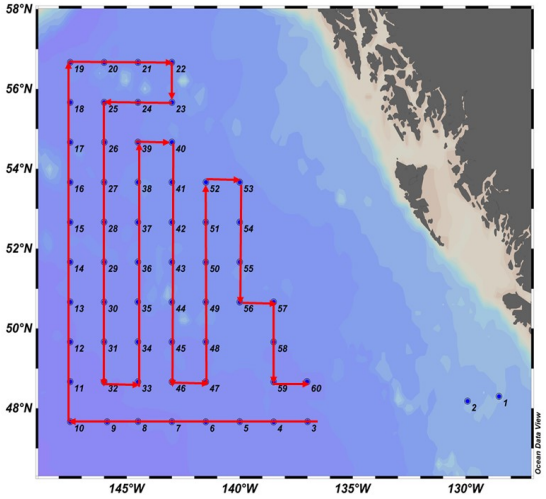


SST Anomaly (1981-2010) during March 2013-2020 in the Gulf of Alaska



ftp://ftp.nnvl.noaa.gov/View/SSTA/Images/Color/Monthly/

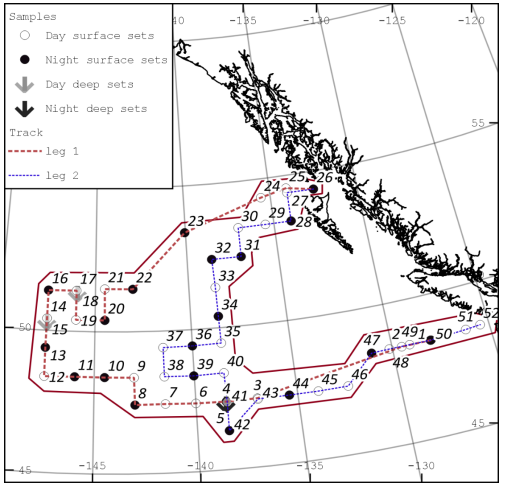
2019

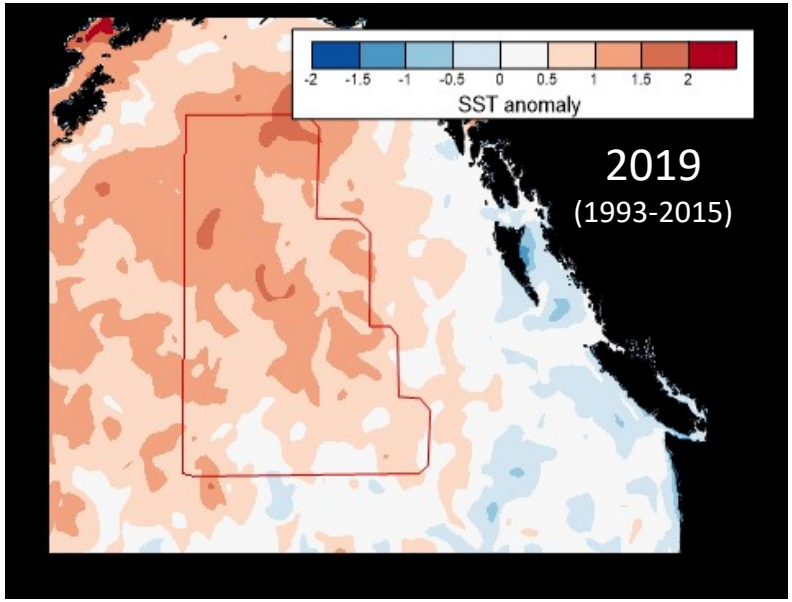


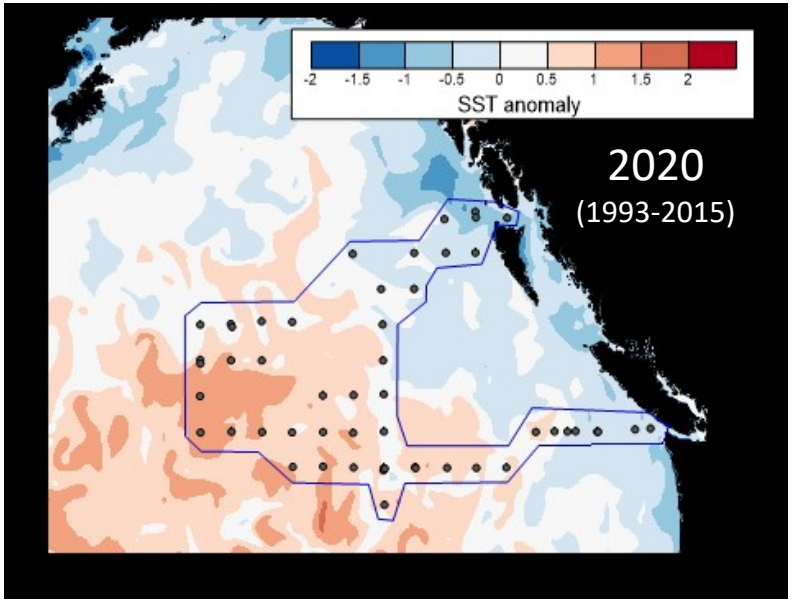
Observations

1. <u>Physical and chemical oceanography</u>: CTDs (0-1000m and 0-300m)
2. <u>Zooplankton</u>: Bongo (0-250m) or Juday nets (0-200m)
3. <u>Micronekton and fish</u>: Midwater trawls (0-30m)

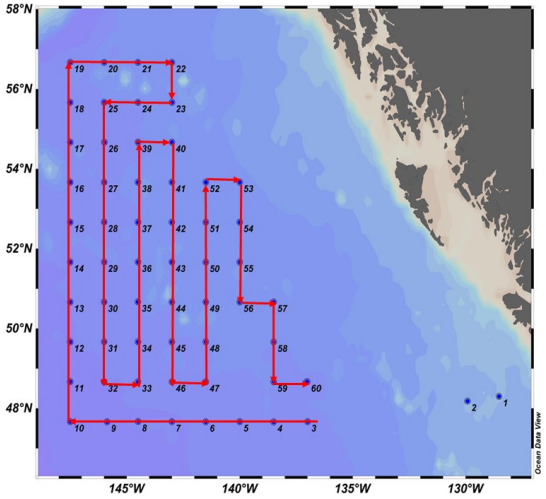
2020







2019



Observations

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2. <u>Zooplankton</u>: Bongo (0-250m) or Juday nets (0-200m)
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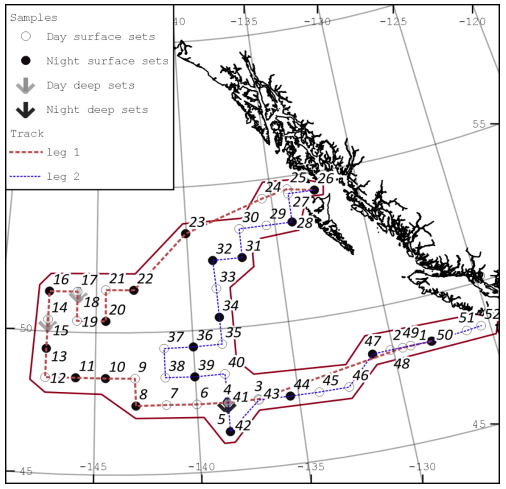
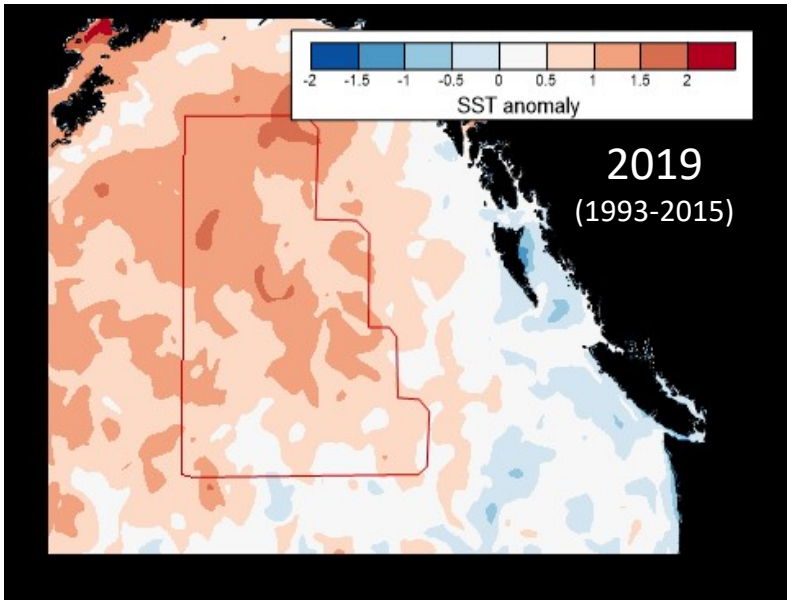
2020

