An underwater photograph showing a dense population of marine life, including various fish and crustaceans, swimming over a seabed covered in plastic debris. The debris includes fragments of plastic, a blue bottle, and other unidentifiable pieces of trash. The scene is set in clear blue water, highlighting the impact of plastic pollution on marine ecosystems.

Monitoring the Presence, Abundance, and Identity of Micro- & Nanoplastics of Arctic and Beringian Foodwebs

Douglas Causey^{1,2}, Soren George-Nichol^{1*}, Veronica Padula^{1,3}

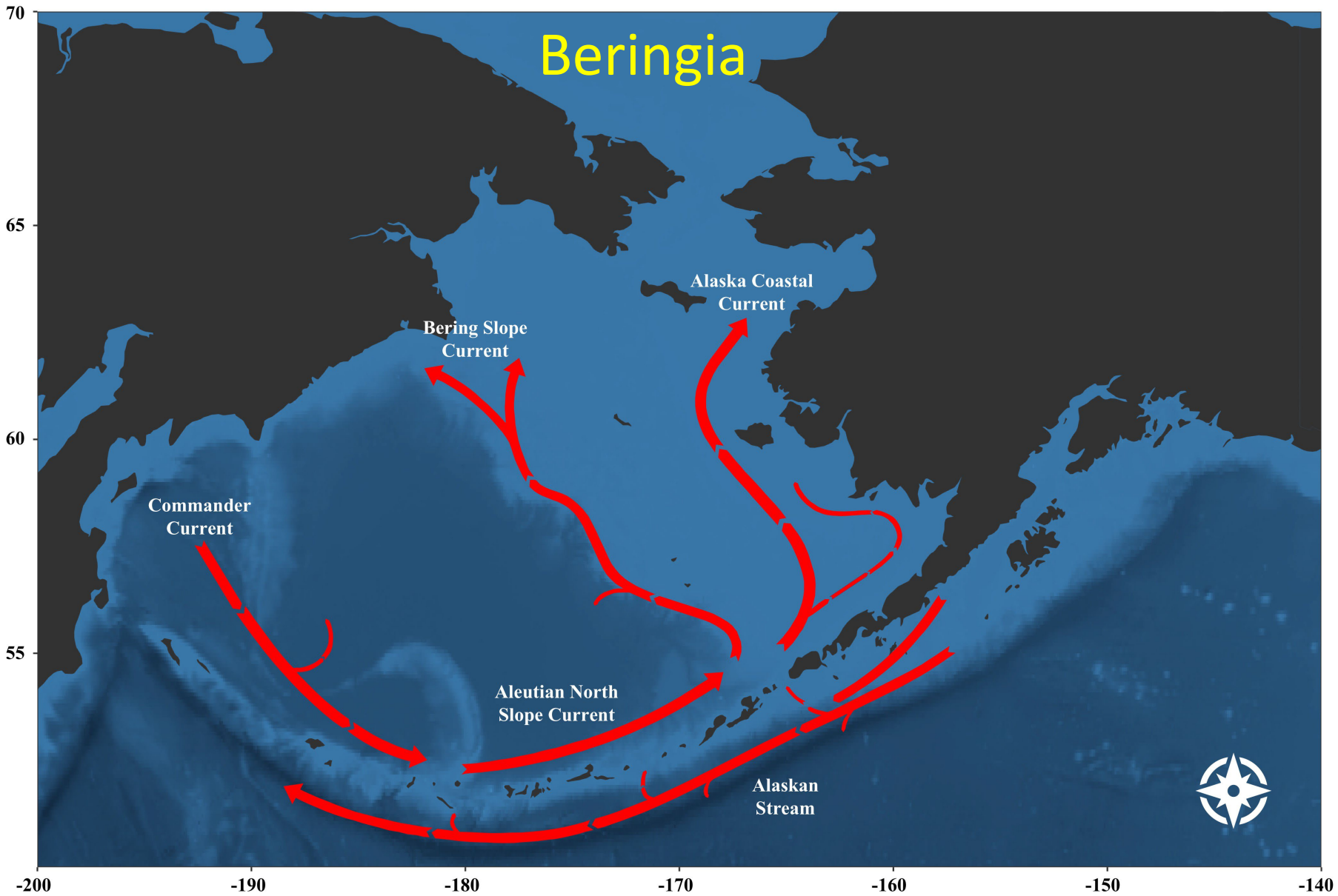
¹University of Alaska Anchorage, Dept Biological Sciences

