How do lower-estuary marshes support fishery production in NC?

Shelby Ziegler
RAMCS
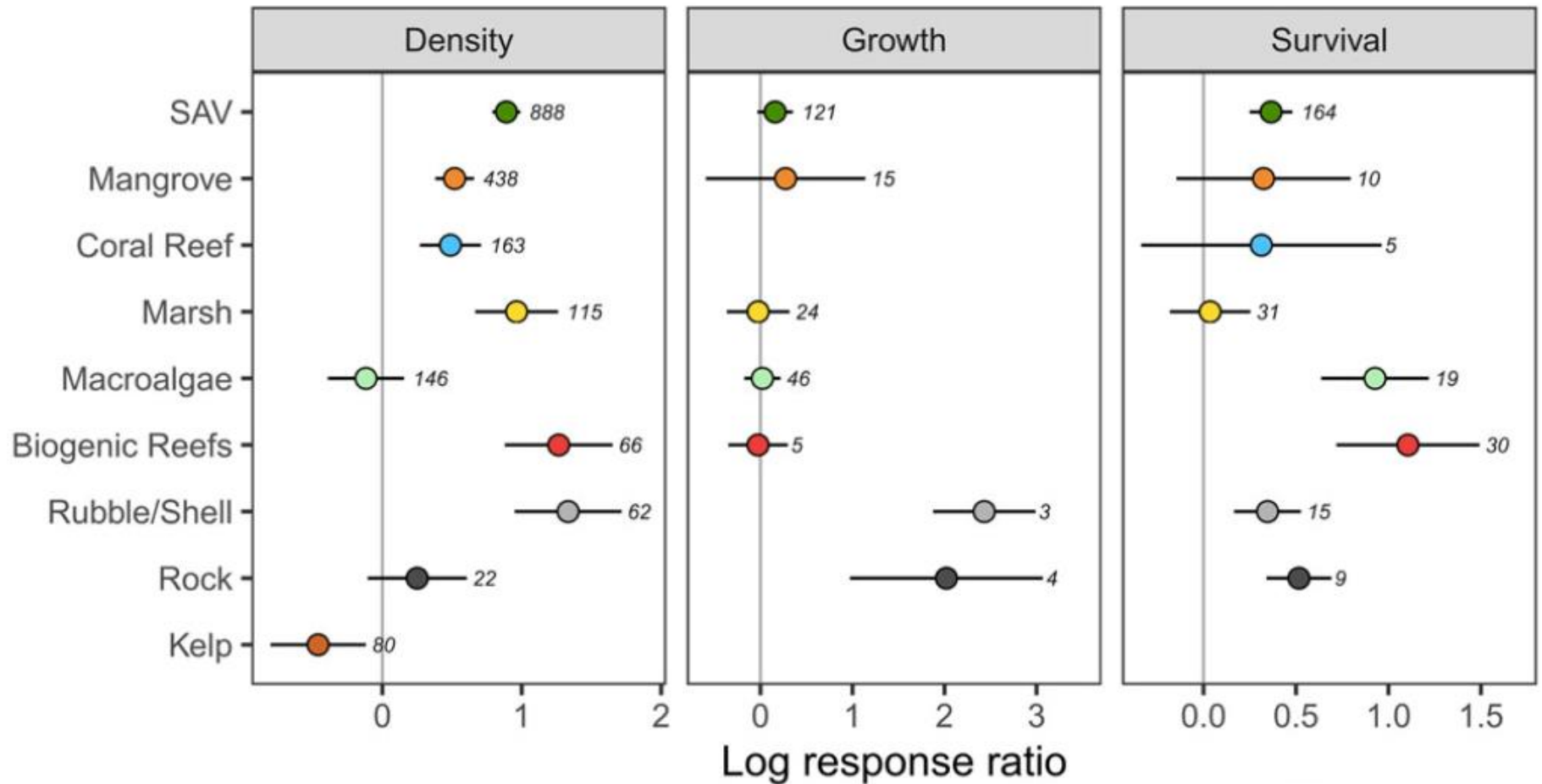2019-03-29

UNC INSTITUTE OF MARINE SCIENCES
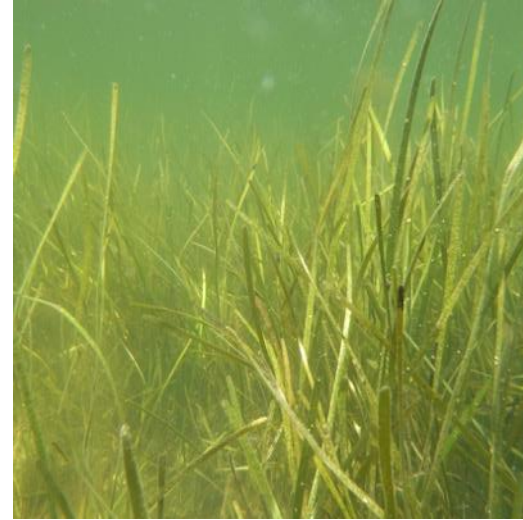
EEP

Structured coastal habitats are important for fish and crustacean density, growth, and survival

Lefcheck et al. 2019

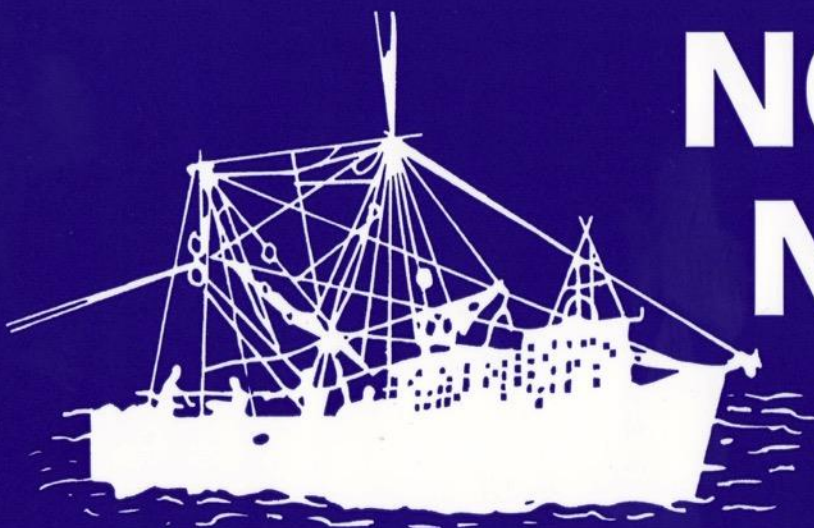# Structured coastal habitats are being lost globally