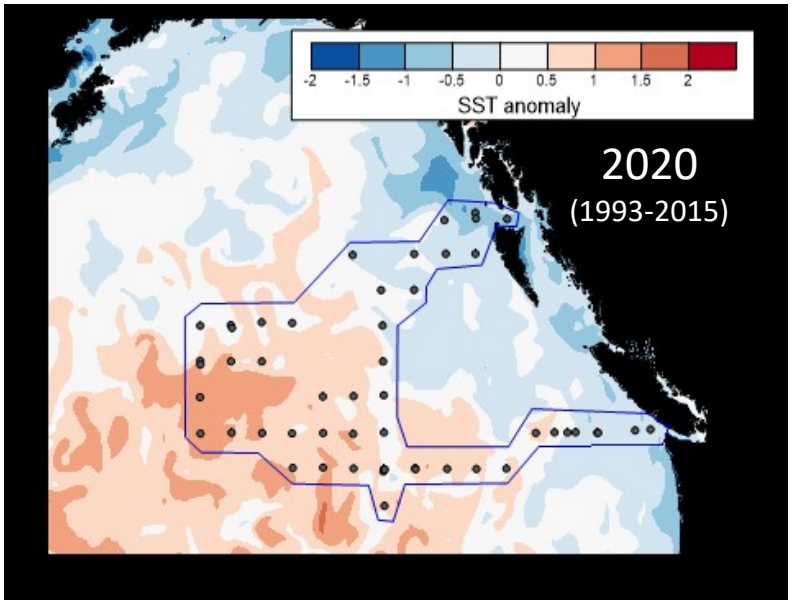




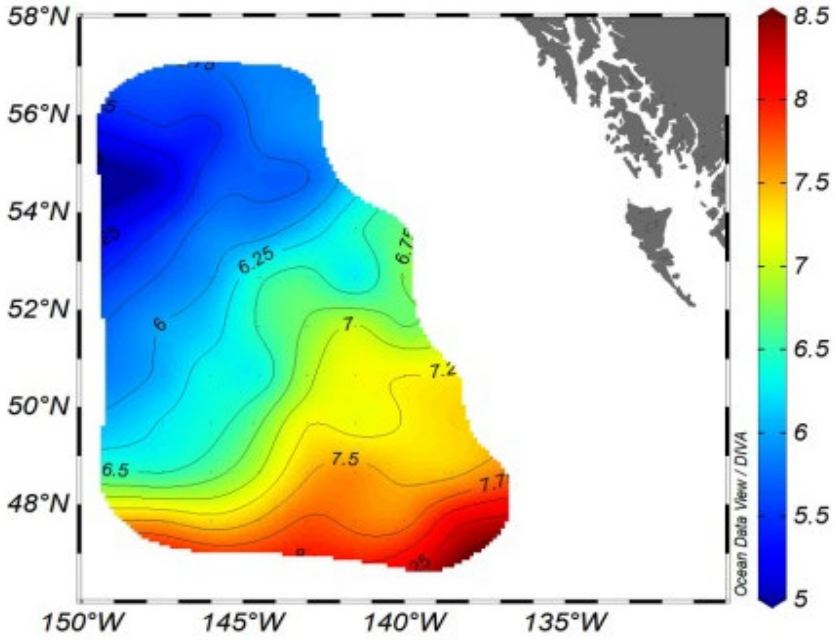
overall (45-64N)
-0.33 °C

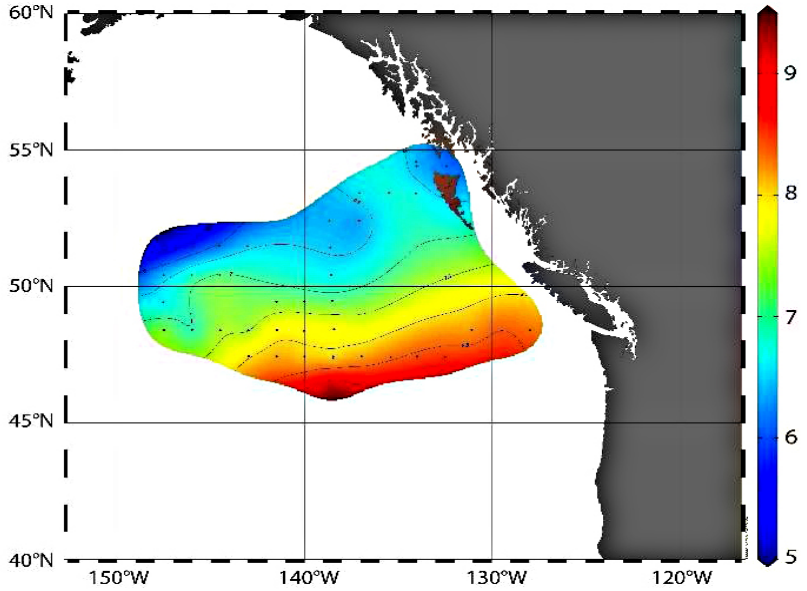
north (52-64N)
-0.82 °C

south (45-52N)
+0.06 °C



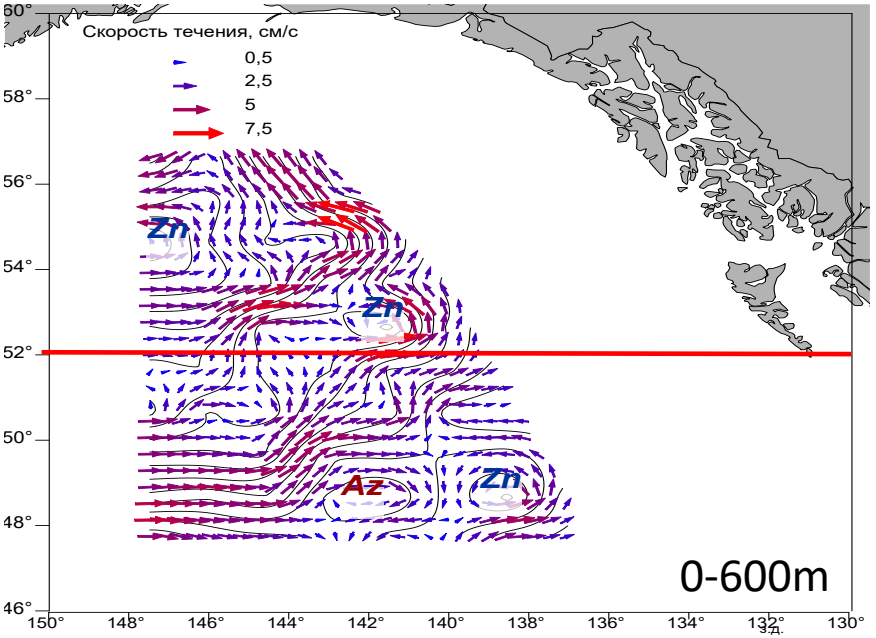
Surface temperature



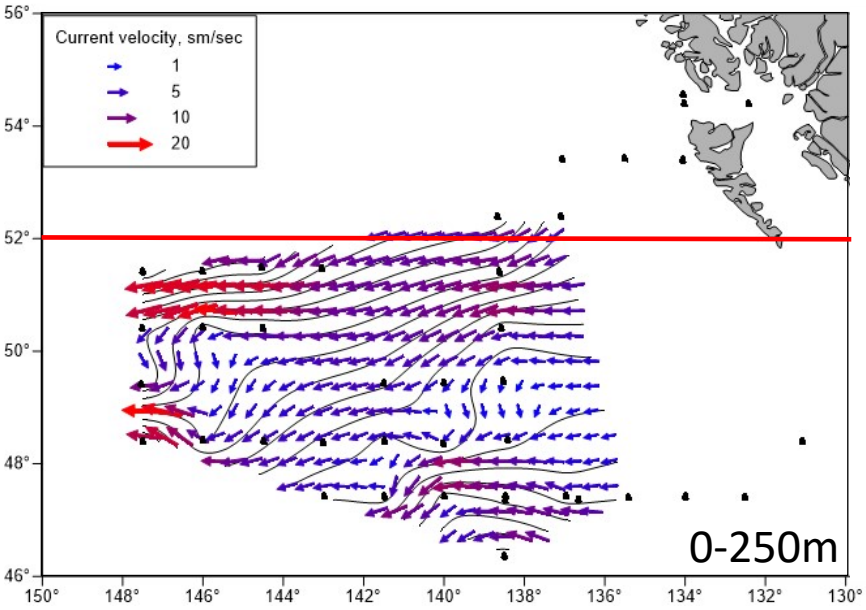


Geostrophic currents

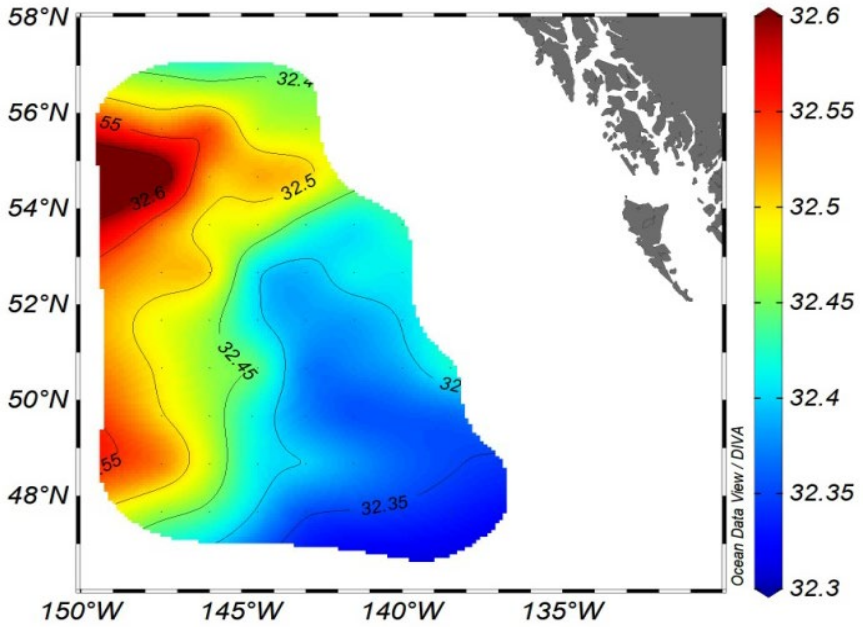
2019

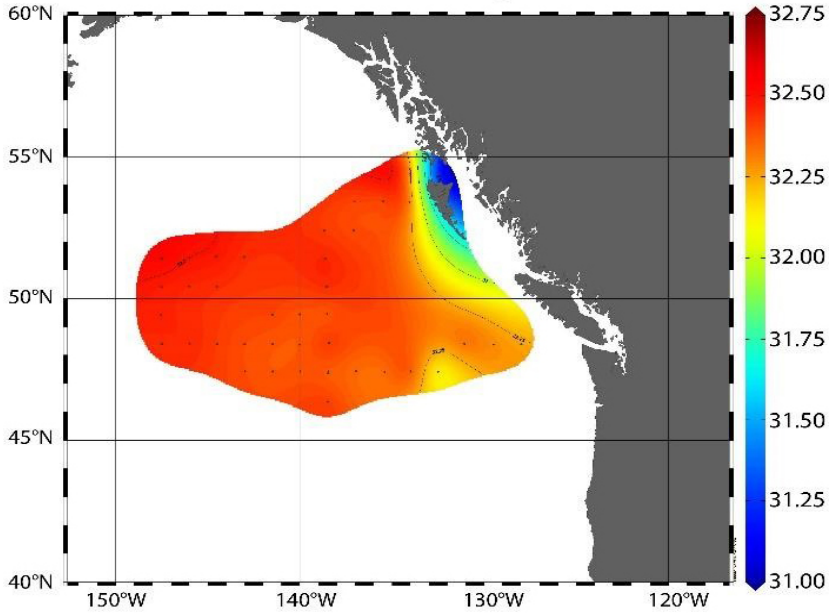


2020



Surface salinity

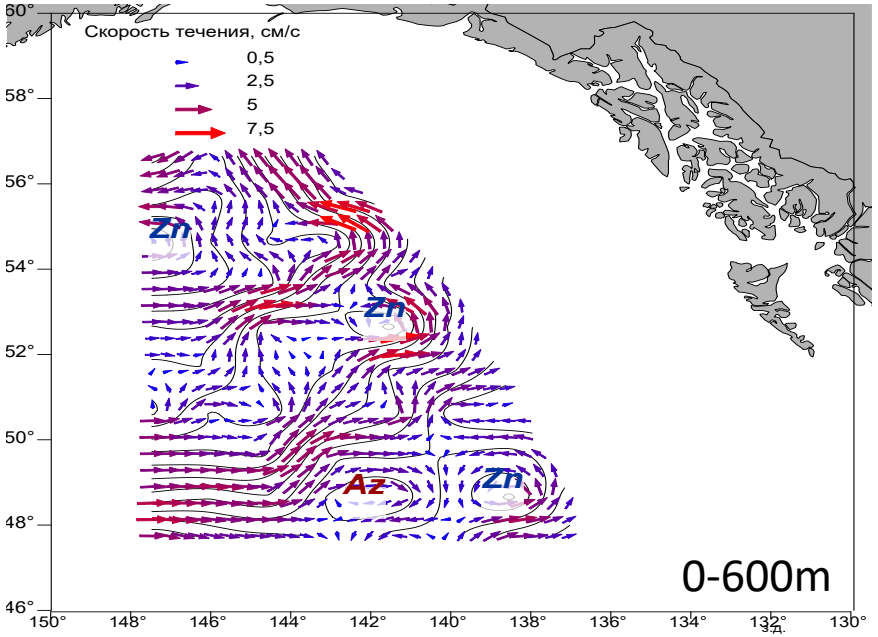


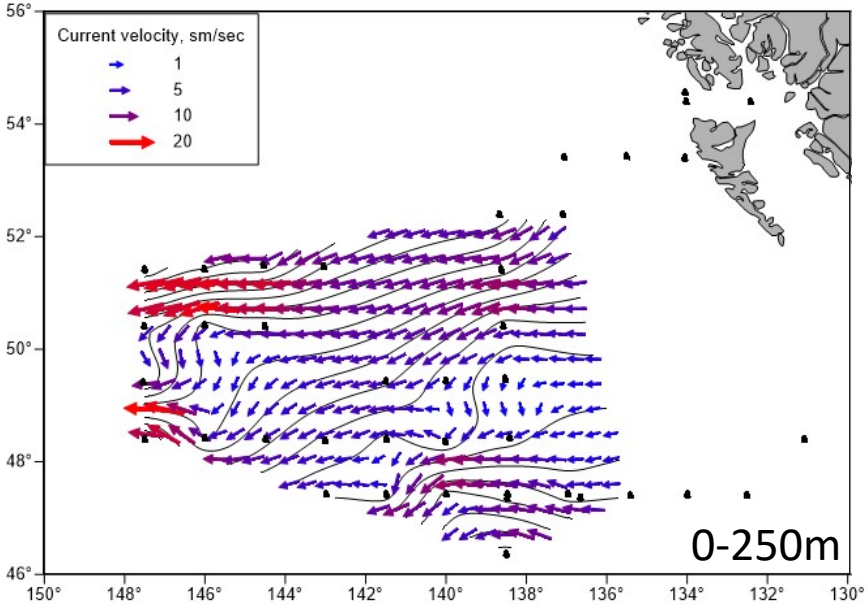


2019

2020