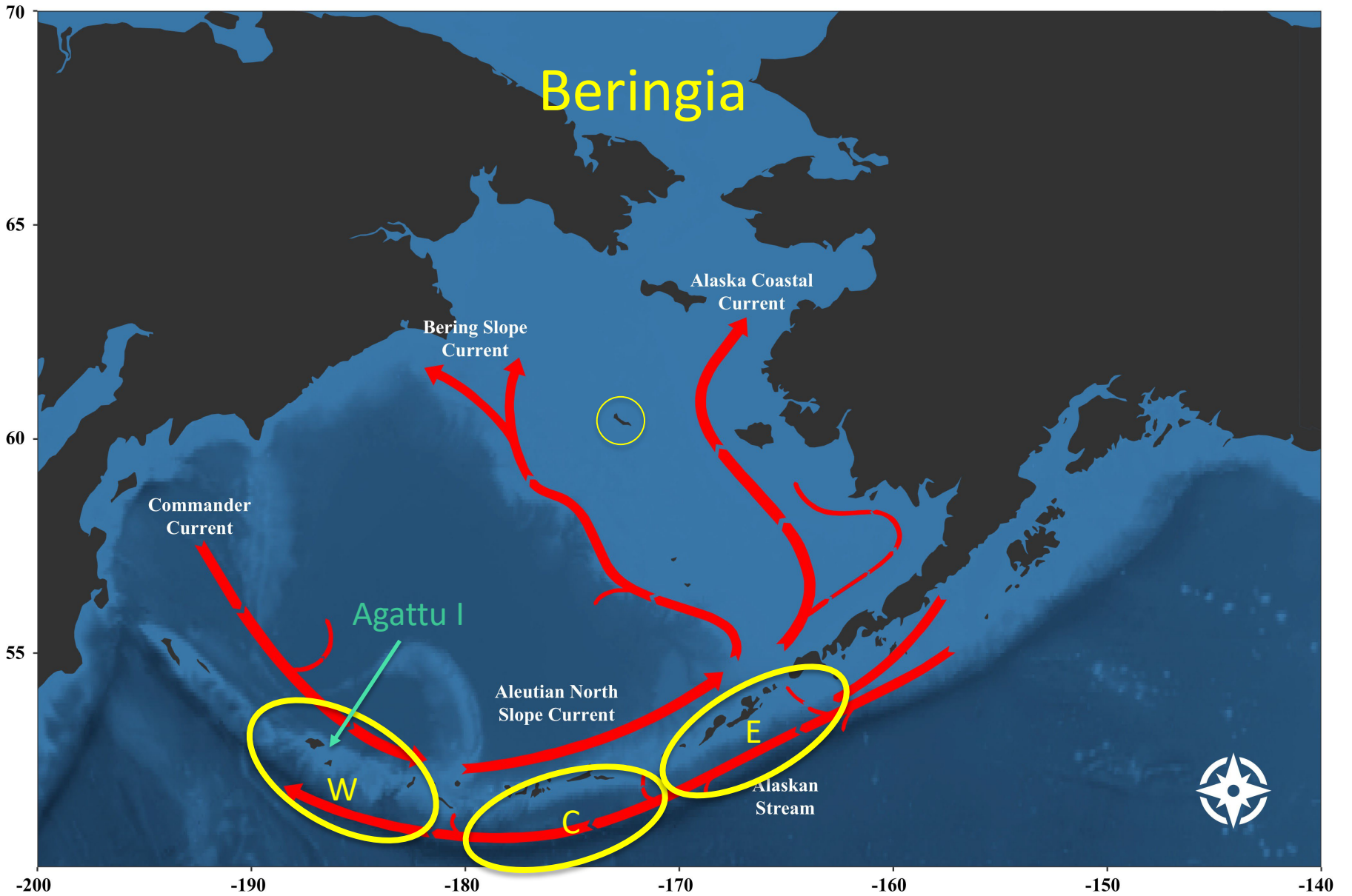
² Harvard Kennedy School Belfer Center Arctic Initiative

