FROM COAST TO OFFSHORE

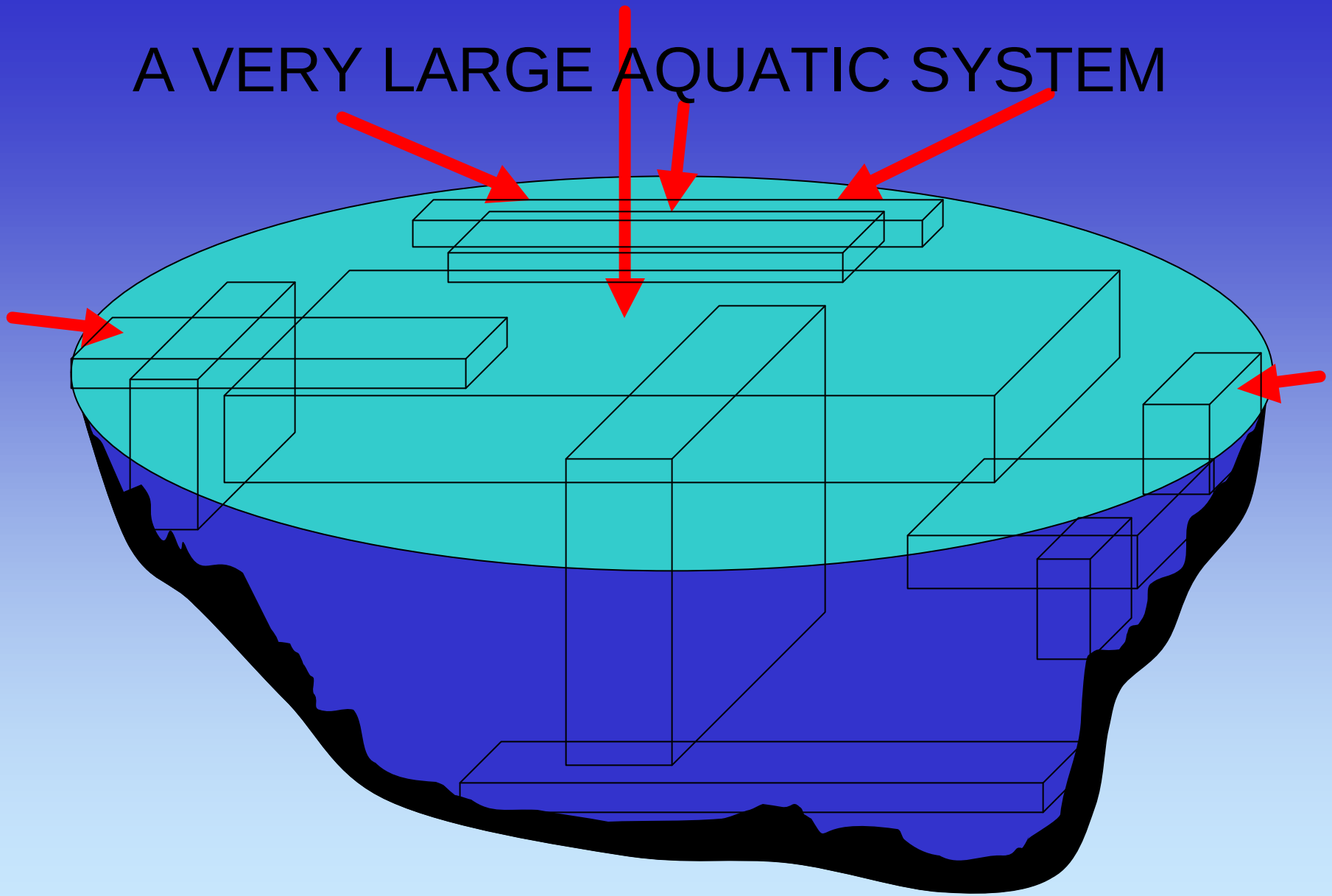
Some Progress in Developing Multi-resource Designs…

Jack Kelly, P. Yurista, J. Morrice,
G. Peterson, J. Scharold, M. Sierszen, C. West

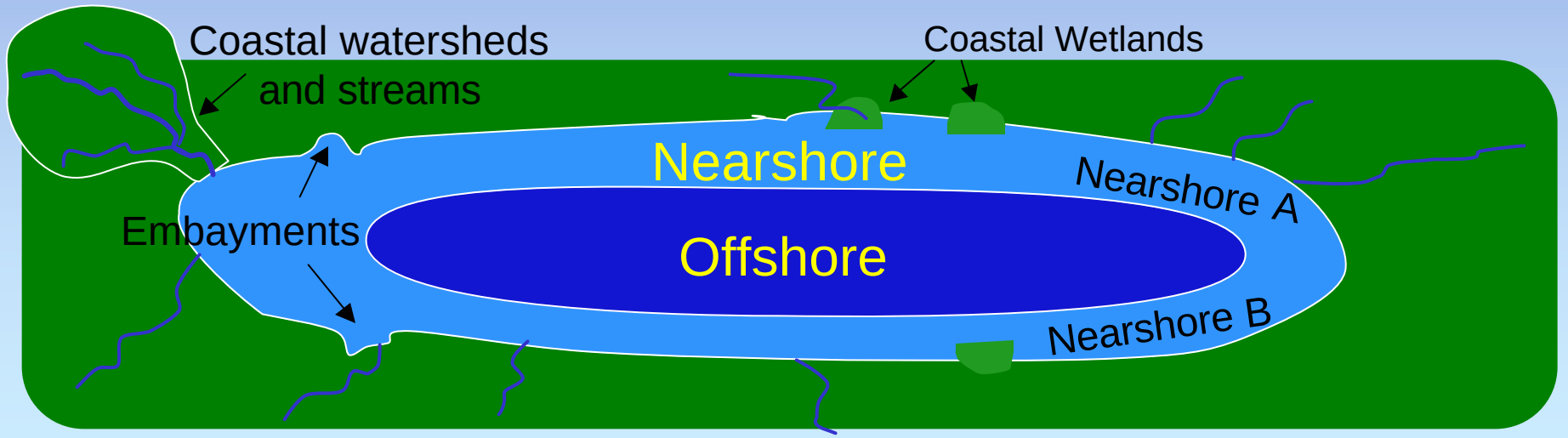
U.S. EPA, Office of Research and Development
National Health and Environmental Effects Laboratory
Mid-Continent Ecology Division, Duluth MN

…for Great Lakes Monitoring

A VERY LARGE AQUATIC SYSTEM

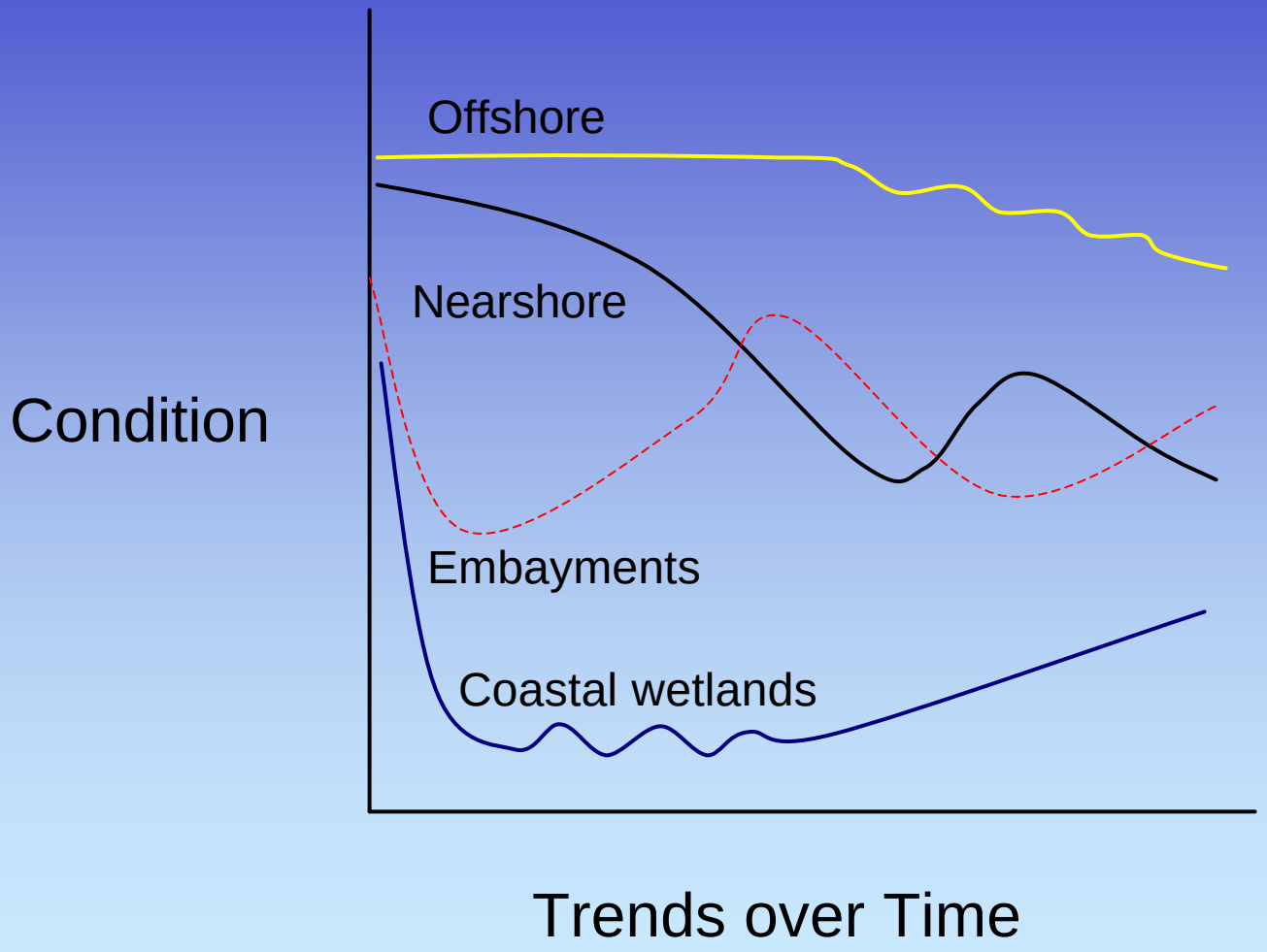


Concepts for an integrated assessment



Multiple resource monitoring

Tracking different “populations”



