Fluxes, Fishes and Feathers: Relationships among the Bering, Chukchi and Beaufort Seas in a time of climate change

George Hunt, Seth Danielson, Lisa Eisner, Kathy Kuletz, Bob Lauth, Libby Logerwell, Martin Renner, and Mike Sigler

Plan of Talk

- Background
- Physical System
- Comparisons of Zooplankton Communities
- Comparisons of Fish Communities
- Comparisons of Seabird Communities
- Comparisons of Marine Mammal Communities
- Overview
- Implications re Impacts of Climate Change

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Background

- Eastern Bering Sea, Chukchi Sea and Beaufort Seas often treated as separate entities
- Physical boundary between Bering and Chukchi obvious
- Boundary between Chukchi and Beaufort less evident
- New work in BEST/BSIERP shows striking discontinuity on Eastern Bering Sea Shelf
- Do the groupings of communities reflect the boundaries as we know them?

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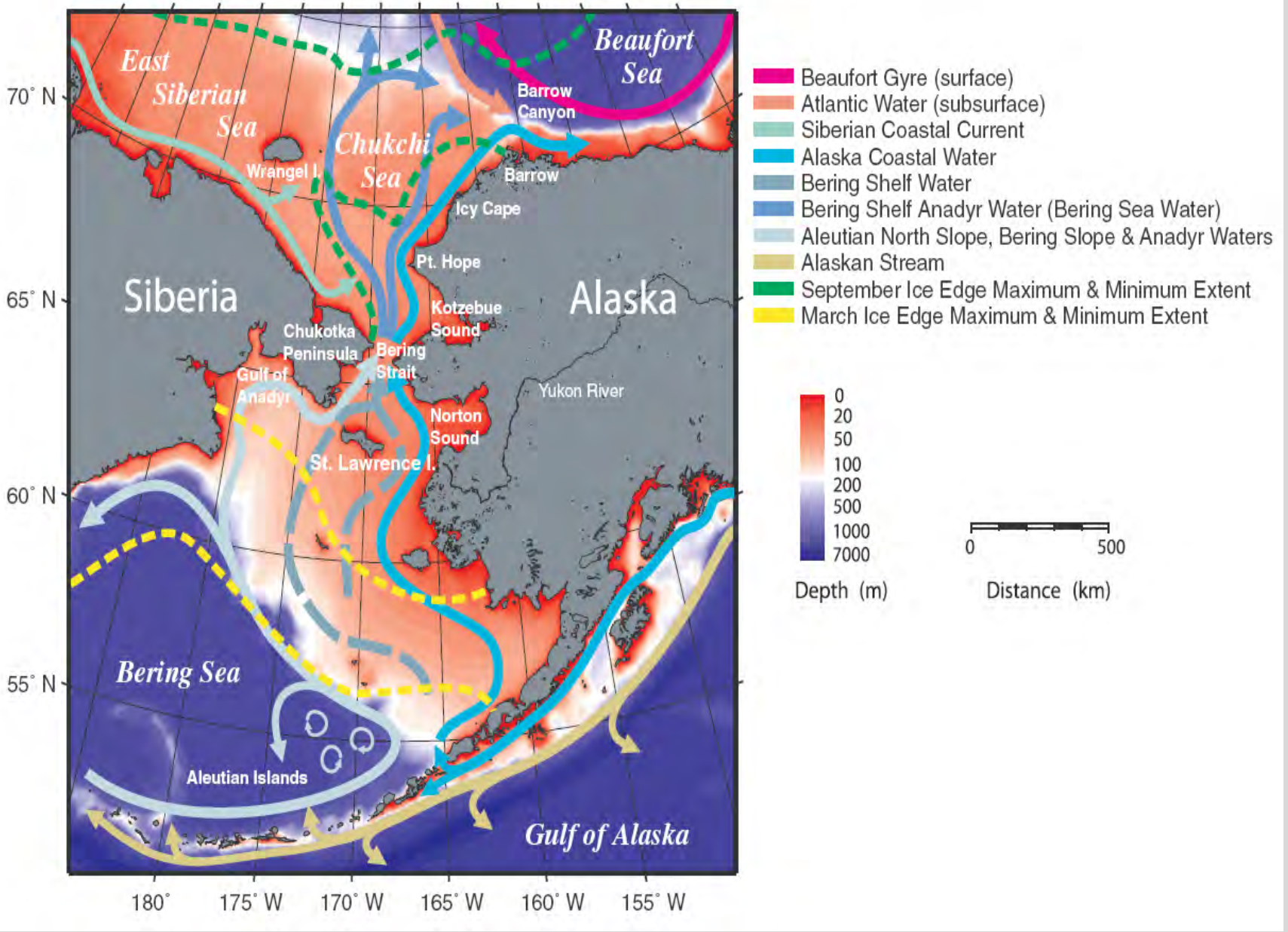
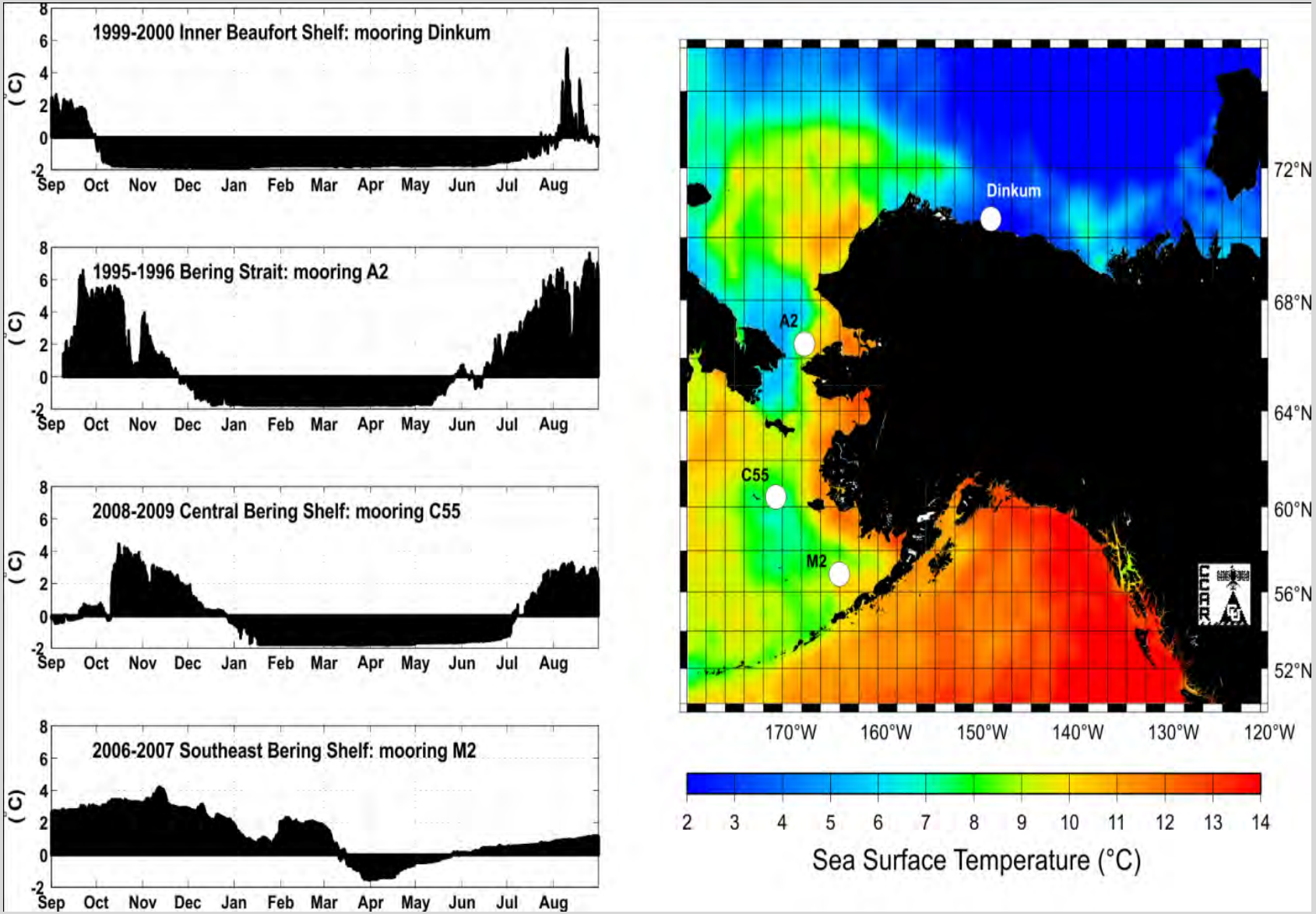
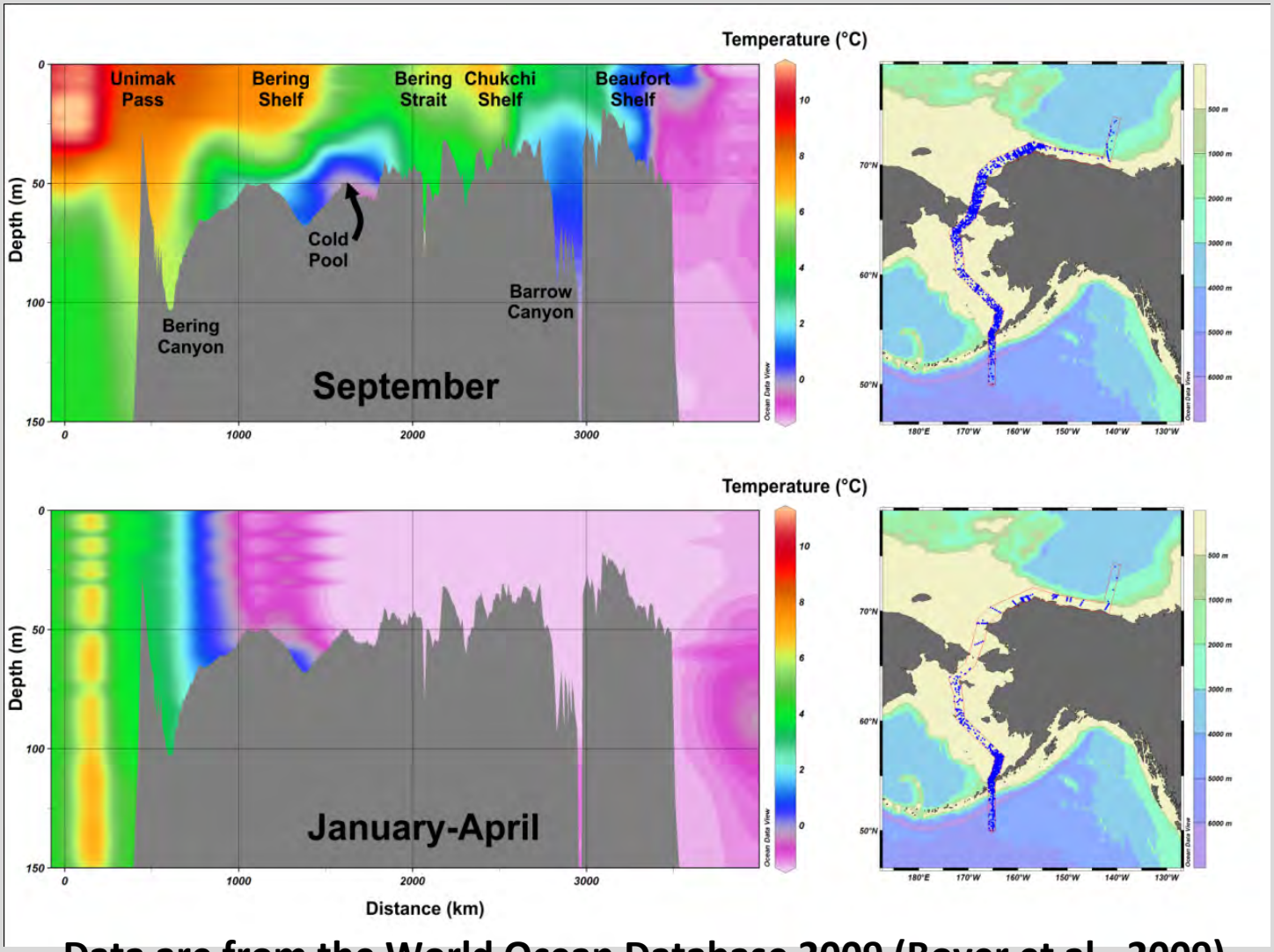

