



Fine scale spatial patterns of gelatinous zooplankton in the Northern Gulf of Alaska

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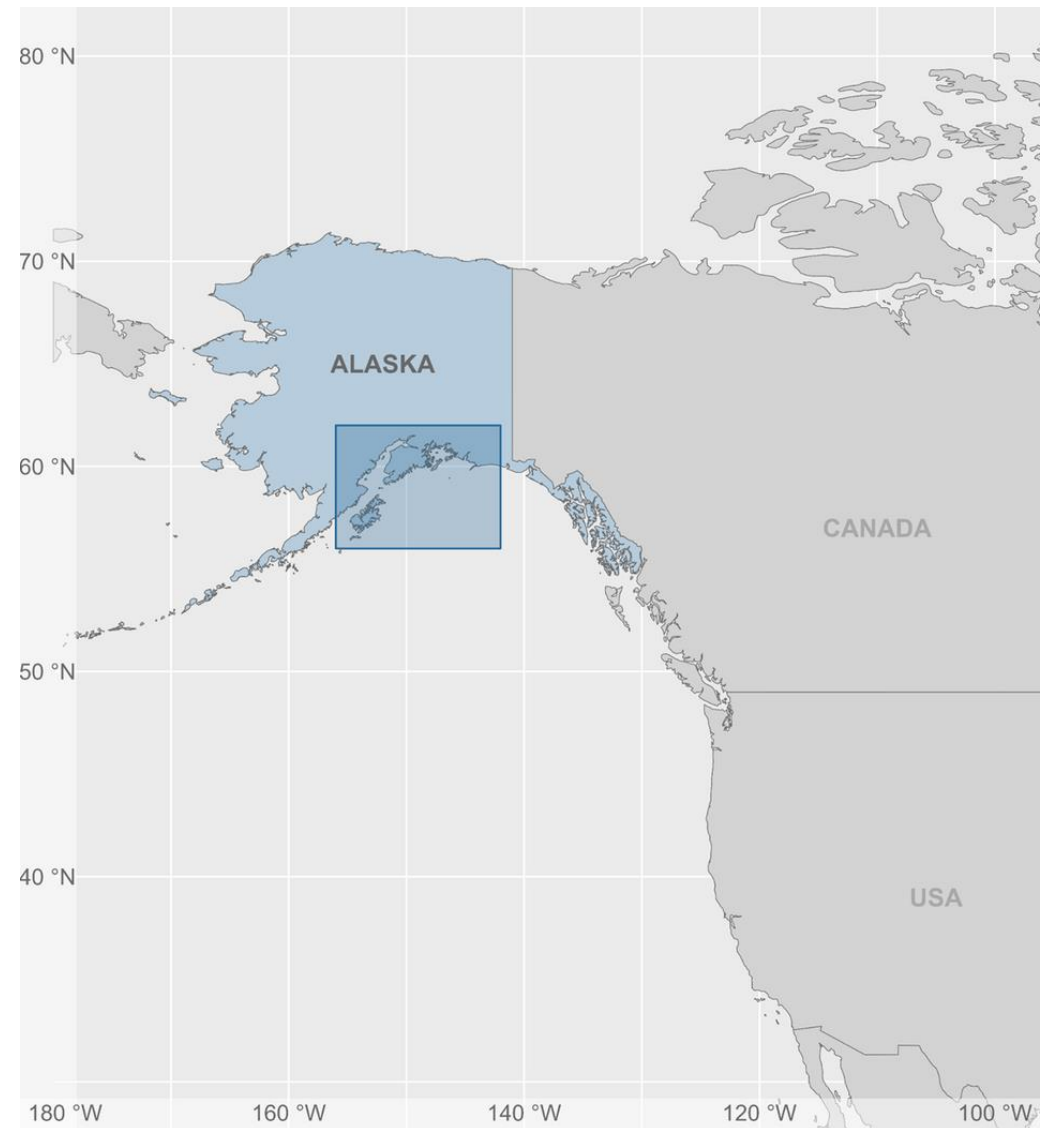
S01-17296

ICES-PICES 7th International Zooplankton Production Symposium
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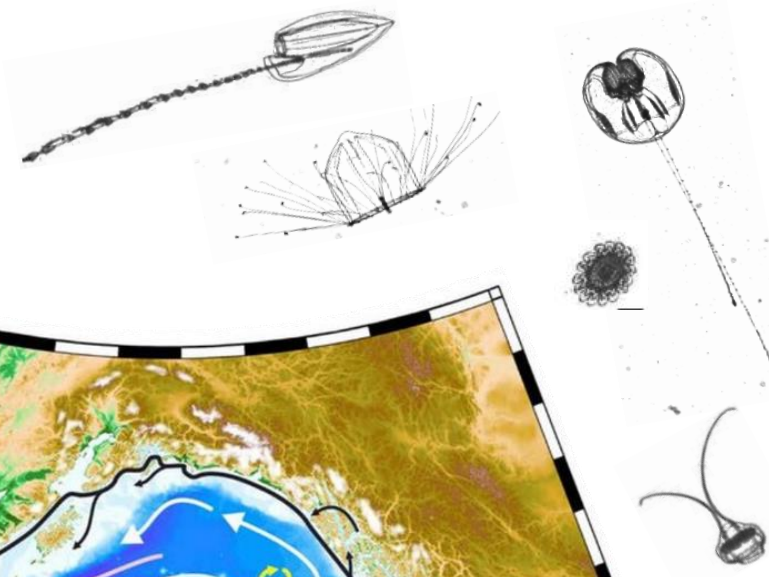
Land Acknowledgement

I live and work on contemporary and ancestral homelands of Alaska Native peoples: Lower Tanana Dena, Sugpiaq/Alutiiq, and Eyak.

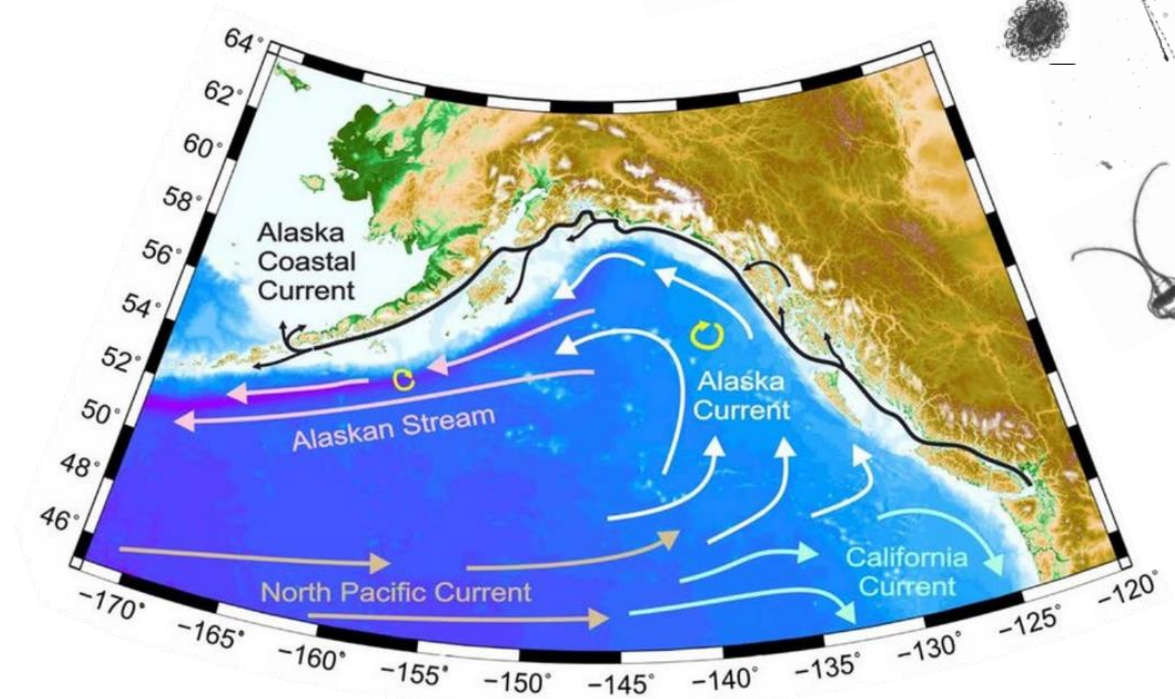
I recognize and respect their past, present, and future stewardship of these lands, animals, and waters.



Northern Gulf of Alaska Marine Environment



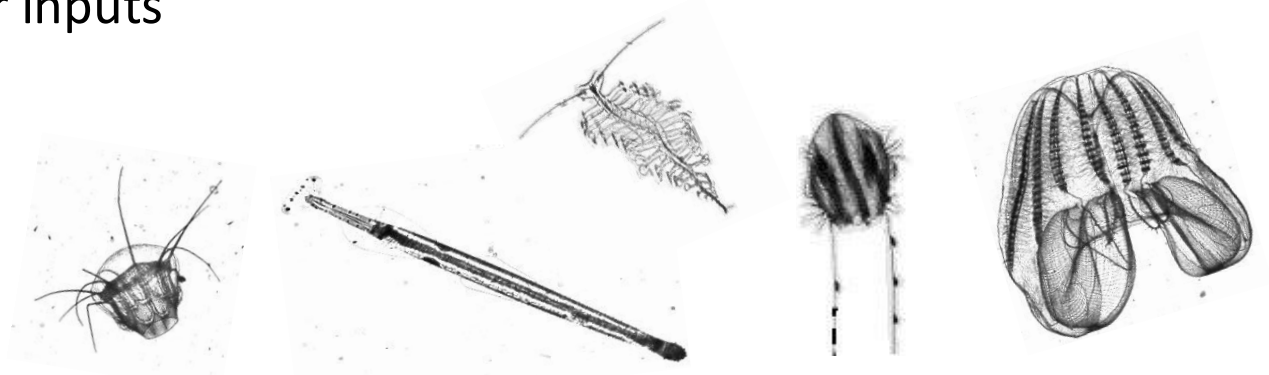
- Subarctic marine ecosystem
- Deep shelf
- Downwelling system
- Highly seasonal
 - light, winds, freshwater, nutrients



(Royer and Finney 2020)

Circulation:

- Alaska Coastal Current: seasonal freshwater inputs
- Alaska Stream: shelf break current

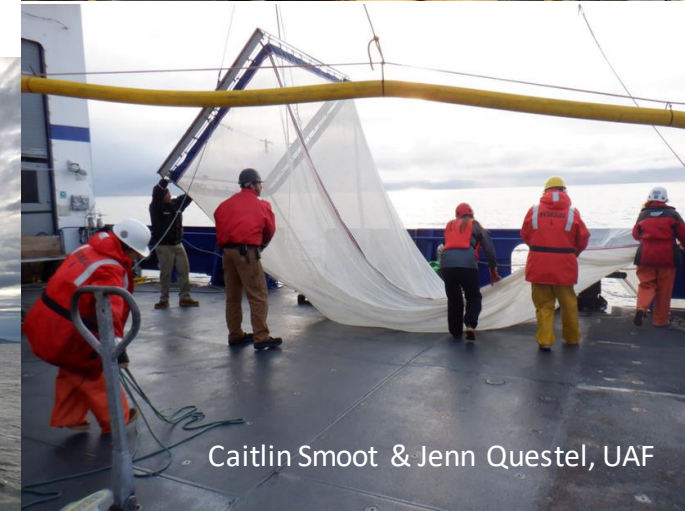
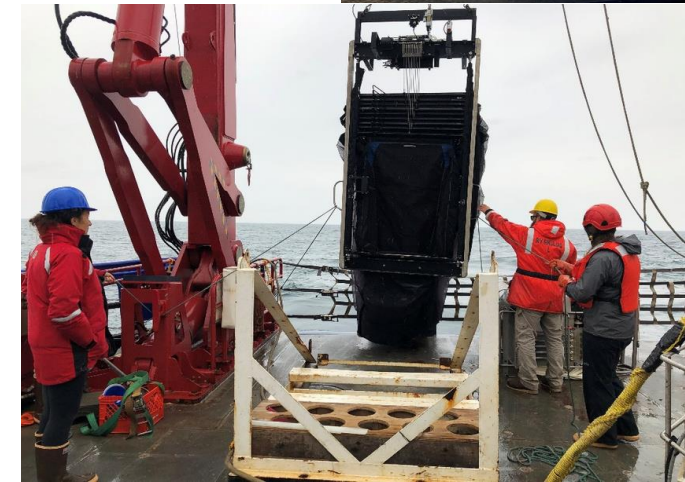


Zooplankton Sampling

Plankton nets come in all shapes and sizes...
... just as diverse as the plankton we're targeting!

