



Summary

By tagging and tracking fish, biologists have evaluated the site fidelities and home ranges of four of the most heavily fished, reef-associated sport fish in Southern California – California sheephead (*Semicossyphus pulcher*), kelp bass (*Paralabrax clathratus*), barred sand bass (*Paralabrax nebulifer*) and ocean whitefish (*Caulolatilus princeps*).

The scientists' findings make it possible to predict the home ranges and habitat preferences of these species from detailed maps of benthic topography and substrate. The research also provides insights into the sizes of marine reserves needed to protect reproductively important adults and whether a given reserve's boundaries will be leaky or tight for a given species.

As the Marine Life Protection Act is implemented in Southern California, the information from this project will allow managers to identify areas and sizes of marine reserves that can truly protect these target sport fish.

Project

The first goal of this project was to estimate the home range sizes of ocean whitefish and barred sand bass in the Catalina Island Marine Science Center Marine Life Refuge, a small no-take marine reserve about the size of two football fields, near Two Harbors on Catalina Island. This involved measuring the species' nocturnal and daytime activity levels and the distances traveled per day.

The second major goal of the project was to evaluate the four species' site fidelities and their willingness to cross expanses of sand and/or mud to return home. Last, the biologists examined the habitat preferences of the four species.

Method

All fieldwork was conducted in the Catalina refuge. Fish were caught by hook and line and then either surgically implanted with or fed acoustic tags. The fish were then acoustically tracked for variable periods of time either actively by boat or passively with moored hydrophones. A variety of statistics were computed from the tracking data, including total distance traveled daily and nighttime vs. daytime movement patterns. To measure the home range areas, the scientists calculated the daily activity.

Translocation experiments were conducted to measure the speed at which (and whether) fish returned "home" when moved to either soft- or hard-bottomed habitats.

Finally, fish tracks and their associated home ranges were compared to GIS maps of topography and substrate type to characterize how fish utilized and responded to different habitats in the refuge, including rock wall, rock boulders, rock rubble, mud and sand.

Results

Home Ranges – Based on tagging data from 16 ocean whitefish, these fish move on average about 3,780 meters a day. Ocean whitefish were observed to be active in the day and relatively stationary at night. This was a new discovery, as previously biologists assumed these fish were active both night and day. Their home range was estimated to be about 20,400 square meters. (For simplicity, the statistics reported here will omit error bars, which are presented in the scientists' full report.)

Barred sand bass proved extremely difficult to catch and so only six of these fish were tagged. Home range size averaged about 10,000 square meters. Barred sand bass were more active during the daytime than at night, but less profoundly so than ocean whitefish. Their daytime activity space was estimated to be 32,670 square meters; their nighttime activity space, 9,040 square meters.

Previous tagging studies led by these researchers in the refuge have shown that the home range size of kelp bass is about 3,250 square meters; for sheephead, 15,130 square meters.

Site Fidelity – Nineteen kelp bass, 19 ocean whitefish, 18 sheephead and 8 barred sand bass were monitored for a year to evaluate their fidelity to the Catalina refuge. Site fidelity was estimated by counting the number of days that each fish was detected in the refuge over the course of the year. By this metric, ocean whitefish and kelp bass had the highest site fidelity, as both were detected in the study area on 317 out of 365 days; barred sand bass, 314 days; sheephead, 266 days. All four species have strong fidelity to their home ranges.

Translocation – Fifteen fish were moved (translocated) from inside the refuge to either discontinuous or continuous rock reef. Discontinuous reef is reef separated by expanses of sand and/or mud. Ocean whitefish and barred sand bass were moved about one kilometer, while the other two species were moved about one-half kilometer. The point of the experiment was to understand how breaks in habitat type (from sand and mud to rock) affect fish movement patterns.

Five of the nine fish that were moved to discontinuous reef returned to the refuge, while all six of the fish moved to continuous rock reef returned home. It took the barred sand bass 9 hours to find its way home from discontinuous reef, the ocean whitefish 19 hours, the two kelp bass 6 days and 7 days, and sheephead 11 days. This shows that expanses of sand and mud are more likely to act as boundaries for kelp bass and sheephead than for barred sand bass and ocean whitefish.

Predictably, fish returned home more quickly when moved to continuous reef. Ocean whitefish took 9 hours and 11 hours, kelp bass 8 hours and 15 hours, and sheephead 27 hours and 32 hours.

Habitat Use – The researchers reported that the most surprising discovery from their study of fish habitat preferences was the importance of edge habitats for all the fish. Every species uses habitat edges, where rocky areas transition to sand or mud. Five of the nine fish that were moved to discontinuous reef returned to the refuge, while all six of the fish moved to continuous rock reef returned home.

Ocean whitefish were found more often on the soft-bottom side of these edge areas while kelp bass seemed to have a distinct preference for the rock side.

Sheephead are “edge walkers,” as they prefer the boundary between rocky and soft-bottomed habitat. This likely is due to their dietary preferences.

Conclusions

Kelp bass and barred sand bass, both ambush predators, have smaller home ranges than ocean whitefish and sheephead. This means that small marine reserves are more likely to protect these species than ocean whitefish and sheephead.

The habitat studies, however, show that size is not the only factor affecting “spill over.” Because all four species use edge habitats, effective marine reserves need to include this type of habitat. In particular, placing reserve boundaries at least 100 meters away from rocky habitat edges will reduce capture rates of all four species.

Collaborators

Cal State University Ocean Studies Institute, Wrigley Marine Science Center, UC Santa Barbara

Publications

Bellquist, L.F., C.G. Lowe, and J.E. Caselle. in press. Fine-scale movement patterns, site fidelity, and habitat selection of ocean whitefish (*Caulolatilus princeps*). *Fishery Research*.

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Presentations

Lowe, C.G., T. Mason, L. Bellquist, D. Topping, B. Hight, and J. Caselle. (Nov. 2007). What do we know about movement patterns and habitat use of rocky reef associated game fishes and why is it essential for MPA design? Presidents Symposium, Ann. Mtg. Western Society of Naturalists, Ventura, CA.

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Theses

Bellquist, L.F. 2006. Movement patterns and habitat selection of ocean whitefish, *Caulolatilus princeps*, in a southern California marine reserve. Master's Thesis. Department of Biological Sciences, California State University, Long Beach.

Mason, T.J. (graduation expected May 2008). The effects of habitat composition, quality, and breaks on home ranges and site fidelity of barred sand bass (*Paralabrax nebulifer*) compared with three other species of exploited nearshore reef fishes. Master's Thesis. Department of Biological Sciences, California State University, Long Beach.

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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.*