

California MLPA Master Plan Science Advisory Team
Round 1 Outputs from Bioeconomic Model: Maps
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Round 1 Outputs from Bioeconomic Models: Maps. Each of the external proposed marine protected area (MPA) arrays for the North Coast Study Region (NCSR) were evaluated using bioeconomic models from the University of California, Santa Barbara (UCSB) and University of California, Davis (UCD). For round 1, the long-term steady state populations of four model species (black rockfish, cabezon, redbtail surfperch, and red sea urchin) was simulated for each external proposed MPA array assuming three different management scenarios: conservative, maximum sustainable yield (MSY)-type, and unsuccessful management. In subsequent evaluations, three additional species will be modeled, including red abalone, brown rockfish and Dungeness crab. The set of maps for each external MPA array includes: (1) knockout index, (2) biomass, (3) fishing effort, (4) larval recruitment, (5) larval production, (6) larval supply, and (7) fishing yield.

- 1) The maps of “knockout index” are graphical representations of the deletion analysis presented in table 3. Colors represent the percent biomass increase (or percent biomass increase per square kilometer protected, with warmer colors indicating MPAs with stronger positive contributions to overall biomass.
- 2) The maps of “biomass” represent the expected equilibrium biomass in each patch. The patch size used in the UCSB and UCD models was 1 square kilometer. Values of biomass are scaled relative to average unfished biomass such that values of 0 indicate no biomass and values of 1 indicate maximum unfished biomass.
- 3) The maps of “fishing effort” represent the expected equilibrium fishing effort in each patch. Values are scaled relative to the average fishing effort under MSY-type management for the existing MPAs, (Proposal 0.) Values of 0 indicate no fishing, values of 1 indicate average levels of fishing, and values greater than 1 indicate patches with greater-than-average fishing.
- 4) The maps of “larval recruitment” represent the expected distribution of new recruits (young of the year) in each patch. Larvae are considered to have 'recruited' after settling into a patch and surviving density-dependent mortality in their first year. Values are scaled relative to the maximum density possible in a patch, so values of 0 indicate no settlers and values close to 1 indicate the maximum density of settlers.
- 5) “Larval production” is the number of larvae produced in a patch that successfully disperse to another patch or return home to their original patch (they are not swept offshore). Values are scaled relative to the value in that patch with the existing MPAs (Proposal 0), so values of 0 indicate no change relative to Proposal 0 and values greater than 0 indicate an increase in larval production relative to Proposal 0.
- 6) “Larval supply” is the number of larvae settling in a patch. This value is similar to larval recruitment, except that larvae are 'counted' prior to any mortality occurring in the patch. Values are scaled relative to the value in that patch with the existing MPAs (Proposal 0), so values of 0 indicate no change relative to Proposal 0 and values greater than 0 indicate an increase in larval settlement relative to Proposal 0.

7) "Fishing yield" is the total harvest of each species in each square kilometer. Values are scaled relative to the average yield under MSY-type management with the existing MPAs (Proposal 0), so values of 0 indicate no yield, values of 1 indicate an average amount of yield (relative to MSY), and values greater than 1 indicate cells with greater-than-average yield.

In round 1, each modeling evaluation was conducted for four species: Black rockfish, cabezon, redbtail surfperch, and red sea urchin. In subsequent evaluations, three additional species will be modeled, including red abalone, brown rockfish and Dungeness crab.

Due to limitations of the SAT's current evaluation methods, for round 1, proposed MPAs in external MPA array A were considered static rather than mobile.

Traditional tribal uses were not integrated into round 1 evaluations of external MPA arrays due to the limited information about tribal uses.