Gelatinous zooplankton sampling challenges:

- fragile-bodied, damaged during collection
- patchy spatial distributions, low abundances
- logistic constraints for sea-time and lab work

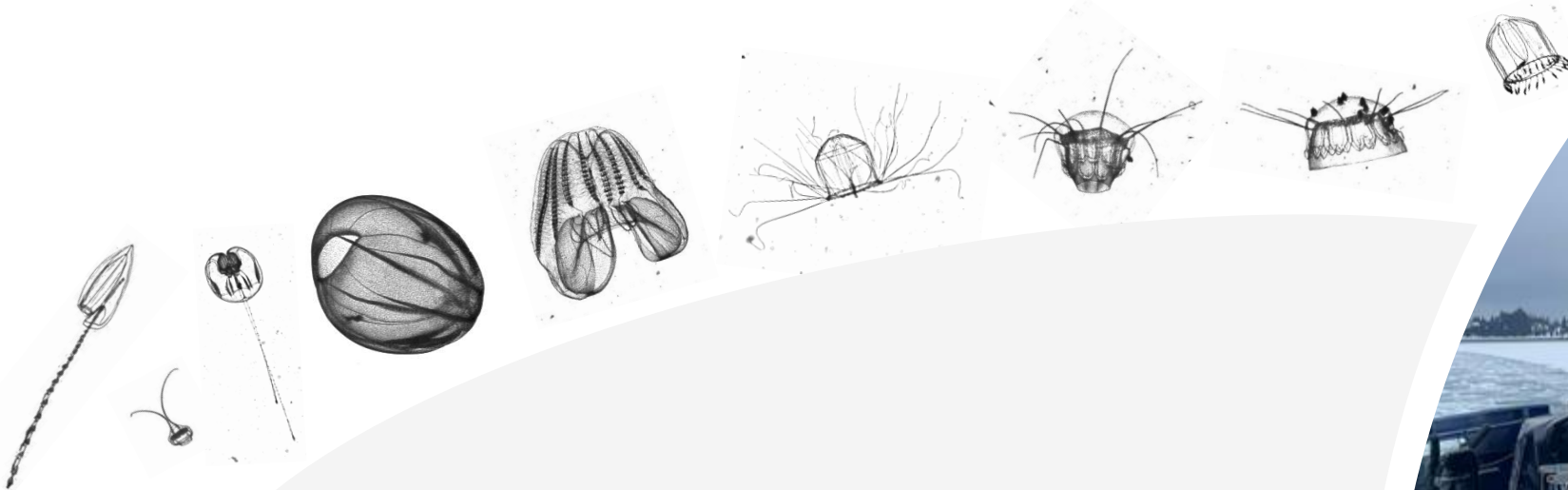


Solution

In situ imaging overcomes many challenges that limit our ability to study gelatinous zooplankton

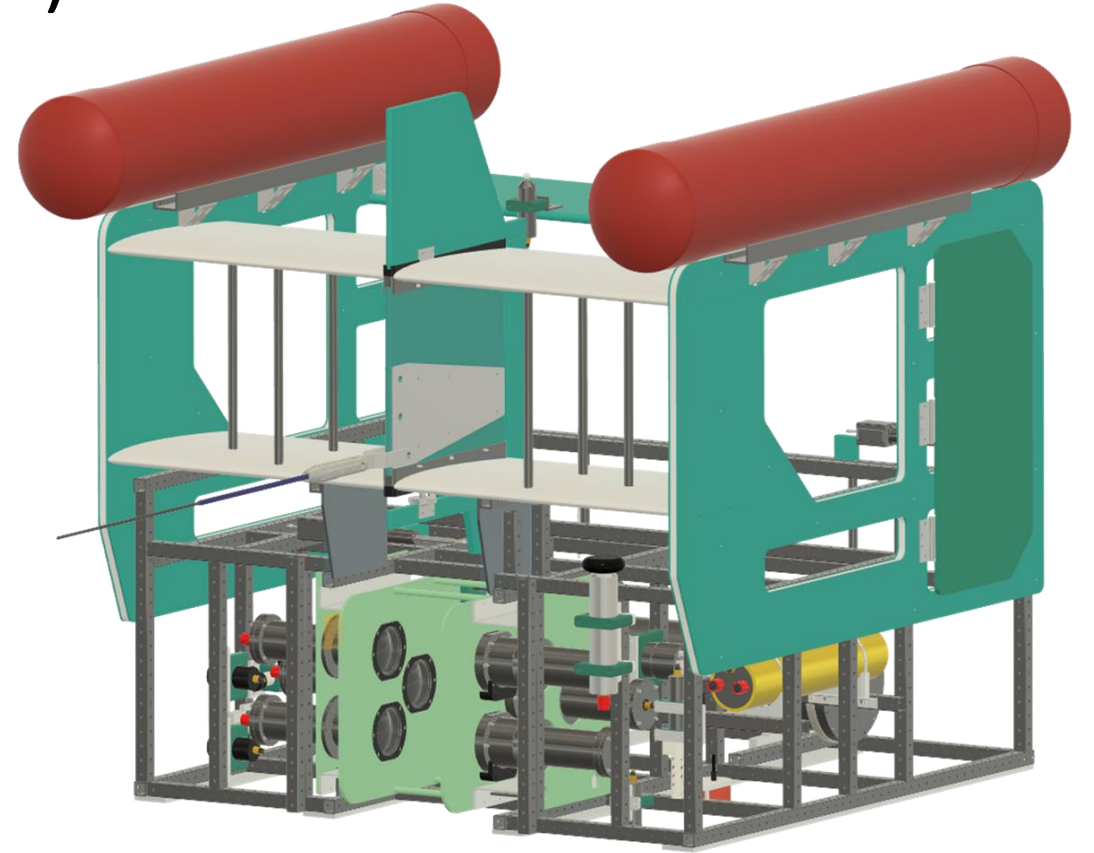
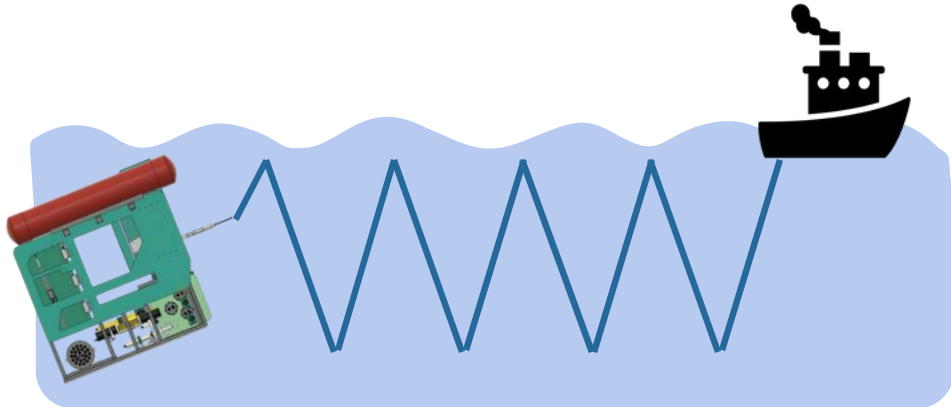
Research Goals:

- Describe NGA gelatinous zooplankton community structure
- Assess variation across spatial and temporal scales



In Situ Ichthyoplankton Imaging System Deep-focus Particle Imager (ISIIS-DPI)

- Remote Operated Towed Vehicle (ROTV)
- imaging and hydrographic data
- manual and automatic flight



ISIIS-DPI

Instrumentation

- depth, temperature, salinity, fluorescence, dissolved oxygen, nitrate, pH, PAR, particle size, multi-spectral attenuation, acoustics

Fiber-optic connections

- real time data streams
- limited by ship capability

Imaging array:

- 3 line-scan, shadowgraph cameras



Imaging array

Line scan:

- continuous image, 1 pixel wide
- cut to 2048 x 2048 frames
- produces 12 x 12 cm images

Shadowgraph

- 30 cm depth of field
- telecentric, preserves scale
- 50 μm pixel resolution

Volume imaged (per camera):

- per camera: 20 frames/sec \approx 80 L/sec
- entire system: \sim 240 L/sec \approx 850 m³/hr

