Diver Visual Census

v 0.1.0

Smithsonian Institution

marinegeo@si.edu

Introduction

The identity, density, biomass, and diversity of organisms are key to understanding the structure and function of ecosystems. Visual census provides a rapid, non-destructive way to quantify these variables for macroscopic organisms across a range of ecosystems where visibility is sufficient (coral reefs, subtidal rocky reefs, seagrass meadows). This protocol describes the Diver Visual Survey method for estimating densities of fishes, other swimming animals (e.g., turtles, cetaceans), and large macroinvertebrates > 2.5 cm at maturity (e.g., gastropods, echinoderms, crustaceans).

These methods are identical to, and adopted from, those employed by the Reef Life Survey (RLS) network, and diver visual survey data collected as part of MarineGEO activities will be integrated into both MarineGEO and RLS global databases. We provide an abbreviated summary of their detailed protocol below, but those working in high diversity systems, with schooling fishes, in kelp forests, or facing other challenges may wish to consult the RLS manual directly for further details: https://reeflifesurvey.com/wp-content/uploads/2015/07/NEW-Methods-Manual_150815.pdf.

Additional copies of this protocol, field datasheets, data entry templates, instructional videos, literature, and more can be found on the MarineGEO protocol website: https://marinegeo.github.io.

Measured Parameters

This assay records species composition, density, diversity, and body sizes of fishes and other swimming animals in a 50 x 5 x 5 m transect (or "block", method 1), measured as:
- Number and identity of all mobile organisms
- Total length (snout to tip of tail) of swimming animals

It also records species composition and density of mobile invertebrates and cryptic fishes in a 50 x 2 x 1 m block along the same transect (method 2), measured as:
- Number and identity of macroinvertebrates and cryptic fishes
- Total length (snout to tip of tail) of cryptic fishes

Requirements

Note: Divers using this protocol to collect MarineGEO data should first be trained by authorized Reef Life Survey trainers. Contact marinegeo@si.edu for information.

Personnel: 2 persons

Time: Preparation: 1 hr
        Field work: 0.5-1 day
        Post processing: None
        Data processing: 1-3 hr

Replication: Two (2) transects per site

Materials Checklist:
- ☐ 50-m fiberglass transect line
- ☐ Dive slate
- ☐ Pencils
- ☐ Field data sheet printed on waterproof paper
- ☐ GPS to record location
- ☐ Underwater camera to record images of species that cannot be identified in field

Methods

Preparation:
1. Print field datasheet on waterproof paper

Fieldwork:
1. Select appropriate site(s) for visual census:
   a. Transects should be placed along a given depth contour with the target habitat comprising at least 90% of the underlying substrate
   b. Record GPS coordinates of transect start point in decimal degrees to 5 decimal places
2. Deploy the transect line:
   a. Lay 50-m transect tape along depth contour
   b. Record depth in meters
   c. Record the compass bearing of the transect from anchor or GPS point so transect may be laid in the same place during future surveys
3. Conduct fish surveys (method 1):
   a. Visualize a "block" 5 m wide and high 5 m, bordering the transect line (Fig. 1). The two divers in a pair will each swim and record from a 5x5 m block along different sides of the transect line.
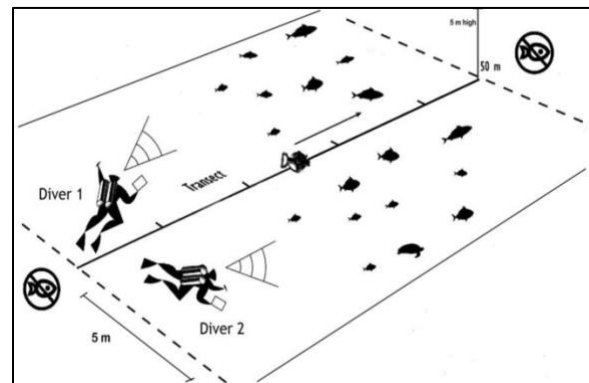

Figure 1. Swimming animal survey diagram (Method 1).

b. Swim through the center of this block about 1 m from the seabed, moving to search mouths of caves, crevasses, and overhangs where present

c. Record the taxon, number, and approximate size of all fish species (and other vertebrates such as turtles) seen within the block. Size-classes of total fish length (from snout to tip of tail, or longest distance, including for stingrays) used are 2.5, 5.0, 7.5, 10.0, 12.5, 15.0, 20.0, 25.0, 30.0, 35.0, 40.0, 50.0, 62.5 cm, and above. Lengths of fish larger than 62.5 cm should be estimated to the nearest 12.5 cm and individually recorded