³ Seattle Aquarium, Clean Seas Program, Seattle, WA

23 November 2023

Beringia







06.04.2013 14:20

Agattu Island, Aleutian Islands

Microplastics are, well, small

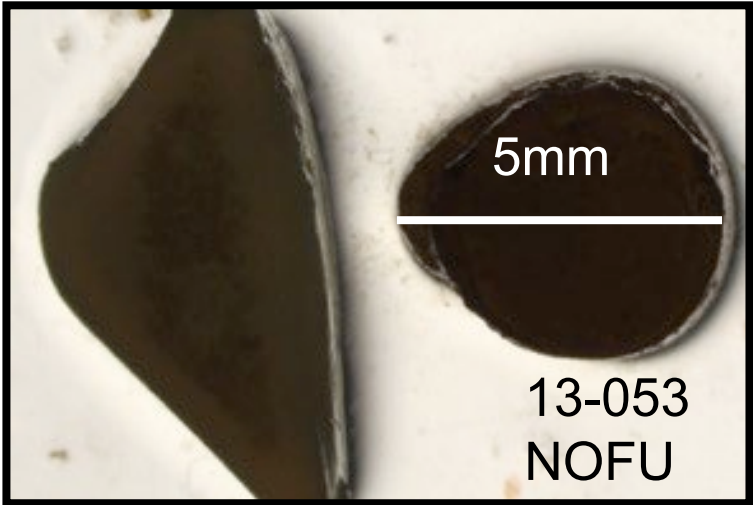
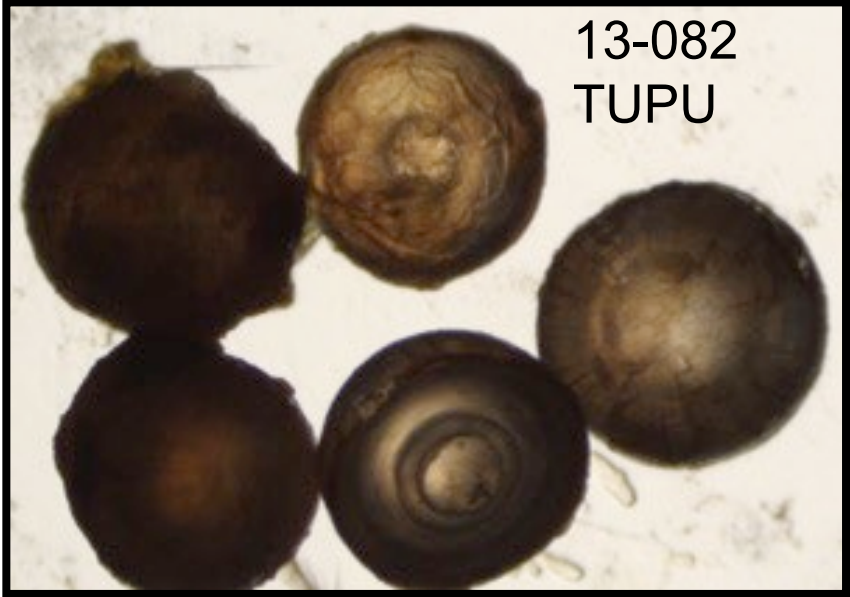
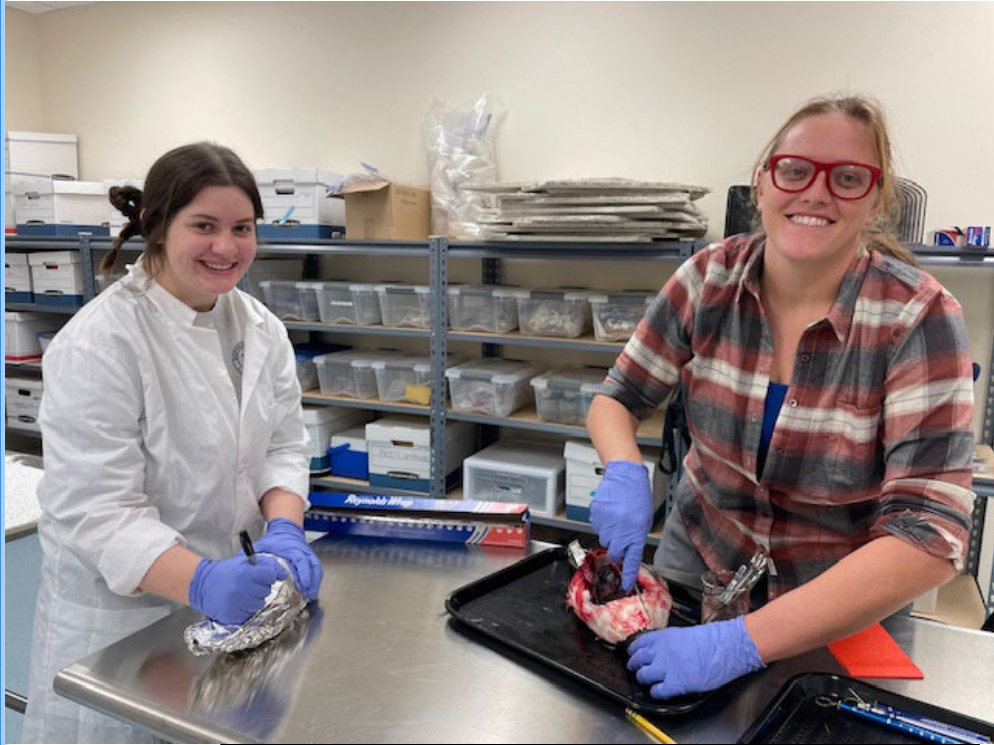




Do you see any plastic around here?

