

# Oceans and Ecosystems Research

## Research to support Ecosystem-Based Management

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## Research to support Ecosystem-Based Management (EBM)

- Major Science Question(s)
  - How do we assess, evaluate, and predict the holistic integrated state of coastal ecosystems to improve management?
- Links to NOAA Strategic Plan
  - A holistic understanding of the Earth system through research
- Links to other authorizing language, statutes, etc. (if appropriate)
  - Water Resources Development Act 2000 (Everglades Restoration), Coastal Zone Management Act, Clean Water Act, Magnuson-Stevens Reauthorization Act, etc.



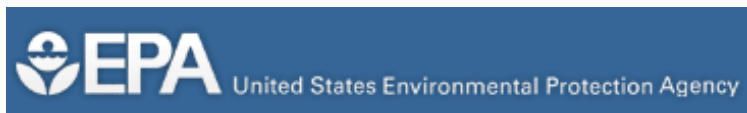
# Partnerships and Stakeholders



NATIONAL MARINE  
SANCTUARIES



Gulf of Mexico **LME**

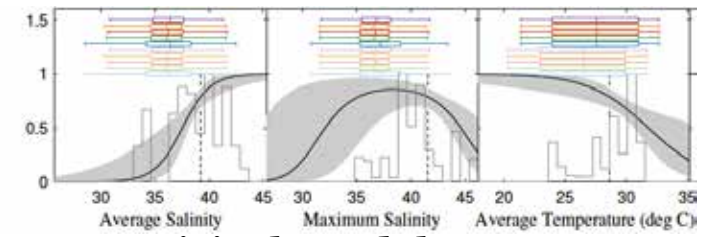
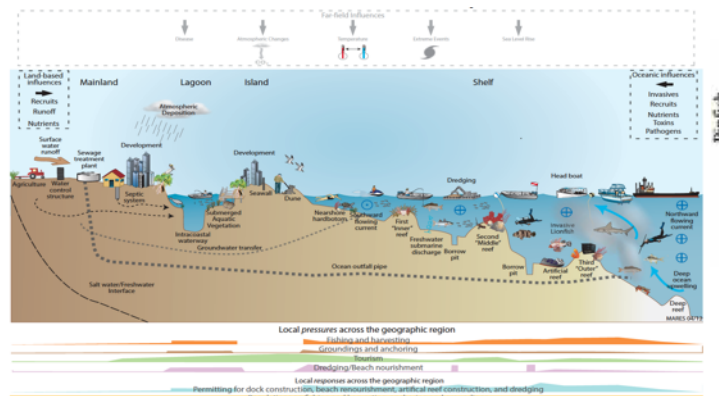
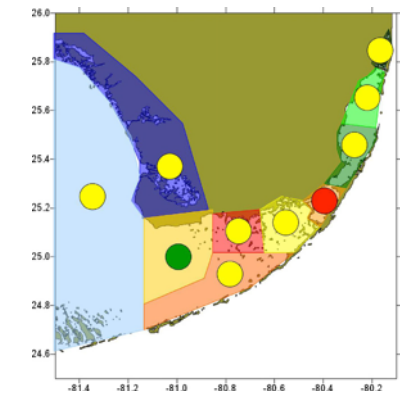


**US Army Corps  
of Engineers®**



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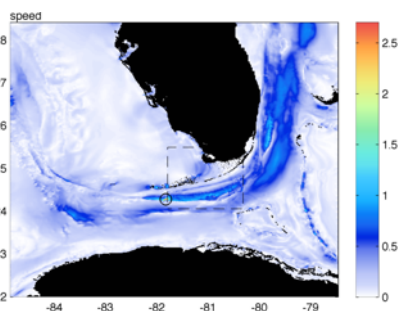
# How do we assess, evaluate, and predict the holistic integrated state of coastal ecosystems to improve management?