>40% decline

30% decline

30% decline

65-85% decline

Gedan & Silliman 2009
Waycott et al 2009
Alongi 2002
zu Ermgassen et al. 2012

NO WETLANDS NO SEAFOOD

North Carolina Coastal Federation
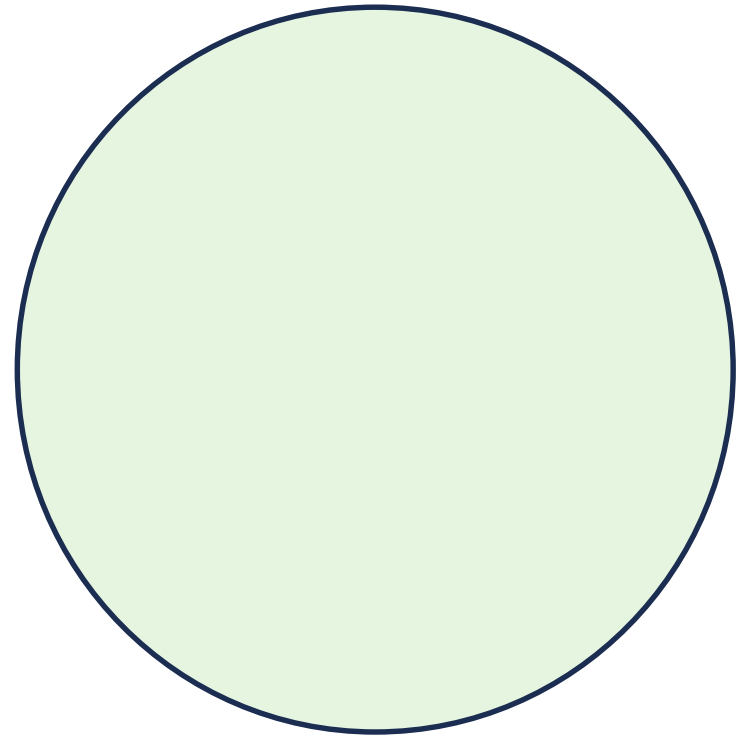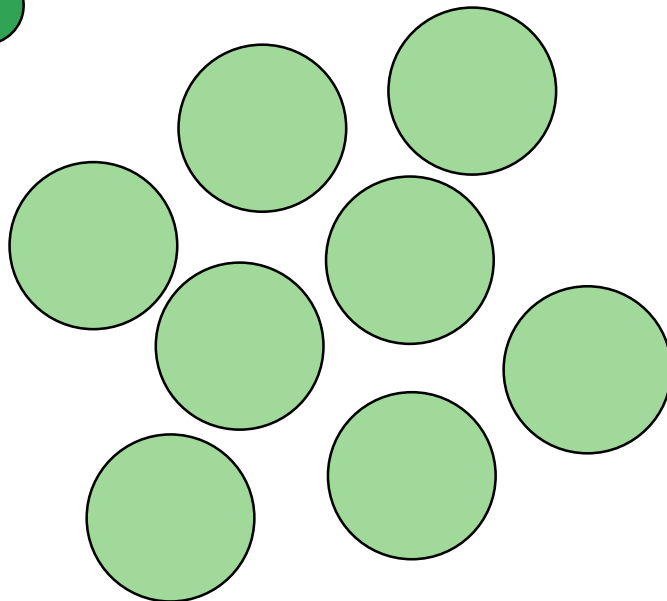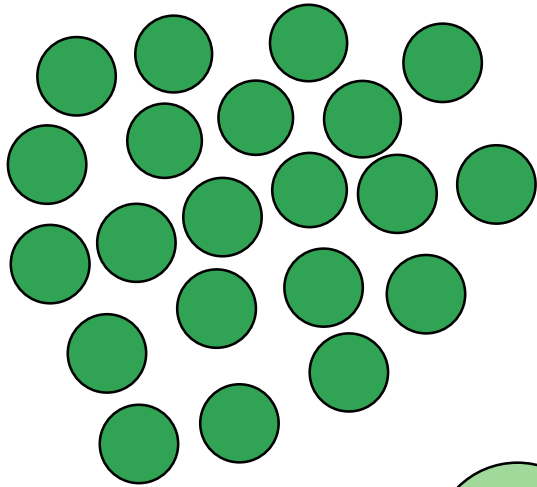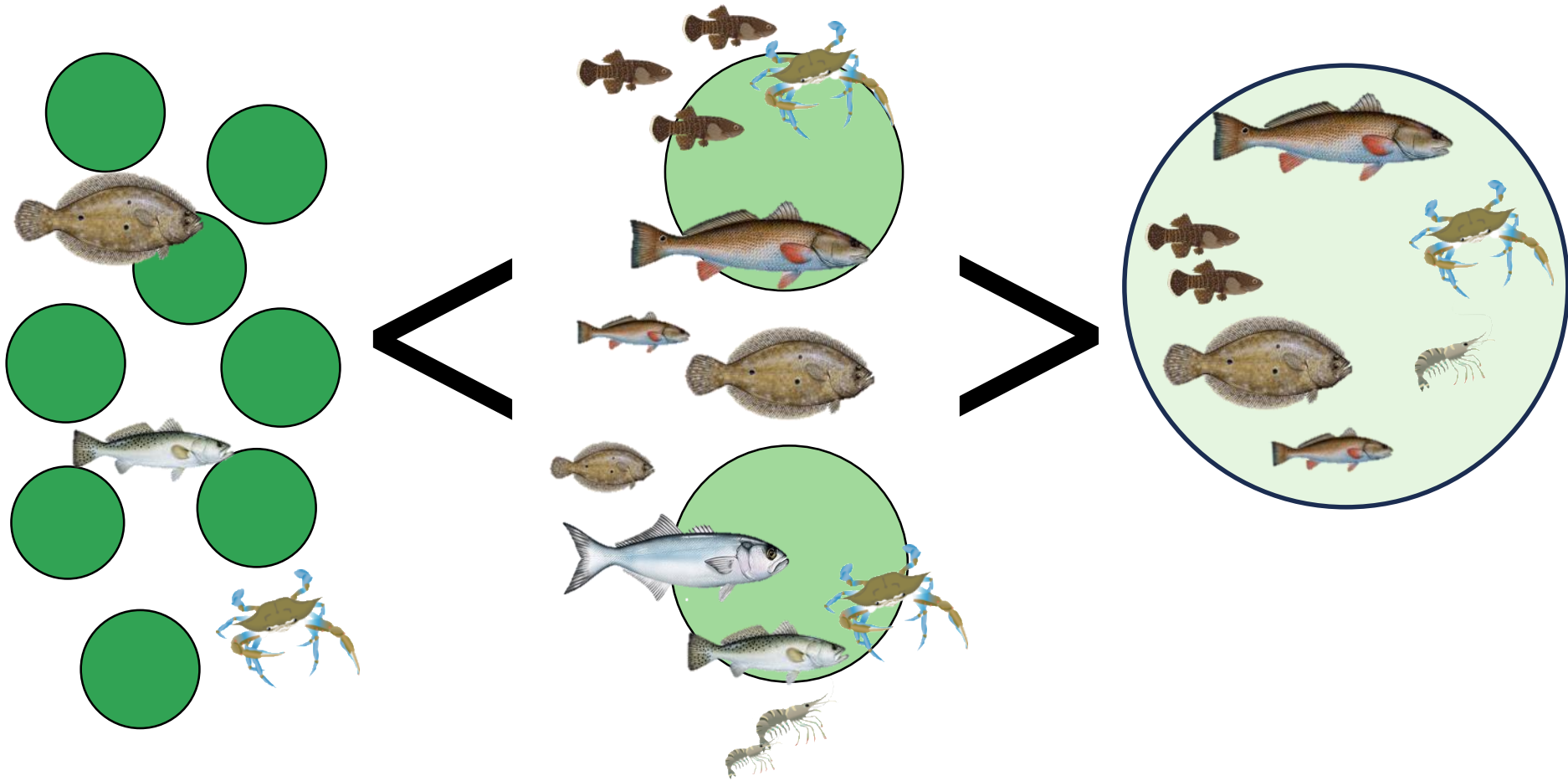www.nccoast.org • 252-393-8185
Ocean, North Carolina

The study of reserves for conservation and management

Single large or several small?

Simberloff and Abele 1982
Saunders et al 1991

# There is a threshold of fragmentation where biodiversity and nekton abundance is highest

McNeil and Fairweather 1993
Yeager et al. 2016

Research questions

- How does overall marsh area influence fish and crustacean (nekton) abundance and biodiversity?

- If area is held constant, does edge to area ratio influence nekton densities?