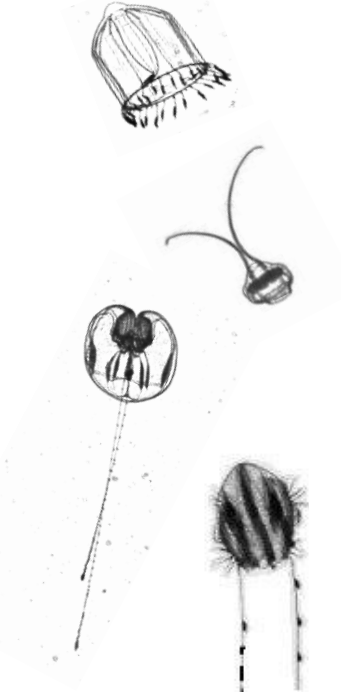
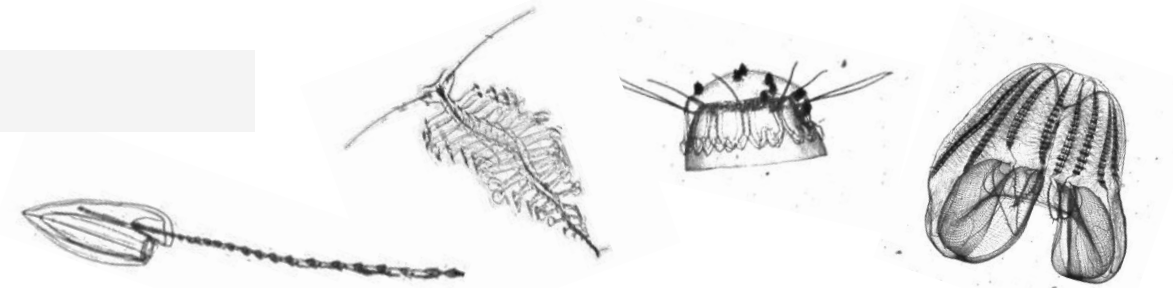
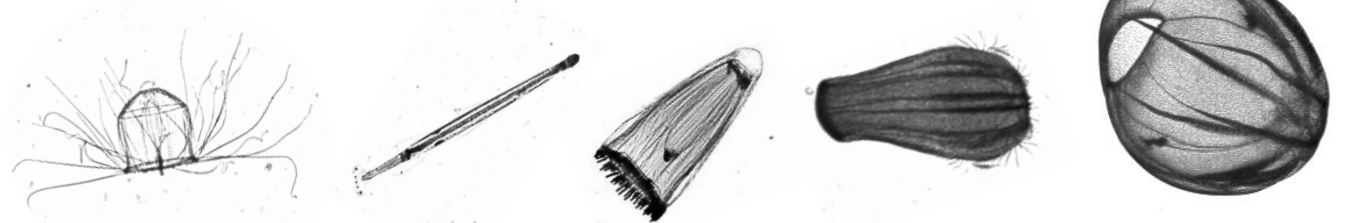
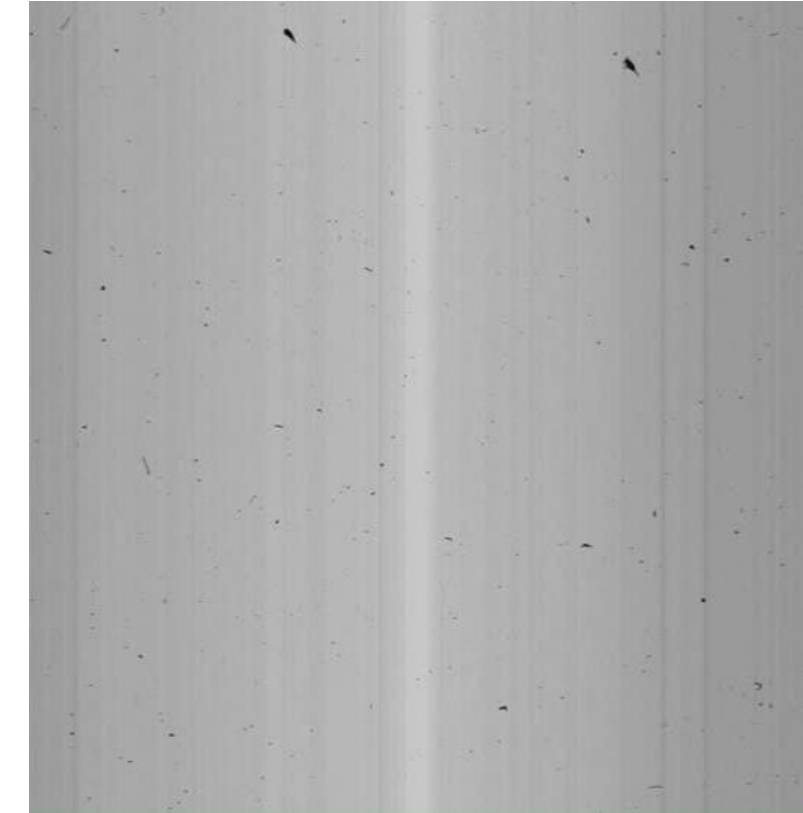
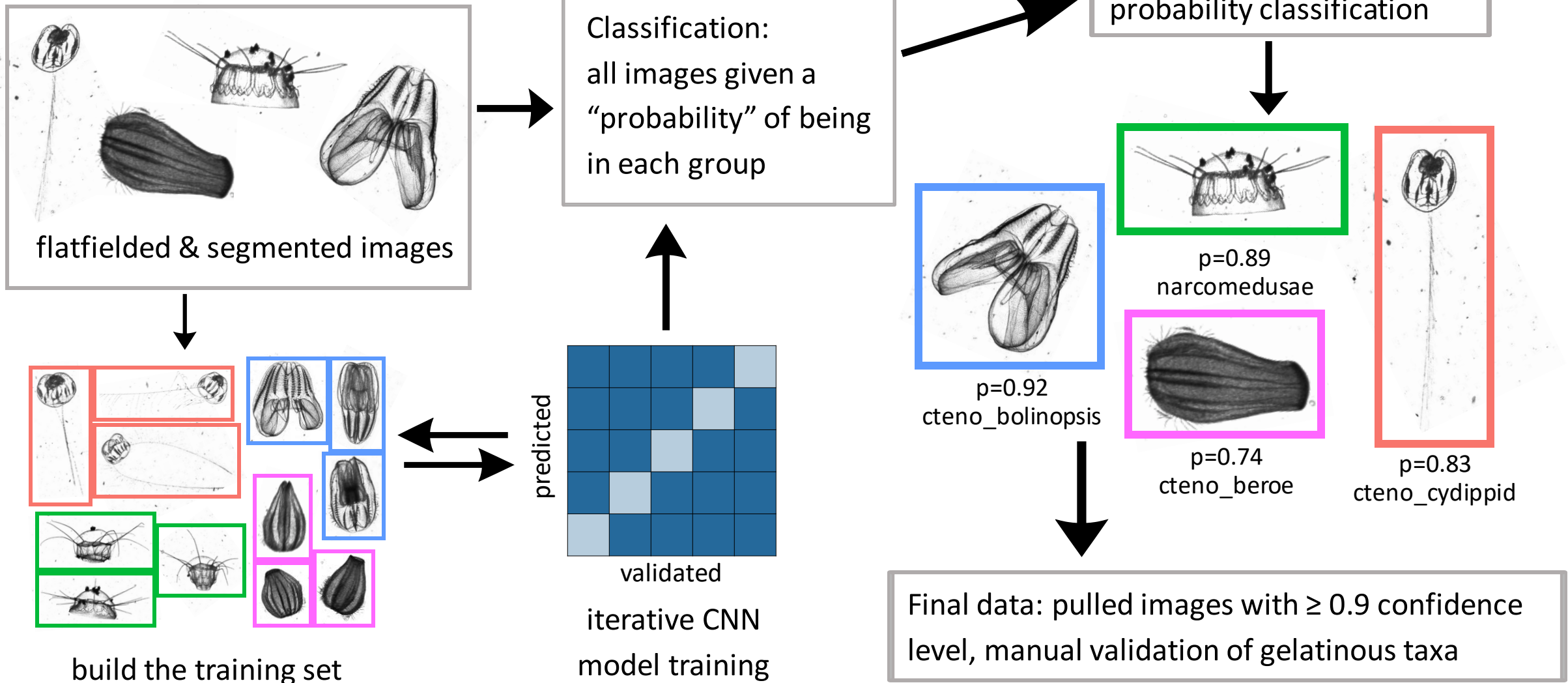


