ANNUAL REPORT
HABITAT ASSESSMENT FUNDED RESEARCH

Project Title:
Integrating spatial habitat and fisheries effort data to improve abundance estimates of west coast groundfish

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Goals:
Overarching goals and objectives of the project -

We developed and applied new methods for estimating groundfish abundance from trawl surveys. We focus on methods that directly incorporated habitat information into the estimation process to improve precision and consistency of abundance estimates for groundfish based on the trawl survey. We are particularly interested in developing methods for understanding how fishing effort may interact with habitat to affect abundance of groundfish.

Approach:
Description of the work that was performed -

We developed a set of Bayesian delta-generalized linear mixed models (delta-GLMMs) and applied them to the West Coast trawl survey. These models extend traditional stock assessment methods for estimating abundance to incorporate habitat variables but can be used in a variety of applications. We applied our models to a variety of settings to illustrate the value and power of directly incorporating habitat variables.

Work Completed:
Summary of progress, including results obtained / products developed, and their relationship to the goals of the project. If problems developed which resulted in unexpected results, they should be discussed.

We completed several example projects to illustrate the potential of spatial, habitat-based approaches to a range of stock-assessment. First, we compared the results from our new approach with traditional stock assessment methods to ask if the inclusion of habitat variables improved the estimation of abundance of a darkblotched rockfish along the west coast. We

showed that habitat models improve abundance estimates. Second, we used a habitat model to examine the seasonal distribution of Dover sole and ask if the abundance of this species showed evidence of localized depletion from fishing or if we could identify other mechanisms responsible for observed species distribution. Third, we applied our model to multi-species metrics of fish communities including species richness, evenness, and functional diversity to explore patterns of fish communities along the west coast. Finally, we applied models to eulachon bycatch in the pink shrimp fishery off the Oregon coast. We showed how our models can be used to identify areas of high bycatch potential and assess if these areas are persistent or variable among years.

Applications:

Describe how results are being used in stock assessments or otherwise benefiting living marine resource management.

At present, our methods are beginning the process of becoming a statistical tool available to stock assessment scientists and we hope they will be incorporated into formal stock assessments in the near future. Our work with diversity will be included in the upcoming Integrated Ecosystem Assessment. The work with eulachon will potentially help to inform the designation of critical and essential habitat for this species and inform fisheries bycatch issues in the pink shrimp fishery.

Publications/Presentations/Webpages:

- Shelton, A.O., J.T. Thorson, E.J. Ward, B.E. Feist. 2014. Spatial, semi-parametric models improve estimates of species abundance and distribution. Canadian Journal of Fisheries and Aquatic Sciences.
- Ono, K., A.O. Shelton, E.J. Ward, J.T. Thorson, B.E. Feist, R. Hilborn. In revision. An investigation of fish population seasonal dynamics. Ecological Applications.
- Tolimieri, N.T., A.O. Shelton, B.E. Feist, V. Simon. In review. Biodiversity indices disagree on the location of hotspots for groundfishes in waters of the U.S. west coast. Ecosphere.
- Ward, E.J., Y-W Lee, K. Ono, A.O. Shelton, J.T. Thorson. In review. Using spatiotemporal species distribution models to identify temporally evolving hotspots of species co-occurrence. Ecological Applications

Please attach visuals for Habitat Science Webpage (pictures, maps, charts from project)