Ecological Historians of the Indian River Lagoon:

Dolphins Provide Insights into Nutrient Loading and UMEs

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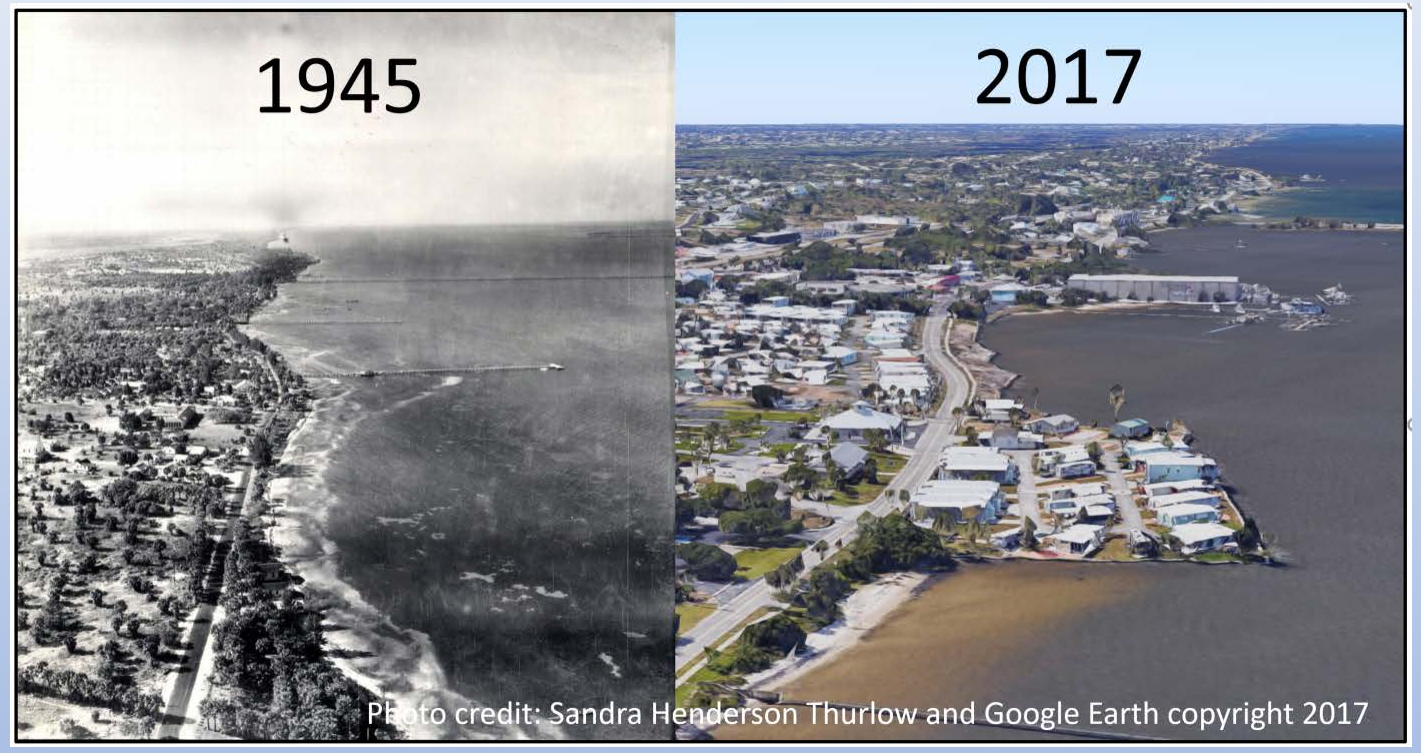
Historic Changes in the IRL

- Increased human Population
  - Nutrient Pollution
  - Increased boat traffic
- Dredging
- Altered shoreline
- Increased fishing



How can we assess changes in ecosystem function on a decadal scale?

Bottlenose dolphins: Integrators of marine ecosystem health

- Dolphins are indicators of ecosystem health
  - Long-lived
  - Multigenerational residents
  - Top predators

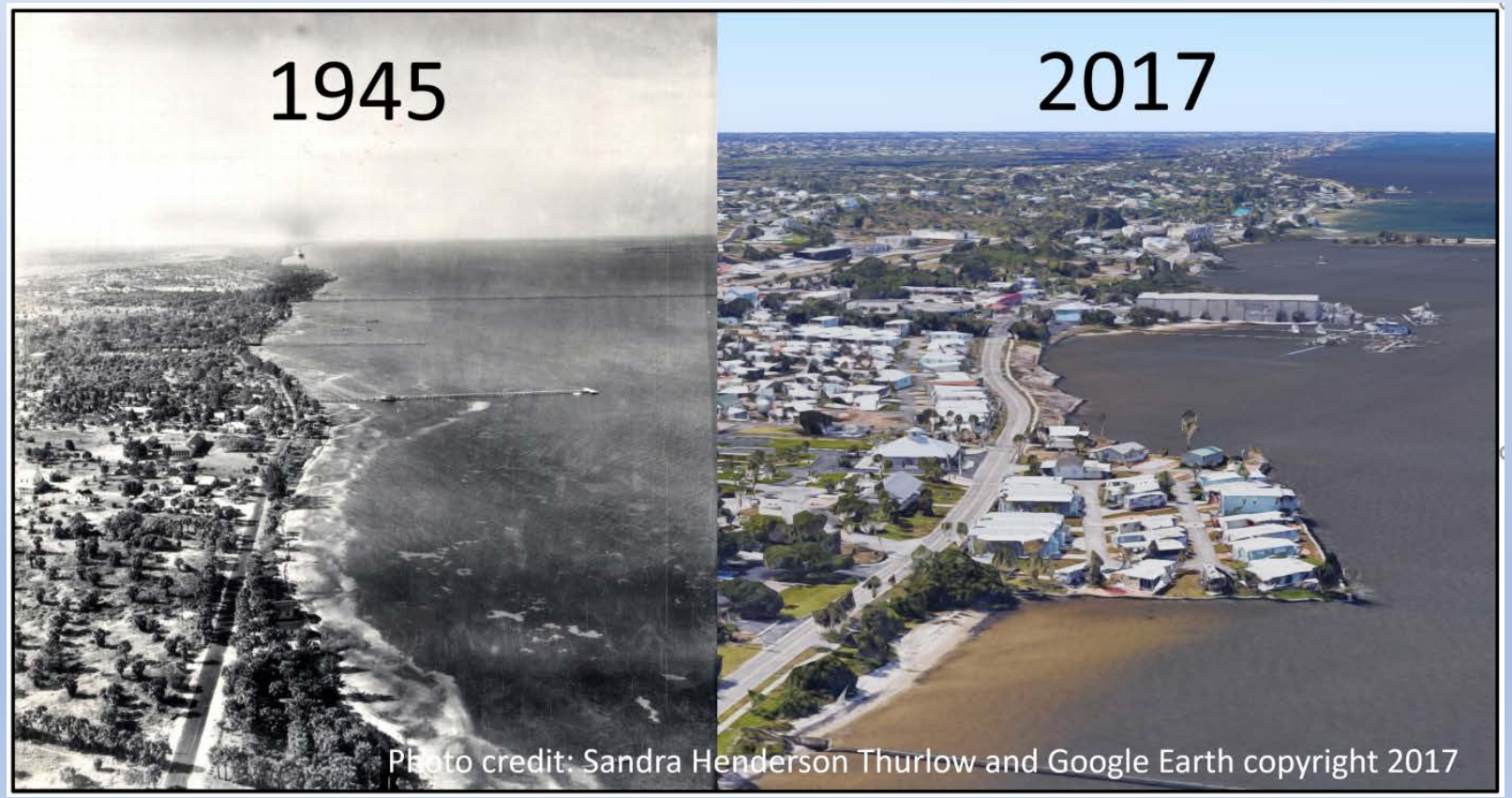
Poor dolphin health → impaired ecosystem

Unexplained Mortality Events Plague IRL

- 2001
  - 41 Mortalities
  - **Unexplained**
- 2008
  - 48 Mortalities
  - **Unexplained**
- 2013
  - >70 Mortalities
  - **Unexplained**

IRL is functioning in an impaired ecosystem state

How can we assess historical ecology of IRL?



