



Fisheries and Oceans
Canada

Pêches et Océans
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SeaStar Biotech

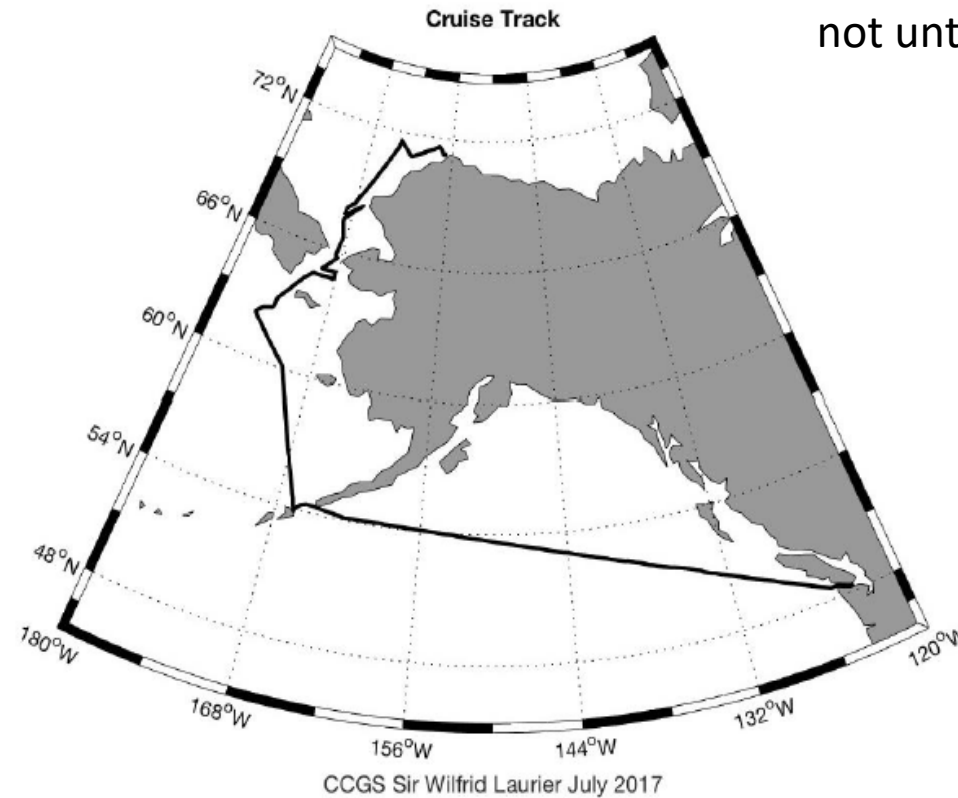
Sir Wilfrid Laurier underway measurements Victoria to Barrow 2007 to 2019 – and DBO zooplankton update

R John Nelson, Gina Nickoloff, Di Wan, Svein Vagle, Sarah Zimmermann, Bill Williams,
Francis Wiese, Clare Ostle, Sonia Batten, Humfrey Melling, Kelly Young, Moira
Galbraith, Sławomir Kwaśniewski, Mateusz Ormańczyk

