



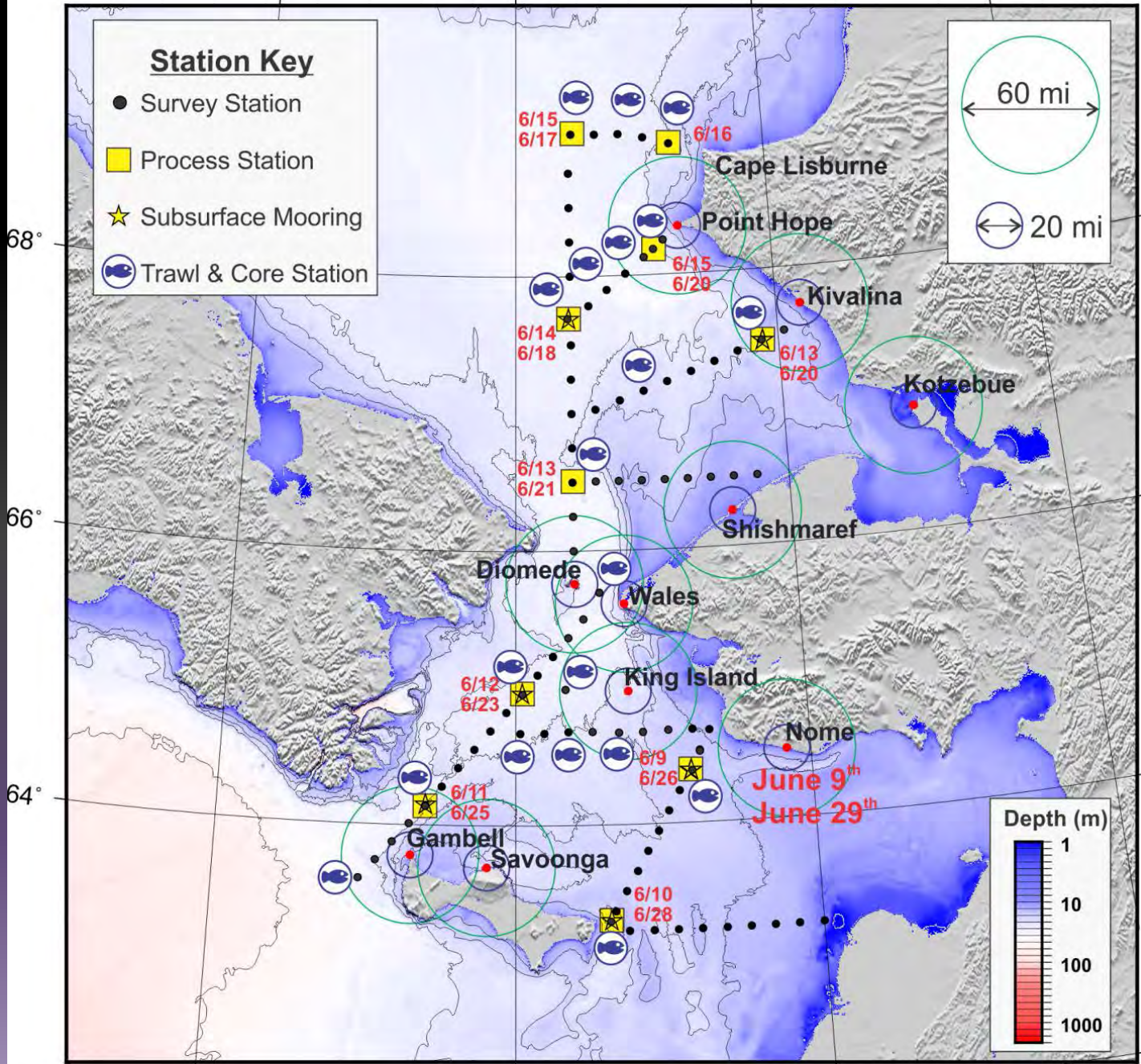
NORTH PACIFIC RESEARCH BOARD

# Arctic Program

2017 Arctic Shelf Growth, Advection, Respiration and Deposition  
(ASGARD) Project  
9-28 June 2017 in the northern Bering and southern Chukchi

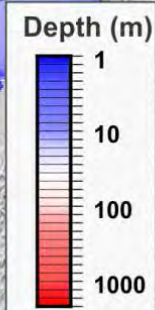
12 university, federal or institute scientists  
8 students  
4 marine, lab & mooring technicians  
1 coastal community observer/participant  
1 media/outreach specialist





**Station Key**

- Survey Station
- Process Station
- ★ Subsurface Mooring
- 🐟 Trawl & Core Station



68°  
66°  
64°

-175° -170° -165°

Cape Lisburne

Point Hope

Kivalina

Kotzebue

Shishmaref

Diomede

Wales

King Island

Nome

June 9<sup>th</sup>

June 29<sup>th</sup>

Gambell

Savoonga

6/10  
6/28

6/12  
6/23

6/13  
6/21

6/14  
6/18

6/15  
6/17

6/16

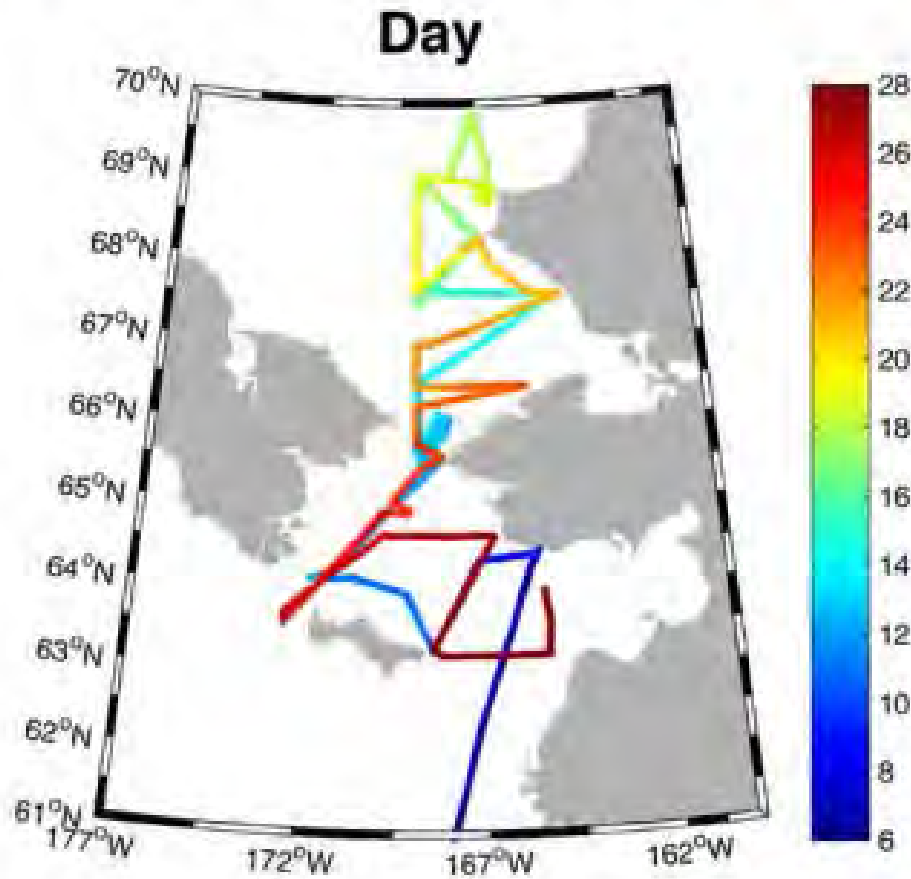
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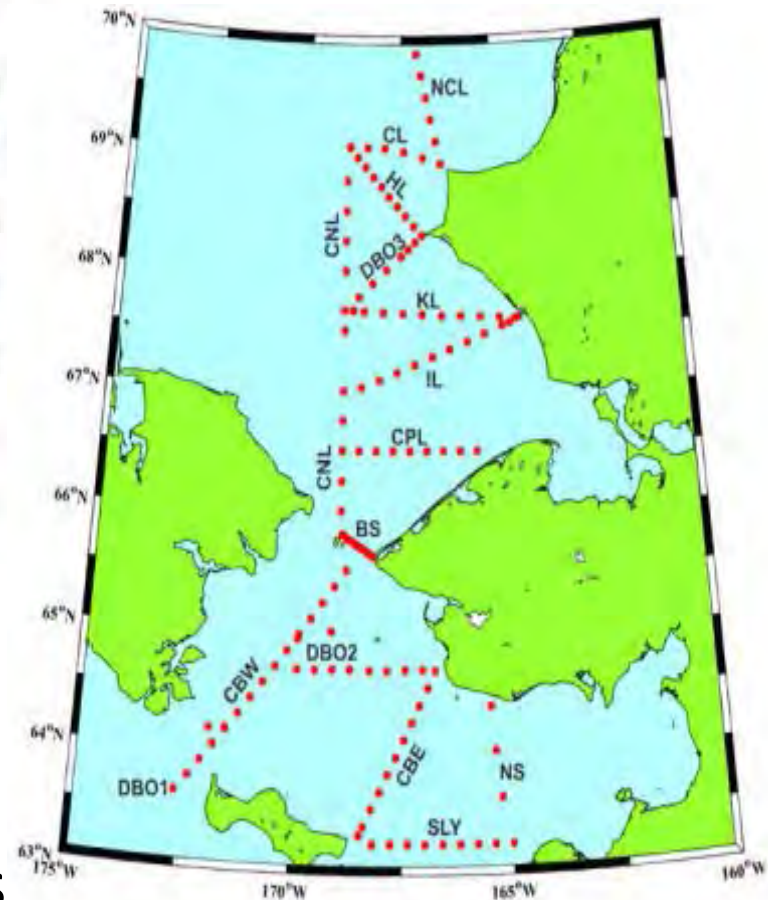
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# SKQ201709S cruise track and station locations



