Natural Habitat Size Frequencies

Purpose
To estimate population age structure and to identify and monitor recruitment cohorts.

Materials
6 stainless steel vernier calipers, 220 mm
6 dive slates
2 meter sticks, non-floating
4 large mesh collection bags
Natural Habitat Size Frequency data sheets (as many as needed; Appendix K)
1-2 underwater data sheets for each species of gorgonians/hydrocoral
2 underwater data sheets for *Macrocystis pyrifera*

Personnel
6 SCUBA divers experienced in the identification and search image needed for species listed in Table 11.

Methods
It is very important in sampling for size frequency distributions that all individuals in the target population are represented in proportion to their abundance in the population. To reduce bias, every size group of the target species present in the study plot must be located and measured. Divers search the area along the fixed transect line using a band transect type search method to limit their search to a specific area.

During this method, a diver performs a swath over an area of approximately 5-10 m by 2 arm-lengths while swimming parallel or perpendicular to the main transect similar to the search made in the Band Transect protocol. These swaths are evenly spaced along the main transect so as to gather a representative sample from the entire 100 m transect line. For example, three swaths may be made: one at the 0 m end, one at the 100 m end, and one around the 50 m mark. The spacing and number of swaths made will depend on the abundance and sample size of the target species.

In cases where there are relatively low densities of the target species, the diver can conduct one long swath along the main transect line using their arms or a 1.5 m band transect bar for reference. In cases where densities are very high one can use 0.5 or 1.0 m^2 quadrats to focus their search effort. Though in nearly all cases the band transect type of swath will be used to locate organisms for measure, the chief scientist may instruct divers in what search method to use. Pairs of divers are often assigned multiple species to measure during a dive to maximize diver efficiency, with each diver concentrating on one side or a separate area of the transect while being able to keep in contact with their dive partner.

Macrocystis pyrifera is always measured along the entire length of the main transect. The area sampled varies depending on plant density, but can extend out to 10 m from the transect line. The greatest holdfast diameter and the number of stipes one meter above the bottom are counted. These data are recorded on underwater datasheets (Appendix J).

Height and width for gorgonians and California hydrocoral, as well as holdfast diameter for *Macrocystis pyrifera* are measured to the nearest centimeter; all other invertebrate measurements are made to the nearest millimeter. Measurements are made in situ with minimal disturbance to the organisms, except for sea urchins which can be removed (if possible) to check under the spine canopy of large adults for juveniles. If time is limited and densities are high, sea urchins can be collected in mesh bags, measured on board the research vessel, and returned to the point of collection. The minimum sample sizes and types of measurements for each species are indicated below.

Except for gorgonians, California hydrocoral, and *Macrocystis pyrifera* (which have separate underwater data sheets), measurements taken underwater are written on a dive slate and then transcribed to a natural habitat size frequency data sheet (Appendix J). One data sheet is used for each diver at each site, and multiple species may be placed on the same data sheet using the corresponding letter listed for each species at the top.

Since *Haliotis spp*. have become rare at most sites and small live *Haliotis* spp. are difficult to locate for measurement since they are cryptic, shells are measured. All *Haliotis* spp. shells at a site should be collected during regular monitoring activities, brought to the surface, identified, and measured. Data is entered on a Shell size frequency data sheet (Appendix J), and noted as either F for a fresh shell (new fresh shinny nacreous layer with no growth on the inside of the shell) or O for an old shell (growth on the inside or dull anacrious layer). Old or Fresh shells can sometimes be difficult to differentiate without considerable experience, so it is always good to have a consensus on this or defer to someone who has had considerable experience in determining these categories. Once shells have been measured they should be disposed of off the site.

Since there are no live emergent *Haliotis* spp. at many of the sites, the data collected on shells could be our first indication that these populations may or may not be recovering.

Time Required

Depending on distribution and abundance, sampling may take between 30-100 minutes for each species.

Table 12. Organisms sampled for natural habitat size frequencies.

Species Name	Sample Size	Measurement
Algae		
Macrocystis pyrifera	100	stipe count (1 m above bottom), max. holdfast diameter, cm
Invertebrates		
Tethya aurantia	60	max. diameter, mm
Stylaster (*Allopora*) *californica*	60	max. height and width, cm
Lophogorgia chilensis	60	max. height and width, cm
Muricea fruticosa	60	max. height and width, cm
Muricea californica	60	max. height and width, cm
Megathura crenulata	60	max. shell length, mm
Haliotis corrugata	60	max. shell length, mm
Haliotis fulgens	60	max. shell length, mm
Haliotis rufescens	60	max. shell length, mm
Haliotis sorenseni	60	max. shell length, mm

Haliotis assimilis	60	max. shell length, mm
Megastraea (*Astraea*) *undosa*	60	max. shell diameter, mm
Lithopoma (*Astraea*) *gibberosa*	60	max. shell diameter, mm
Kelletia kelletii	60	max. shell length, mm
Crassadoma (*Hinnites*) *gigantea*	60	max. shell length, mm
Strongylocentrotus purpuratus	200	max. test diameter, mm
Strongylocentrotus franciscanus	200	max. test diameter, mm
Lytechinus anamesus	200	max. test diameter, mm
Pycnopodia helianthoides	60	length of the longest ray, mm
Patiria (Asterina) miniata	60	length of the longest ray, mm
Pisaster giganteus	60	length of the longest ray, mm
Tegula regina	60	max. shell diameter, mm