Mega-swarm of northern sea nettles (*Chrysaora melanaster*) in the Gulf of Alaska, winter 2019

Brian Hunt, IYS Workshop, PICES, 19-20 October 2019
Expedition Science Team

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Photo by Egor Glyzin, 3rd mate
TODAYS PRESENTATION

1. Chrysaora in the Gulf of Alaska

2. Update on Stable Isotope analysis of food webs
Chrysaora melanaster – A scyphozoan jellyfish

Chrysaora life cycle
**CHRYSAORA IN THE BERING SEA**

- *Chrysaora* well documented in the Bering Sea;
- Particularly abundant in cold years;
- Have not found previous records of *Chrysaora* in the GoA
<table>
<thead>
<tr>
<th>Species</th>
<th>q</th>
<th>Frequency of occurrence (%)</th>
<th>Numbers (million fish)</th>
<th>Biomass (thousand tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oncorhynchus gorbuscha</td>
<td>0.3</td>
<td>17.2</td>
<td>4.21</td>
<td>1.63</td>
</tr>
<tr>
<td>Oncorhynchus keta total</td>
<td></td>
<td>63.8</td>
<td>27.73</td>
<td>27.70</td>
</tr>
<tr>
<td>Oncorhynchus nerka total</td>
<td></td>
<td>31.0</td>
<td>9.04</td>
<td>10.30</td>
</tr>
<tr>
<td>Oncorhynchus kisutch</td>
<td>0.3</td>
<td>37.9</td>
<td>13.59</td>
<td>10.37</td>
</tr>
<tr>
<td>Oncorhynchus tshawytscha</td>
<td>0.3</td>
<td>5.17</td>
<td>0.37</td>
<td>1.32</td>
</tr>
<tr>
<td>All species total</td>
<td></td>
<td>82.8</td>
<td>54.95</td>
<td>51.33</td>
</tr>
<tr>
<td>Chrysaora melonaster</td>
<td>0.1</td>
<td>51.7</td>
<td>5,021.54</td>
<td>1,233.49</td>
</tr>
</tbody>
</table>

**Dry weight: Salmon = 10.26 vs Chrysaora 50.57 thousand tons**
Food Consumption

*Chrysaora* were distributed in the northern area (265,200 km²)

*Zooplankton biomass* (Juday Net - upper 200m)
485,316 tons Carbon

*Chrysaora biomass*
2386.8 – 3978 tons Carbon

% winter zoo standing stock consumption *(November to Feb)*
Ave = 13.5%, Max = 35%
Brodeur estimated 33% for Bering sea *(Brodeur et al MEPS 2002)*

Important factors in calculations
- Catchability coefficient - Visual observations indicated that q was 10% of actual biomass
- Daily ration
**SOURCE OF CRYSAORA**

- *Chrysaora* well documented in the Bering Sea
- Particularly abundant in cold years;
- Center of distribution appears to be Aleutian Islands
  - Support for benthic polyp phase
  - Aleutian shelf the likely source to the GoA
Modelled circulation

Current vectors
CHRYSAORA IN THE ALASKA GYRE

Whitney 2005 – defined the central gyre by the 15μM nitrate contour (upwelling)

Chrysaora within and on edge of the gyre
SOURCE OF CHRYSAORA
**FURTHER CONSIDERATIONS**

*Chrysaora* clearly overwintered in the GoA
- What is their life cycle in this region? Longevity?
- Do they recruit back to the shelf?
- Is the GoA a dead end?

Can not find prior records of *Chrysaora* in the GoA
- Is this normal? (not reported)
- Is this a shift in the ecosystem dynamic (increased southward transport?)
FURTHER CONSIDERATIONS

Where do they fit in the food web?
• Consumption calculations used entire zooplankton community
• Data from Bering Sea suggests that they favour large crustacean zooplankton and small fish - may have underestimated impact on salmon prey
NEXT STEPS

Isotopic analysis of the GoA food web

Phytoplankton (POM)

Zooplankton
  • Size fractions & major species

Micronekton

Nekton
All salmon species
NEXT STEPS

Isotopic analysis of the GoA food web

POM from all stations already processed; data in hand
NEXT STEPS

Isotopic analysis of the GoA food web

POM from all stations already processed; data in hand

Full catch from 26 Stations processed and submitted for analysis.
**Next Steps**

Isotopic analysis of the GoA food web

Food web mapping

- Species & size based trophic levels
- Mixing models to estimate contributions of major macroplankton / micronekton taxa to predators; niche overlap and potential competition among consumers, e.g., salmon and *Chrysaora*

*Figure 1. Generalised pelagic food web.*
NEXT STEPS

Validation of North Pacific Isoscapes

δ^{13}C

2015

2016

2017

δ^{15}N

2015

2016

2017
NEXT STEPS

Comparison of isotope derived predictions of salmon distribution with catch

Salmon stocks

Predicted distributions (estimated using salmon isotopes time series)

*In review*