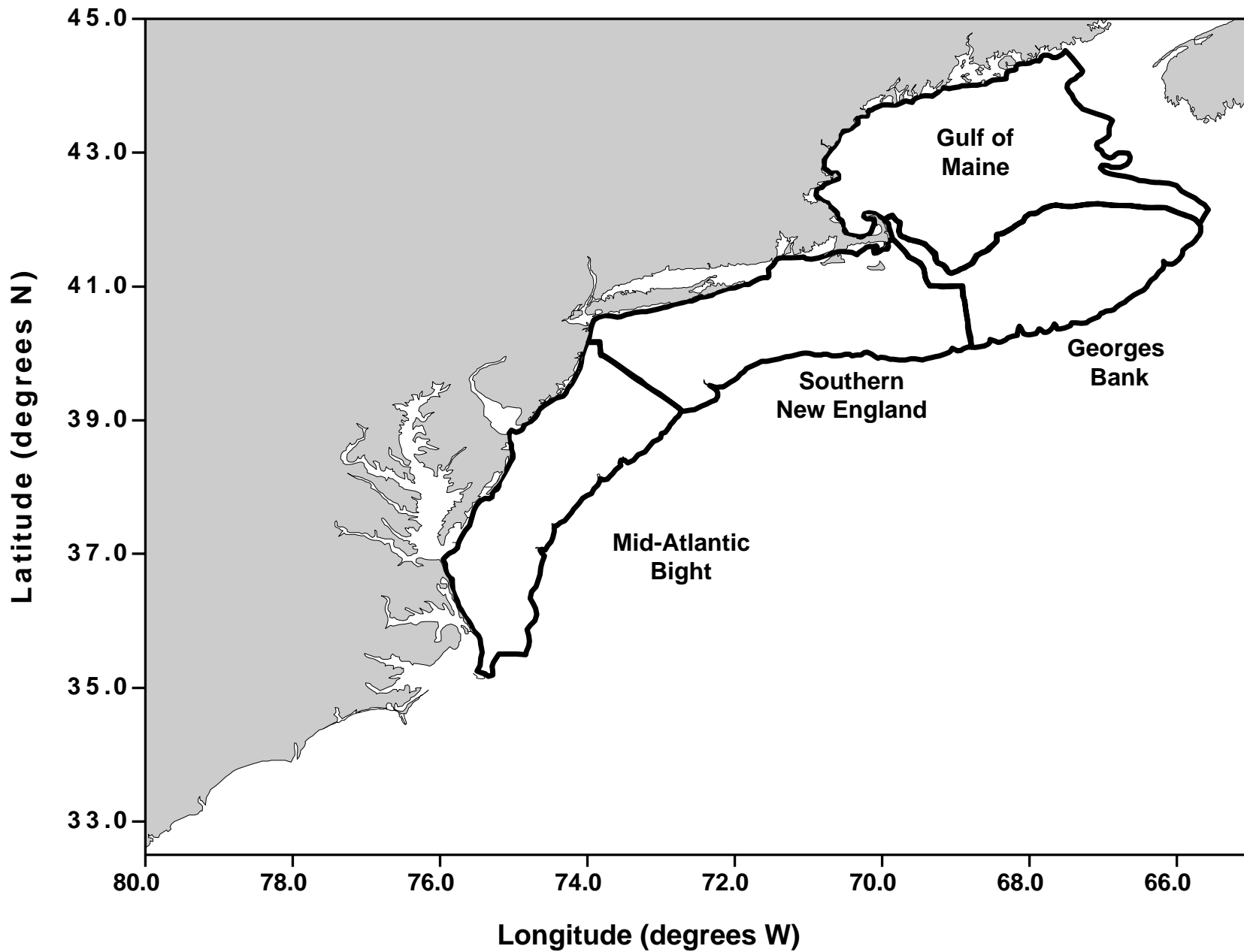


# Evaluating the Role of Small Pelagics in the Gulf of Maine: EMAX Scenarios of Energy Flow

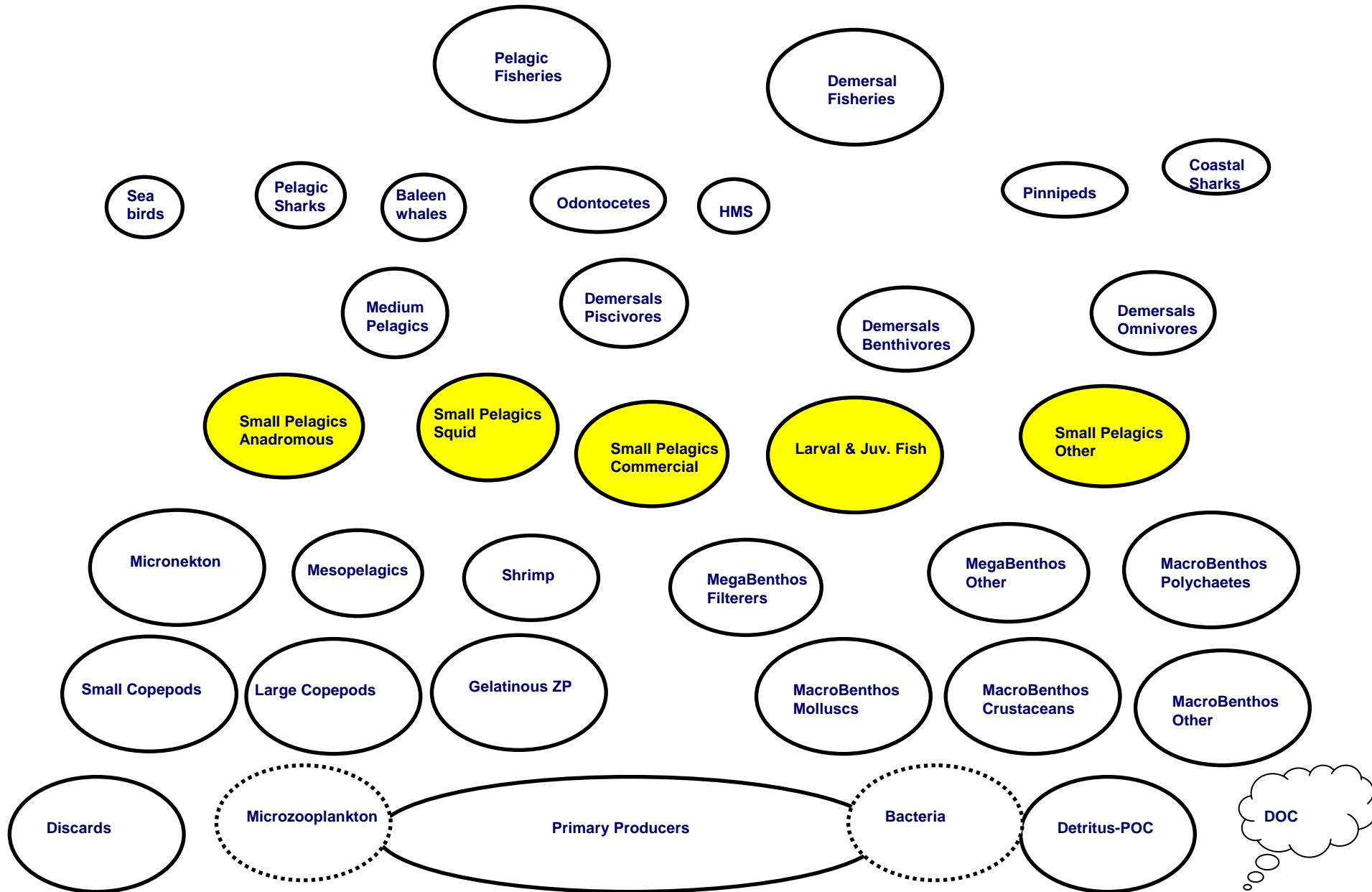
Jason S. Link, Laurel Col, William Overholtz, John O'Reilly, Vincent Guida, Jack Green, David Dow, Debra Palka, Chris Legault, Joseph Vitaliano, Carolyn Griswold, Michael Fogarty and Kevin Friedland