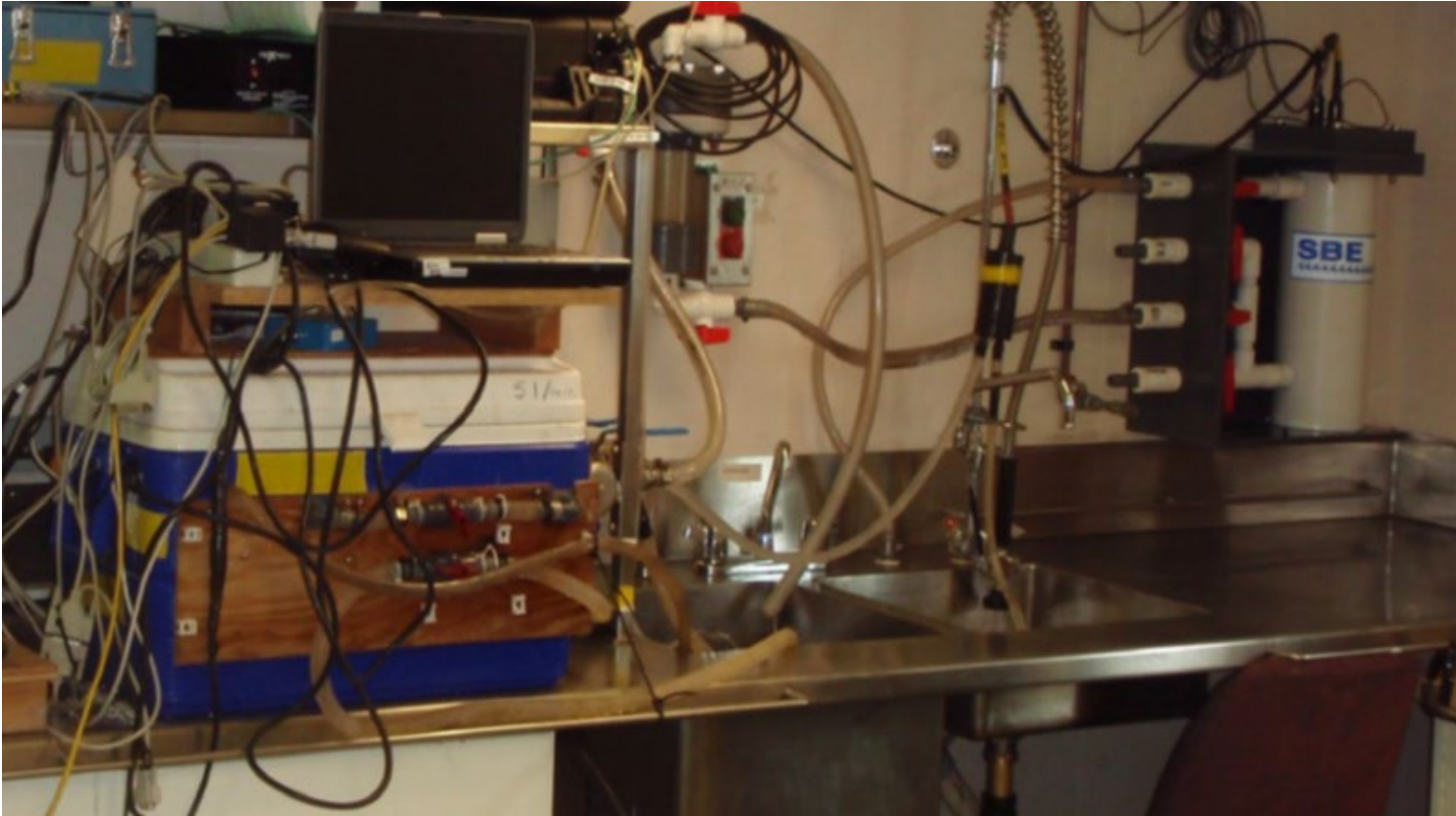


Geographical and temporal extent of C3O/DBO annual cruise Victoria, BC to Barrow AK

Cruise approx. 3 weeks in July every year,
Time series begun in late 90s, underway system
not until early 2000s



Measurements



“continuous” assessment of:
temperature
salinity
fluorescence (2009 onwards)

dissolved oxygen
dissolved nitrogen

Since 2018 CPR

Dissolved N₂ and Dissolved O₂
taken together and accounting for
solubilities and non-biological
driver (wind) can be used to derive
Net Community Production as per

$$\frac{\delta O_2}{\delta N_2} [O_2]_{\text{sat}} k_w \rho$$

Underway sensor work

- Calibrate and “clean up” underway time series to use for assessment of how the sea surface conditions have been changing over the past decade plus.
- Link this analysis to other data sets including but not limited to directly derived DBO data sets
- Learn how changes and ocean conditions and productivity may be effecting higher trophic level taxa and what the future may bring.

Recent relevance see...

- Extreme mortality and reproductive failure of common murrelets resulting from the northeast Pacific marine heatwave of 2014-2016
- Piatt et al. 2020 PLOS one and popular press...govt reports etc

[Alaska News](#)

Fifth straight year of bird die-off in Alaska waters linked to starvation

✍ Author: [Alex DeMarban](#) ⌚ Updated: September 9, 2019 📅 Published September 9, 2019

Federal wildlife officials said Monday that the deaths of thousands of seabirds in Western Alaska this summer was because of starvation, as they investigate a fifth straight year of unusually high numbers of seabird fatalities amid warm sea surface temperatures.