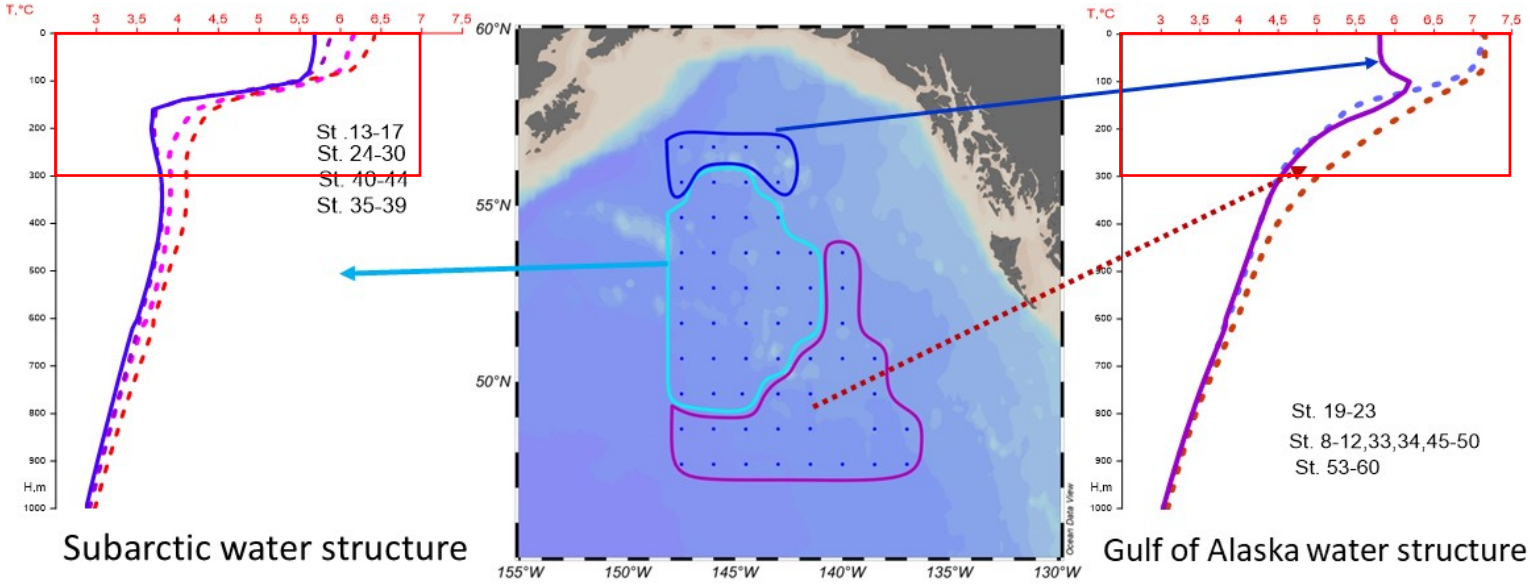
Geostrophic currents



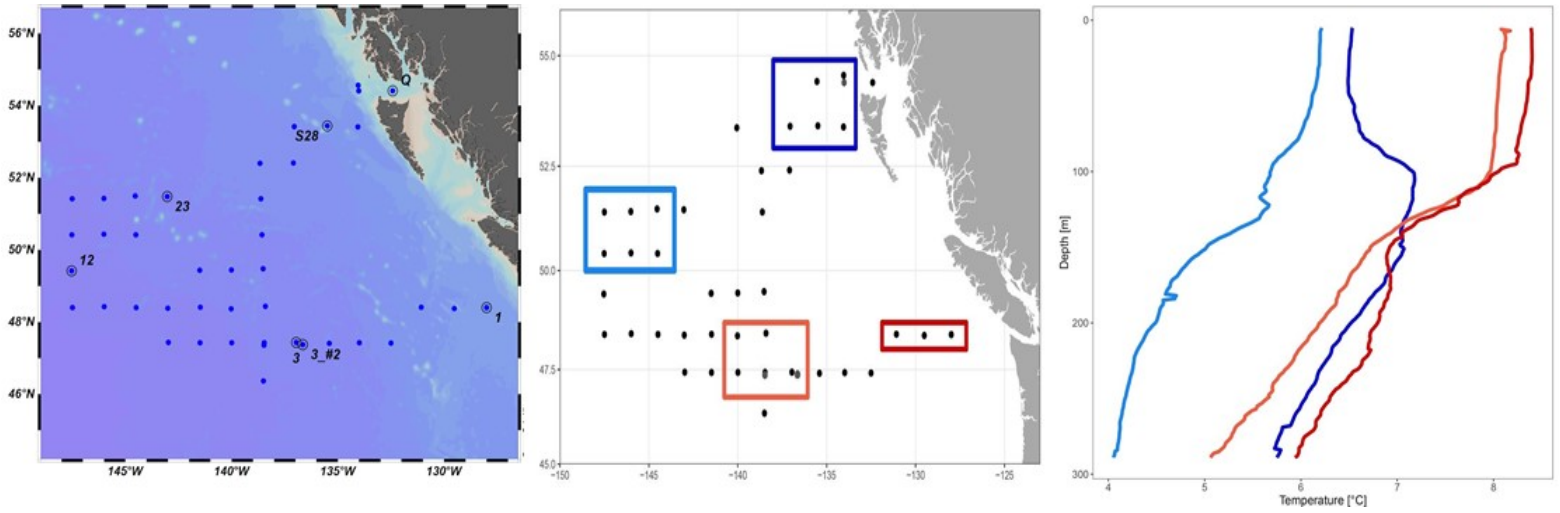


Water masses in the GoA

2019



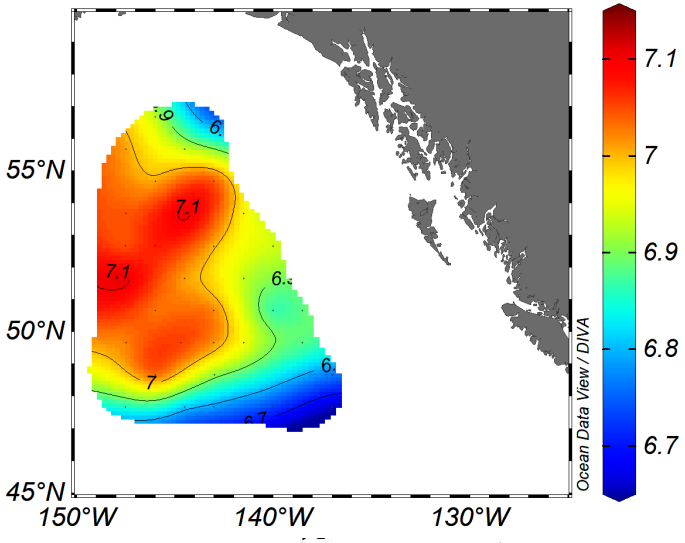
2020

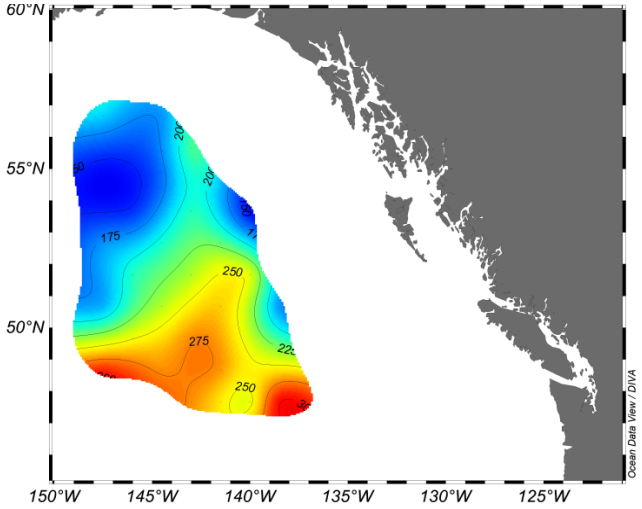


Surface dissolved oxygen, mL/L

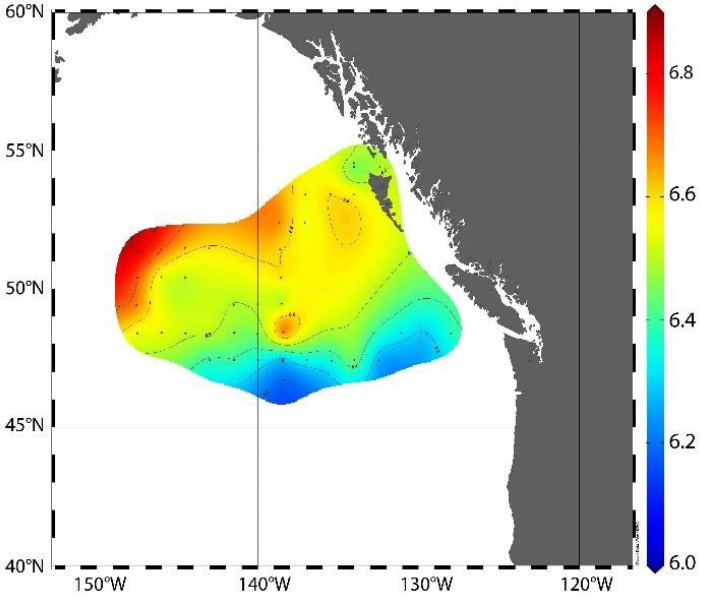
Critical oxygen depth, 2.5 mL/L

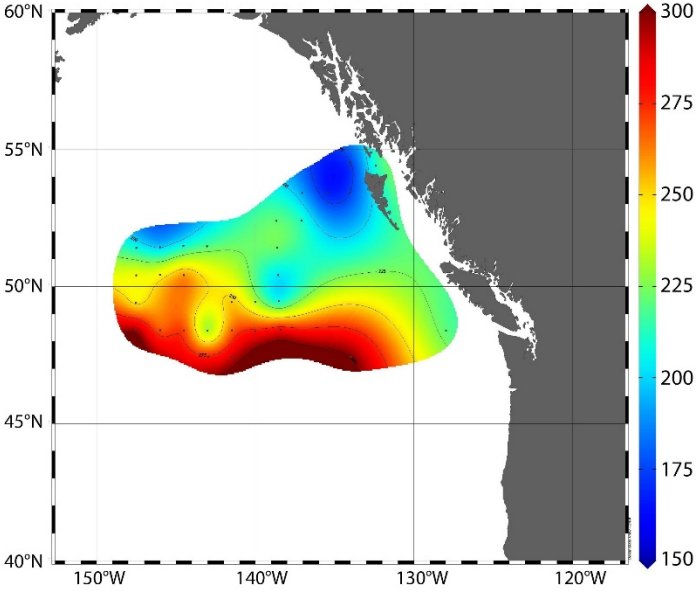
2019



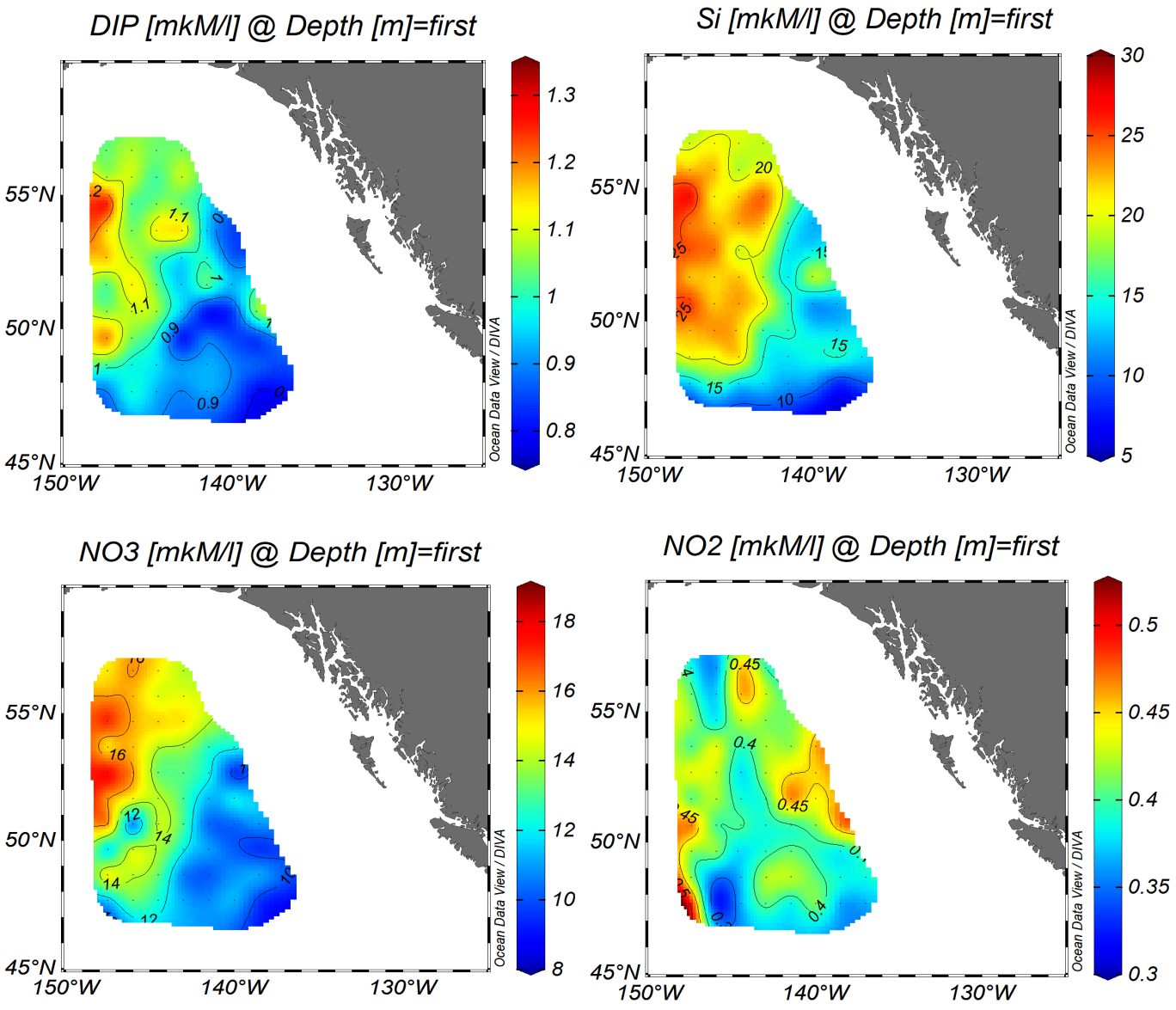


2020

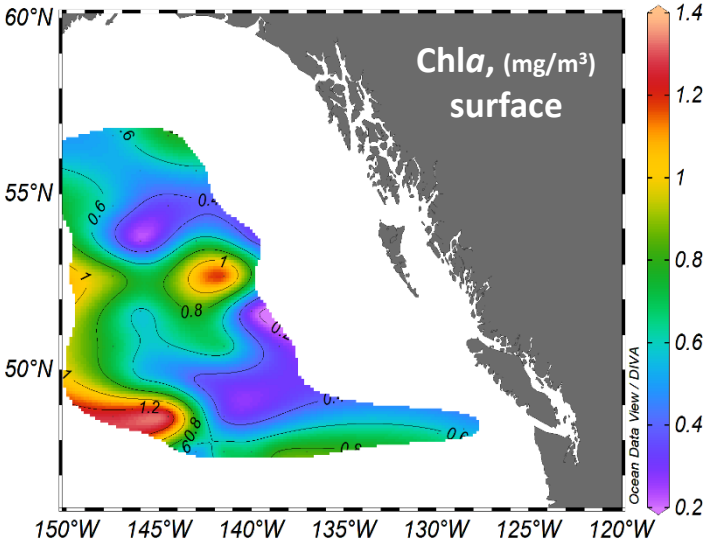


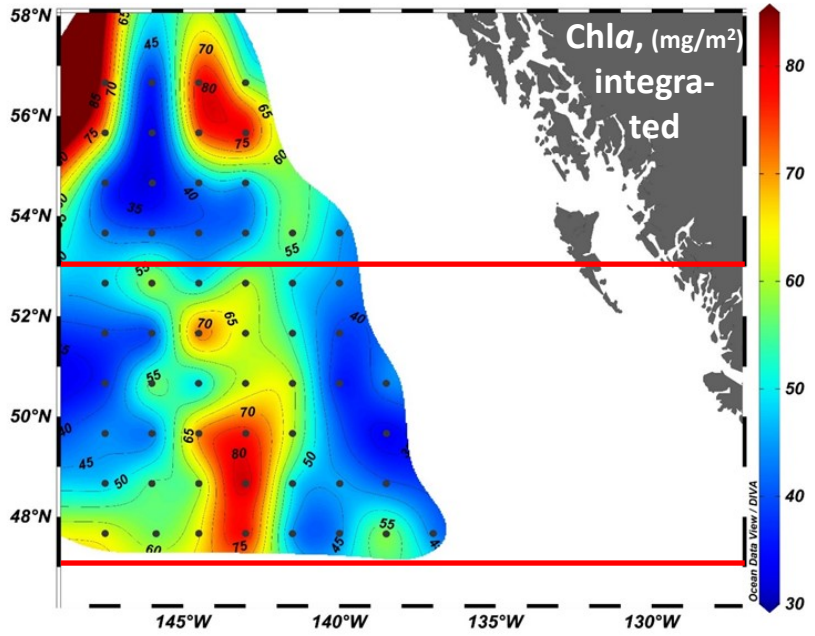


2019: Surface nutrient concentrations (µM/L)