Crested Auklets *Aethia cristatella* Attu Island, Aleutian Islands

Stomach Content Analyses



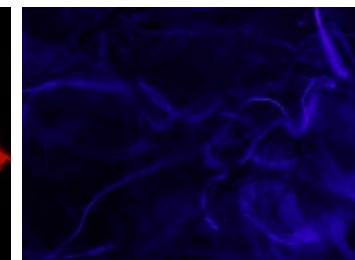
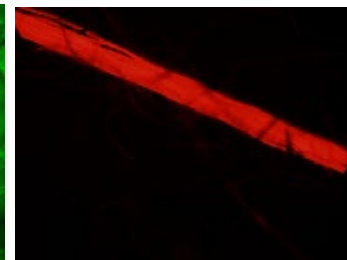
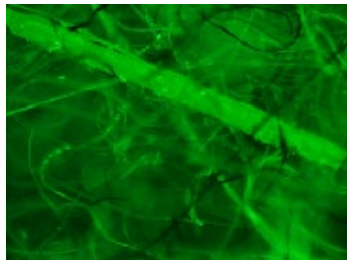
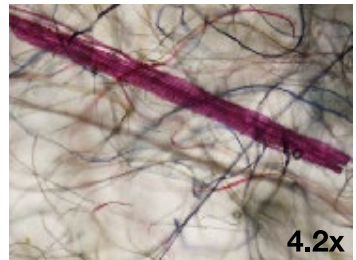
Bright Field

Red

Ex: 530-550 nm
Em: 575-650 nm

science
Intensity/Plastic
Type

Fishing
Gear



4.2x

+ ++ 0



Stomach
Content
with bones

4.2x

0 0 0

No Plastic

Stomach
Content

4.2x

0 0 +



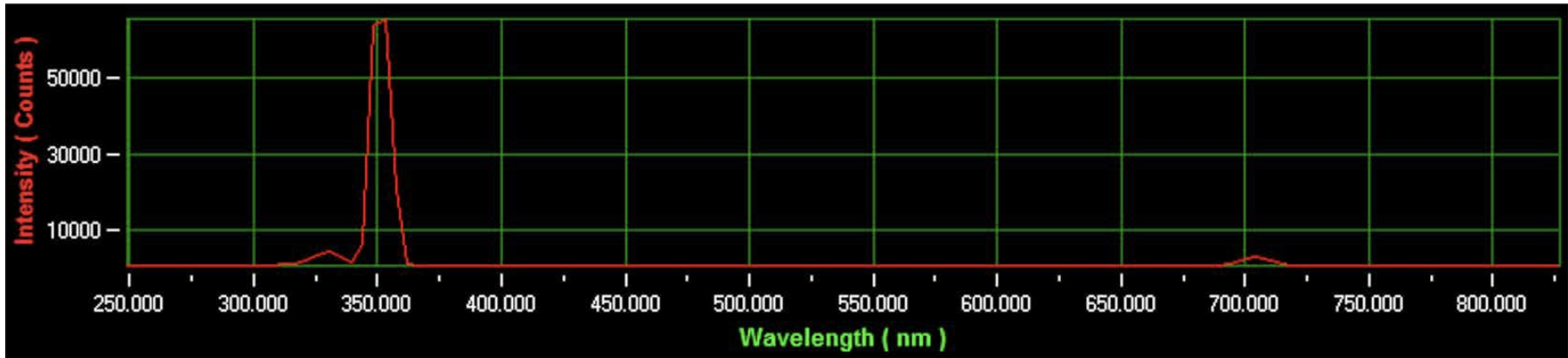
Stomach
Content

4.2x

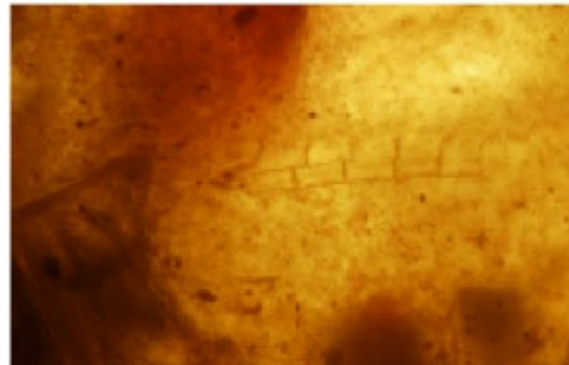
++ ++ +



Absorbance Transmission Fluorescence Excitation and Emission Matrix (A-TEEM) Spectroscopy