# Context

- EMAX
- GoM
- Role of Small Pelagics
  
- Establish method for other comparisons
- Contrast Ecopath & Econetwrk



# EMAX



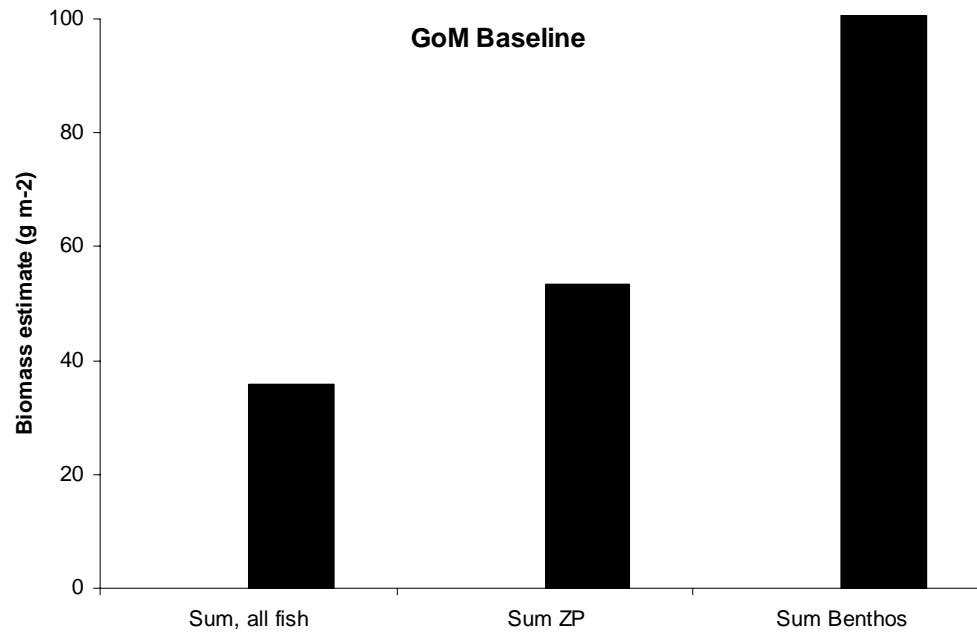
# Objectives

- Examine how two ecosystem network models respond to large-scale perturbations to input parameters
  - Various scenarios affecting multiple elements of its component biota
  - T-D, B-U, Fishing, etc.
- Determine if the observed model responses can be used to evaluate the relative importance of the small pelagics in this ecosystem

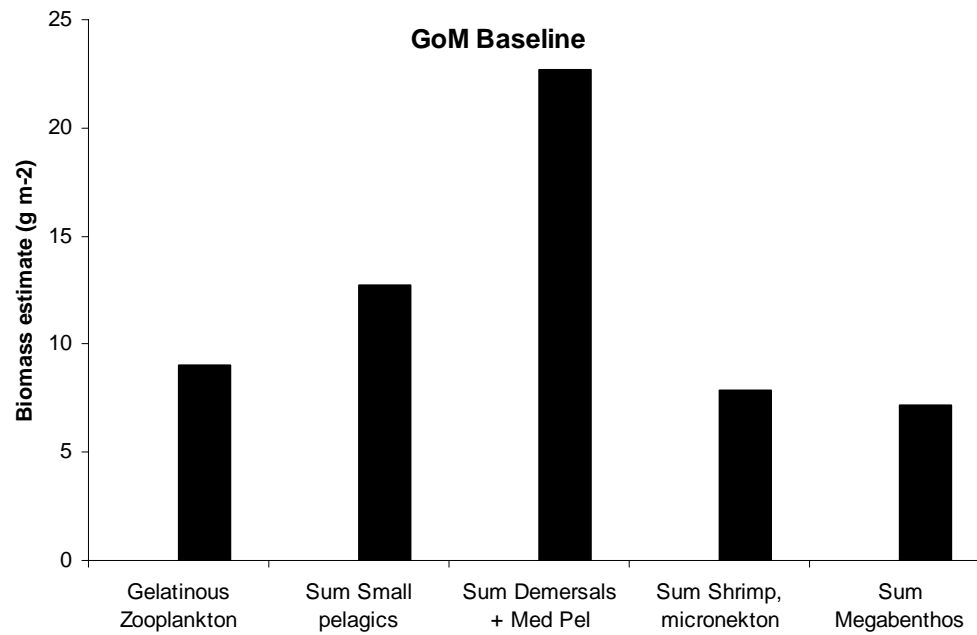
# Approach

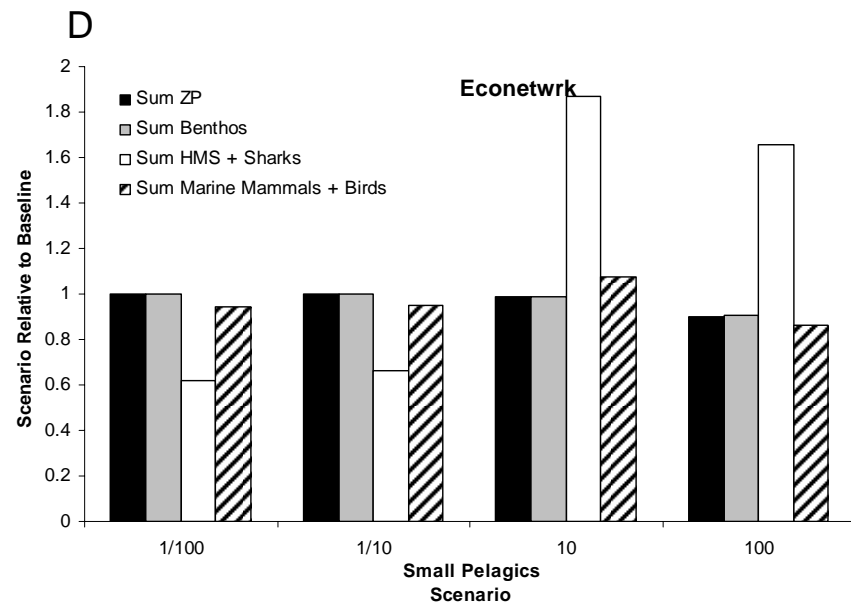
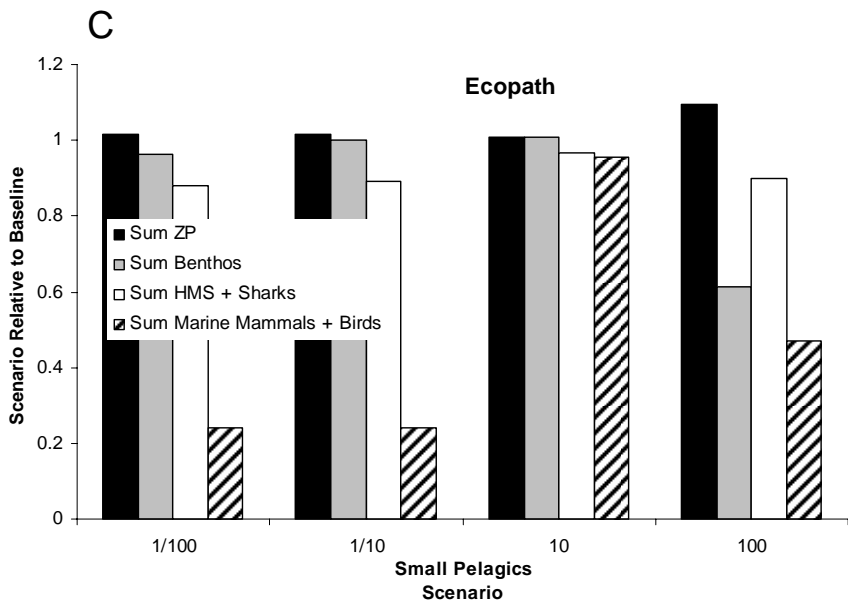
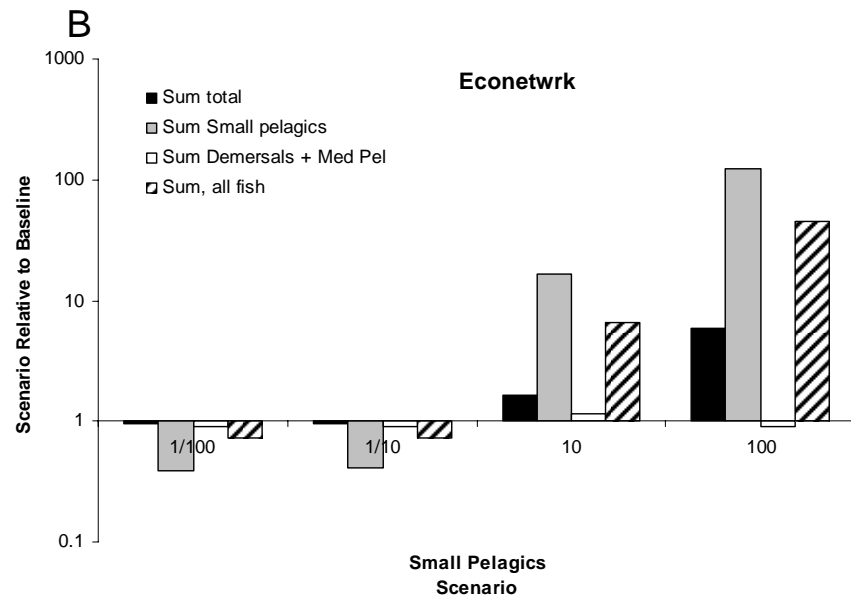
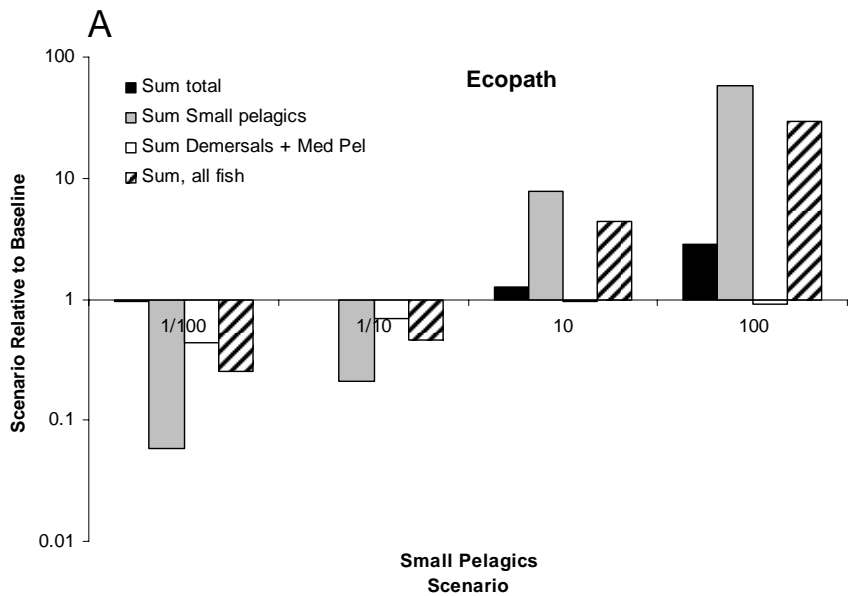
- Establish a balanced baseline model of the GoM food web
- Perturb specific network nodes, rebalance
- Evaluate a suite of response metrics relative to baseline
  - Here relative B presented
- Gauge internal diagnostics and logical consistencies

