

Marine Life Protection Act Initiative



Spatial Bioeconomic Model Evaluation of Blue Ribbon Task Force Recommended Marine Protected Area Proposals for the North Coast Study Region

Presentation to the MLPA Master Plan Science Advisory Team
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Model Description



- Models simulate population dynamics.
- Model inputs include:
 - Life history characteristics of modeled species
 - Larval dispersal predicted by ocean currents
 - Habitat data
 - Spatial fishing effort
- Models consider outcomes of three management scenarios:
 - Conservative management
 - Maximum Sustainable Yield (MSY)-type management
 - Unsuccessful management



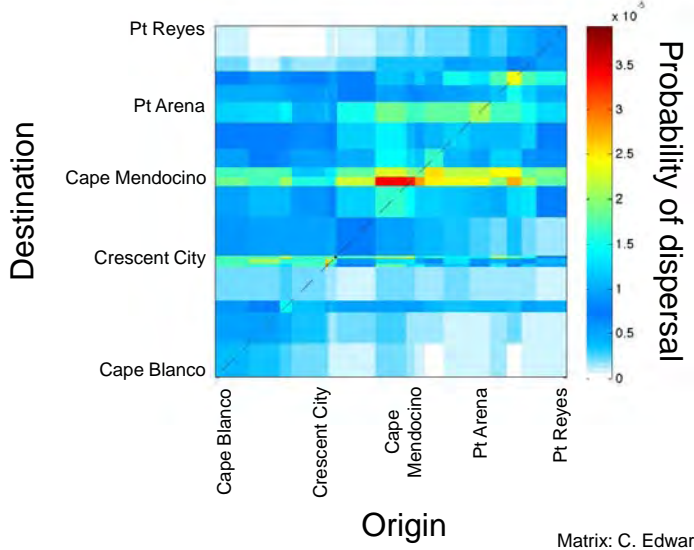
Enhanced Compliance Alternative

- The Enhanced Compliance Alternative (ECA) includes nearshore “ribbon MPAs” where a variety of uses are proposed to accommodate traditional tribal uses, paired with MPAs offshore where proposed uses are restricted to those at moderate high level of protection (LOP) and above.
- Ribbon MPAs (which extend from shore to 1,000 feet offshore) generally are narrower than a single model cell (1 square kilometer).
- To complete the modeling evaluation, it was necessary to assign the proposed uses associated with a nearshore ribbon MPA to the entire model cell, if the ribbon MPA overlapped the model cell.
- Because of this model constraint, the evaluation of the ECA is conservative; the ECA actually offers slightly more protection than indicated in the modeling evaluation.



Model Input: Larval Dispersal

Matrix for black rockfish (2000-2006 average)



Matrix: C. Edwards & P. Drake, UCSC



Model Description

- Six core species were modeled:
 - Black rockfish
 - Brown rockfish
 - Cabezon
 - Redtail surfperch
 - Red sea urchin
 - Red abalone
- Dungeness crab were also modeled but are presented separately because of characteristics of the fishery (only males are taken).



Model Outputs

- **Conservation metrics**
 - Spatial distribution of biomass
 - Total biomass (summed over study region, weighted sum across species), relative to unfished biomass
- **Economic metrics**
 - Spatial distribution of fishery yield
 - Total fishery yield (summed over study region, weighted sum across species), relative to maximum sustainable yield under Proposal 0



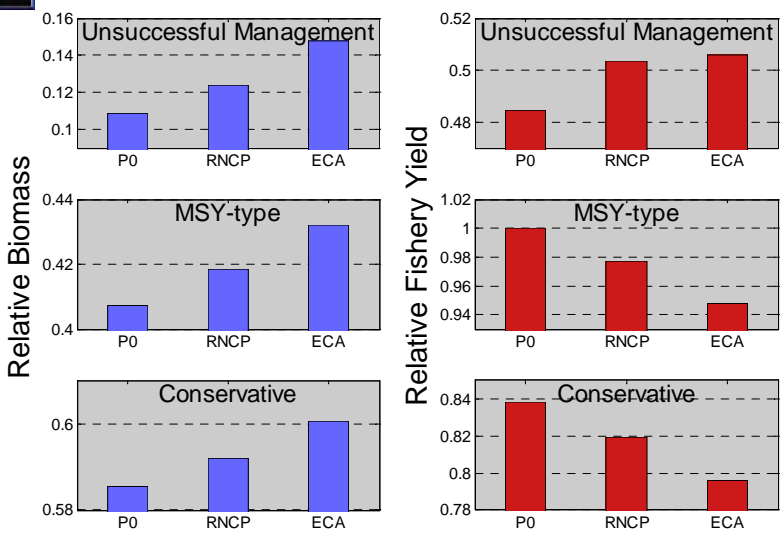
Model Outputs: Biomass

- Map represents predicted spatial distribution of biomass.
- Outputs available for each:
 - Model species
 - Proposal
 - Management scenario
- Maps are posted online for:
 - Biomass
 - Fishery yield
 - Fishing effort
 - Larval production
 - Biomass for each MPA (deletion analysis)