*Vessel trackline colored by day of month over 6-28 June, 2017.*



2700 nautical miles

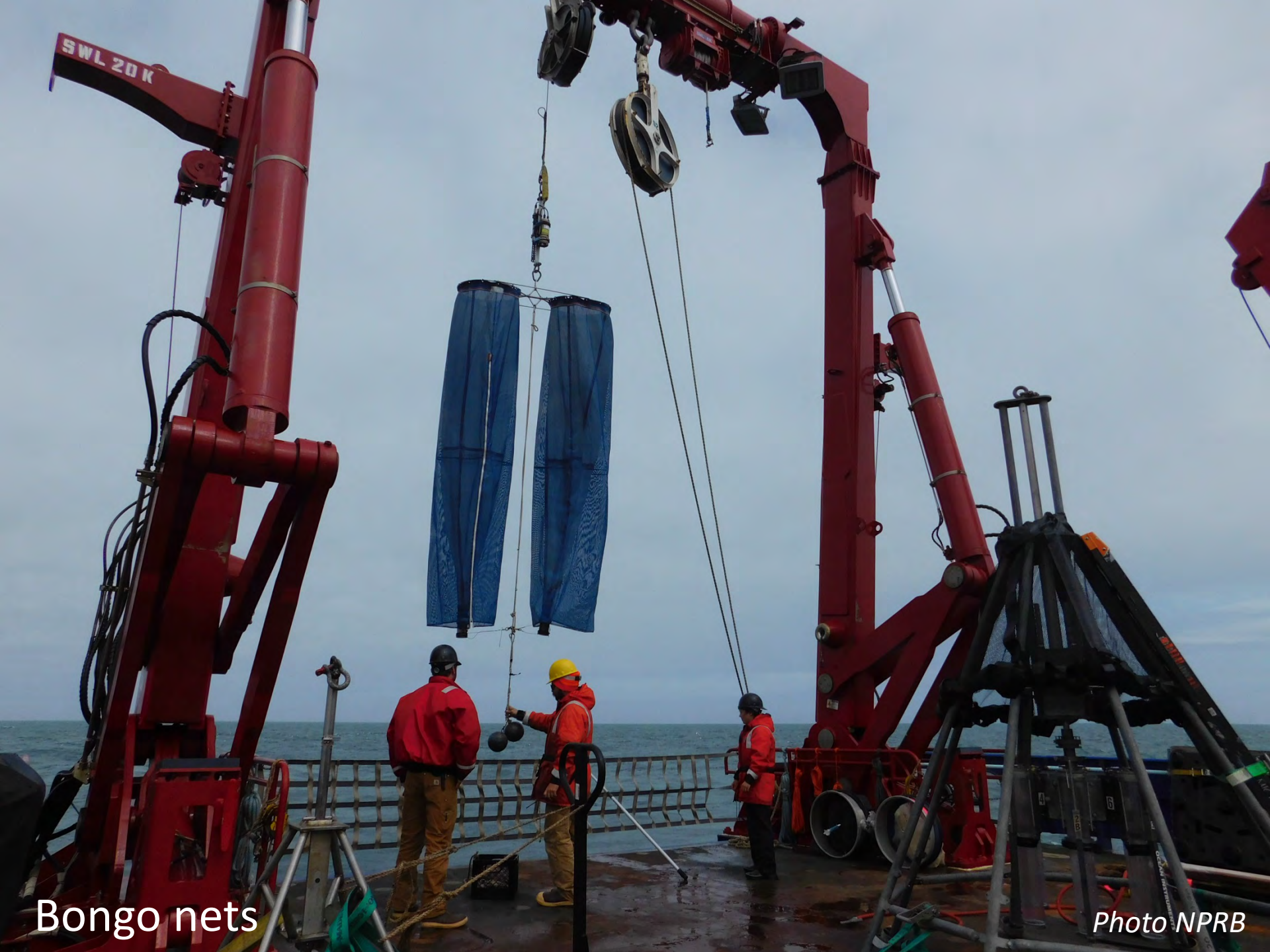
1200 miles of bird surveys

800 miles of marine mammal surveys

# Mesoplankton

- 120 towed bongo & vertical net tows for mesozooplankton abundance, biomass, distribution
- Nine 10-day cohort incubation experiments
- 1500 individual pseudocalanus egg production experiments
- 10 sets of 40 individuals of 2 species in respiration experiments

LOTS of *Neocalanus*



Bongo nets

Photo NPRB



Seward Marine Co

LEICA 16

ESP 2014 Nutrition D# 0123  
Date: \_\_\_\_\_  
Site: \_\_\_\_\_  
ESP 2014 Nutrition D# 0124  
Date: \_\_\_\_\_  
Site: \_\_\_\_\_

DUMMIES  
Original RED

KIMTEK  
Kimwipes  
Soft  
Lint-free  
Non-bleed  
Non-bleed  
Non-bleed

Photo NPRB



Zooplankton respiration experiments

Photo NPRB





10-day cohort incubation experiments

Photo NPRB



10-day cohort incubation experiments

*Photo NPRB*

# Beam Trawl

- 45,445 *Nuculana radiata*
- 2,672 shrimp
- 1,299 snow crab
- 720 hermit crab
- 274 sea stars
- 113 sea urchins
- 2 blue king crab
- 417 fish