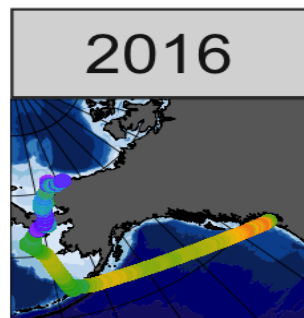
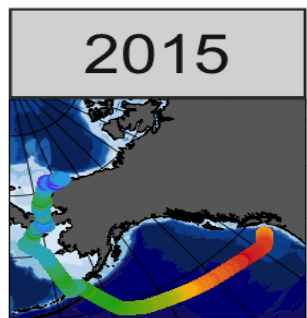
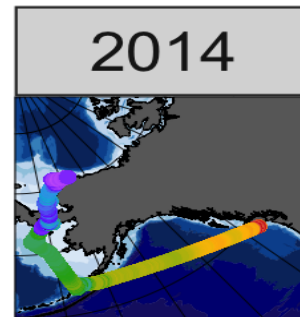
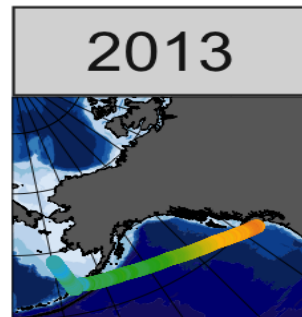
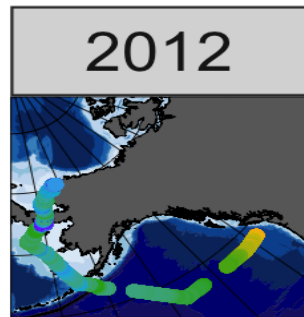
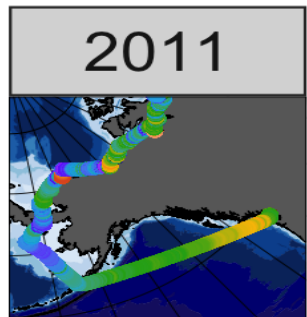
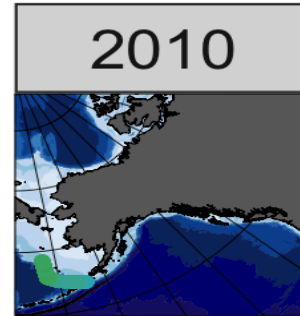
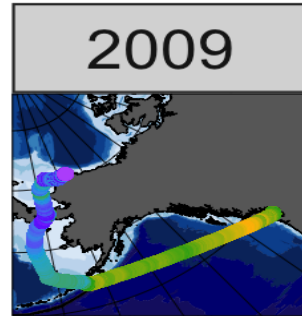
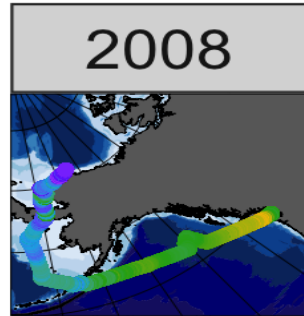
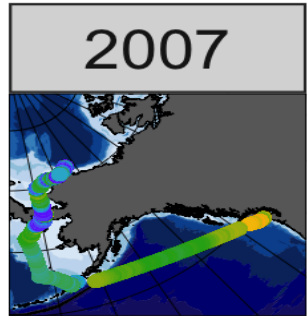
Thousands of short-tailed shearwaters were reported dead and washing onto beaches in the Bristol Bay region starting in late June, the National Park Service said in a statement on Monday.

As the summer continued, the deaths of the dark-colored birds extended to the Chukchi Sea off Northwest Alaska.

