

Right whale habitat in the southern Gulf of St Lawrence

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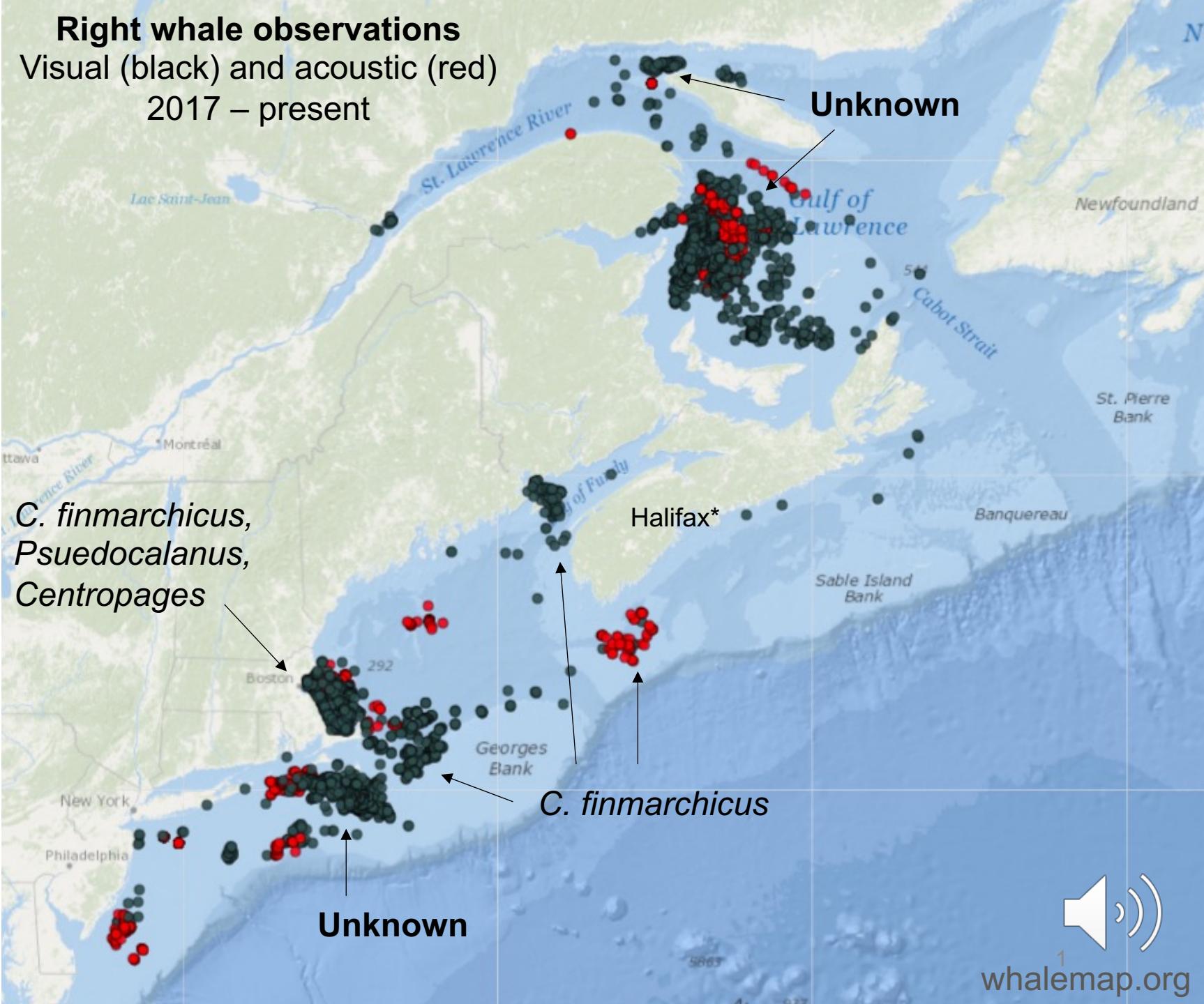