Image Identification

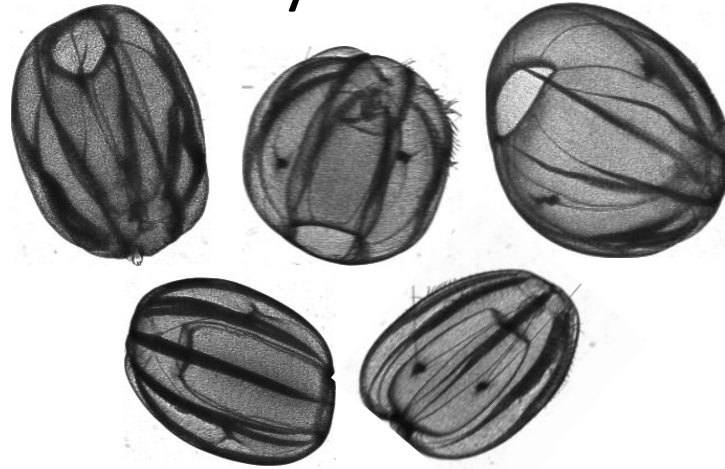


Ctenophores

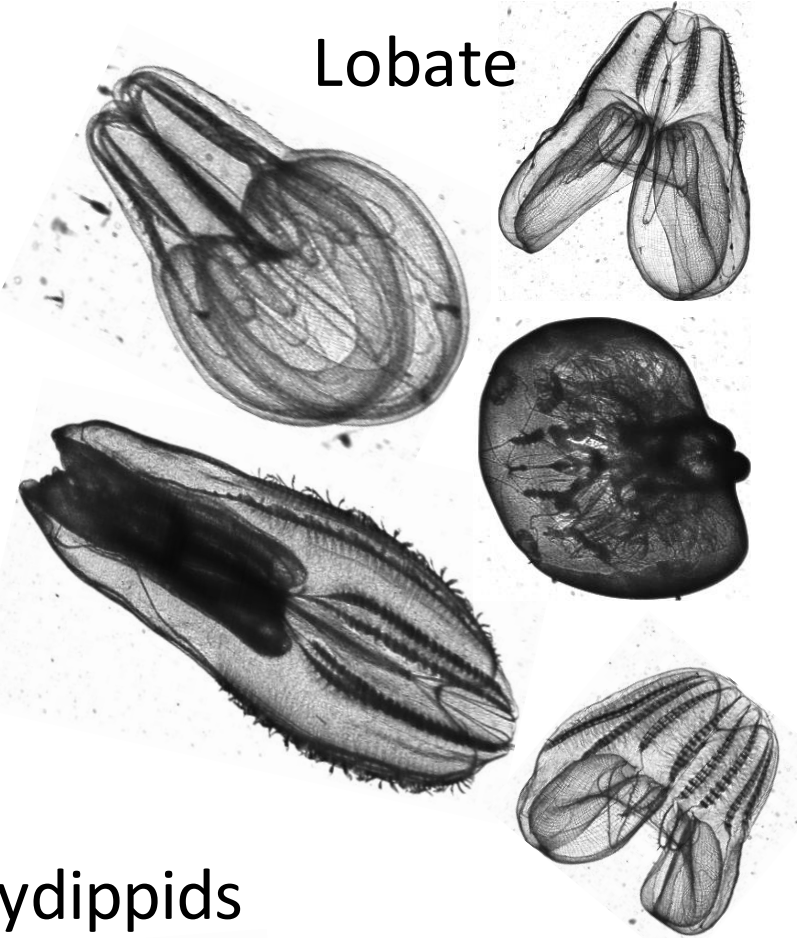
Beroe



Dryodora



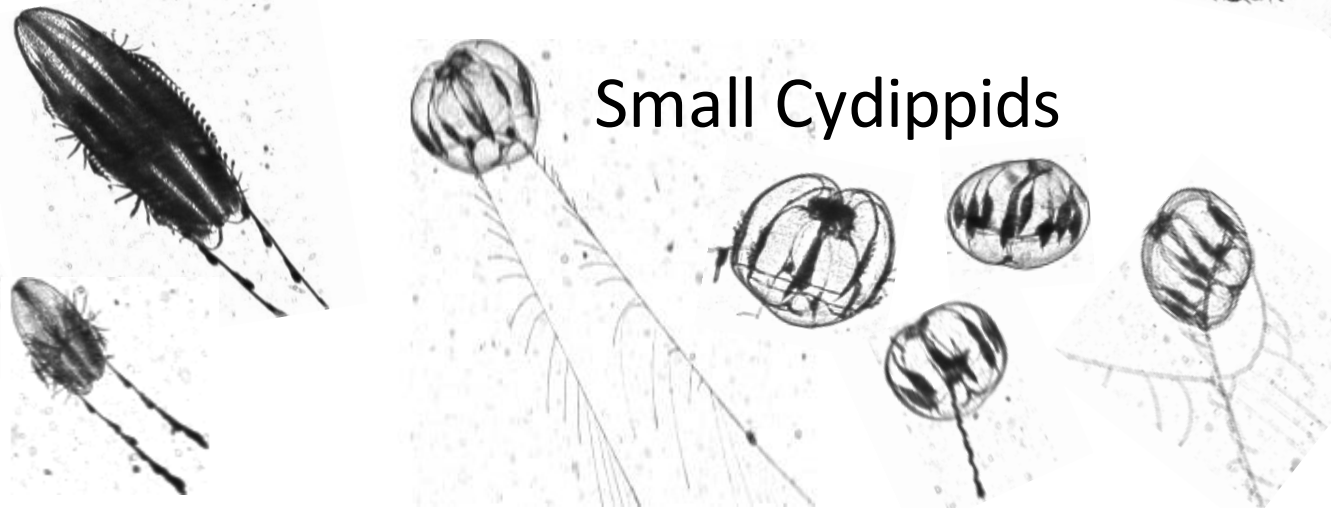
Lobate



Large Cydippids

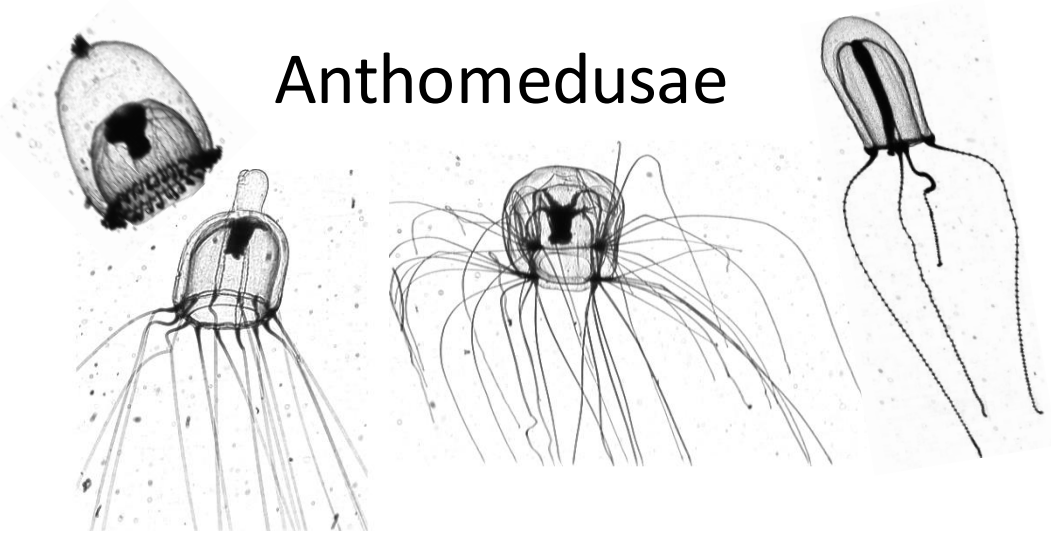


Small Cydippids

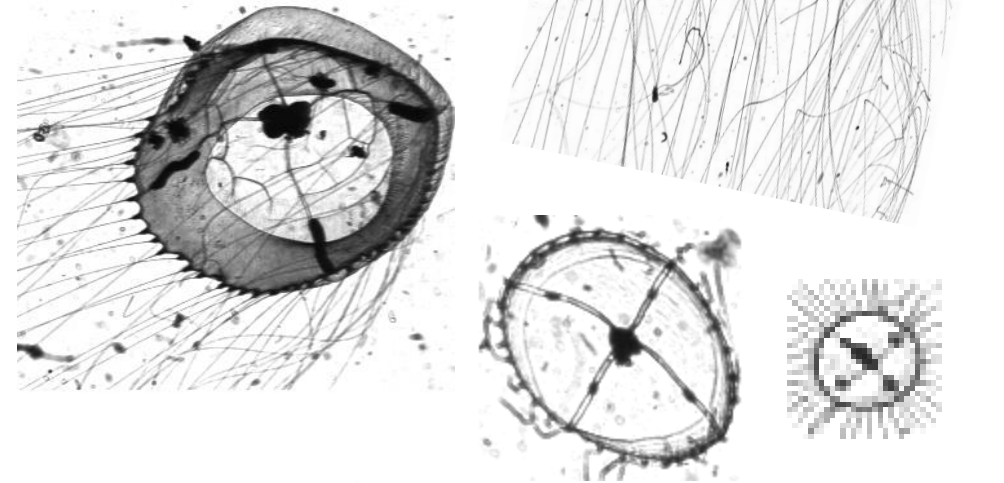


Hydromedusae

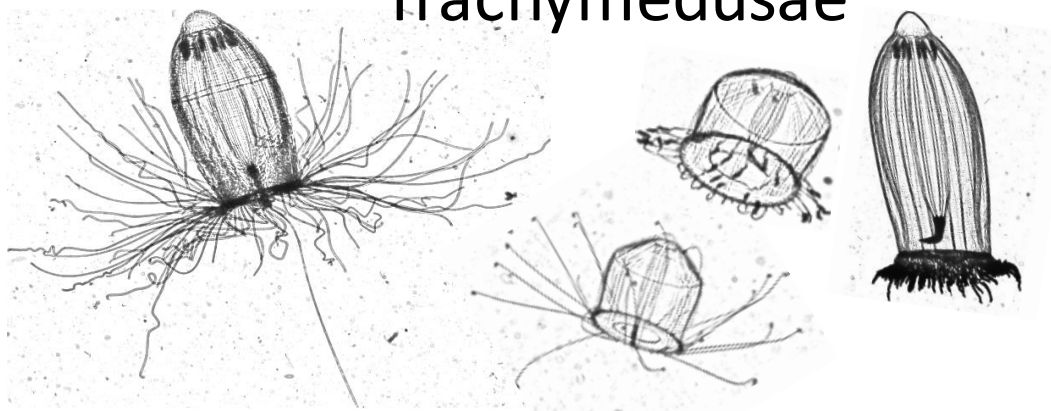
Anthomedusae



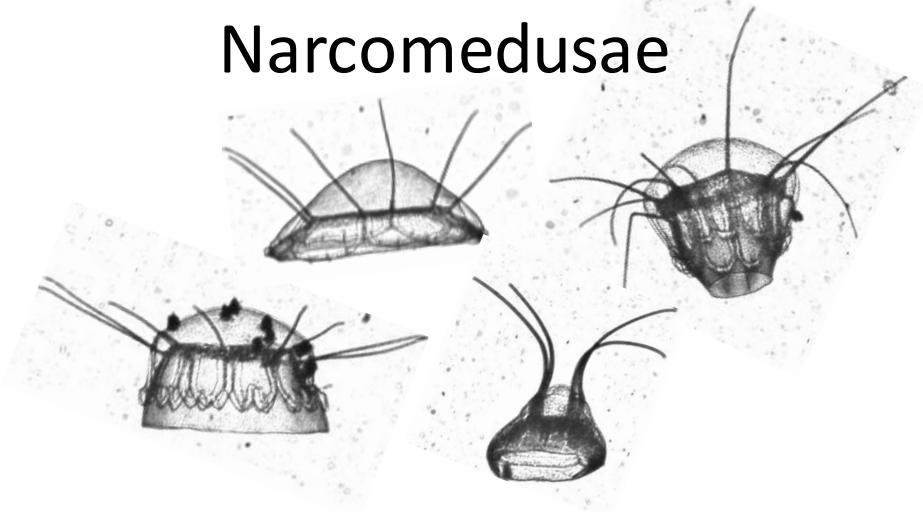
Leptomedusae