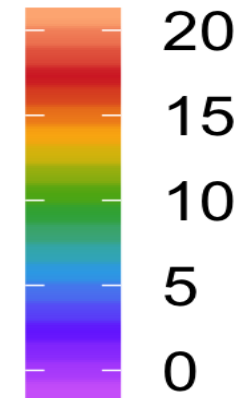
“Initial results indicate starvation as the cause of death for



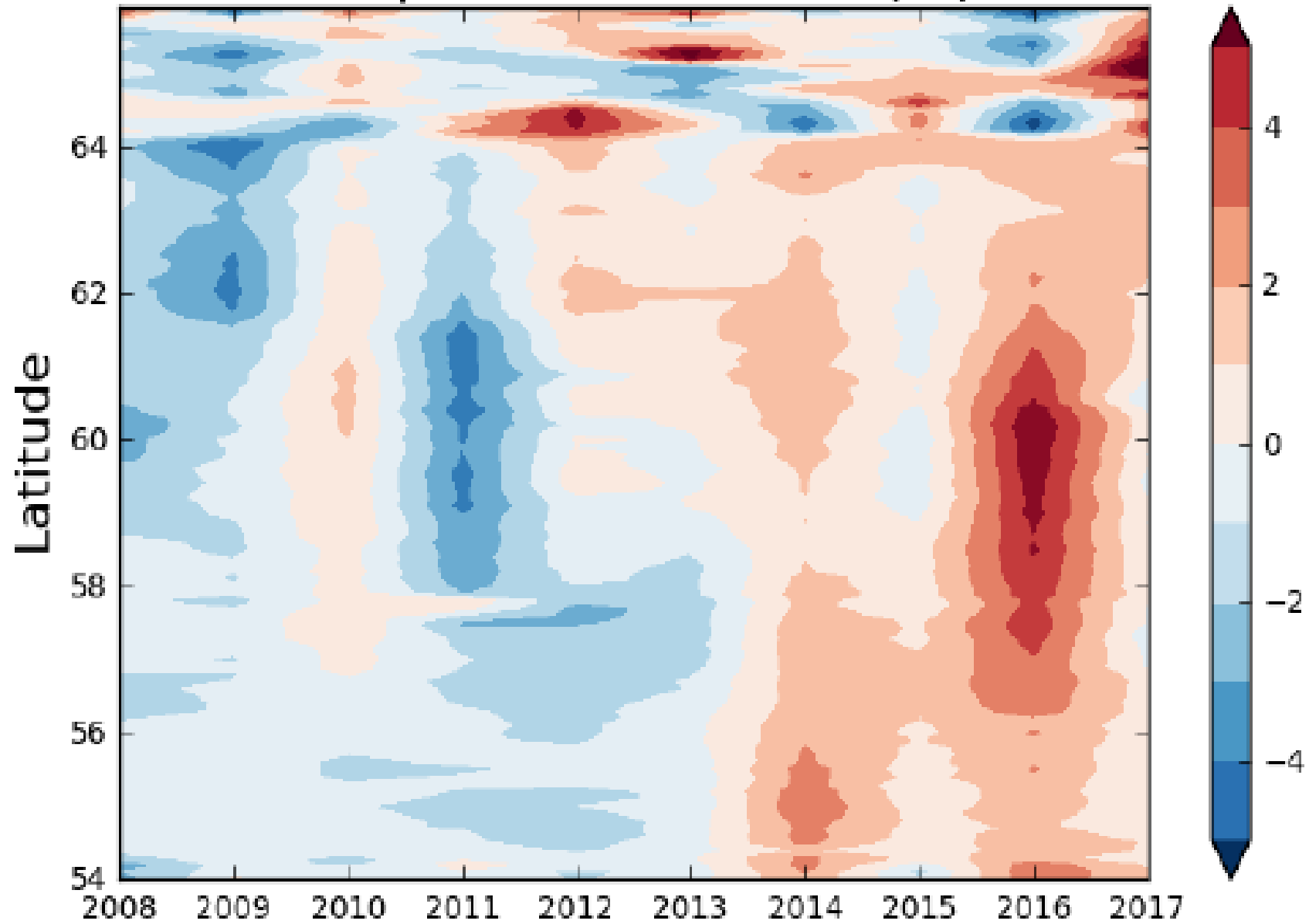
Temperature



Temp deg C