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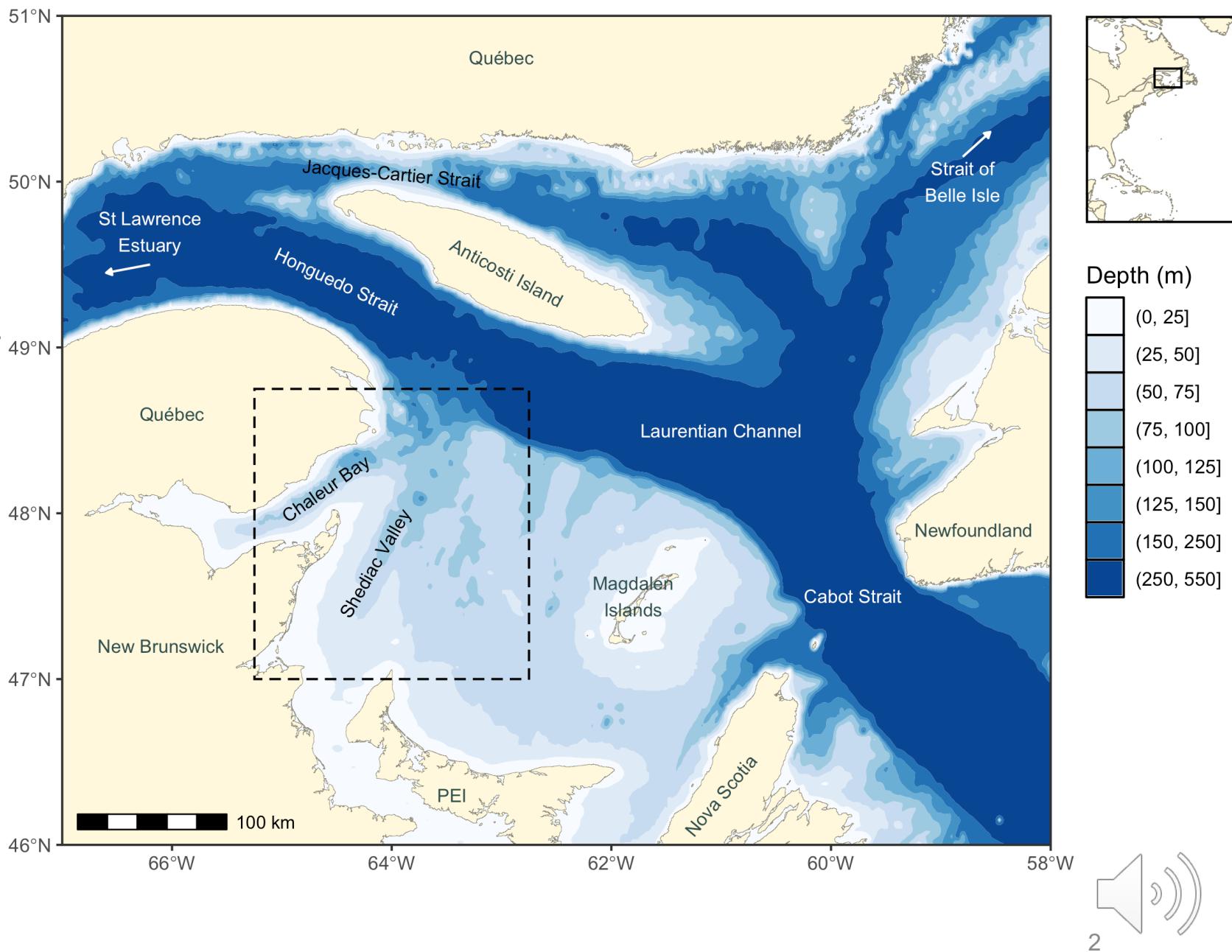
Right whale habitat