East Siberian Sea
Beaufort Sea
Chukchi Sea
Barrow Canyon
Wrangel I.
Barrow
Icy Cape
Pt. Hope
Siberia
Alaska
Kotzebue Sound
Chukotka Peninsula
Bering Strait
Gulf of Anadyr
Yukon River
Norton Sound
St. Lawrence I.
Bering Sea
Aleutian Islands
Gulf of Alaska
70° N
65° N
60° N
55° N
180°
175° W
170° W
165° W
160° W
155° W
Beaufort Gyre (surface)
Atlantic Water (subsurface)
Siberian Coastal Current
Alaska Coastal Water
Bering Shelf Water
Bering Shelf Anadyr Water (Bering Sea Water)
Aleutian North Slope, Bering Slope & Anadyr Waters
Alaskan Stream
September Ice Edge Maximum & Minimum Extent
March Ice Edge Maximum & Minimum Extent
0
20
50
100
200
500
1000
7000
Depth (m)
0
500
Distance (km)



Annual cycle of temperature

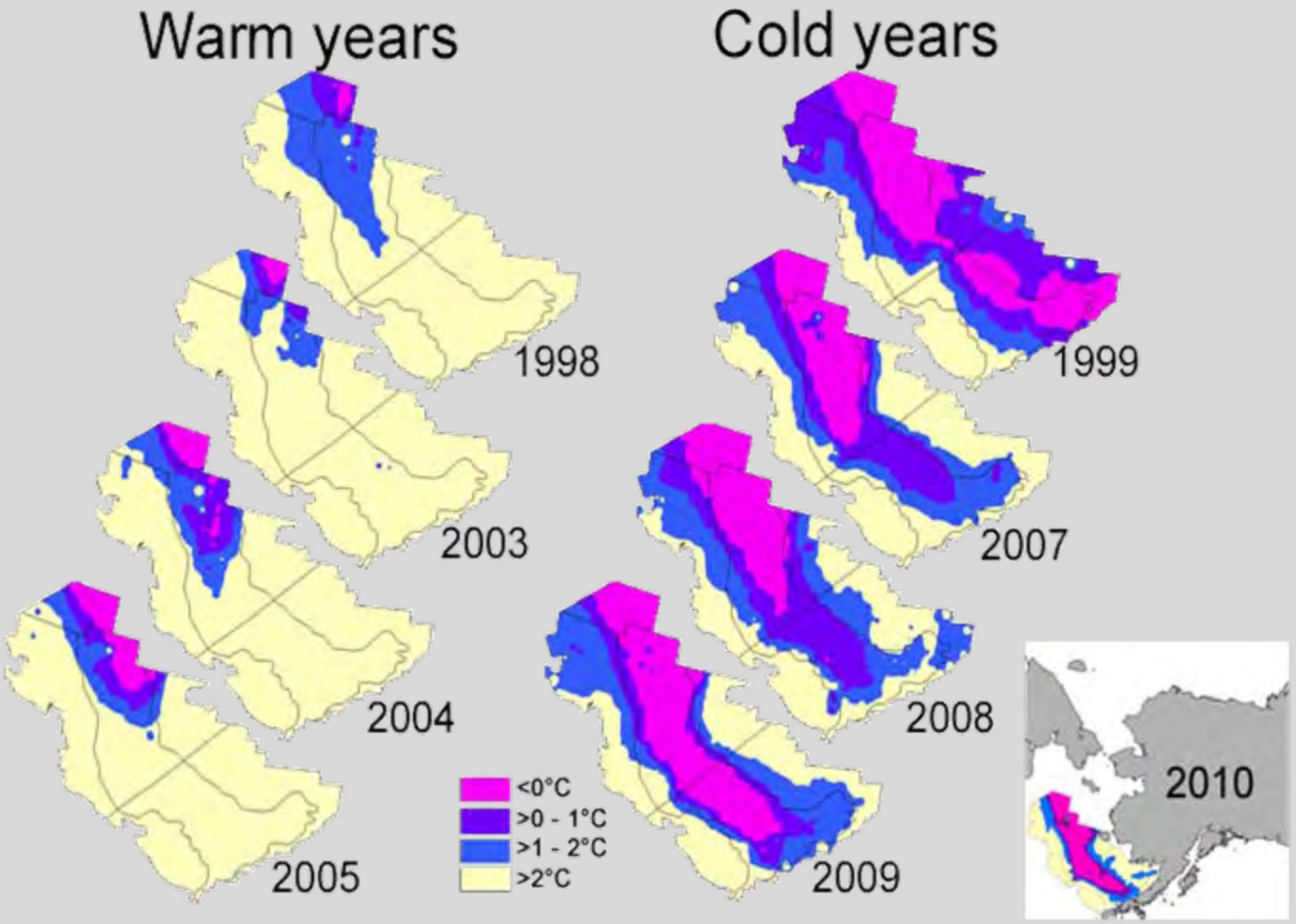
Surface temperature (ºC) for mid-September using GHRSST

Cross-section of temperatures North Pacific to the Beaufort Sea



Data are from the World Ocean Database 2009 (Boyer et al., 2009)