From Coast to Offshore, a Hydroscape

- Resource Definition/Distinctions

  Open and semi-open, connected systems

  Unique value? Character?

- Integration into Overall Design

  Just parts of whole?

  “Frontline” sentinel systems?

Selected Examples on These Themes

- Landscape signal and responses

  Great lakes-wide gradients to inform connections and response scales

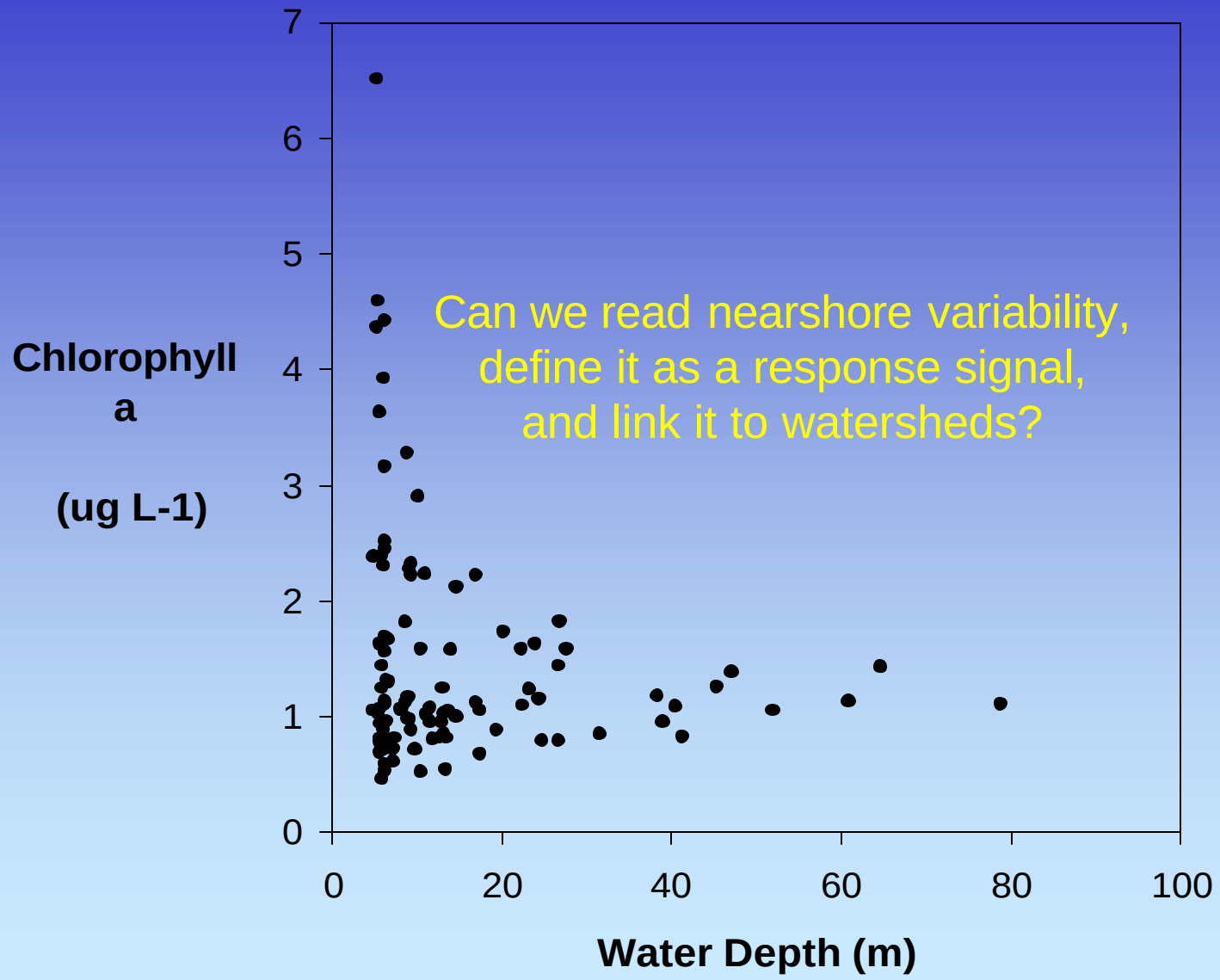
- Continuous towed sensors

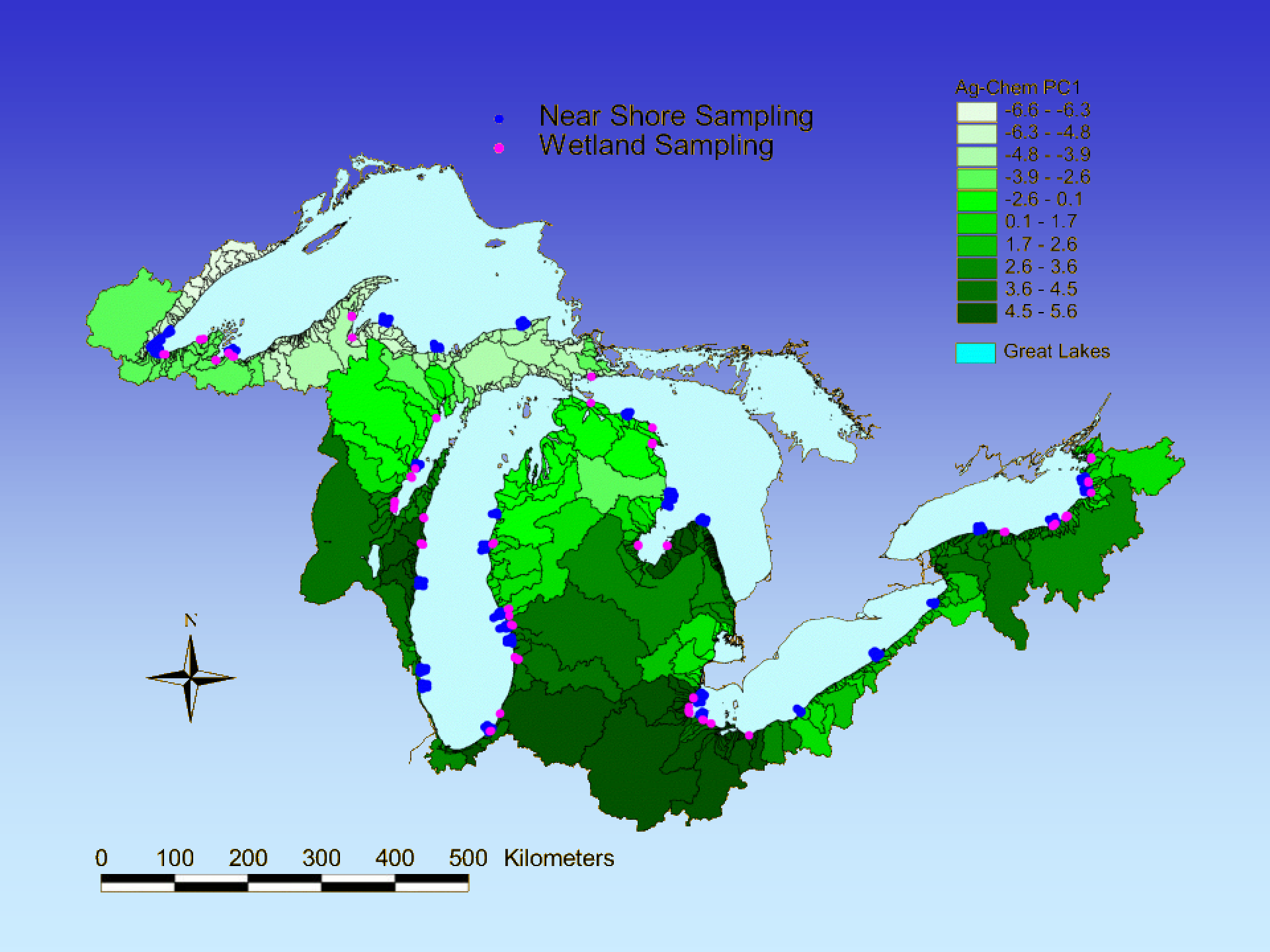
  Nearshore-offshore distinction and trends; zooplankton size spectra