- Right whales are filter feeders with high energetic demands
- Rely on ocean to aggregate prey into energy-rich patches
- Commonly target late stage *Calanus finmarchicus* zooplankton
- Characterizing habitat associations improves knowledge of distribution and informs conservation



Right whales in the GSL

- Right whales have been seen in the GSL in low numbers for many years
- Increase since ~2015 coincides with declines in sightings and prey in other habitats
- Same ~40% of population (~140 whales) present in GSL last 3 years
- Mostly concentrated in Shediac Valley



Questions

1. What are the **primary prey of right whales** in the **Gulf of St Lawrence**?
2. What are the temporal and spatial **relationships** among **right whale presence, prey, and environmental conditions**?

Data collection: visual surveys



Nick Hawkins



Nick Hawkins

Data collection: oceanographic sampling

NEAq / Dal



Oblique ring net tows

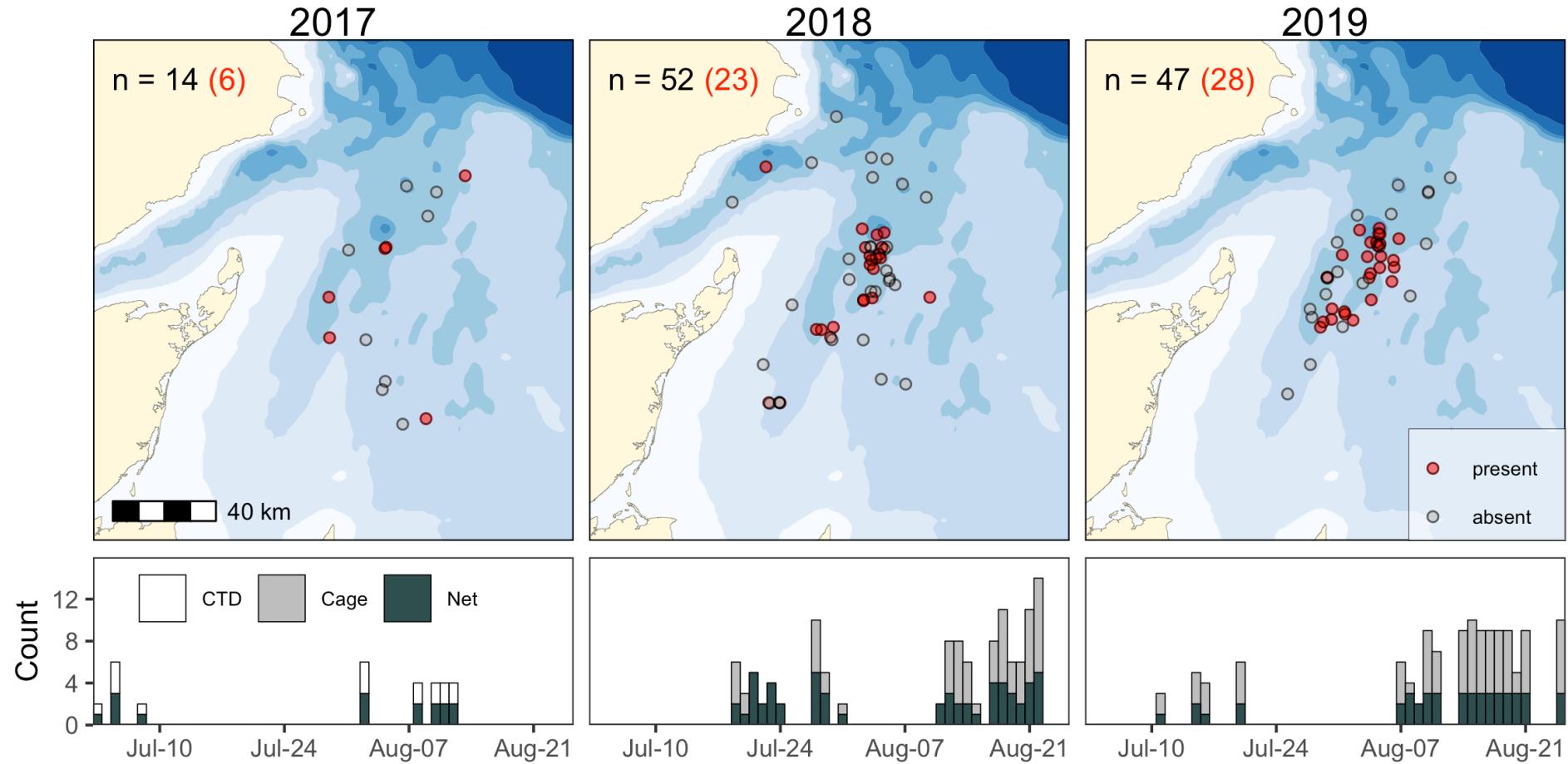


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Profiling Cage: CTD + Optical Plankton Counter (OPC)