A

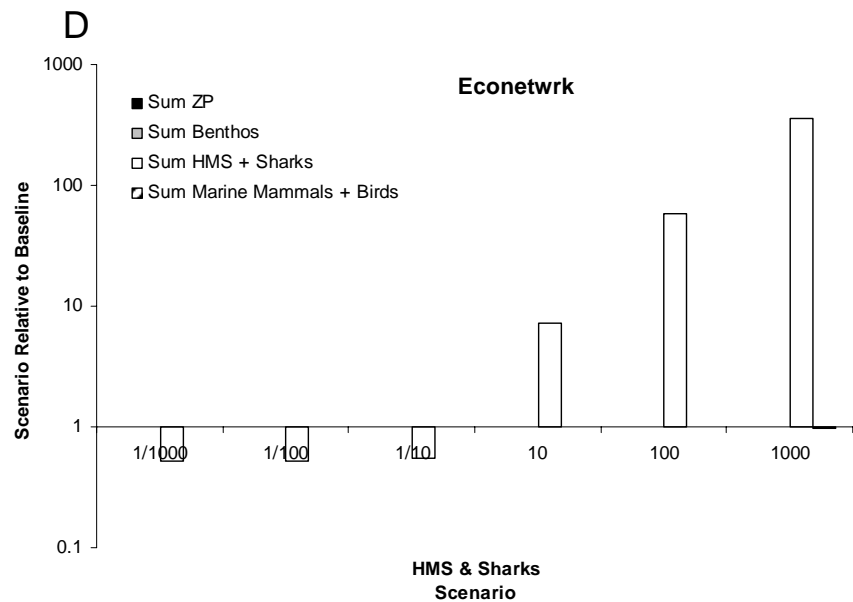
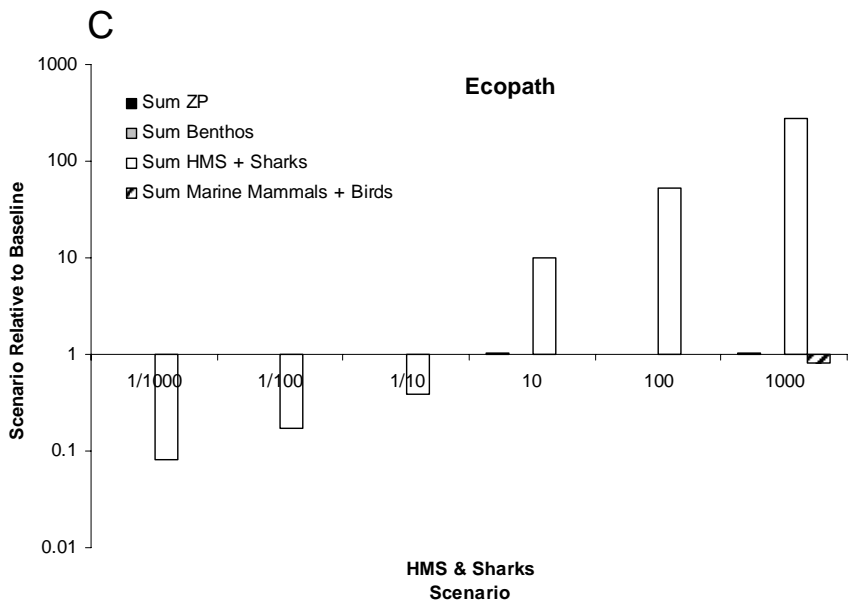
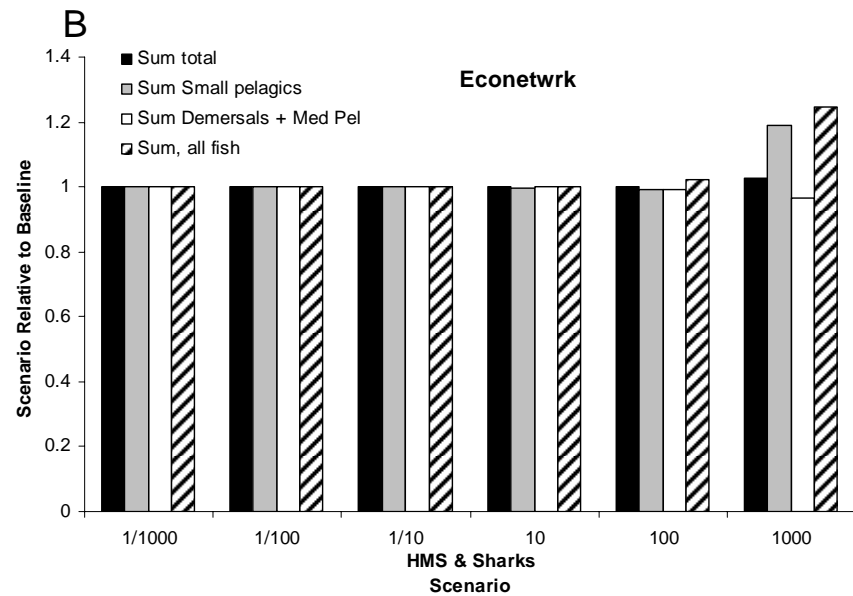
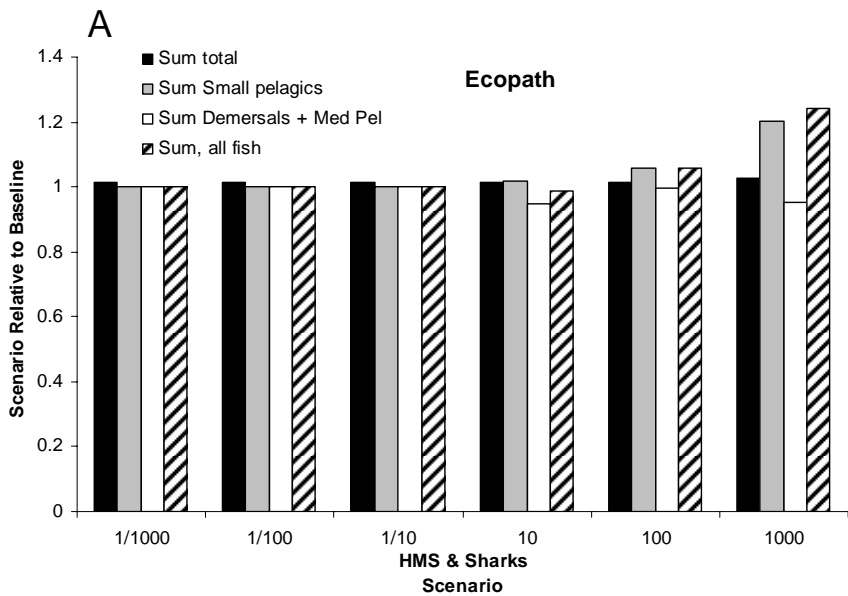