Extent of the Cold Pool during Summer in warm and cold years



Data from NOAA Bottom Trawl

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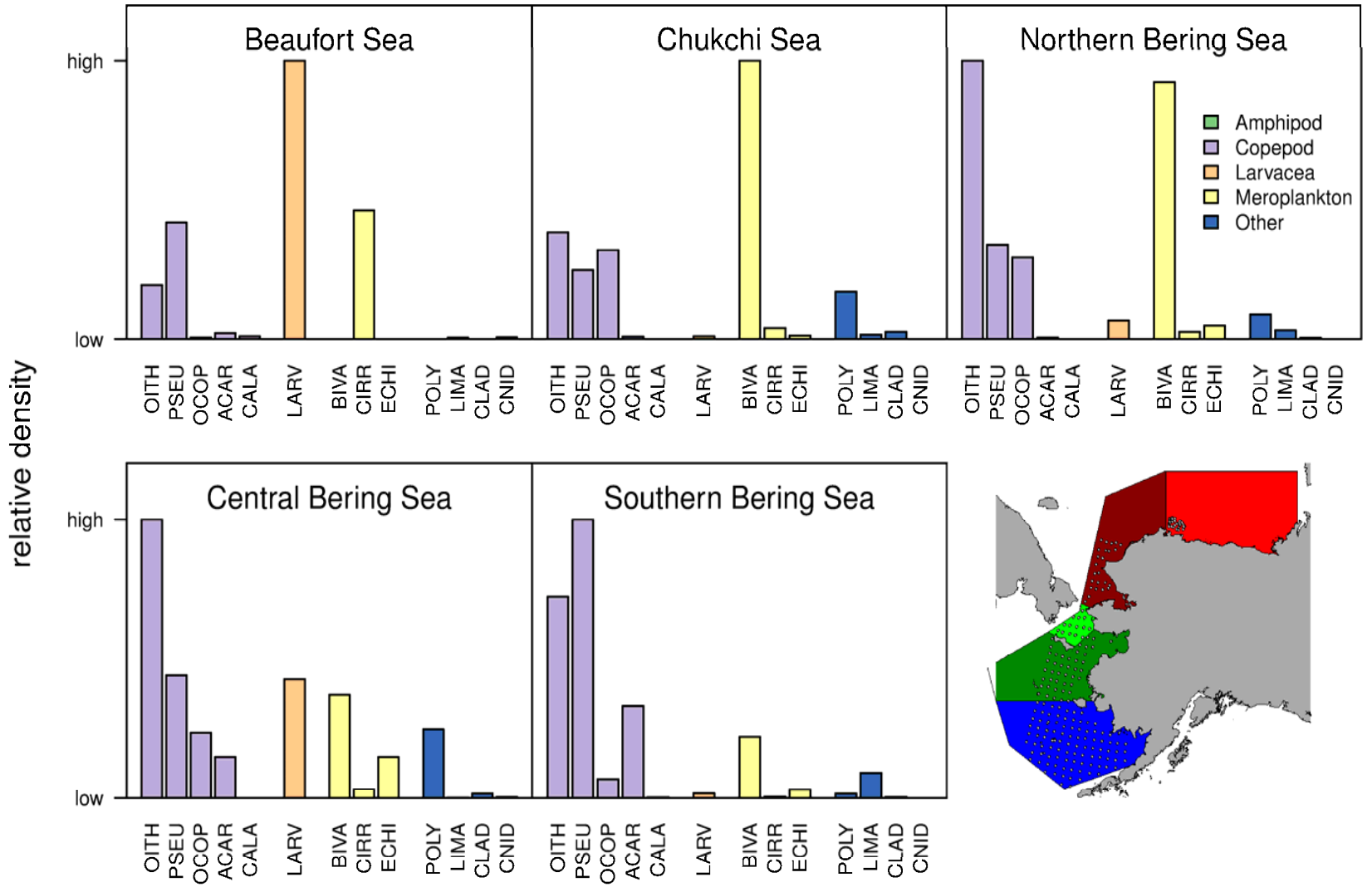
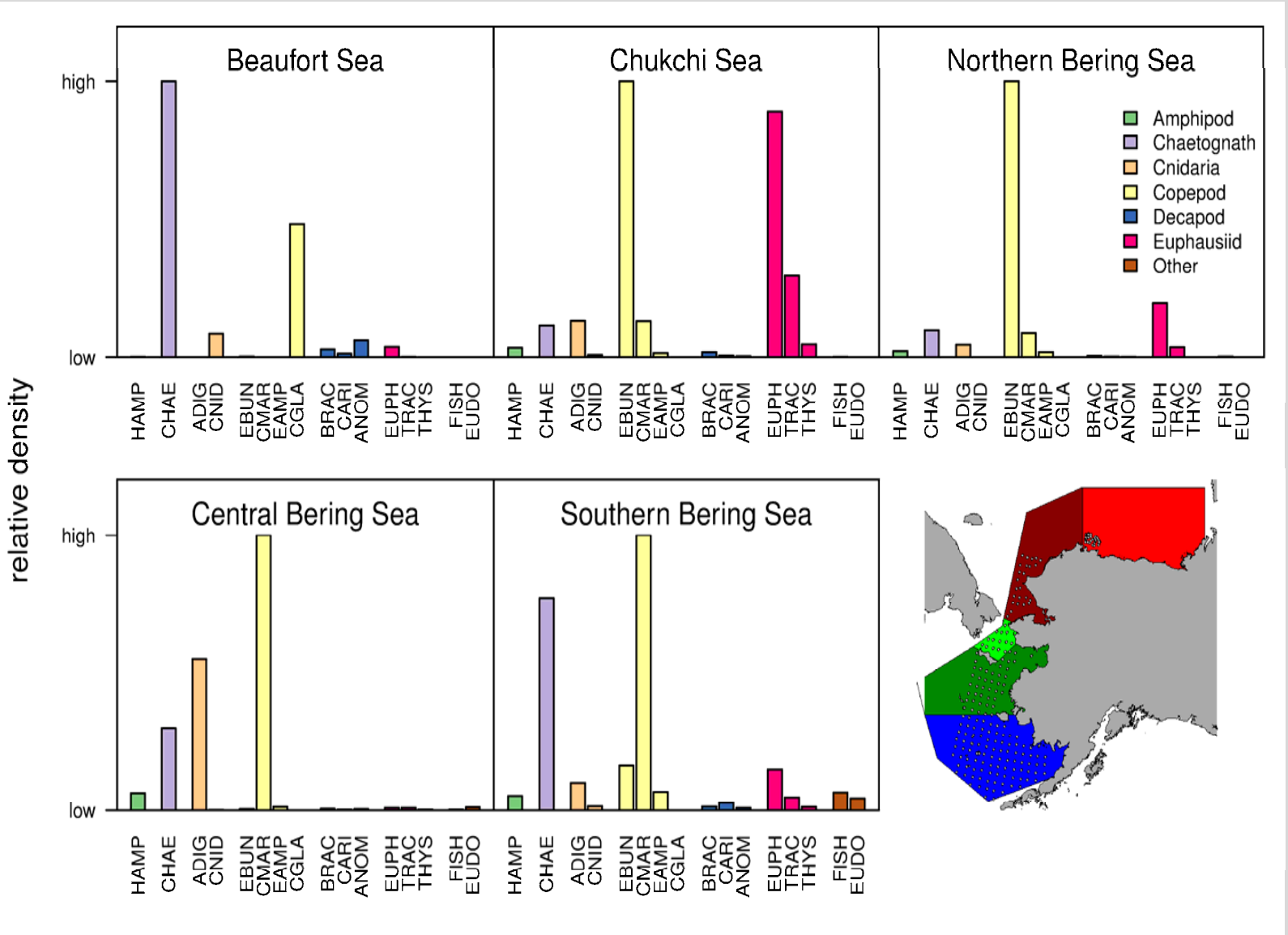
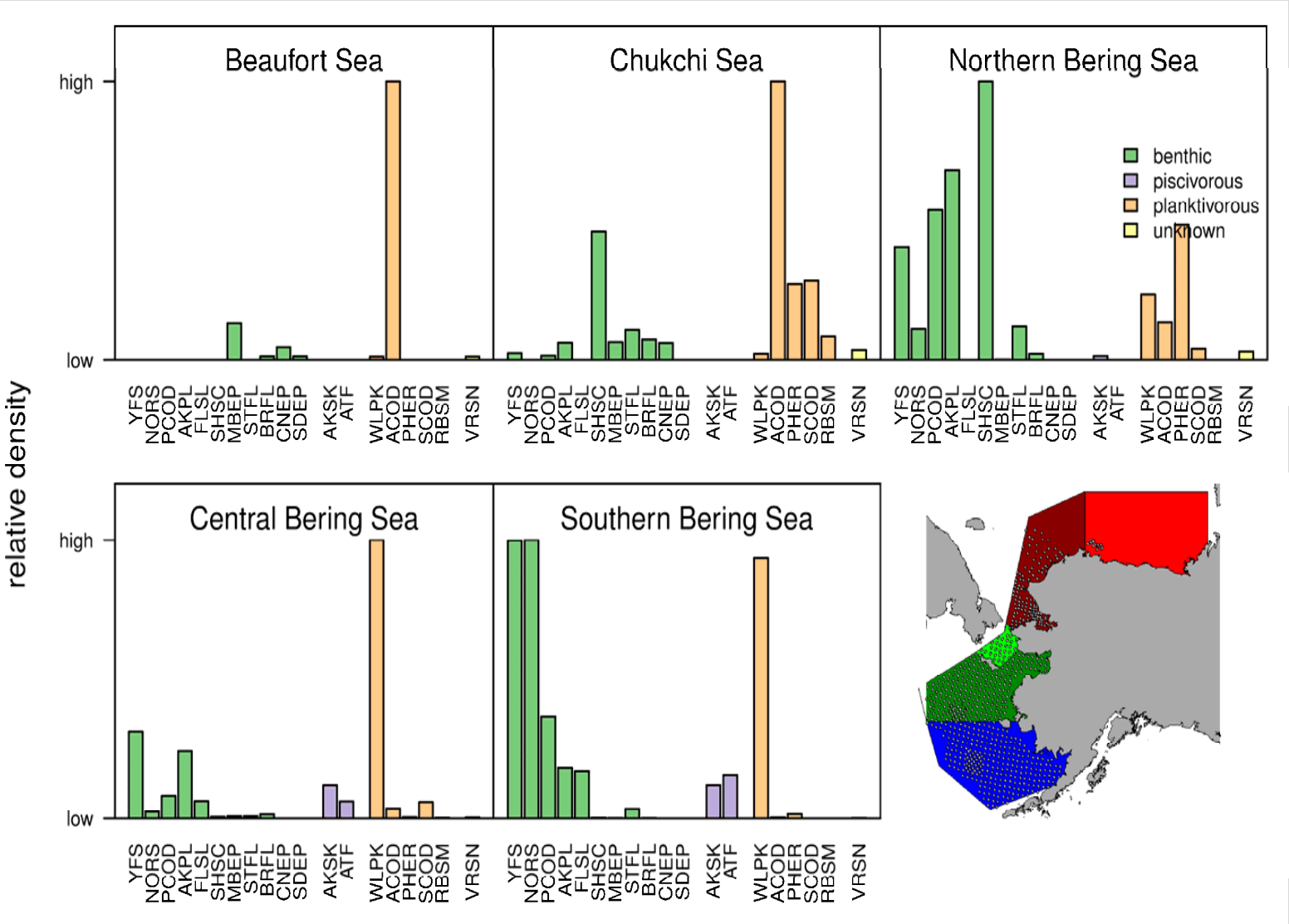
Relative Abundances of Most Common Small Zooplankton



