

Using ecosystem models to evaluate how climate change influences ecological indicators' response to fishing effects in the southern Benguela system

Kelly Ortega-Cisneros, Lynne Shannon, Kevern Cochrane, Elizabeth A. Fulton and Yunne-Jai Shin



Indicators

- Ecosystem indicators are useful tools to provide insights on marine ecosystems.
- Sensitivity and specificity.
- Likely increases in climate variability associated with climate change.
- Simulation experiments can assist the selection of candidate indicators within controlled conditions.
- Comparative approaches.

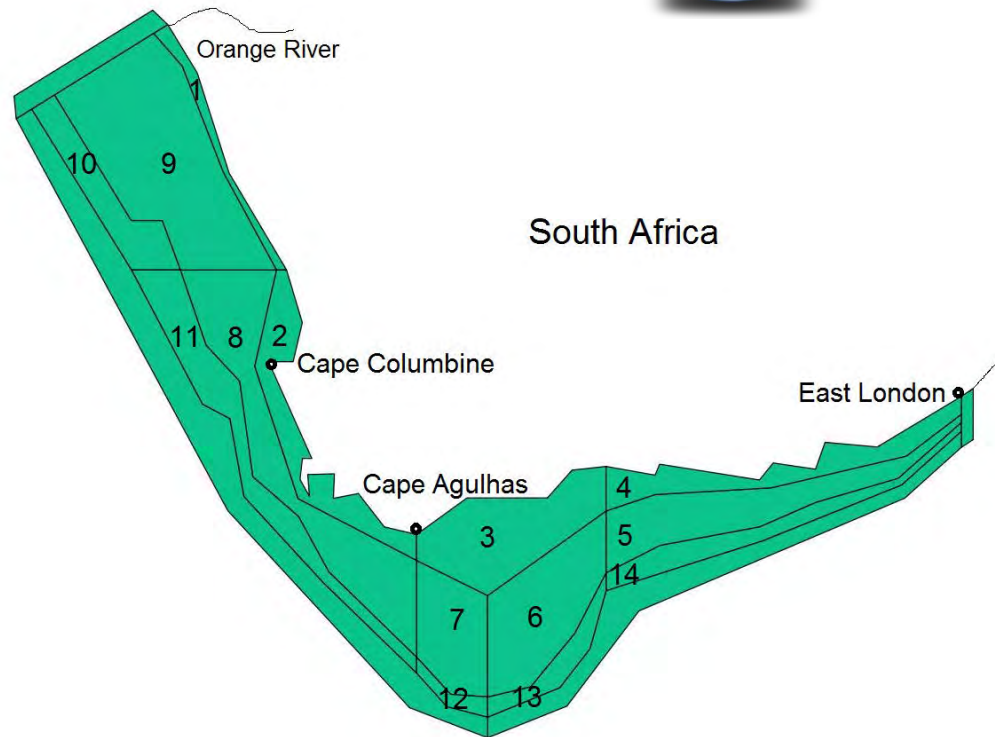


Methods - models

Atlantis on the Benguela and Agulhas Current System



Ecopath with Ecosim



Methods - models

- ABACuS initialized at 1990s conditions, validated against 1990-2013 time series
- EwE initialized at year 1978, validated against 1978-2003 time series
- 33 (ABACuS) and 31 (EwE) groups



Methods – models fisheries

- Fisheries were represented using fishing mortality rates

Small pelagics fishery

Inshore and offshore trawl fishery

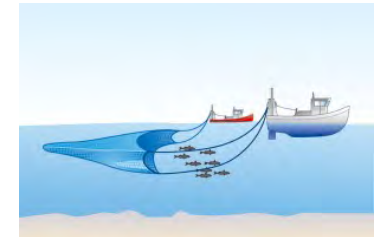
Directed mid-water trawl fishery

Squid fishery

Line fishery



- The catches of mesopelagic fish and chub mackerel are modelled in the EwE model but not in ABACuS v2.