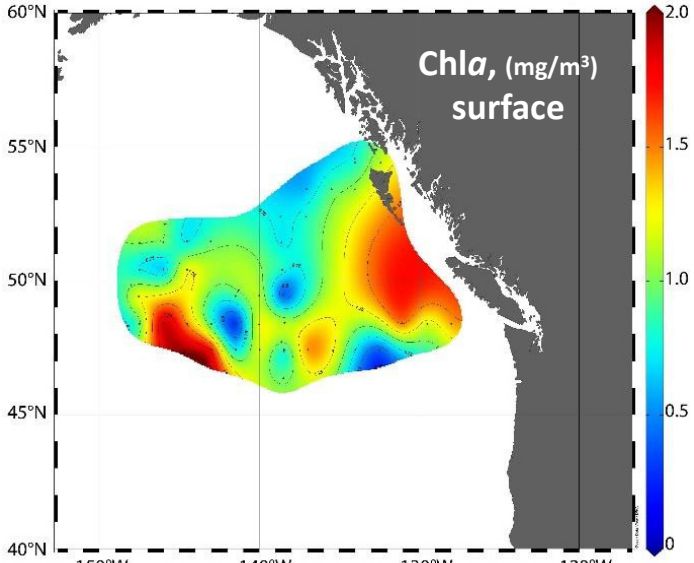


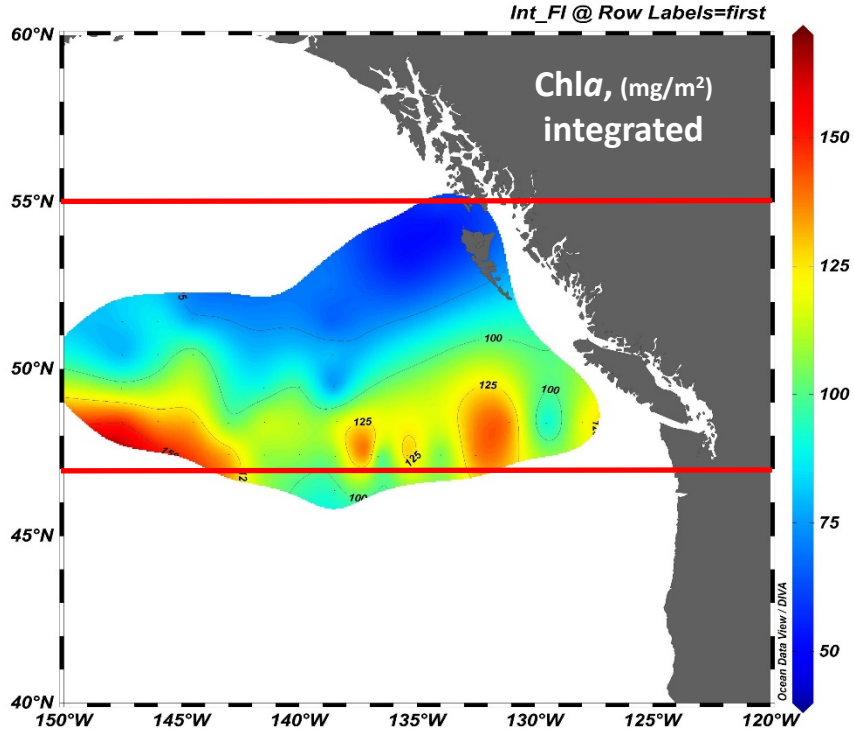
2019


Chl*a*, (mg/m³)
surface
60°N
55°N
50°N
150°W
145°W
140°W
135°W
130°W
125°W
120°W
1.4
1.2
1
0.8
0.6
0.4
0.2
Ocean Data View / DIVA

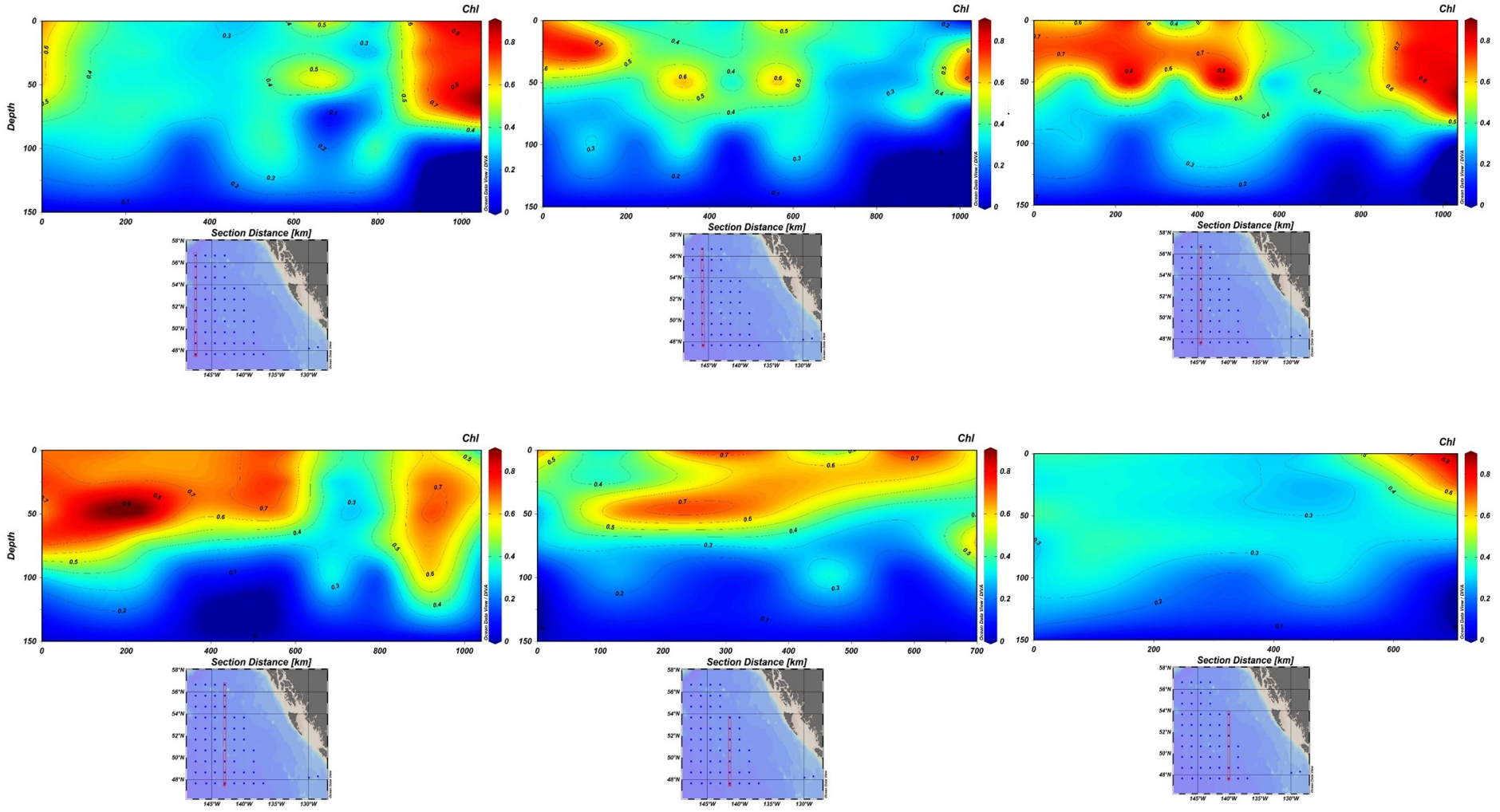

Chl*a*, (mg/m²)
integra-
ted
58°N
56°N
54°N
52°N
50°N
48°N
145°W
140°W
135°W
130°W
80
70
60
50
40
30
Ocean Data View / DIVA

2020

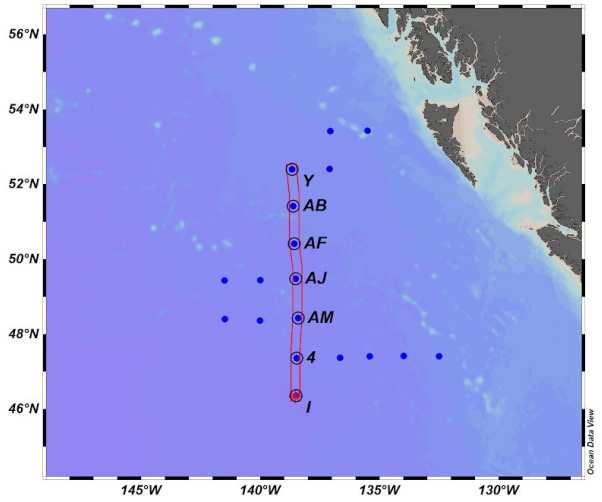

Chl*a*, (mg/m³)
surface
60°N
55°N
50°N
45°N
40°N
150°W
140°W
130°W
120°W
2.0
1.5
1.0
0.5
0

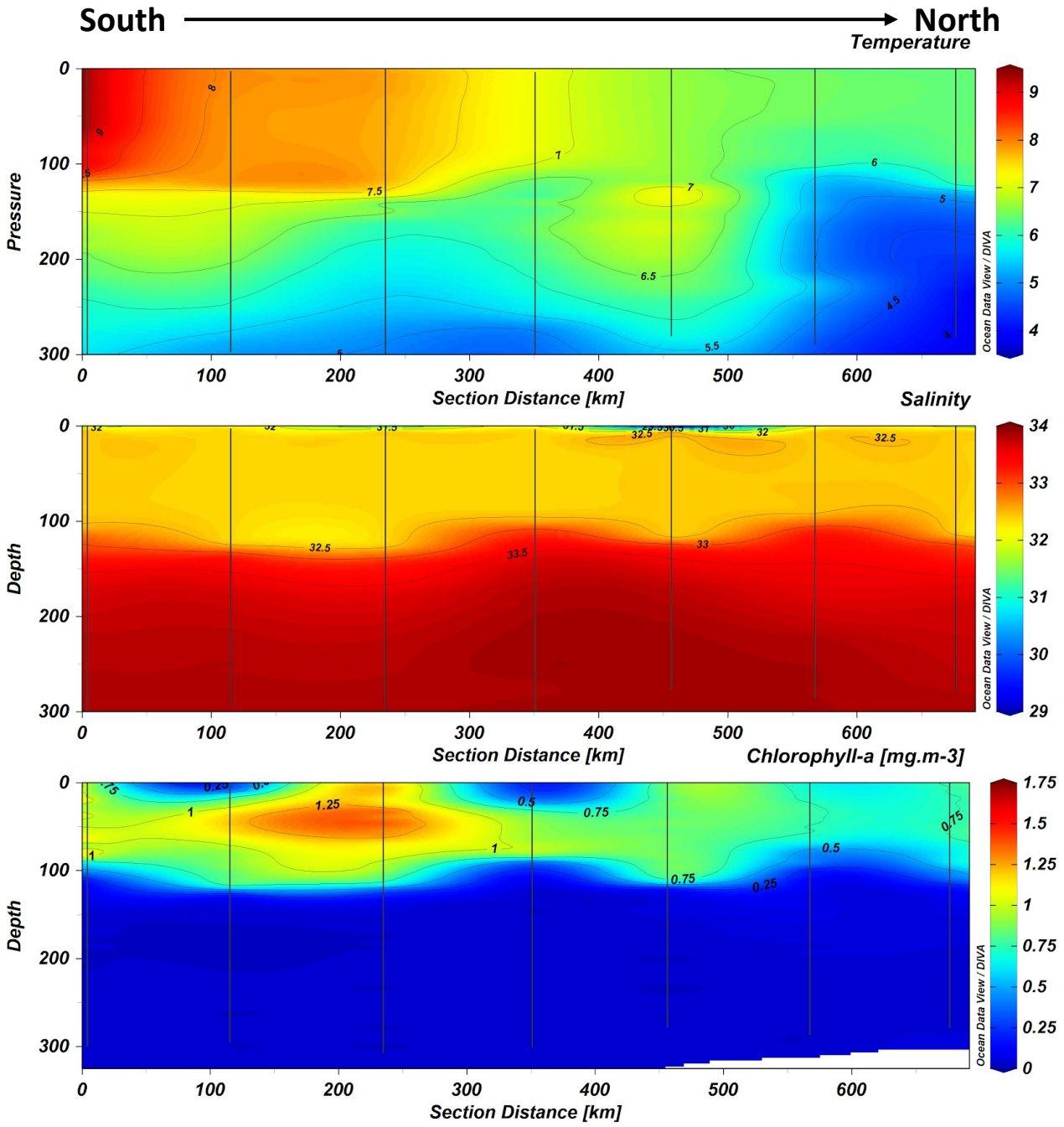

Int_Fl @ Row Labels=first
Chl*a*, (mg/m²)
integrated
60°N
55°N
50°N
45°N
40°N
150°W
145°W
140°W
135°W
130°W
125°W
120°W
150
125
100
75
50
Ocean Data View / DIVA