Data collection

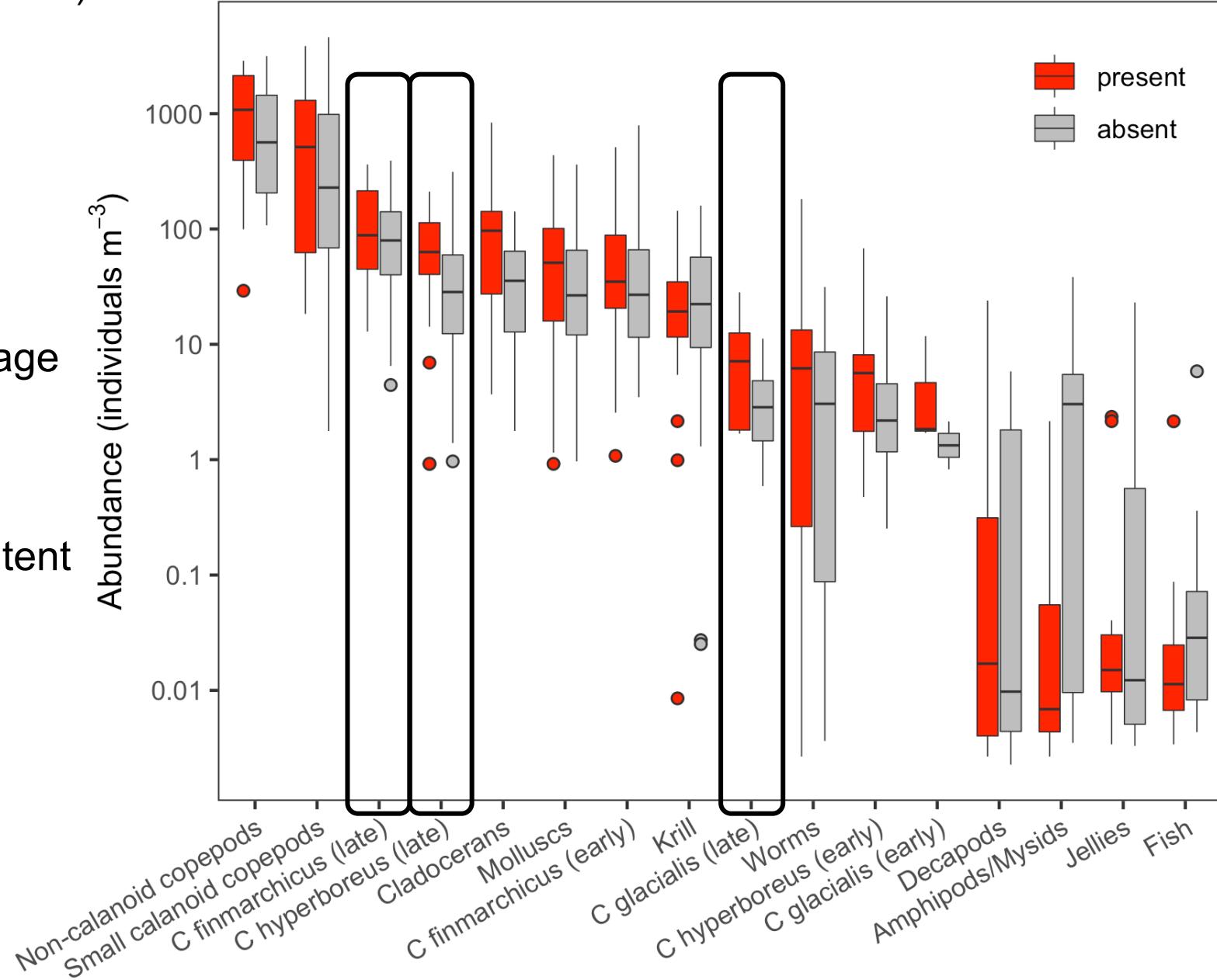
- Research cruises in July and August 2017 – 2019
- Oceanographic stations ($n=113$)
 - Net tows
 - CTD casts
 - OPC casts (18/19)
- Whale presence:
 ≥ 1 whale in $+\/- 3$ h and 5 km of station