Example (RNCP): Black Rockfish Biomass

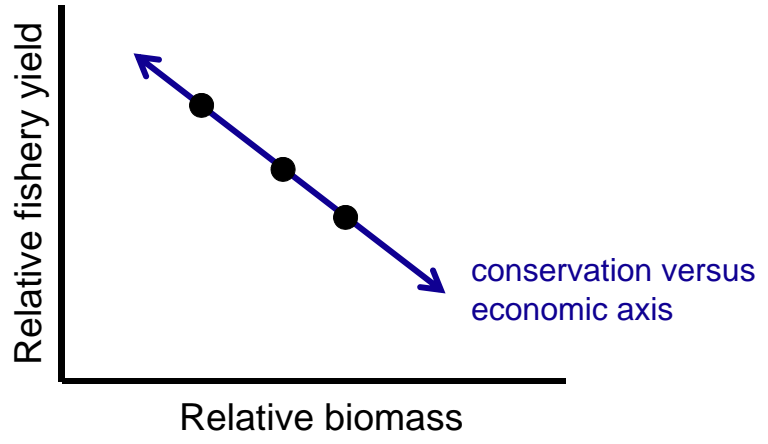


Model Outputs: Proposal Rankings





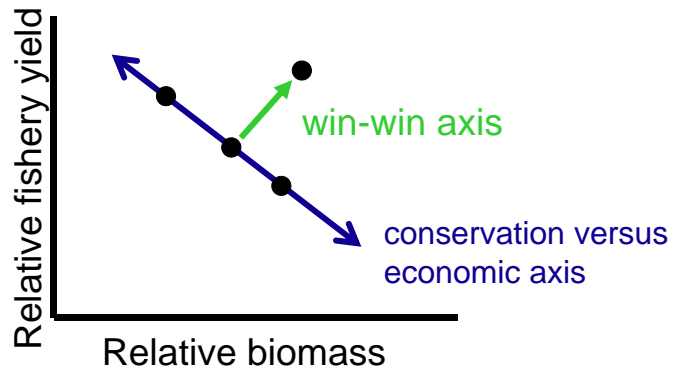
Model Results: Rankings in Context



- Choice along this axis is a matter of priorities, not science.
- Models can put the options in context



Model Results: Rankings in Context

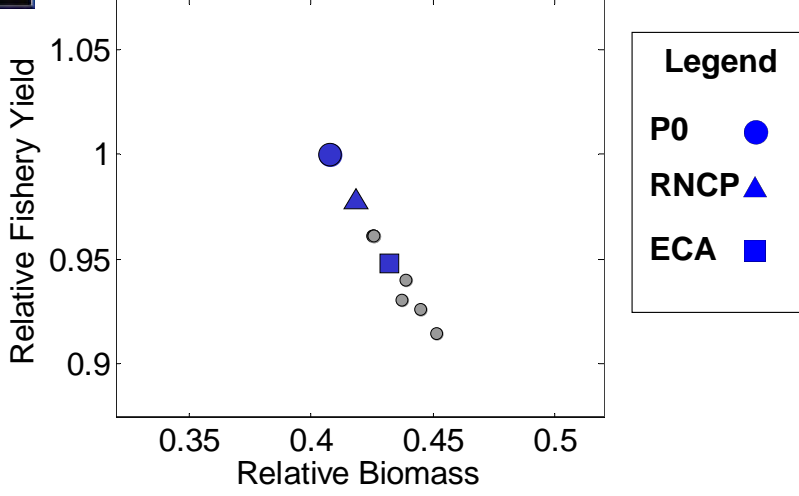


- Models can reveal where one proposal performs better than another for the species modeled.
- Differences are most apparent under assumption of unsuccessful management.



Results: MSY-type Management

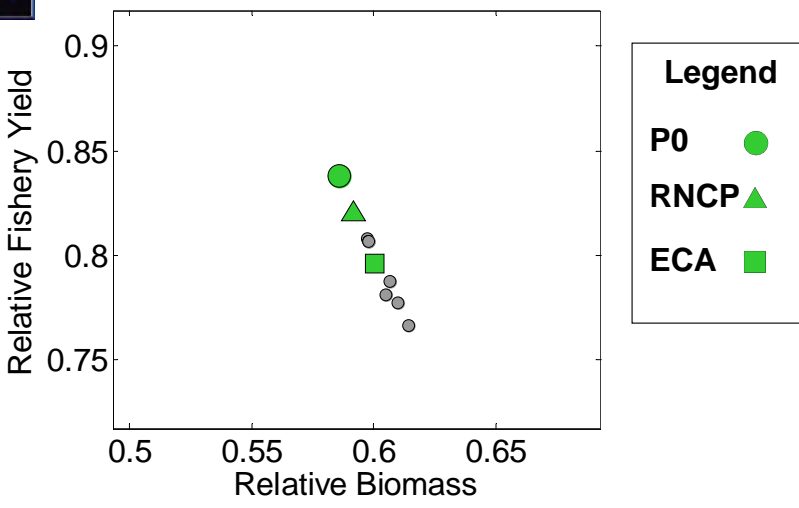
*MSY is Maximum Sustainable Yield



Smaller grey dots indicate proposals from rounds 1,2, and 3.



