Fish Size Frequency

Purpose
To estimate fish population size structure.

Materials
1 fish slate with 40 cm etched marks along top edge (Figure 10)
1 fish size frequency summary sheet (Figure 11, Appendix K)

Personnel
A minimum of one SCUBA equipped observer who has been trained in underwater fish size frequencies. If only one trained observer is available, this observer's buddy can conduct roving diver fish counts, as both divers will be covering the same area within the same time frame.

Methods
This method will be performed during or after the RDFC in accordance with the RDFC protocol with a minimum sampling time of 30 minutes. As with the RDFC, the observer will sample as much of the 2000 m^2 area (ten meters on either side of the 100 m permanent transect line) as possible. Within this area and time, as many fish as possible are sized of all species, however the species in Table 10 are given higher priority than other species if not all can be measured, see the section on Organisms Sampled below. The observers for this protocol must be trained, tested and be able to accurately estimate fish sizes underwater. Training procedures for this protocol can be found in Appendix H. The observer should be proficient in sizing fish to within 20% of the actual total length (TL).

Observers will estimate TL (Figure 9) of small fish (<15 cm TL) to the nearest centimeter and larger fish (>15 cm) to the nearest 5 cm. All observed species names and sizes are recorded on a blank dive slate. In the case where there are relatively high densities of certain species (e.g. *Chromis punctipinnis,* blacksmith), a size range measurement for the entire school is recorded in parentheses followed by a count (Figure 10). If gender is visually distinguishable (e.g. California sheephead and rock wrasse) these are kept separate and recorded as well. Similar to the RDFC method, each observer should attempt to search all habitats (i.e. bottom, midwater, under ledges, water column, canopy, etc.); however, cryptic species are not measured (see organisms sampled section below). In addition, due to limited time and the increased importance of measuring some fish we have prioritized where observers should concentrate their efforts if they are unable to measure all of the fish at a site (see below).

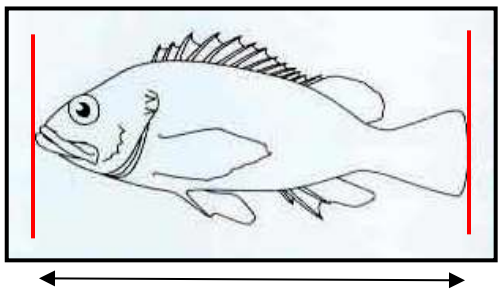

Figure 9. Total length, TL, of a fish.

A minimum of 30 minutes is required to cover a site and collect adequate sample size of indicator species present. More time can be used if necessary to aquire a larger sample size, similar to size frequency measurements of invertebrates and *Macrocystis pyrifera*.

Upon completion of the dive, each observer will review and tally all totals for each size category per species. On the surface and as soon as possible with the assistance of a recorder, the observer transfers the information from the dive slate to a fish size frequency summary datasheet (Figure 11, Appendix J). Repeat this procedure for each observer on the same datasheet. The summary datasheets are then stored and from these sheets the data are entered into the database after the cruise.

Time Required

A minimum of 30 minutes per observer is required to measure fish.

