ESA-Listed Coral Colony and Acropora Critical Habitat Survey Protocol
Updated July 2019

Objective

To outline recommended survey methods for determining the distribution and abundance of coral species listed under the Endangered Species Act (ESA) and the amount of Acropora critical habitat at sites under ESA Section 7 consultation. The methods should be applicable to a broad range of project scales. ESA-listed coral species include *Acropora cervicornis* (staghorn coral), *Acropora palmata* (elkhorn coral), *Orbicella annularis* (lobed star coral), *Orbicella faveolata* (mountainous star coral), *Orbicella franksi* (boulder star coral), *Dendrogyra cylindrus* (pillar coral), and *Mycetophyllia ferox* (rough cactus coral).

Problem

Two aspects make quantitative sampling for coral species difficult:
Patchy and clumped distribution, with colonies as small as 0.01 m2, which may be clumped together within a sub-area of the project area; and

1. Stratified distribution, with occurrence perhaps limited to a particular depth gradient or substrate type within a project area.
2. Additionally, hard bottom habitat can be interspersed with sand patches, making it difficult to accurately determine the amount of Acropora critical habitat present in a project area.

Recommended Methods for Critical Habitat Delineation

Surveying to identify the presence of coral hard bottom is important both for delineating the Acropora critical habitat essential feature and as a simplified way to identify areas where ESA-listed coral species may occur. The staghorn and elkhorn coral critical habitat essential feature is substrate of suitable quality and availability (i.e., consolidated hard bottom or dead coral skeletons free from fleshy macroalgae or turf algae and sediment cover); such substrate supports successful larval settlement, recruitment, and reattachment and recruitment of asexual fragments. If available, recent benthic habitat maps (as approved by NMFS) can be used to identify hard bottom areas and to estimate the amount of critical habitat present in the project area. If recent habitat maps are not available, high-resolution geophysical surveys will likely be necessary. Diver conducted surveys can be used to help ground-truth the presence and distribution of hard bottom habitat. Diver surveys can be conducted in conjunction with the surveys for species distribution as described below.

Recommended Methods for Species Distribution:

The most appropriate approach depends on scale, and the amount of expected error depends on the approach. Unless a complete survey of the entire area is done, the estimated distribution and

abundance of these species may be significantly in error. With the exception of very small project areas, efficient field sampling may require sampling in two stages. A preliminary visual reconnaissance of the site should be conducted to locate any visible occurrences of ESA-listed coral species regardless of size. Following the preliminary reconnaissance, a more comprehensive sampling should be initiated. All surveys should be completed by divers (or snorkelers if water depths are shallow and visibility is adequate) working in teams of two. Divers should swim at a speed slow enough to detect small corals and maintain a depth of approximately 1m from the bottom.

When using the following survey methods, survey personnel should record the following:

1. Species name;
2. Single largest linear dimension of the colony or length, height, and width (units = mm);
3. Rank of percentage live tissue and recent partial mortality (i.e., 1-25%, 26-50%, 51-75%, 76-100%);
4. GPS coordinates of each colony (if possible) or GPS location of each survey site (unit = decimal degrees and state datum) along with a description of where each colony occurs (measurement along a transect or location within a quadrant); and
5. Site map with locations of each colony.

Small Project Area (< ~0.1 hectare or 0.25 acre)

Conduct a visual reconnaissance of the entire project area. Reconnaissance can be limited to areas of hard bottom. Record the required information (items 1-5 above) for all ESA-listed coral colonies encountered. The total amount of hard bottom surveyed must also be provided so that a density of corals can be calculated.

Intermediate to Large Project Area (> ~0.1 hectare or ~0.25 acre)

Data should be collected at 1 sampling site per every 10,000 m^2 within the project area. Sampling can be limited to the portion of the project site that contains hard bottom (i.e., where the species may occur). The portion that contains unconsolidated sediment can be omitted from the sampling area. At each sampling site, a 2-tiered survey will be conducted.

1. Divide the area to be surveyed into plots of 10,000 m^2 (100 m X 100 m). Swim the whole plot using a grid pattern, noting any ESA-listed coral colonies. Placing two intersecting 100 m long transects to divide the plot into 4 quadrants may be helpful for orientation within the plot. If 5 or fewer colonies of any ESA-listed species are encountered, collect the required data (items 1-5 above) on those colonies. Density will be calculated by number of colonies (by species) divided by the amount of hard bottom per 10,000 m^2 (estimated using recent habitat maps or geophysical survey as defined above). No further surveying is required at the sampling plot, so proceed to the next sampling plot. If more than 5 colonies of any ESA-listed coral species are encountered, proceed to 2nd tier (item #2 below).
2. Conduct 3 non-overlapping belt transects at 3 locations within each 100 m by 100 m plot. Each belt transect should measure 4 m X 50 m and be placed over as much hard bottom as possible. Record the required data (items 1-5 above) for all colonies encountered along the transects. Also record the habitat transitions from hard bottom to sand along the transects and calculate

the proportion of the surveyed transect that is hard bottom. This calculation is necessary to determine the density of corals. Density of corals reported as number of colonies by species per site (calculated as number of coral colonies per area of actual hard bottom surveyed in water).

Staff Qualifications

All field work and Quality Assurance/Quality Control (QA/QC) of the surveys and data collected will be completed by qualified biologists who meet at least the following minimum requirements (1) Bachelor of Science in Marine Biology, Biology with a concentration in marine sciences, Environmental Science with a minor in Biology, or similar degree; (2) At least 3 years documented experience monitoring coral hardbottom / coral reef communities in South Florida; (3) Knowledge of marine benthic ecosystems and organisms, including but not limited to identification of Caribbean coral species.

QA/QC

Prior to initiating fieldwork, the entire dive survey team (boat operators, divers, data transcribers, and QA/QC reviewers) will hold a training session to discuss the proper completion of survey protocols, field data sheets, and proper species identification. An appropriate QA/QC protocol should include the following:
1. Test dive of a complete transect. If more than 1 dive team is employed then the test dive should be replicated by each diver pair. If a single dive team is employed then the test dive should be repeated with the divers swapping duties.
2. Results of repeated test transects should not vary by more than 10%.
3. Training should be documented and all divers should sign the training record.
4. All field data sheets should be signed by the divers and a separate QA/QC reviewer.

The QA/QC reviewer should be a separate qualified biologist who is responsible for verifying survey results and ensuring proper implementation of the survey protocols.

Surveyor's name_____   Date_____   Site ID _____

Site Latitude_____   Site Longitude_____

Transect ID_____   Surveyor signature_____   QA/QC review signature_____

Start Latitude_____   Start Longitude   _____

End Latitude_____   End Longitude_____

Species name	Length	Width	Height	% Live Tissue	% Recent Mortality	Latitude	Longitude	Location along Transect

Habitat Transition Line - Note habitat type and changes

0m   50m