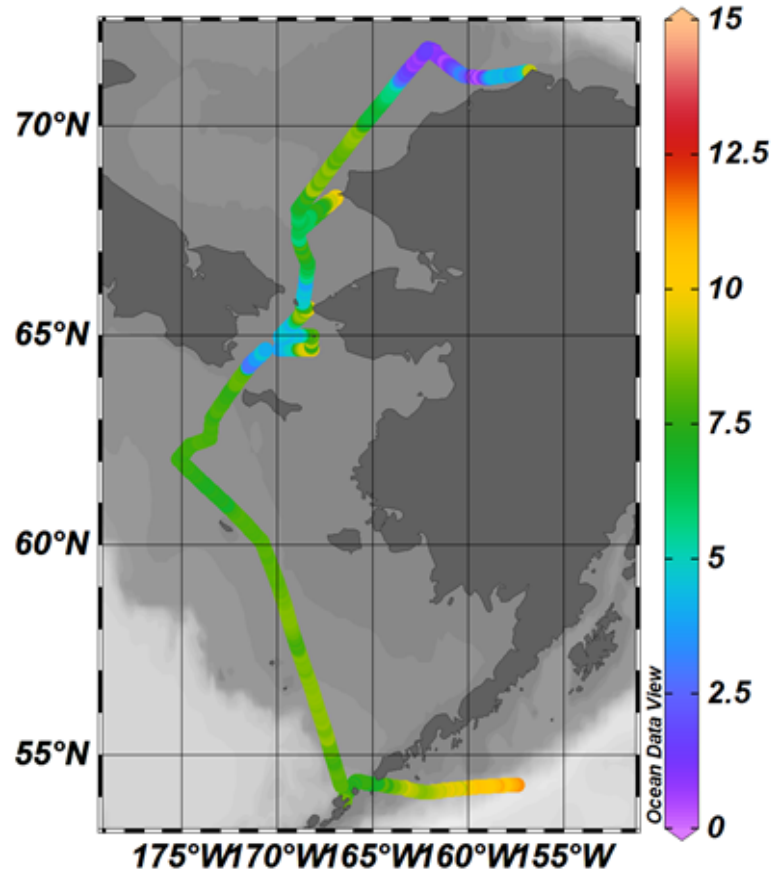


Temperature Anomalies ($^{\circ}\text{C}$)



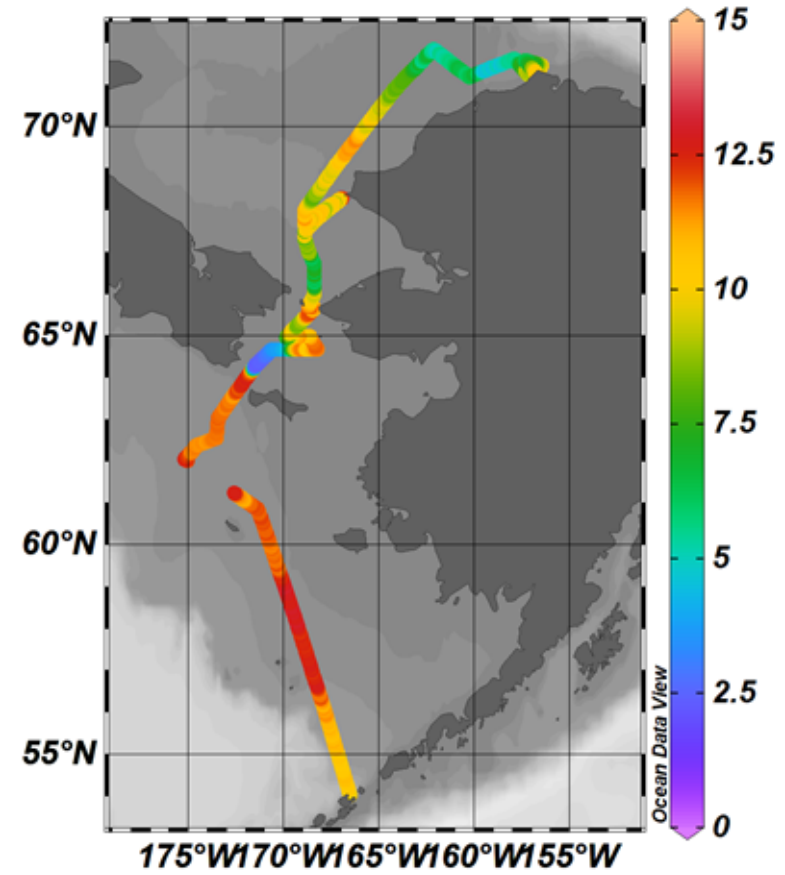
2018

Temperature, 2 [ITS-90, deg C]