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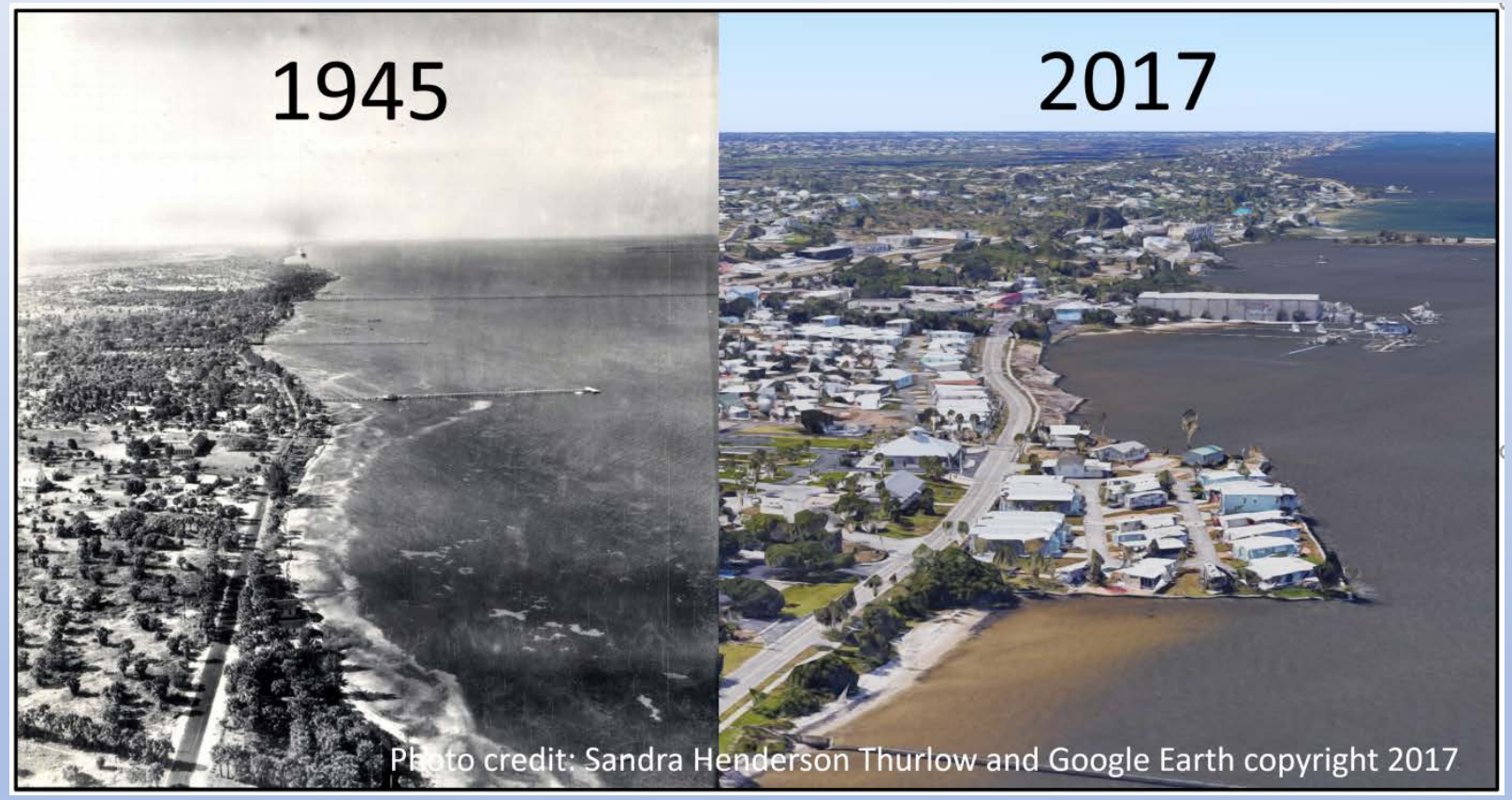
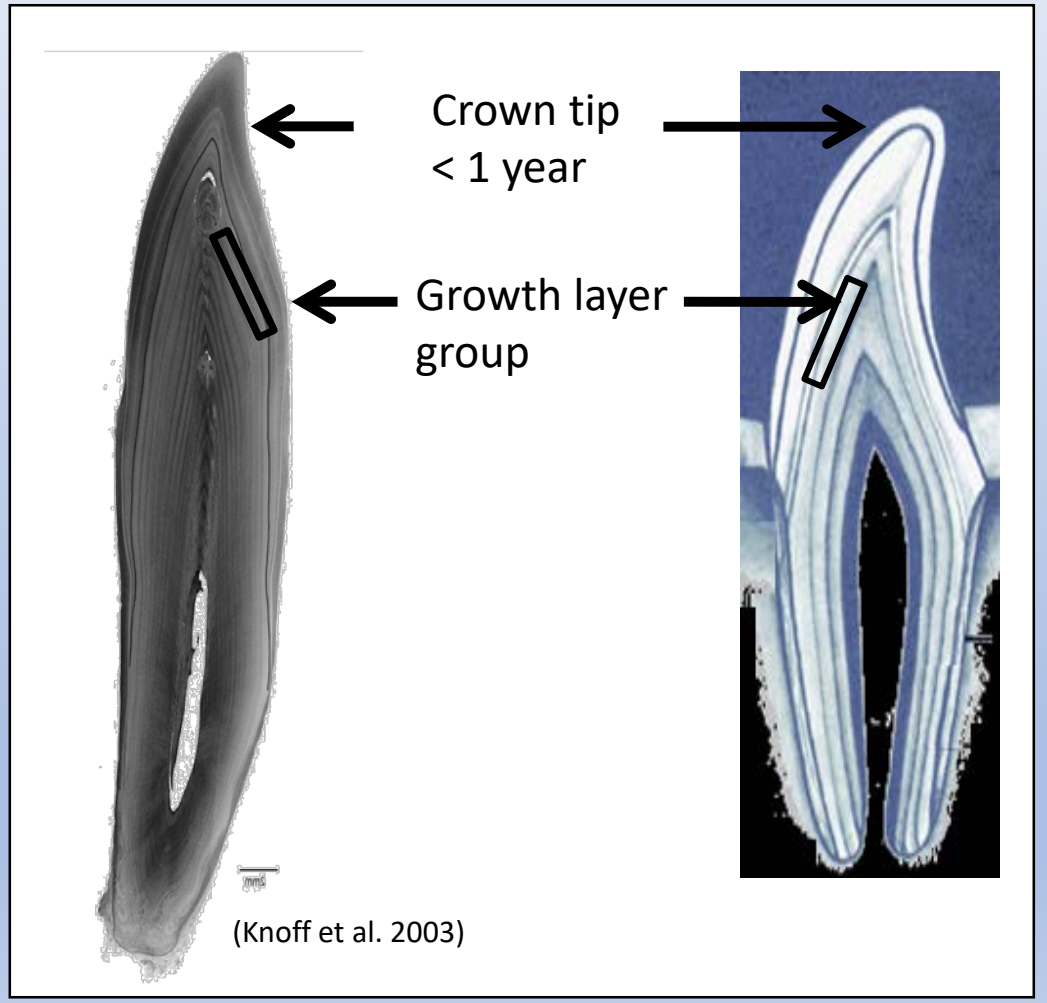