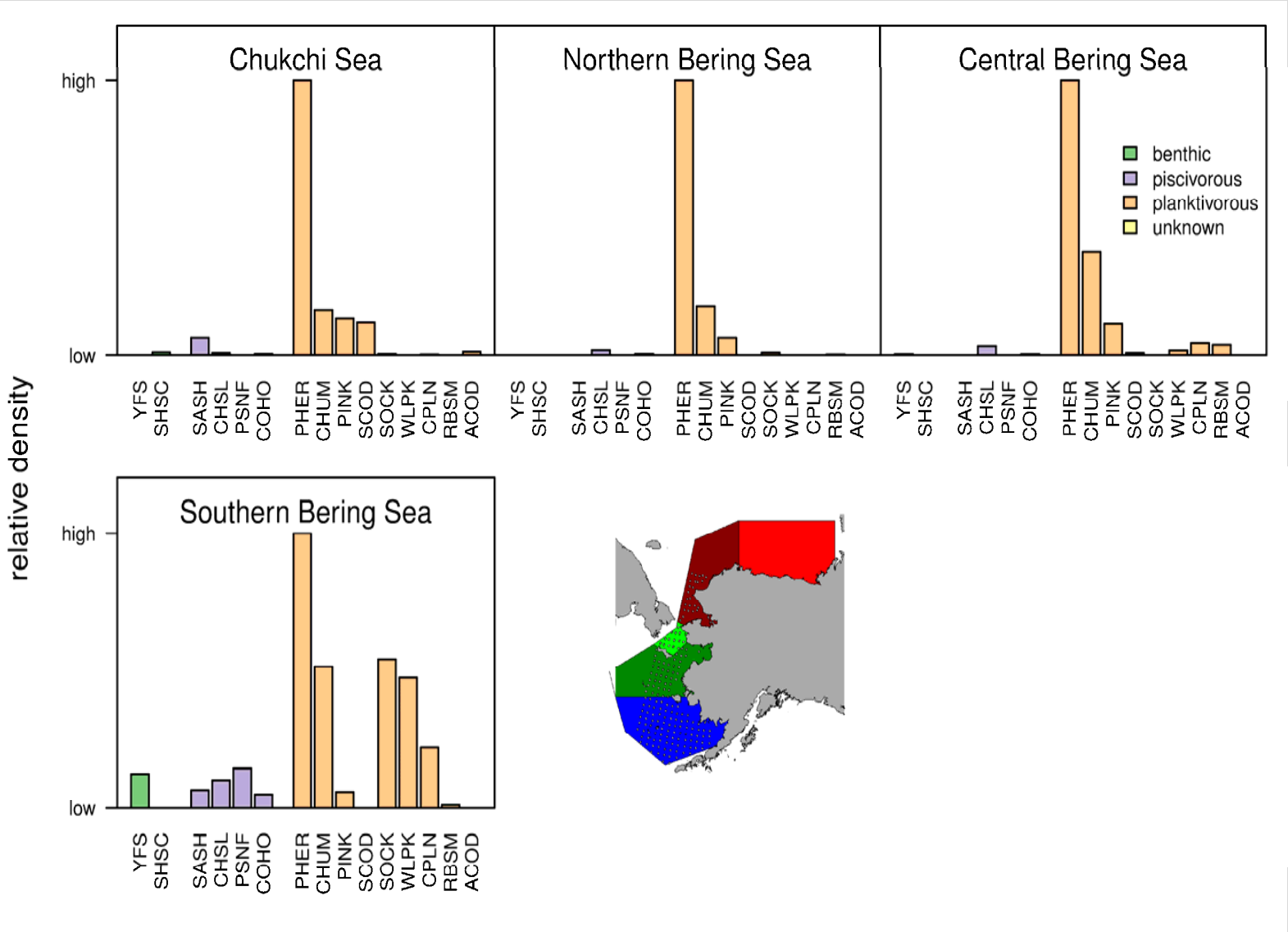
Relative Abundances of Most Common Large Zooplankton



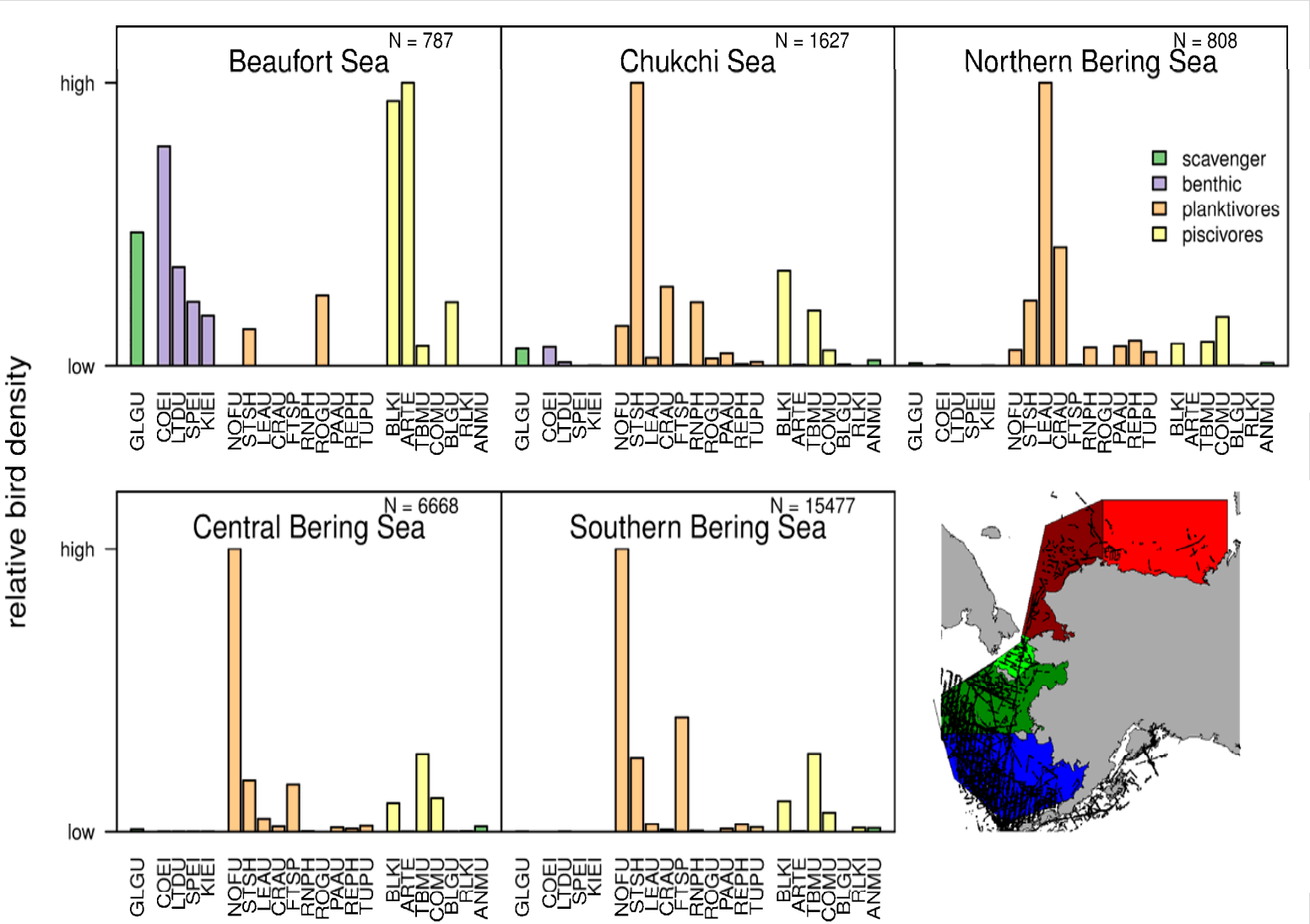
Relative Densities (weight) of the Most Common Fish from Bottom Trawls