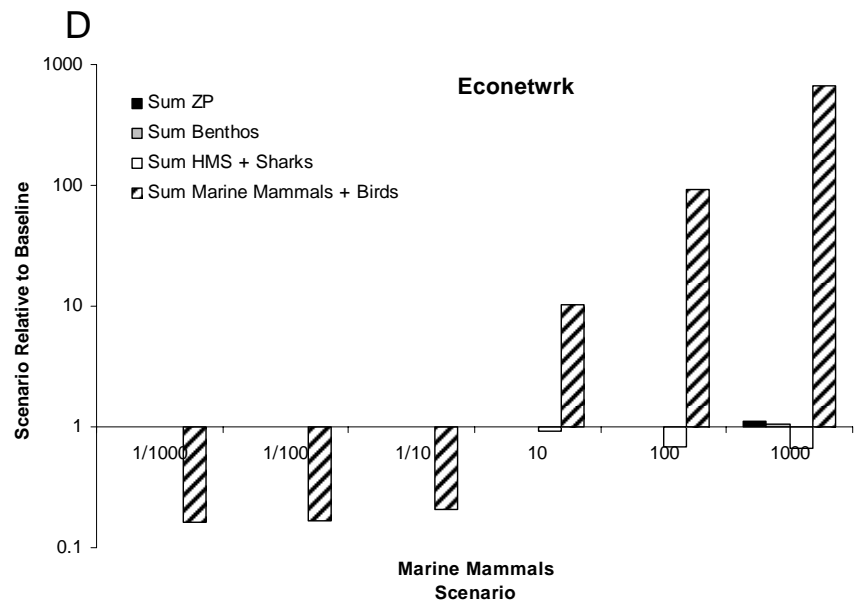
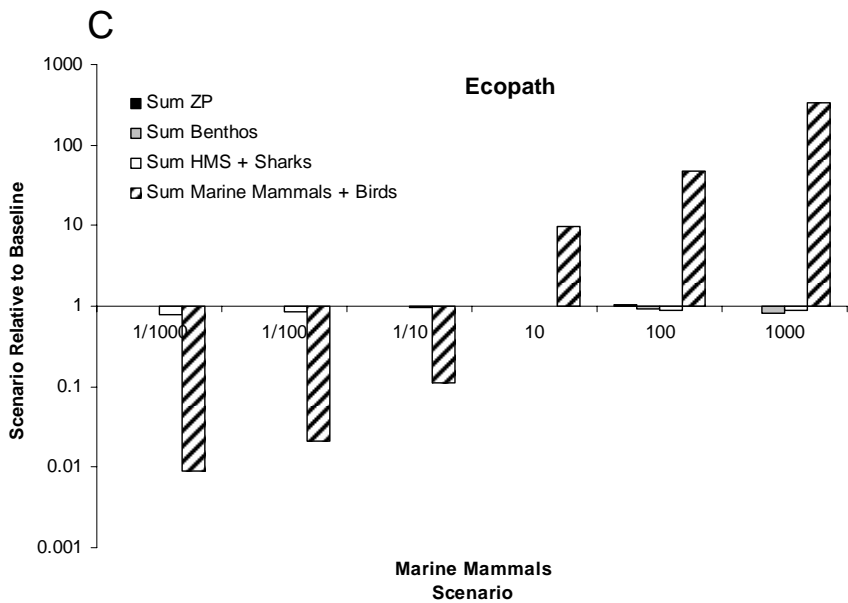
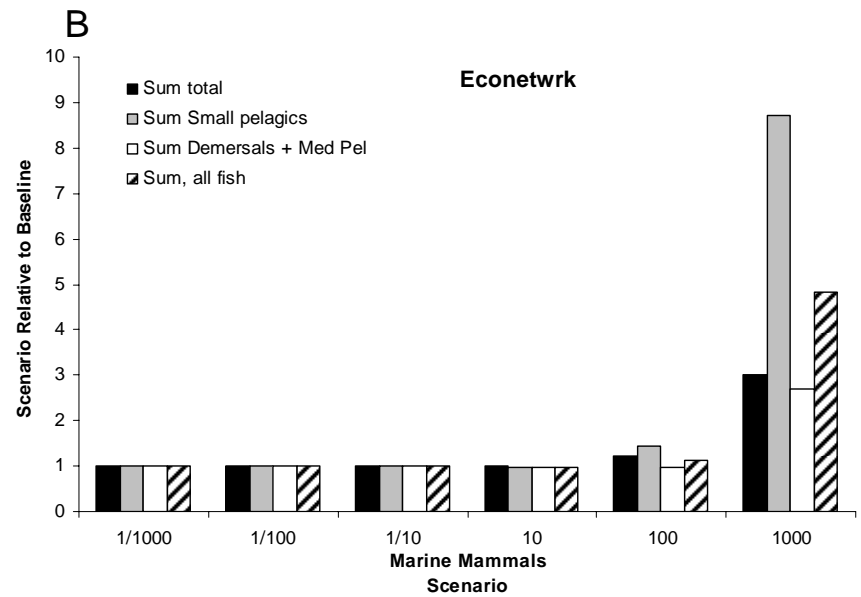
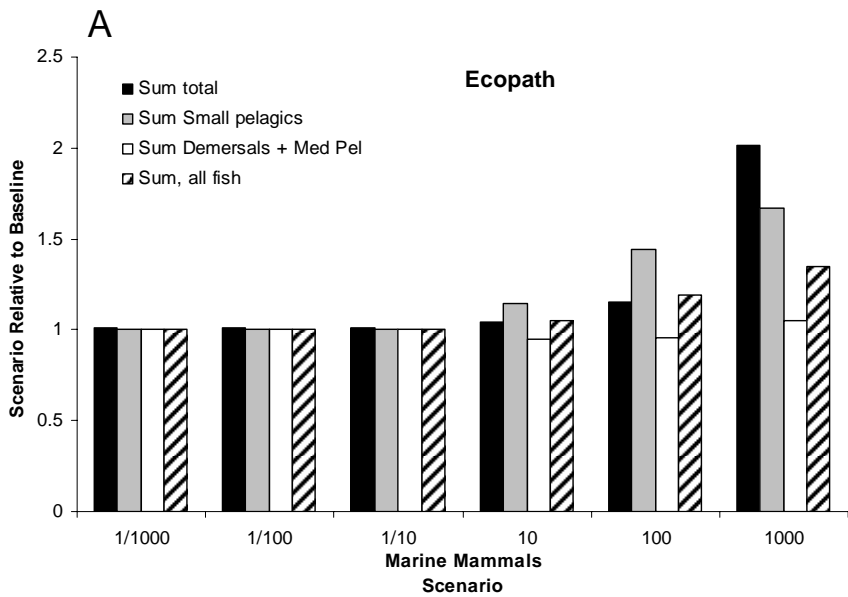
B