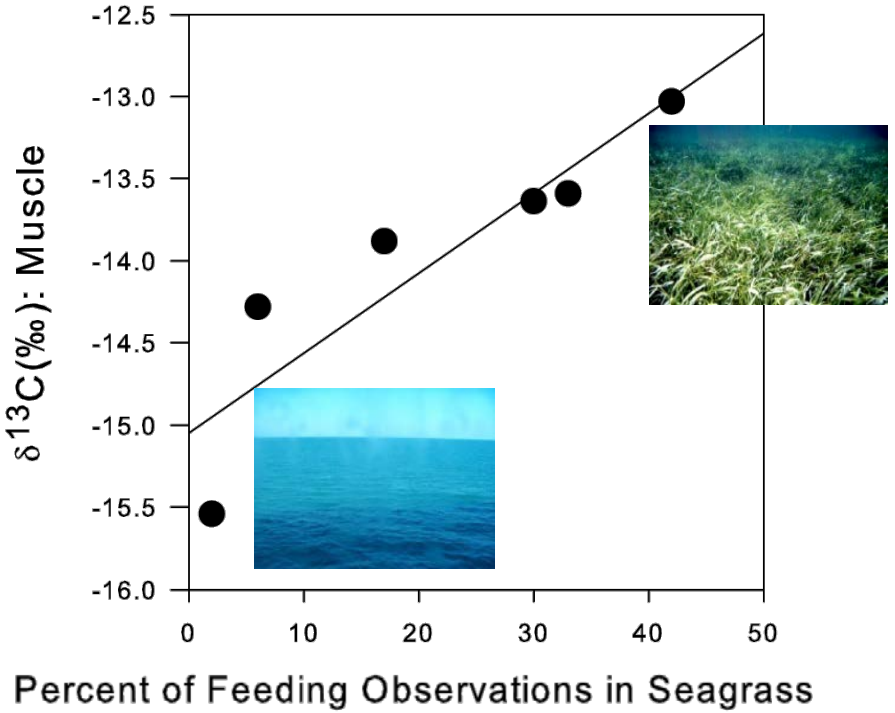
Study wildlife that lived through ecological changes

Historical Ecology in the IRL

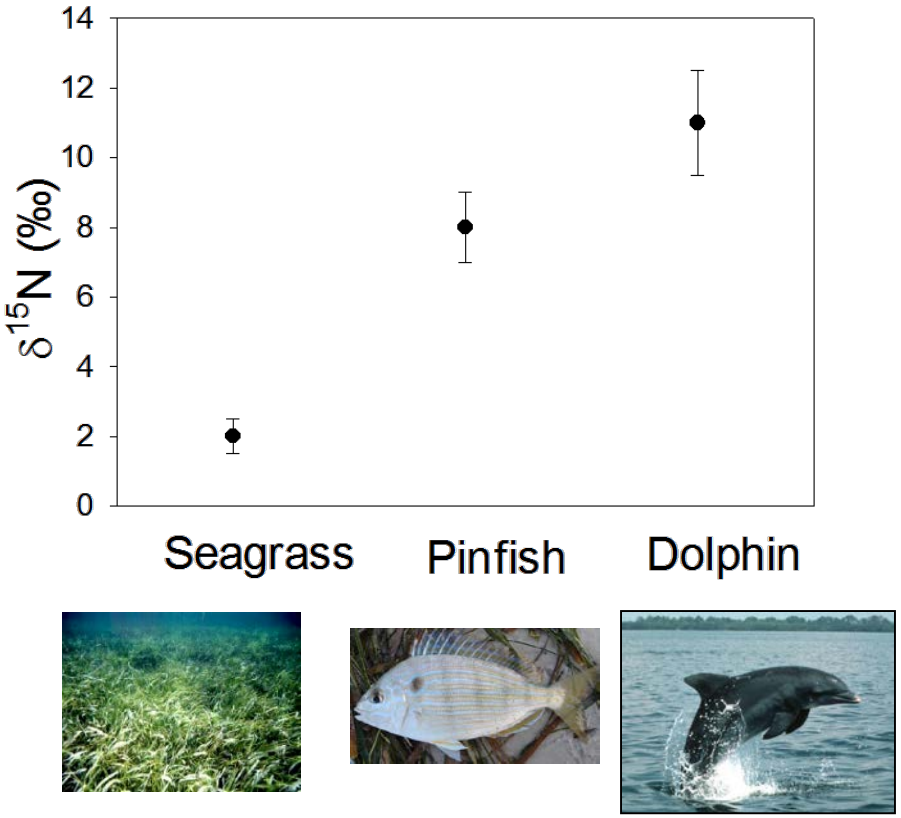
- Dolphin teeth are laid down in layers, like tree rings
- HSWRI has records which extend into the 1950s
- This material may contain important insight into the past ecology of the IRL



Stable Isotopes Record Ecological Information



(Rossman et al. 2013)



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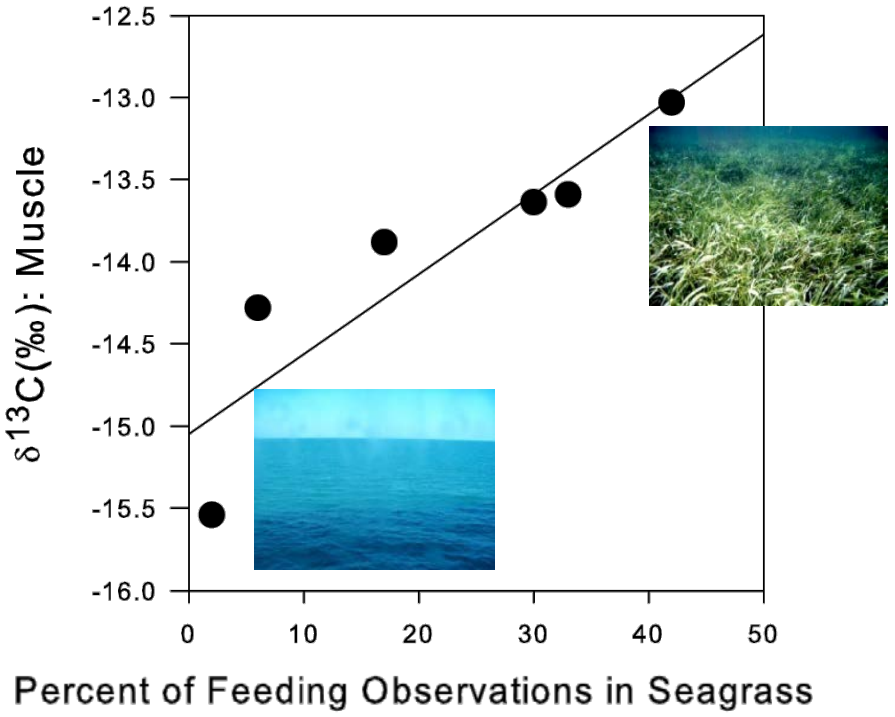