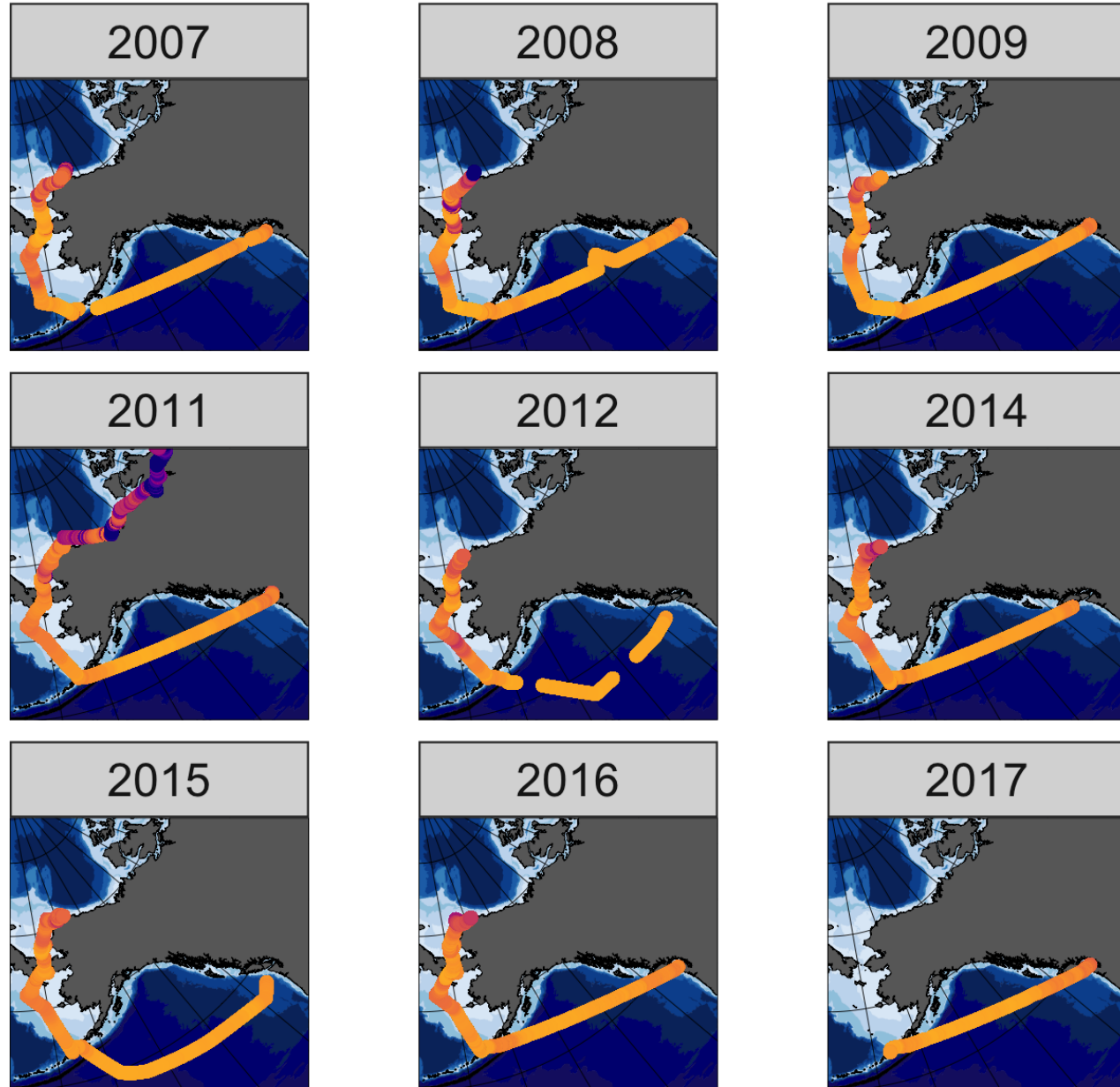


2019

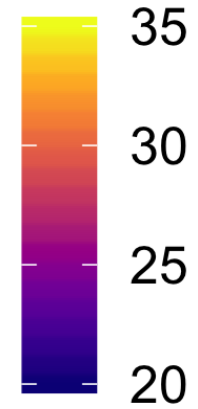
Temperature, 2 [ITS-90, deg C]