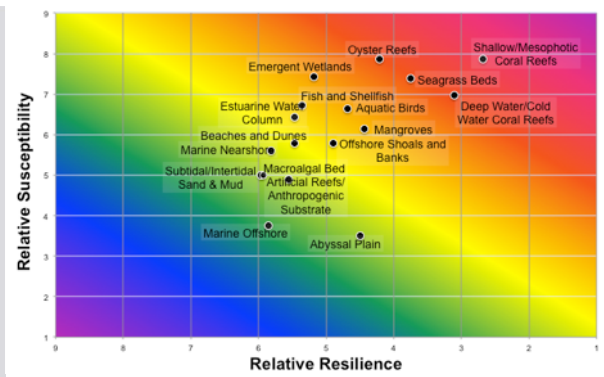
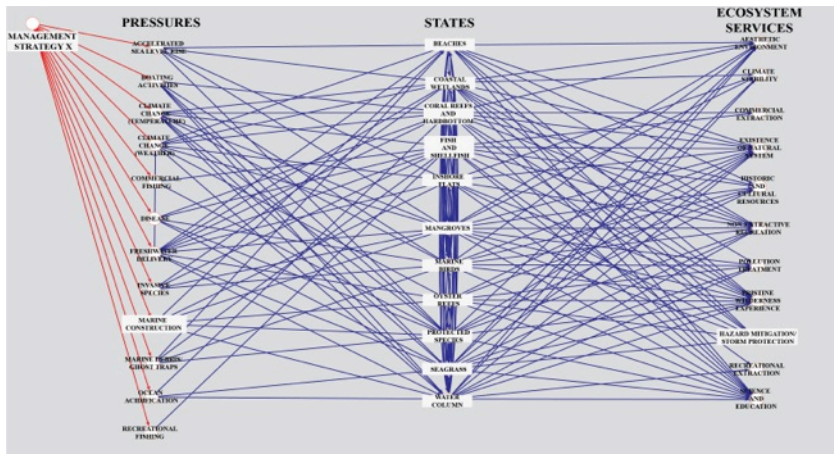
Empirical Models