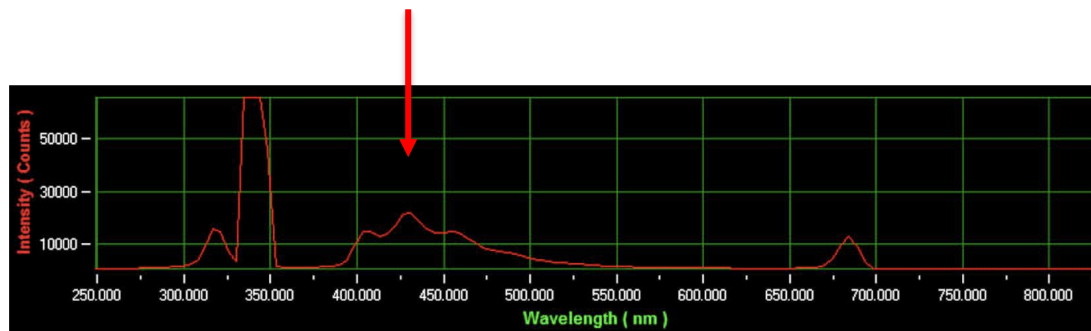
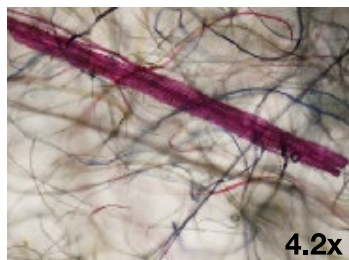
Wavelength Spectrum (nm)



19-052 NOFU
Stomach contents withput plastic

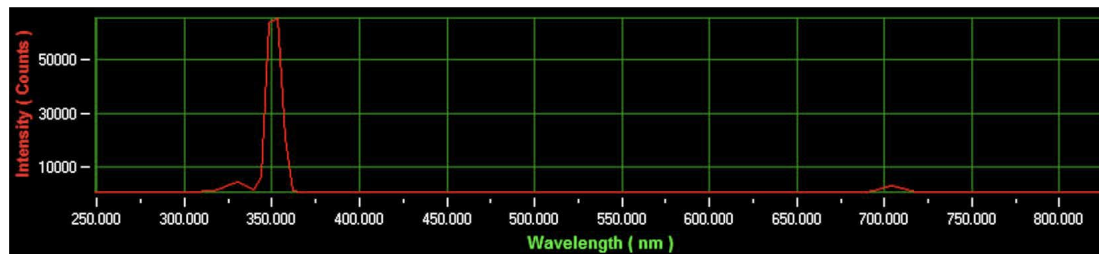
Bright Field

Fishing Gear



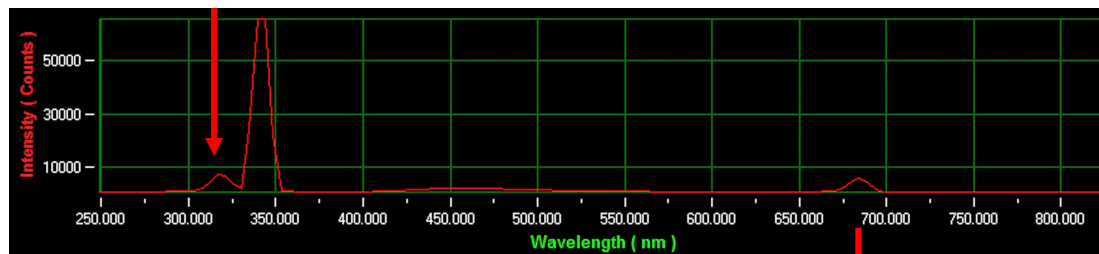
Stomach Content with bones

4.2x



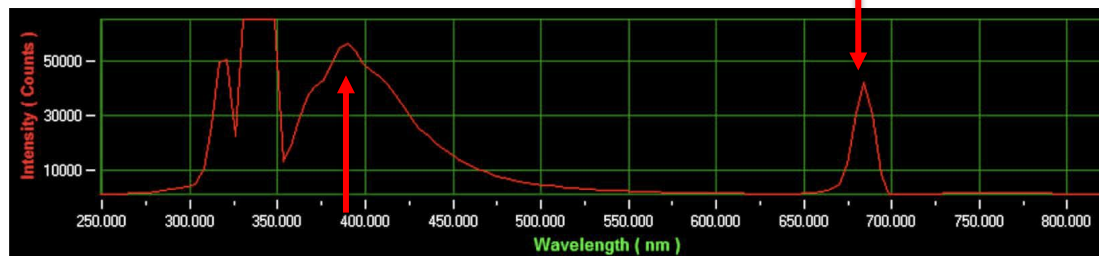
Stomach Content

4.2x



Stomach Content

4.2x



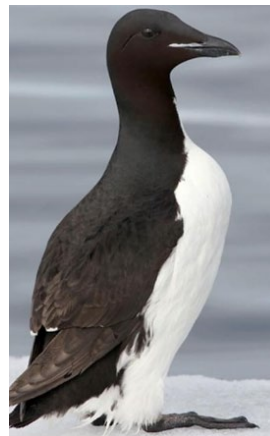
Bird Samples Obtained by Region and Foraging Type