- Food Webs (Stable Isotope Analysis)

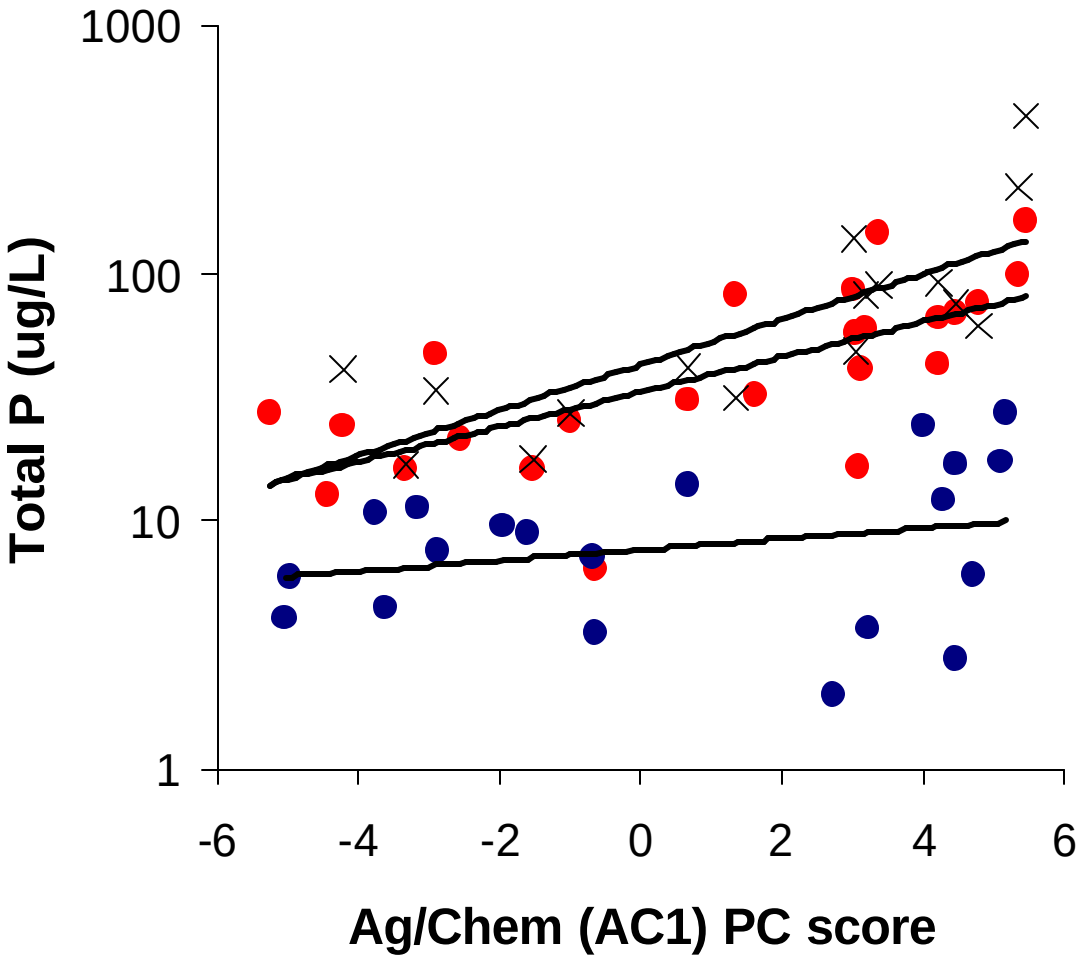
  Ecological distinction of embayments among coastal systems

FROM COAST TO OFFSHORE




Near Shore Sampling
Wetland Sampling
Ag-Chem PC1
-6.6 - -6.3
-6.3 - -4.8
-4.8 - -3.9
-3.9 - -2.6
-2.6 - 0.1
0.1 - 1.7
1.7 - 2.6
2.6 - 3.6
3.6 - 4.5
4.5 - 5.6
Great Lakes
N
0
100
200
300
400
500
Kilometers