## Observations/ Indicators

## Conceptual Models



Mechanistic Models



Risk analysis

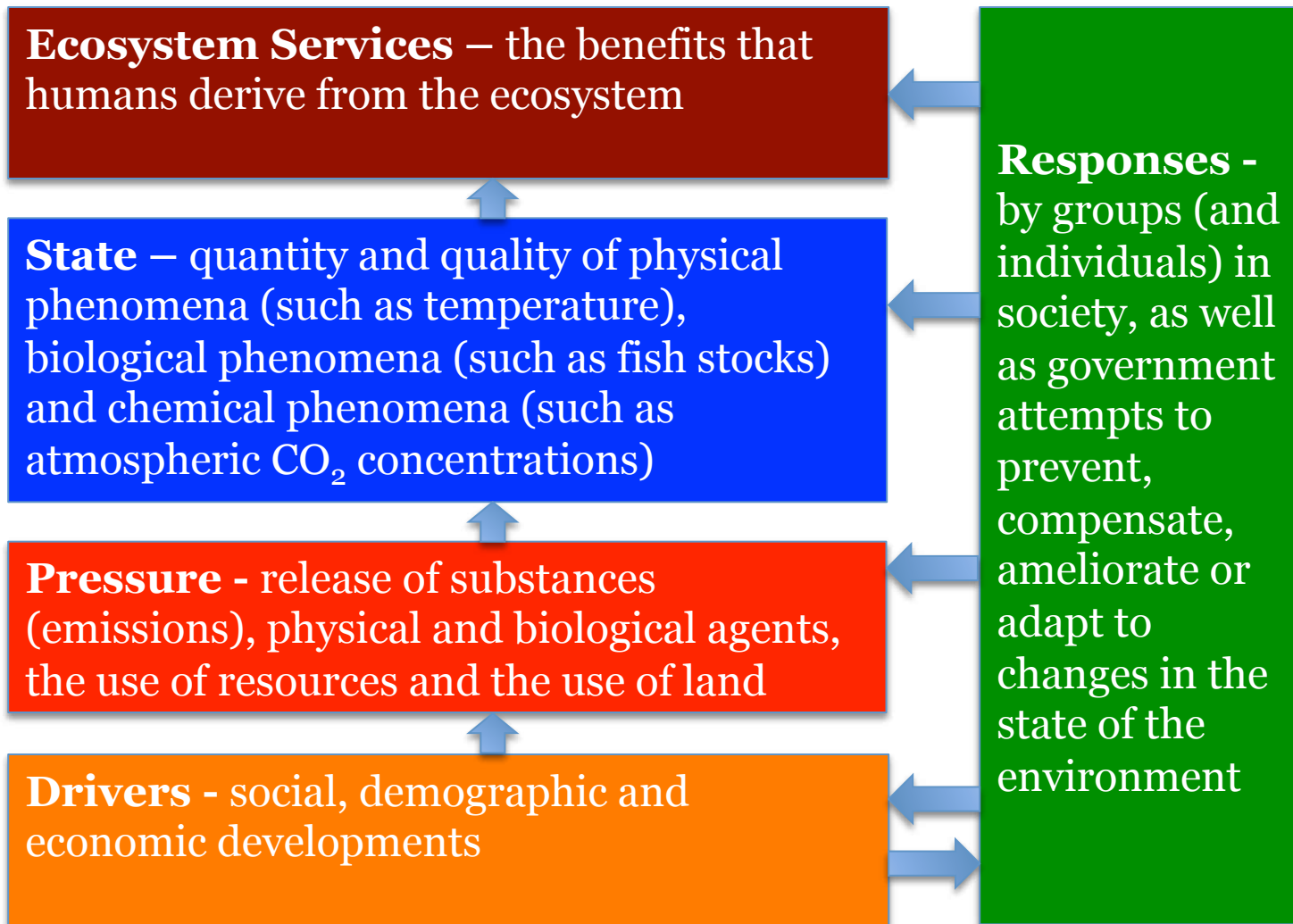
## Integrations with Human