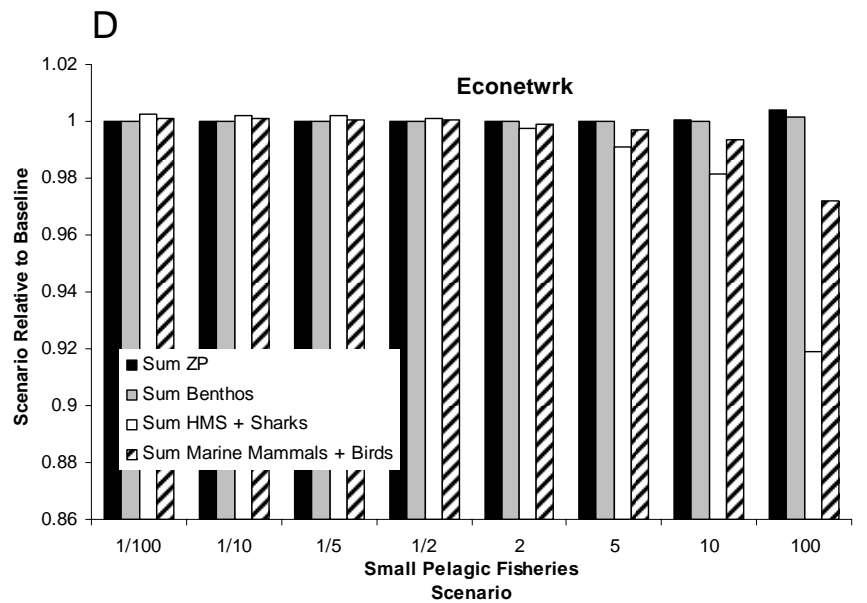
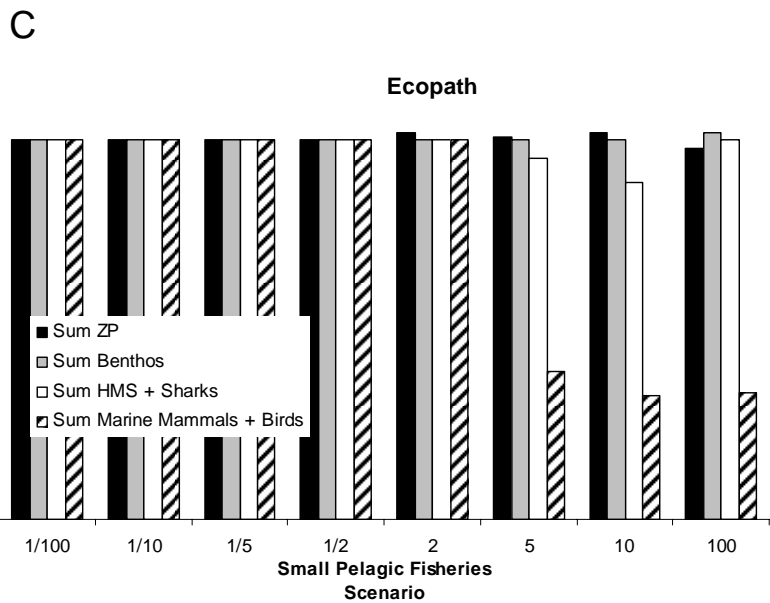
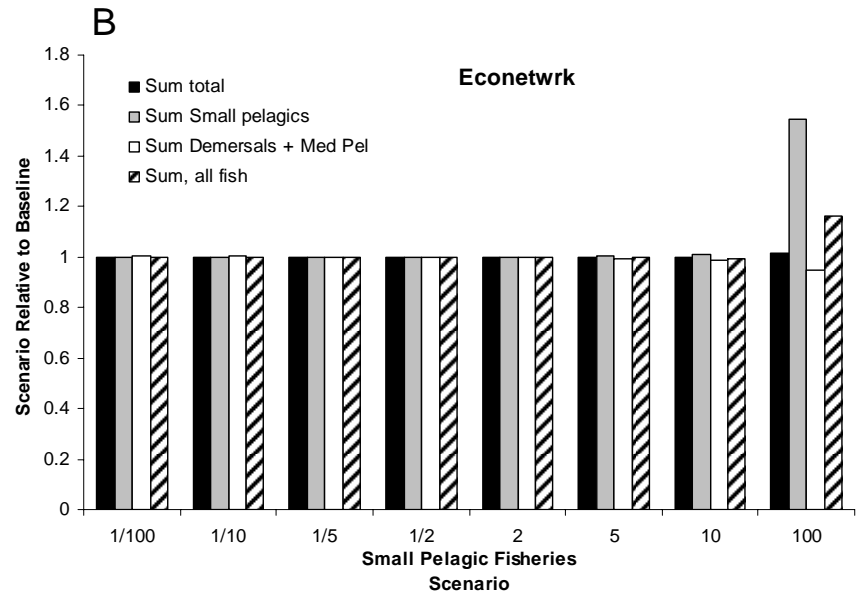
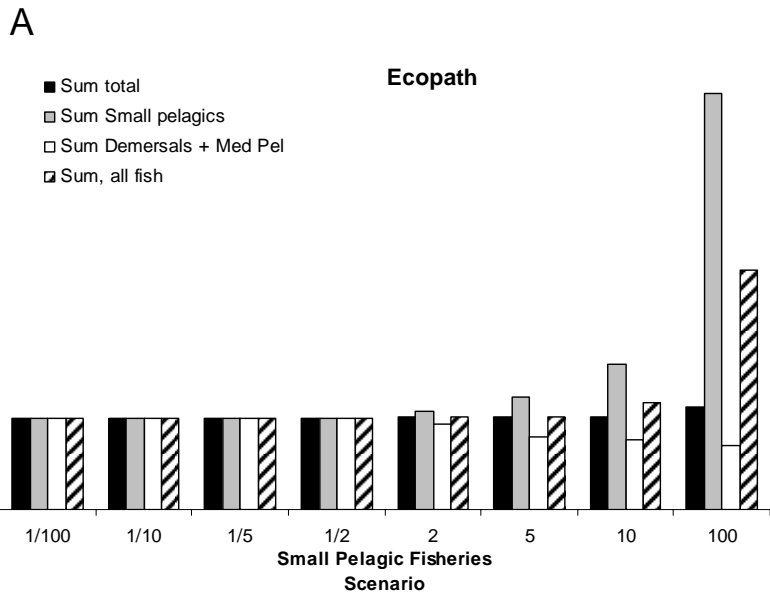