Coastal Receiving Systems



$TRIB = 43e^{0.21(AC1)}$; $R^2 = 0.62$

$CW = 33e^{0.16(AC1)}$; $R^2 = 0.48$

$NS = 7.7e^{0.05(AC1)}$; $R^2 = 0.07$

- Coastal wetlands
- Nearshore (5-10 m)
- Tributary

Paired Sampling Design

Fixed stations

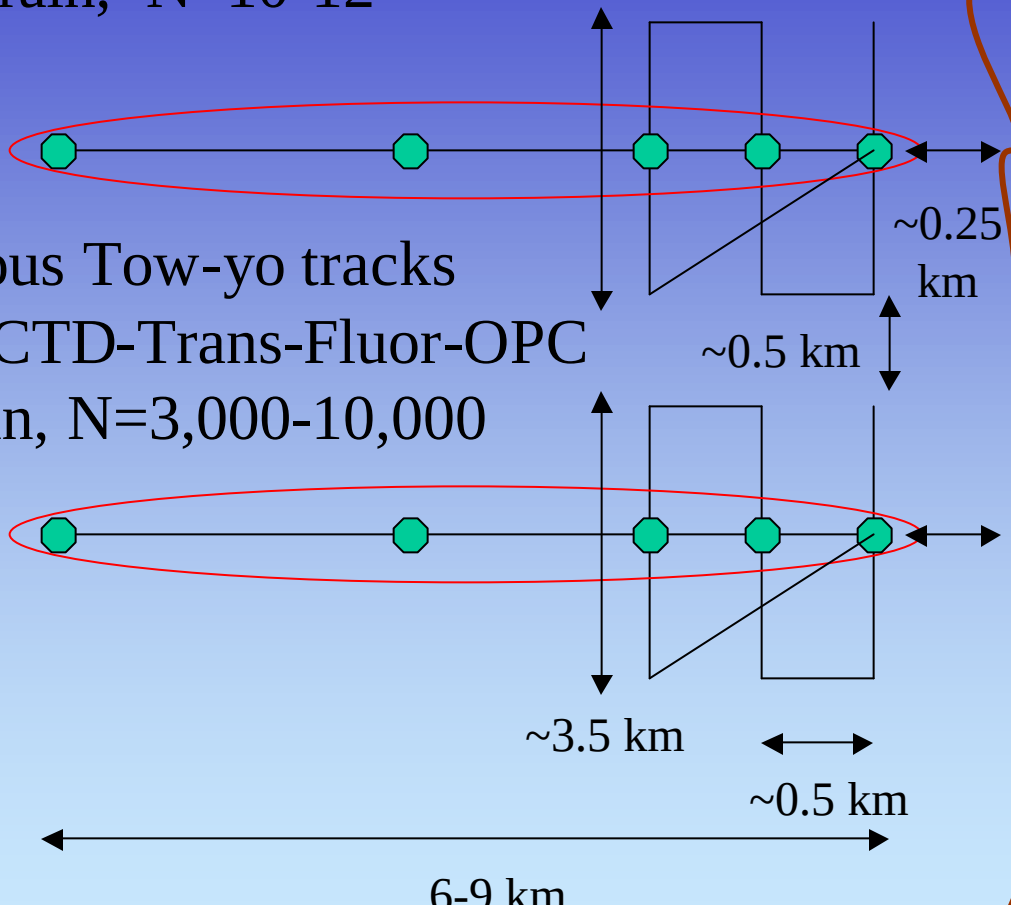
Bottles-Nets-CTD-sensors

Coarse grain, N~10-12

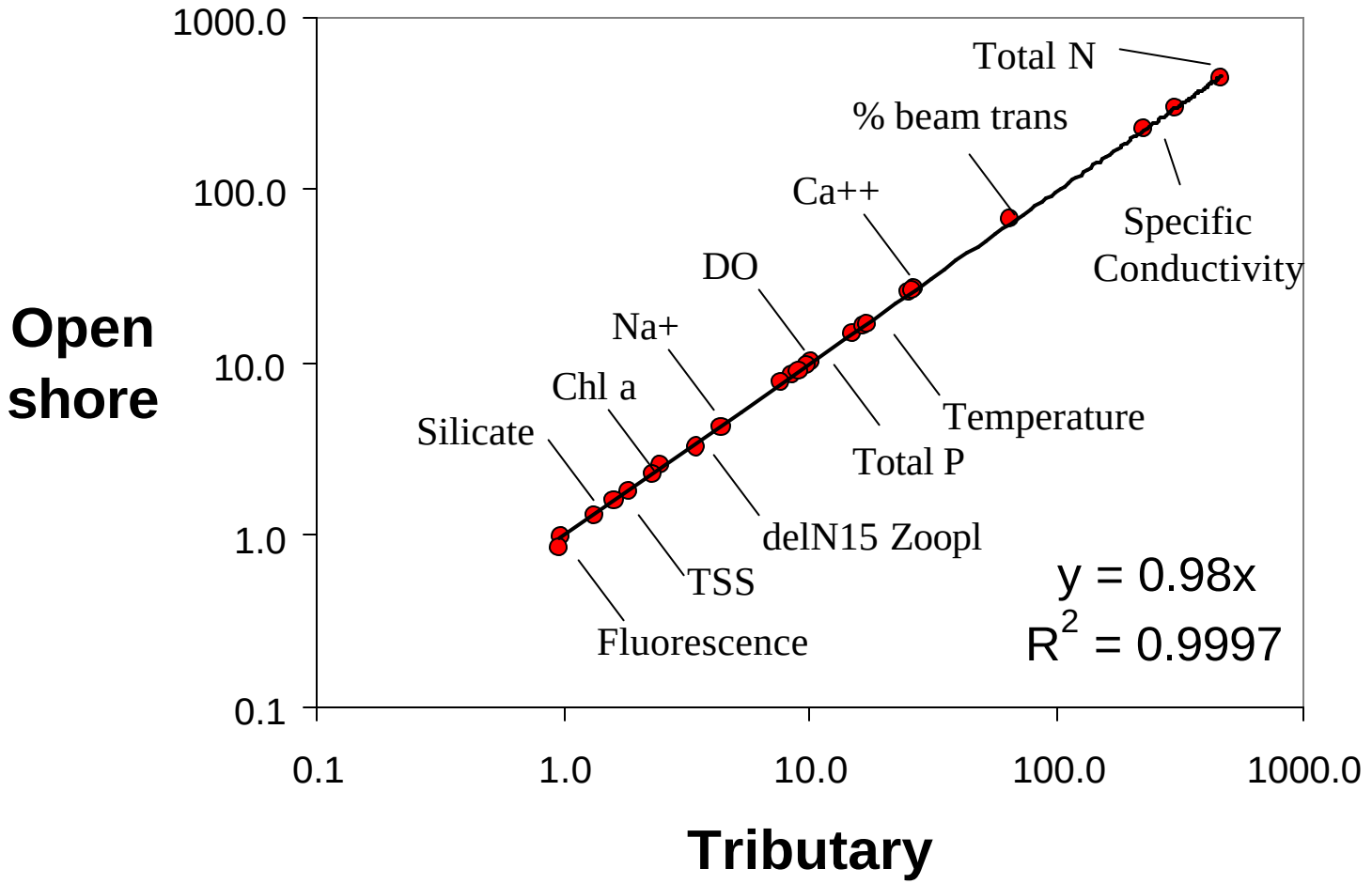
Continuous Tow-yo tracks

Sensors CTD-Trans-Fluor-OPC

Fine grain, N=3,000-10,000



Scale: ~8 km transect to offshore **Resolution:** Coarse (N=5-6)
~24 parameters (CTD/bottle cast and net tows)

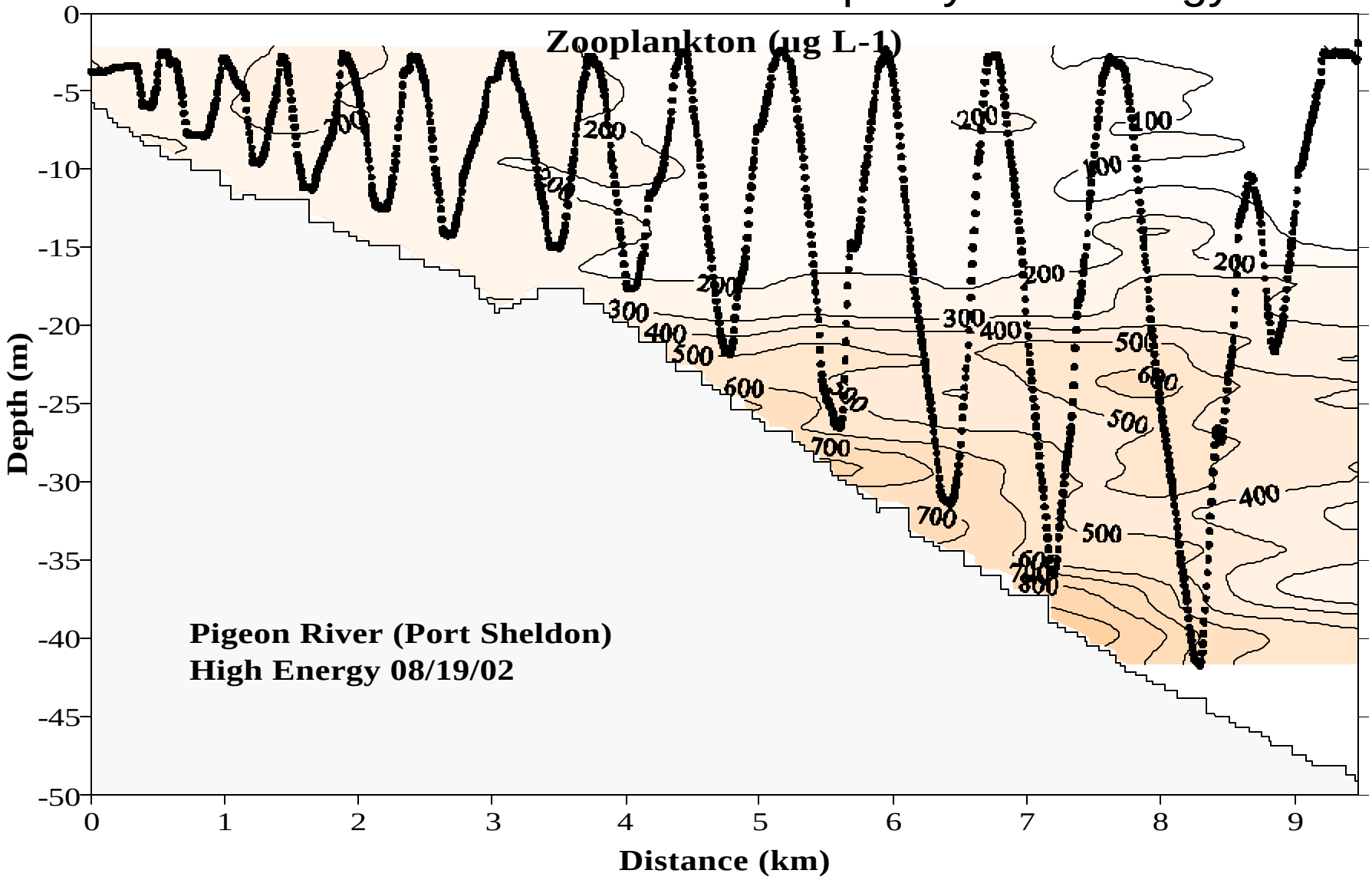


Open Nearshore

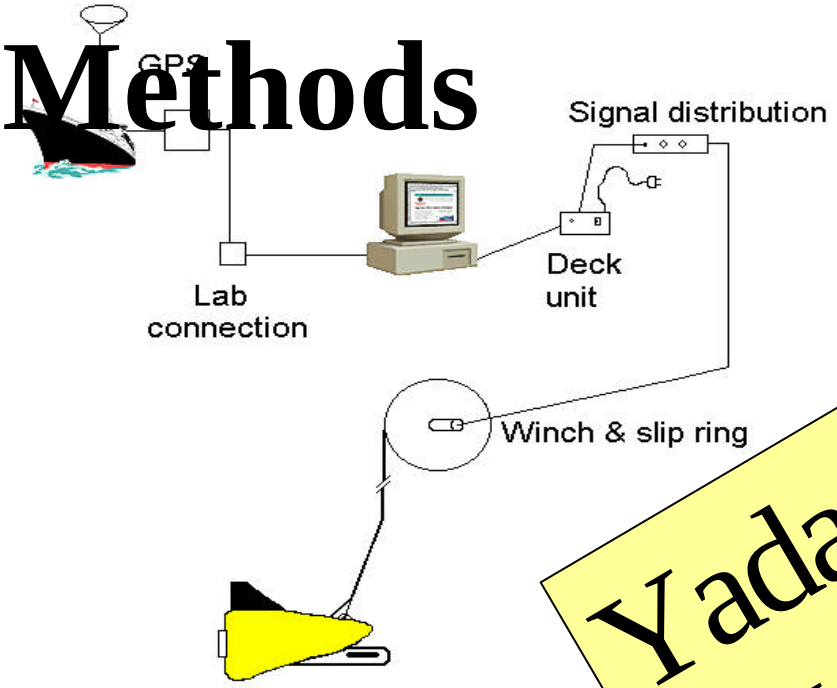
Searching for Response Scales/Useful Boundaries

FROM COAST TO OFFSHORE

Towed *in situ* sensors for water quality and biology



Methods



Yada …
Yada …
Yada.