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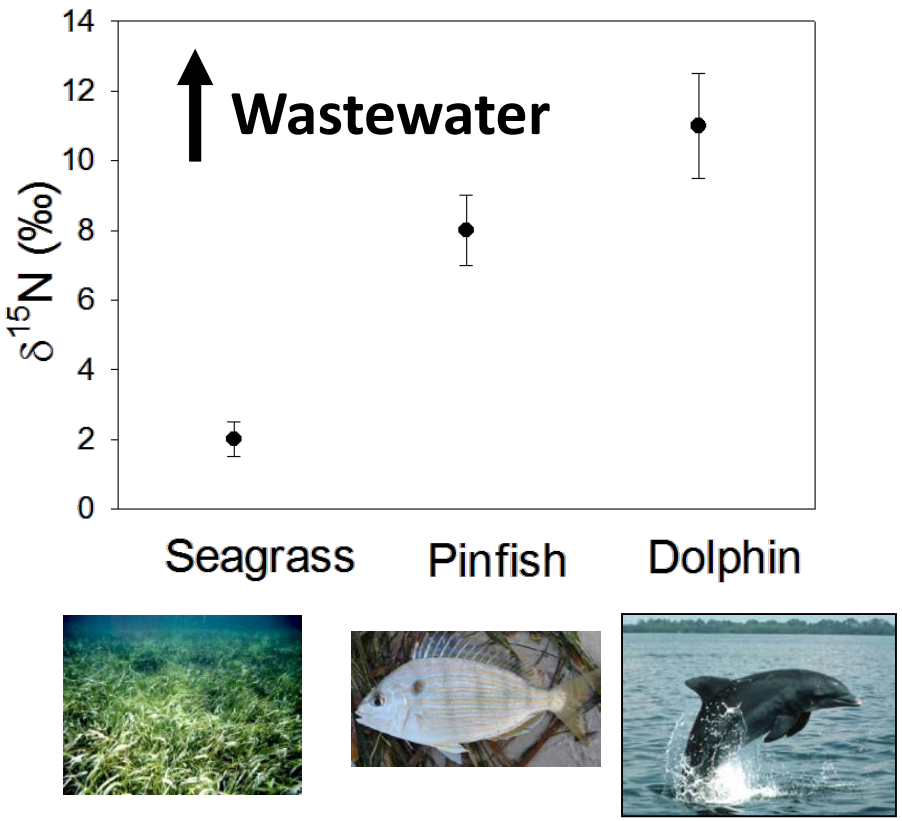
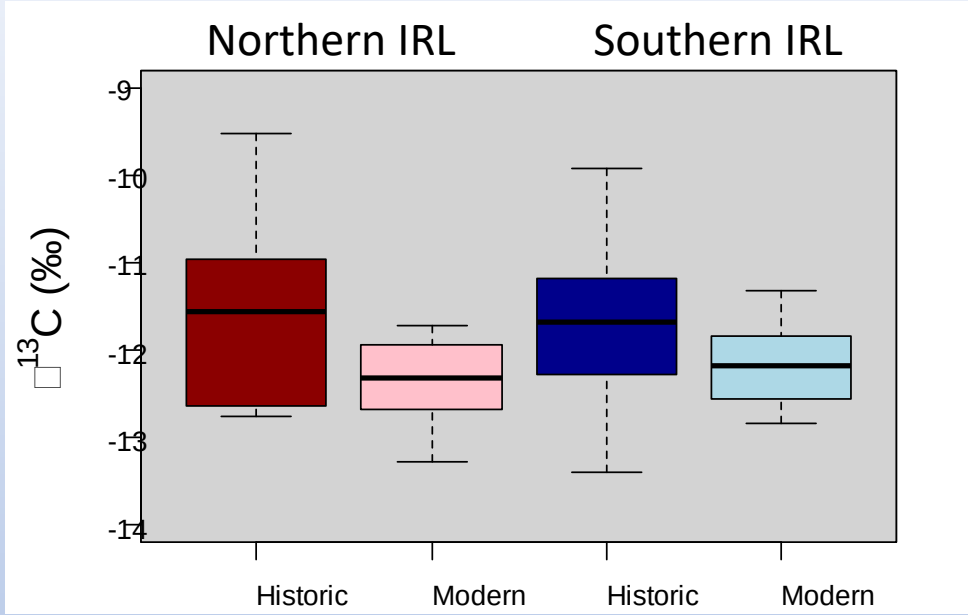


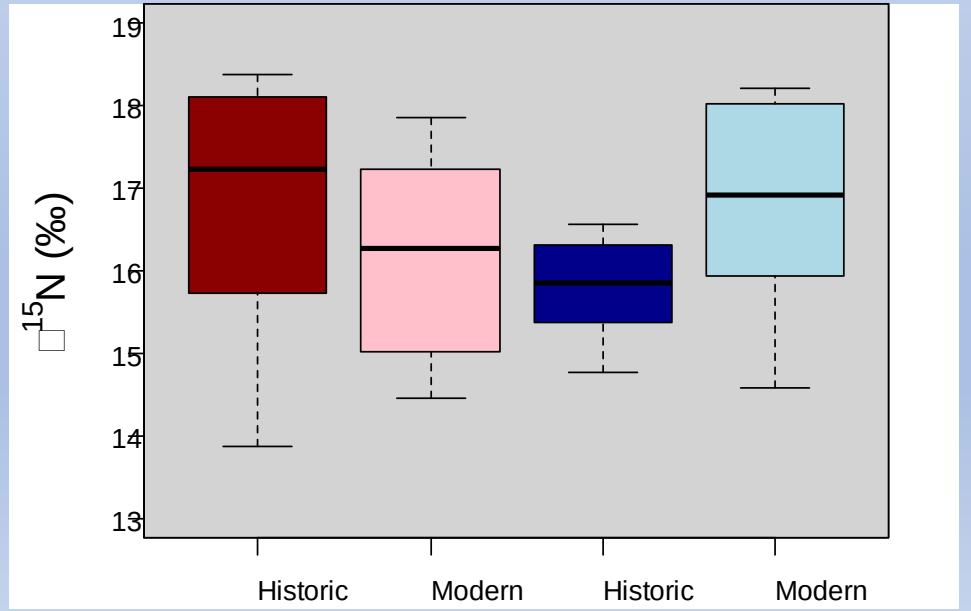
Historical Ecology of IRL Bottlenose Dolphins

Small sample size but…

- Less seagrass use by modern N. IRL dolphins
- No significant change in $\delta^{15}N$