- What is the optimal island size and number to conserve or restore to best enhance fish communities and does this vary for recreationally and commercially important taxa?
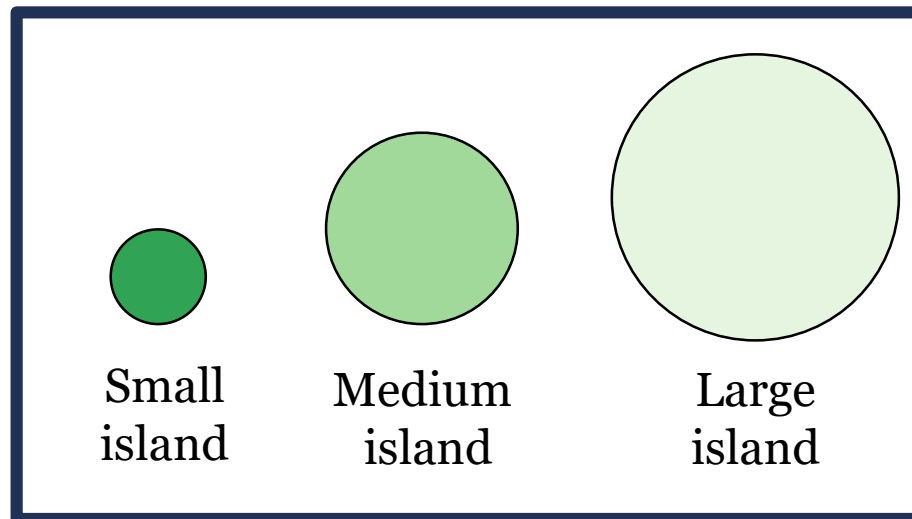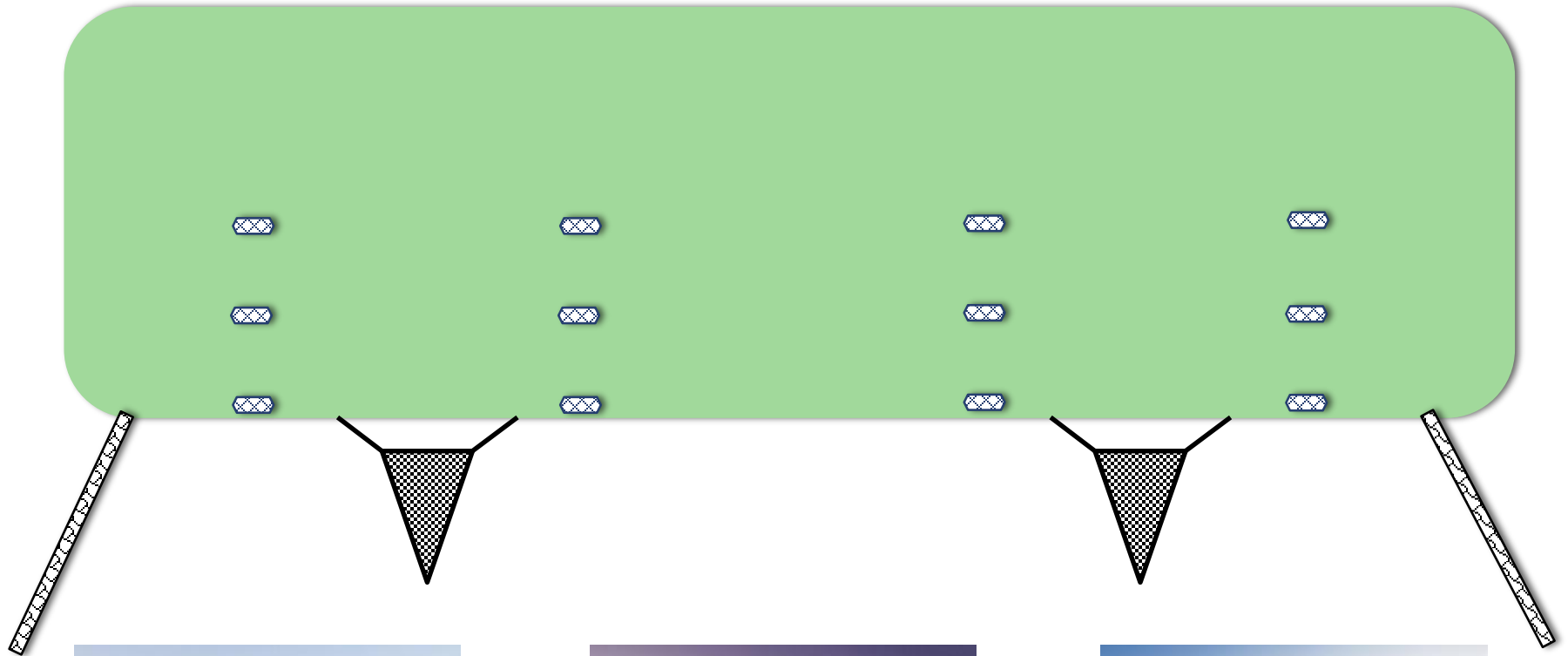
Study Sites
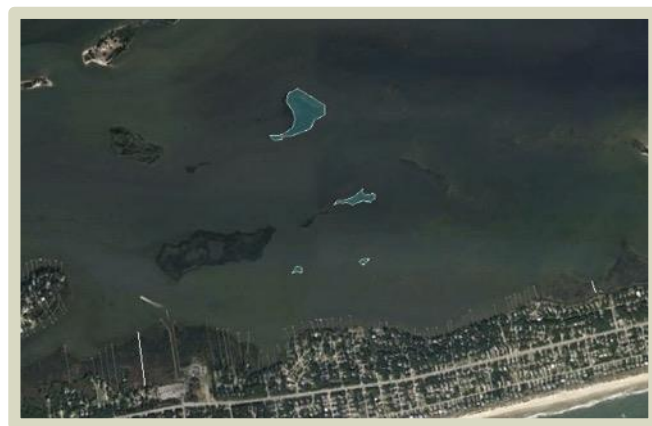
Study Sites