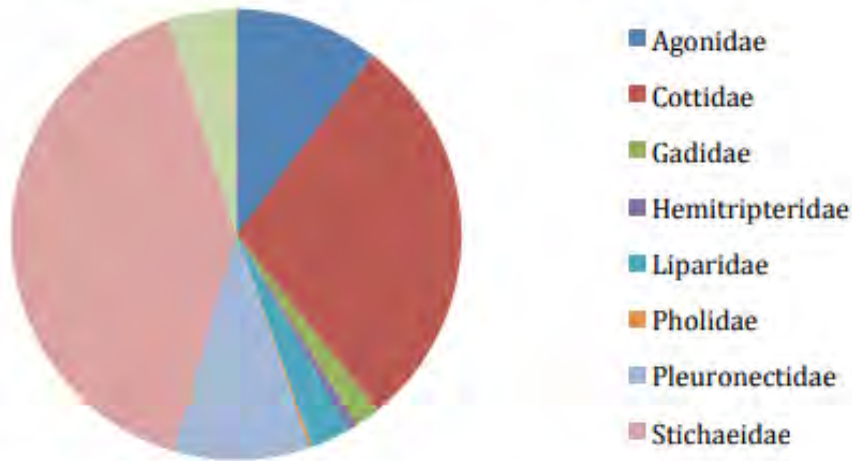


Photo NPRB



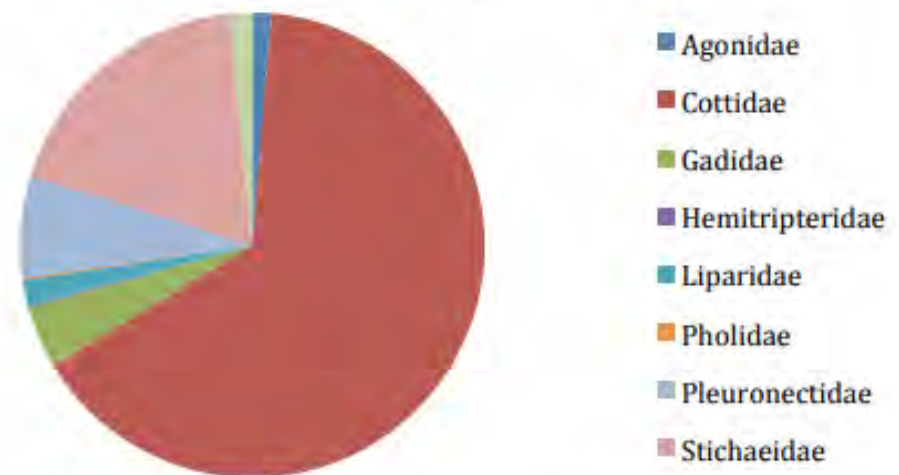
Photo NPRB

## Demersal Fish Abundance



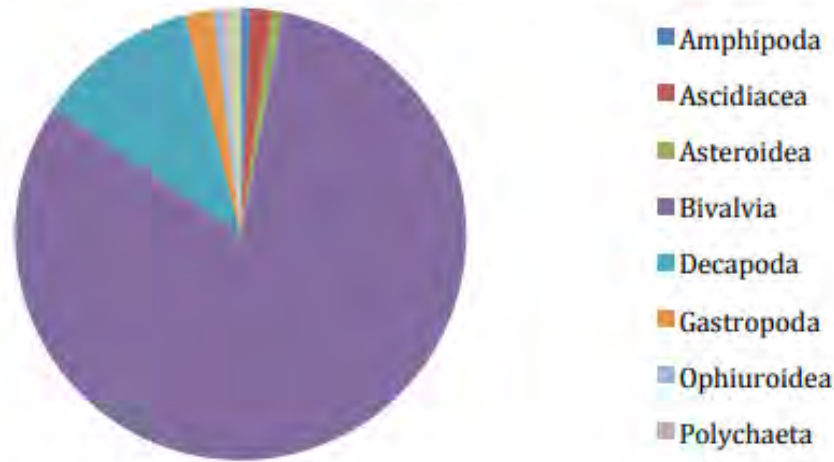
**Figure F1.** Relative abundance of fish families caught by beam trawl, standardized to # of fish per 1000 m<sup>2</sup>.

## Demersal Fish Biomass



**Figure F2.** Relative biomass of fish families caught by beam trawl. Catches were standardized to grams of fish per 1000 m<sup>2</sup>.

## Epibenthic Community Catch



**Figure F4.** Proportional number of epibenthic communities from plumb staff beam trawl hauls.

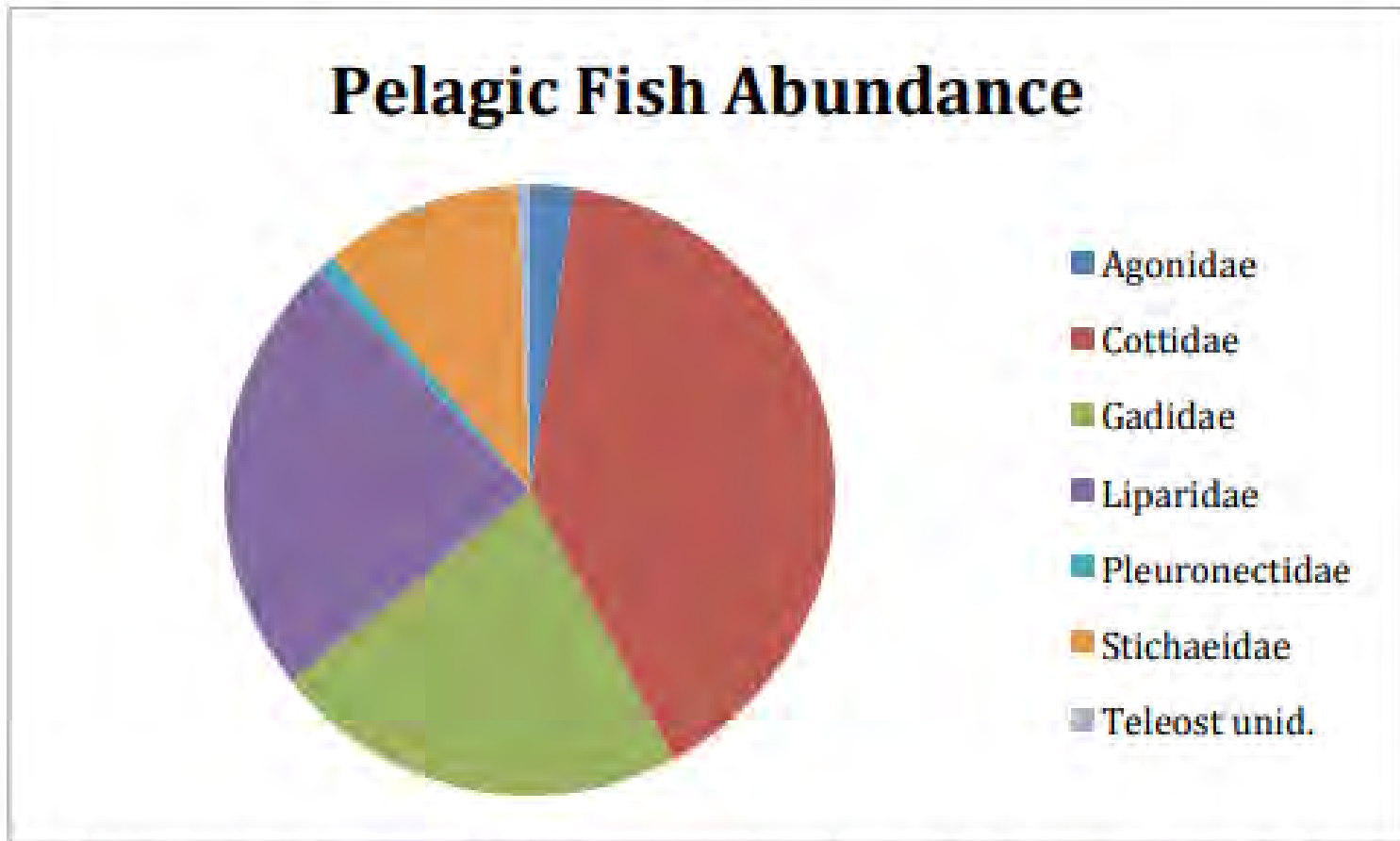
## Epibenthic Community Weight



**Figure F5.** Proportional weight of taxa within larger taxon groups found for epibenthic communities from plumb staff beam trawl hauls. Weight is not adjusted for area towed.

## Total caught

- 301 fish
- plankton



**Figure F3.** Relative abundance of fish families caught in the Isaacs-Kidd midwater trawl. Catches were standardized to # of fish per 1000 m<sup>3</sup>.



- 44 multi-core deployments to be analyzed for:
  - Macro & meiofauna
  - Chlorophyll a and quality of organic matter
  - Environmental DNA
  - Grain size
  - $^{234}\text{Th}$
- Oxygen flux incubations:
  - 7 worms, 33 clams, 11 amphipods
- 3 mud primary productivity experiments