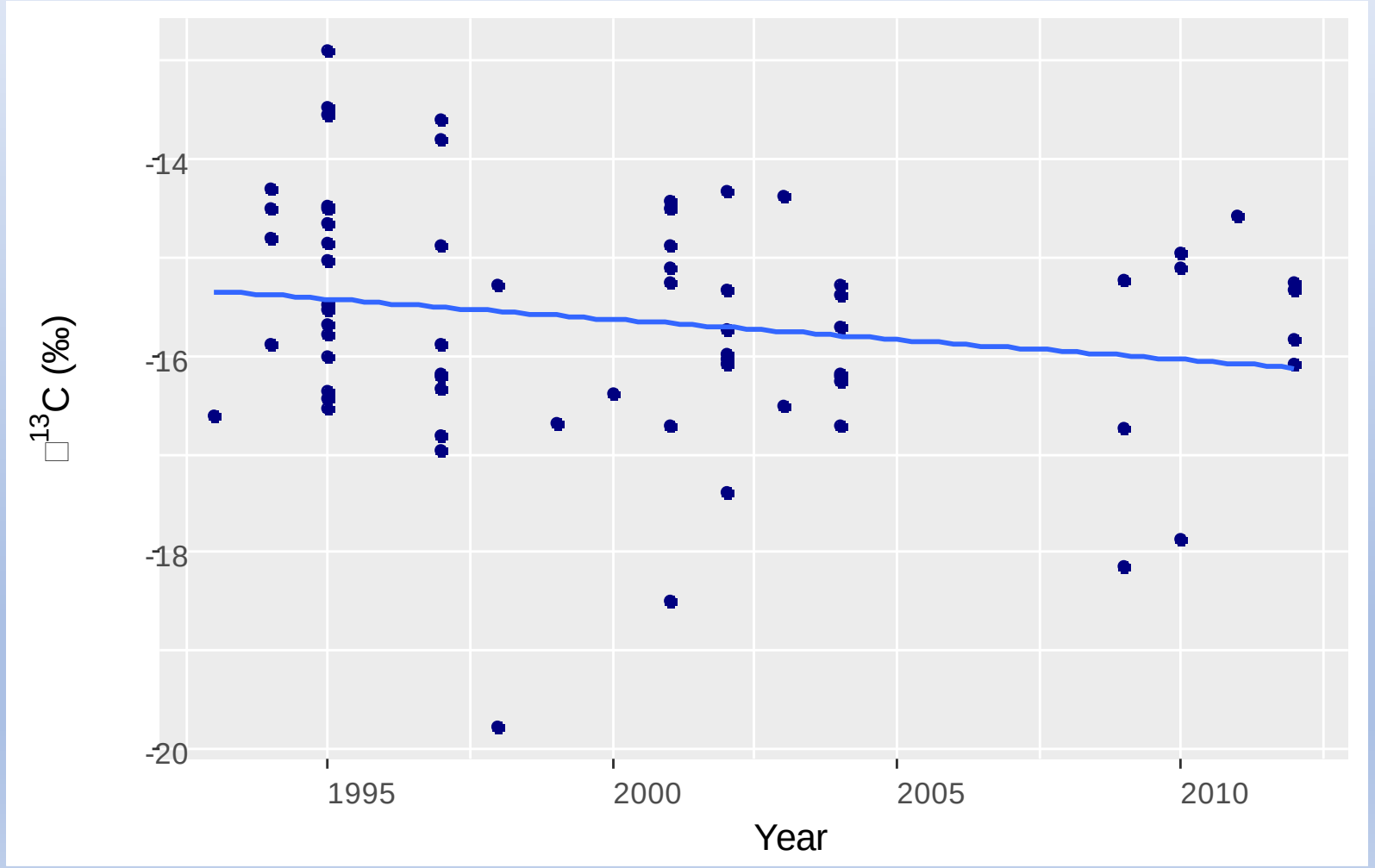
More samples to be run thanks to funds from IRL NEP





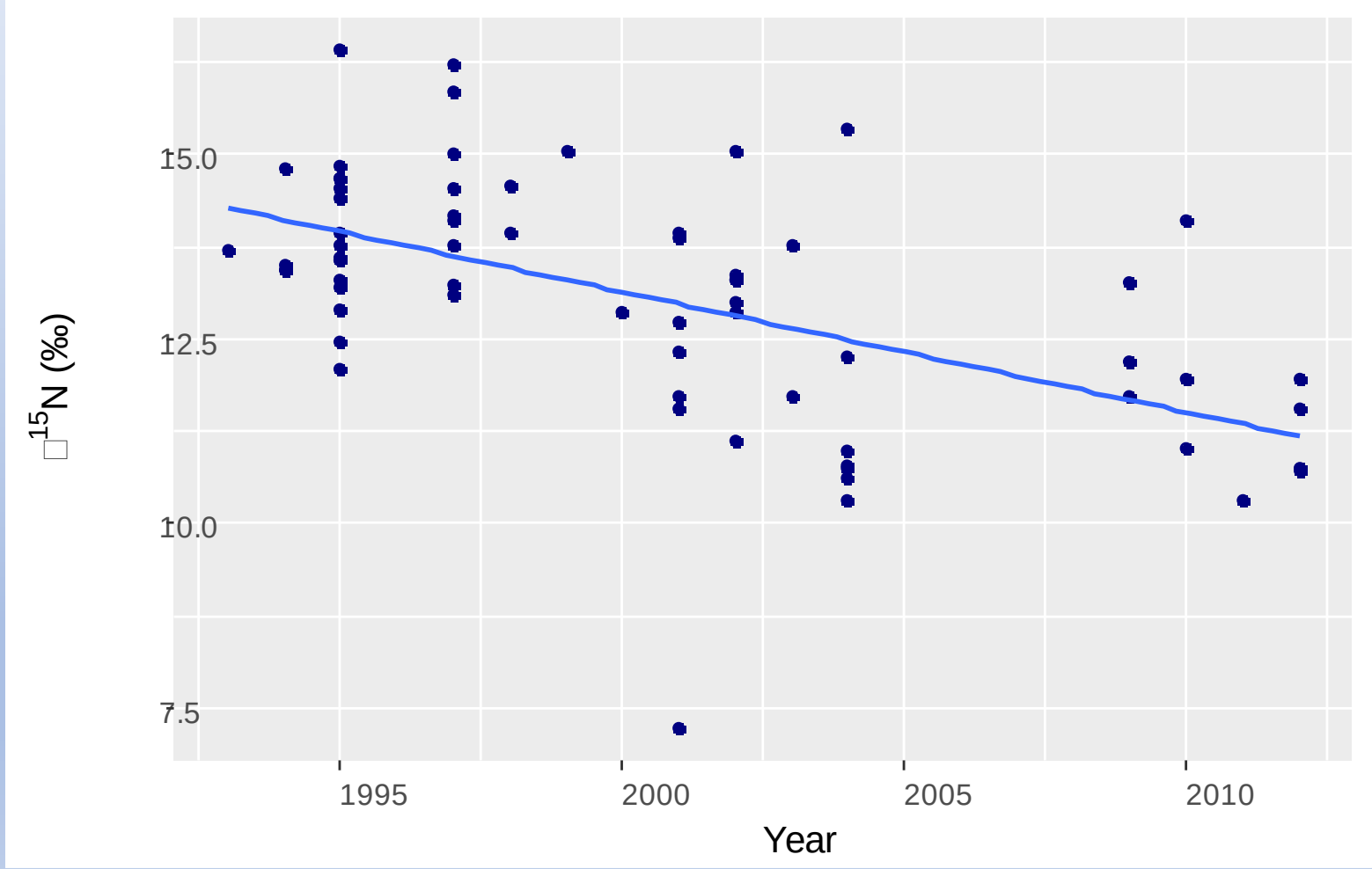
Changes in foraging habitat 1998 to 2012

- No significant change in habitat use
- Decline in seagrass habitat use may be specific to females with young



