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Project Title: Developing recruitment indices for West Coast rockfish using individual-based models and environmentally forced ocean circulation models

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Goals:

This project is intended to produce candidate environmental indices for recruitment of rockfishes off central and northern California and possibly elsewhere in the California Current System, with a specific focus on yellowtail, widow, and chilipepper rockfish.

Approach:

This project includes three complementary projects, which are being pursued in parallel and are all directed at the goals above, and will culminate in test-case stock assessments that include the recruitment indices produced in the course of this work. First, we are developing otolith growth data from archived collections of pelagic juvenile rockfishes collected off California since the early 1980s and are developing statistical analyses to examine environment-growth relationships affecting the early life history stages of rockfishes. Second, we are implementing ocean circulation models for the coastal upwelling system to examine temporal variability in production of prey resources for larval and juvenile rockfish as a function of environmental forcing during the winter and early spring. Third, we are examining a suite of models spanning a continuum from simple correlations between recruitment deviations (from stock assessments) and environmental indices to individual-based models for rockfish early life history stages to identify indices suitable for inclusion in stock assessments. Information on environment-growth relationships and temporal variability in environmental forcing and modeled productivity are being used to inform development of the individual-based model for rockfish.

Work Completed:

Our work is still very much in progress, and we have no completed results to report.

To date we have completed reading and preliminary analysis of approximately one-quarter of the anticipated 350 otoliths to be read. At current rates, we anticipate completion of this phase of the work by early winter, and are making progress on building the statistical models for linking the resulting growth trajectories to environmental time series. These models are based on state-space methods that allow hidden processes (e.g., somatic growth, etc.) to be included as links between environmental forcing and otolith growth.

We have nearly completed configuration of the ocean circulation model (in ROMS), and will shortly be generating time series of modeled zooplankton distributions and advection for winters and early springs from 1983 to the present. We have developed a statistical framework using maximum-likelihood to evaluate the ability of candidate environmental time series (whether empirical or modeled) to explain interannual variability in recruitment deviations. This framework includes a suite of "sampling" methods by which environmental time series are translated into indices of recruitment success over the course of the rockfish spawning season. Progress on this last aspect of the project includes substantial refinements of the initial version of the individual-based model, with specific improvements to how bulk zooplankton concentration is linked to individual foraging success and growth.

Applications:

We intend for the indices developed in the course of this work to be evaluated using test-cases stock assessments. If this proves successful and informative, we will continue to refine the indices and promote their inclusion in formal stock assessments.

Publications/Presentations/Webpages:

Preliminary results and ongoing progress was presented during the joint session of the 9th National Stock Assessment Workshop and 1st National Habitat Assessment Workshop held 17-20 May 2010 in St. Petersburg FL