Roving Diver Fish Count (RDFC)

Purpose

To estimate species diversity and abundance of fishes within the entire transect area (10 m of each side of the 100 m transect line and from bottom to surface)

Materials

1 underwater roving diver fish count slate and pencils for each diver
1 watch or bottom timer for each diver
1 summary data sheet (Appendix K), for surface use only.

Personnel

A minimum of four SCUBA equipped observers with two of the four observers being at least at the experienced level (see below)

Experience Levels: Experience levels are assigned to every observer based on the discretion of the team leader. This information is recorded on the summary sheet with each observer's name and permanent observer number.

Expert – an observer who can confidently identify and count all species of fish that commonly occur at the Channel Islands. Table 9b has a list of all fish species that have been positively identified on the RDFC up to 2011.

Intermediate – an observer who can identify and count all indicator species and most non-indicator species of fish (see indicator species list below) including differentiating between adult and juvenile. An observer is determined to be intermediate based on the discretion of the team leader.

Novice – an observer who can confidently identify all core RDFC indicator species (see Table 9a.) and estimate the Abundance indice on those species. Typically for a Novice we only record the Abundance category, but if the Lead Biologist is confident the Novice is able to accurately count any of the core RDFC indicator species, the Counts can also be recorded.

Note: an observer should not conduct a RDFC if they do not know all of the RDFC indicator species (Table 9a.).

Note: Score is recorded for all (Novice, Intermediate and Expert observers) observers.

Methods

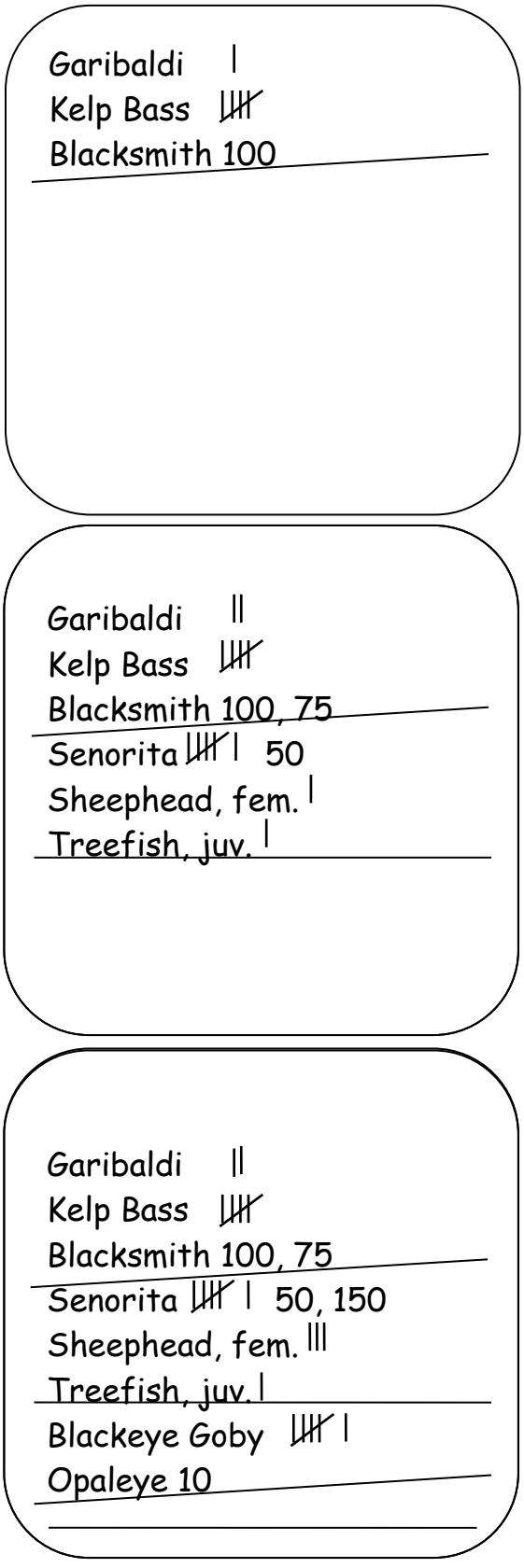
This method produces three indices of fish abundance: a time Score, Abundance and Count of fish. The Abundance indice is based on the Count. During the RDFC, divers gradually swim around the transect line covering the entire transect area in 30 minutes. The sampling area encompasses ten meters on both sides of the line from top to bottom yielding a total sampling bottom area of 2000 m^2. Throughout the fish count, each observer should attempt to search in all habitats (i.e. bottom, midwater, under ledges, kelp canopy, etc). It is best to perform a kelp canopy count either just before descent at the beginning of the dive or during ascent at the end of the dive, depending on whether the RDFC is the last task for the dive.