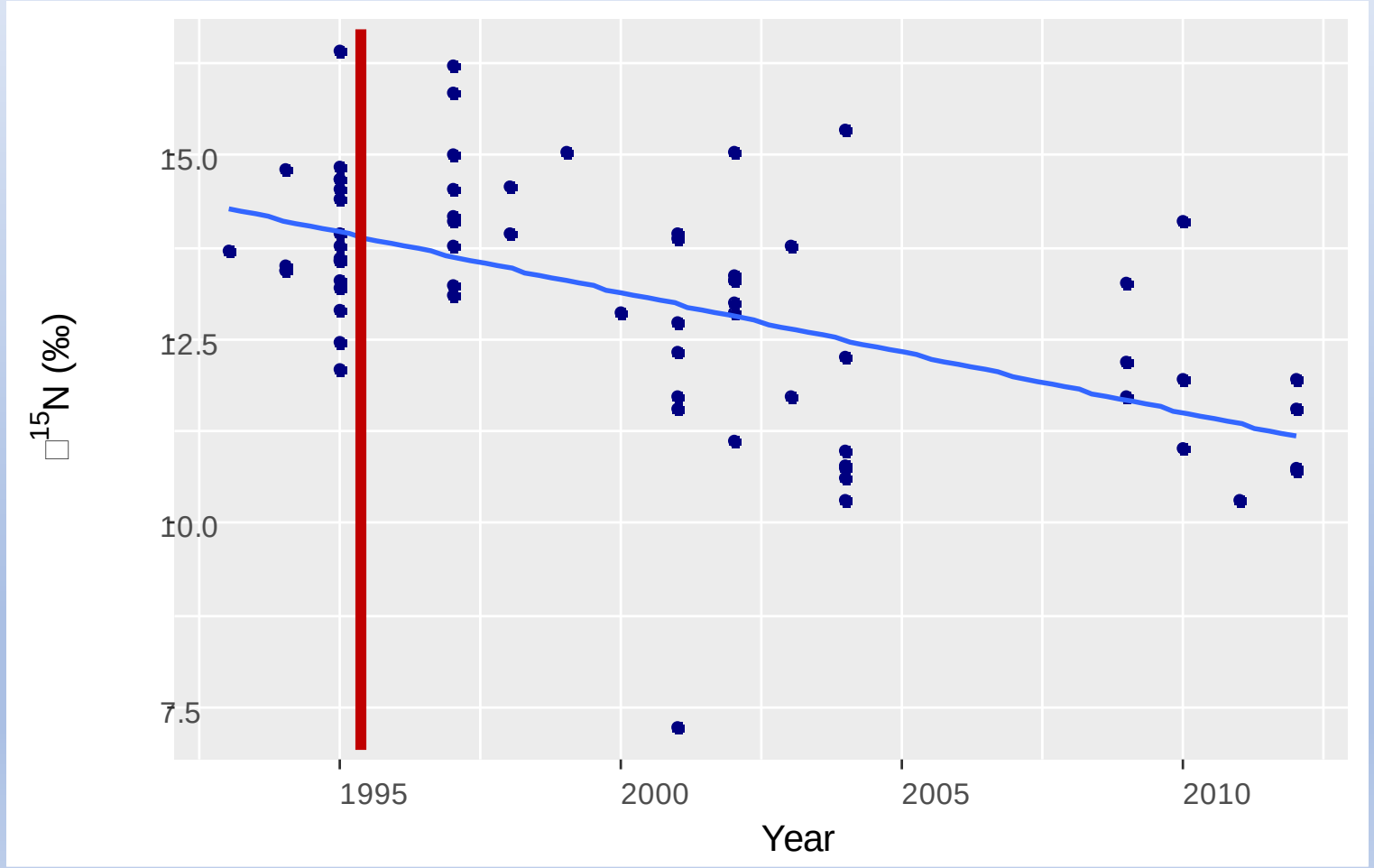
Changes in Nitrogen Cycling 1998 to 2012