Number and % positive for plastic

Island Region	Opportunistic Feeders	Diving Fish Feeders	Diving Planktivores	Surface Feeders	Total
Eastern	4	9	0	7	20
Central	3	10	4	1	18
Western	9	52	6	10	77
Total	16	71	10	18	115
% Plastic	50.0%	28.4%	85.1%	55.6%	36.4%



L glaucescens
Glaucous-winged
Gull









U lomvia
Thick-billed
Murre



A cristatella
Crested Auklet



F glacialis
Northern Fulmar

Resin Identification Number	Resin	Resin Identification Code - Option A	Plastic Obs
1	Poly(ethylene terephthalate)	 PETE	8 (4.6%)
2	High density polyethylene	 HDPE	73 (63.1%)
3	Poly(vinyl chloride)	 V	2 (< 1%)
4	Low density polyethylene	 LDPE	0
5	Polypropylene	 PP	42 (36.4%)
6	Polystyrene	 PS	0

Plastic bottles

Fishing Gear

Medical, cling wrap

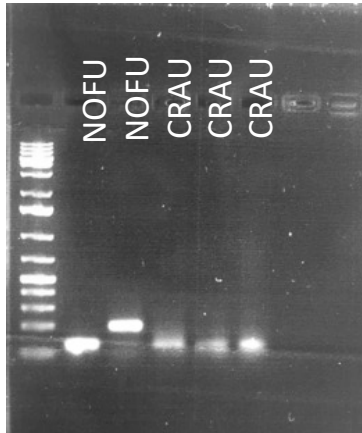
Shopping bags, trash bags

Food containers

Hard clear plastic, Styrofoam

Microbiome Investigation of Northern Fulmars

St Matthew Island, June 2018

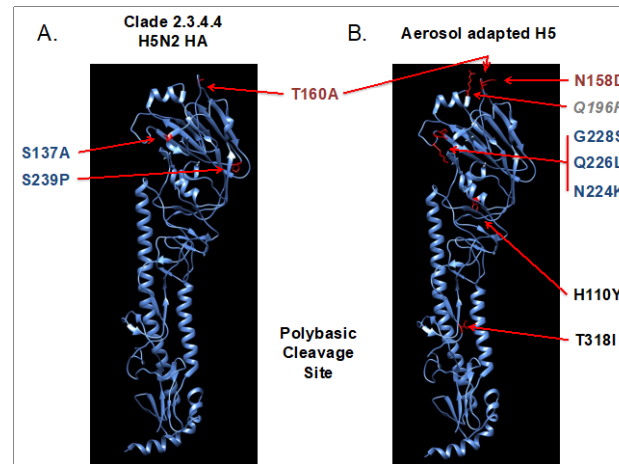
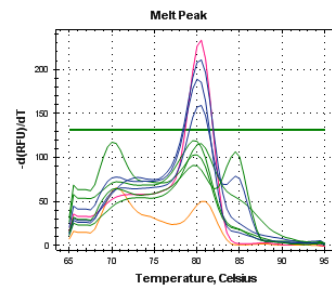
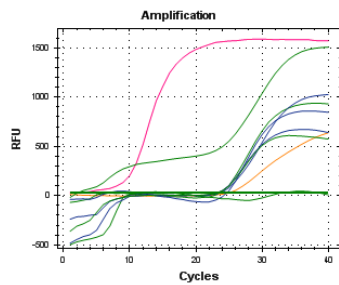