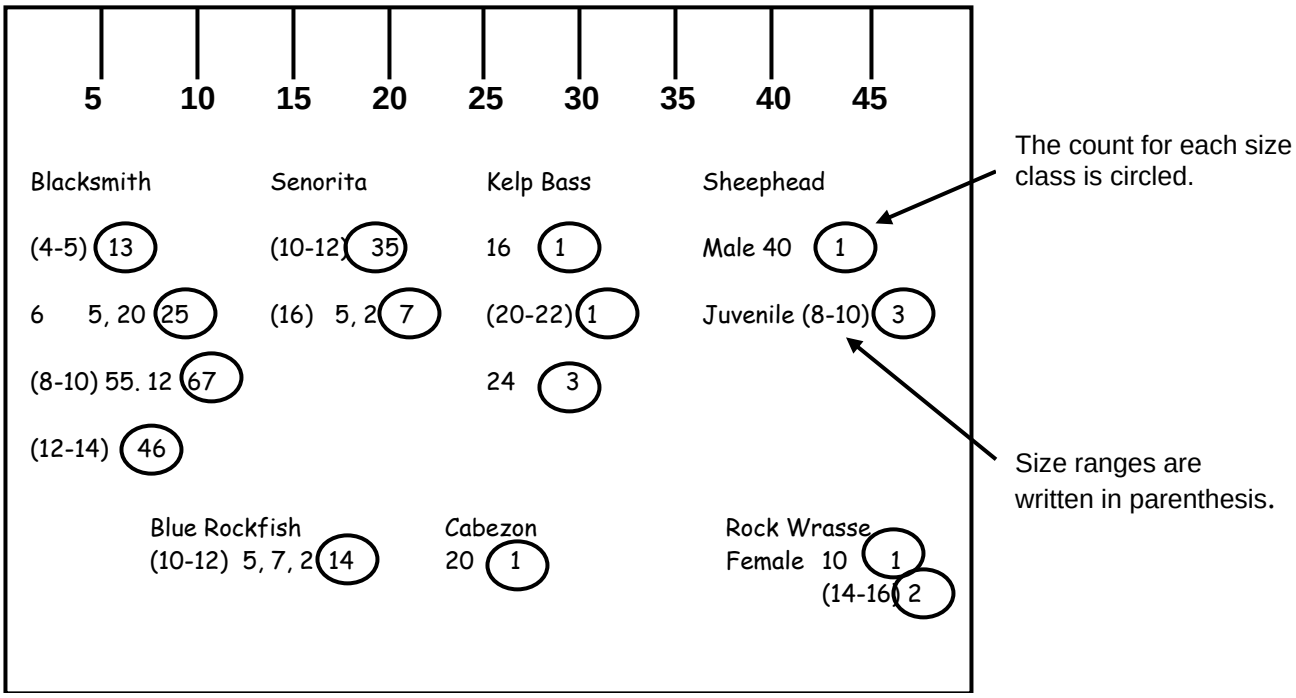

Figure 10. An example dive slate for fish size frequency measurements.

Common Name									
Black & yellow rockfish	Count								
	Length (cm)								
Black surfperch	Count								
	Length (cm)								
Blacksmith	Count	13	25	67	46				
	Length (cm)	4-5	6	8-10	12-14				
Blue rockfish	Count	14							
	Length (cm)	10-12							
Cabezon	Count	1							
	Length (cm)	20							
California scorpionfish	Count								
	Length (cm)								
California sheephead	Count **fem**								
	juv		3						
	male	1							
	Length (cm)	40	8-10						

Notice the separate rows for gender and juveniles.

Figure 11. An example of summarized data on a fish size frequency summary sheet.

Organisms Sampled

No cryptic species should be measured for size (e.g. *Alloclinus holderi*, *Gibbonsia* spp., *Citharichthys* spp, *Coryphopterus nicholsii*, *Cottidae*, *Leiocottus hirundo*, *Lythrypnus dalli* and *L. zebra,* etc.). Schooling baitfish such as sardines, anchovies and smelt will also not be sized. All other species can be measured, but the ones listed in Table 10 should be measured and will be prioritized if not enough time allows for the measurement of all species at a site.

The following fish are among those species that will be prioritized for measurement with 1 being higher priority than 2 and so on. Typically a well trained experienced observer can measure all fish of these species at a site in 30 minutes.

Table 11. Fish species that are prioritized for sizing.

Species Name	Common Name	Prioritization for measuring
Chromis punctipinnis	blacksmith	3
Oxyjulis californica	senorita	3
Sebastes mystinus	blue rockfish	1
Sebastes serranoides	olive rockfish	1
Sebastes atrovirens	kelp rockfish	1
Sebastes serriceps	treefish	1
Sebastes caranatus	gopher rockfish	2
Sebastes miniatus	vermillion rockfish	1
Sebastes chrysomelas	black and yellow rockfish	2
Sebastes spp.	rockfish	2
Ophiodon elongatus	lingcod	1

Scorpaena guttata	California scorpionfish	2
Paralabrax clathratus	kelp bass	1
Semicossyphus pulcher (male, female and juvenile)	California sheephead	1
Embiotoca jacksoni	black surfperch	1
Embiotoca lateralis	striped surfperch	1
Damalichthys vacca	pile perch	1
Rhacochilus toxotes	rubberlip surfperch	2
Hypsypops rubicundus	garibaldi	1
Halichoeres semicinctus (male, female and juvenile)	rock wrasse	1
Caulolatilus princes	ocean whitefish	1
Girella nigricans	opaleye	3
Medialuna californiensis	halfmoon	3
Sebastes paucispinis	bocaccio	2