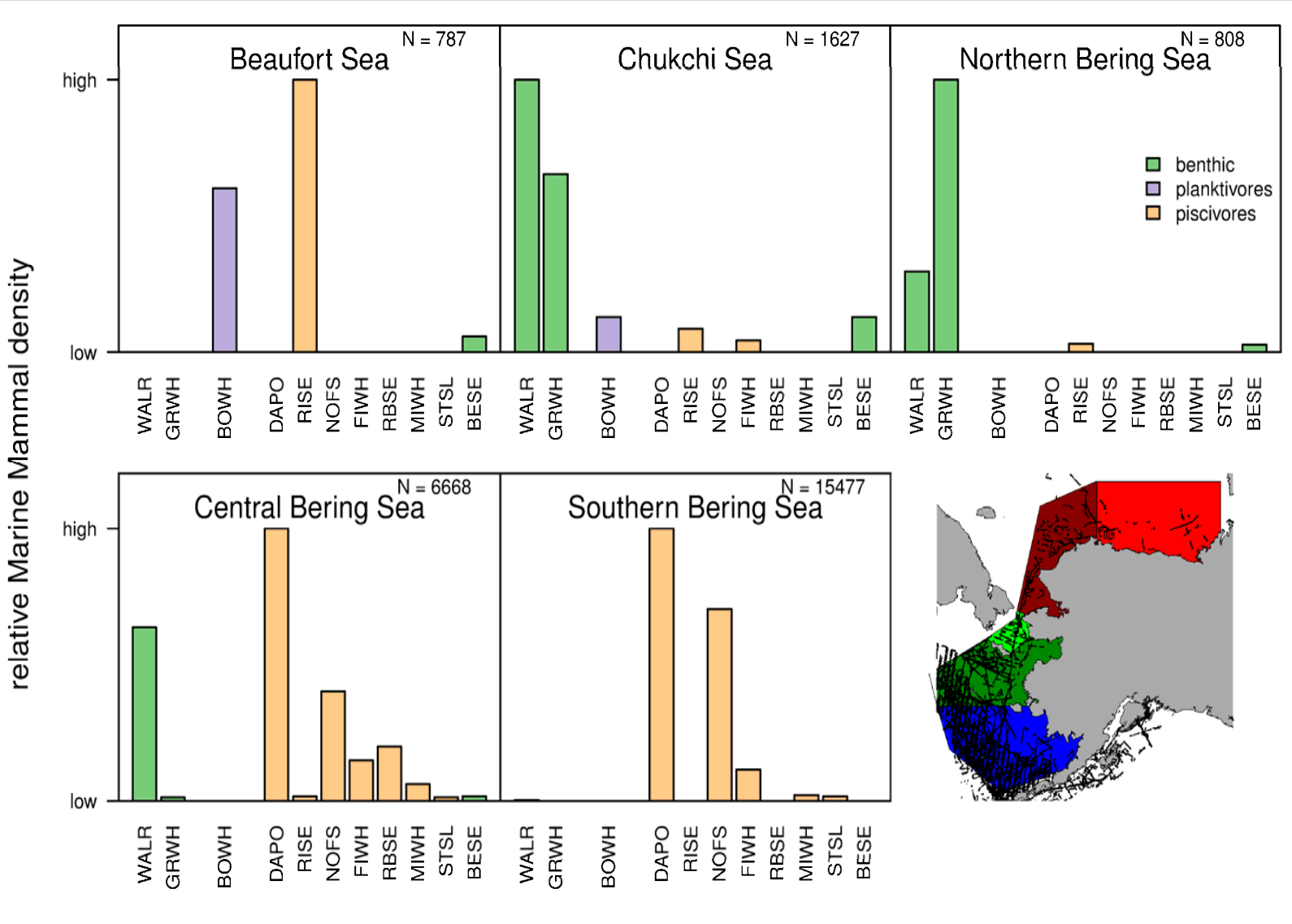
Relative Densities (weight) of the Most Common Fish from Surface Trawls