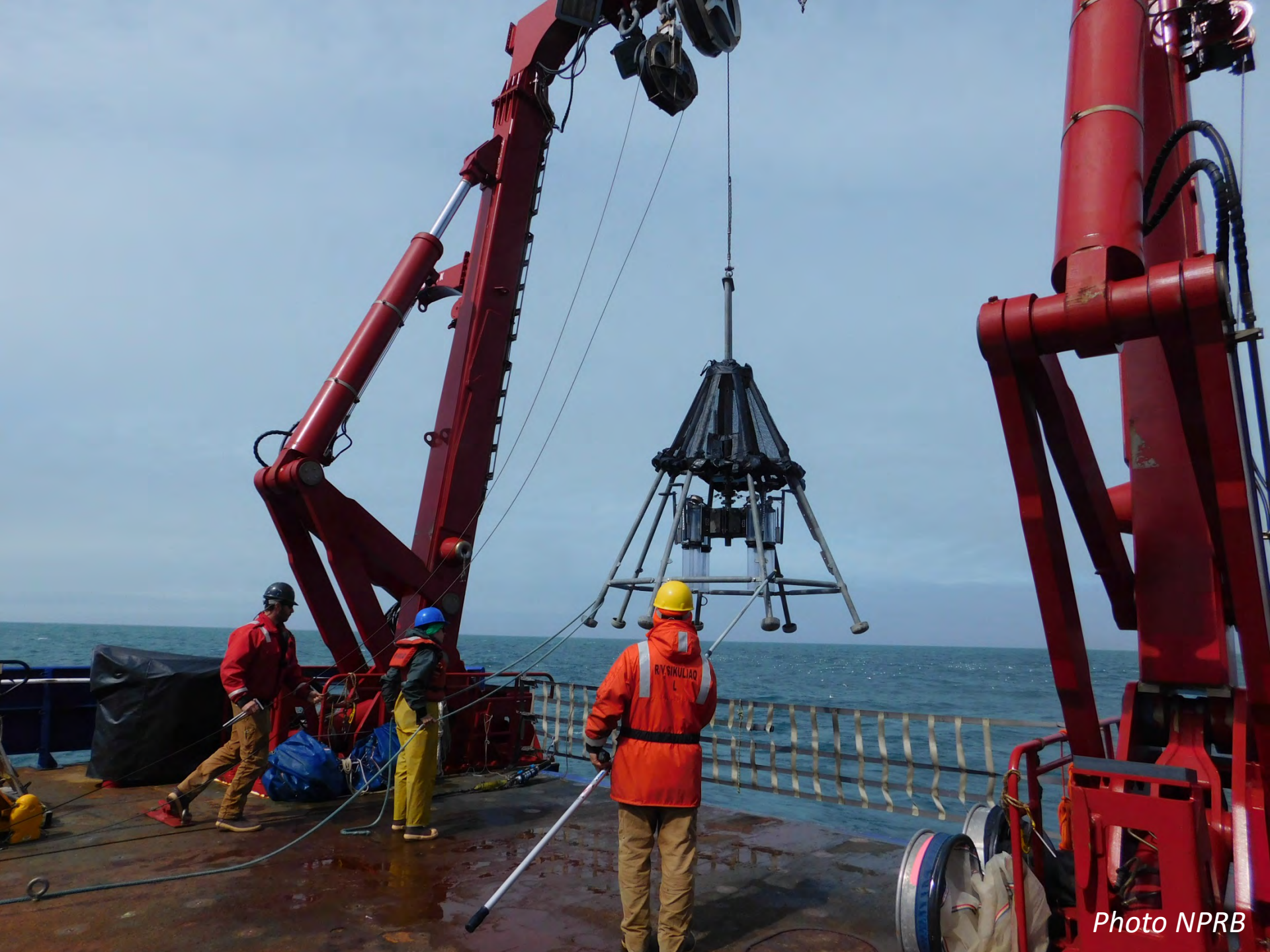
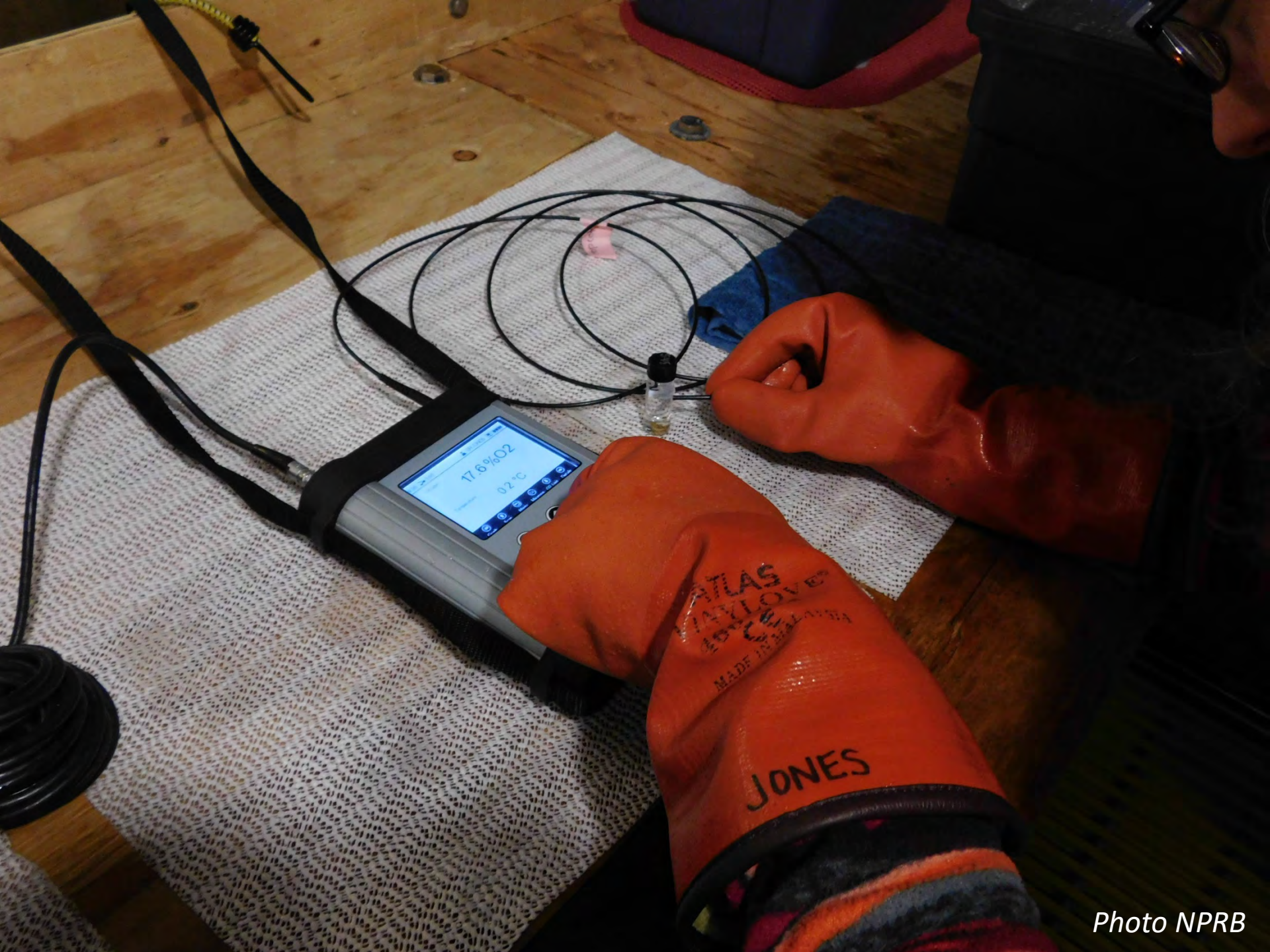