Small island   Medium island   Large island

Field sampling
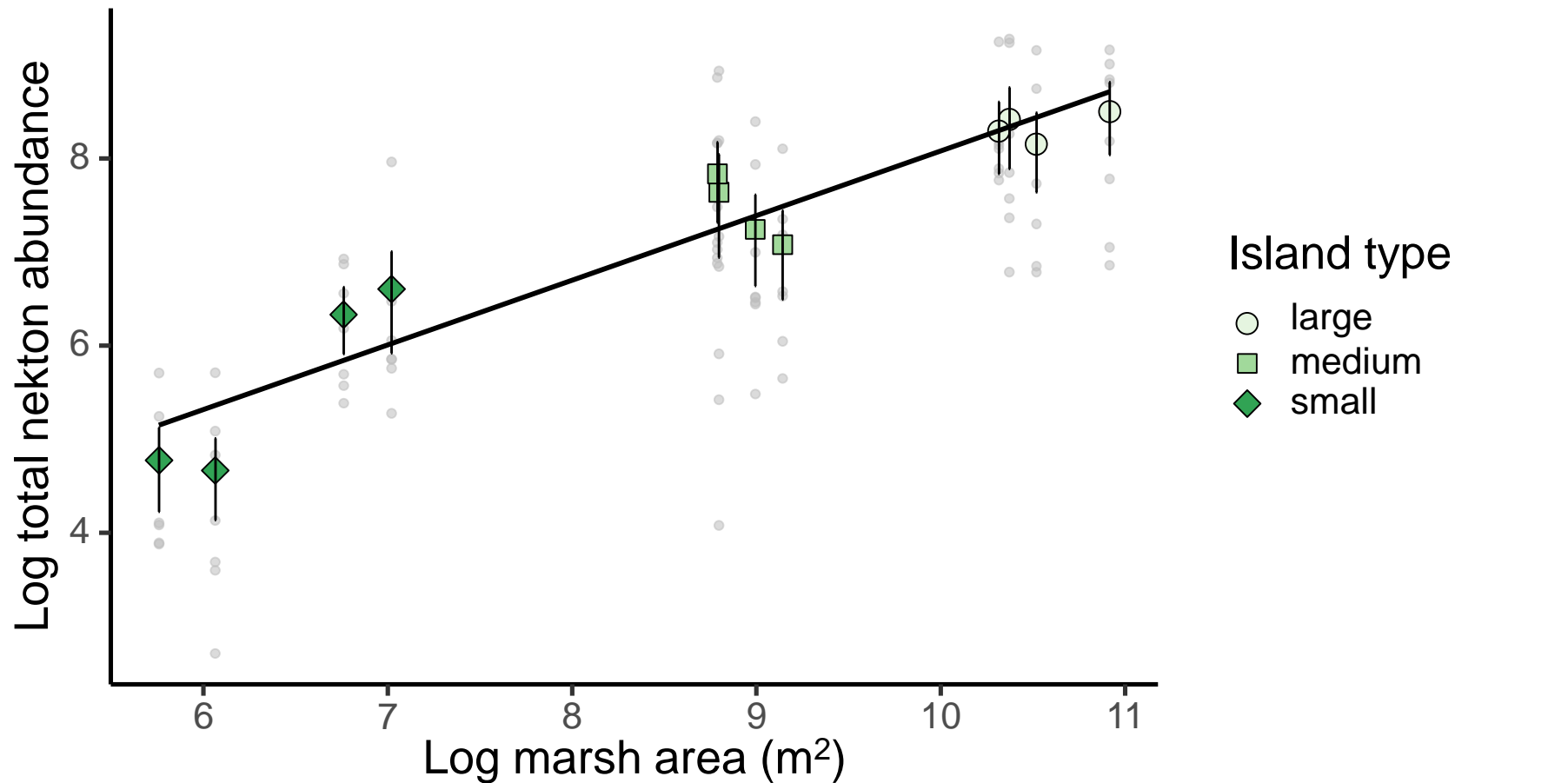
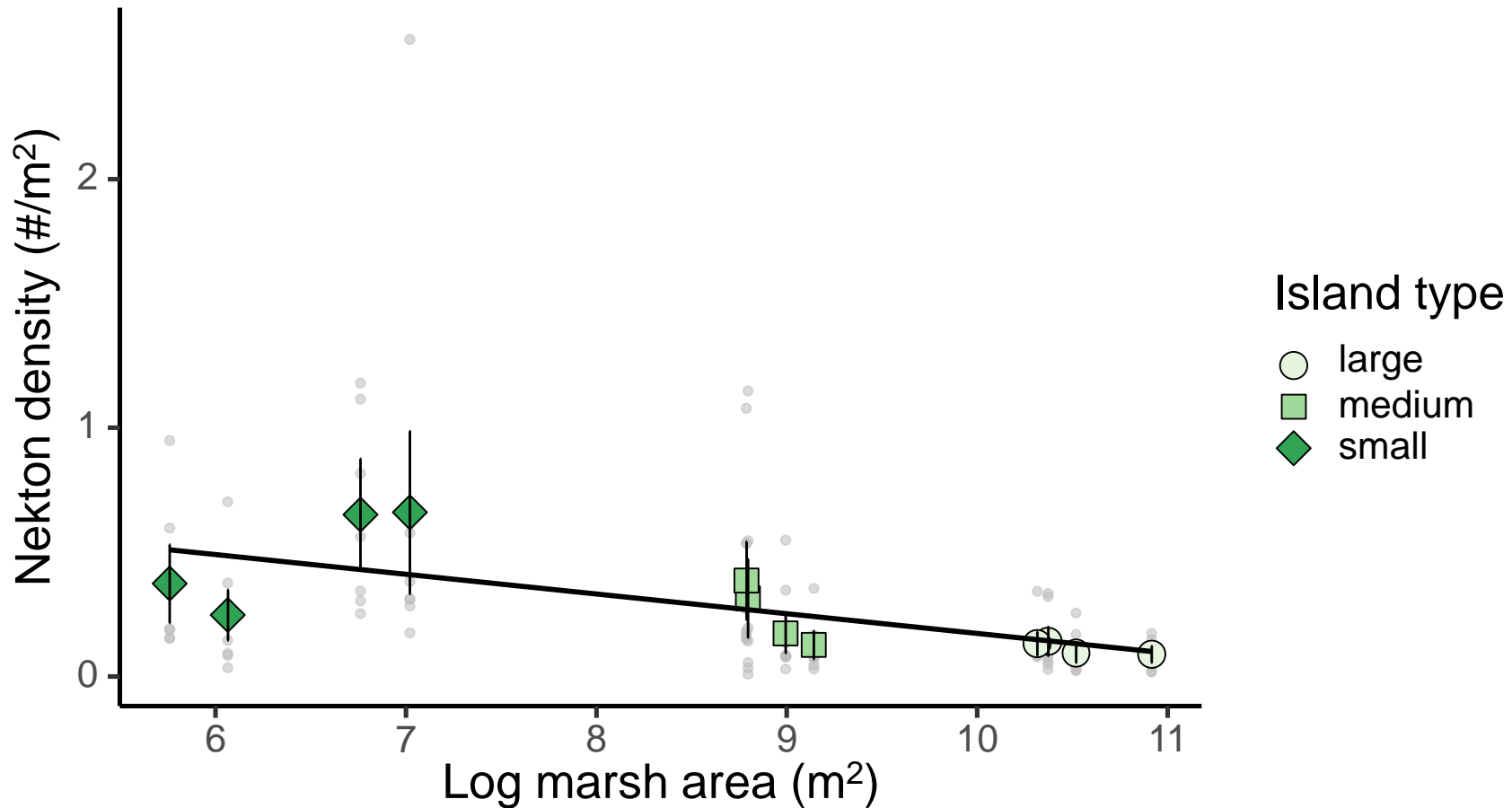# There is no relationship between marsh island area and species richness
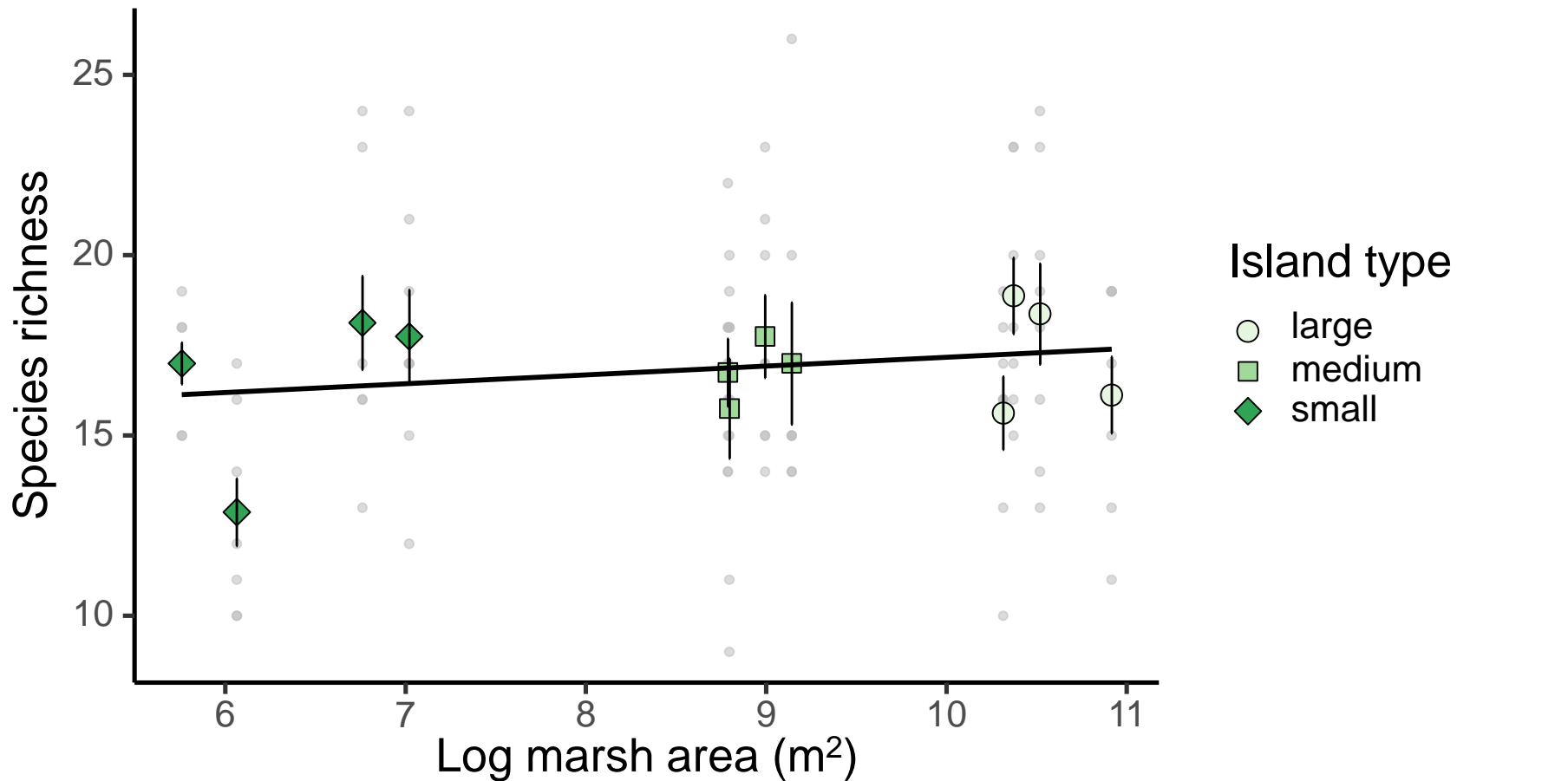
R²=0.02; p=0.225