Time Score: The Score field is a time Score assigned to each fish species that relates to when during the 30 minute count it was observed. More abundant fish will more often be seen sooner

than less abundant fish and thus get a higher score. Divers enter the water above the transect and immediately begin to list the species observed while descending towards the bottom. As each species is noted, the name and count are written down on a blank dive slate. Sampling is divided into five minute increments and is limited to 30 minutes. After every five minutes has passed, a horizontal line is drawn across the slate under the list of species seen during that five minute increment (Figure 8). If no species were observed during any 5 minute intervals, a horizontal line is drawn anyway to assist with tracking the time intervals.

The Time Score was originally taken from the Great Annual/American Fish Count protocol. In that protocol, counts could be longer than 30 minutes. Since the RDFC is limited to 30 minutes, no Time Scores less than 5 should ever be present. If an observer sees a new species after the 30 minute count is over, this should not be included in the RDFC, but instead written up in the site notes.

Divers need to be active, swim at a moderate pace in an attempt to cover the full 2000 m^2 of bottom and above water column area. With the exceptions of sites that have extremely high abundance of fish and complex habitat, the entire site should be searchable within the 30 minutes. The most useful component of the time score is to keep the diver on track with completing a search over the entire transect. For example, if a diver has only completed the first 50 m of transect in 10 minutes, they will need to speed up their pace.



Time into the dive: 5 minutes. This diver sees 3 fish species in the first 5 minutes: a single garibaldi, 5 kelp bass, and 100 blacksmith. After 5 minutes, a horizontal line is drawn.

Time into the dive: 10 minutes. In the second 5 minute interval, the diver sees 3 new fish species: 56 adult senoritas, a single female sheephead, and a single juvenile treefish. In addition, the diver sees a school of 75 blacksmith and another garibaldi. However, these fish are NOT listed again. Rather, the diver adds to the counts previously written on the slate. So, the garibaldi count increases from 1 to 2 and blacksmith from 100 to 175 total fish.

Time into the dive: 15 minutes. In the third 5 minute interval, the diver sees two new species. First, a single blackeye goby is seen and then a few minutes later 5 more gobies are seen, making the total abundance 6. A school of 10 opaleye is also observed. In addition, the diver sees a huge school of senoritas and 2 more female sheephead. So the abundance estimates for these species are updated – the fish are NOT listed again. In the fourth 5 minutes no new fish were observed but a horizontal line is still drawn to keep track of the 5 minute time increments. Continue the procedure for a total of 30 minutes.

Figure 8. An example of how to record roving diver fish count data during a dive.

In the fourth and subsequent five minute intervals, newly observed species are listed. If more individuals of an already noted species are observed, the species is not written again but the count is added to the previous observation of that species. Be sure to only list species once! Continue to record new species and draw a horizontal line at each five minute increment until 30 minutes have passed. Do your best not to count the same individual fish more than once, so take note of features such as fin or body damage, coloration, size, and even the number of copepods on a fish

In addition to listing and counting all identifiable fish, each diver will search for all original indicator species (Table 9a) and note if they are absent during the RDFC. Novice divers should at minimum be able to correctly identify all indicator species and actively search for them during their dive. This enables us to assign these species a zero (0) in the database indicating that observer was able to identify the fish species, they were actively searched for and they were not observed during their fish count.

