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## Marine Life Protection Act Initiative




### Spatial Bioeconomic Model Evaluation Method for the North Coast Study Region

Presented to the MLPA Master Plan Science Advisory Team  
February 11, 2009 • Webinar and Teleconference

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## Model Inputs



- **Geographic**
  - Habitat maps
  - Ocean circulation
  - Proposed MPA boundaries and regulations
- **Species-specific**
  - Life history (growth, natural mortality, fecundity)
  - Adult movement (home range diameter)
  - Larval dispersal (pelagic larval duration, spawning season)
  - Egg-recruit or settler-recruit relationship
- **Fleet response**
  - Spatial abundance of fish
  - Distance from port



## North Coast Model Species

### Proposed list of model species:

- Black rockfish
- Brown rockfish
- Cabezon
- Redtail surfperch
- Dungeness crab
- Red abalone
- Red sea urchin



## Model Outputs

- All outputs are based on long-term steady states—*What will the system look like 30 to 50 or more years from now?*
- Each output is calculated for a range of assumptions about future fishery management outside MPAs:
  - Conservative management
  - Maximum sustainable yield (MSY)-type management
  - Unsuccessful management



## Model Outputs: Entire MPA Network

- **Conservation**
  - Maps of larval settlement and biomass
  - Total biomass (summed over study region, weighted sum across species)
- **Economic**
  - Maps of fishery yield
  - Total fishery yield (summed over study region, weighted sum across species)
- **Other Model Outputs**
  - Maps of fishing effort
  - Maps of % change in larval production and successful larval settlement (measures of MPA effectiveness in maintaining larval connectivity)



## Model Outputs: Individual MPAs

- **MPA-by-MPA results**
  - Biomass
  - Larval self-recruitment
  - Self-persistence
- **Deletion analysis**
  - How does removal of an individual MPA from an MPA network affect the expected consequences of the network?
  - Change in overall biomass if a given MPA were deleted

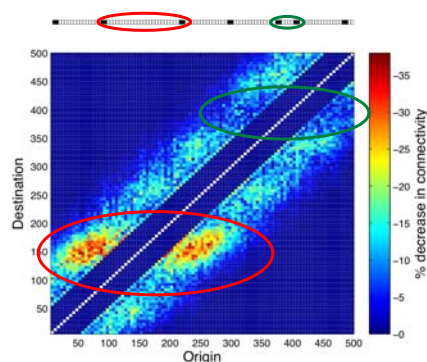


## Supplemental Connectivity Metric

### Neutral allele model with finite population size:

- Introduce new allele at patch  $i$ , calculate average number of generations for allele to spread to every other patch
- Transmission occurs by movement of finite individuals (stochastic)
- Metric: Percent increase in transmission time from unfished state

Example MPA Array



- Dark blue = no change in connectivity
- Warmer colors = decrease in connectivity



## Summary

### Approval sought for:

- Methods for the bioeconomic modeling evaluation and supplemental connectivity metric to be inserted into the *Methods Used to Evaluate MPA Proposals in the North Coast Study Region* as Chapter 8 and Appendix B
- Modeling evaluation and supplemental connectivity metric will be applied to round 1 – evaluation of *external MPA arrays* – and subsequent rounds of evaluation of MPA proposals