Zooplankton abundance

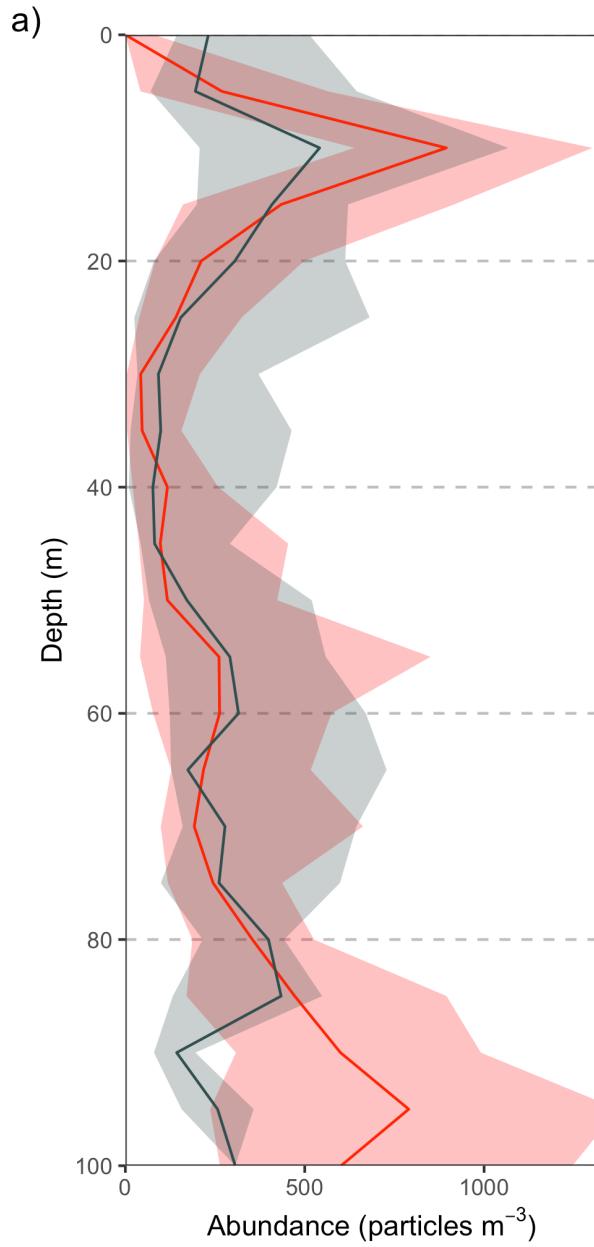
a)

- Small copepods dominate
- Possible whale preference for late-stage *C. hyperboreus* and higher total biomass
- Ongoing work for biomass / energy content



Vertical distribution

- Peaks in abundance near surface and bottom
- Size and biomass increase with depth
- Whales associated with deep layer of large, abundant zooplankton (likely *Calanus spp.*)
- Our gear was unable to sample close to the bottom, so we likely **underestimate abundance**



Logistic regression

- Whale presence as dependent variable
- Independent variables
 - Physical
 - Biological