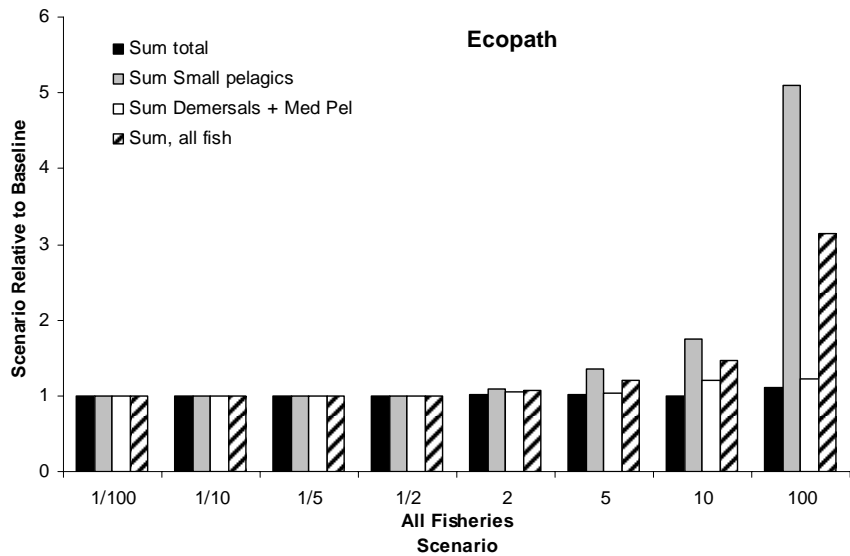


# Biomass Scenarios Observations

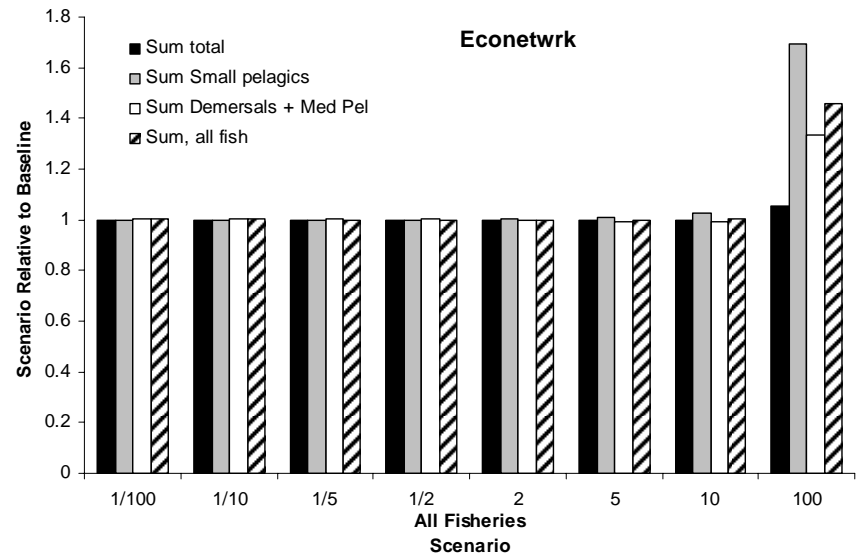
- Changes in a node resulted in obvious predicted responses for those nodes
- Changing small pelagics resulted in:
  - predicted changes in HMS/Sharks & Marine Mammals- predators of small pelagics (B-U!?)
  - in minimal predicted effects on zooplankton and lower TLs (T-D?)
- Changing small pelagic predators (MM & HMS/Sharks) resulted in:
  - minimal predicted changes in other nodes with decrease, no predatory release (T-D?)
  - a predicted increase in small pelagics with an increase- counterintuitive and suggestive of B-U!?



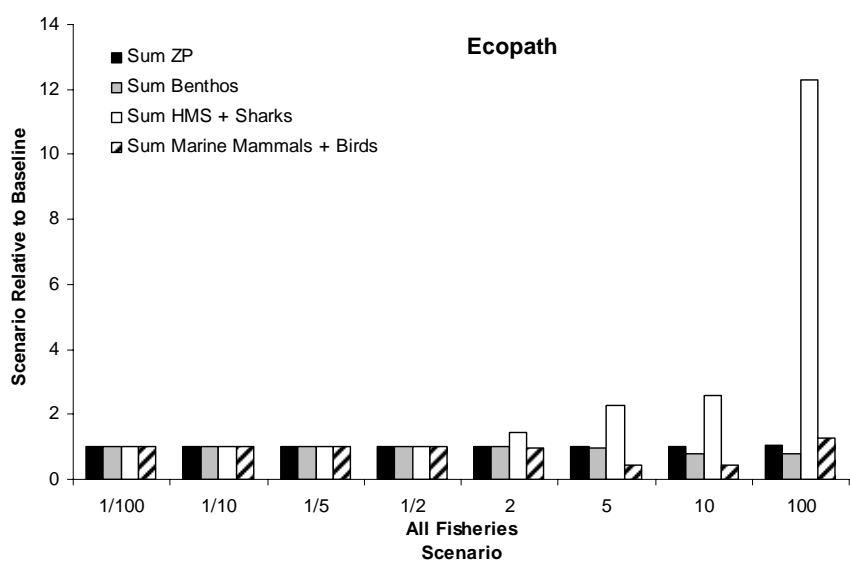
A



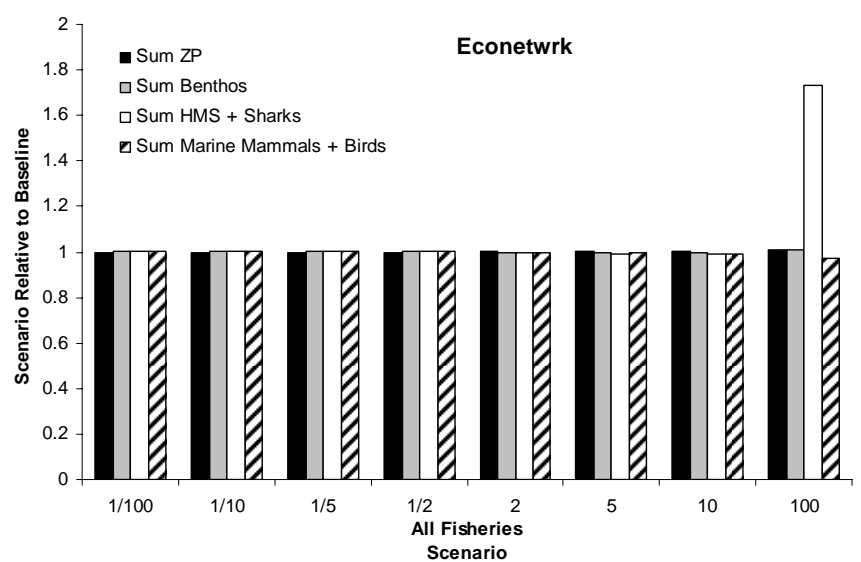
B



C



D



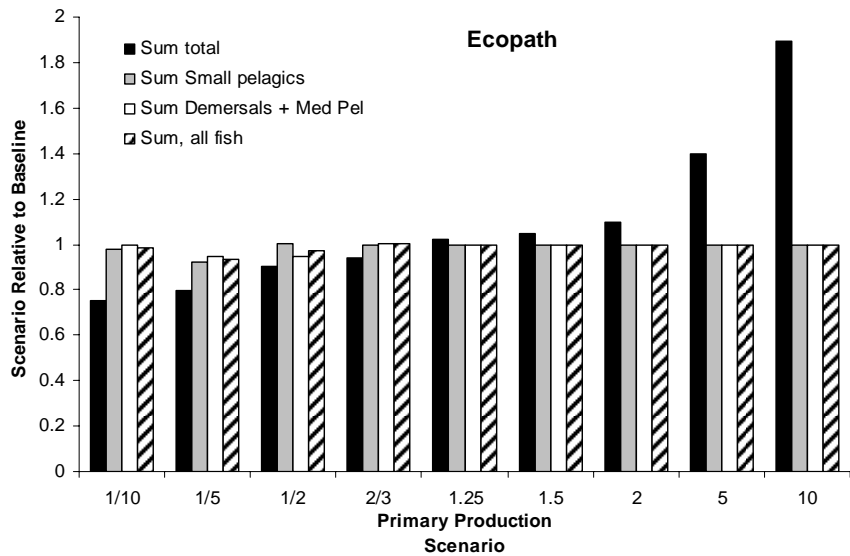
# Fisheries Scenarios Observations

- Changing fisheries removals resulted in:
  - minimal predicted changes in other nodes with a decrease (T-D?)
  - a predicted increase in the targeted node/s with an increase, particularly small pelagics-counterintuitive but B-U!?
- Results reflect the levels of biomass that would be required to sustain these increased levels of fishing in a balanced ecosystem

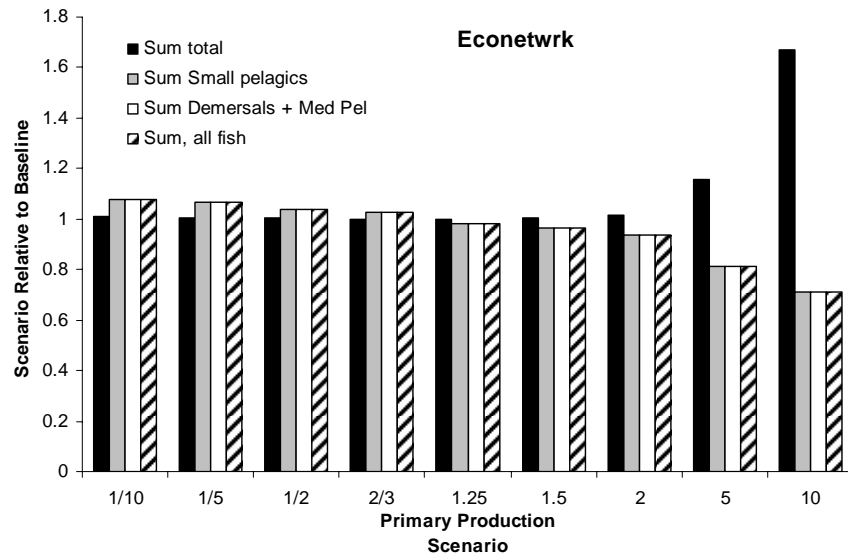
# Not so fast...

