Objectives

- Establishing benchmark for marine fishes
  - Open water sampling
  - Multi-year collections
  - Under-ice pilot surveys
UAF Beaufort Sea surveys completed

• 3 cruises
  – 2010: WWW1004 (6 days, *Westward Wind*)
  – 2011: BeauFish (21 days, *Norseman II*)
  – 2012: US Transboundary (10 days, *Norseman II*)

• Sampling gears:
  – **Bottom nets: Fish and Invertebrates**
  – Midwater nets: Fish and Zooplankton
  – Oceanography
  – Sediments and Infauna

• 2013: Under Ice (2 sites, Barrow, AK)
2010

• Small sampling area, mostly shallow
  – Camden Bay, “Sivuliq area”
  – 15 stations from 20-100 m
  – Funded by Shell Exploration and Production Co.

• Captured approximately 800 fish total
  – 600 in bottom gear

Photo credit: T. Foster

Photo credit: S. Carroll
2010 - small area, shallow

- **Sculpins**: 55%
- **Cods**: 26%
- **Snailfishes and Lumpsuckers**: 15%
- **Eelpouts**: 2%
- **Poachers**: 1%
- **Pricklebacks**: 1%
2011

- Large area, mostly shallow
  - BeauFish cruise, from Camden Bay to Pt. Barrow
  - 79 stations from 15-200 m
  - Funded by BOEM

- Captured approximately 17,000 fish
  - 13,000 in bottom gear

Photo credit: I. Rutzen
2011 - large area, shallow

- Cods: 51%
- Smelts and Sand lance: <1%
- Sculpins: 23%
- Pricklebacks: 6%
- Poachers: 4%
- Eelpouts: 4%
- Snailfishes and Lumpsuckers: 12%
- Flatfishes: <1%
- Smelts and Sand lance: <1%
- Sculpins: 23%
- Pricklebacks: 6%
- Poachers: 4%
- Eelpouts: 4%
- Snailfishes and Lumpsuckers: 12%
- Flatfishes: <1%
- Smelts and Sand lance: <1%
All fishes
Captured 13,000
Size range: 25 - 300 mm

CPUE = (# fish) / (1000 m^2)
High: 981
Low: 52
Snailfishes
Captured 750  Size range: 25 - 200 mm

CPUE = (# fish) / (1000 m^2)

High: 176
Low: 1
Sculpins
Captured 2,700  Size range: 25 - 270 mm

CPUE = (# fish) / (1000 m^2)

- High: 271
- Low: 20

Photo credit: B. Sheiko
Cods
Captured 6,800  Size range: 25 - 180mm

CPUE = (# fish) / (1000 m^2)
- High: 376
- Low: 5
2011
Larval Arctic cod

From Gallaway et al., submitted
2012

Map showing the locations of Barrow, Prudhoe Bay, Kaktovik, Tuktoyaktuk, and Inuvik. The map highlights the survey areas for 2010, 2011, 2012, and 2013 by the UAF and DFO. The map also indicates the UAF Under Ice 2013 survey area.
2012

• Small area, shallow and deep depths
  – US Transboundary cruise, central US Beaufort
  – 18 stations from 20-1,000 m
  – Funded by BOEM

• Captured approximately 5,500 fish
  – 4,700 in bottom gear
2012 - small area, deep

Cods: 32%
Snailfishes and Lumpsuckers: 31%
Sculpins: 18%
Pricklebacks: 4%
Eelpouts: 11%
Poachers: 4%
Rays: <1%
Smelts and Sand lance: <1%
Flatfishes: <1%
2012 Percent composition of catch at depth

- **Snailfishes and Lumpsuckers**
- **Sculpins**
- **Rays**
- **Pricklebacks**
- **Poachers**
- **Flatfishes**
- **Eelpouts**

**Depth**
- 20
- 50
- 100
- 200
- 350
- 500
- 1000

**Percent composition of catch**
- 0%
- 20%
- 40%
- 60%
- 80%
- 100%
2012 Average length at depth

- Sculpins
- Cods
- Snailfishes
- Flatfishes
- Eelpouts
- All other families
## Species list