2019: Chlorophyll-*a* (mg/m^3), GoA



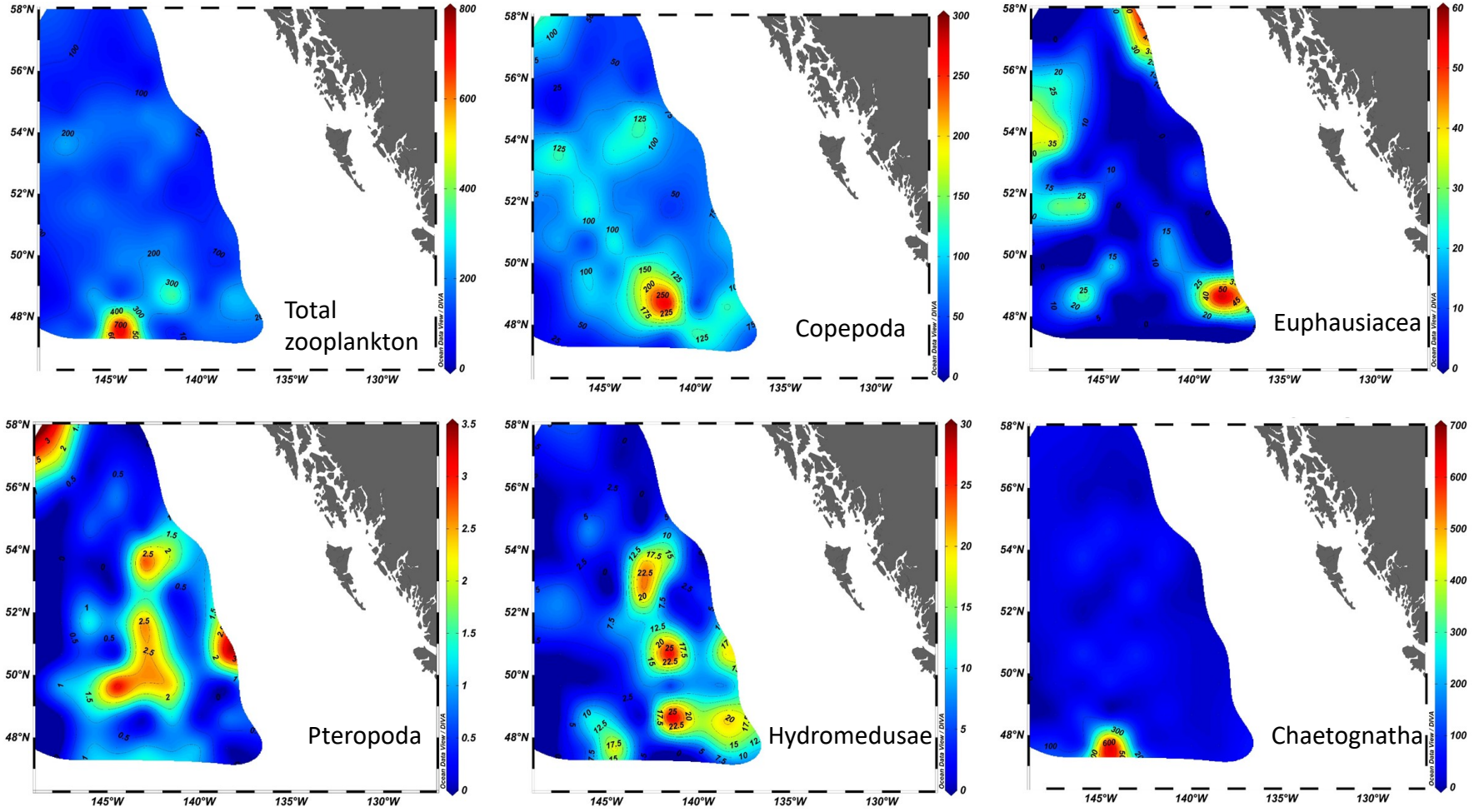
2020: Chlorophyll-*a* (mg/m³), GoA



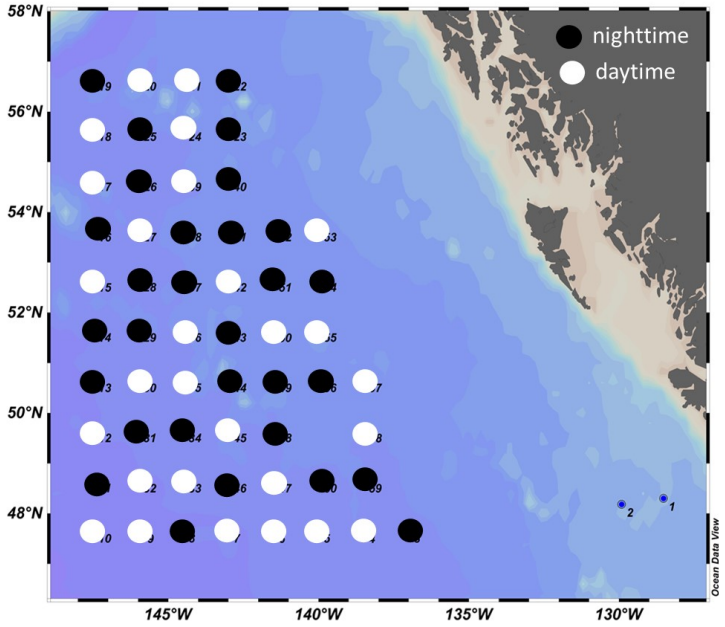


2019, Gulf of Alaska

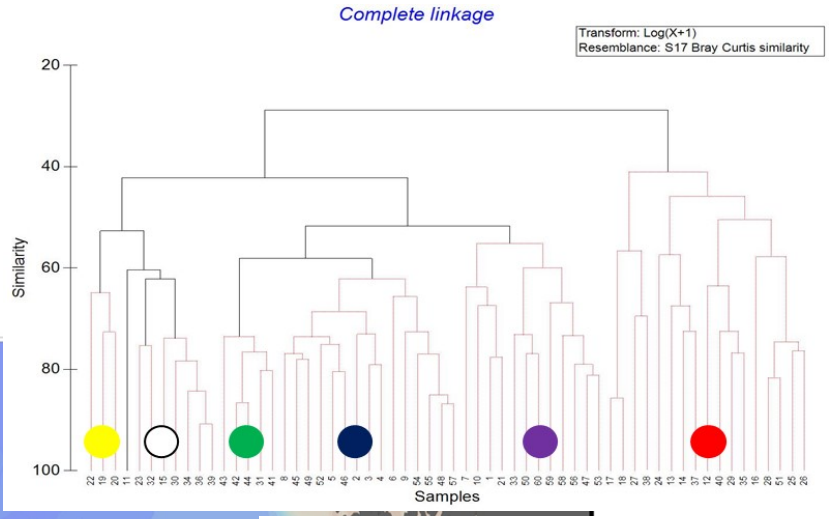
Zooplankton biomass (mgWW.m^{-3}), 0-200 m, Juday net)

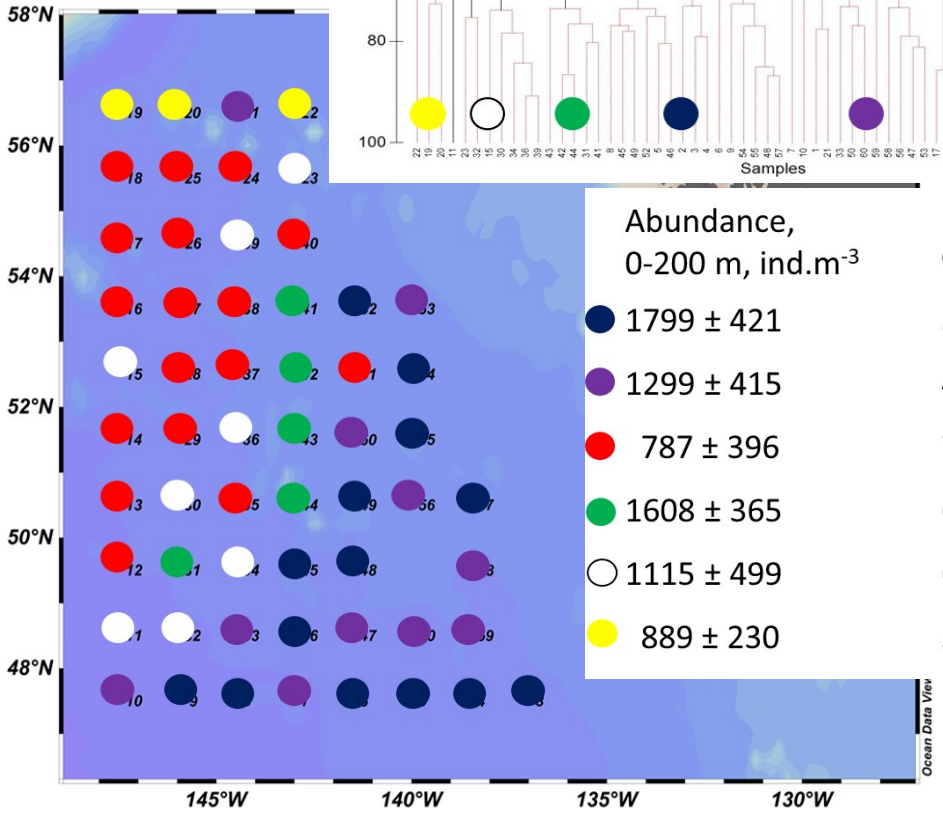


2019: GoA, zooplankton sampling



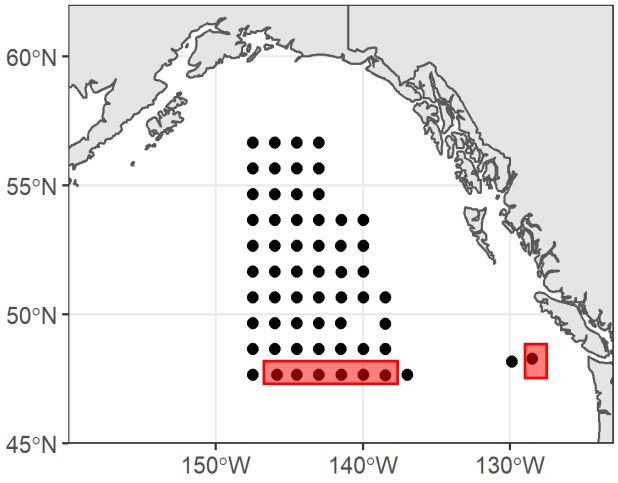
2019: GoA, zooplankton assemblages



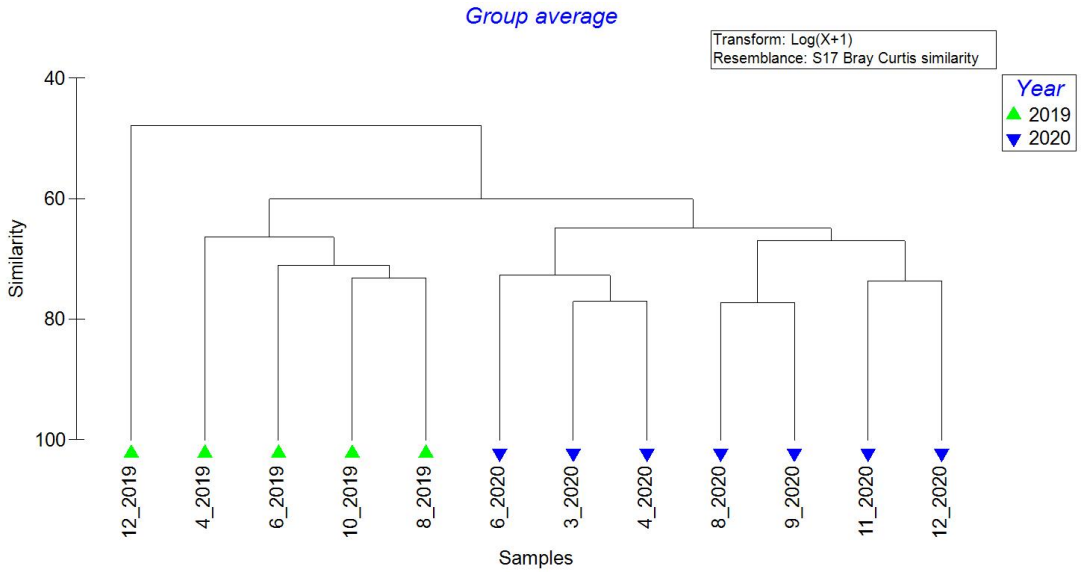


Abundance, 0-200 m, ind.m^{-3}	% *Oithona similis*
1799 ± 421	34
1299 ± 415	40
787 ± 396	70
1608 ± 365	63
1115 ± 499	67
889 ± 230	56

Preliminary comparison of 2019 and 2020 zooplankton communities



Red – compared stations

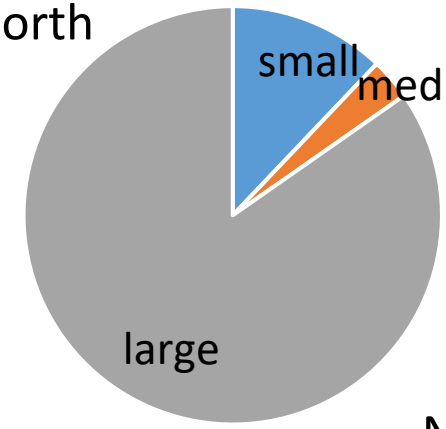


Significant difference between 2019 & 2020 – higher contribution of Southern species in 2020