- Significant decline in nitrogen isotope values

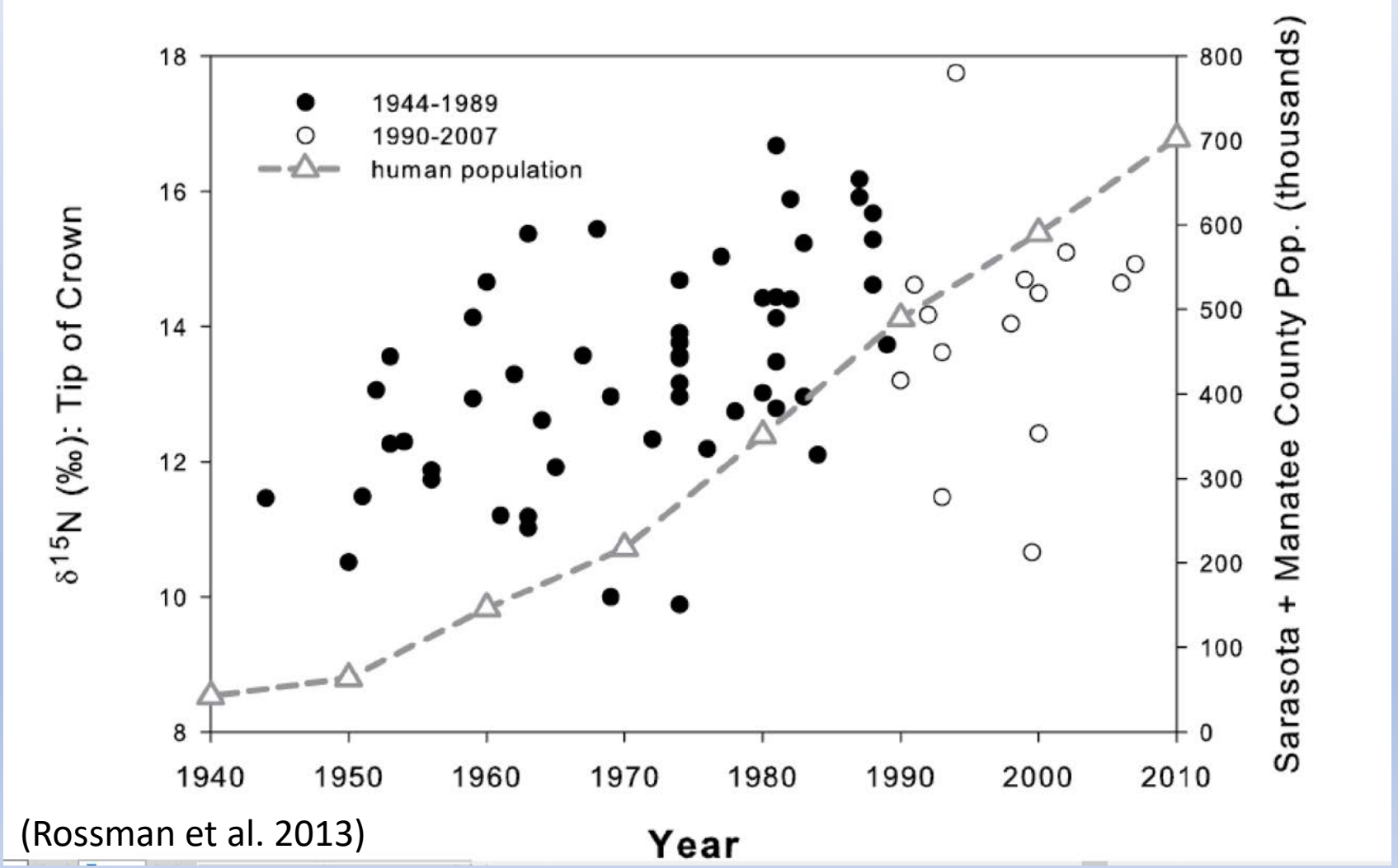


Changes in Nitrogen Cycling

Cessation of direct discharge of wastewater into IRL



Dolphins also Record Wastewater treatment in Sarasota Bay



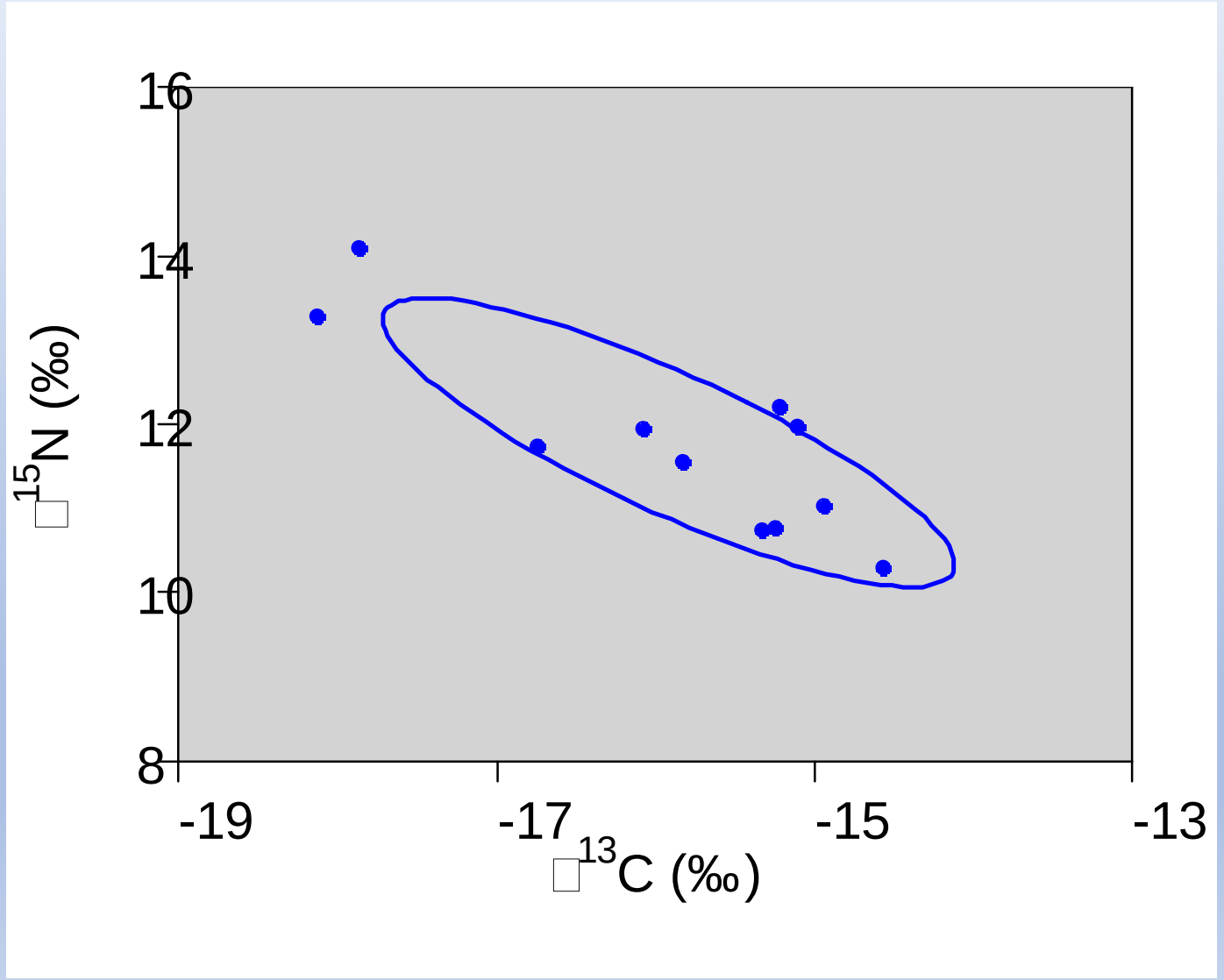
(Rossman et al. 2013)

Insights into 2013 UME

- Hypothesized to be the result of loss of seagrass habitat in 2011-2012 during agal “super-bloom”
- Only consistent pathological finding was emaciation
- Concurrent manatee and pelican UMEs

Foraging habits 2009-2012

- Both seagrass and open water habitat used before 2013 UME
- If loss of seagrass caused 2013 UME → expect high $\delta^{13}C$



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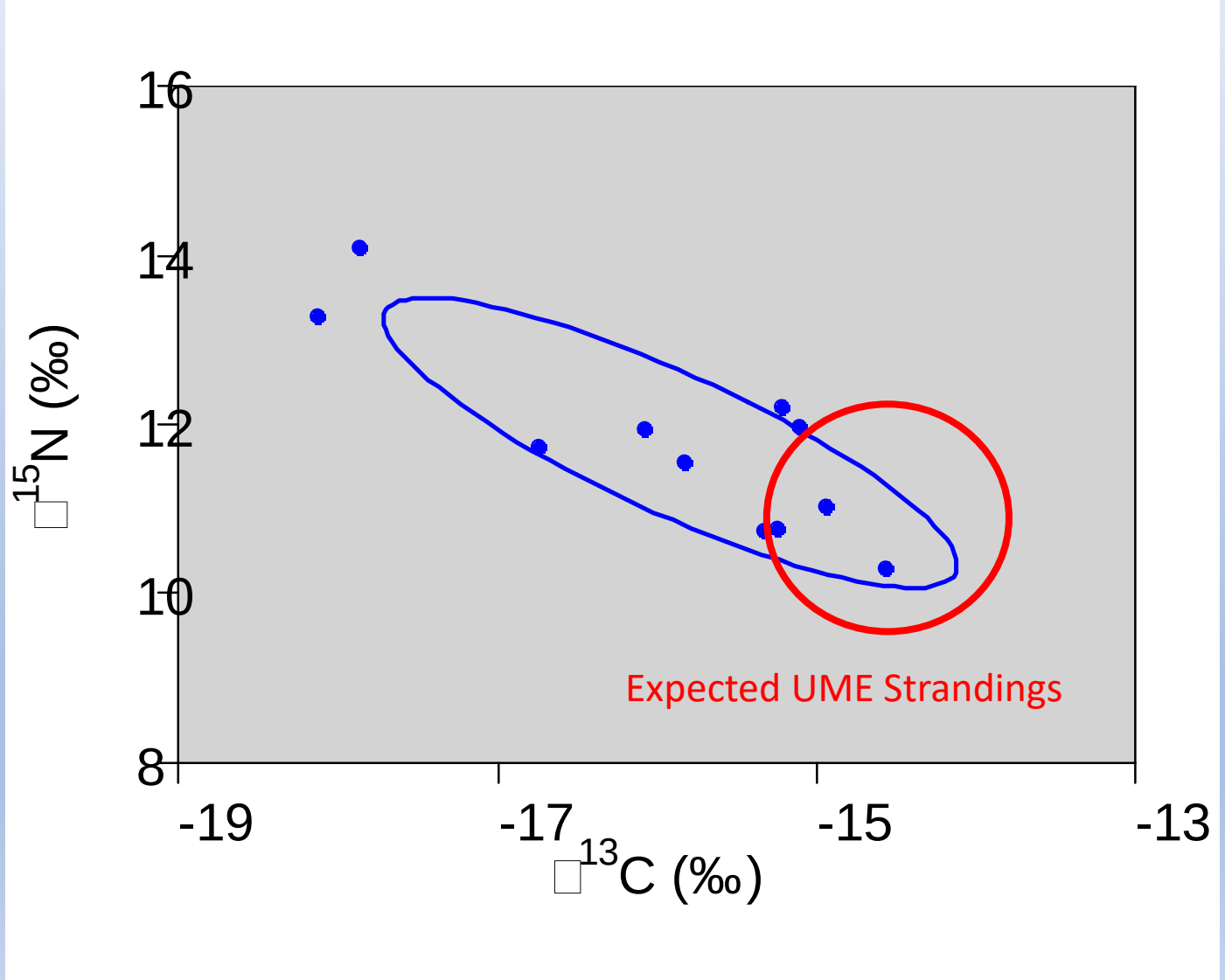
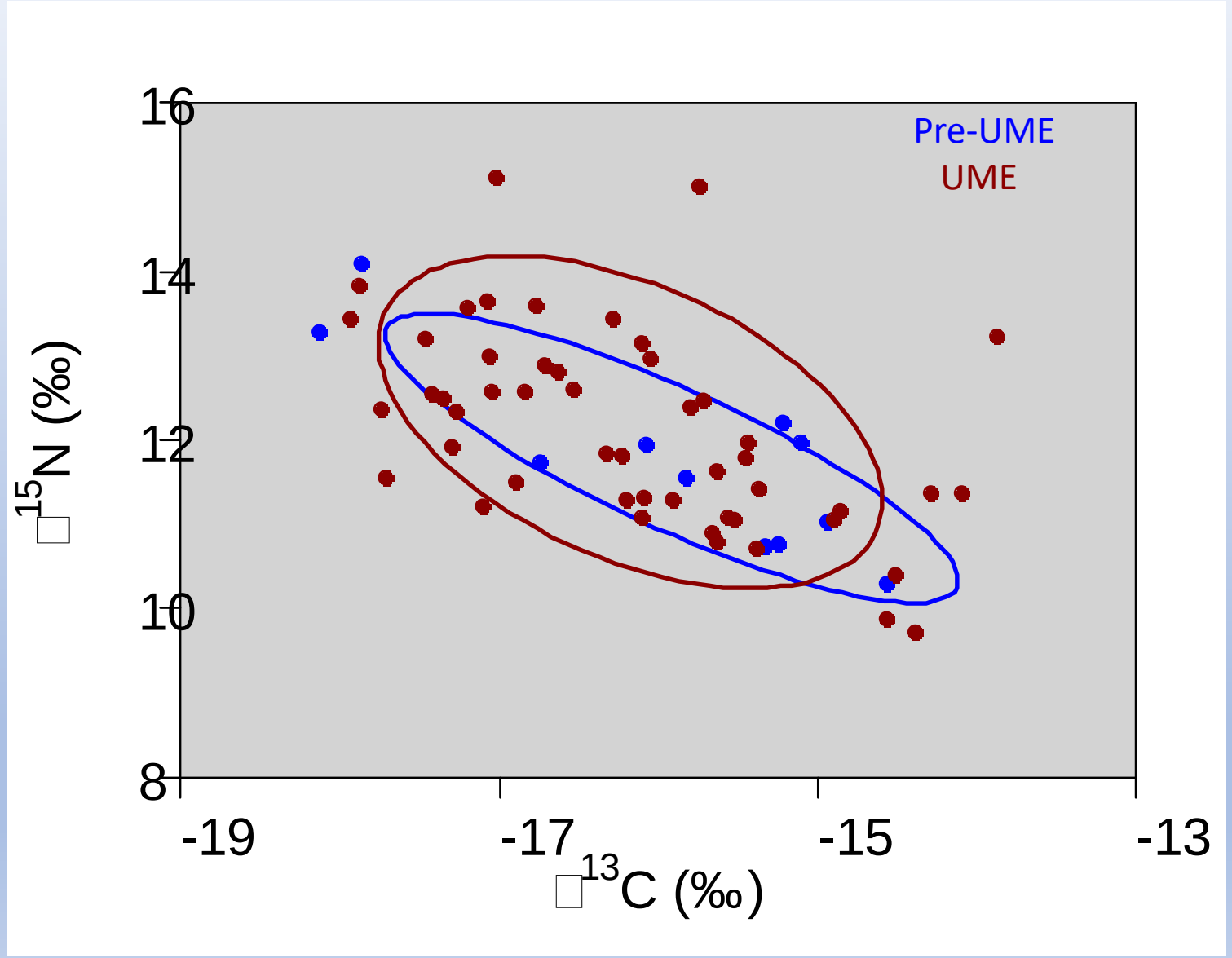