Northern Fulmar

Crested Auklet

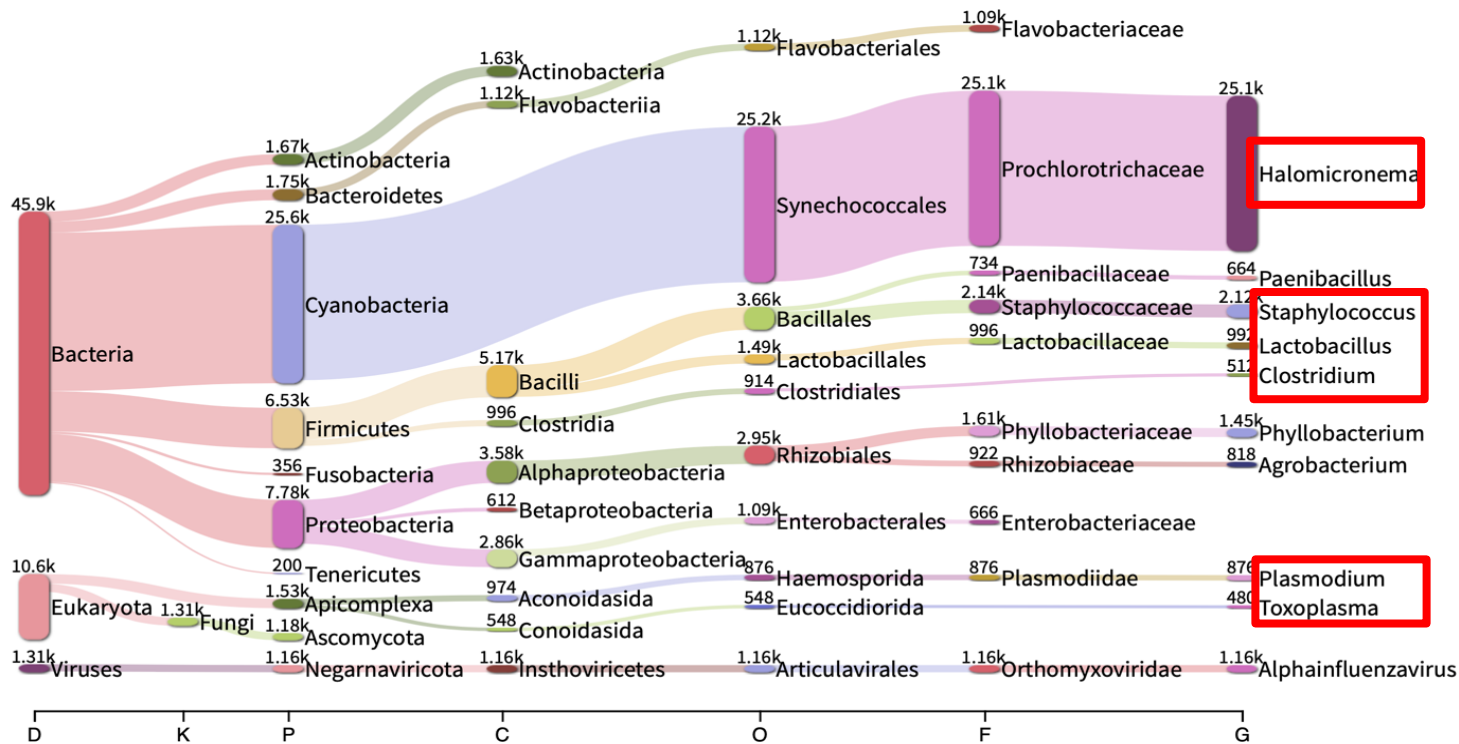
H5N2
H11N5

H1N4



Branson, Bortz, Causey 2023

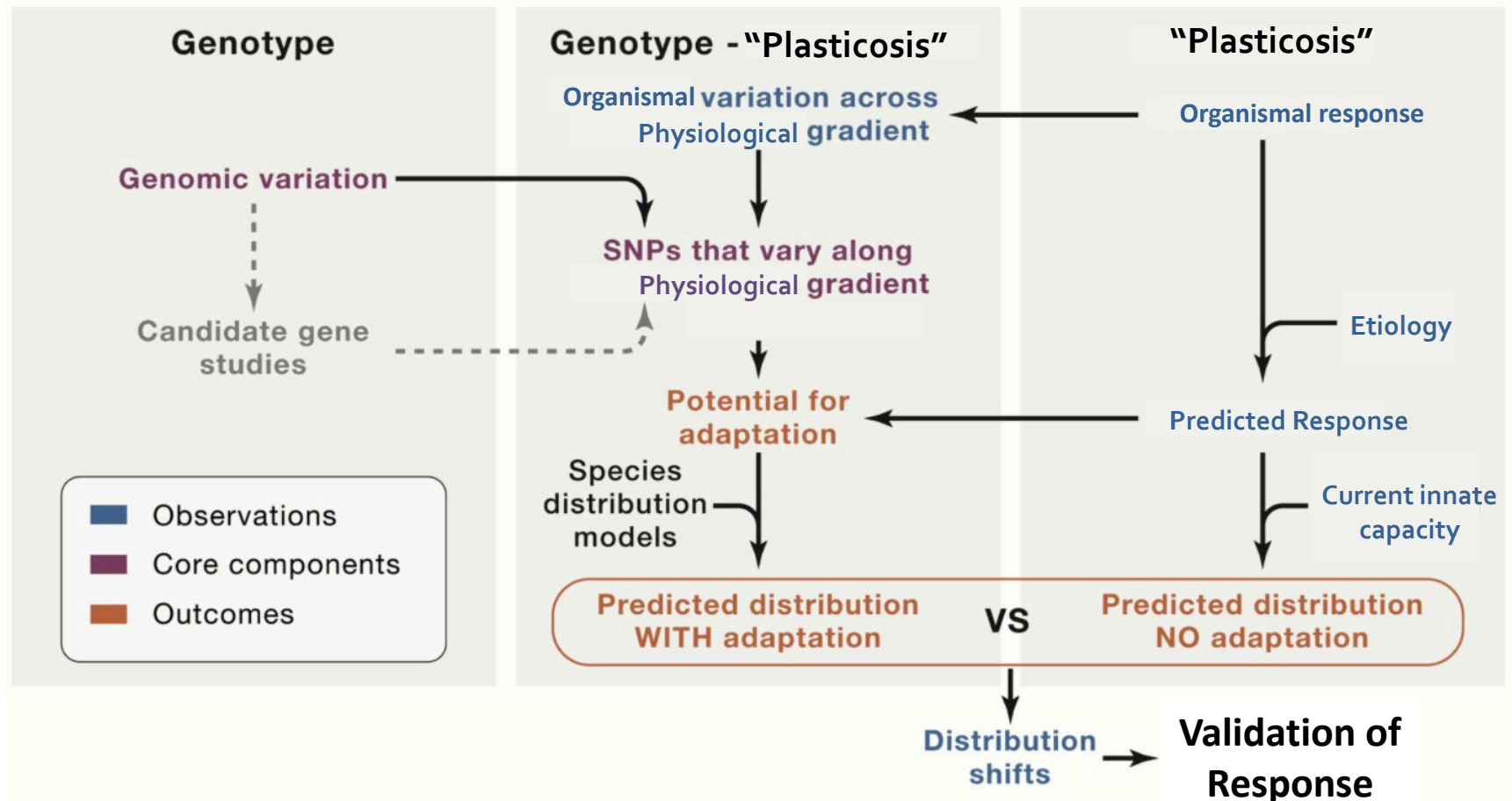
Respiratory microbiome of the Beringian Northern Fulmar (*Fulmarus glacialis*) positive for microplastic