As marsh area increases there is an increase in total nekton abundance

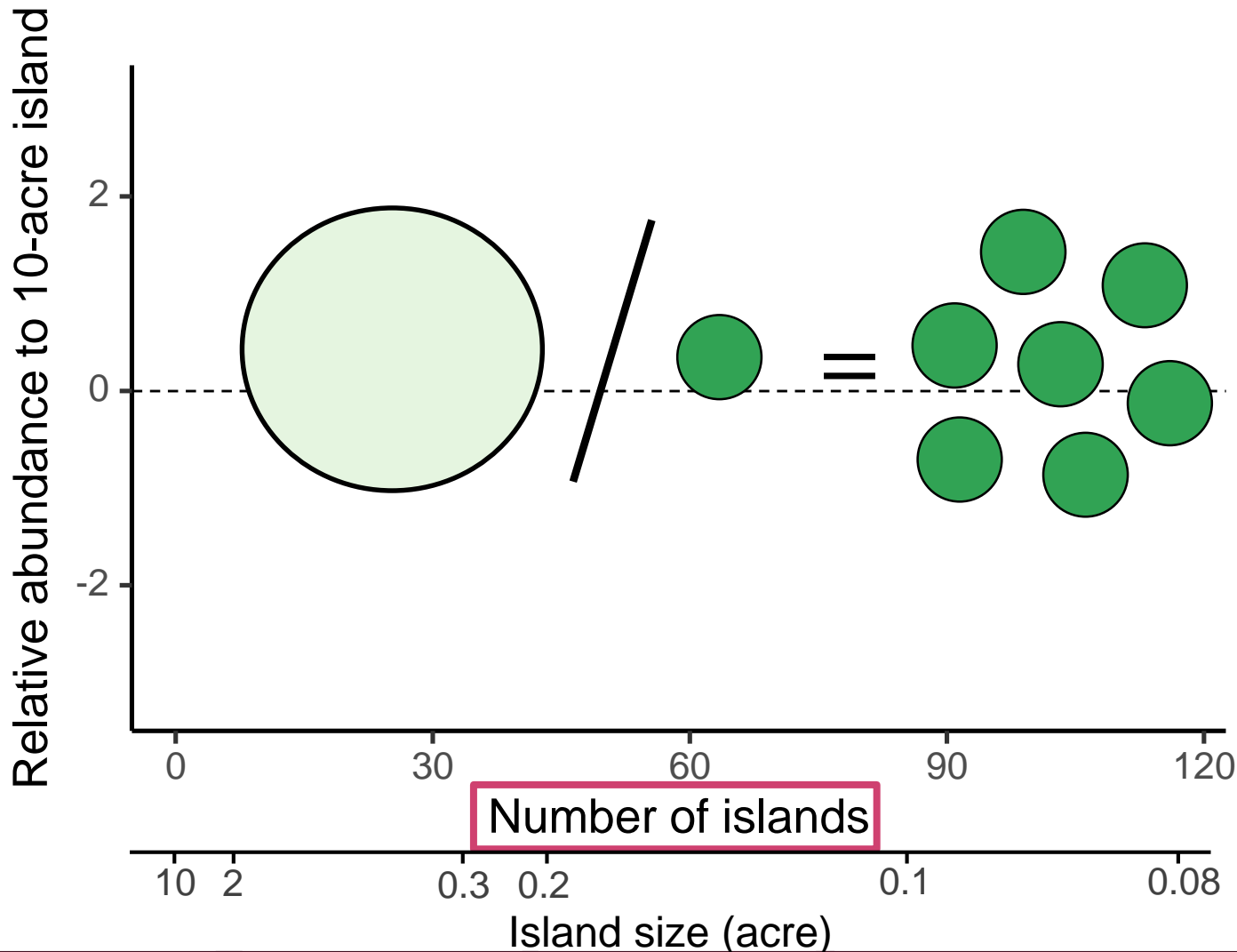R²=0.89; p<0.001

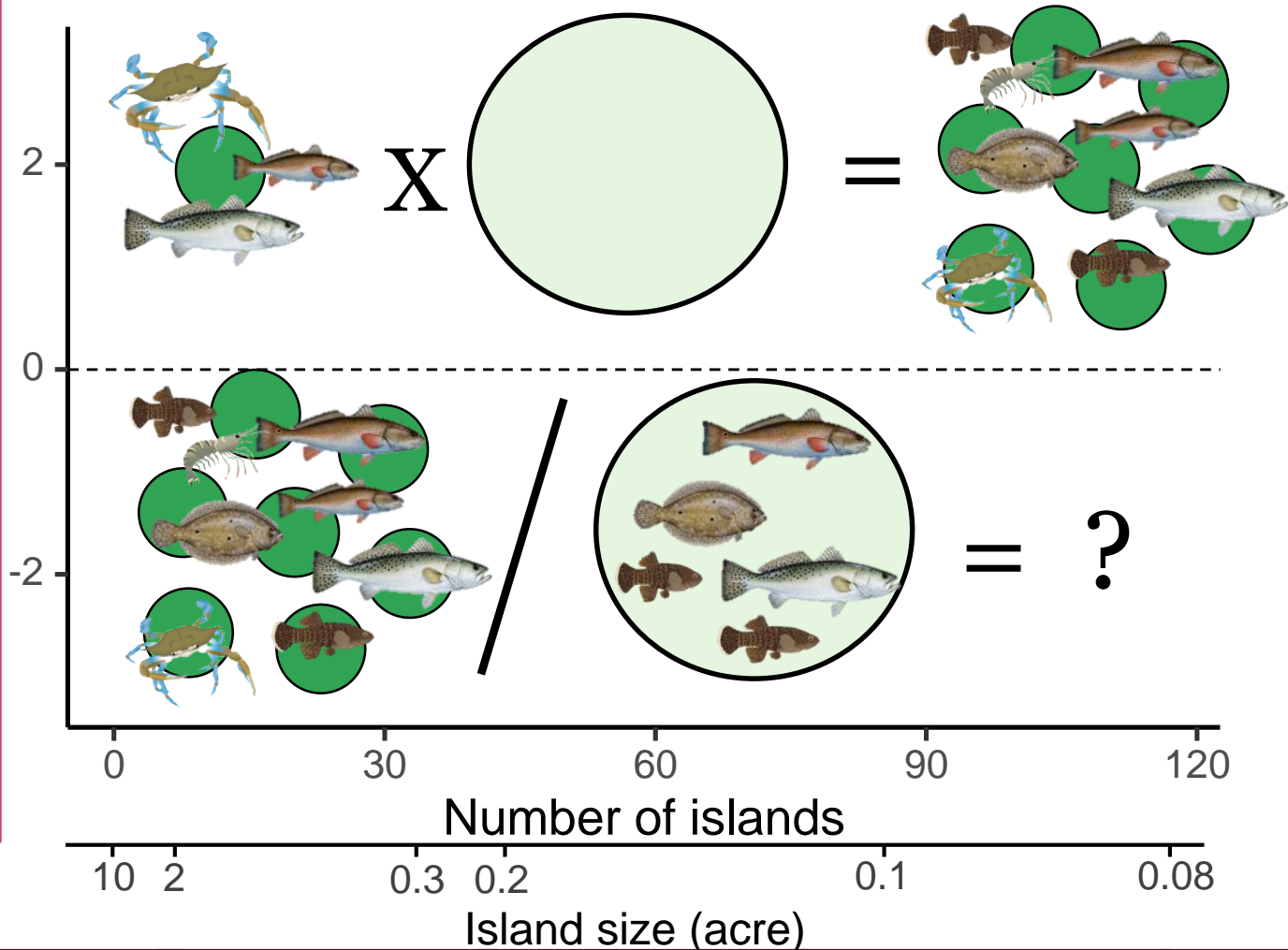# However, the density of nekton decreases with increasing marsh island area.

R²=0.5; p=0.009

If were were to conserve or restore a given area of habitat is one large island or several small islands better for fish production?