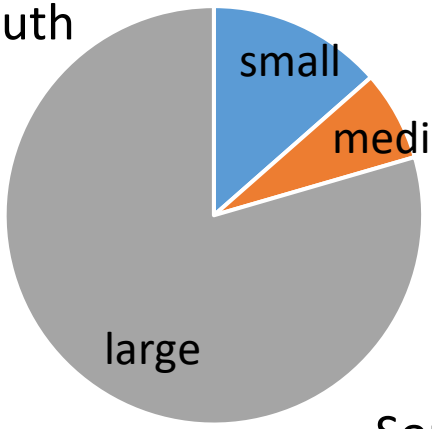
2019, Gulf of Alaska

Juday net, 0-200 m, Biomass, mgWW.m^{-3}

North



South



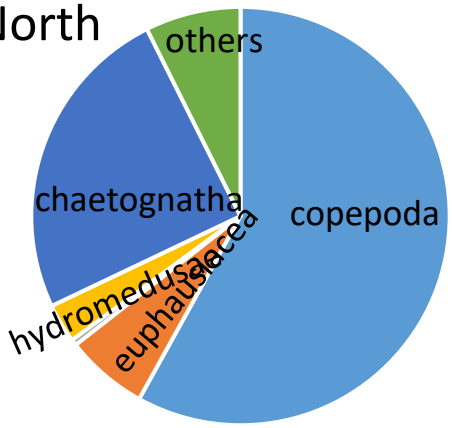
Total biomass
187 ± 135 mgWW.m^{-3}

Total abundance
1602 ± 452 ind.m^{-3}
Copepods 88 ± 8 %

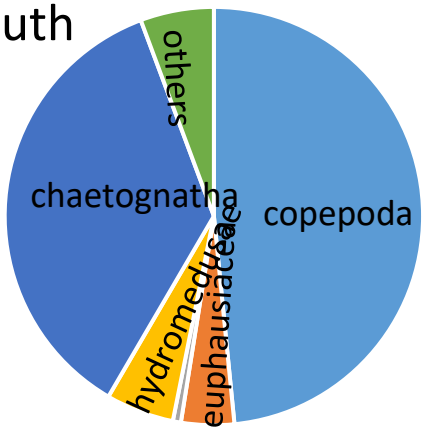
Total biomass
128 ± 47 mgWW.m^{-3}

Total abundance
1007 ± 512 ind.m^{-3}
Copepods 93 ± 5 %

North



South

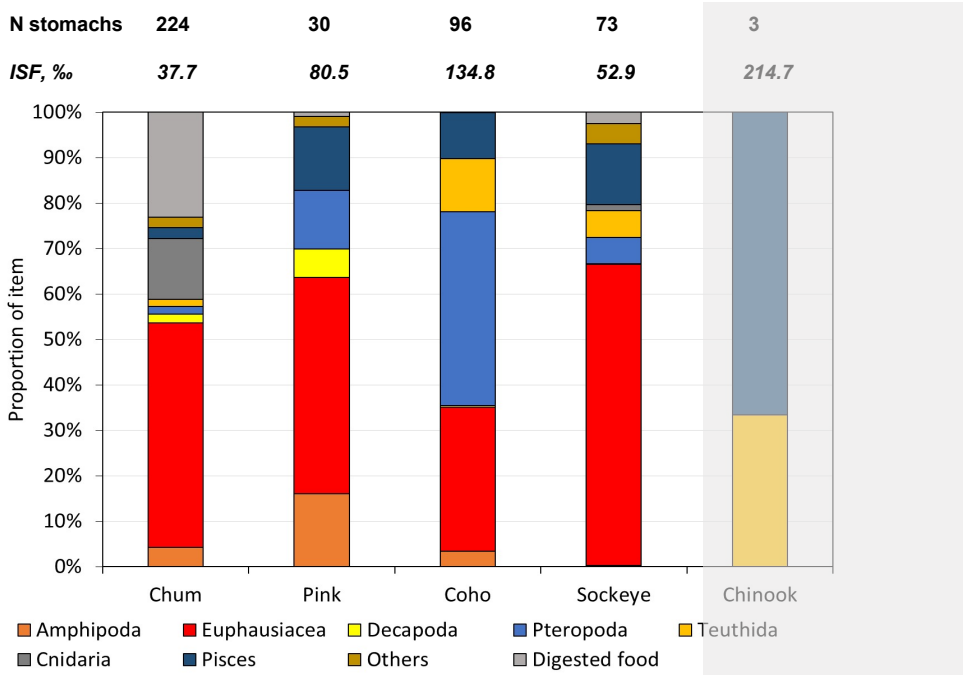


<u>Station Papa:</u>
230-340 mgWW/m^3
(max 1700 mgWW/m^3)

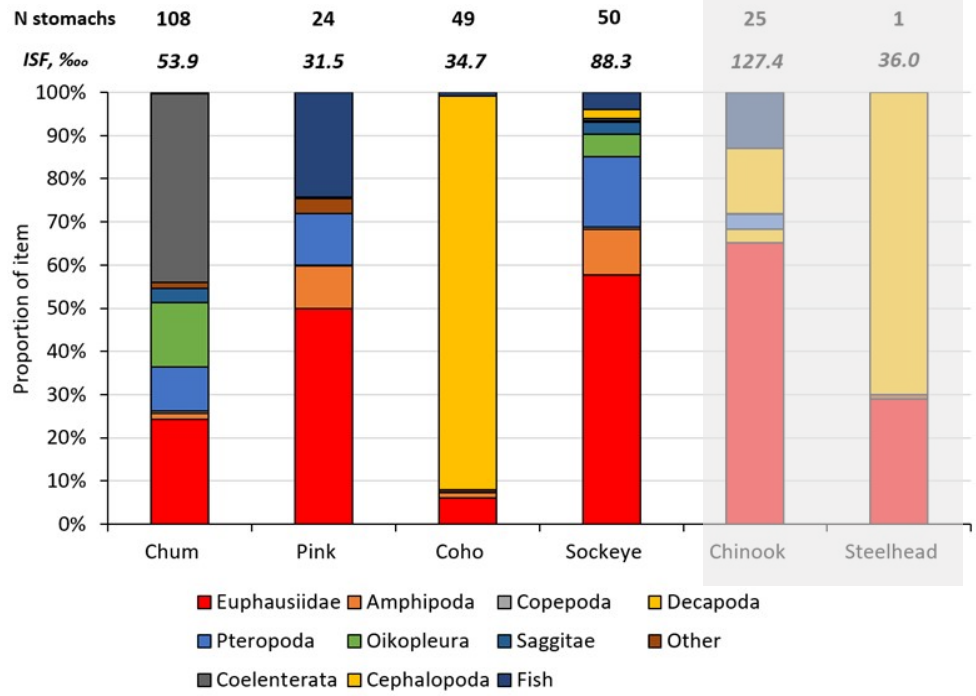
<u>North West Pacific:</u>
200-500 mgWW/m^3
(up to 1200 mgWW/m^3)