Relative Densities (number) of the most Common Seabirds



Relative densities (number) of the most commonly sighted marine mammals



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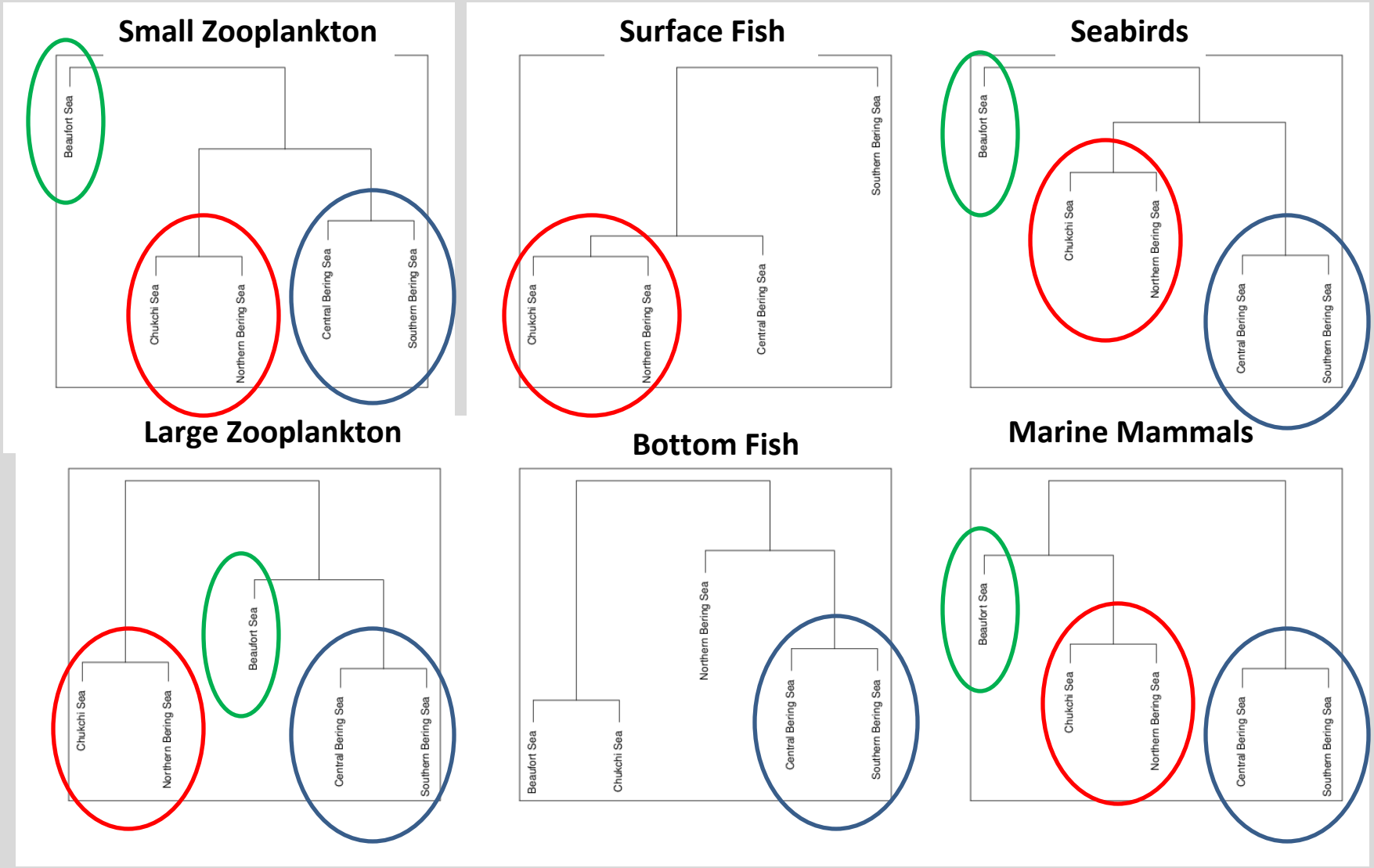
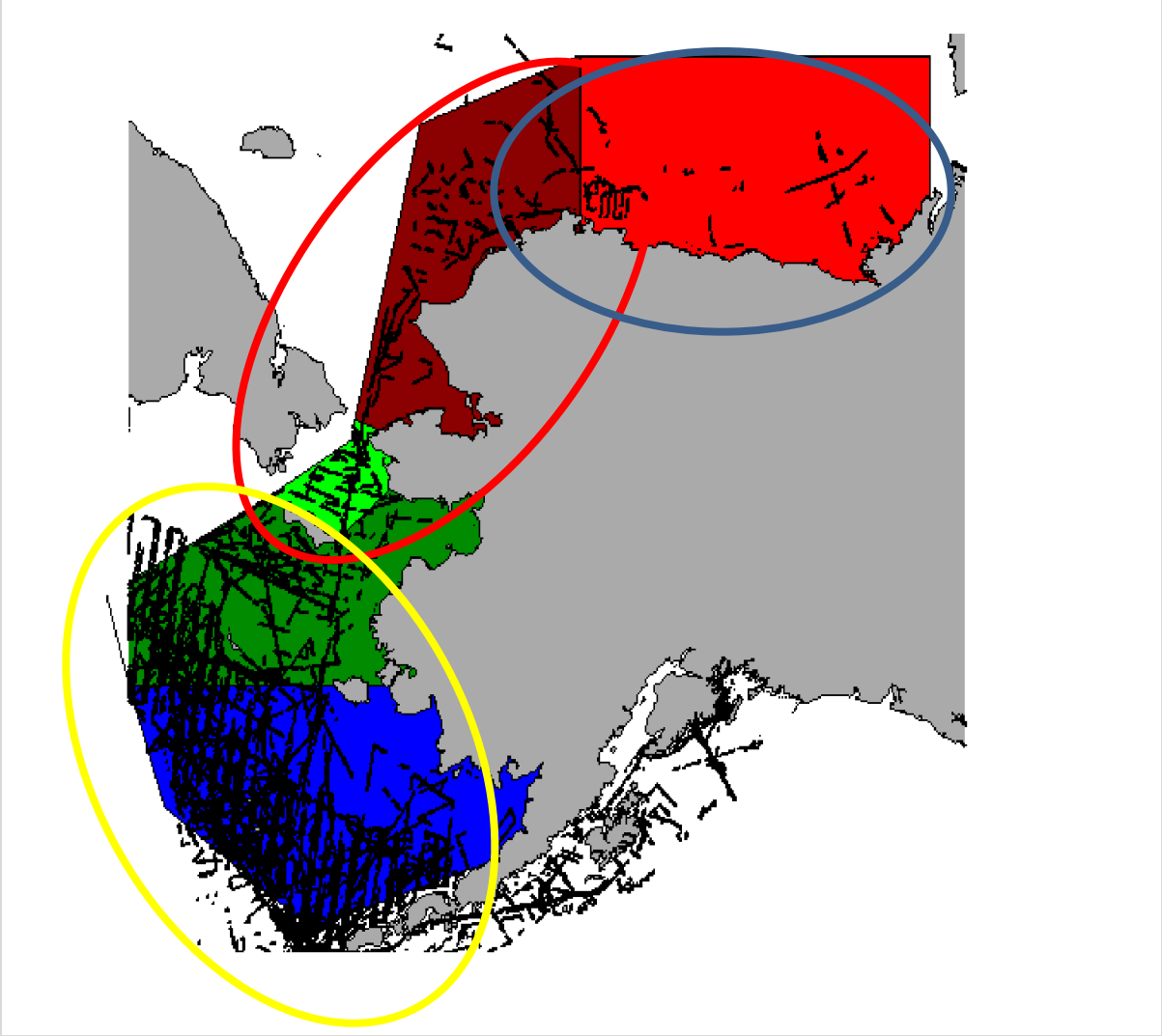
Cluster Analyses of Various Taxa



Groupings of regions



Summary of Cluster Analyses

- Southern & Central Bering grouped for 5 of 6 taxa
- Northern Bering & Chukchi grouped for 5 of 6 taxa
- Beaufort Sea alone for 5 of 6 taxa

- Southern Bering was alone for 1 taxon-(surface fish)
- Central Bering was alone for 1 taxon (surface fish)
- Northern Bering was alone for 1 taxon (bottom fish)