Dimensions



## AOML Program Review

# EBM-DPSEER:

A next generation conceptual ecosystem model



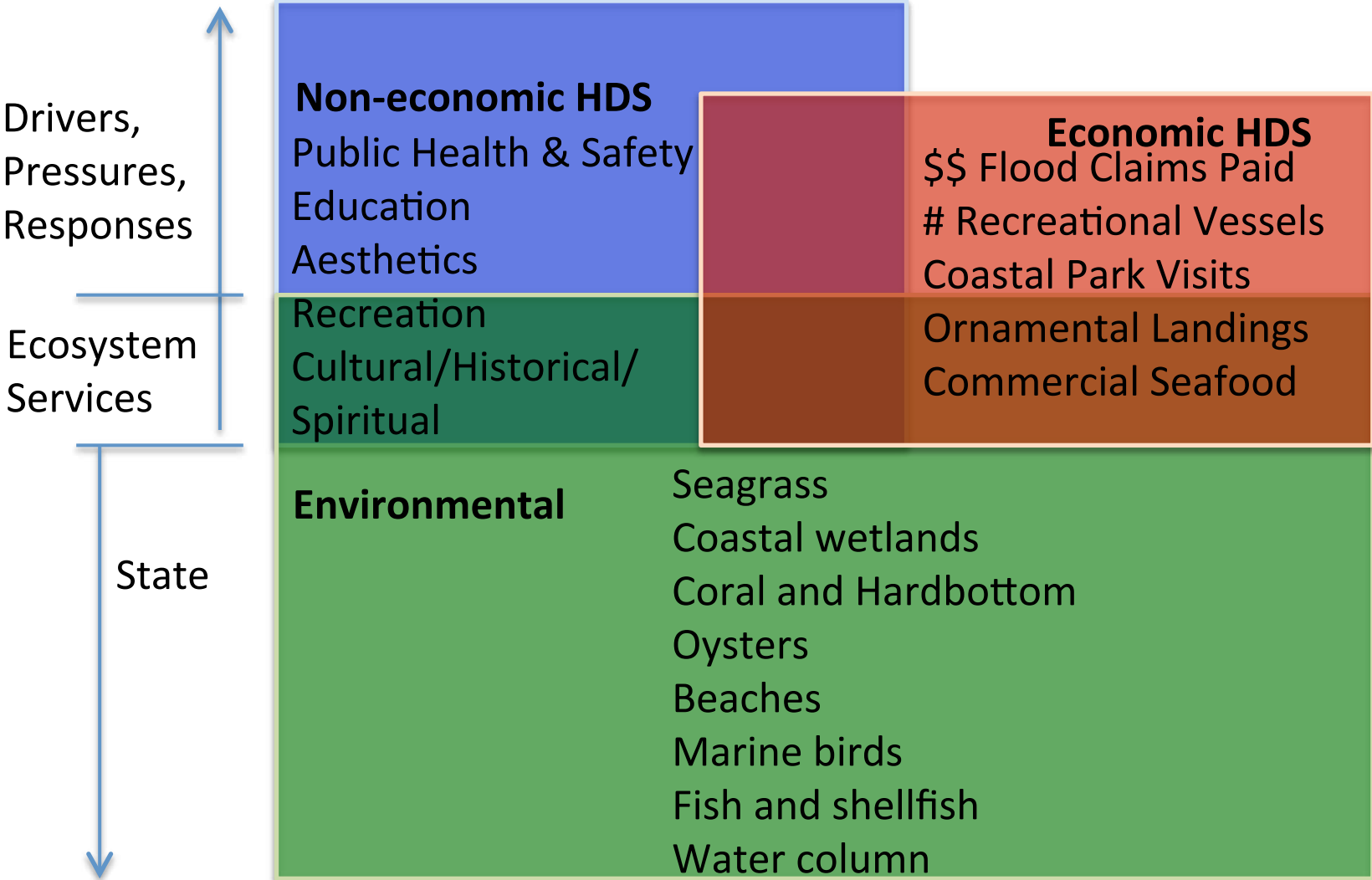
Kelble et al. (2013)