Trachymedusae

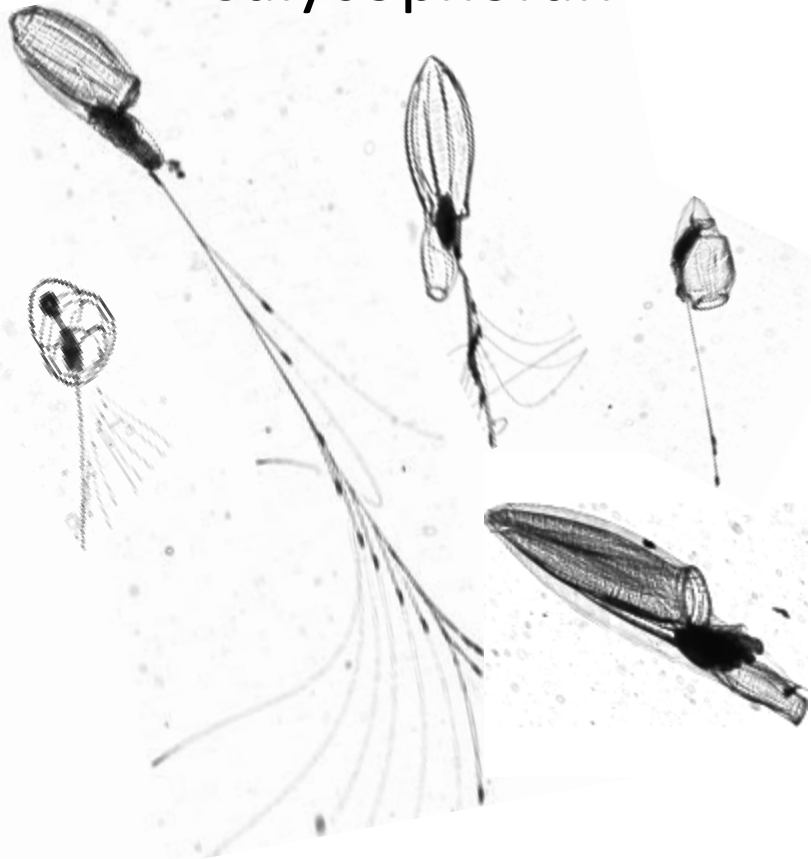


Narcomedusae

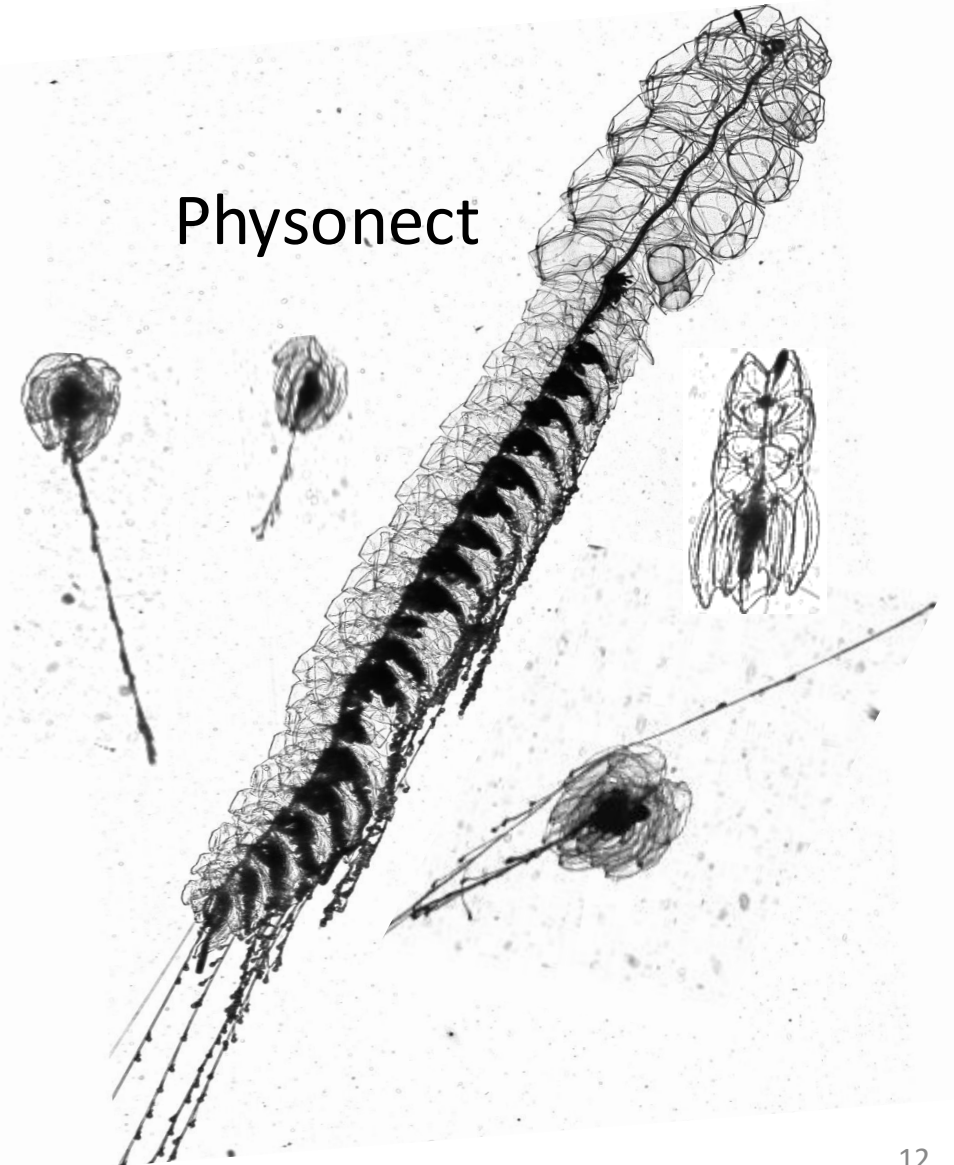


Siphonophores

Calycophoran

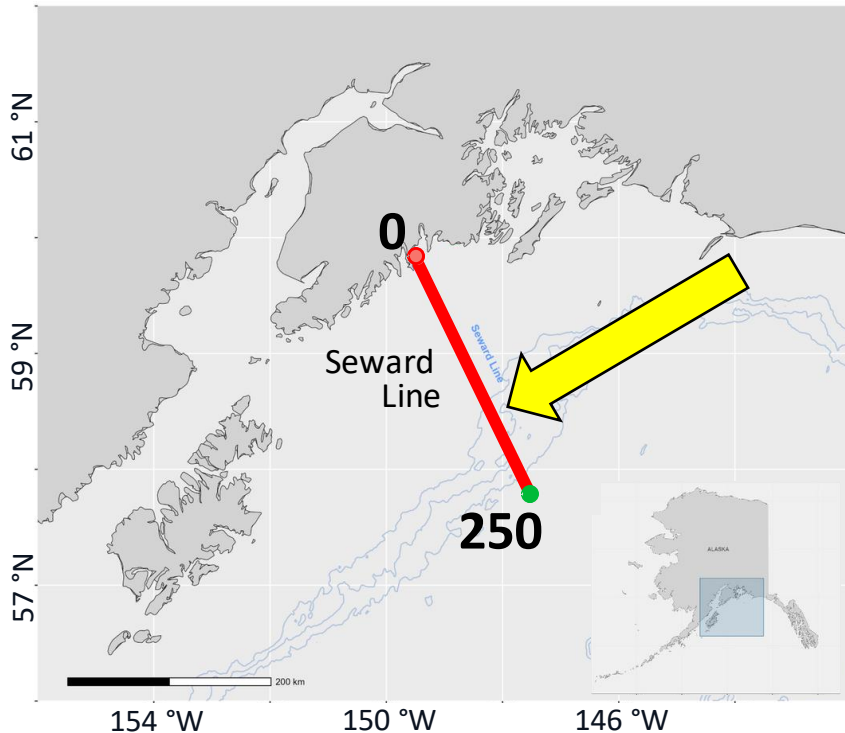


Physonect

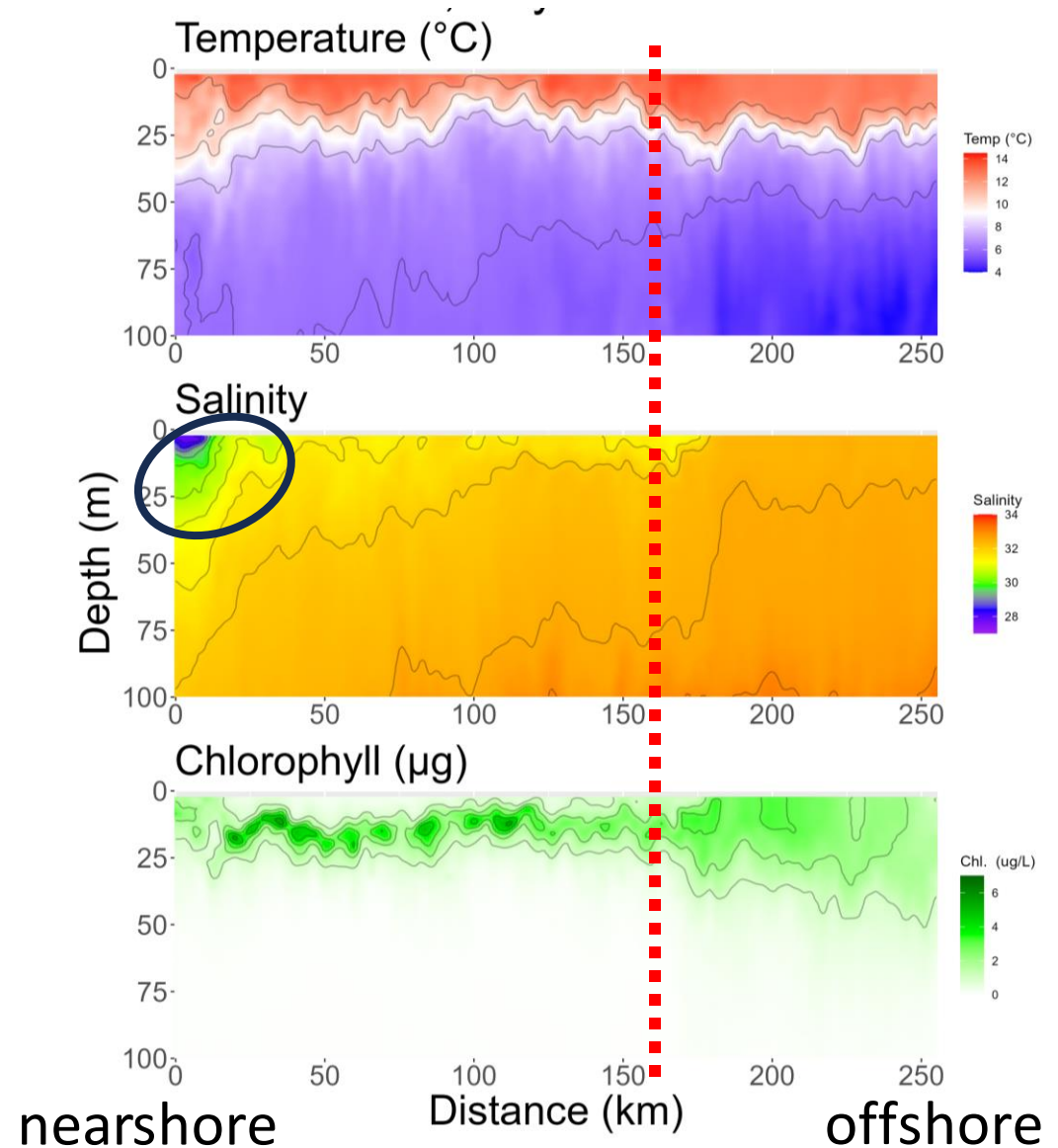


Environmental Gradients

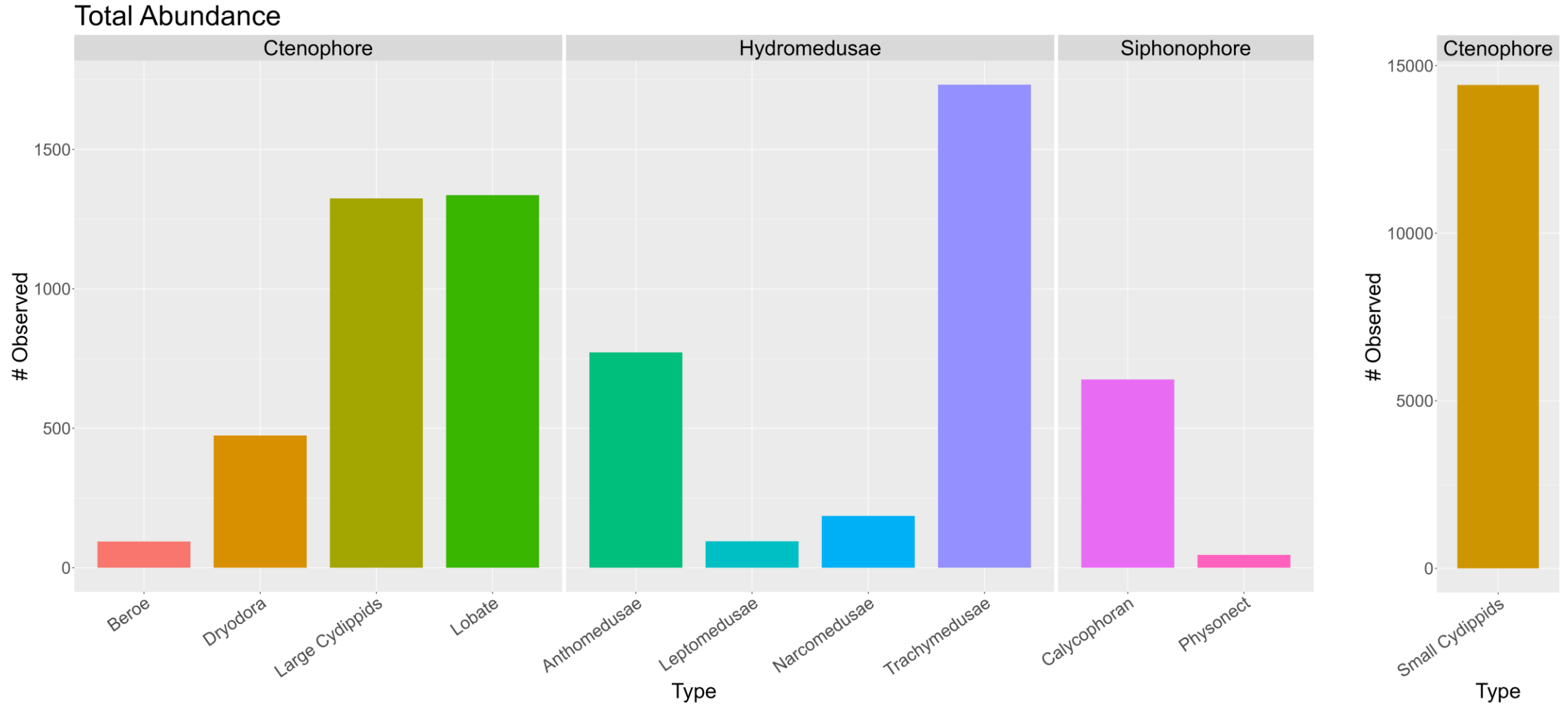
Seward Line: July 22-23, 2022



- Nearshore to offshore
- Coastal freshwater signal
- Frontal zone at the shelf break