Please note that each observer's data is an individual count and each observer should refrain from pointing out species to other observers. If a diver is unable to identify a fish species, careful notes related to size, shape, color, etc. should be taken for possible later identification. Males, females, and juveniles should also be counted individually when applicable.

Typically, the RDFCs will be conducted immediately after the fish transects. During fish transects a secchi disc reading is taken to measure visibility. If fish transects were not performed a secchi disc reading should be taken at the time of the roving diver fish count.

After the count is completed, the divers should be debriefed and any unusual fish sightings should be discussed and confirmed. All questionable fish identifications are eliminated from the survey. Be sure to ask each diver if they looked for the indicator species in Table 10.

Immediately following the dive, RDFC data from all observers at each site is transcribed from the slates to one RDFC summary sheet (Appendix J). Fish observed in the first five minute increment will be given a Time Score of 10, the second five minute increment will be given a score of 9, the third five minute increment score of 8, the fourth five minute increment a score of 7, the fifth five minute increment a score of 6, and the last five minute increment a score of 5. Indicator species that were not present will receive a Time Score of 0 if not present during the RDFC. No other fish species will get a zero if not present. When providing your data to the recorder call out the Time Score first followed by the tallied count for each species (garibaldi 10, 2; kelp bass 10, 5; blacksmith 10, 175; senorita 9, 206; etc).

To record RDFC data on the summary sheet correctly, please use the guidelines summarized below:

Novice Observers

For indicator species positively identified, fill in **Score** and **Abundance** columns and leave **Count** column blank.

Example:

10	C	

For indicator species NOT observed, only place "---"in the **Abundance** column and leave **Score** and **Count** columns blank. This means the species was looked for but not found.

Example:

Expert and Intermediate Observers

For indicator species positively identified, fill in **Score**, **Abundance** and **Count** columns.

Example:

8	**F**	**4**

For indicator species NOT observed, only fill in **Abundance** and **Count** columns and leave **Score** column blank. This means the species was looked for but not found.

Example:

	----	**0**

Time Required

It is essential for this protocol that exactly 30 minutes per observer is used to count fish.

Table 9. Indicator Organisms sampled on RDFC. NOTE: this is not an exhaustive list, but rather the core indicator species that all observers must be able to identify correctly.

Species Name	Common Name	Juvenile Characteristics
Chromis punctipinnis	blacksmith	yellow tail coloration
Oxyjulis californica	señorita	<10 cm length
Sebastes mystinus	blue rockfish	<10 cm length
Sebastes serranoides	olive rockfish	<10 cm length
Sebastes atrovirens	kelp rockfish	<10 cm length
Sebastes serriceps	treefish	<10 cm length
Paralabrax clathratus	kelp bass	<10 cm length
Semicossyphus pulcher (male, female and juvenile)	sheephead	<10 cm length AND white stripe*
Embiotoca jacksoni	black surfperch	<10 cm length
Embiotoca lateralis	stripped surfperch	<10 cm length
Rhacochilus vacca	pile perch	<10 cm length
Hypsypops rubicundus (adult and juvenile)	garibaldi	blue spots
Girella nigricans	opaleye	
Halichoeres semicinctus (male, female and juvenile)	rock wrasse	<10 cm length AND white stripe**
Lythrypnus dalli	bluebanded goby	
Coryphopterus nicholsii	blackeye goby	
Alloclinus holderi	island kelpfish	
*Oxylebius pictus****	painted greenling	

*sheephead greater than 10 cm and displaying juvenile morphology are recorded as females.
**rock wrasse greater than 10 cm and displaying juvenile morphology are recorded as females.
***Not an indicator species, but is added to the data sheet due to being present at nearly all sites.

Table 10. Fish species list of all positively identifiable species counted on RDFC from 1996-2011.

Species Name	Common Name	Juvenile Characteristics