Depth

Bottom mixed layer

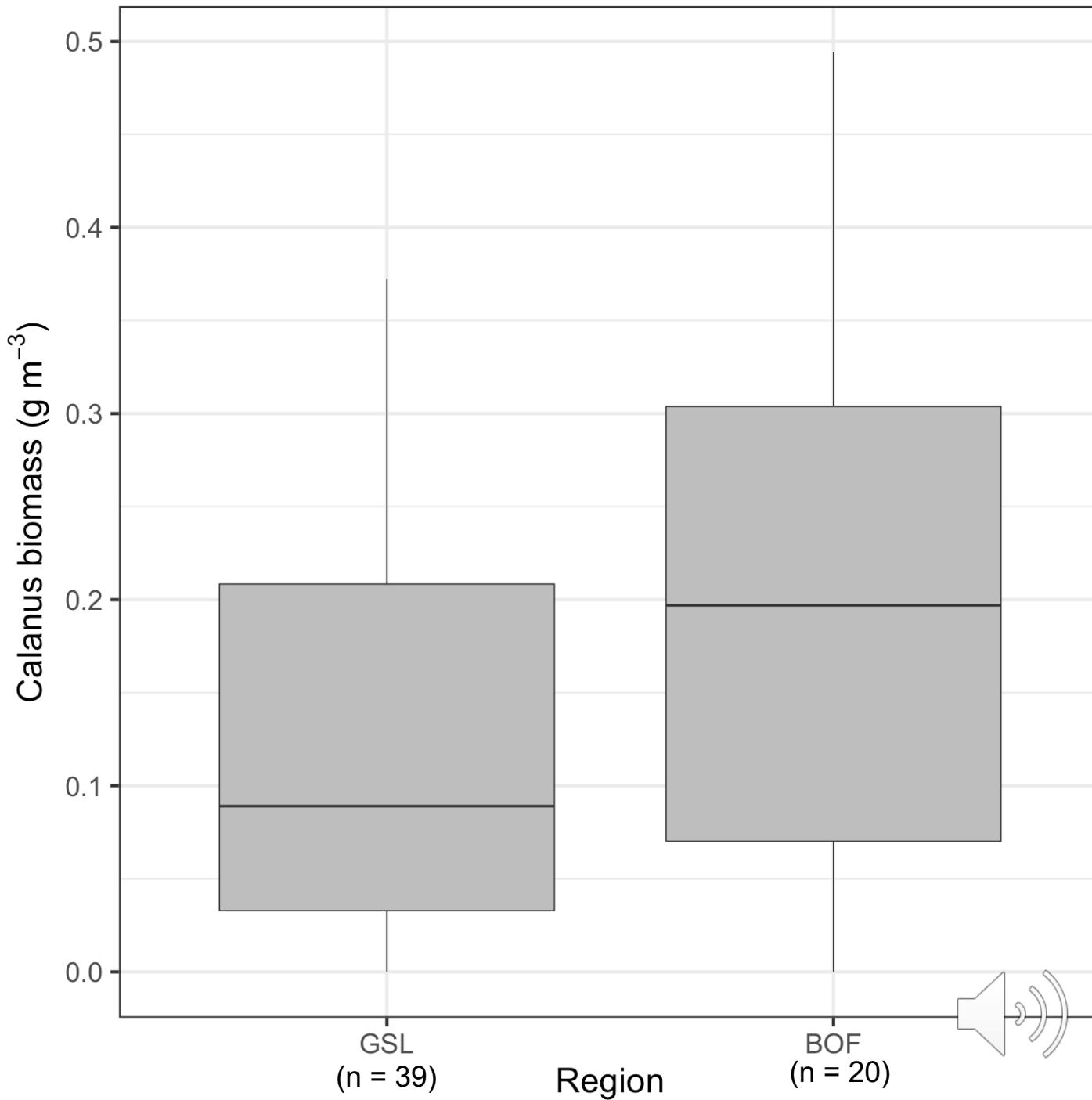
Deep OPC maximum

Variable	Units	Definition
depth	m	Bottom depth from shipboard echosounder
ctd_bottom_density	kg m ⁻³	Density at maximum depth
ctd_surface_density	kg m ⁻³	Density at minimum depth
ctd_sml_depth	m	Depth of maximum buoyancy frequency
ctd_bml_width	m	Height from max depth to a density change of -0.05 kg/m ³
net_calanus_conc	ind m ⁻³	Concentration of late stage (IV,V,VI) Calanus spp
net_total_conc	ind m ⁻³	Concentration of all zooplankton
net_mass	g m ⁻³	Wet weight of net contents
opc_max	g m ⁻³	Maximum OPC biomass
opc_avg	g m ⁻³	Average OPC biomass
opc_depth_max	m	Depth of max OPC biomass
opc_deep_max	g m ⁻³	Max OPC biomass in bottom 15 m



Habitat comparison

- Compare to samples taken near right whales in BOF in 1999-2000
- BOF is dominated by *C. finmarchicus*
- GSL has lower *Calanus* abundance, but a higher relative proportion of *C. hyperboreus*
- Converting to biomass can correct for species-specific size differences
- *Calanus* biomass near right whales was similar between habitats



Summary

- Right whales likely targeting deep layer of large zooplankton, likely a mixture of *C. finmarchicus* and *C. hyperboreus*
- Relatively low abundance may be compensated by large *C. hyperboreus*
- More work to be done on:
 - Potential for multiple feeding strategies
 - Energetics
 - Time / space variation
 - Comparisons to regional / systematic sampling efforts

Thank you!

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