Marine Protected Areas Along California's Central Coast: A Multicriteria Analysis of Network Design

Project Team: Allison Chan, Amanda Cundiff, Nadia Gardner, Yvana Hrovat, Lindsay Kircher, Carissa Klein.
Advisor: Dr. Bruce Kendall, Donald Bren School of Environmental Science and Management. Client: Dr. Satie Airamé, PISCO

Background

California's Marine Life Protection Act (MLPA) directed the State's Department of Fish and Game (DFG) to establish and manage a network of marine protected areas (MPAs) based on the best available science. A Blue Ribbon Task Force (BRTF) and Science Advisory Team (SAT) evaluated proposals for this network, beginning with the Central Coast Study Region between Point Conception and Pigeon Point.

Project Goal

To integrate biological, physical, and socioeconomic data with policy to help the BRTF evaluate and recommend a network of MPAs in accordance with the MLPA for the Central Coast Study Region.

Photo Credit: Laura Francis CINMS Image Library

Project Objectives

• Compile reliable data on species likely to benefit from an MPA network.

• Using the optimization tool, MARXAN, identify and map areas of biophysical, recreational, research, and educational conservation value, taking into account socioeconomic data (1,2).

• Identify key features of MPAs that maximize compliance and enforcement and use them to evaluate proposed networks and make recommendations for improved MPA design.

• Provide results of our analyses in forms useful to the MLPA Initiative process for the Central Coast.

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Biophysical & Socioeconomic Results

Biophysical Targets

Areas chosen frequently (in blue) have a high irreplaceability because they contain several and/or rare biophysical conservation targets (Figure 1). Areas chosen less often (in green) offer some flexibility for planning and may contribute to conservation goals. Areas may be chosen less often for a final solution if they contain fewer conservation targets or if they are similar to other areas.
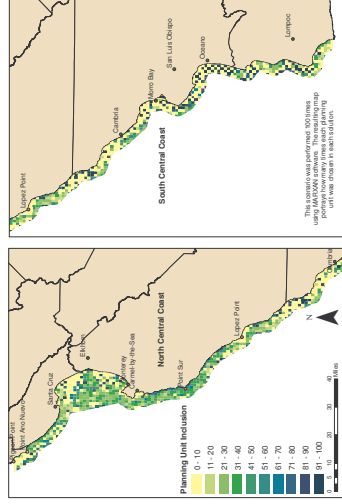

Figure 1. MARXAN output with biophysical targets and area as cost with a conservation goal of 30%.

Socioeconomic Considerations

The socioeconomic analyses integrated biophysical, recreational, and educational conservation targets, while avoiding potentially negative socioeconomic impacts on recreational and commercial fishing (Figure 2). Selection moved away from inner Monterey Bay and other heavily fished areas.
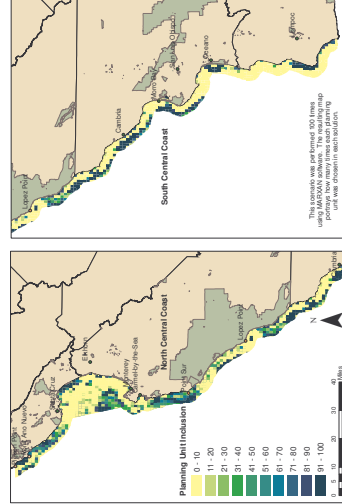

Figure 2. MARXAN output with biophysical, infrastructure, and parks (in green) targets and area, commercial and recreational fishing as cost with a conservation goal of 30%.

Compliance & Enforcement Results

Our evaluation of design criteria (Table 1) for proposed MPAs provides boundary adjustment recommendations to increase compliance and ease enforcement (Figure 3). Also, we recommend that the DFG:

• Increase enforcement effort by utilizing volunteer groups and adding boats and staff;

• Create an interagency Memorandum of Agreement with suitable state and federal agencies;

• Invest in a cross-agency computer tracking system for violations; and

• Partner with fishing industry organizations, non-governmental organizations, and other government agencies to efficiently disseminate outreach information. We identified potential partners for such a program on the Central Coast.

Figure 3. Example of proposed MPAs requiring some boundary changes to meet design criteria.

ENFORCEMENT & COMPLIANCE DESIGN CRITERIA
Clear, regularly shaped boundaries
• Along lines of latitude/longitude
• Aligned with points on shore
Adjacent to shore
Adjacent to land parks
Close to harbors
Close to each other
Large in size

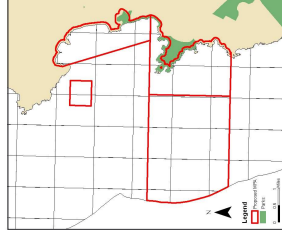Table 1. Design criteria for improved MPA enforcement and compliance.

Conclusions

Our major findings suggest that MARXAN analysis and evaluation of compliance and enforcement criteria are valuable tools that should be incorporated earlier in the network design process, rather than during the evaluation phase, as California expands its network of MPAs to the north and south of the Central Coast Study Region.

References:
(1) Ball, I. R. and H. P. Possingham (2000) MARXAN (V1.8.2): Marine Reserve Design Using Spatially Explicit Annealing, a Manual.

(2) Possingham, H. P., I. R. Ball and S. Andelman (2000) Mathematical methods for identifying representative reserve networks. In: S. Ferson and M. Burgman (eds) Quantitative methods for conservation biology. Springer-Verlag, New York, pp. 291-305.