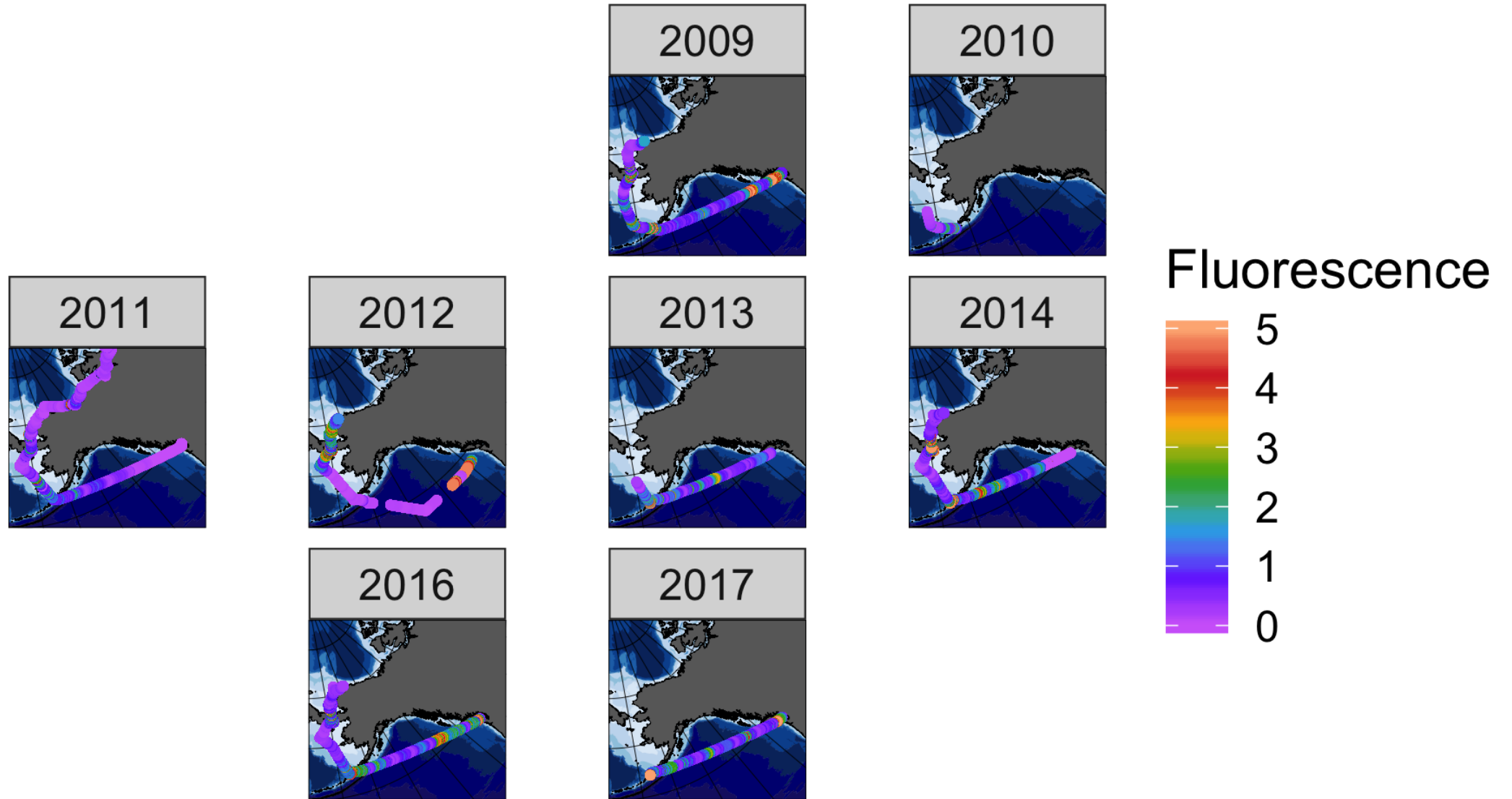
Salinity



Salinity (PSU)