- Model results generally imply a bottom-up control of the food web
- But does that hold true???

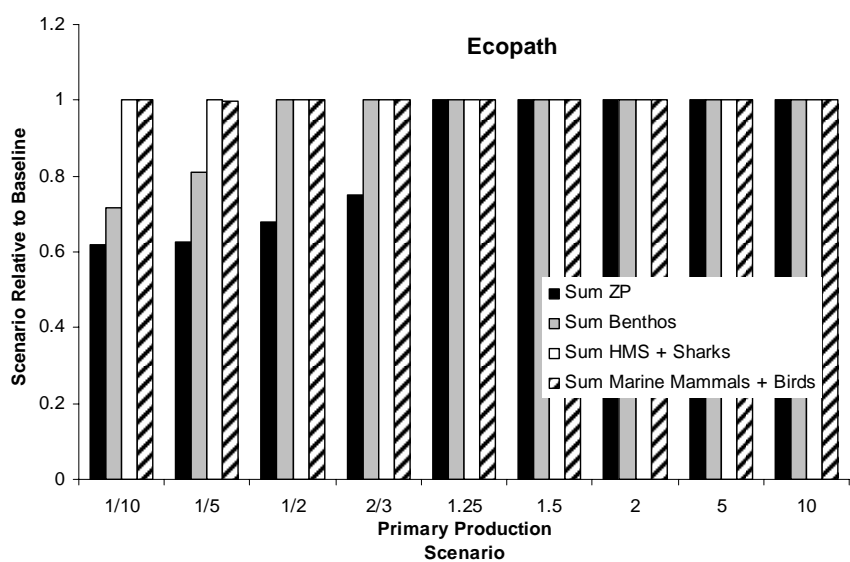
**A**



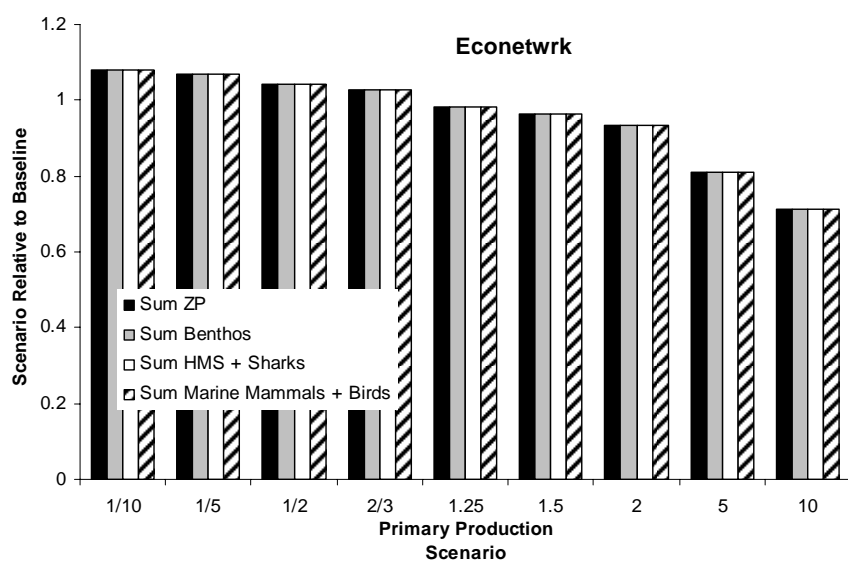
**B**



**C**

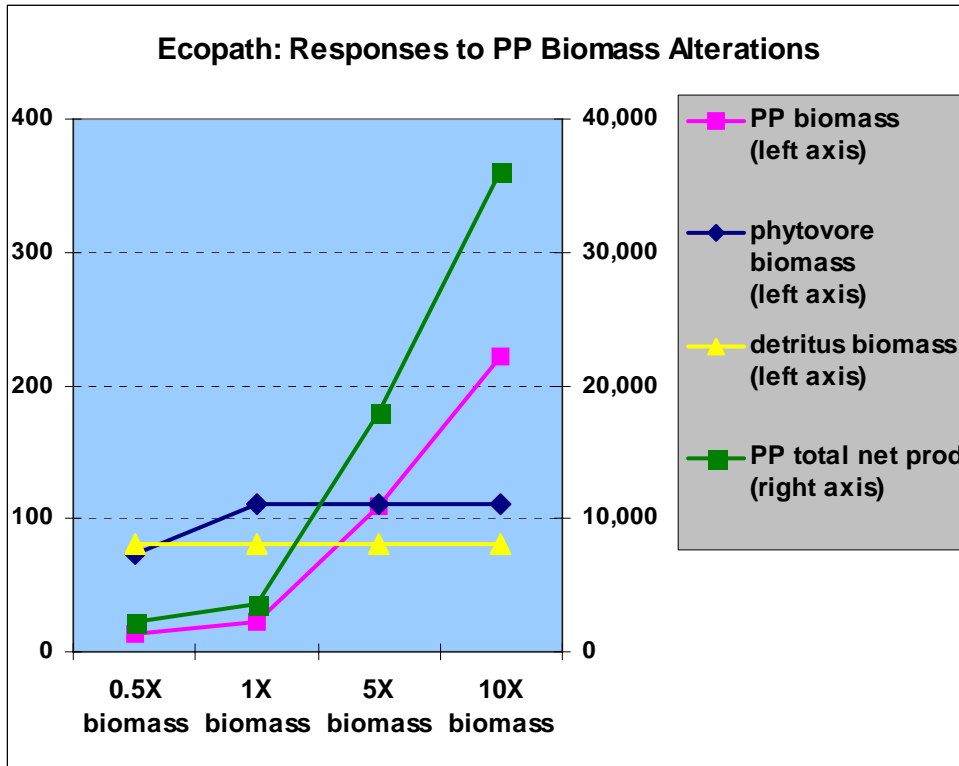


**D**



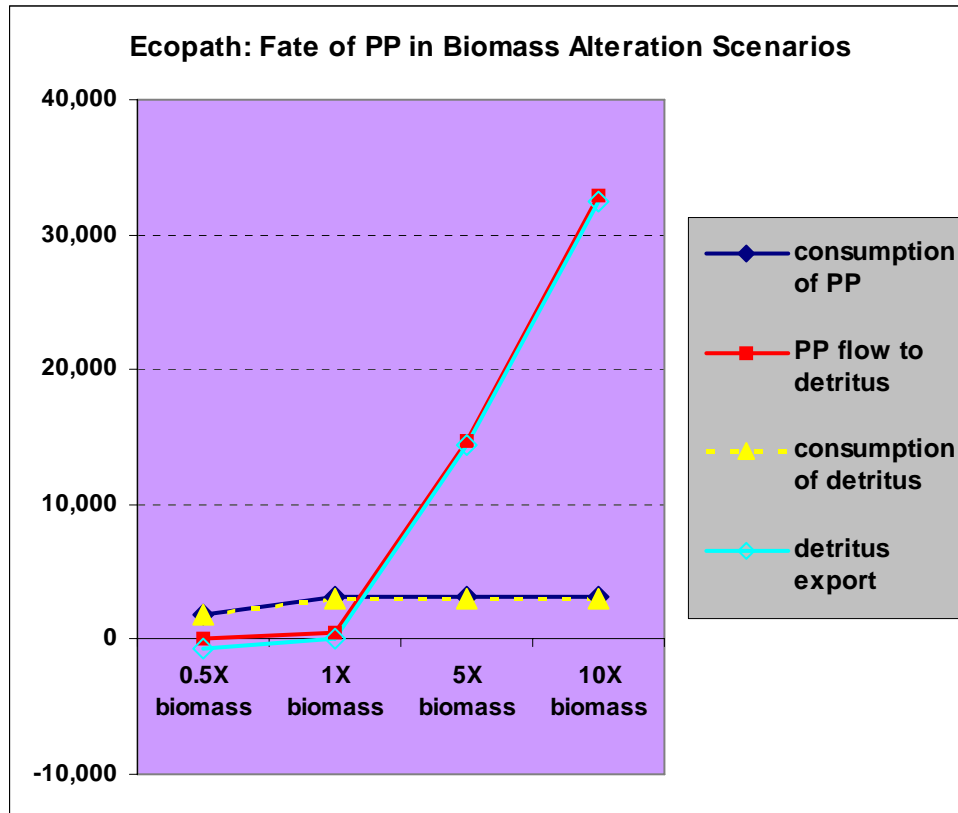


# Why no change?



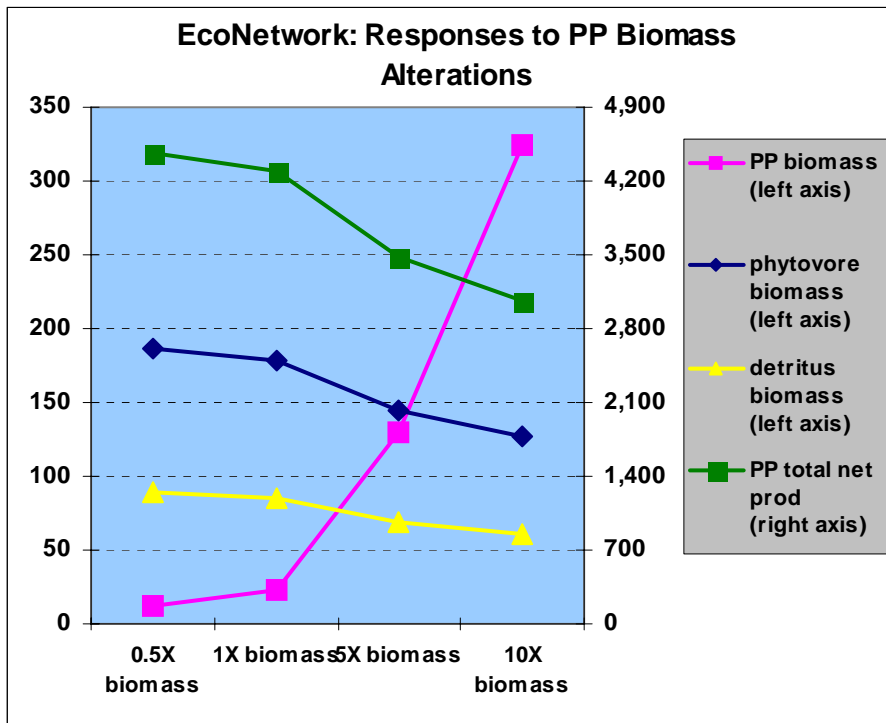
- Should see changes:
- Specifically in phytovore biomass or detritus buildup

# Why no change?



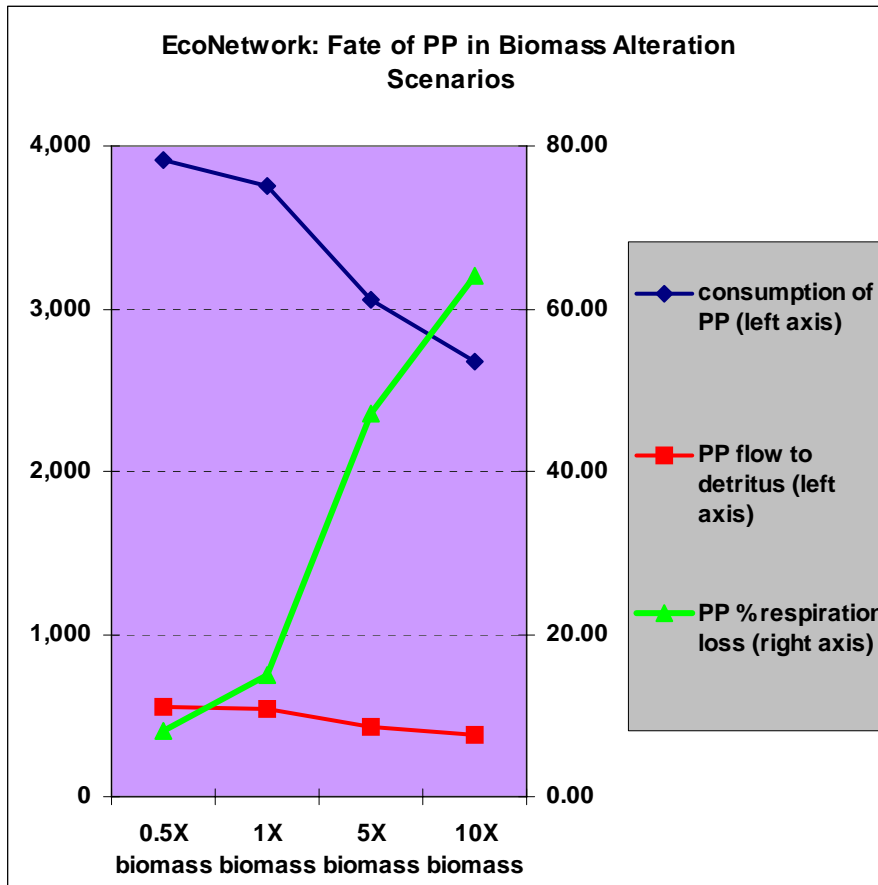
- A function of EE
- Flows to detritus & subsequently exported
- Thus, may be difficult to definitively show bottom-up effects with this model

# Why no change?



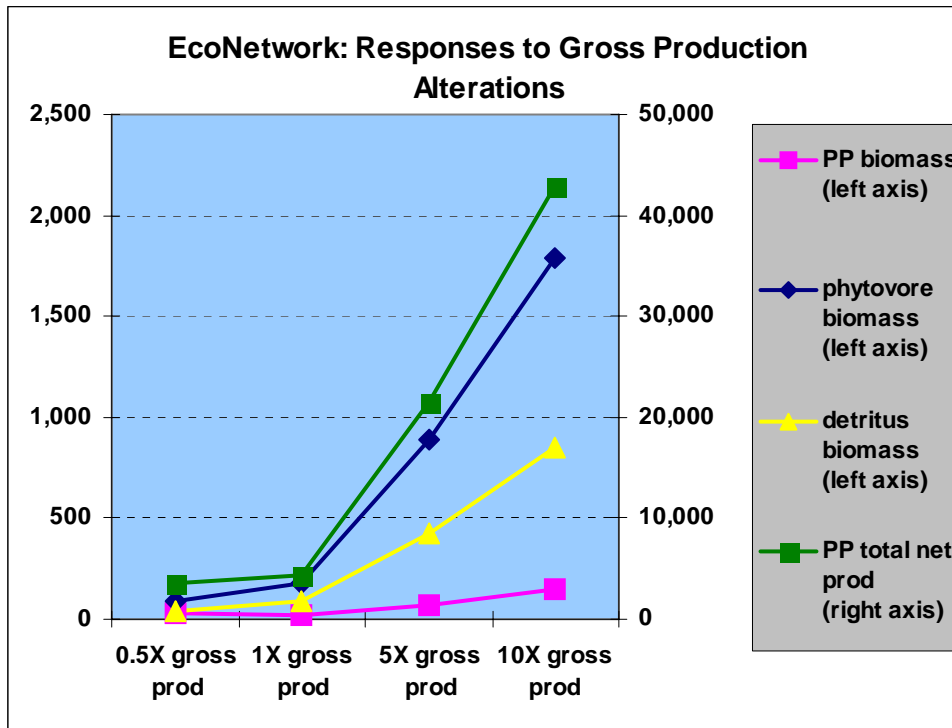
- Should see change specifically in phytovore biomass or detritus buildup
- Results very counterintuitive for EcoNetwork

# Why no change?



- A function of R/B
- No notable change in flows to detritus

# Why no change?



- Don't change biomass, change the production rates
- Thus, may be able to show some bottom-up effects with this model

# Conclusions - I

- How much of our predicted results are true features of the ecosystem vs. caveats of these network models?
  - Some results ecologically intuitive
  - Others less so
  - Need for key diagnostics (as in PP example) for full interpretation
- These model results generally imply top-down (predator-prey, fishing) effects may be small in magnitude relative to total system fluxes
  - Fishing mortality rates in the balanced baseline model were low compared to consumption and predation rates
  - Reducing the fishing mortality rates further in the model did not require major rebalancing
  - May be important for particular nodes, but minor relative to larger system flows

# Conclusions - II

- Challenge remains to use these kinds of models to evaluate hypotheses pertaining to carrying capacity of fisheries systems
  - Need for careful interpretation and application of model results
- Given caveats noted, results and previous studies imply some measure of predicted prominence for small pelagics in this ecosystem