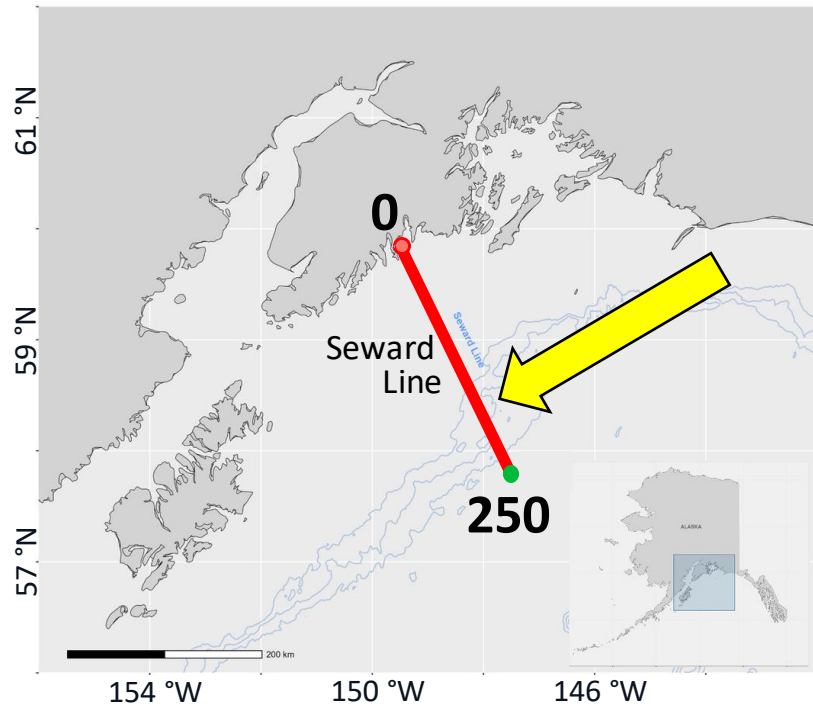


Total Gelatinous Zooplankton Abundance

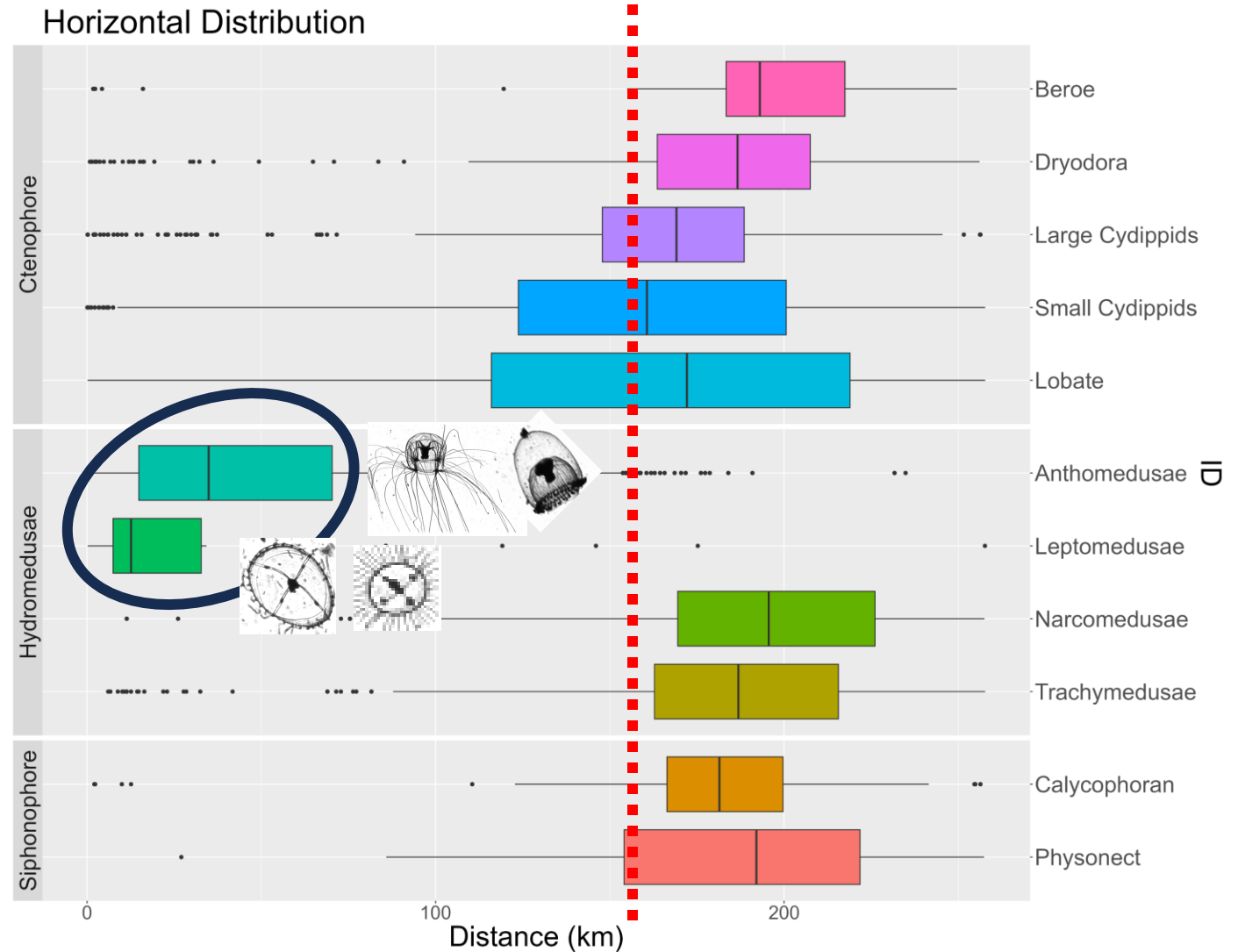


Horizontal Distributions

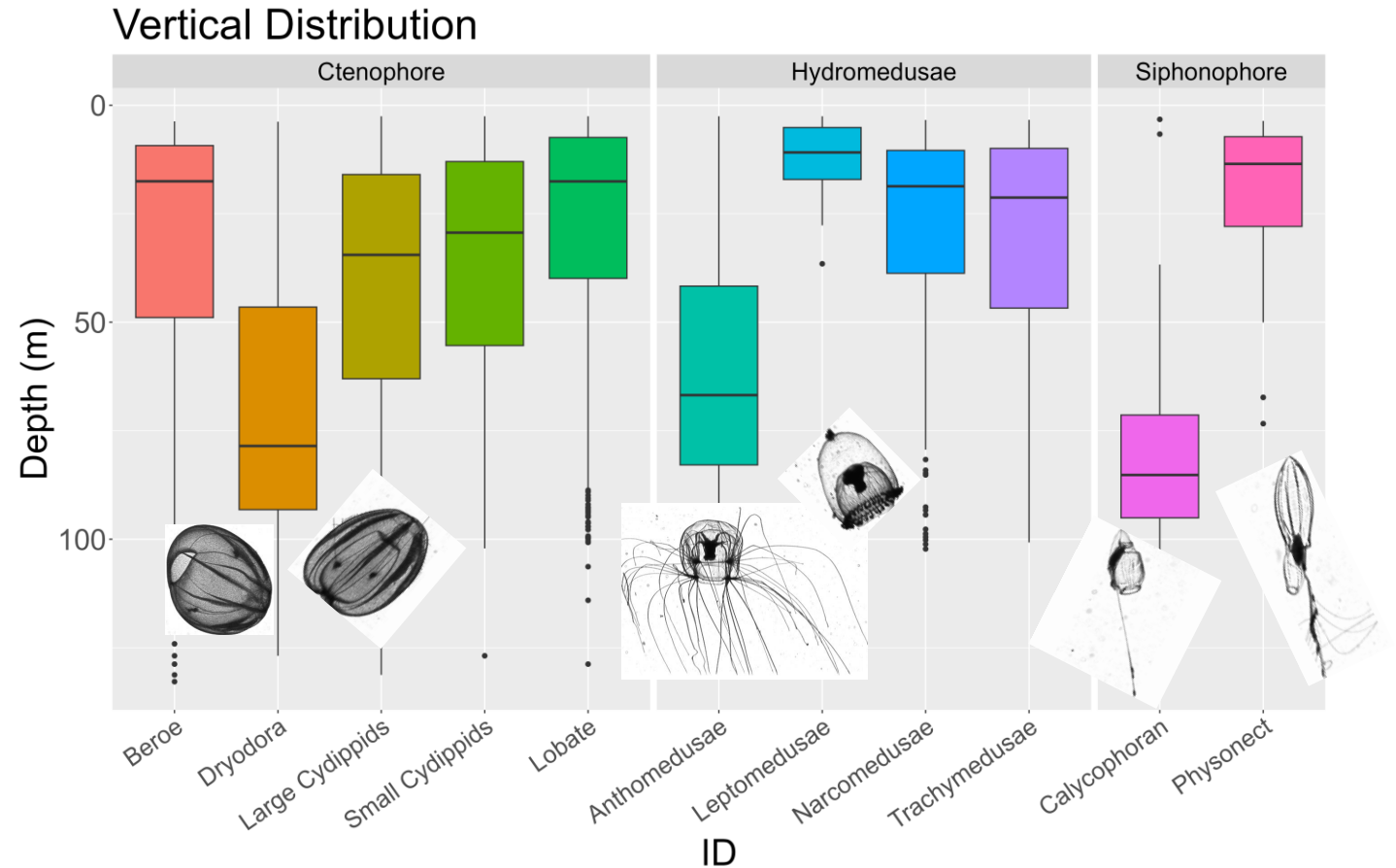
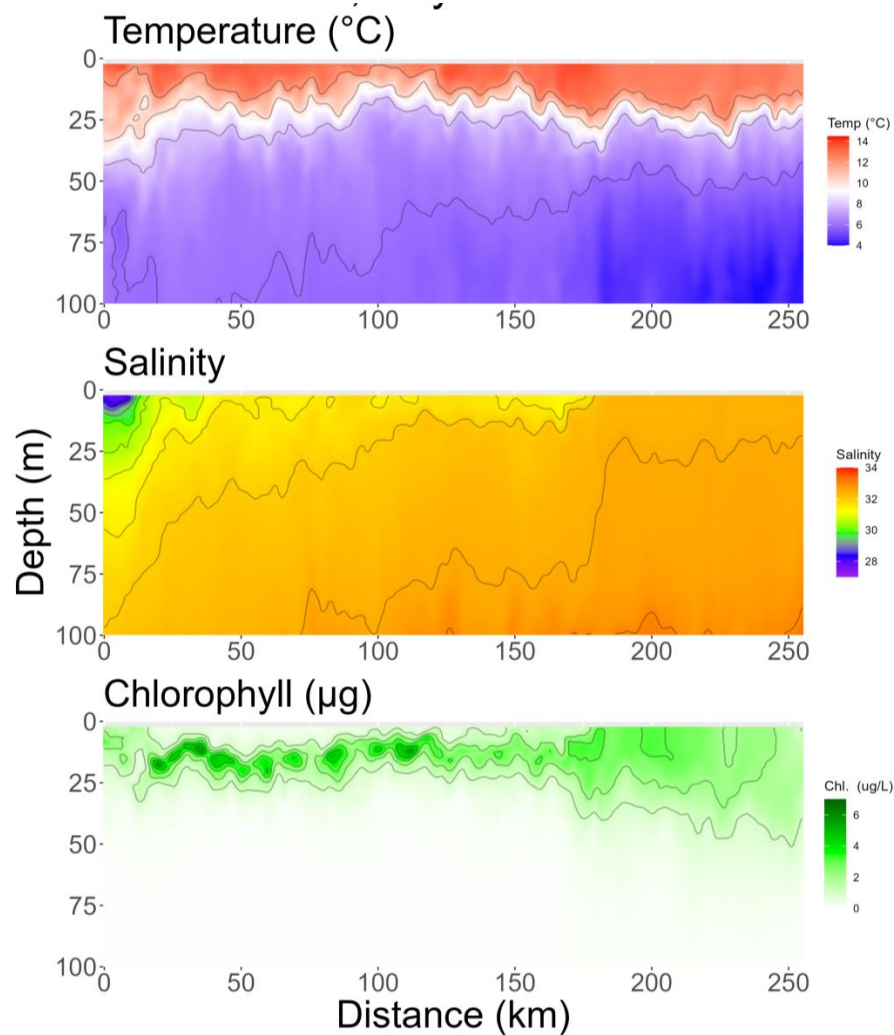
July 22-23, 2022