If were were to conserve or restore a given area of habitat is one large island or several small islands better for fish production?

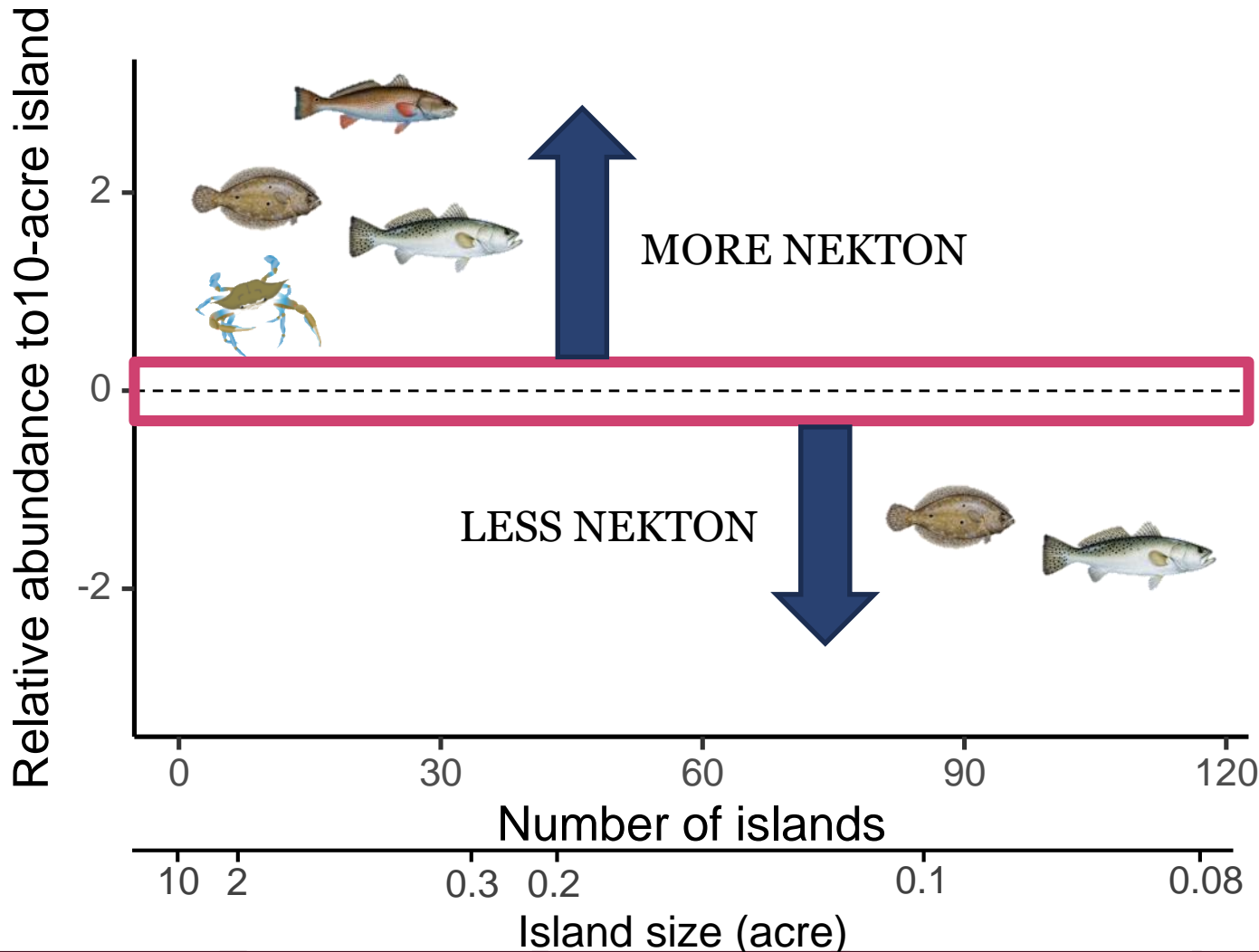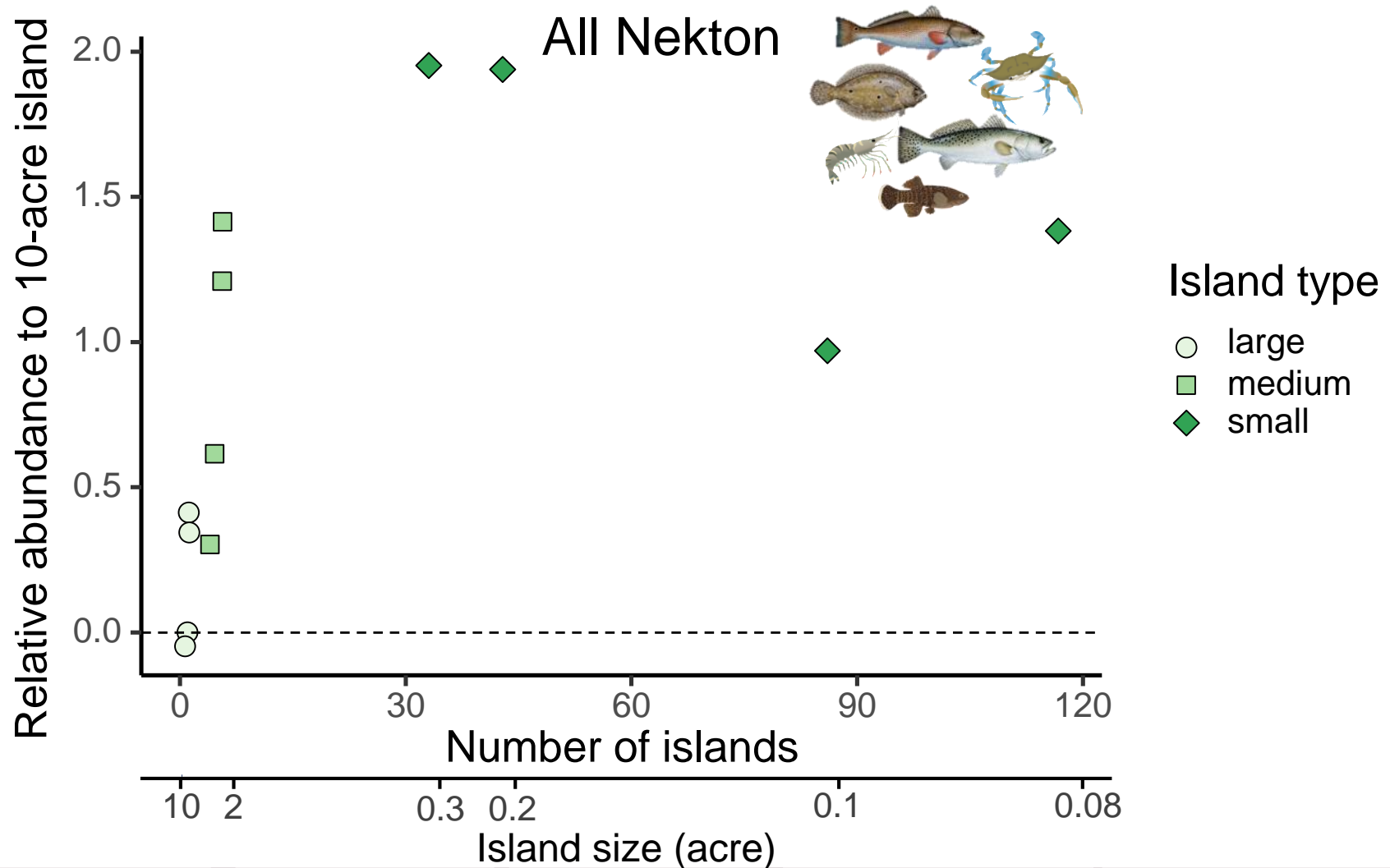# If were were to conserve or restore a given area of habitat is one large island or several small islands better for fish production?