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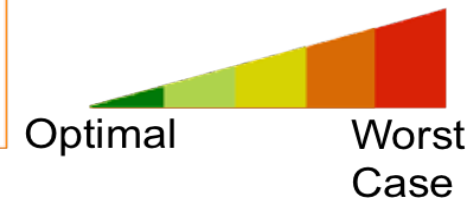
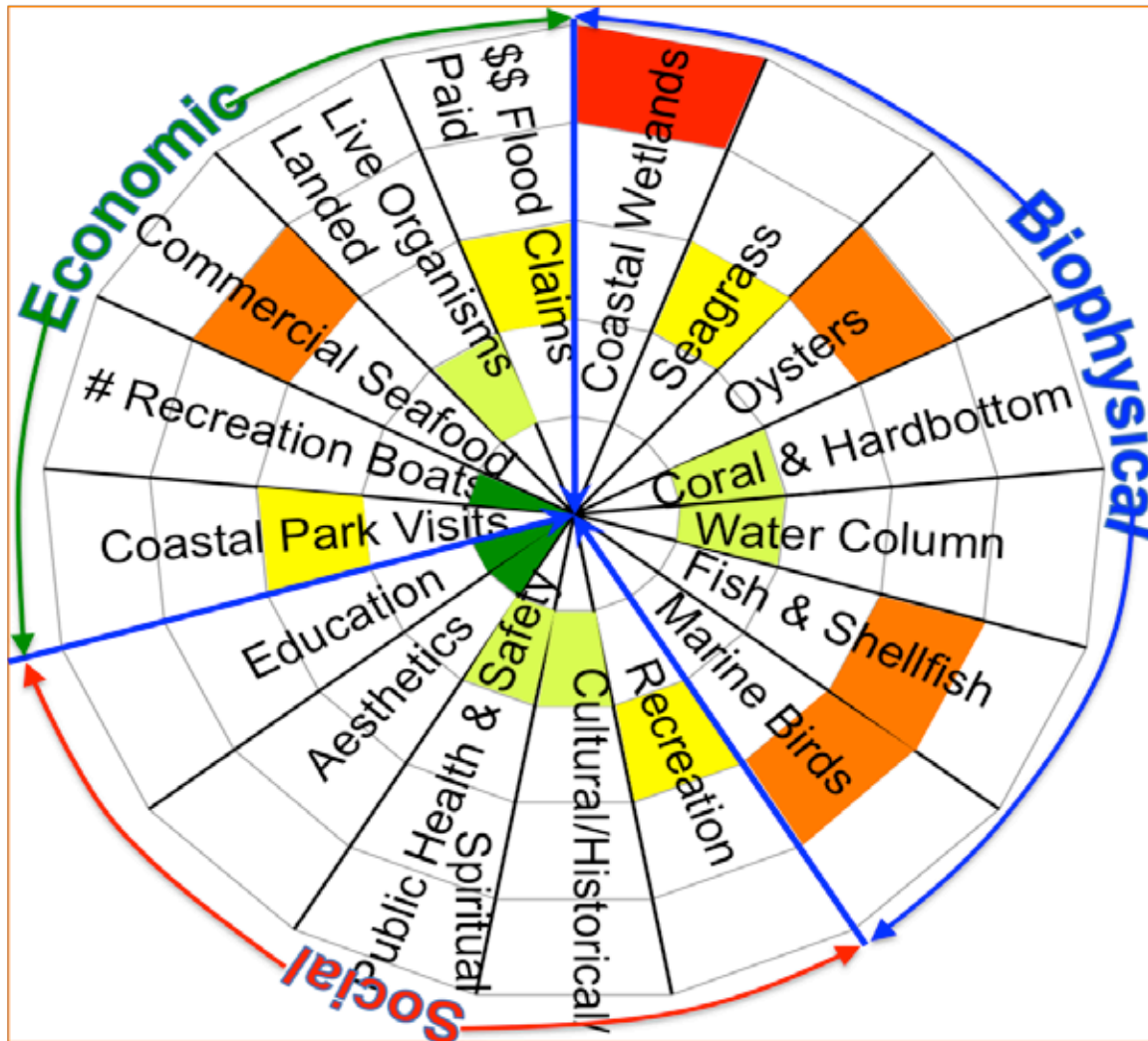