- Most groups are concentrated offshore
- Antho- and leptomedusae are more abundant nearshore

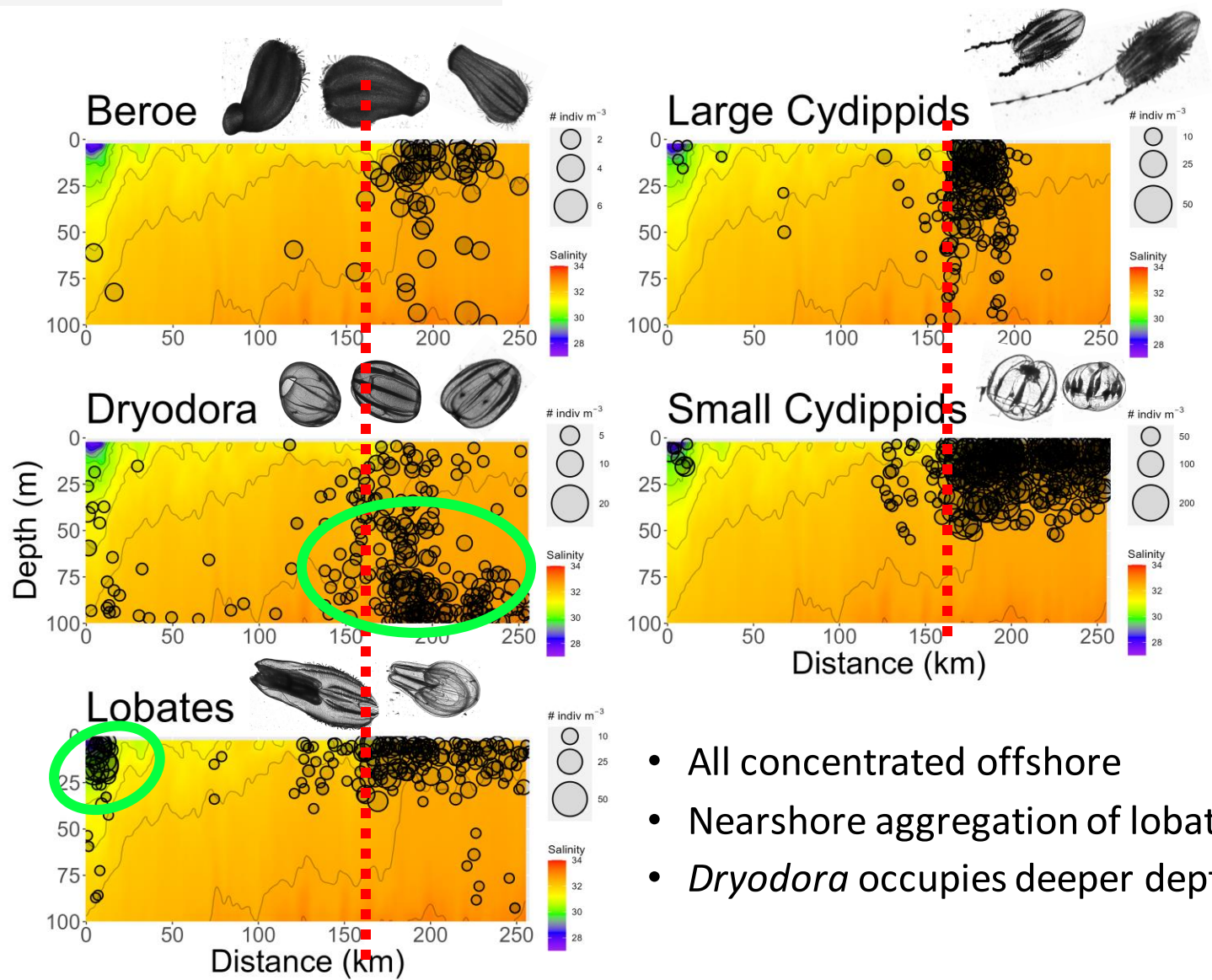
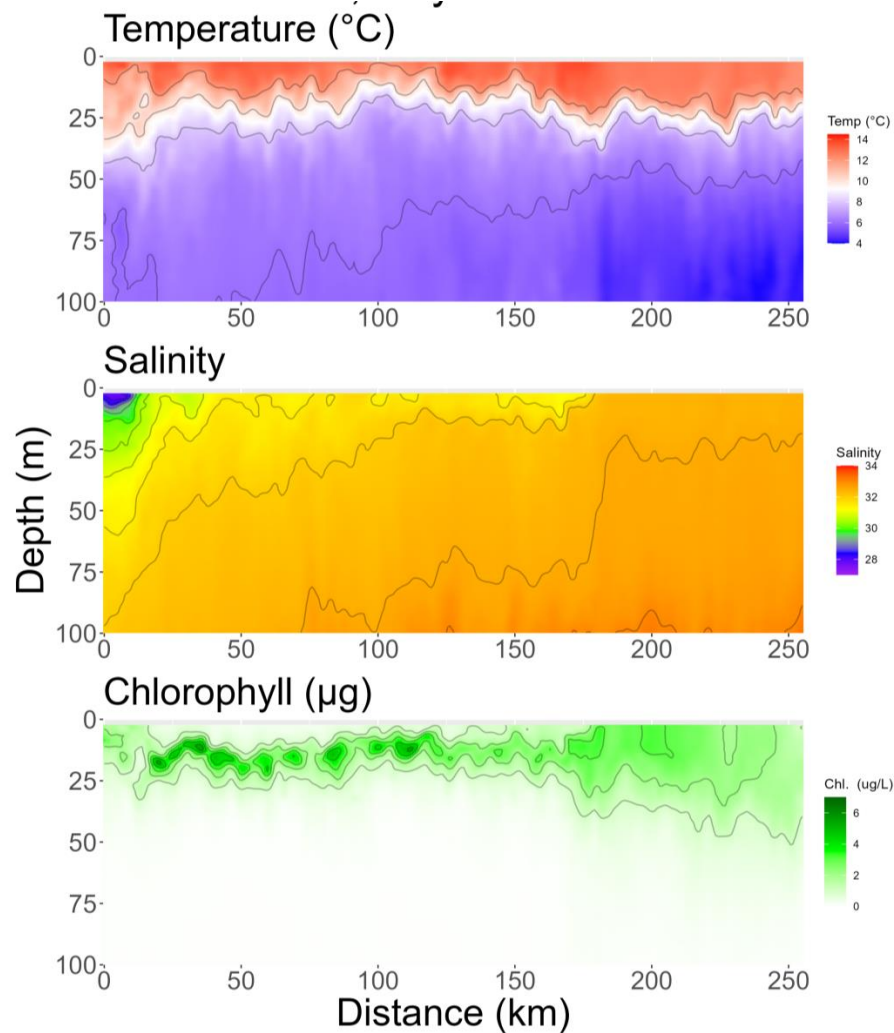


