



# Evaluation of Regional-Scale Marine Reserves and Groundfish Trawl Fishery

Michael Dalton, NOAA, Alaska Fisheries Science Center



## Background

Closing fishing in one area, by means of a marine reserve, for example, can intensify groundfish trawling nearby, and this compression of fishing activity into a smaller area may reduce a closure's ecological benefits temporarily. In the long term, a reserve may cause minimal intensification of fishing in nearby open waters.

Uniform assumptions about how fishers will respond to marine reserves, however, may misrepresent both their ecological and economic ramifications, as shifts in fishing activity are predicted to vary significantly depending on a vessel's homeport. These conclusions are based on a computer model developed by economist Mike Dalton, a former professor at Cal State University Monterey Bay, now with NOAA's Alaska Fisheries Science Center, and ecologist Steve Ralston at NOAA's Southwest Fisheries Science Center.

## Project

California Sea Grant funded the researchers to use the California groundfish trawl fleet as a case study for understanding how no-take zones or other spatial management options might shift fishing activity. Their original plan was to simulate changes in fishing effort caused by hypothetical no-take zones.

The project took a different course in 2003 when the Pacific Fishery Management Council banned all trawling in a narrow swath of ocean from Mexico to Canada, to reduce bycatch of several overfished rockfish species. The creation of this Rockfish Conservation Area (RCA) provided a rare opportunity to model the effects of a real no-take zone—one established specifically as a fisheries management tool to prevent a complete closure of the entire West Coast groundfish fishery. Their project was thus modified to examine the effects of the rockfish reserve on "fishing effort" (as measured by the duration trawl nets are in the water) at four California ports.

Bottom trawlers are fishing vessels that drag large weighted nets along the seabed. They target a group of bottom-dwelling fishes, which in central California includes Dover sole, thornyheads and sablefish. Trawlers can also inadvertently harvest overfished species, such as bocaccio and widow rockfish. The rockfish reserve was created to protect these and other overfished species.

There were three main components of this project: (1) Compile groundfish landings and logbook data from 1981 to 2001 for 10 California ports and more than 100 trawl vessels; (2) Test the validity of a mathematical technique known as "data pooling" for the ports included in the analysis. In the context of this research, pooling refers to the process of adding together all landings data for a fleet at a given port and then averaging by the number of vessels in that fleet. The general idea is to represent the fleet as a set of identical vessels responding in statistically similar ways to regulatory change; and (3) Develop a bioeconomic model (which incorporates biological and economic theory) to predict how the rockfish reserve might shift fishing activity. This model applies only at ports where data pooling is appropriate, hence the importance of meeting the second objective.

## Results

The investigators created a series of GIS maps of the California coast that show annual changes in the spatial distribution of fishing effort, as represented by net-soak hours, from 1981 to 2001. These attractive, easy-to-read maps are publicly available at <http://science.csumb.edu/~mdalton/pacfin/>

Of the 10 ports analyzed, data pooling was found to be valid at four ports—Crescent City, Princeton, Moss Landing and Monterey. At these ports, there might be greater cohesion or communication among vessels or an absence of intense competition among them, Dalton said, explaining what the pooling method implies in terms of the character of a fishing community. *(continued)*

### California Sea Grant College Program

Russell A. Moll, Director • Paul Olin, Extension Director • Marsha Gear, Communications Director  
University of California, San Diego, 9500 Gilman Drive, Dept. 0232, La Jolla, CA 92093-0232  
Communications Phone: (858) 534-4446 • Fax: (858) 453-2948 • Web: <http://www.csgc.ucsd.edu>

A bioeconomic model was “run” for the four ports listed above, using fishing data compiled for the GIS maps. The model predicted shifts in fishing effort a year after the closure as follows: In **Crescent City**, the Rockfish Conservation Area (RCA) reduced the total amount of fishing by 20%. However, 25% of the fishing that would have occurred within the RCA was displaced to nearby areas, meaning that fishers were somewhat able to compensate financially for the closure. This ability to fish harder elsewhere translates into an 8% increase in fishing in open areas. This increase could erode some of the ecological benefits of the reserve.

In **Princeton**, the RCA would reduce total fishing effort by about 60%; 11% of the fishing effort would be redistributed to nearby open areas, representing a 24% increase in effort outside the RCA. In **Moss Landing**, the RCA would reduce total fishing effort by 44%; 1% of the fishing effort would be redistributed to nearby open areas, representing a 1% increase in effort outside the RCA. In **Monterey**, the RCA would reduce total fishing effort by 58%; 23% of the fishing effort would be redistributed to nearby open areas, representing a 70% increase in effort outside the RCA. The model predicts these shifts in fishing effort are temporary and gradually decrease after the first year such that in 5-10 years, the closure has a negligible effect on fishing around the RCA.

## Applications

The scientists are now in the process of comparing model simulations to 2004-05 logbook data from the California trawl fleet. The comparison will allow them to test the various assumptions implicit in the model’s design. It may also shed light on yet another recent development in the trawl fishery—the West Coast trawl buyback program.

In 2004, the federal government supported a vessel buyback program to reduce the capacity of the West Coast groundfish fishery, to deal with the problem of “too many boats chasing too few fish.” Through this program, 92 of the 274 trawl boats with groundfish permits in 2003 were permanently retired. The model will allow scientists to look at how the buyback program reallocated fishing effort.

## Cooperating Organizations

Monterey County Office of Economic Development, Pacific States Marine Fisheries Commission, California Department of Fish and Game

## Publications

M. Dalton, May 2006. Effects of Spatial Management on Fishing Effort in California’s Groundfish Trawl Fishery: Results from a Rational Expectations Model with Dynamically Interrelated Variables. (dalton\_cocost2.pdf)

M. Dalton, January 2006. Simulated Maximum Likelihood Estimation and Analysis of Covariance in a Panel Tobit Model of California’s Groundfish Trawl Fishery, 1981-2001. (dalton\_sml5a.pdf)

M. Dalton and S. Ralston. 2004. The California Rockfish Conservation Area and Groundfish Trawlers at Moss Landing Harbor, Marine Resource Economics, Vol. 18, pp. 67-83.

C. Pomeroy and M. Dalton, June 2003. Socio-Economics of the Moss Landing Commercial Fishing Industry, Monterey County Office of Economic Development.

## For More Information

Michael Dalton, NOAA, Alaska Fisheries Science Center  
Tel: 206.526.6551 • Email: michael.dalton@noaa.gov

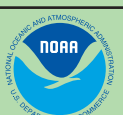


Michael Dalton

## Photo Credits Left to Right

(Front) Rick Starr (Back portrait) Leiwen Jiang, Brown University

Sea Grant



This publication is sponsored by a grant from the National Sea Grant College Program, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, under grant number NA04OAR4170038, Project number C/P-1. The views expressed herein are those of the authors and do not necessarily reflect the views of NOAA or any of its sub-agencies. The U.S. government is authorized to reproduce and distribute for governmental purposes. *This document is available in PDF on the California Sea Grant website: [www.csgc.ucsd.edu](http://www.csgc.ucsd.edu).*