

Appendix G. Methods: Coral Reef Ecosystem Assessments

Reef Fish Surveys

Field Method

All sites were surveyed using NOAA-CREP's standard coral reef fish survey method, i.e., stationary point counts (SPC). The SPC protocol closely follows that used by Ault and colleagues (2006) and involves a pair of divers conducting simultaneous counts in adjacent, visually estimated 15 m diameter cylindrical plots extending from the substrate to the limits of vertical visibility (Figure 111).

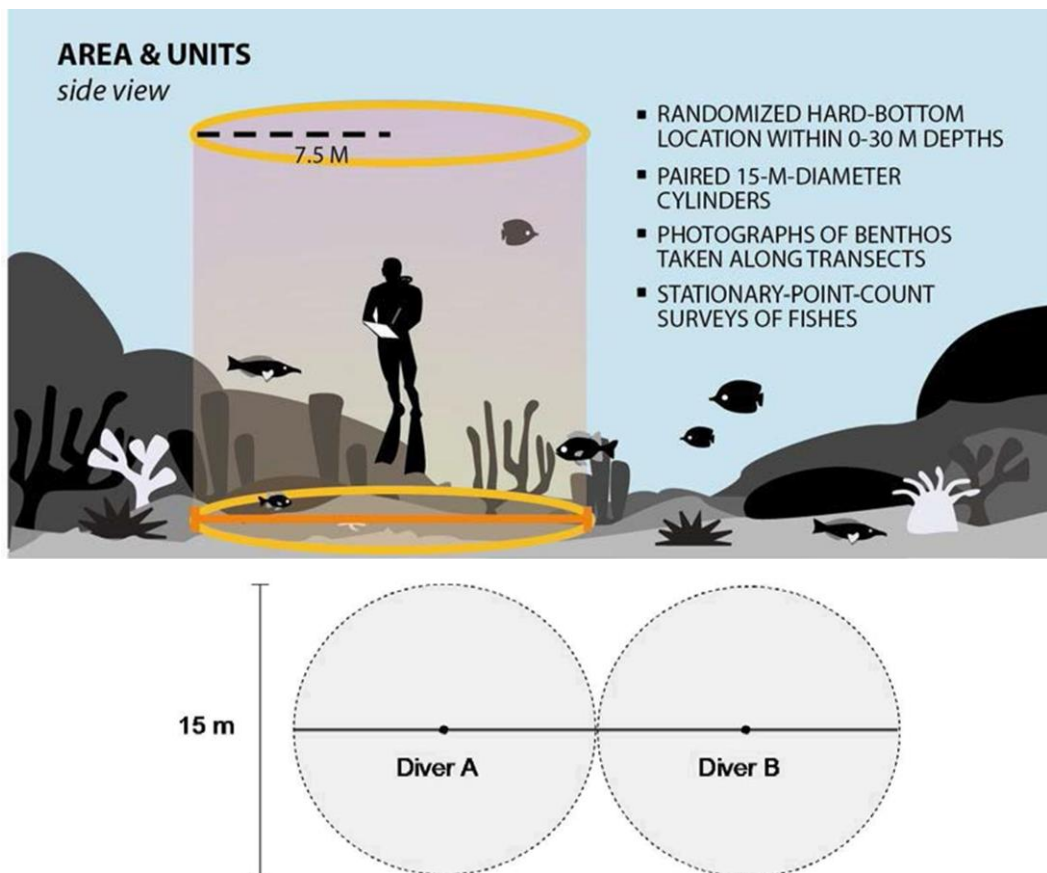


Figure 111. Schematic of NOAA-CREP stationary point count reef fish survey method.

Each count consisted of two components. The first was a 5-minute species enumeration period in which each diver recorded the taxa of all species observed within their respective cylinders (Figure 111). At the end of the 5-minute period, divers began the tallying portion of the count, in which they systematically worked through their list for each species and recorded the number of fish and size (total length, to nearest centimeter) of each individual fish. The tallying portion was conducted as a series of rapid visual sweeps of the plot, with one species-grouping counted per sweep. In cases where a species was observed during the enumeration period but was not present in the cylinder during the tallying period, divers recorded their best estimates of size and number observed in the first encounter during the

enumeration period and marked the data record as ‘non-instantaneous.’ See Ayotte et al. (2011) for the complete fish survey standard operating procedure.

Analysis: Estimation of Biomass by Fish Groupings

Fish biomass was calculated using the following equation to estimate weight (W) from length (L)

measurements: $W = a \times L^b$

The parameter a is a scaling coefficient for the weight and length of the fish species, and the parameter b is a shape parameter for the body form of the fish species. Biomass was calculated for each species at each site by averaging the two divers’ estimates.

In estimating fish biomass, species data were pooled into “all fishes” and into several trophic, taxonomic, and size groupings. The four trophic groupings used were: “primary consumers” (herbivores and detritivores); “secondary consumers” (omnivores and benthic invertivores); “planktivores”; and “piscivores”. Family-level data on emperors, snappers, breams, parrotfish, and groupers were also presented because of their general importance as fishery targets. Biomass was also pooled into size classes: small- (0–20 cm), medium- (21–50 cm), and large- bodied reef fish (greater than 50 cm).

Total biomass (“TIMOR ALL”) and each of the fish groupings from Timor-Leste were compared to averages of reef fish biomass at populated and remote areas across the Pacific Islands where NOAA-CREP has conducted reef fish surveys since 2009 using the same survey methods (Heenan et al. 2014). Data from these remote and populated islands provide context and reference for interpreting fish biomass values from Timor-Leste. While there are other important sources of natural variability among these Pacific reefs, including biogeographic differences, these data from other remote and populated Pacific islands serve as useful reference points for interpreting the Timor-Leste dataset. For example, fish communities observed from Timor-Leste reefs with high human impacts (including fishing activities) are expected to be more similar to the fish communities observed from other populated Pacific reefs. These types of comparisons can help contextualize the baseline datasets NOAA-CREP generated for Timor-Leste’s coral reef ecosystems.

Benthic Cover

Field Method

Upon completion of the fish survey, one diver conducted a photoquadrat by photographing the benthos at 1-m intervals along the 30-m transect line between the centers of the two cylinders (30 photographs per site). A 1-m plastic polyvinyl chloride (PVC) pole was used to position a digital camera directly above the substrate to frame a photograph approximately 0.7 m² in area (Figure 112).



Figure 112. A fish diver conducting a photoquadrat survey.

Analysis: Benthic Cover Derived from Analysis of Benthic Images Collected during Fish Surveys

For the estimation of benthic cover, each benthic photograph was analyzed using Coral Point Count with Excel Extensions image analysis software (CPCe v.4.12; Kohler and Gill 2006). A photo analyst identified the substrate types under 10 randomly-assigned points overlaid by CPCe on each image.

Benthic organisms and substrate type on the photographs were classified into broad ecological functional groups: hard (scleractinian) coral, soft coral, crustose coralline algae (CCA), macroalgae, turf algae, invertebrate, sediment (sand), and unclassified (the benthos was not clear and/or could not be identified with a high level of confidence). Percent cover estimates for each site were calculated from the photographs as the proportion of the total number of points falling within each functional group divided by the total number of identifiable points for each site (points falling on the transect line or the PVC stick were removed from the total number of points, but unclassified points were retained). Site estimates were averaged for each sector.

Photographs were analyzed for benthic cover implementing CPCe following the same Tier-2 classification and approach as in Lozada-Misa et al . (2017).

From the categorical estimates, a benthic substrate ratio was calculated as the sum of the percent cover of hard coral, soft coral, and CCA divided by the sum of the percent cover of macroalgae and turf algae.