Methods - Ecosystem indicators

- Sub-set of indicators recommended by IndiSeas

Biomass/Landings

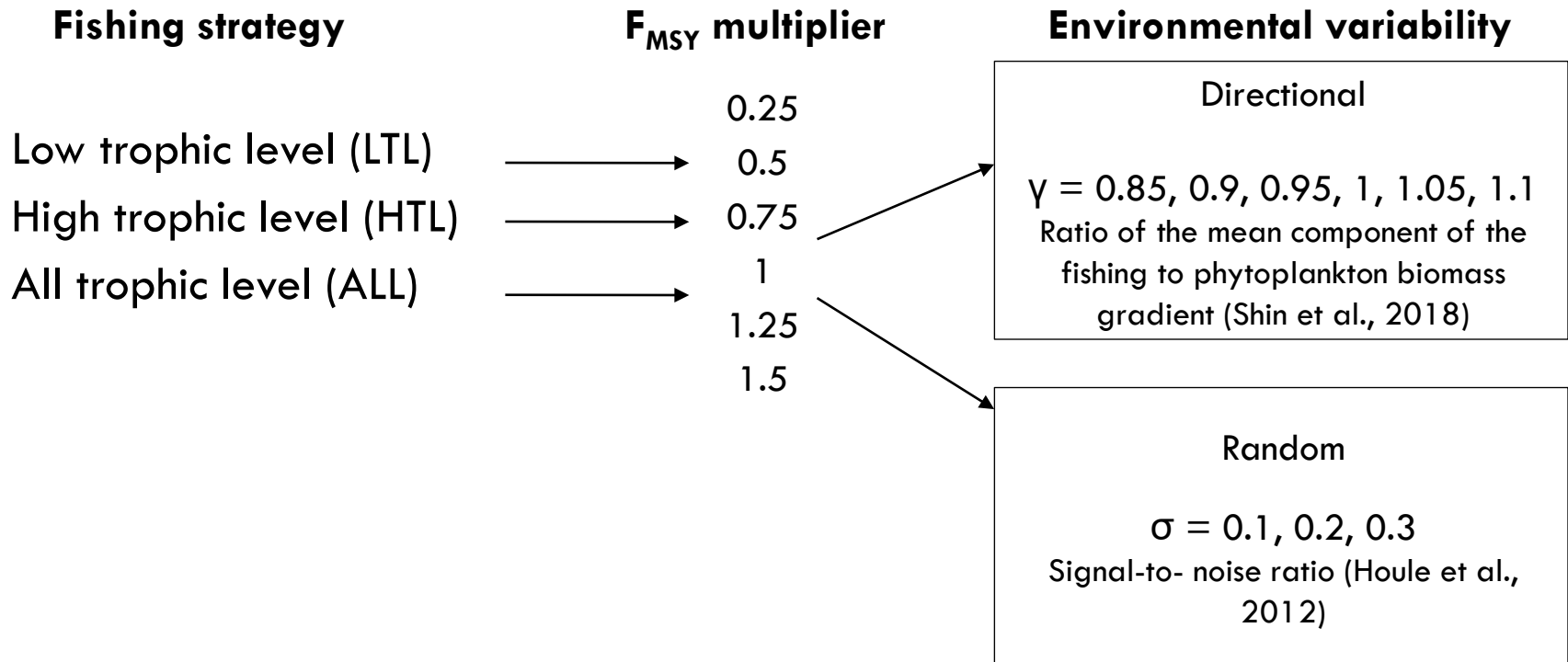
Proportion of predatory fish

Trophic level of the community

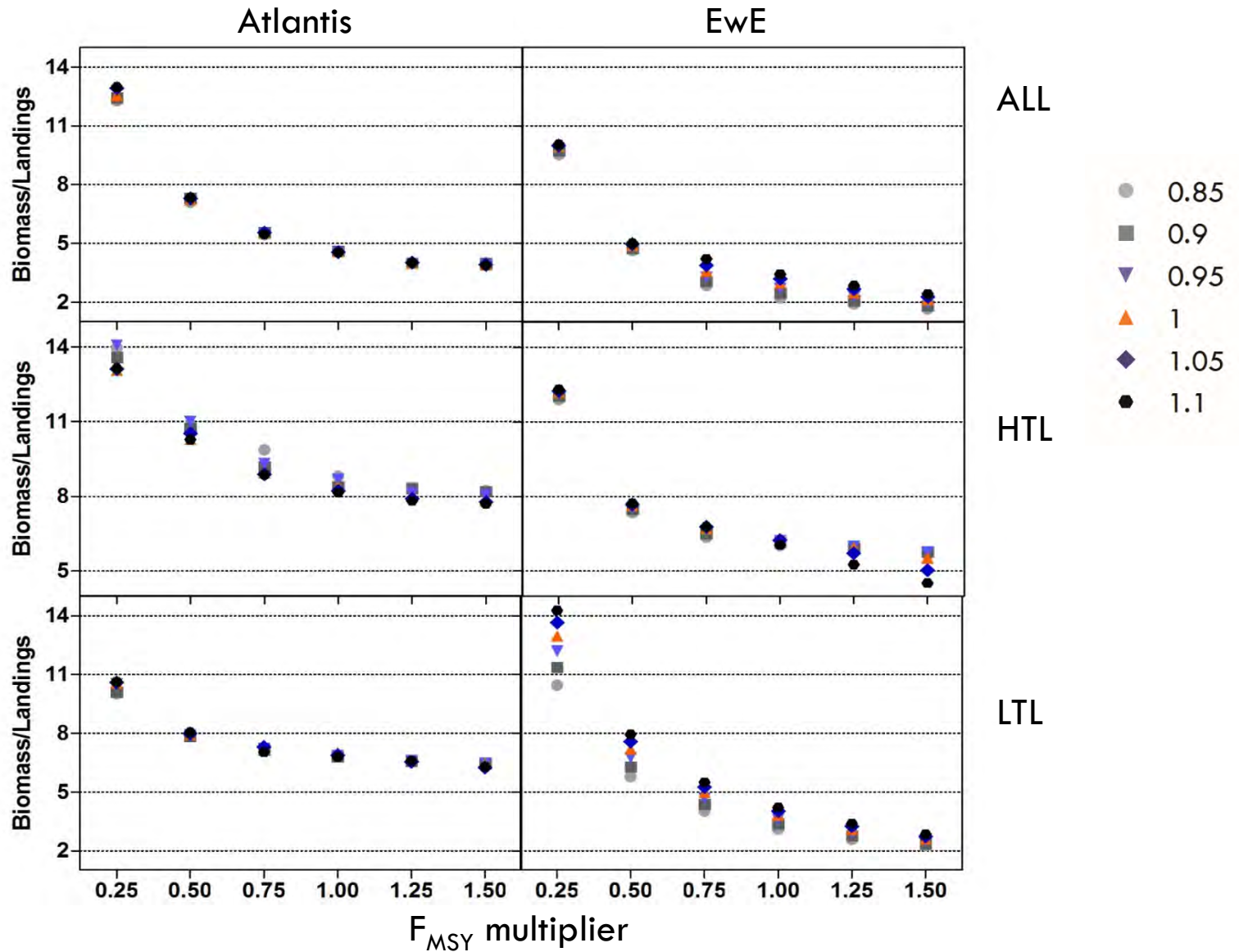
Marine Trophic Index