Pacific salmon diets in the Gulf of Alaska

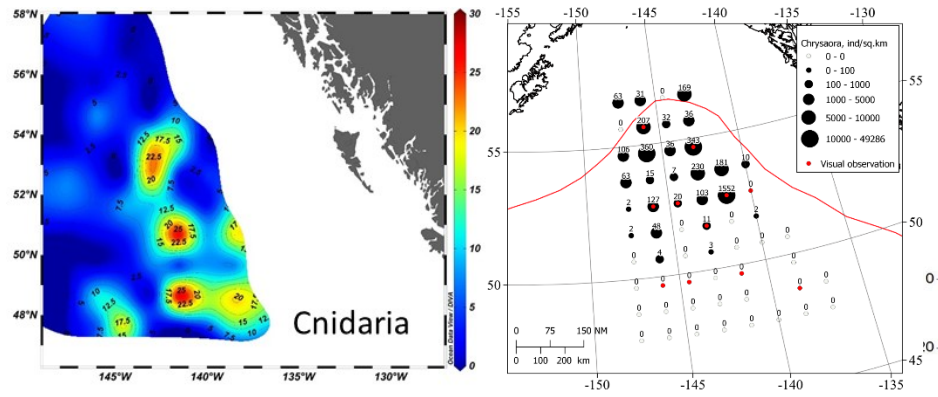
2019



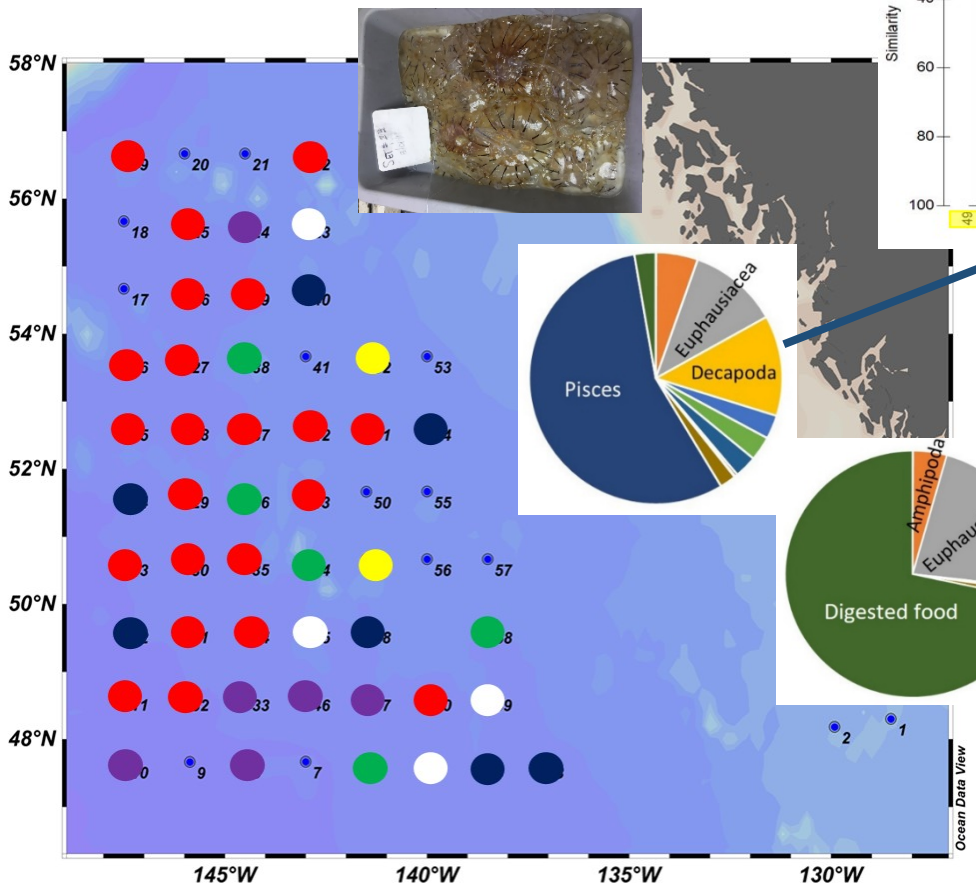
2020

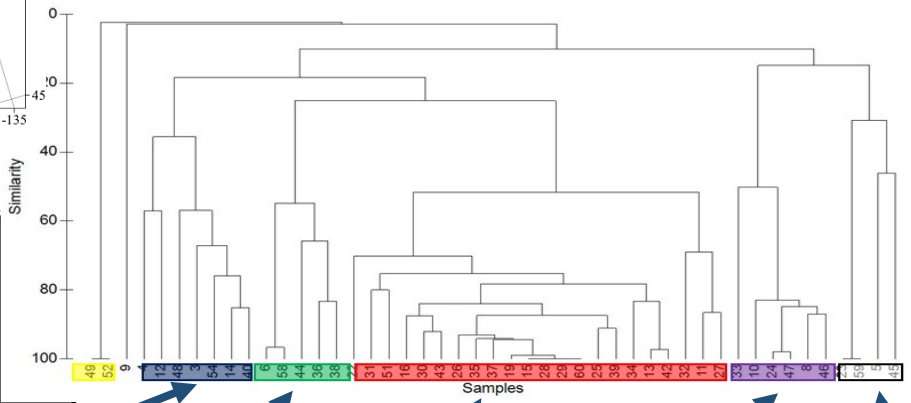


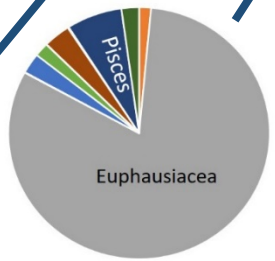
Chrysaora spp. distribution

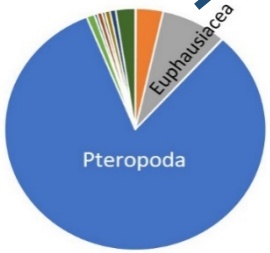


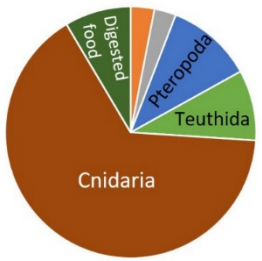
2019: Salmon diets







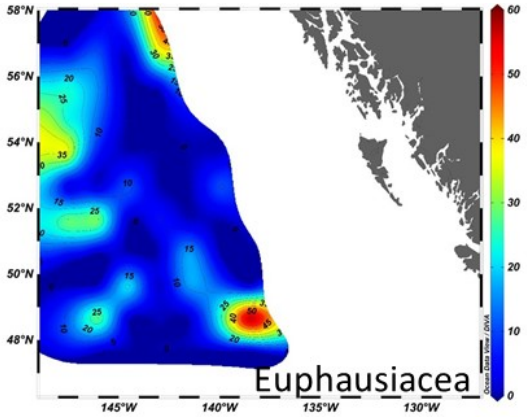


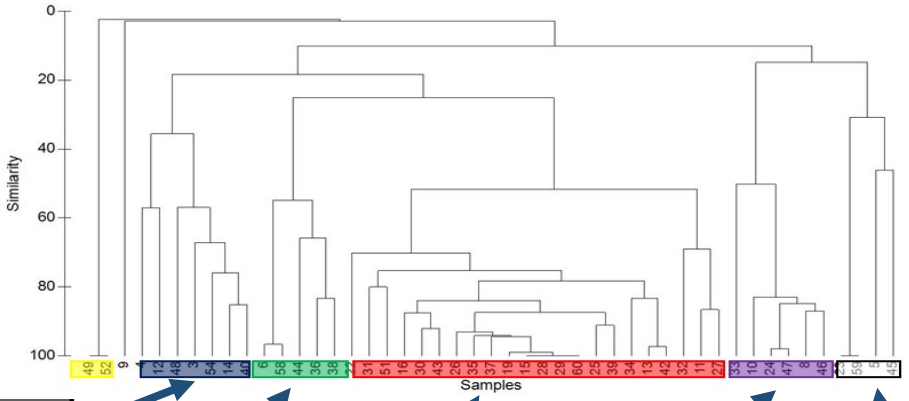


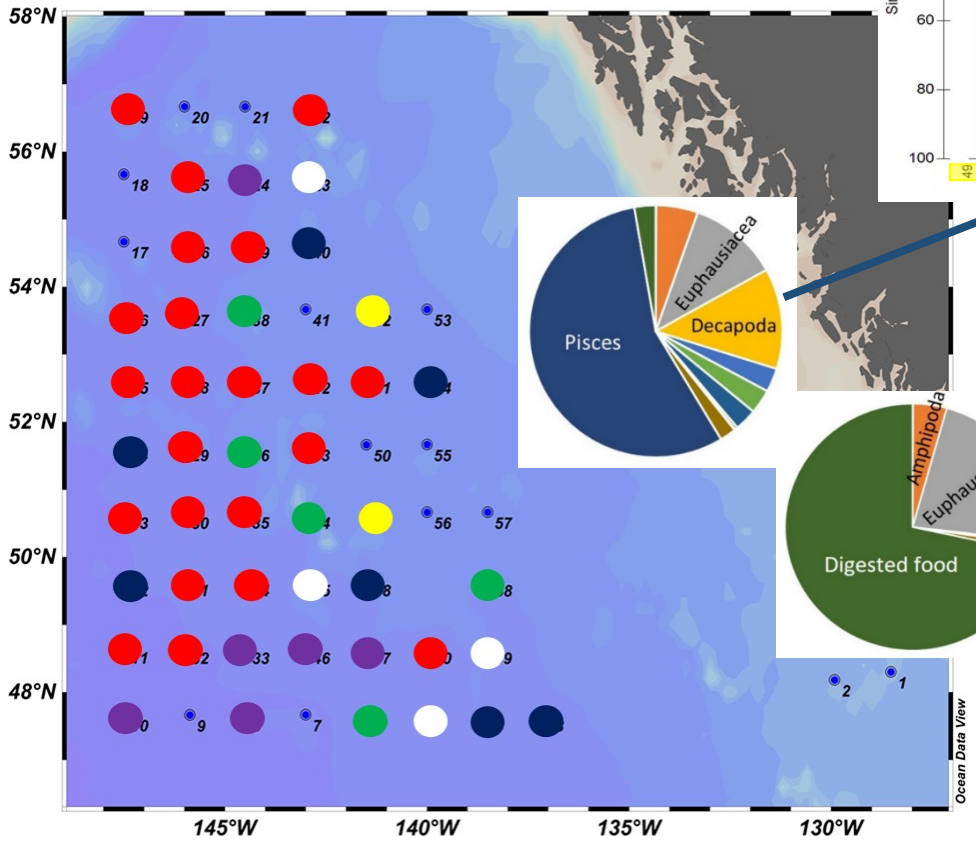
Prey items

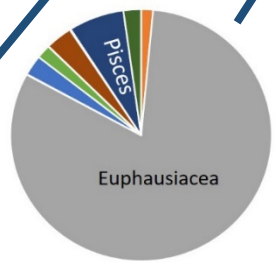
- Copepoda
- Amphipoda
- Euphausiacea
- Decapoda
- Pteropoda
- Teuthida
- Polychaeta
- Cnidaria
- Chaetognatha
- Tunicata
- Pisces
- Digested food

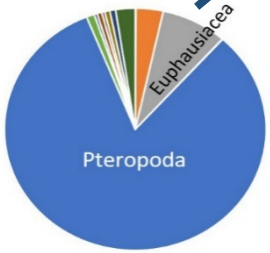
2019: Salmon diets

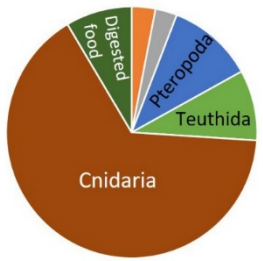










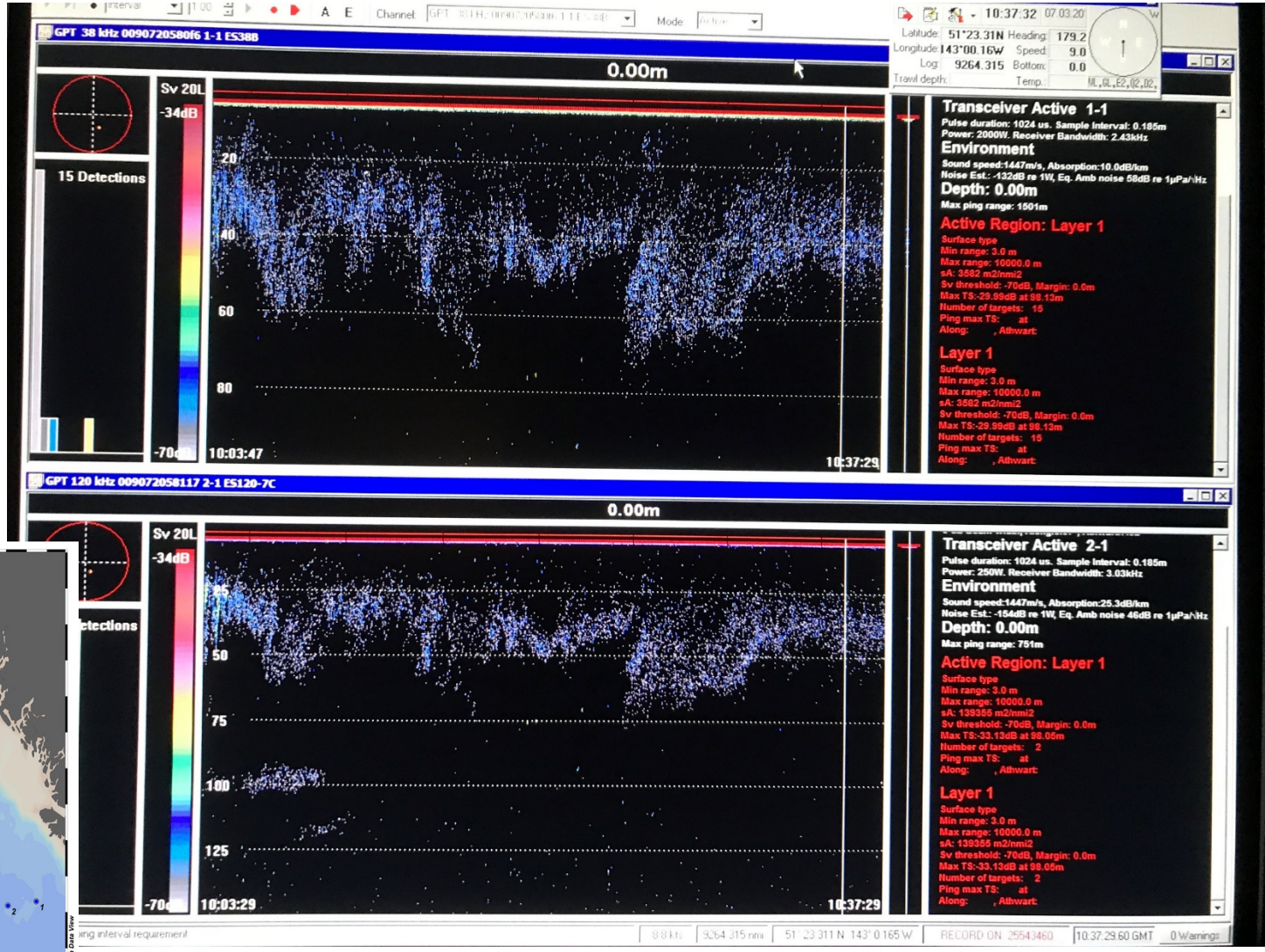


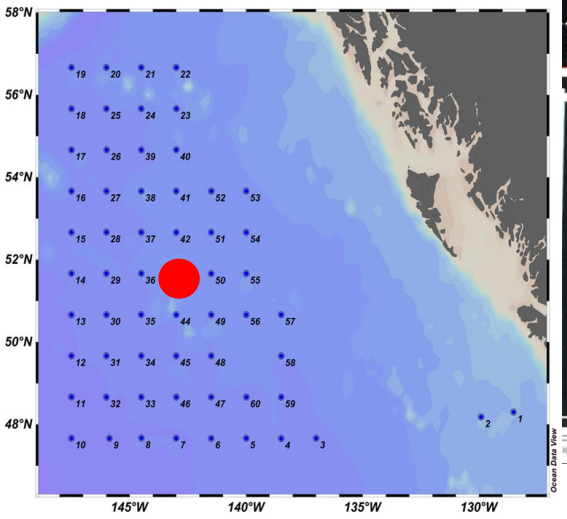
Prey items

- Copepoda
- Amphipoda
- Euphausiacea
- Decapoda
- Pteropoda
- Teuthida
- Polychaeta
- Cnidaria
- Chaetognatha
- Tunicata
- Pisces
- Digested food

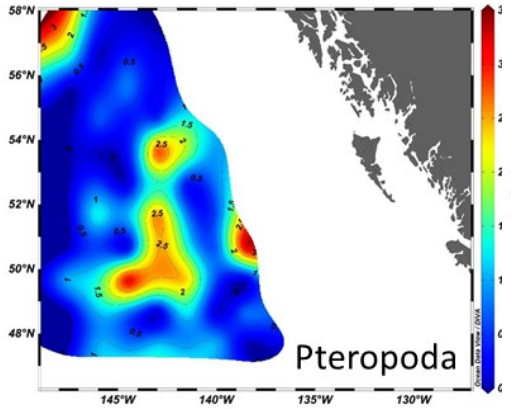
Station 43 (N): euphausiid dominated diet