Photo NPRB







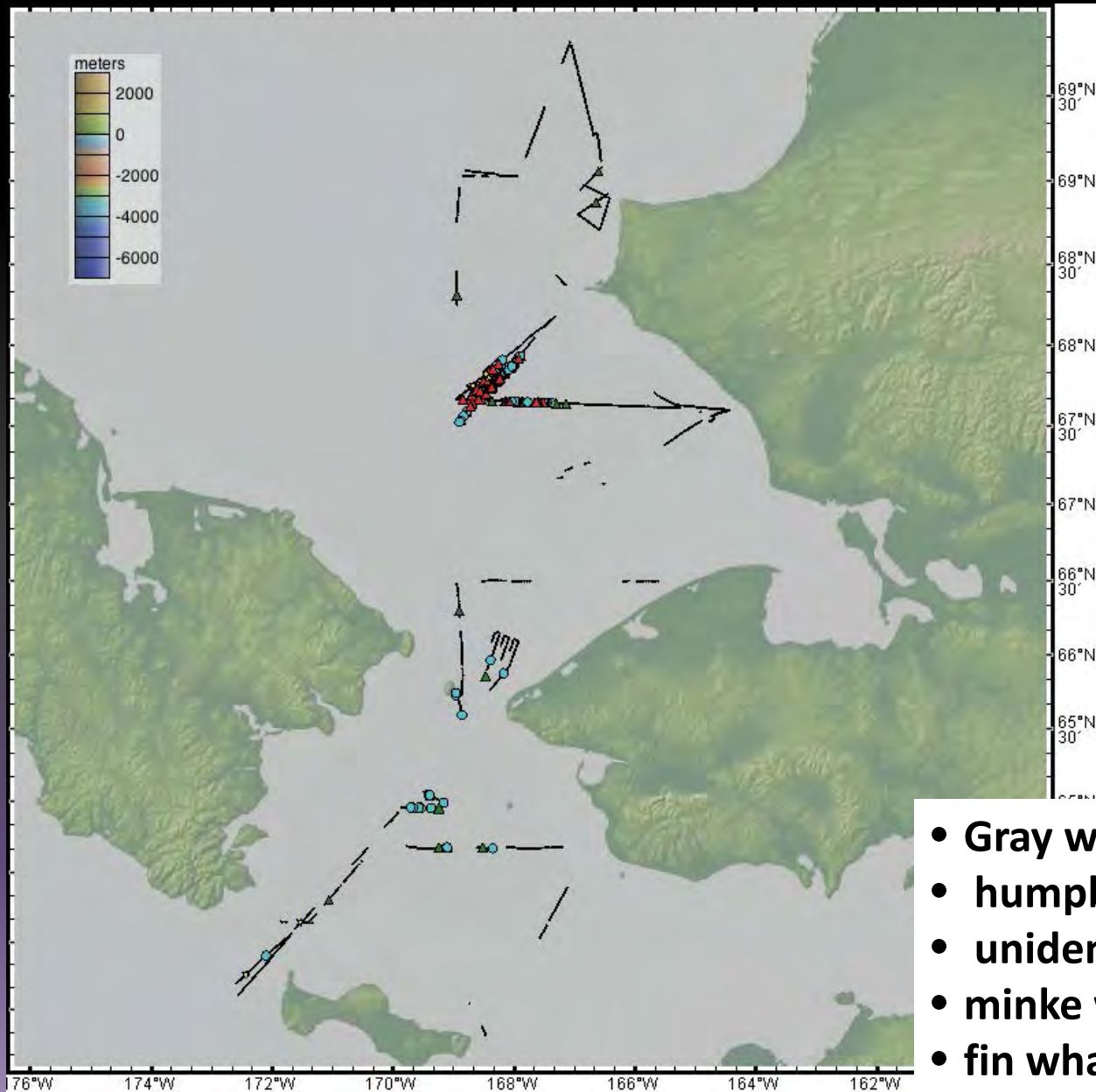
17.6% O2  
02 °C

ATLAS  
IN LOVE  
2000  
MADE IN MALAYSIA

JONES

Photo NPRB

- 2 Fin Whales
- 4 Minke Whales
- 317 Grey whales in 104 sightings
- 30 Walrus
- Ring seal, bearded seal
- 2 harbor porpoise



# Sightings

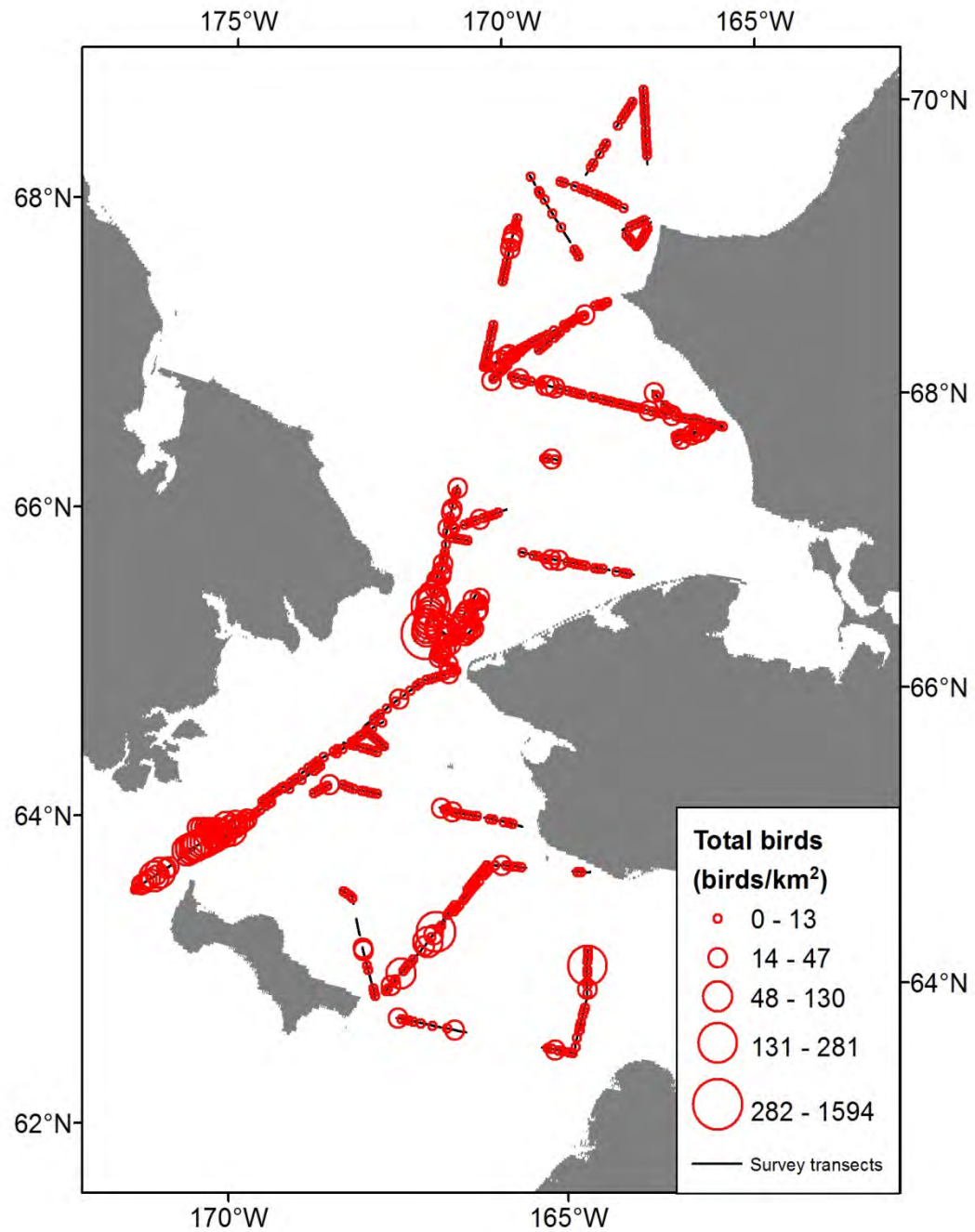
- Gray whales (blue),
- humpback whales (red),
- uniden. (green),
- minke whales (yellow)
- fin whales (black triangles).



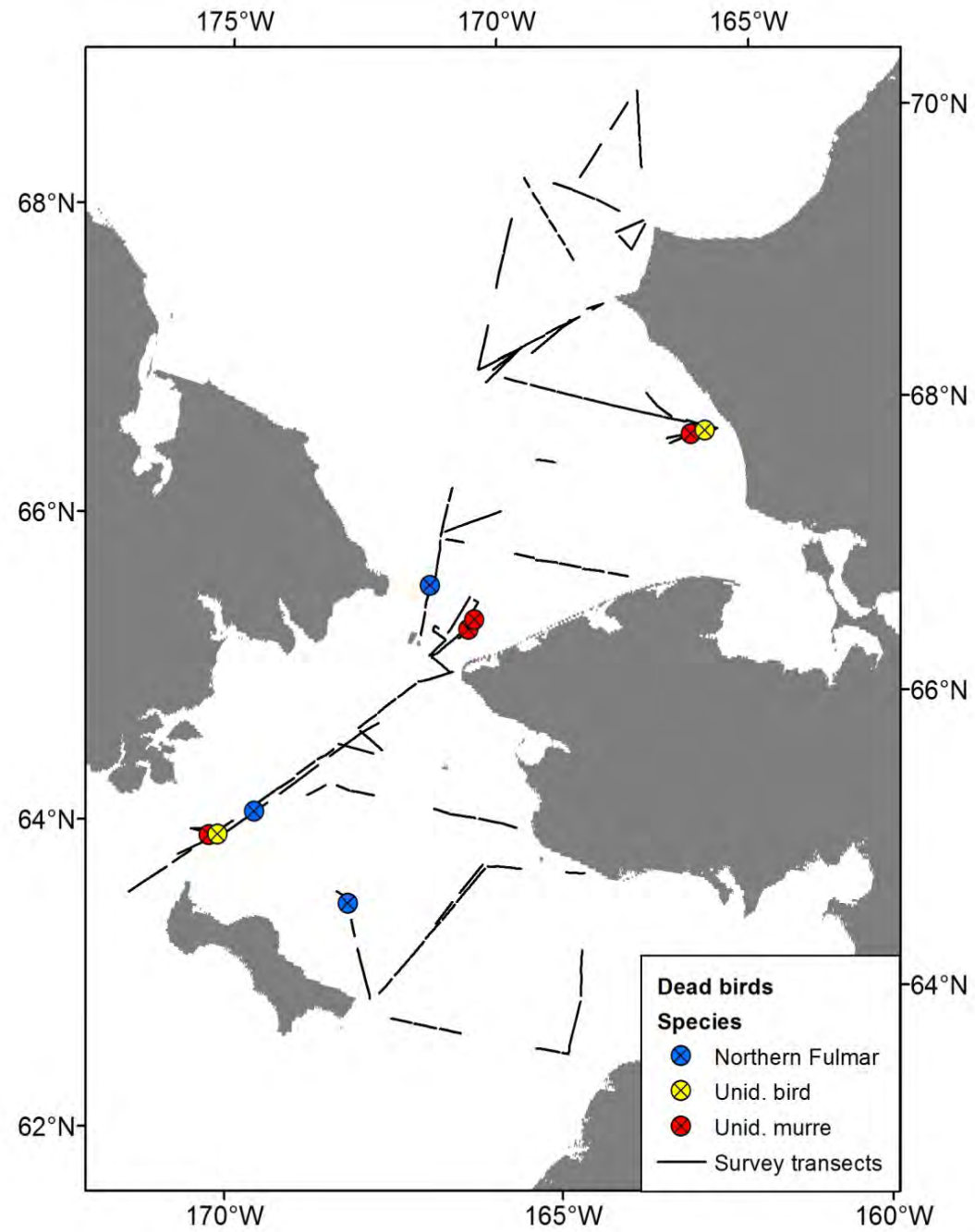
<b>Taxa</b>	<b>No. on transect</b>	<b>Rel. abund. (%)</b>	<b>No. off transect</b>
Least Auklet	847	15.68	58
Short-Tailed Shearwater	757	14.01	1253
Thick-Billed Murre	730	13.51	233
Black-Legged Kittiwake	591	10.94	217
Crested Auklet	535	9.90	209
Parakeet Auklet	245	4.54	30
Common Murre	236	4.37	47
Northern Fulmar	156	2.89	861
Horned Puffin	113	2.09	59
Tufted Puffin	104	1.93	30