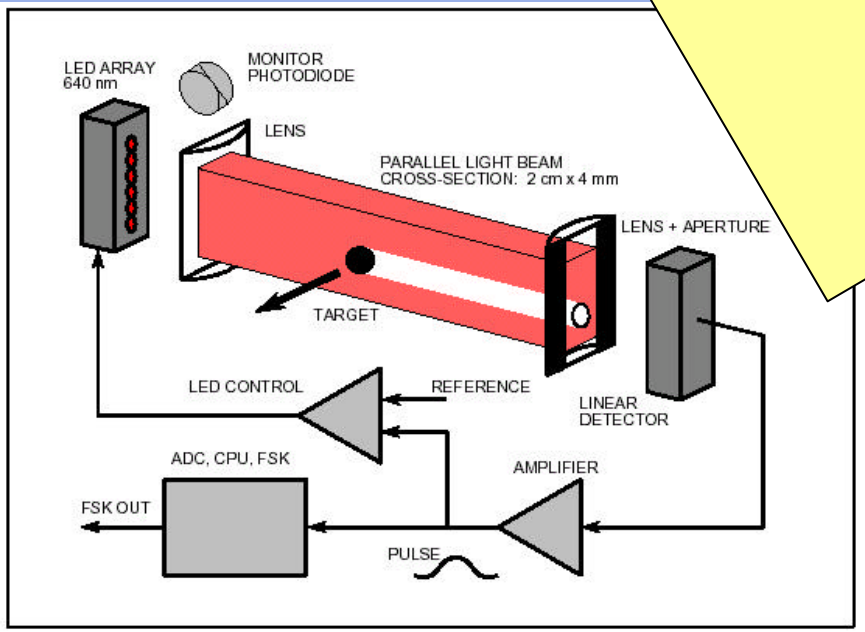
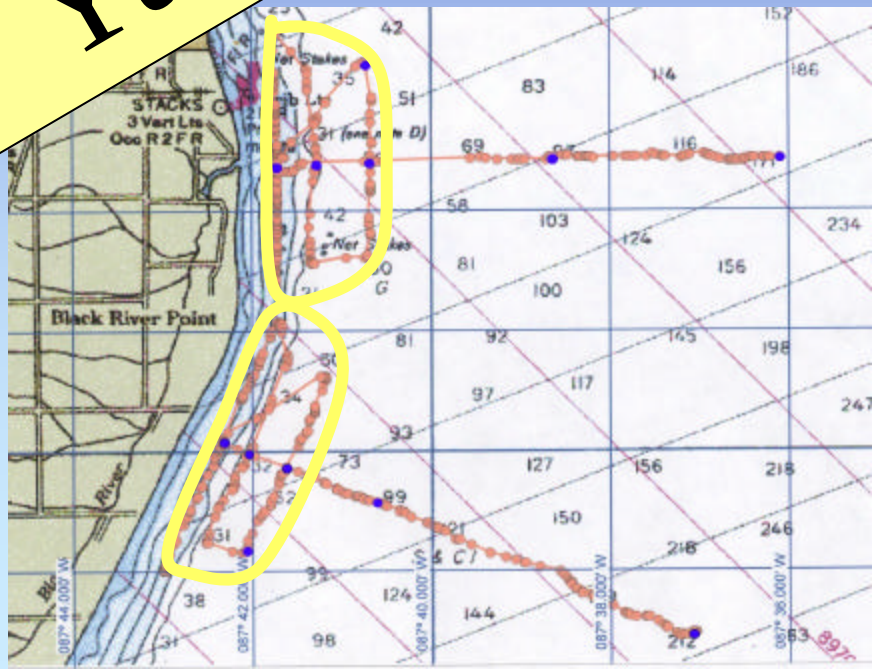
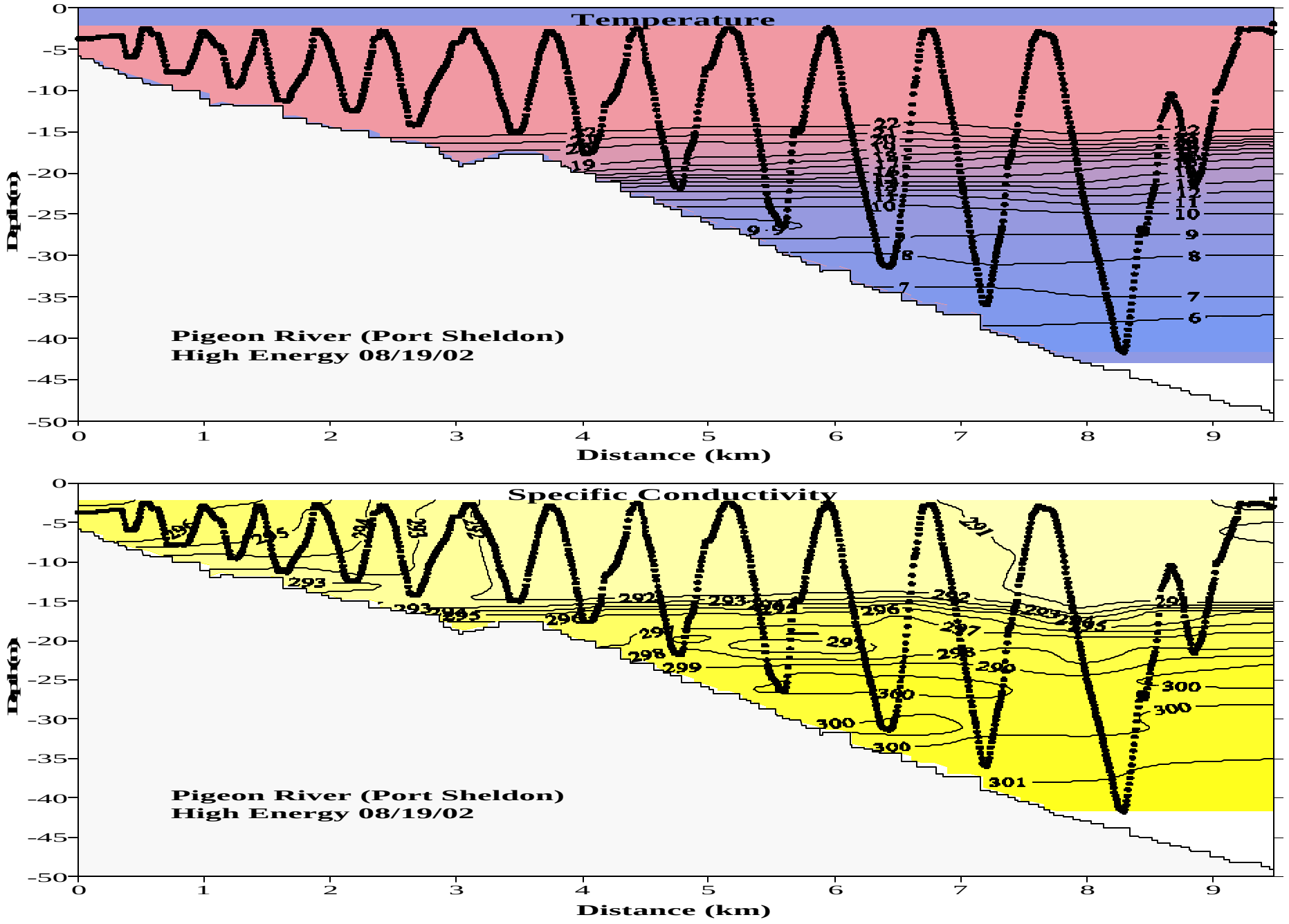
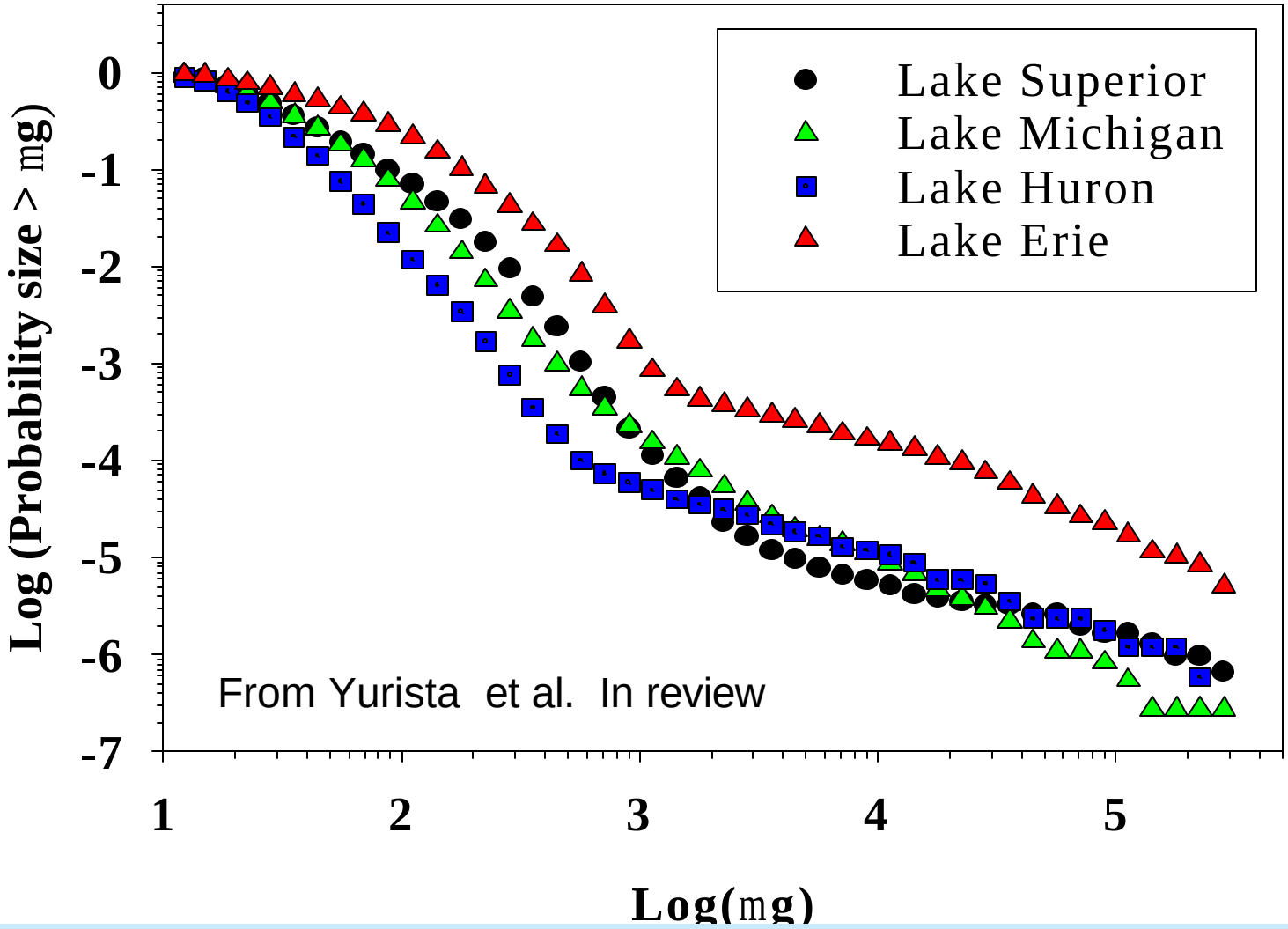


