

## Density of Reef Fish

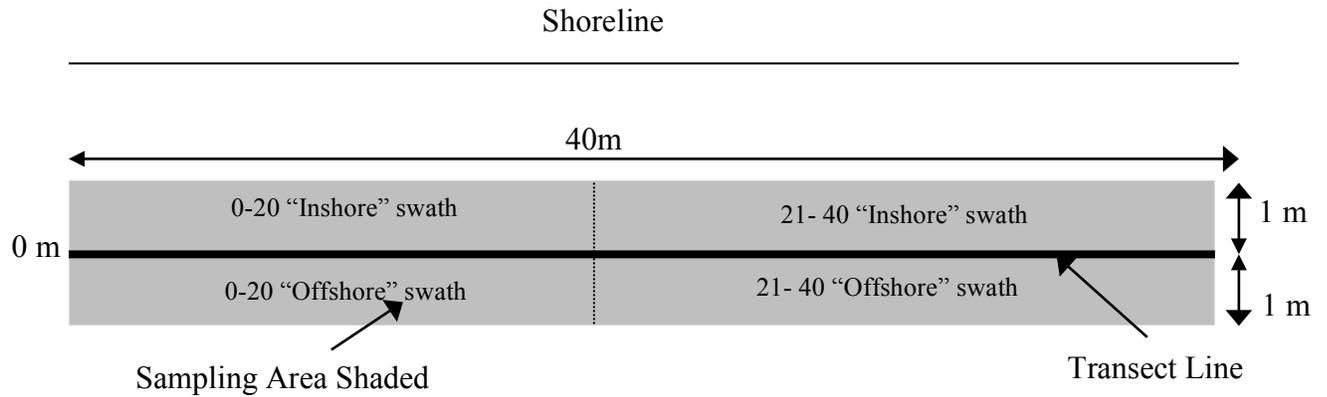
**Overview:** One of the main strengths of the long term ecological research program is that it allows us to evaluate changes in the ecological community against the background of natural long-term variability. This long-term context is particularly important when we seek to distinguish between changes caused by natural processes and those caused by human activities. SBC LTER has undertaken long-term measurements of the abundance of reef algae, invertebrates and fish within permanent transects at 11 kelp forest sites in the Santa Barbara Channel. These data represent one of the core research activities of SBC LTER and they provide a relatively comprehensive description of community structure and dynamics of kelp forest communities within our study region. .

**Experimental design:** Time-series data on the abundance of ~250 species of algae, invertebrates and fish are collected each summer on replicate 40m x 2m permanent transects (n = 2 to 8 transects per site) at 9 mainland and 2 Santa Cruz Island reefs that have historically supported giant kelp forests. Data collection began in the summer of 2000 and continues annually to provide information on community structure, population dynamics and species change.

**Methods:** The number, size and species identity of reef fish are 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 are carried out by only a select number of highly trained divers whose sampling techniques have been standardized in order to minimize observer bias. The horizontal visibility along the transect is measured and recorded for each sampling event. The number of fish taxa sampled is not fixed as all species of reef fish encountered in the sampling area are recorded. Species that are difficult to identify underwater are 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 are 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 searches 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 which 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 is recorded as total length (TL) to the nearest cm. The species of small cryptic fish counted in this survey are listed in Table 1.

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



**Table 1.** Species list of small cryptic fish surveyed.

| SP_CODE | GENUS                | SPECIES           | COMMON_NAME          |
|---------|----------------------|-------------------|----------------------|
| AHOL    | <i>Alloclinus</i>    | <i>holder</i>     | Island kelpfish      |
| CLIN    | <i>Gibbonsia</i>     | spp.              | Crevice kelpfish     |
| CNIC    | <i>Rhinogobius</i>   | <i>nicolsii</i>   | Blackeye goby        |
| COTT    | Cottid               | spp.              | Sculpins             |
| CSTI    | <i>Citharichthys</i> | <i>stigmaeus</i>  | Pacific sanddab      |
| LDAL    | <i>Lythrypnus</i>    | <i>dalli</i>      | Bluebanded goby      |
| LHIR    | <i>Leiocottus</i>    | <i>hirudo</i>     | Lavender sculpin     |
| NBLA    | <i>Neoclinus</i>     | <i>blanchardi</i> | Sarcastic fringehead |
| OPIC    | <i>Oxylebius</i>     | <i>pictus</i>     | Painted greenling    |