# Total birds



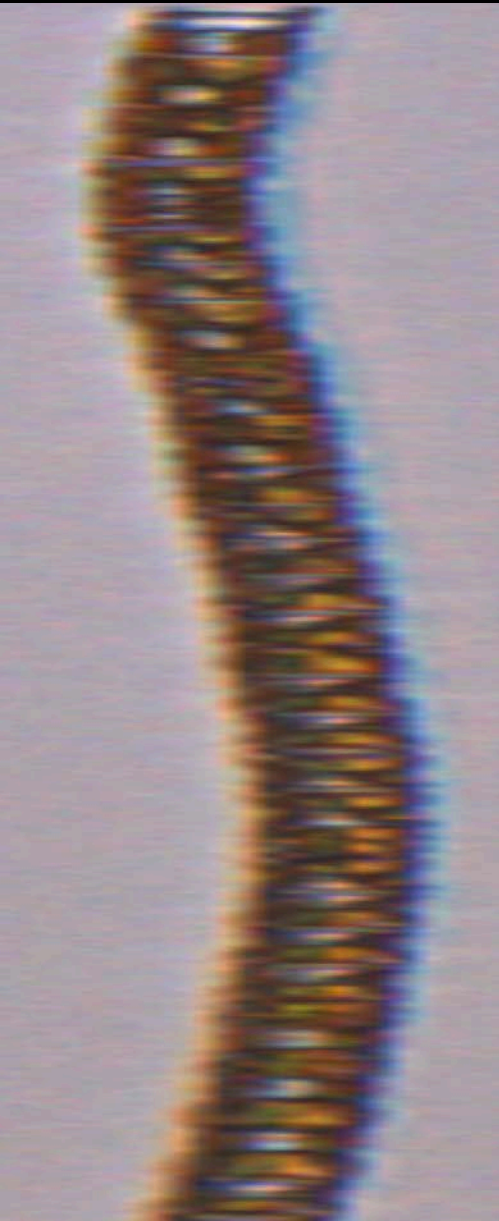
# Dead birds



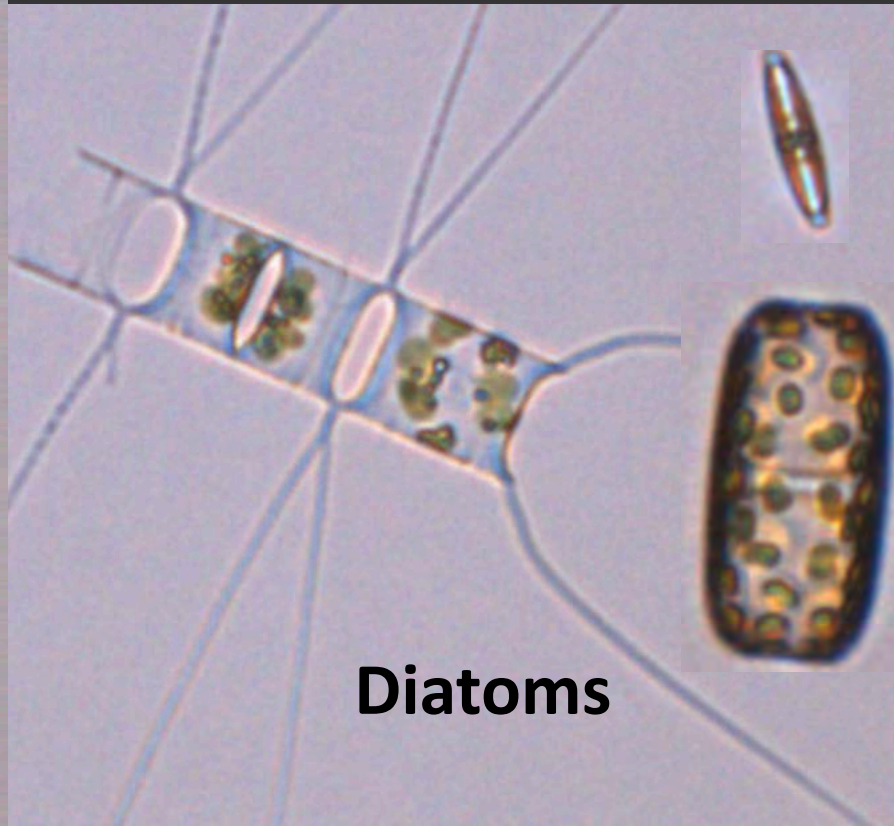
# Microzooplankton

- 1080 chlorophyll samples for 15 microzooplankton grazing experiments
- 150,000 FlowCam plankton photographs
- 655 flow cytometry discrete samples
- 30 Lugol samples for microzooplankton community analysis

# Cyanobacteria



# Microzooplankton



# Diatoms

Images by:  
J. Krause  
M. Lomas

# Phytoplankton

- 1072 chlorophyll filters (total and size-fractionated)
- 160 CTD casts with chlorophyll fluorescence
- 18 water column primary productivity experiments
- 14 size-fractionated primary productivity experiments
- 3 seafloor mud primary production experiments
- 200 filters for fatty acid analysis
- 27 transects sampled for toxic algae

# Particles & Microbes

- 165 water column optics profiles
- 1171 liters of water passed (0.2 micron filter)
- 650 samples suspended particulate matter/ CHN