# Holistic Indicator selection





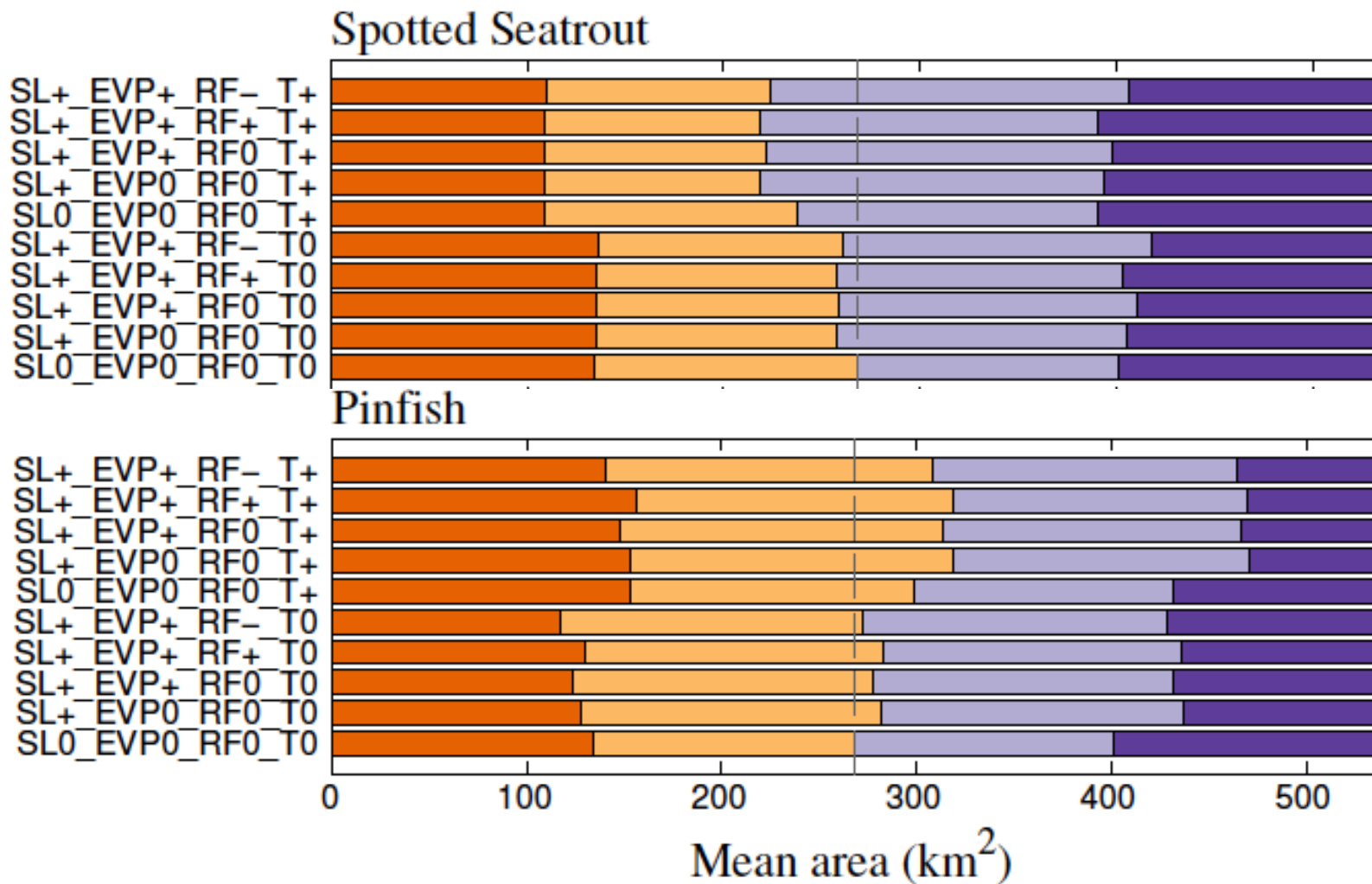
# Developing Consistent Indicators for IEAs