Figure 2. Macroinvertebrate and Cryptic Fish Survey diagram (Method 2).

d. Make a record of any fish you see that you can't identify: take a photograph, draw a picture, and/or write a descriptive note (more information is better). Do not ignore unidentified species. It is better to include uncertain ID's (e.g. unidentified member of a particular genus) than to make no record at all

e. Do not re-record fish that overtake you

4. Conduct mobile macroinvertebrate and cryptic fish surveys (method 2):
   a. Using the same transect line censused with Method 1, visualize a block 1 m wide and 2 m high with the transect line on one edge. (Fig. 2)
   b. Swim the block
   c. Record the taxon, number, and size of all cryptic fishes seen in this block (those families not recorded in Method 1)
   d. Record the taxon and number of all large, mobile macroinvertebrates seen in the block (see Appendix 1 for examples)
   e. Only cryptic fishes (those closely associated with seaweeds or the seabed; e.g., gobies, blennies, cardinal fishes, scorpion fishes) should be recorded during method 2. Non-cryptic fishes (e.g. wrasses and damselfishes) seen during this survey should _not_ be recorded here or added to the fish count already completed with Method 1

5. Individual fish not seen during the time of the above surveys or seen outside the block boundaries can be recorded if notable. This is especially important for large, rare species or species outside their usual range. Do _not_ record these individuals in the transect surveys if they were not seen within the block during the survey (methods 1 or 2).

6. The transects established with this protocol are also used in assessments of Density (Seagrasses) and Cover (Coral Reefs)
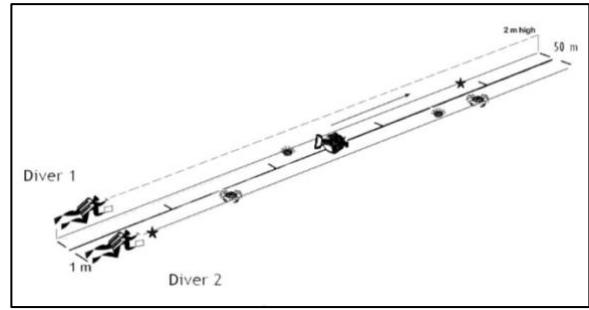
Post-processing:

As soon as possible after the dive, while still fresh in memory, determine the identity of species that could not be identified in the field and record those names on the data sheets. Ask others familiar with the local fauna and check field guides to identify all species seen. No other post-processing of samples is required for visual censuses.

Data Submission

1. Scan the completed field datasheets as PDFs. Name the file to include the MarineGEO site code, specific location, date (yyyymmdd), and the name of the protocol, with underscores between these sections (e.g., "BEL-CBC_Site1_20180101_visual_survey_Method_1")
2. Enter data into provided data entry templates
3. Scan the completed field data sheets and save both paper and electronic versions]]
4. E-mail data entry file, scanned field data sheets, and any additional photos or notes to: marinegeo-data@si.edu

Appendix 1. Groups of Macroinvertebrates to Count During Macroinvertebrate and Cryptic Fish Survey

GROUPS	ORDER/SUB-GROUPS	RULES/EXCEPTIONS
Echinoderms	Echinoids	Count all
	Crinoids	Count all
	Holothurians	Count all
	Asteroids	Count all
	Ophiuroids	ONLY count basket stars (because they are exposed)
Crustaceans	Crabs & hermit crabs	Count only if they grow bigger than 2.5cm
	Lobsters	Count and size all
	Shrimps	Cleaner shrimps only (Don't count small shrimps such as hinge-beak shrimps).
	Barnacles	DON'T count any
	All others	Count only if: (1) grow bigger than 2.5cm
Molluscs	Gastropods	Count only if: (1) mobile, AND (2) grow bigger than 2.5cm. Also NOT Patellidae, Polyplacophora
	Bivalves	Count giant clams (e.g. Tridacna spp.), razor clams (e.g. Pinna spp.), scallops (e.g. Pecten spp.) and pearl oysters (e.g. Pinctada spp.). Don't count other bivalves including edible oysters.
	Cephalopods	Count all
	All others	Count only if: (1) mobile, AND (2) grow bigger than 2.5cm
Worms (including Polychaetes)	All	DON'T count any
Sessile groups	Ascidians	DON'T count any
	Sponges	DON'T count any
	Bryozoans	DON'T count any
	Hydroids	DON'T count any