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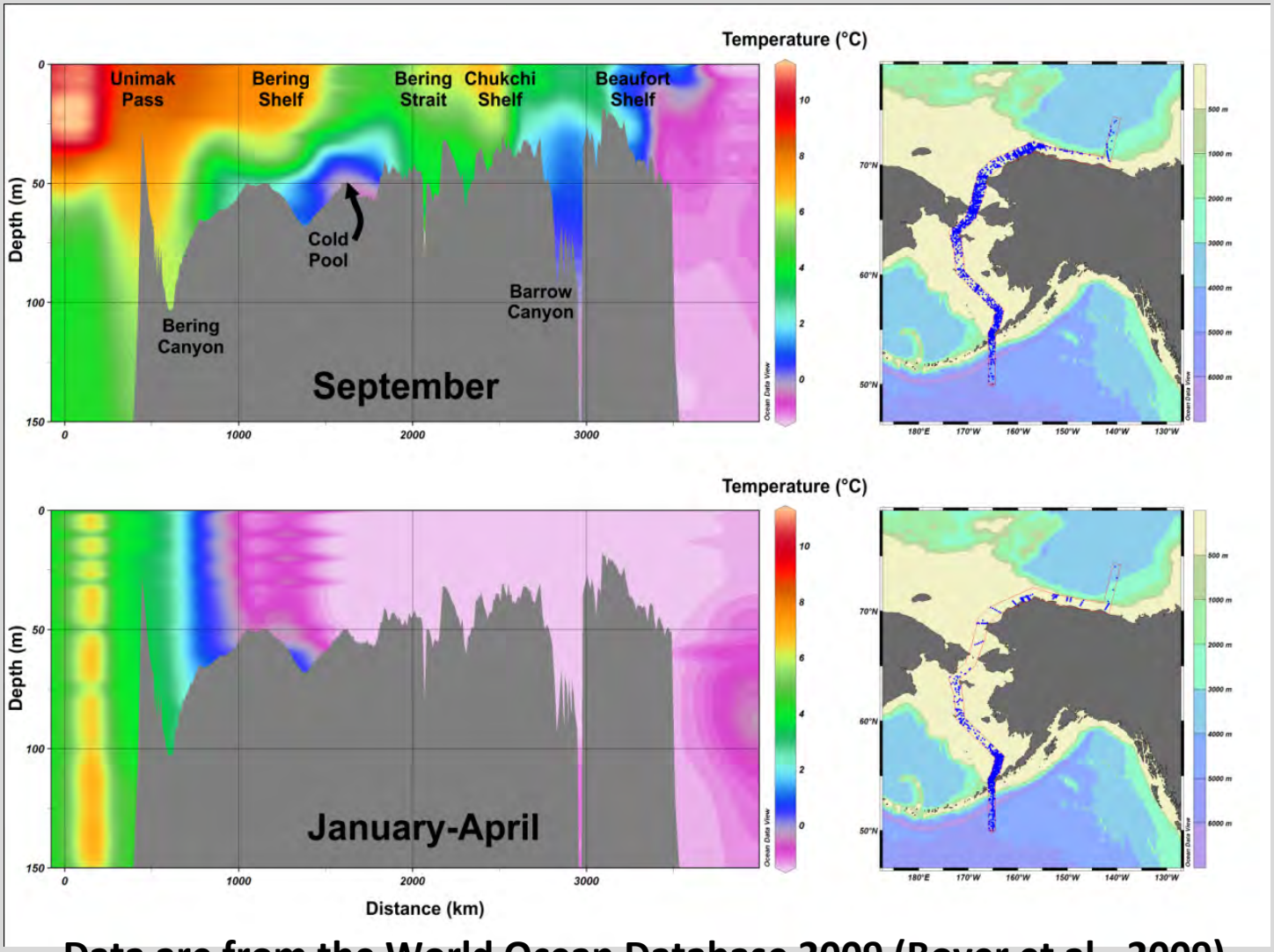

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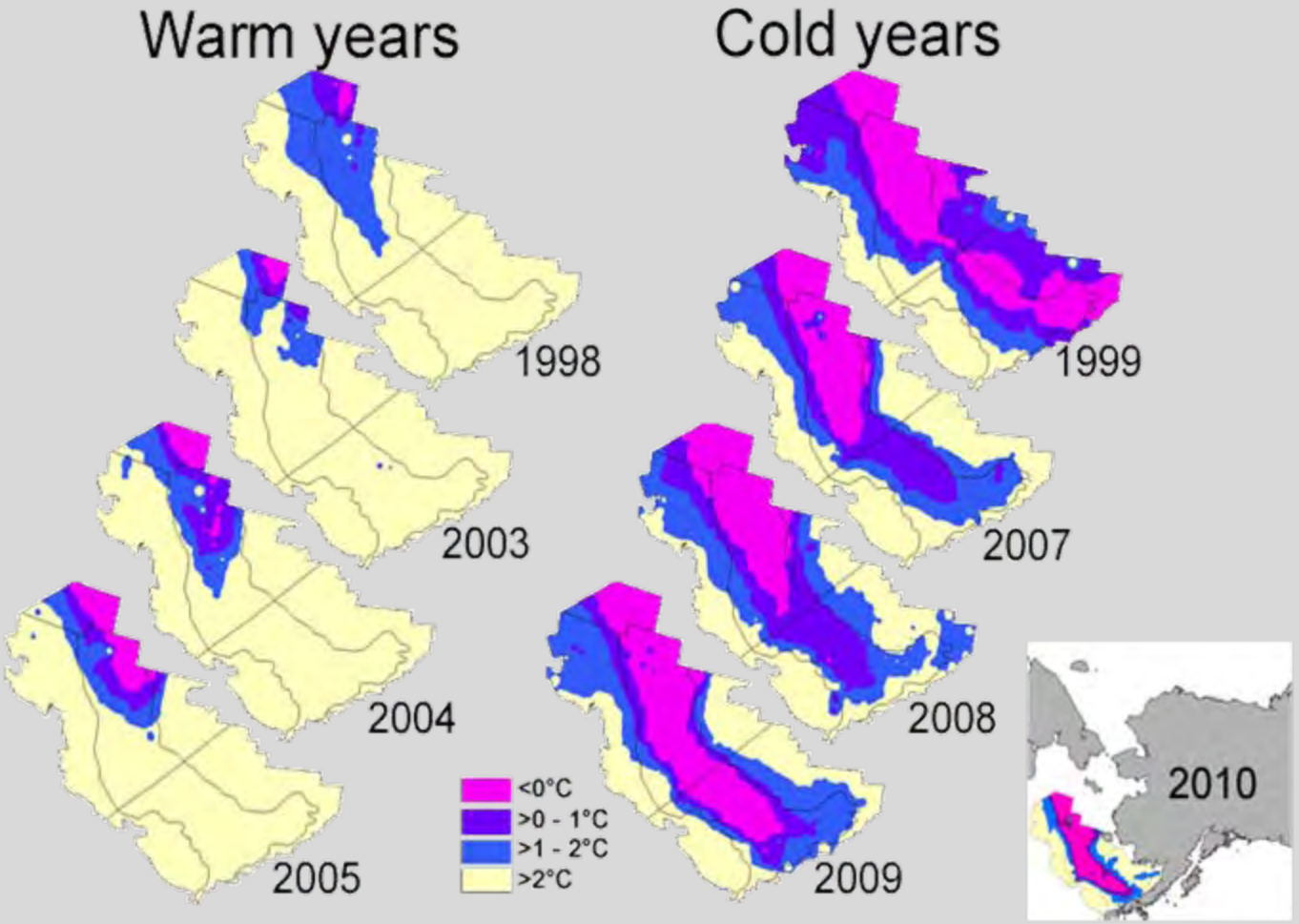

Data from NOAA Bottom Trawl Surveys

Implications re Impacts of Climate Change

- Fish may move about in Southeastern and Central Bering Sea- refuigia from winter cold and summer cold pool
- Crossing into Northern Bering harder- no refuge from cold in winter
- Some juvenile fish may move north in surface layer; will be challenged in winter
- Northern Bering and Chukchi seaswill be hard for temperate zone fish to colonize as long as they Freeze in winter