6 moorings deployed  
To be recovered and  
re-deployed in 2018

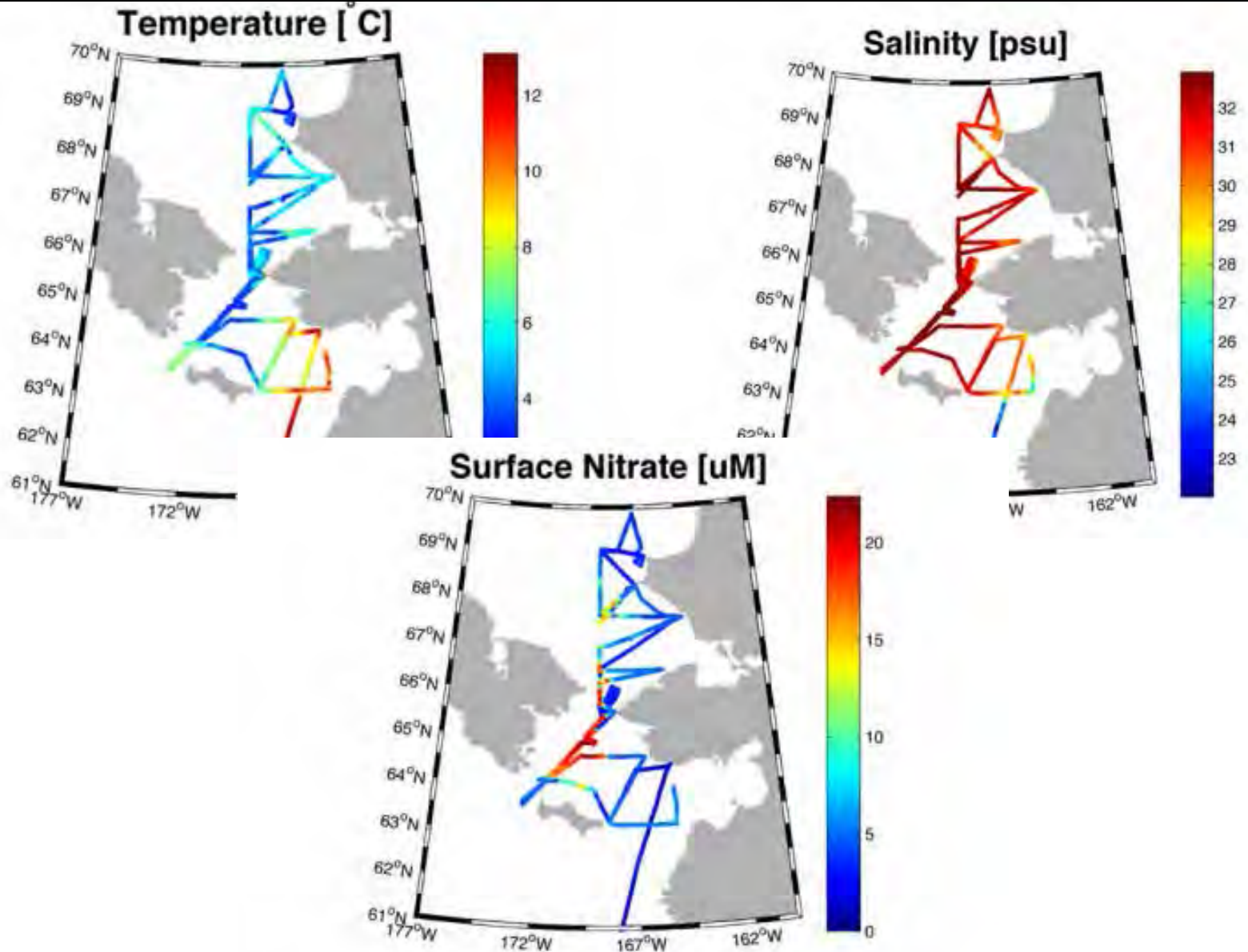


# Hydrography and Underway

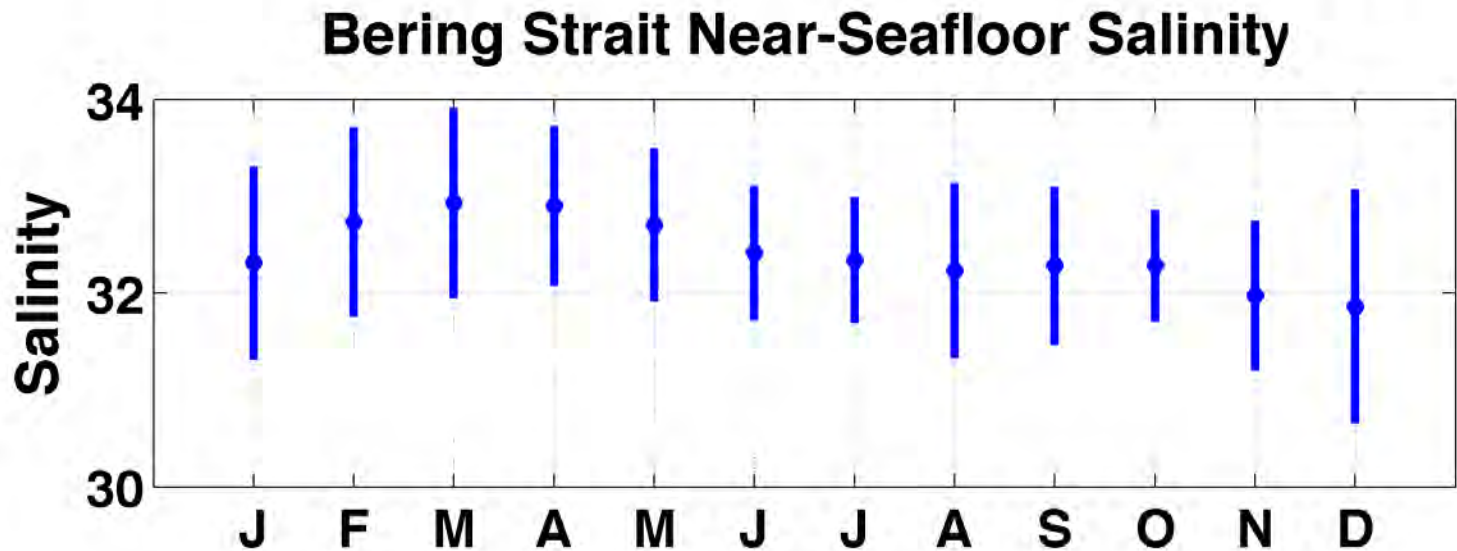
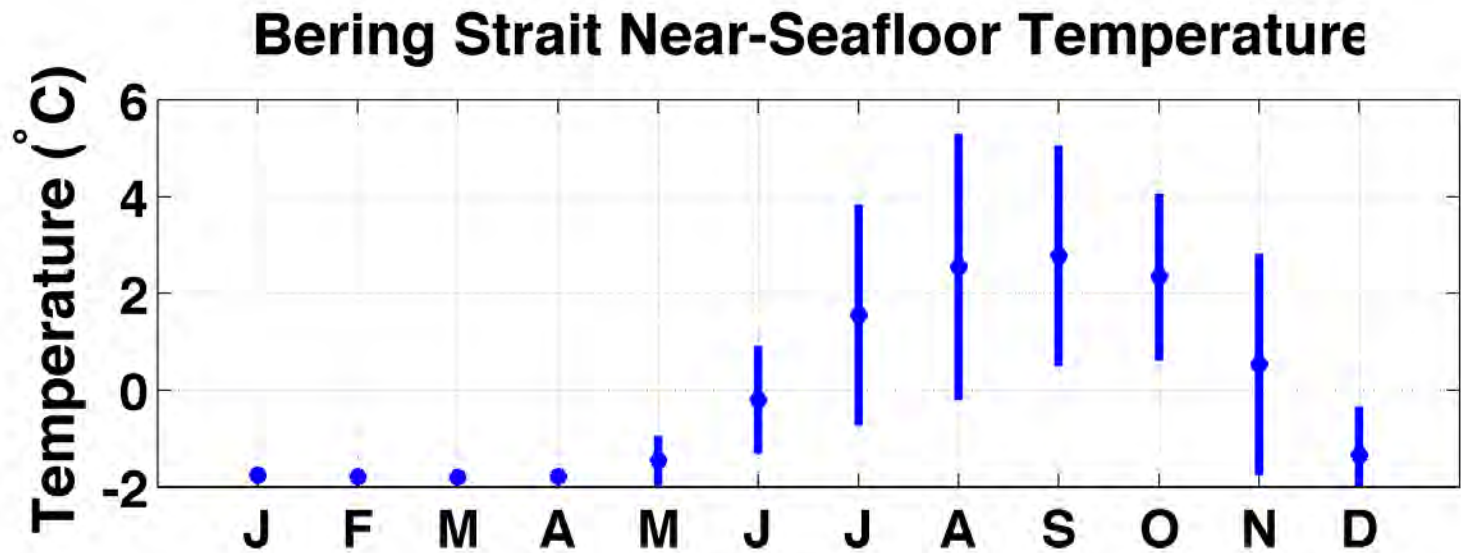
- 172 CTD water column profiles
- 630 discrete samples dissolved nutrients (surface-seafloor)
- 20 days of continuous measurements:
  - Weather and sea surface hydrography
  - Water speed and direction
  - 5-frequency water column echograms
  - Multi-beam seafloor depth swath mapping