Restoring ~**30** 0.3-acre islands would produce 2x more nekton than one 10-acre island.

The optimal island size and number varies by taxonomic group but overall several smaller islands tend to have higher abundances than one large island regardless of taxon
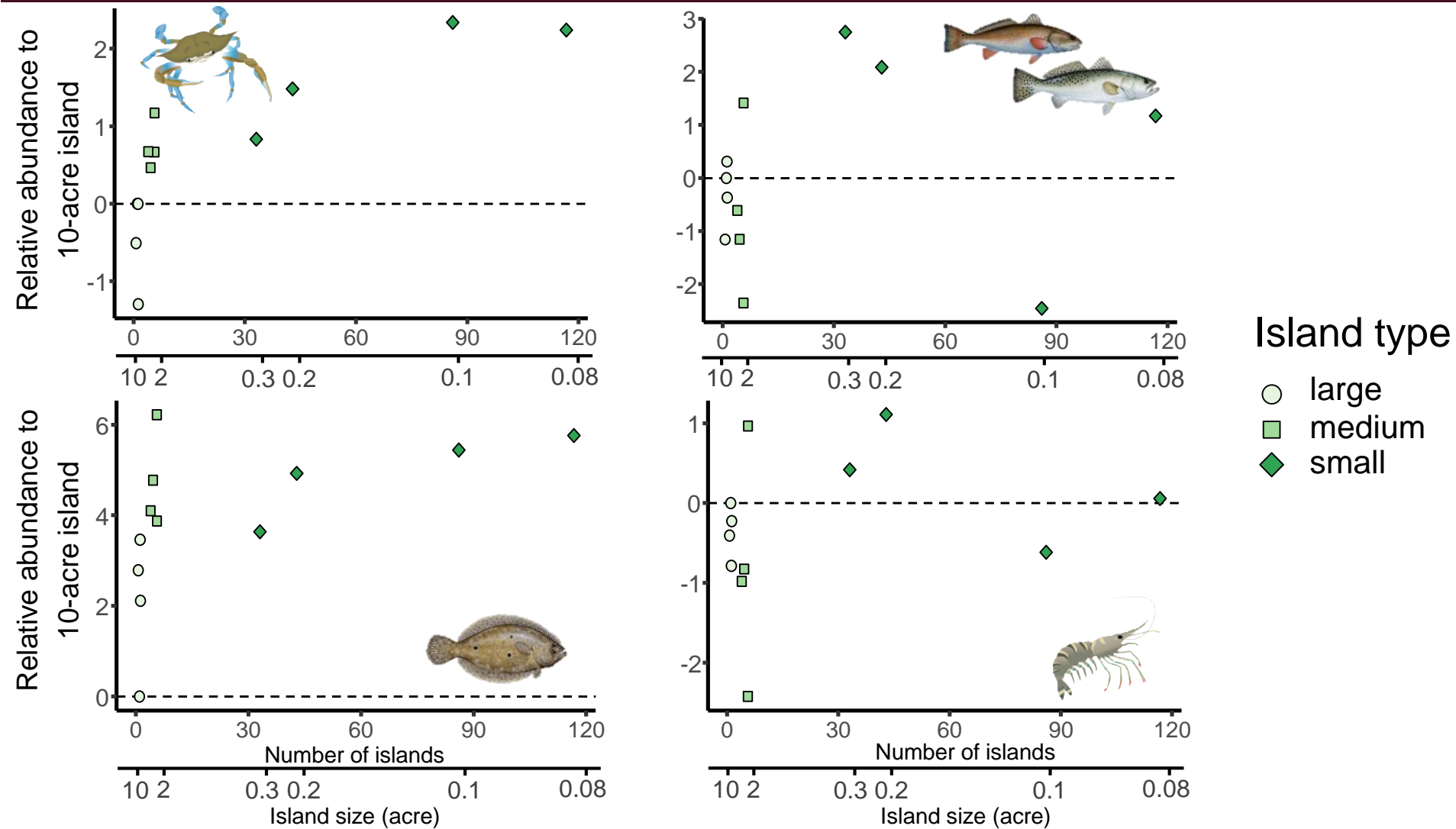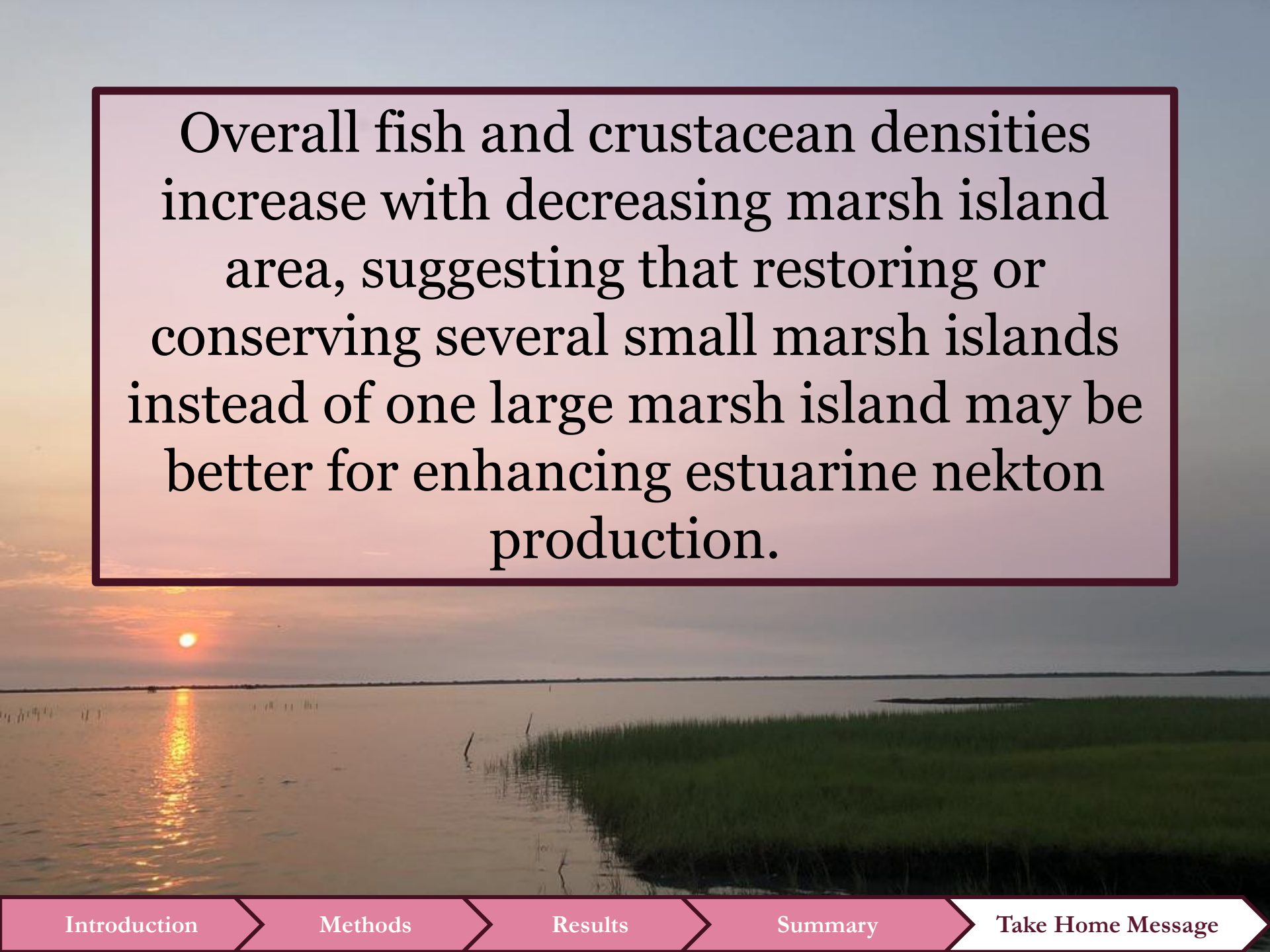
However there are exceptions to this overall trend. For example, coastal shark abundances are variable across many island sizes.
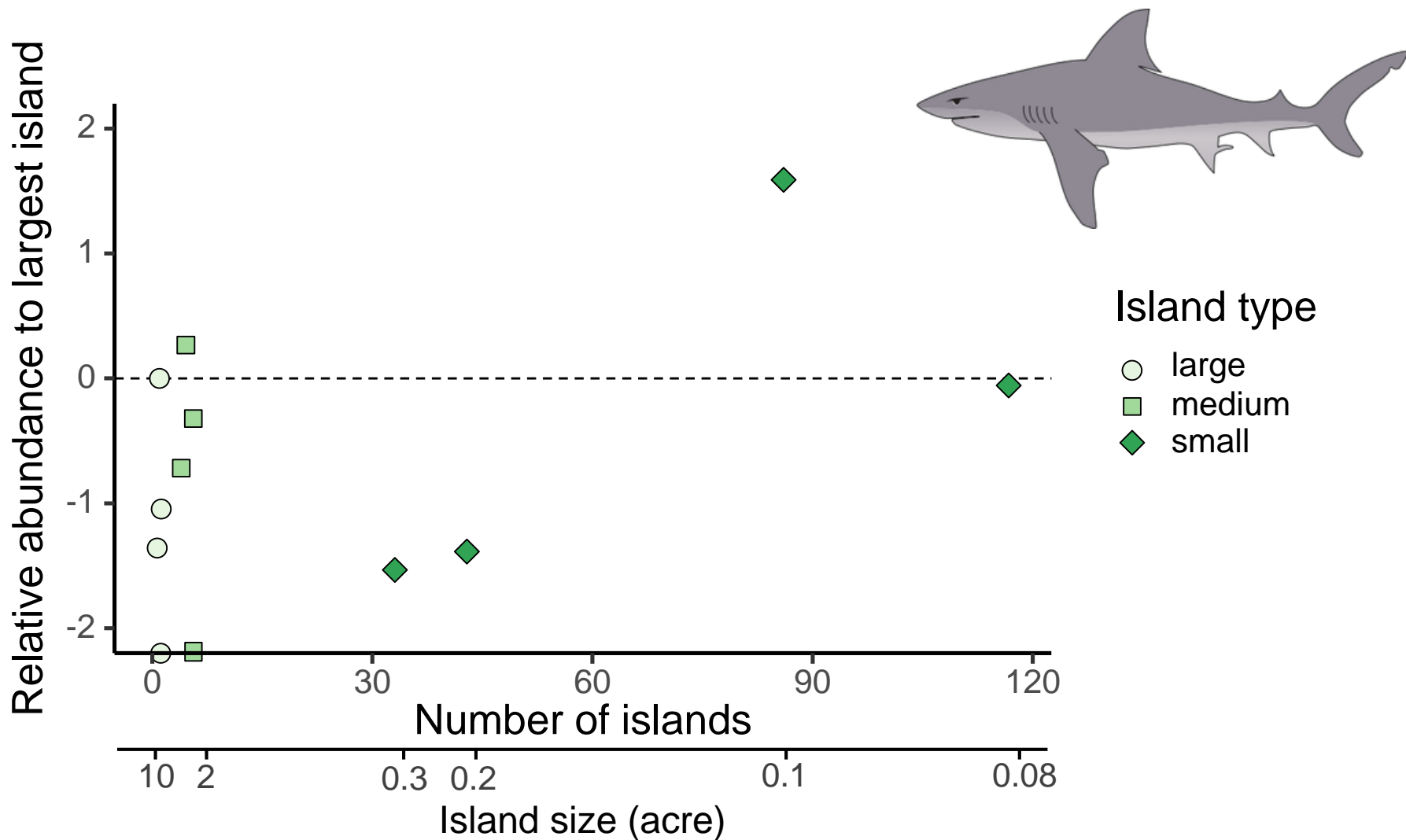
What did we find?

- How does overall marsh area influence fish and crustacean (nekton) abundance and biodiversity?
  Biodiversity – No
  Abundance – Yes!
- If area is held constant, does edge to area ratio influence nekton densities?
  Smaller islands have higher densities of nekton
- What is the optimal island size and number to conserve or restore to best enhance fish communities and does this vary for recreationally and commercially important taxa?
  For an area of 10-acres, total fish abundance peak with numerous small islands that are 0.2-0.3 acres in size
  This relationship tracks for most demersal taxon but not for some pelagic species such as coastal sharks

Overall fish and crustacean densities increase with decreasing marsh island area, suggesting that restoring or conserving several small marsh islands instead of one large marsh island may be better for enhancing estuarine nekton production.

Acknowledgments

Lauren Clance, Marianna Miller, Andrew McMains, & Rich Mahoney

UNC IMS Fish Ecology Lab

Photo credit: Mary Lide Parker, UNC Research

Questions?

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