<table>
<thead>
<tr>
<th>Rajidae</th>
<th>Hemitripteridae</th>
<th>Zoarcidae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raja binoculata</td>
<td>Nautichthys pribilovius</td>
<td>Gymnelus hemifasciatus</td>
</tr>
<tr>
<td>Osmeridae</td>
<td>Agonidae</td>
<td>Gymnelus viridis</td>
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<tr>
<td>Mallotus villosus</td>
<td>Aspidophoroides monopterygius</td>
<td>Lycodes mucosus</td>
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<tr>
<td>Osmerus mordax</td>
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<td>Lycodes polaris</td>
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<tr>
<td>Gadidae</td>
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<td>Lycodes raridens</td>
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<tr>
<td>Arctogadus glacialis</td>
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<td>Lycodes sagittarius</td>
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<tr>
<td>Boreogadus saida</td>
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<td>Lycodes adolfi</td>
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<tr>
<td>Eleginus gracilis</td>
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<td>Lycodes rossi</td>
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<tr>
<td>Cottidae</td>
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<td>Lycodes reticulatus</td>
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<td>Artediellus scaber</td>
<td>Liparis fabricii</td>
<td>Lycodes frigidus</td>
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<tr>
<td>Gymnocanthus tricuspis</td>
<td>Liparis gibbus</td>
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<tr>
<td>Icelus spatula</td>
<td>Liparis bathyarticus</td>
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<tr>
<td>Myoxocephalus quadricornis</td>
<td>Liparis tunicatus</td>
<td>Anisarchus medius</td>
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<tr>
<td>Myoxocephalus scorpius</td>
<td>Careproctus sp.</td>
<td>Eumesogrammuss praecisus</td>
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<tr>
<td>Triglops nybelini</td>
<td>Ammodytidae</td>
<td>Leptoclinus maculatus</td>
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<tr>
<td>Triglops pingelii</td>
<td>Ammodytes hexapterus</td>
<td>Lumpeninus fabricii</td>
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<tr>
<td>Pleuronectidae</td>
<td>Hippoglossoides robustus</td>
<td>Stichaeus punctatus</td>
</tr>
<tr>
<td></td>
<td>Reinhardtius hippoglossoides</td>
<td></td>
</tr>
</tbody>
</table>

43 confirmed species from 12 families
East vs. West

Density of all fishes is greater in west

Larval cod density high in east
Shelf vs. Slope

• Average length
  – Shelf = small
  – Slope = big

• Catch composition
  – Shelf- sculpins, snailfishes, and cod
  – Slope- eelpout, rays, and flatfishes
  – Different species within families
### Length differences

<table>
<thead>
<tr>
<th>Year</th>
<th>Minimum Length (mm)</th>
<th>Maximum Length (mm)</th>
<th>Average Length (mm)</th>
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<tbody>
<tr>
<td>2010</td>
<td>19</td>
<td>146</td>
<td>48</td>
</tr>
<tr>
<td>2011</td>
<td>18</td>
<td>300</td>
<td>56</td>
</tr>
<tr>
<td>2012</td>
<td>15</td>
<td>795</td>
<td>99</td>
</tr>
</tbody>
</table>

**2010-2011 vs 2012**
Objective: To test the feasibility of deploying gear to examine fish in their under-ice habitat.
Under-ice pilot study 2013

- Divers
- ROV
- Gill net
- DIDSON
- ADCP
- CTD
- Plankton net

All gear was successfully deployed/retrieved!
Adaptive improvements in sampling design

• 2010:
  – Need to use different nets

• 2011:
  – Wide fish distributions, but need to sample on slope

• 2012:
  – Slope and shelf are very different

• 2013:
  – Ice: Need to sample closer to jumble ice
  – Open water: Plan to sample wide distribution on slope and shelf
2013

Beaufort Sea

Barrow
Prudhoe Bay
Kaktovik
Tuktoyaktuk
Inuvik

UAF 2010 - 15 stations
UAF 2011 - 79 stations
UAF 2012 - 2.5 transects, 18 stations
DFO 2012 - 6 transects, 31 stations
UAF 2013
DFO & UAF 2013
DFO 2013

UAF Under Ice 2013

University of Alaska Fairbanks

Nautical Miles
Future transboundary surveys

• US and Canadian Beaufort
  – 12 planned transects on US and Canadian side of border
  – collaboration among scientists
• 2013: Norseman II (UAF) and Frosti (DFO)
• 2014: R/V Sikuiliaq
  – Both US and DFO scientists
Climate-related factors

• Window of opportunity for sampling
• Sampling site availability
• Expect changes in distribution and abundance of fishes
• Food web effects on fish life history
Potential enhancements to future transboundary surveys

- Ichthyoplankton
- Primary productivity
- Under-ice surveys
- Hydroacoustics
- ROV/gliders
- Ocean acidification
- Marine mammal surveys
- Seabird observations
Thanks!

• The Under-Ice Pilot Study team and the staff of Umiaq, LLC.
• UAF Fisheries Oceanography Lab students and technicians
• BOEM and Shell Exploration and Production Co. for funding
• Canada Department of Fisheries and Oceans