Data are read counts versus taxonomic hierarchy (D=Domain K=Kingdom P=Phylum C=Class F=Family O=Order G=Genus).

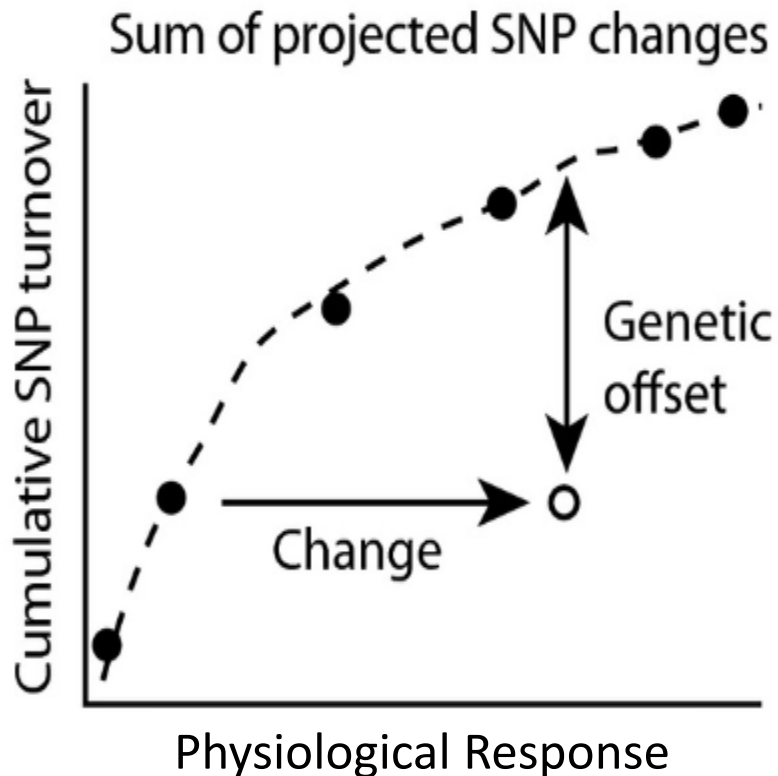
Red Boxes indicate bacteria and protozoans observed only in microplastic positive

Schematic approach for investigation of Adaptive Capacity using Environmental Genomics



Summary of Research Approach

Genomic Adaptive Capacity - Plasticosis



- Quantify the physiological consequences of plasticosis (presence, etiology)
- Identify the genomic differentiation (offset) of affected birds
- Relate to population genetics of target species and populations



Acknowledgments

- **Alaska INBRE program**
- Harvard Kennedy School Belfer Center for Science and International Affairs, Arctic Initiative
- Alaska Maritime NWR
- ANSEP Acceleration Academy students
- Undergraduate slaves interns



富士三十六景 神奈川沖
波裏

浪裏

Questions?