2013 UME

- Isotope values of bottlenose dolphins nearly identical before and during UME
- **Loss of seagrass unlikely to be causal in 2013 UME**



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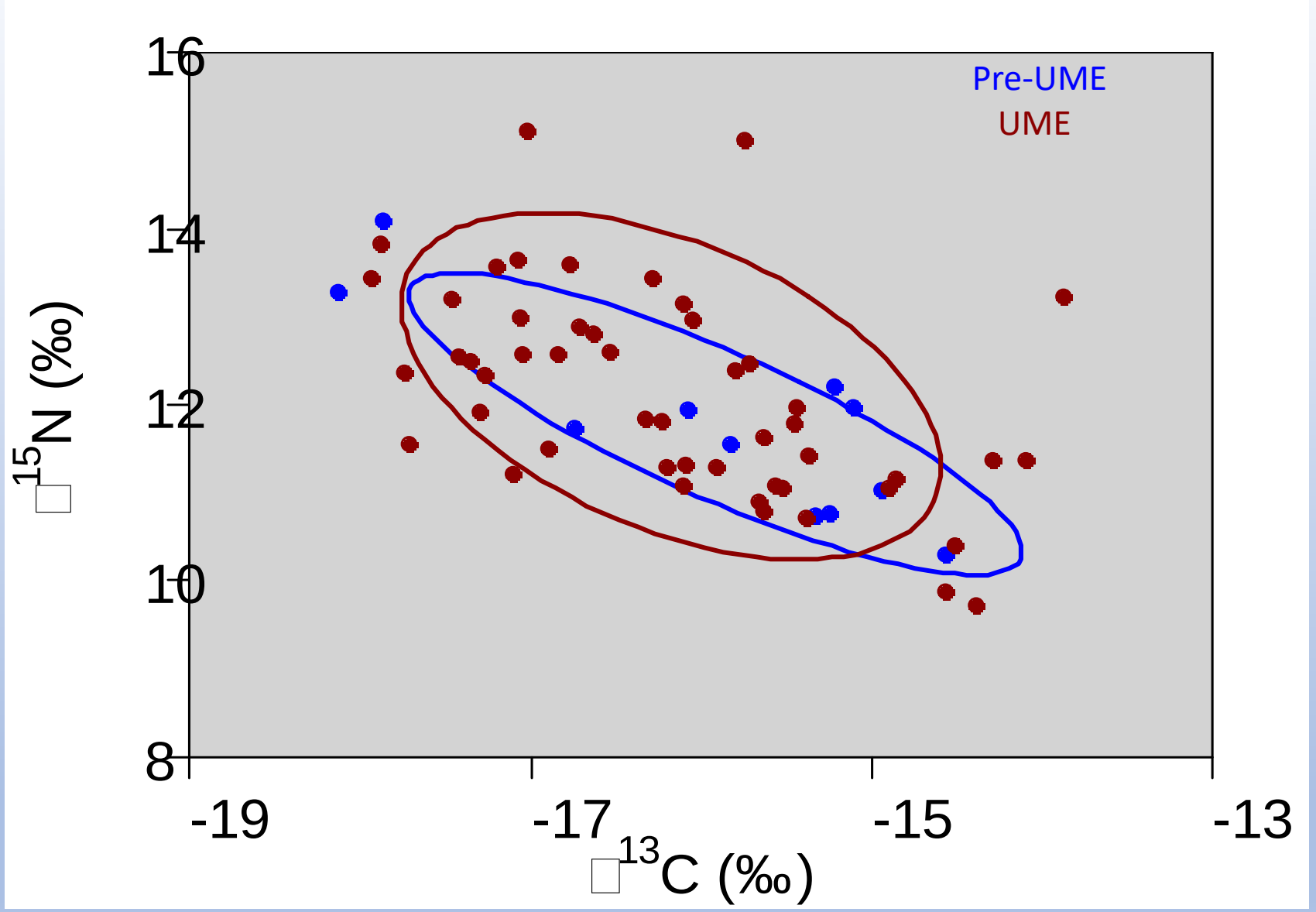

Perhaps bottlenose dolphin UME and loss of seagrass should be viewed as separate symptoms of larger epidemic

Conclusions

- Bottlenose dolphins can provide ecological insight into past where little other environmental data exists
- IRL is an impaired ecosystem experiencing a myriad of environmental impacts

- But… there is hope, our data from 1990s to present demonstrate the ability to make positive remediation in nitrogen pollution

Next Steps

- Comprehensive review of bottlenose dolphins health in IRL
- Further testing of historical samples to gain additional insight into past nitrogen cycle in IRL
- Formation of IRL Wildlife Consortium

Special Thanks to:

- IRL National Estuary Program
- Discover Florida's Oceans
- SeaWorld Busch Gardens Conservation Fund
- Prescott Marine Mammal Health Stranding Award
- Brevard County Tourism and Development Committee
- Teresa Jablonski and HSWRI Volunteers