How far do fish move relative to marine protected area boundaries? Understanding the influence of habitat on fish movements

Christopher G. Lowe[1], Tom Mason[1], Lyall Bellquist[1], Darin Topping[1], & Jenn Caselle[2]

[1]California State University, Long Beach, [2]University of California, Santa Barbara

Understanding fish movements will help scientists determine the extent to which marine protected areas (MPAs) protect fish, and if and how often fish spillover from MPAs into surrounding waters. Knowledge of fish movements also will improve future design of MPAs because the size and spacing of MPAs are based on movements of adult and young fish and other animals.

Until recently, we did not have the technology to measure the sizes of home ranges of nearshore reef fish. In this study, we used a new technique--acoustic telemetry tagging—to track movements of four species of nearshore reef fish in a MPA at Catalina Island. Habitats and species are similar at Catalina Island and the Channel Islands, so results from this study can be applied to the evaluation of MPAs around the Channel Islands

How far do fish move?

- All 4 species we studied have distinct home ranges (average sizes: 0.75 – 5.6 acres), but ocean whitefish and California sheephead, which both actively look for food, have larger home ranges than kelp and barred sand bass, species that wait for and ambush their prey.
- Based on the relatively small home range sizes, small MPAs (~250 acres or 1 square kilometer) should be effective in protecting individuals of these four nearshore fish species, while larger reserves will protect a greater proportion of their populations.

What habitats do fish prefer?

- California sheephead, ocean whitefish and barred sand bass prefer edges of habitat (ecotones) where rock meets sand, but kelp bass prefer rock habitat.
- Kelp bass and sheephead are less likely to cross expanses of sand or mud to move to other rock habitat.
- Areas where MPA boundaries cross or are close to (within 100 m) of rock habitat may have higher spillover of California sheephead, kelp bass, ocean whitefish, and barred sand bass.

Do fish move from MPAs to surrounding waters?

- Between 68-83% of the fish monitored remained in their home ranges for at least a year. Ocean whitefish and kelp bass exhibited the least movement, with 75 and 82%, respectively, remaining in their home ranges in the MPA.
- Between 17-32% of the tagged fish were not detected after one year and they likely moved outside of the MPA, died or were caught by fishers. California sheephead and barred sandbass exhibited the greatest movement (30 and 32%, respectively) outside of the MPA.

Funding for this research was provided by California Sea Grant and USC Sea Grant via State of California MLPA, UCSB, and CSULB. Additional support was provided by USC WIES and CSU Ocean Studies Institute.