Mark and recapture studies of nearshore groundfishes at Carmel Pinnacles State Marine Reserve

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Introduction
In 1999, the California legislature passed the Marine Life Protection Act (MLPA) to help conserve biodiversity, protect habitat, and rebuild depleted fisheries. As part of the MLPA, a 100% network of 28 marine protected areas (MPAs) was implemented along the central California coast between Carmel and Pismo Beach. The MPAs call for monitoring of selected areas to assess with adaptive management of the MPAs network (OMPA Master Plan, 2005). Baseline data on species and habitats within MPAs and comparable areas outside MPAs are needed to inform monitoring.

Most of the central coast MPAs are currently being monitored or have been studied in the past; however, very few data exist for the Carmel Pinnacles State Marine Reserve (Pinnacles SMR) (Figure 3a). The Pinnacles SMR is a small, isolated marine protected area in the central Monterey Bay (Figure 3b). The Pinnacles SMR has been designated as a Marine Life Protection Act (MLPA) MPAs. In 2006, three monitoring methods to tag and recapture fish, data from the two studies can be compared.

The purpose of this study has been to collect baseline information on fish populations inside the recently designated Pinnacles SMR and nearby Carmel Point. These data will allow future comparisons to help determine whether the community has changed over time and whether the protected status of Pinnacles SMR has benefited the fish populations.

Materials and methods
A commercial passenger fishing vessel (CPFV or Party Boat) was used as a platform to hook-and-line catch and tag fishes at the Pinnacles and a nearby reference site, Carmel Point (Figure 2). Fishing occurred within two 300m x 100m grid cells at each site. Three 15-minute drifts were fished in each of the four grid cells each sampling day for nine days from July-September 2006. To enlist local fishing knowledge of the Carmel Bay Area, fishers were posted at boat ramps, tackle shops and online to recruit experimental volunteer anglers to catch fish for the study. Locations of each drift within a grid cell were determined by the skipper and fisher with a balanced sampling. Three gear types were used equally to catch fish: drift, otter-trap, stationary net with a light and fish with a net. Fish were measured, tagged and released. Fish exhibiting excessive trauma or fish that were less than 20 cm total length were released without tagging.

Results
Fish tagging complemented the hook-and-line component of this study in aid of catching fish species more effectively sampled using trap gear. Trapping occurred within the same grid cells as above, but during different weeks than the hook-and-line fishing. Two 10-trap sets were fished in each of the four grid cells during 8 days from August-October 2008. Traps were standard 24” x 24” x 10” commercial wire traps with two 5-inch openings and two-inch mesh (Figure 3b). One pint of squid was used as bait and set in a smaller cage in the center of the trap. Traps were pulled after soaking for about one hour. To reduce mortality and facilitate trap retrieval, trapping was limited to depths less than 75 feet; similar depths were fished both inside the MPA and at the reference site. Following capture, fish were measured, tagged and released.

Future work is planned to continue tagging and recapturing fish during the same months (summer and fall) for these consecutive years and then periodically thereafter to examine the rate of change in populations and any trends that develop over time.

Discussion
This study has been a collaboration between DFG researchers at Moss Landing Marine Labs (MLML) and Cal Poly, San Luis Obispo, members of the commercial fishing industry, and recreational anglers in central California Counties. MLML scientists have tagged fish at Point Lobos and nearby reference sites. Point Lobos is in the same vicinity as Carmel Pinnacles and the Pinnacles SMR. MLML scientists have used these data to develop baseline data on species and habitats within MPAs and comparable areas outside MPAs are needed to inform monitoring.

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For further information
More information can be found on the Sanctuary Integrated Monitoring Network website:

Figure 1. Underwater image showing the rocky, high-relief, bottom type at Carmel Pinnacles SMR. Photo: Kawika Chotrun.

Figure 2. Location of sampling sites at Carmel Pinnacles State Marine Reserve and the Carmel Point reference area.

Table 1. CPUE for hook-and-line and trap gear. * indicates a value of less than 0.1 when rounded and a blank indicates no fish caught for that species. Yellow highlights indicate significant differences in CPUE (ANOVA and LSD) between sites.

Table 2. Species composition of fish caught by site and gear type.

Figure 3. Species composition of fish caught by site and gear type.

Figure 4. Species composition of fish caught by site and gear type.

Figure 5. Average total lengths of the most common species caught at Pinnacles SMR and Carmel Point. Error bar denotes one standard error. Tag recapture

to date, 13 tagged fish have been recaptured and released by us on our sampling days. 4 tagged fish have been recaptured by the public (recreational fishers, recreational divers), and 5 tagged fish have been visually "recaptured" by DFG using SCUBA gear on dive surveys for fish (Figures 6 and 7). All fish were recaptured at the same site at which they were originally tagged.

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