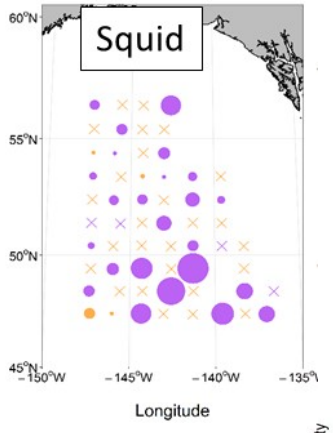
Euphausia pacifica
20-30mm

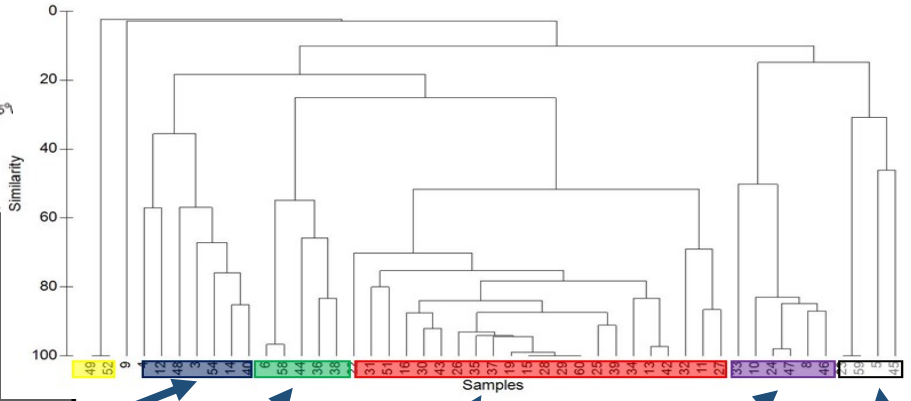


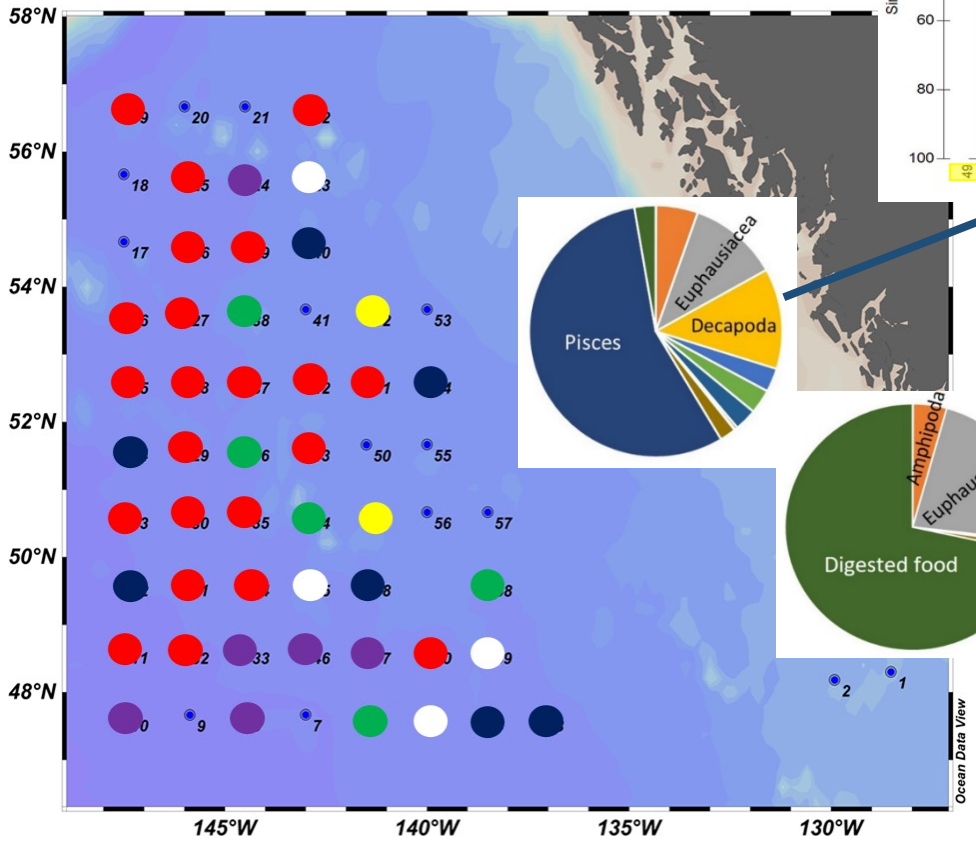


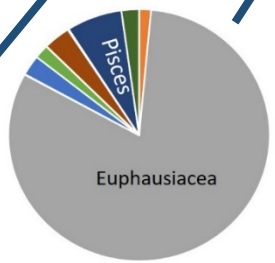
2019: Salmon diets

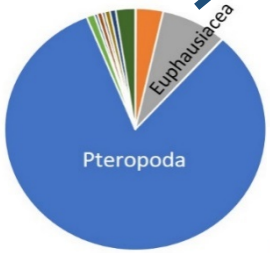


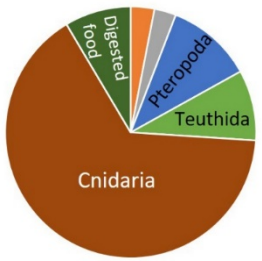












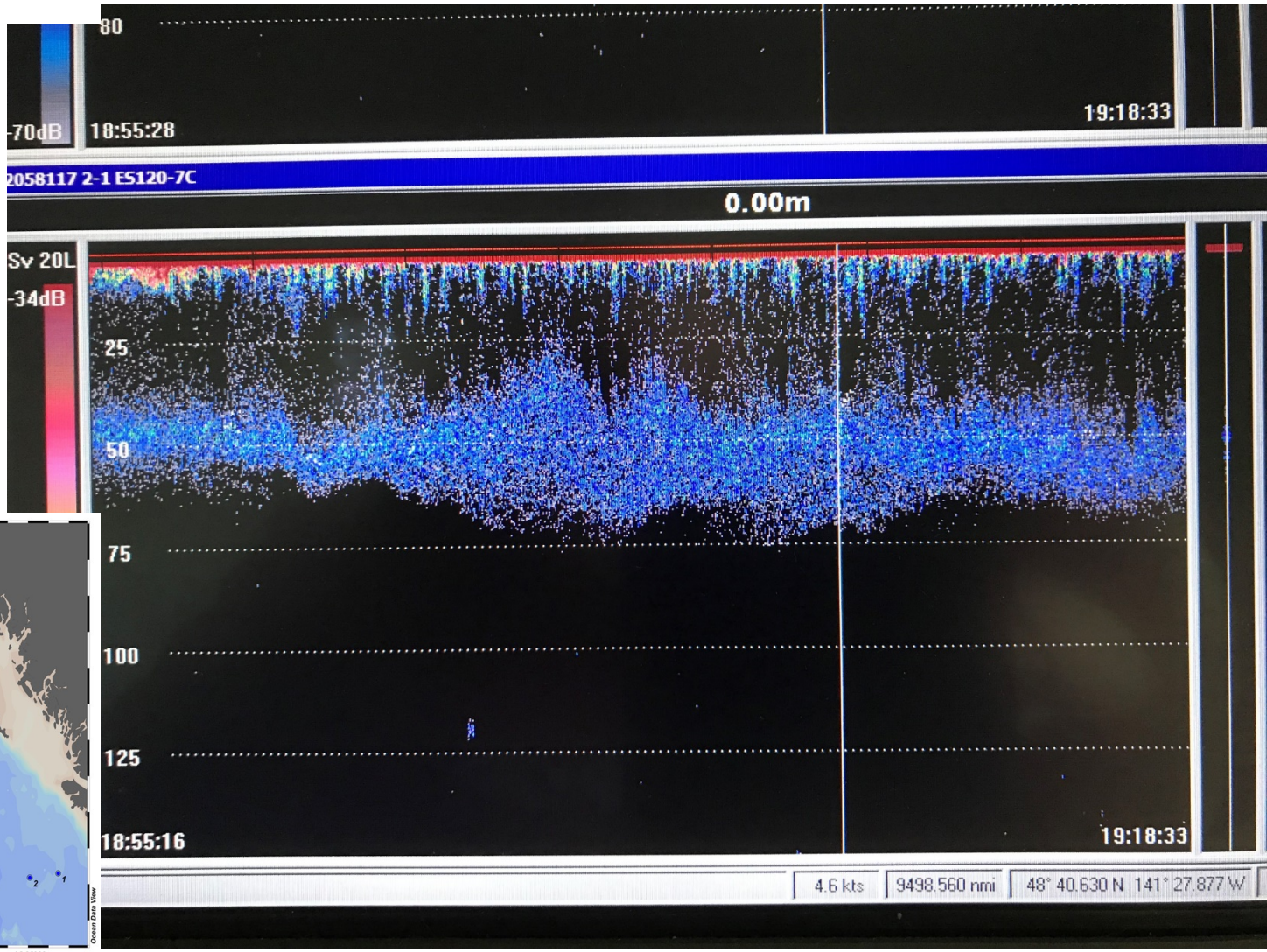
Prey items

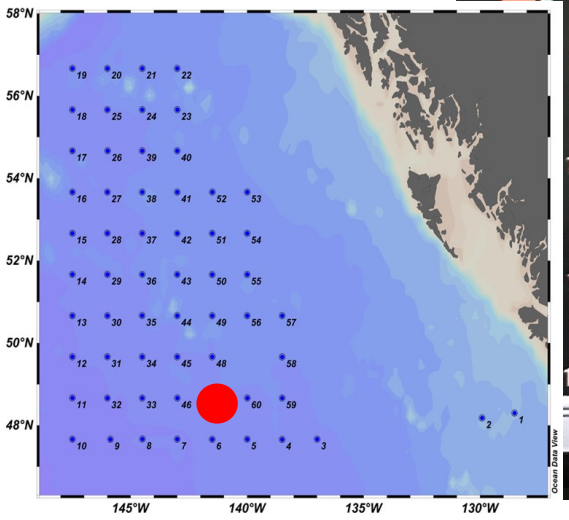
- Copepoda
- Amphipoda
- Euphausiacea
- Decapoda
- Pteropoda
- Teuthida
- Polychaeta
- Cnidaria
- Chaetognatha
- Tunicata
- Pisces
- Digested food

Station 47 (D): pteropod dominated diet

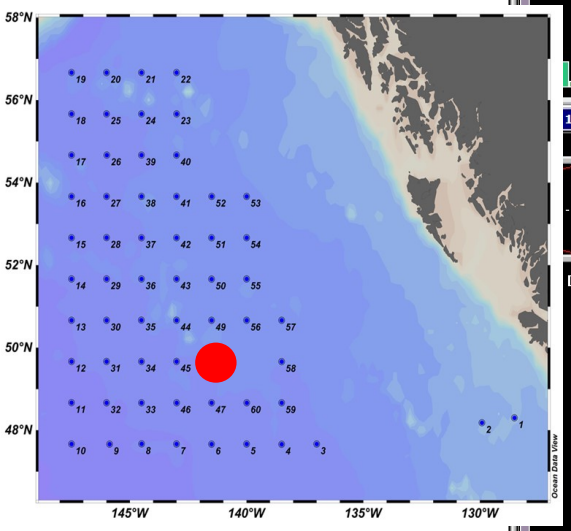
Clio pyramidata
10-15mm

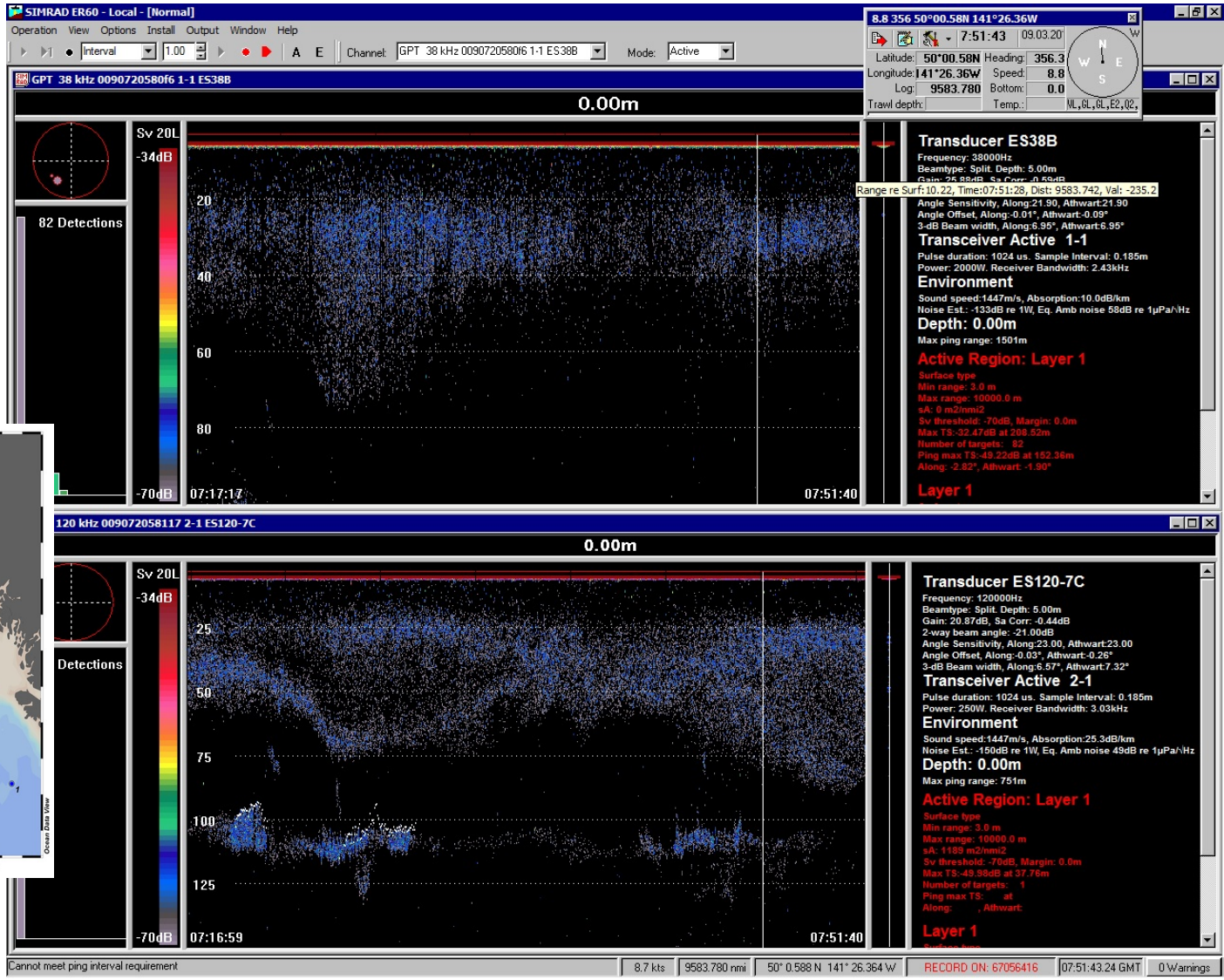
Coho stomach content





Station 48 (N): fish dominated diet





Summary

- 2019 and 2020 surveys were conducted in the transitional zone and encountered both the Sub-Arctic and Alaskan Currents
- mean surface temperature of the region during 2020 was 0.33 ^{o}C cooler than in 2019 and it was most pronounced in the northern part of the survey
- there was a strong north-south gradient in all oceanographic parameters and surface 7 ^{o}C isotherm separated colder and warmer parts of surveys
- surface and integrated chlorophyll-*a* concentrations were patchy and indicative of phytoplankton bloom development in the southern part of the surveys
- total zooplankton density and assemblage composition was uniform during 2019 but showed high patchiness of main taxonomic groups
- there is a weak match between Juday net zooplankton distribution and prey items found in salmon stomachs
- later requires changes in sampling methodology to be able to reflect and understand salmon foraging behavior (acoustics + different nets and sampling strategy)

Thank you !

Questions?