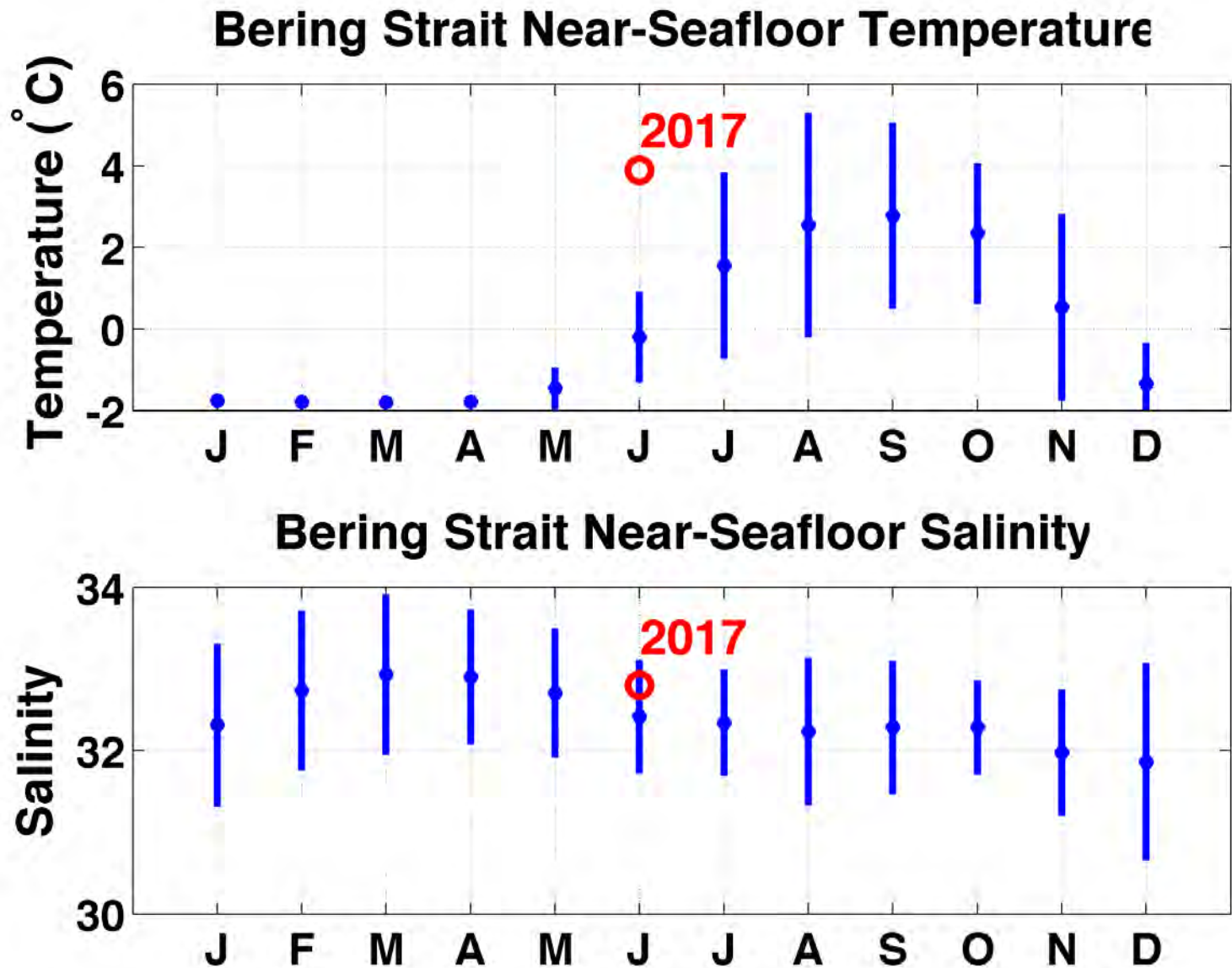
# Higher nitrate in salty, cold water mass (Anadyr Water)



# Climatology for June (1990-2004)



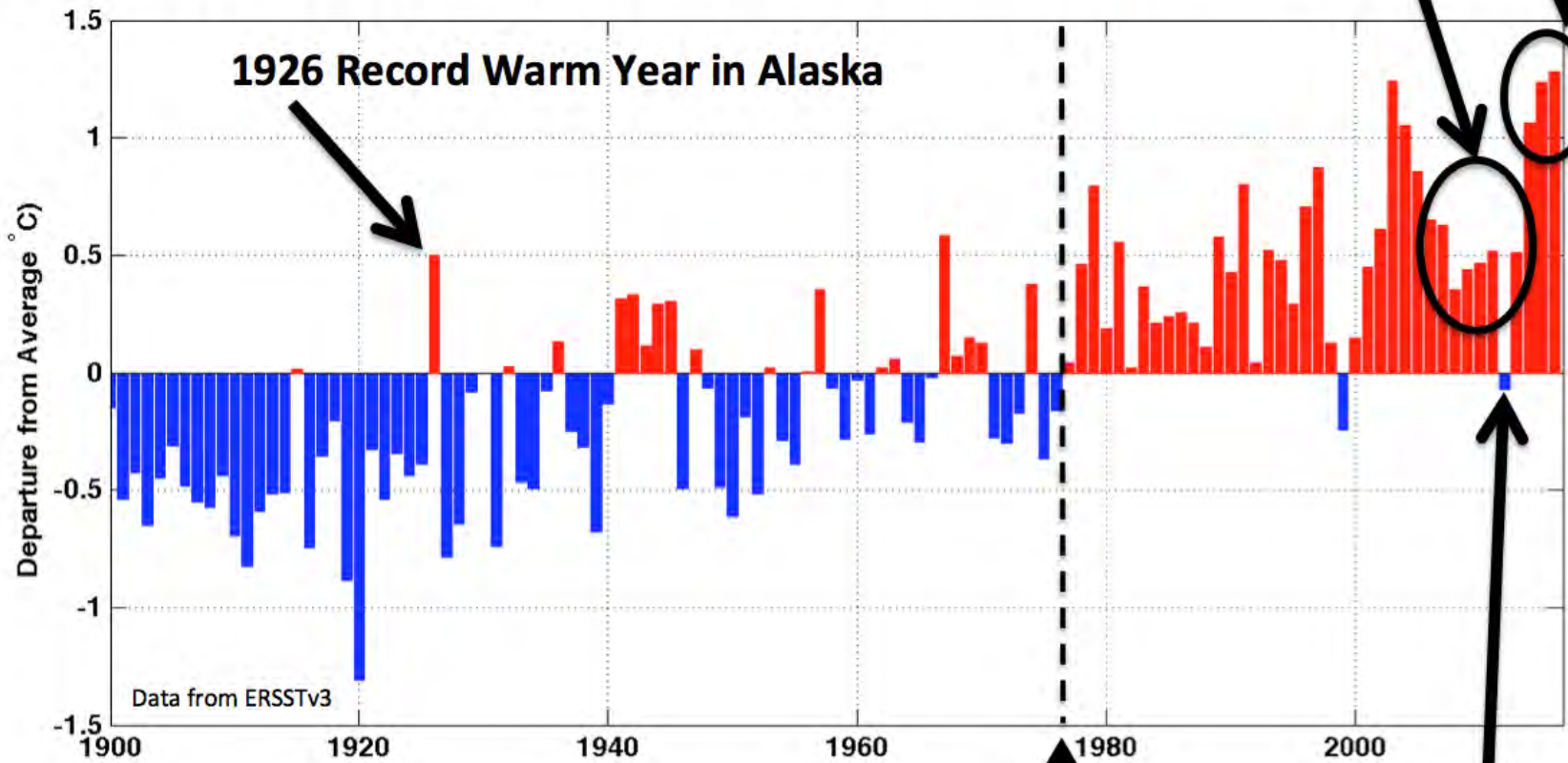
# Climatology for June (1990-2004)



# Northern Bering Sea 1900-2016 Sea Surface Temperature Anomaly

2014-2016  
Marine Heat Wave

2007-2013  
"Cool" Years



(S. Danielson, UAF)

1976  
North Pacific  
Ecological "Regime Shift"

2012  
Satellite-era  
Bering Sea ice  
extent record in  
January

# Highlights

- Heat:
  - early ice retreat, many indications of an unusually warm year.
  - station closest to Bering Strait mooring MA3 had near-bottom temperatures 5 standard deviations warmer than long-term mean.
  - Surface waters off of the Yukon river were 11-12 °C.
- Nutrient distributions:
  - More nitrate found in near-surface waters than expected.
  - Plenty of nitrate left to continue surface plankton blooms
- *Neocalanus copepods*:
  - appeared in higher densities than expected.
  - possibly a bigger role than previously appreciated.

# Highlights

- Early arrival for sub-arctic marine mammals (e.g., humpbacks)
- Larval Arctic cod in coastal waters, especially at stations with ice melt signals.
  - Low catches of older Arctic Cod was unexpected.
  - Saffron Cod only caught on southernmost survey line.
- More dead birds (murre, northern fulmar) than usual
  - Two subsequent cruises in the region also ( multiple species).