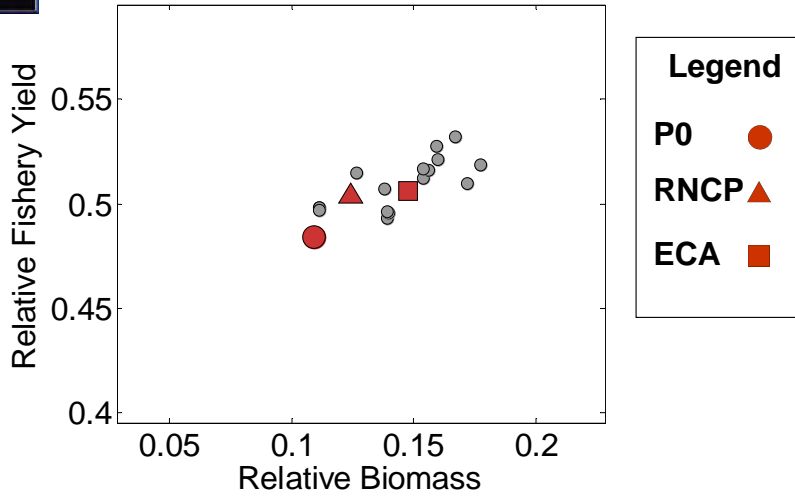
Results: Conservative Management



Smaller grey dots indicate proposals from rounds 1,2, and 3.



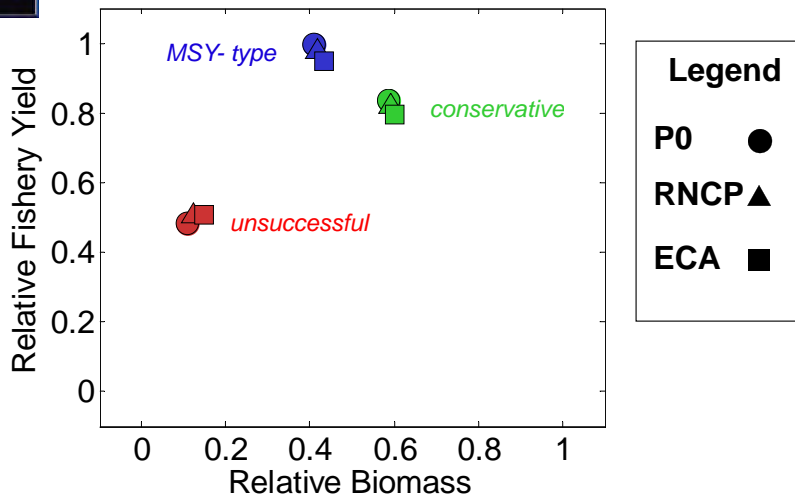
Results: Unsuccessful Management



Smaller grey dots indicate proposals from rounds 1,2, and 3.



Results: Comparing Scenarios





Conclusions

- Deletion and larval production analyses suggest that the Skip Wollenberg-Ten Mile State Marine Reserve (SMR), Sea Lion Gulch SMR, and South Cape Mendocino SMR should be especially effective for most species in both **ECA** and **RNCP**.
- Vizcaino SMCA, Reading Rock Inshore SMCA, and Pyramid Point SMCA are predicted to be more effective in **ECA** than in **RNCP**.
- No MPAs are predicted to decrease noticeably in effectiveness in **ECA** relative to **RNCP**.
- Genetic connectivity analysis suggests no difference between **P0**, **RNCP**, and **ECA** for long-dispersing species (e.g., black rockfish). For short-dispersing species (e.g., red abalone), **ECA** improves connectivity to Shelter Cove region from points south (relative to **RNCP** and **P0**).

All model outputs from this evaluation are posted on the MLPA website (www.dfg.ca.gov/mlpa).



Conclusions

- The **ECA** consistently had highest conservation value for all management assumptions.
- **Proposal 0** (no action alternative) had highest economic value under MSY-type or conservative management.
- The **ECA** had highest economic value under unsuccessful management.
- The **RNCP** was intermediate between **Proposal 0** and the **ECA** in all rankings.

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