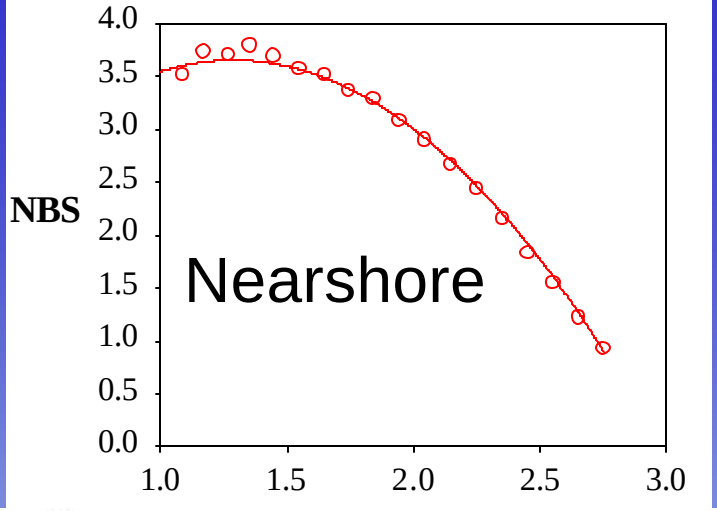
Figure 1 - Schematic of Operating Principle

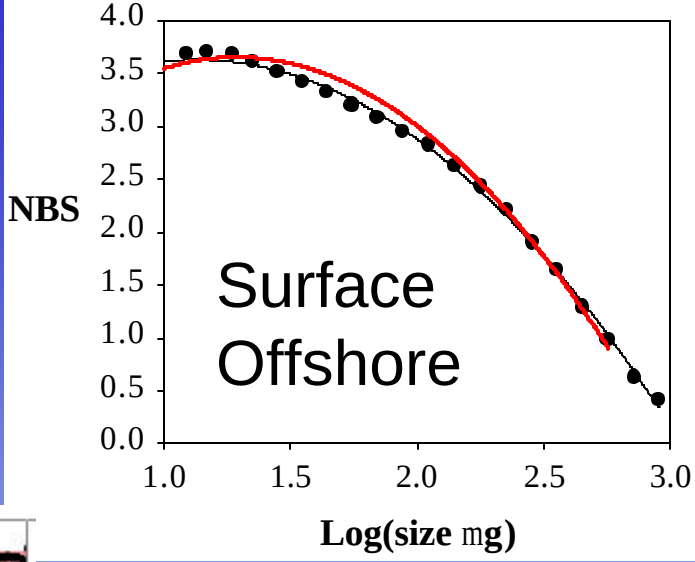


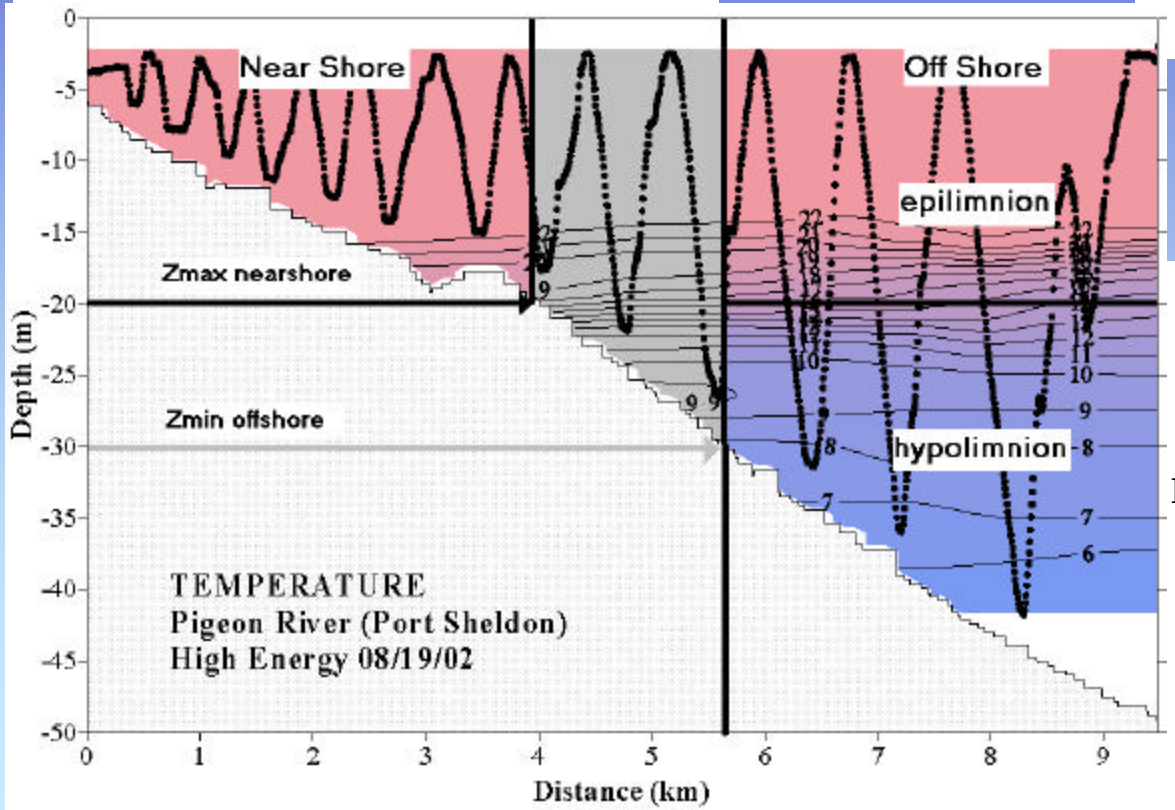

Temperature
Pigeon River (Port Sheldon)
High Energy 08/19/02
Depth(m)
Distance (km)
Specific Conductivity
Pigeon River (Port Sheldon)
High Energy 08/19/02
Depth(m)
Distance (km)

