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
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
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
**Figure F1.** Relative abundance of fish standardized to # of fish per 1000 m².

**Figure F2.** Relative biomass of fish families caught by beam trawl. Catches were standardized to grams of fish per 1000 m².
**Figure F4.** Proportional number of epibenthic communities from plumb staff beam trawl hauls.

**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 m³.
• **44 multi-core deployments to be analyzed for:**
  – Macro & meiofauna
  – Chlorophyll a and quality of organic matter
  – Environmental DNA
  – Grain size
  – $^{234}$Th

• **Oxygen flux incubations:**
  – 7 worms, 33 clams, 11 amphipods

• **3 mud primary productivity experiments**
• 2 Fin Whales
• 4 Minke Whales
• 317 Grey whales in 104 sightings
• 30 Walrus
• Ring seal, bearded seal
• 2 harbor porpoise
Large Whale Sightings

- Gray whales (blue),
- humpback whales (red),
- uniden. (green),
- minke whales (yellow)
- fin whales (black triangles).
<table>
<thead>
<tr>
<th>Taxa</th>
<th>No. on transect</th>
<th>Rel. abund. (%)</th>
<th>No. off transect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Least Auklet</td>
<td>847</td>
<td>15.68</td>
<td>58</td>
</tr>
<tr>
<td>Short-Tailed Shearwater</td>
<td>757</td>
<td>14.01</td>
<td>1253</td>
</tr>
<tr>
<td>Thick-Billed Murre</td>
<td>730</td>
<td>13.51</td>
<td>233</td>
</tr>
<tr>
<td>Black-Legged Kittiwake</td>
<td>591</td>
<td>10.94</td>
<td>217</td>
</tr>
<tr>
<td>Crested Auklet</td>
<td>535</td>
<td>9.90</td>
<td>209</td>
</tr>
<tr>
<td>Parakeet Auklet</td>
<td>245</td>
<td>4.54</td>
<td>30</td>
</tr>
<tr>
<td>Common Murre</td>
<td>236</td>
<td>4.37</td>
<td>47</td>
</tr>
<tr>
<td>Northern Fulmar</td>
<td>156</td>
<td>2.89</td>
<td>861</td>
</tr>
<tr>
<td>Horned Puffin</td>
<td>113</td>
<td>2.09</td>
<td>59</td>
</tr>
<tr>
<td>Tufted Puffin</td>
<td>104</td>
<td>1.93</td>
<td>30</td>
</tr>
</tbody>
</table>
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
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)

Bering Strait Near-Seafloor Temperature

Bering Strait Near-Seafloor Salinity
Climatology for June (1990-2004)

Bering Strait Near-Seafloor Temperature

Bering Strait Near-Seafloor Salinity

2017
Northern Bering Sea 1900-2016
Sea Surface Temperature Anomaly

1926 Record Warm Year in Alaska

1976 North Pacific Ecological "Regime Shift"

2007-2013 "Cool" Years

2012 Satellite-era Bering Sea ice extent record in January

2014-2016 Marine Heat Wave

Data from ERSSTv3

(S. Danielson, UAF)
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 (murres, northern fulmar) than usual
  - Two subsequent cruises in the region also (multiple species).