

## Density of Reef Fish

**Overview:** These data are part of a larger collection of ongoing data sets that describe the temporal and spatial dynamics of kelp forest communities in the Santa Barbara Channel. Data on the abundance (density or percent cover) and size of ~250 species of reef associated macroalgae, invertebrates and fishes, substrate type and bottom topography are collected annually by divers in the summer within fixed plots (i.e. 40 m x 2 m transects) at 11 sites (n = 2 to 8 transects per site) that have historically supported giant kelp (*Macrocystis pyrifera*). Species-specific relationships between size (or percent cover) and mass developed for the region are used to convert abundance data to common metrics of mass (e.g., wet, dry, de-calcified dry) to facilitate analyses of community dynamics involving all species. Data collection began in 2000 and is ongoing.

**Study Sites:** Nine of the 11 study sites occur along the mainland coast of the Channel (Arroyo Burro 34° 24.007' N 119° 44.663' W; Arroyo Hondo 34° 28.312' N, 120° 08.663' W; Arroyo Quemado 34° 28.127' N, 120° 07.285' W; Bulito 34° 27.533' N, 120° 20.006' W; Carpinteria 34° 23.545' N, 119° 32.628' W; Goleta Bay 34° 24.827' N, 119° 49.344' W; Isla Vista 34° 24.170' N 119° 51.472' W; Naples 34° 25.340' N 119° 57.176' W; Mohawk 34° 23.660' N, 119° 43.800' W) and two occur on the northern coast of Santa Cruz Island (Diablo 34° 03.518' N, 119° 45.458' W; Twin Harbors West 34° 02.664' N, 119° 42.908' W).

The time period of data collection varied among the 11 kelp forest sites. Sampling at Bulito, Carpinteria, and Naples began in summer 2000, sampling at the other six mainland sites (Arroyo Burro, Arroyo Hondo, Arroyo Quemado, Goleta Bay, Isla Vista, Mohawk) began in summer 2001 (transects 3, 5, 6, 7, 8 at Isla Vista were added in fall 2011). Data collection at the two Santa Cruz Island sites began in summer 2004. In addition to the annual surveys in summer, the number, size and species identity of reef fish were sampled monthly at transect 1 at Arroyo Burro, Arroyo Quemado, and Mohawk beginning in 2002.

**Methods:** The number, size and species identity of reef fish were recorded within a 2 m wide swath centered along each transect extending 2 m off the bottom. A diver swims the length of the 40 m transect approximately 1m above the bottom at a constant deliberate speed and records all fish passing through the sampling area. Fish size is measured as total length (TL) estimated to the nearest cm. Care is taken by the diver to not count the same individual more than once if it leaves and re-enters the sampling area. Surveys were carried out by a select number of highly trained divers whose sampling techniques were standardized in order to minimize observer bias. The horizontal visibility along the transect is measured and recorded for each sampling event (*note, the accuracy of sampling fish may vary with water clarity and data collected during sampling events when horizontal visibility was < 2 m should be used with caution*). The number of fish taxa sampled is not fixed and all species of reef fish encountered in the sampling area were recorded. Species that are difficult to identify underwater were lumped into broader taxonomic categories (e.g., flatfish in the family Bothidae) to facilitate sampling.

Several species of small bottom-dwelling fish are difficult to accurately count and size during the reef fish survey due to their cryptic appearance and behavior. Individuals in a select group

of these species were counted and sized in a separate survey done in the four contiguous 20 m x 1 m swaths that centered on the 40 m transect (Figure 1). A diver carefully searched the area within each swath taking time to look on the undersides of ledges and in crevices, and within understory vegetation for select species of small cryptic fish that are purposely not counted in the reef fish survey. Understory algae are brushed aside during the search, but no organisms or boulders are physically moved. Size was recorded as total length (TL) to the nearest cm. The species of fish included in this dataset are listed in the master species data package: <https://portal.edirepository.org/nis/mapbrowse?scope=knb-lter-sbc&identifier=120>.

**Figure 1.** Schematic diagram showing the position of the four 20 m x 1 m swaths relative to the 40 m transect.