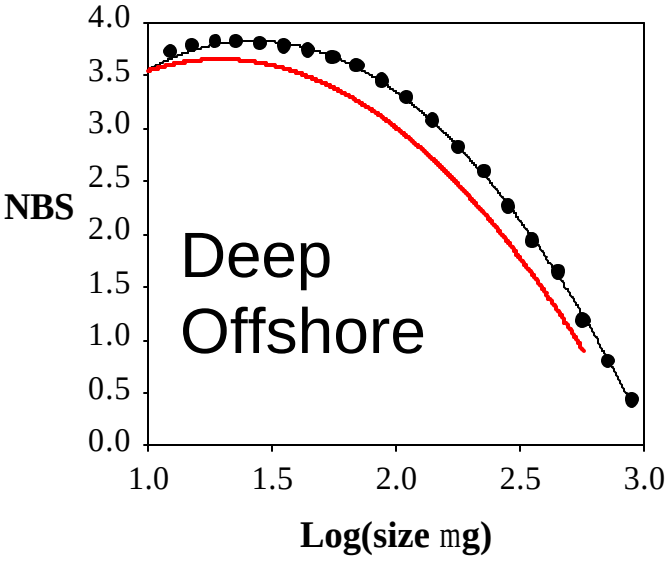
EVALUATION OF ZOOPLANKTON SIZE SPECTRA AS A POTENTIAL ASSESSMENT TOOL

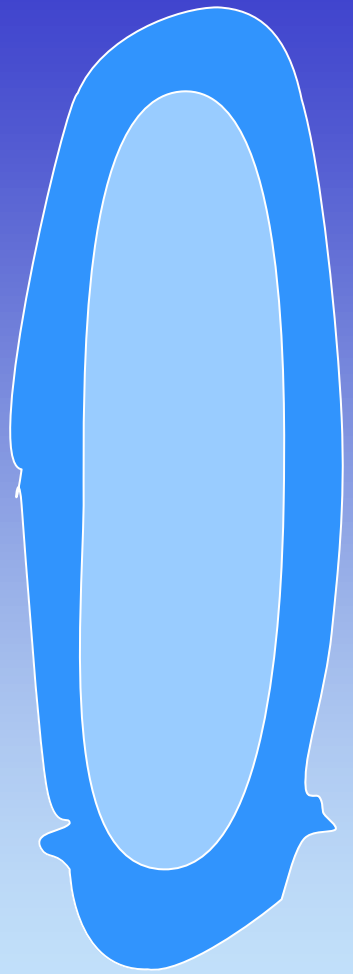


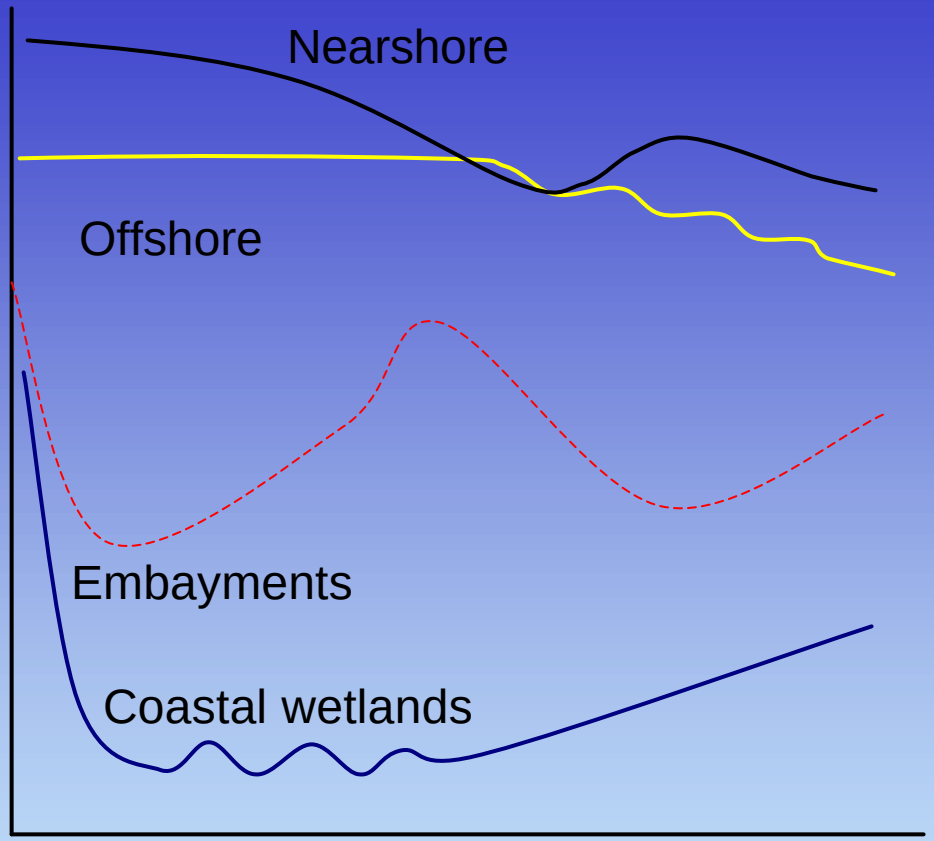

NBS
Nearshore


NBS
Surface
Offshore
Log(size mg)

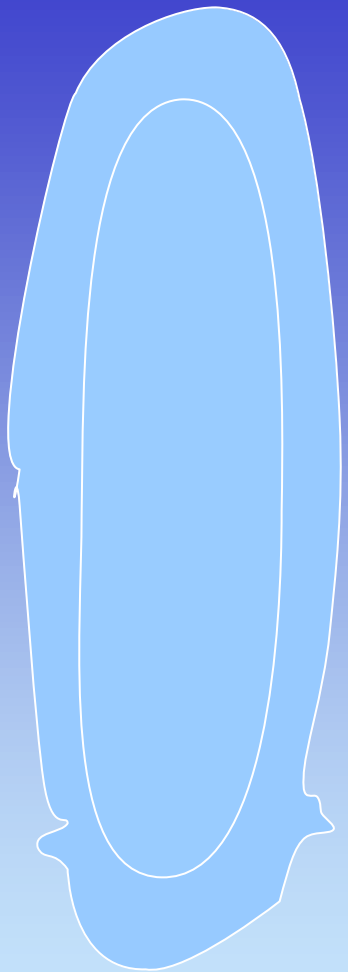

Near Shore
Off Shore
epilimnion
Zmax nearshore
Zmin offshore
hypolimnion
TEMPERATURE
Pigeon River (Port Sheldon)
High Energy 08/19/02
Depth (m)
Distance (km)


NBS
Deep
Offshore
Log(size mg)





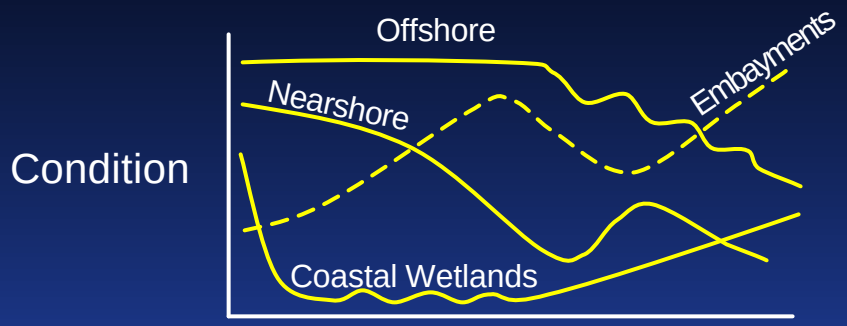
Trends over Time
(Hypothetical)



Circa 1970s?

Circa 2000?

Next Generation Integrated Monitoring and Assessment



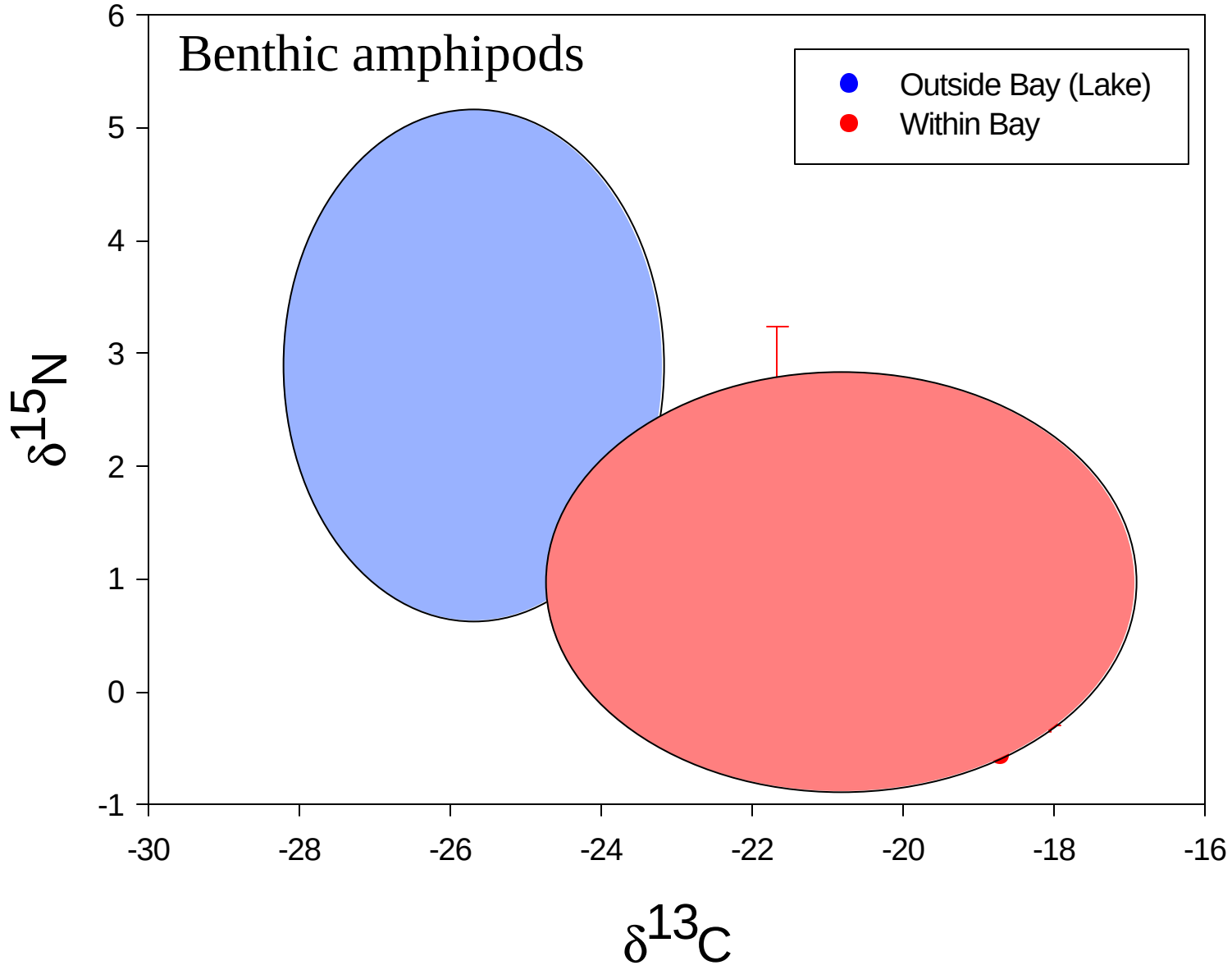
What makes an Embayment?