Mean Intrinsic Vulnerability

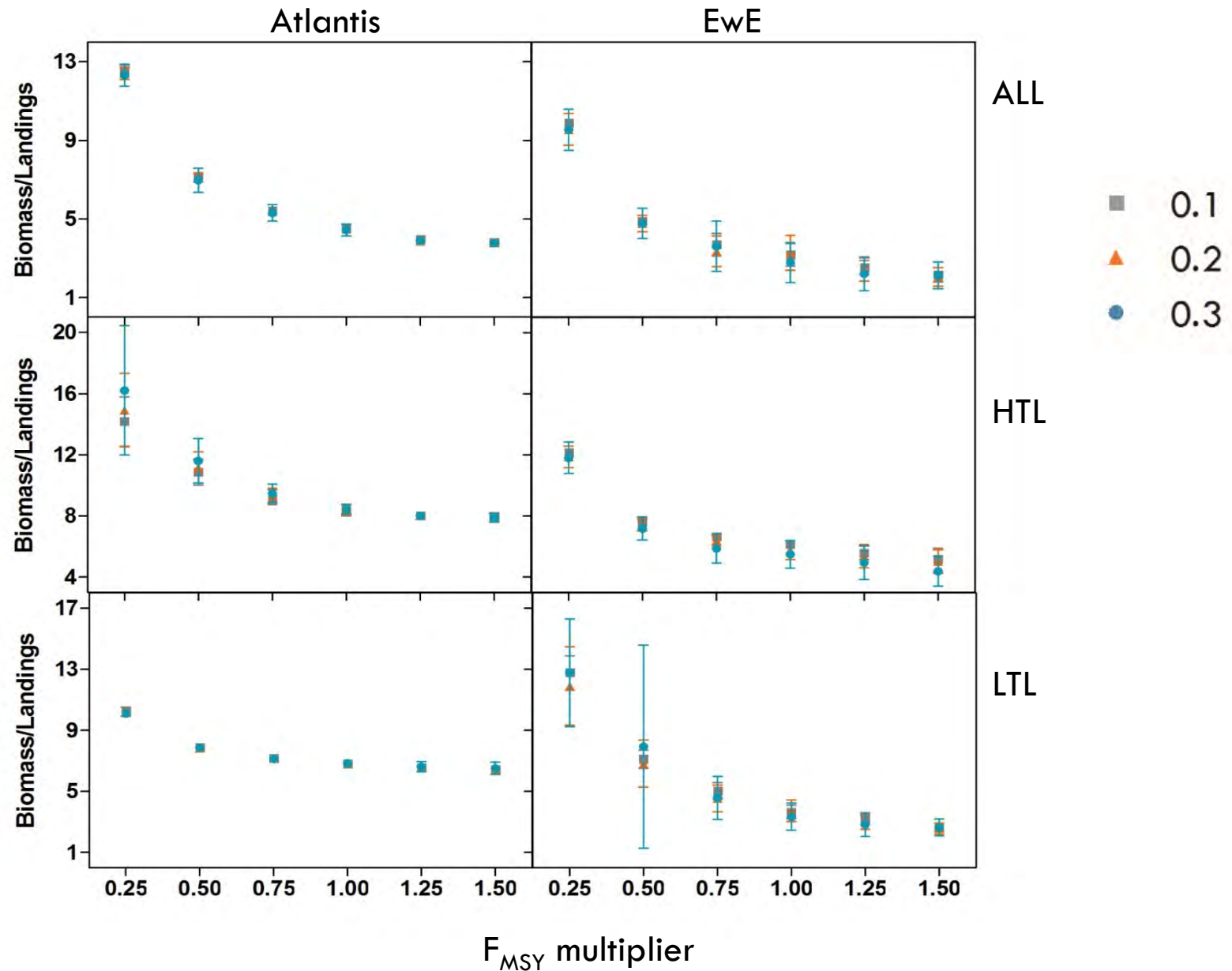
Methods - Scenarios



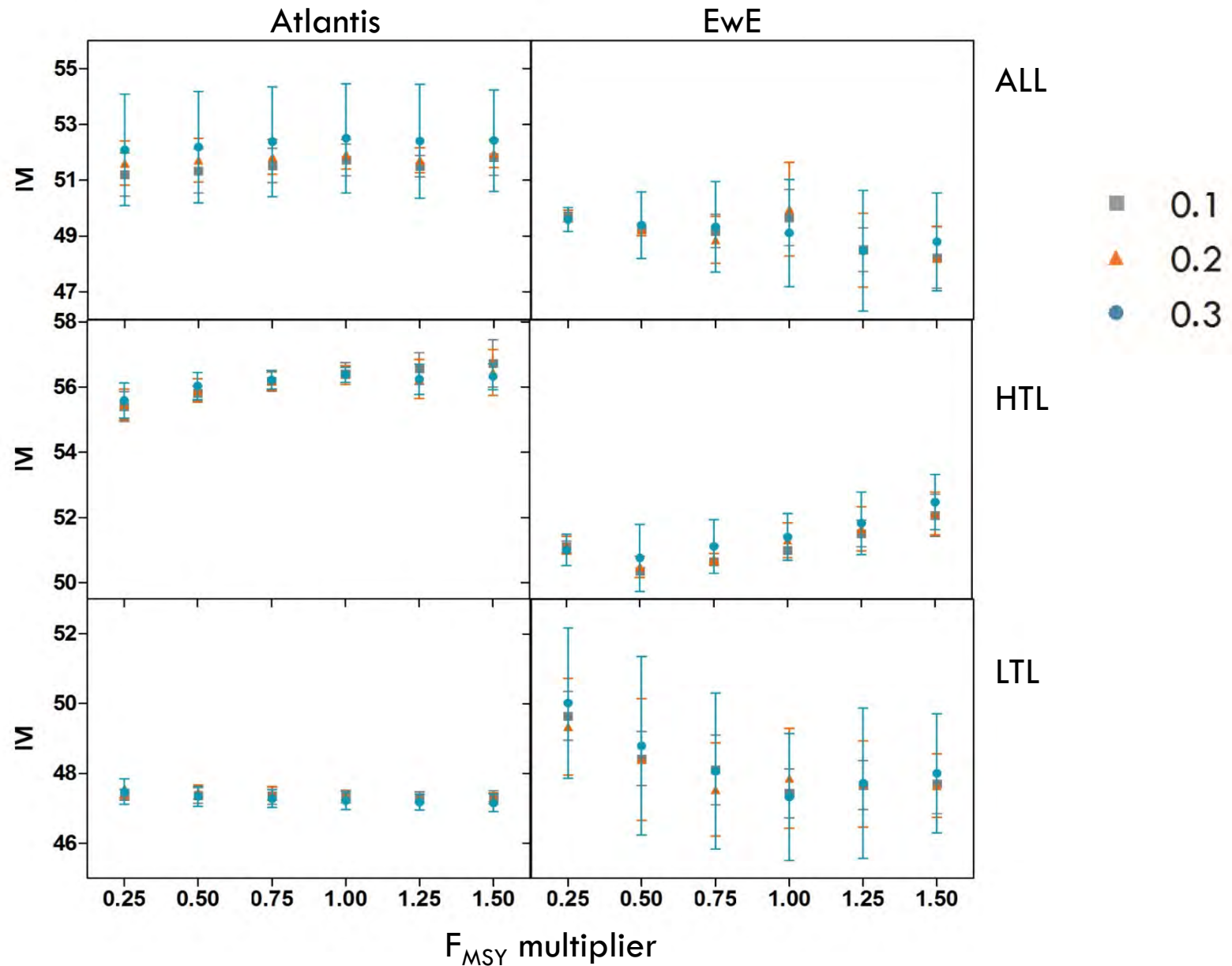
Indicators - directional change



Indicators (Mean \pm SD) - random environmental change

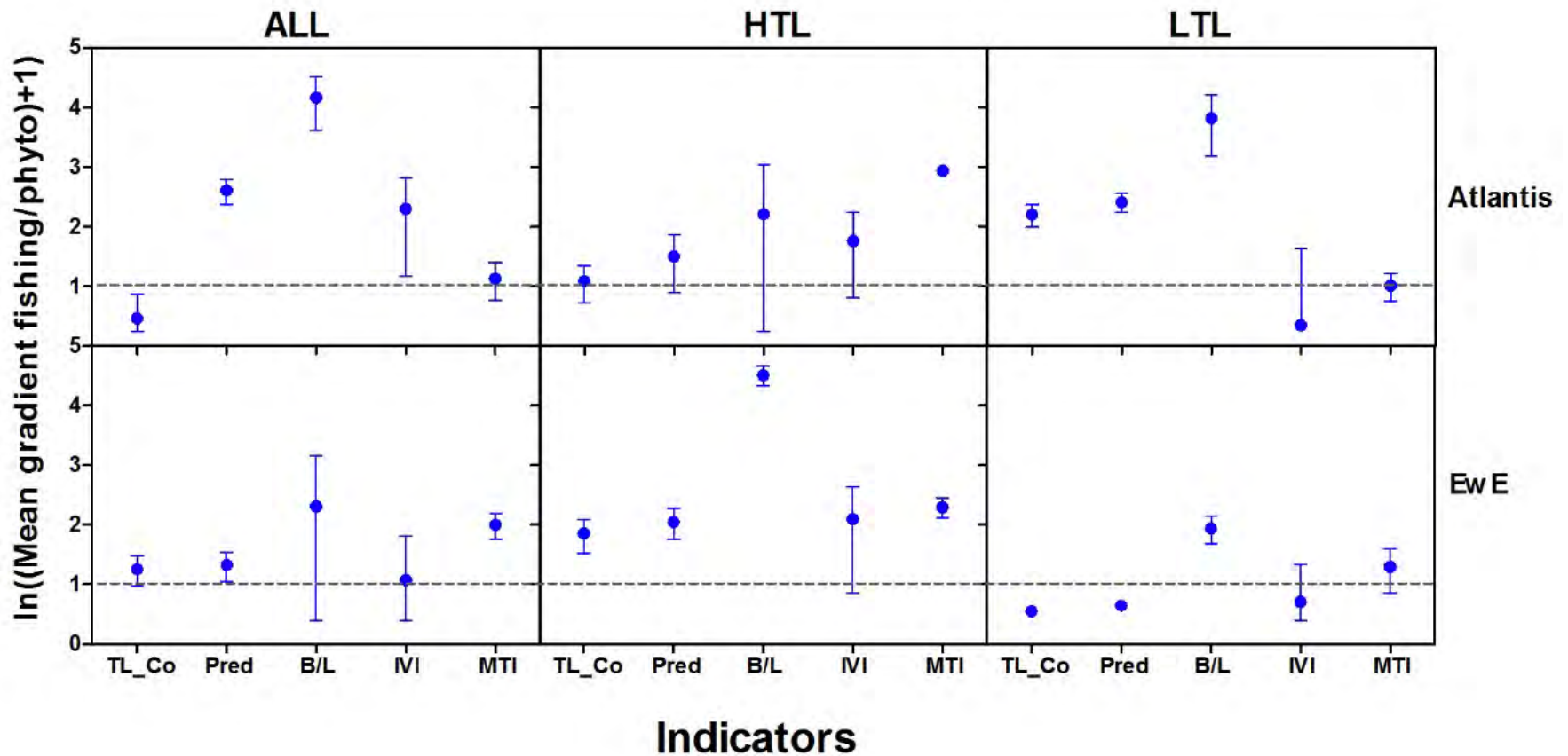