Vertical Distributions



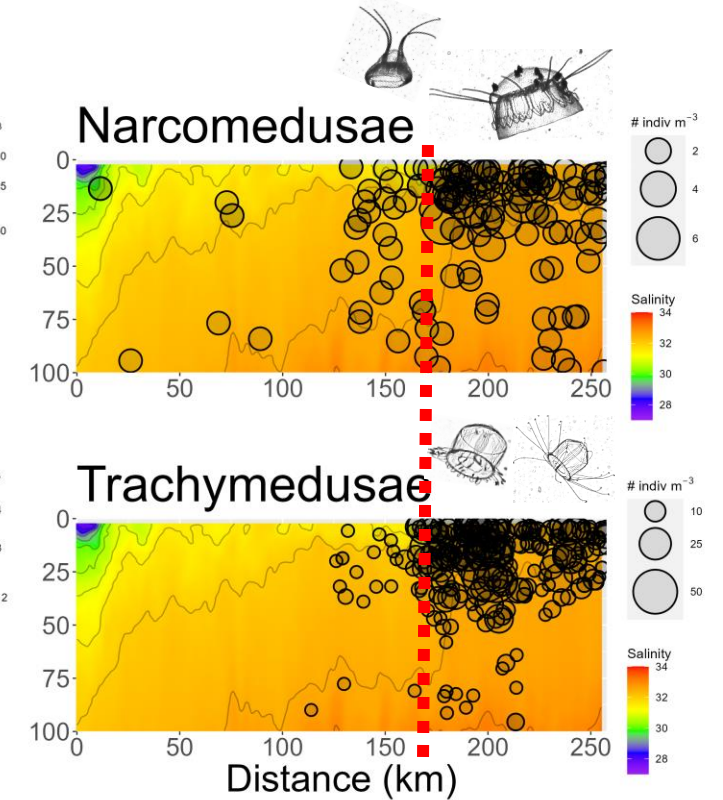
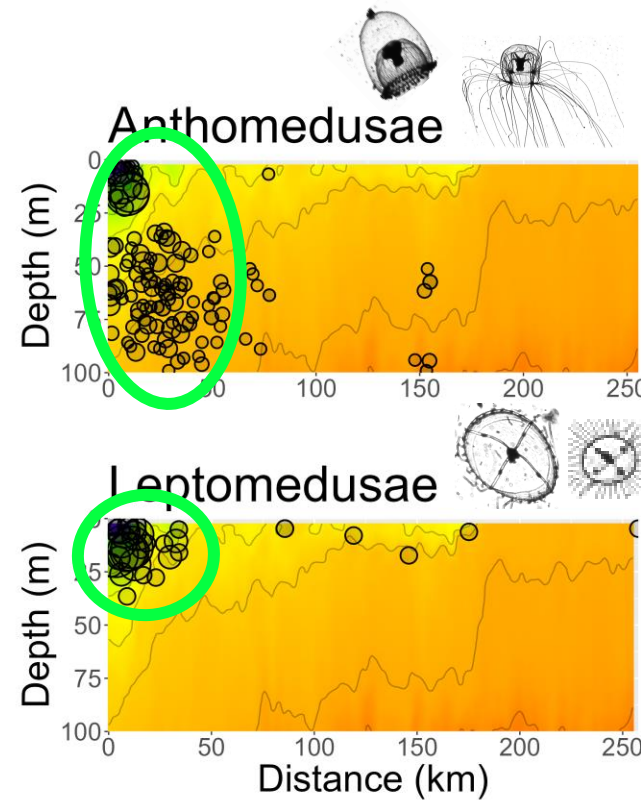
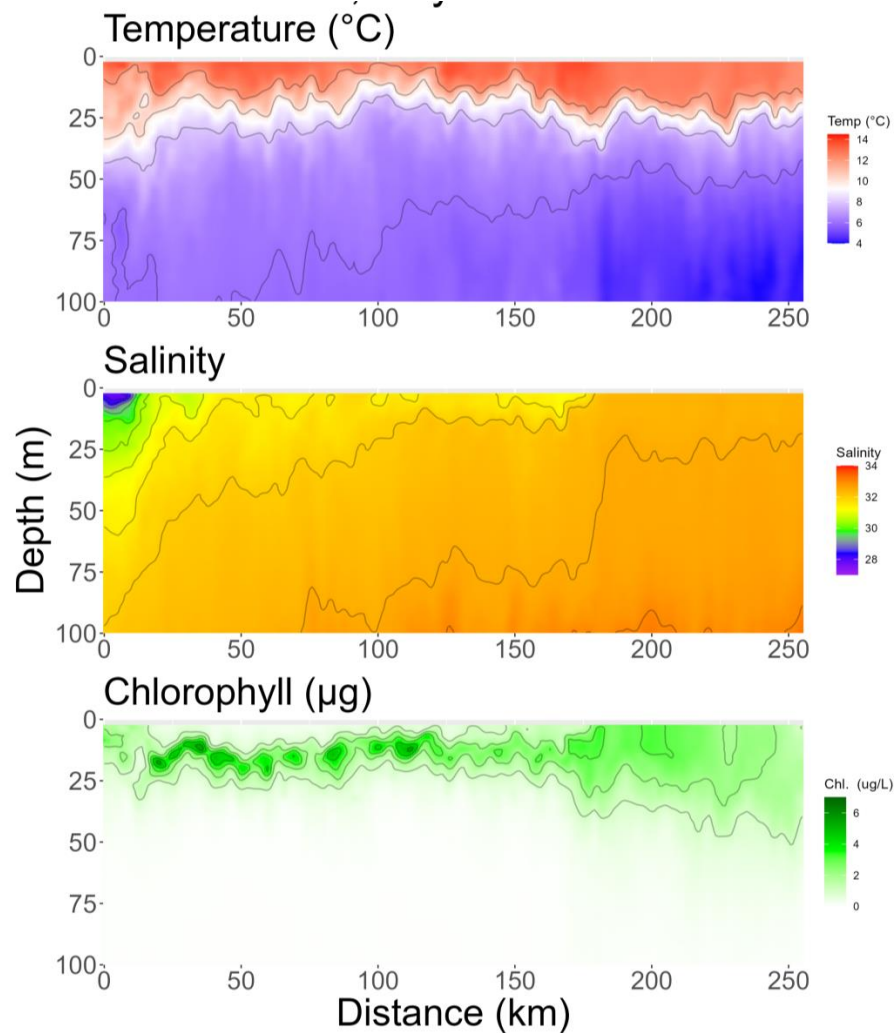
- Most groups are concentrated in surface waters
- *Dryodora* ctenophores, Anthomedusae, and calycophoran siphonophores occupy deeper depth ranges

Ctenophores



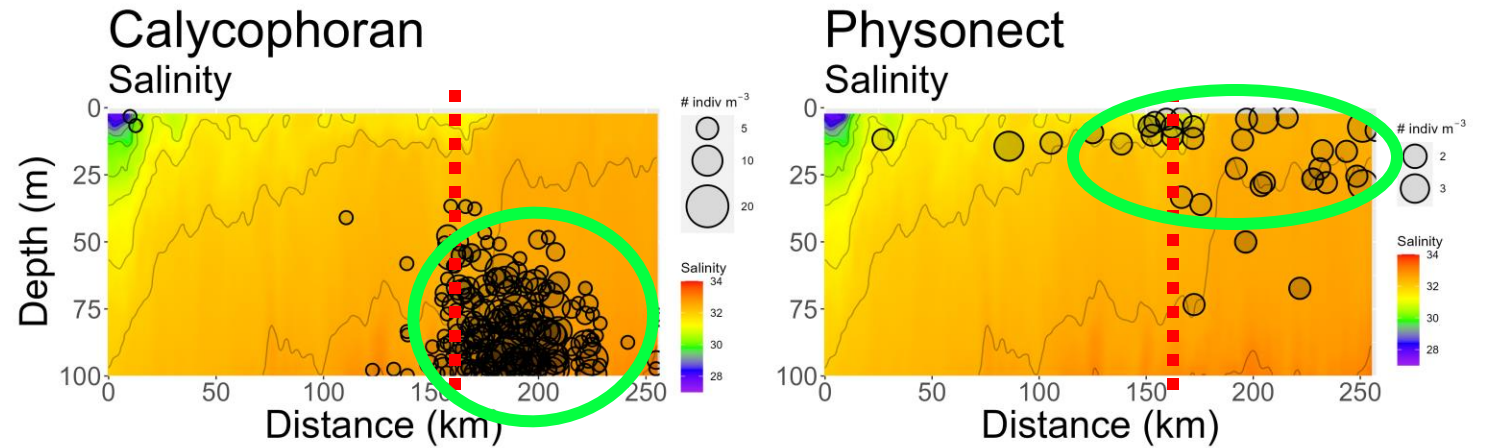
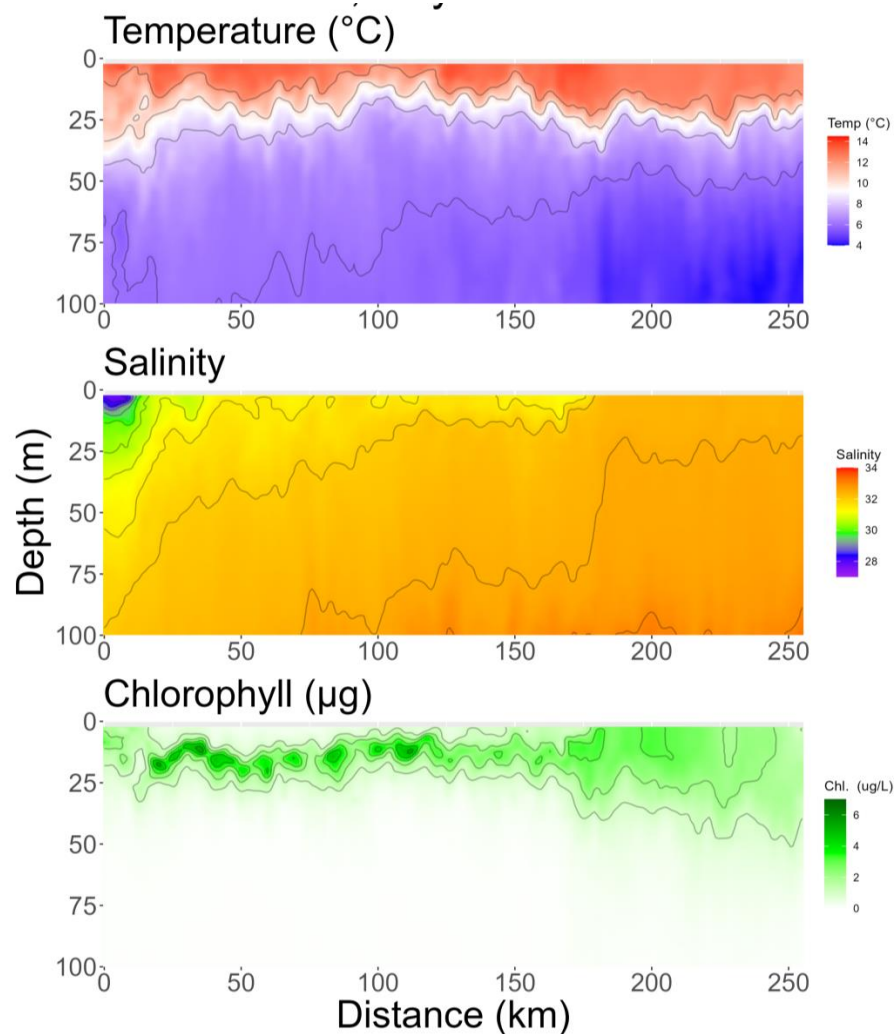
- All concentrated offshore
- Nearshore aggregation of lobates
- *Dryodora* occupies deeper depths

Hydromedusae



- Narco- and trachymedusae are more abundant offshore
- Anthomedusae are more abundant nearshore
- Leptomedusae are more abundant nearshore, with a shallower depth range

Siphonophores



- Both groups are more abundant offshore
- Calycophorans are concentrated in a deeper aggregation
- Physonects occupy a shallower range



Conclusions

- 1) ISIS-DPI collects data at finer spatiotemporal scales than possible with net sampling
- 2) *In situ* imaging overcomes historical sampling biases against gelatinous zooplankton
 - Automated analysis processes sufficient volumes to allow for quantification of less abundant or patchier taxa
 - Minimal damage inflicted on fragile-bodied zooplankton
- 3) Gelatinous zooplankton groups occupy distinct spatial distributions, structured by surrounding biophysical features

Acknowledgements

Captains and crews of the RV Sikuliaq, RV Kilo Moana

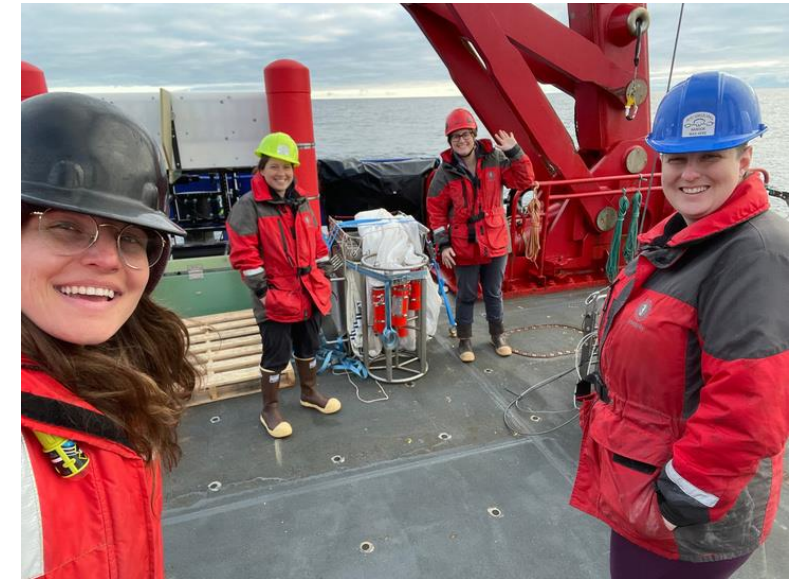
ISIIS-DPI R&D: Charles Cousin, Bellamare LLC

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QUESTIONS?

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