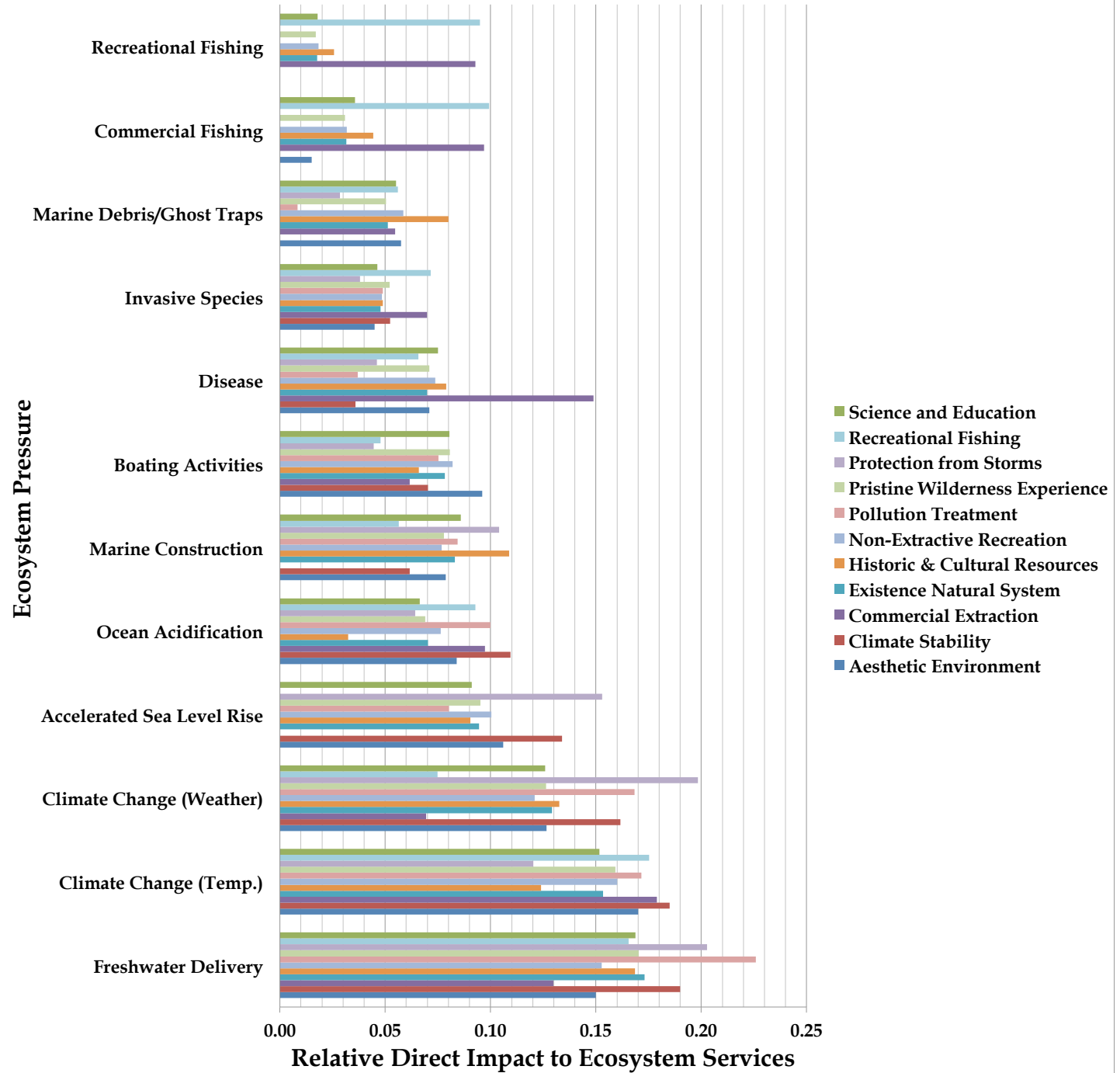


# Empirical Models to Assess Climate Change Impacts



# Impact of multiple pressures upon Ecosystem Services

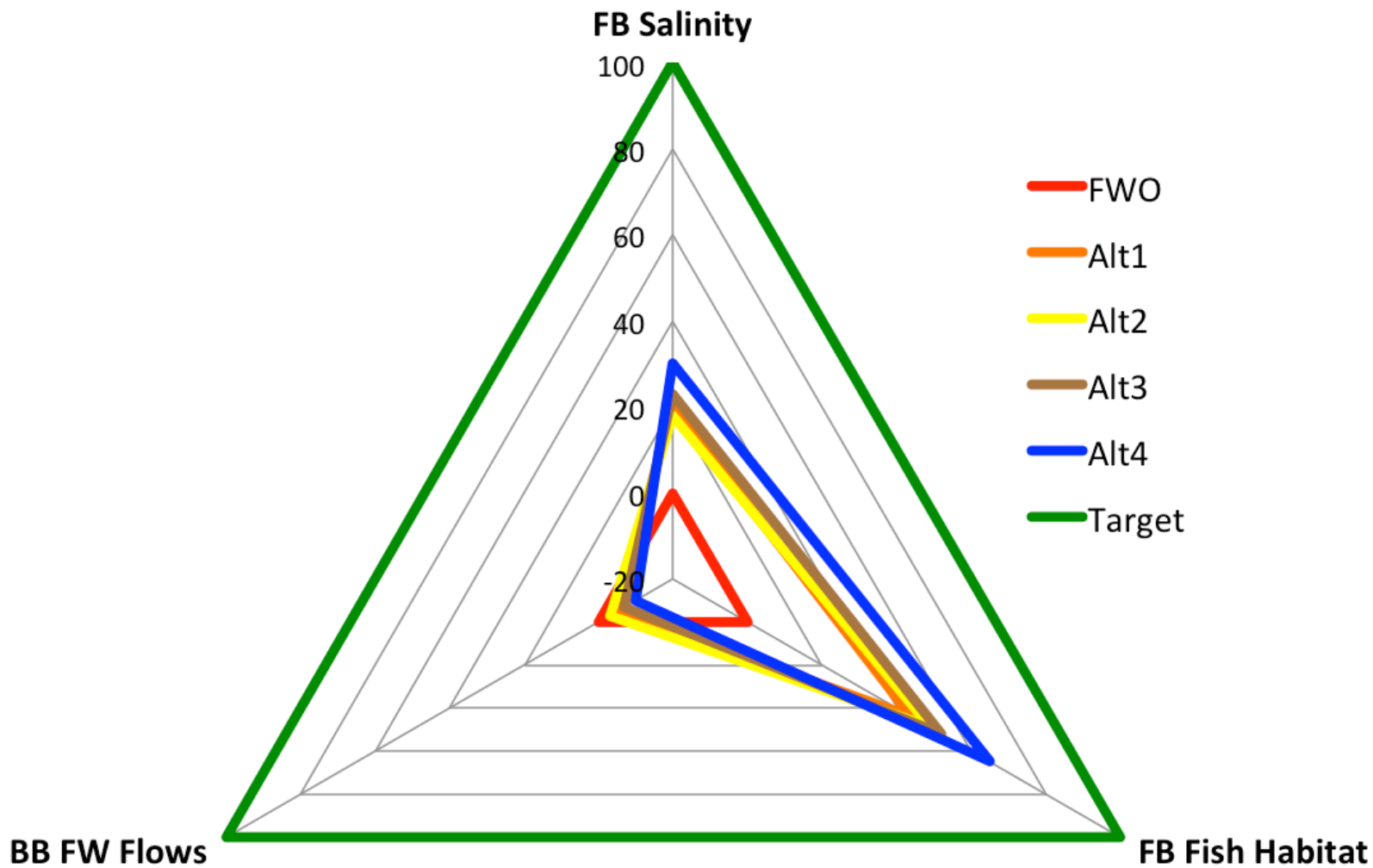
Direct Impact of Ecosystem Pressures on Ecosystem Services