Fluorescence

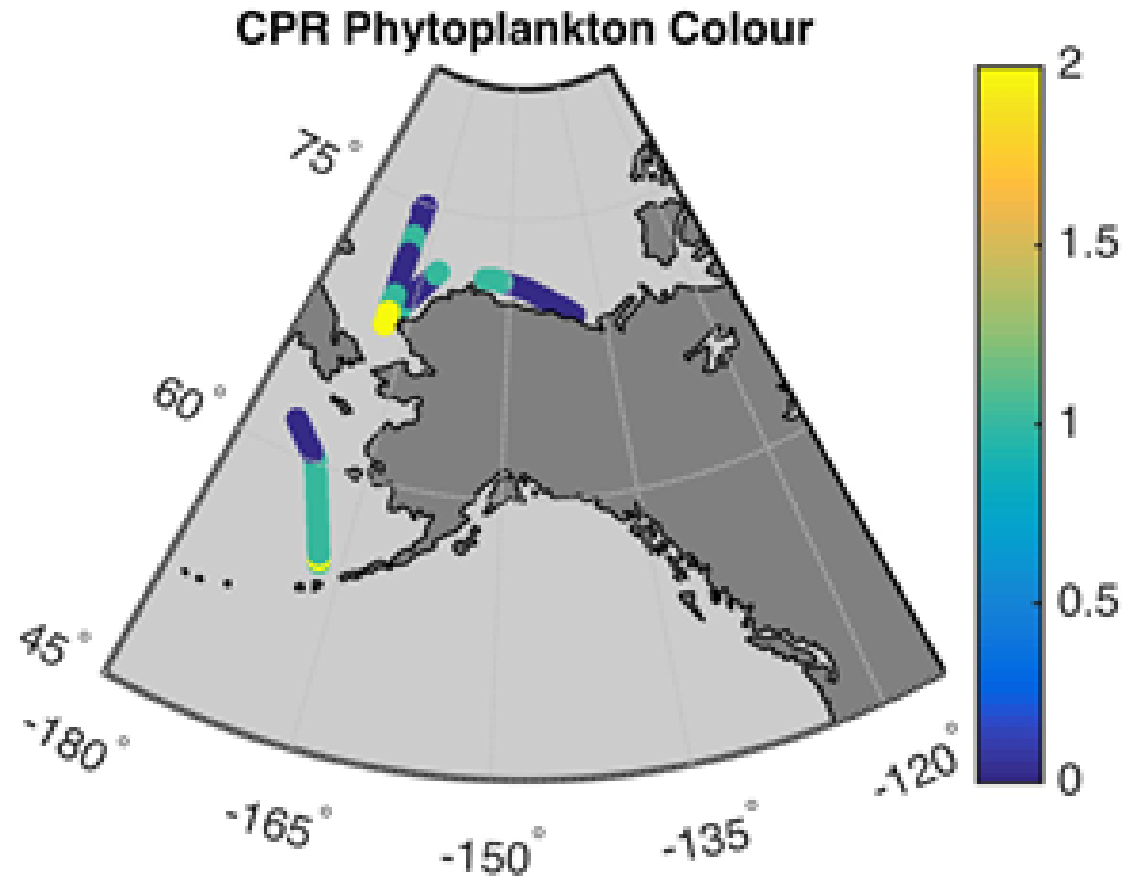


Zooplankton:

DBO samples taxonomy progress:

2007	28 / 50
2008	37 / 46
2009	19 / 19
2010	26 / 33
2011	29 / 29
2012	18 / 18
2013	1 / 36
2014	32 / 32
2015	41 / 41
2016	33 / 44
2017	45 / 56
2018	33 / 33
2019	0 40 in process

CPR- continuous plankton recorder – 2018, 2019, 2020?



To do 2020:

Laurier Cruises

NCP time series - in progress

CPR zooplankton data – in hand

DBO bongo time series analysis ? !!