Indicators (Mean \pm SD) - random environmental change



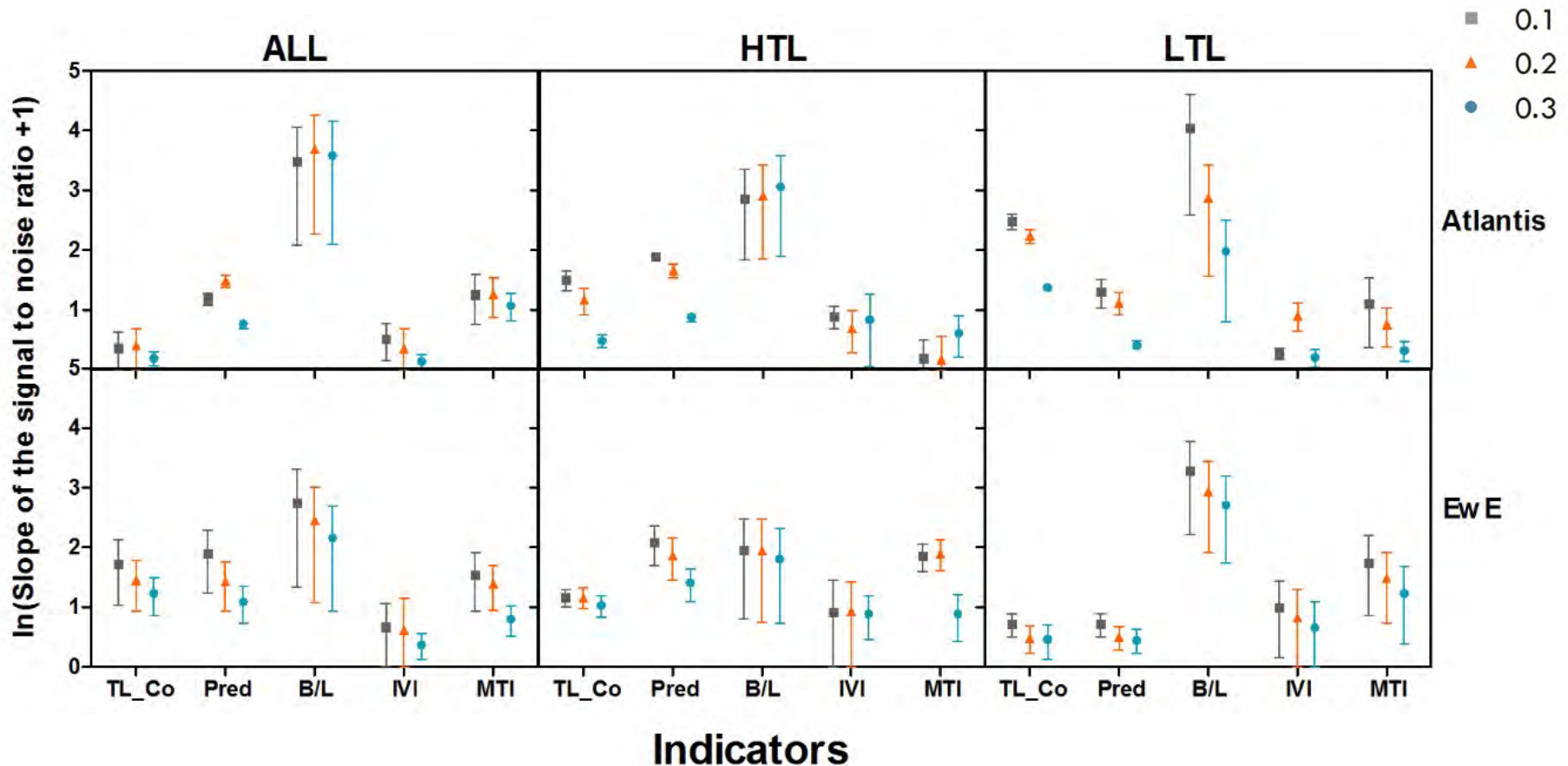
Results

Specificity (Mean \pm 95 % CI) of ecosystem indicators to fishing in the presence of directional change for both ecosystem models



Results

Specificity (Mean \pm 95 % CI) of ecosystem indicators to fishing in the presence of random environmental change for both ecosystem models



Summary

- Similarities in indicator and specificity values were recorded between models for some indicators under certain fishing strategies.
- Important differences between indicators calculated from the two model outputs were also found.
- A moderate to high specificity of indicators to fishing was demonstrated for the southern Benguela.
- Total biomass/landings was the most specific indicator to fishing.
- Others indicators seem better suited to tracking the effects of fishing under one or other fishing strategy.
- Higher specificity of ecosystem indicators to fishing was generally recorded at lower levels of variability of phytoplankton biomass.

Thanks!!!