Cook et al. (201

# Evaluating Management Strategies

**% Increase Towards Target over Future Without Project/Management**



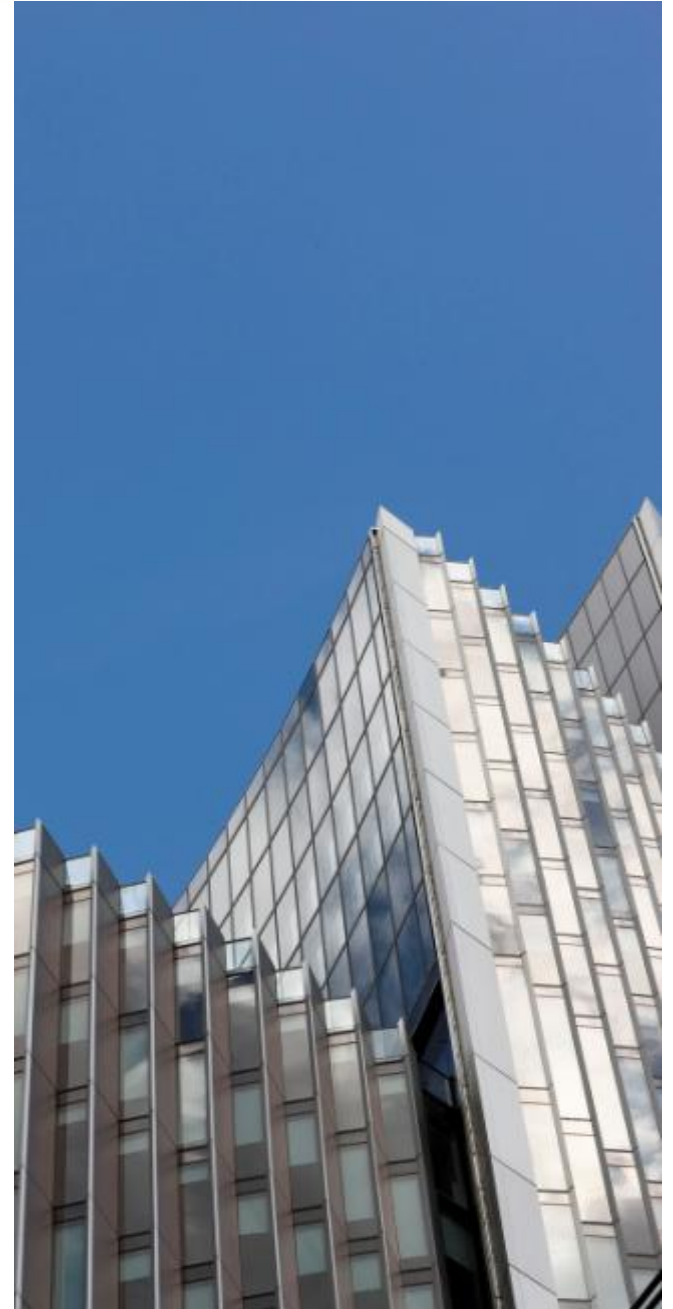
*Kelble et al. (In Prep)*



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# Looking Ahead

- In the works:
  - Investigating climate change with coupled climate, physics, & ecosystem models
  - Better integration with Human Dimensions Science by incorporating Human Well-Being
  - Methodology to determine optimal yield for fisheries
  - Setting reference points for EBM
- Known risks and issues
  - Governance; untested hypothesis; political will; accounting for uncertainty in complex systems





## Recent Publications (2013-2014)

1. Fletcher, P. J., C. R. Kelble, W. K. Nuttle, and G. A. Kiker. 2013. Using the integrated ecosystem assessment process to build consensus and transfer information to managers. *Ecological Indicators*. *In Review*
2. Loomis, D. K., P. Ortner, and C. Kelble. 2013. Developing Integrated Ecosystem Indices. *Ecological Indicators* *In Review*
3. Kearney, K., M. Butler, R. Glazer, C. Kelble, J.E. Serafy, E. Stabenau. 2014. Quantifying Florida Bay habitat suitability for fishes and invertebrates under climate change scenarios. *Environmental Management*. *Accepted*
4. Smith, R.H., E.M. Johns, G. J. Goni, J. Trinanes, R. Lumpkin, A. M. Wood, C. R. Kelble, S. R. Cummings, J. T. Lamkin, S. Privoznik. 2014. Oceanographic conditions in the Gulf of Mexico in July 2010, during the Deepwater Horizon oil. *Continental Shelf Research*. *Accepted*
5. Conmy, R., P. Coble, J. Farr, A.M. Wood, K. Lee, W. Pegau, I. Walsh, C. Koch, M. Abercrombie, S. Miles, M. Lewis, S. Ryan, B. Robinson, T. King, C. Kelble, J. Lacoste. 2014. Submersible optical sensors exposed to chemically-dispersed crude oil: wave tank simulations for improved oil spill monitoring. *Environmental Science and Technology*. *Accepted*
6. Cook, G. S., Fletcher, P. J., & Kelble, C. R. 2014. Towards marine ecosystem based management in South Florida: Investigating the connections among ecosystem pressures, states, and services in a complex coastal system. *Ecological Indicators*. doi:10.1016/j.ecolind.2013.10.026
7. Levin, P. S., C. R. Kelble, R. Shuford, C. Ainsworth, Y. de Reynier, R. Dunsmore, M. J. Fogarty, K. Holsman, E. Howell, M. Monaco, S. Oakes, and F. Werner. 2014. Guidance for implementation of integrated ecosystem assessments: a US perspective. *ICES Journal of Marine Science* *In Press*.
8. Kearney, K.A., C. Stock, and J.L. Sarmiento. 2013. Amplification and attenuation of increased primary production in a marine food web. *Marine Ecology Progress Series*, 491:1-14, doi:10.3354/meps10484
9. Carson, H.S., P.C. Lopez-Duarte, G.S. Cook, F.J. Fodrie, B.J. Becker, C. DiBacco, and L.A. Levin. 2013. Temporal, spatial, and interspecific variation in geochemical signatures within fish otoliths, bivalve larval shells, and crustacean larvae. *Marine Ecology Progress Series*, 473:133-148, doi:10.3354/meps10078
10. Kelble, C. R., Loomis, D. K., Lovelace, S., Nuttle, W. K., Ortner, P. B., Fletcher, P., Cook, G.S., Lorenz, J.J., Boyer, J. N. (2013). The EBM-DPSER conceptual model: integrating ecosystem services into the DPSIR framework. *PloS one*, 8(8), e70766. doi:10.1371/journal.pone.0070766
11. Cannizzaro, J. P., C. Hu, K. L. Carder, C. R. Kelble, N. Melo, E. M. Johns, G. A. Vargo, and C. A. Heil. 2013. On the Accuracy of SeaWiFS Ocean Color Data Products on the West Florida Shelf, *Journal of Coastal Research* 29(6):1257-1272.
12. Kelble, C. R. 2013. Low Salinity Predation Refugia Could Cause HAB Initiation. *Journal of Phycology* 49:18-19.





Questions?





# Back-up slides