Tributary receiving waters

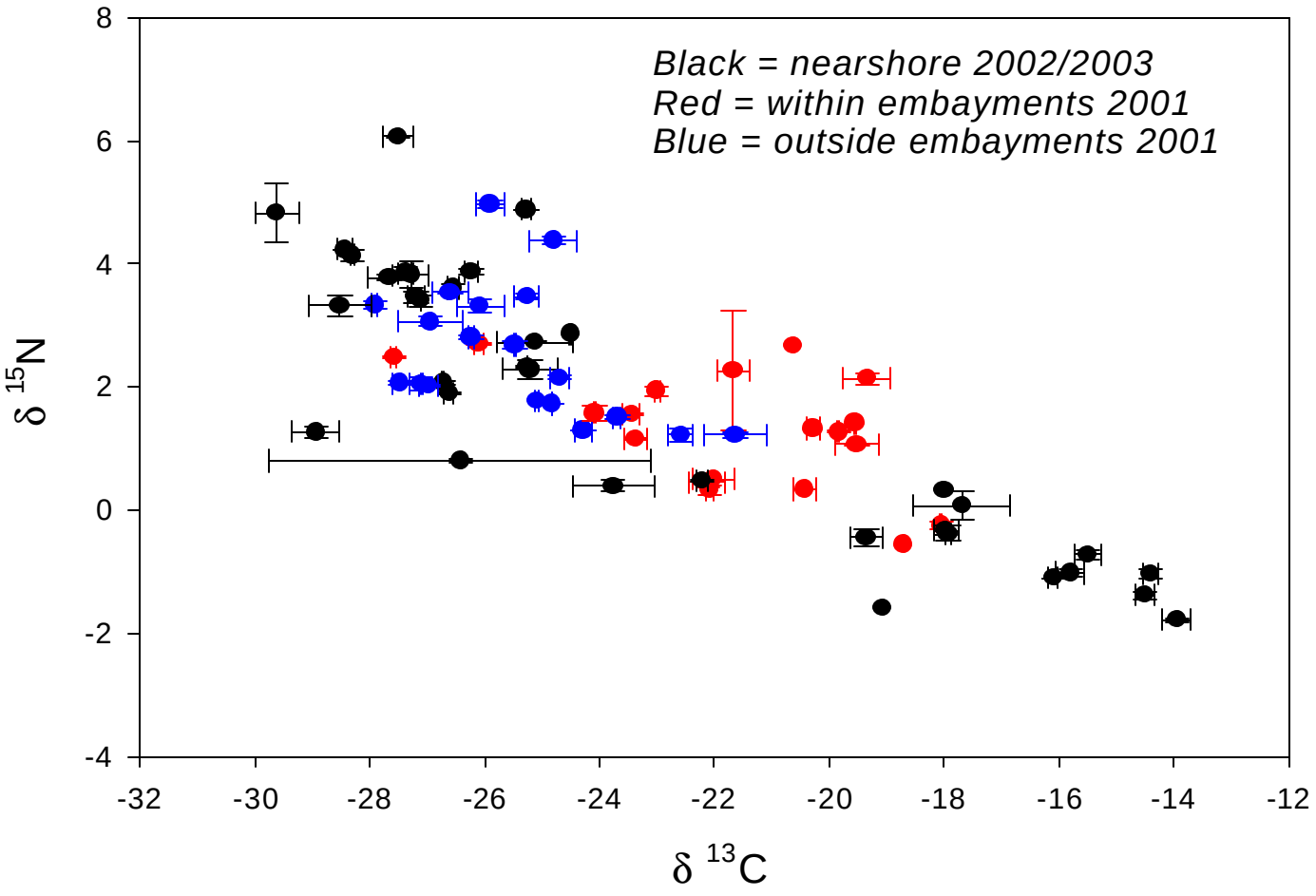
Coastal Wetlands

Open shoreline

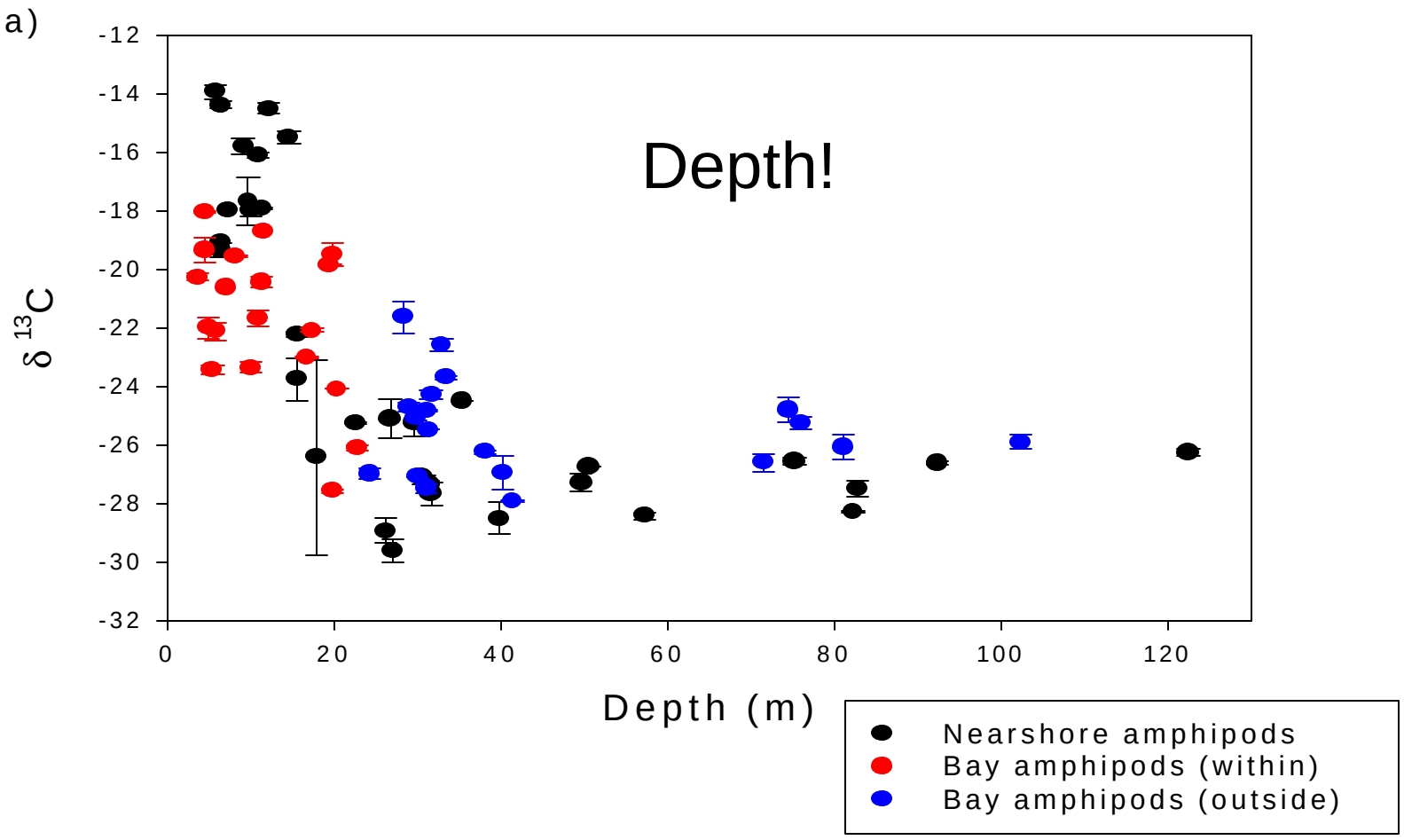
Different food web defines embayments?



Carbon and nitrogen signature relationship for Lake Superior amphipods from embayments and nearshore sites 2001-2003



a) $\delta^{13}C$ and b) $\delta^{15}N$ signatures by depth, for amphipods collected at Lake Superior embayment ('01) and nearshore ('02 and '03) sites



Concepts for an integrated assessment