South Florida/Caribbean Network

National Park Service
Inventory and Monitoring Division

Standard Operating Procedure RF02

Participant Training—Version 1.1

Please cite this as:

South Florida/Caribbean Network. 2025 Participant Training—Version 1.1. South Florida/Caribbean Network Standard Operating Procedure NPS/SFCN/SOP—RF02. South Florida/Caribbean Network, Palmetto Bay, Florida.

Purpose

This standard operating procedure (SOP) describes the training required for participants to collect reef fish visual monitoring data.

Revision History Log

Revision Date	Author	Changes Made	Reason for Change	New Version #
3/24/2020	Mike Feeley	Added list of Contacts and minor updates	Contact list removed from Narrative	1.1

Contents

Page

Initial Participant Training 3

Species Identifications 3

Habitat Characterization 3

In-water Training 3

Fish Models 4

Annual Refresher Training for Previous Participants 7

Data Entry and Proofing Training 9

Diver Training Log 10

Contacts 10

Statistical design 10

Training methods 10

Data collection methods 10

Data entry and proofing 10

Data analysis and reporting 10

Interagency collaboration 11

Park Units 11

Literature Cited 12

Initial Participant Training

The following guidelines are used for training new fish counters prior to participation and are also used for refresher training. Failure to follow these guidelines may result in inaccurate and unusable data. Training sessions allow an opportunity to check the collection of field data to determine if the program is meeting data quality standards established in Appendix C in SOP RF04 *Data Entry and Proofing—Version 2.0* (SFCN 2025a). Details on RVC methodology can be referenced in SOP RF03 *Field Data Collection—Version 2.0* (SFCN 2025b).

Species Identifications

Participants conducting fish surveys need to be competent in the identification of reef fish to the species level before conducting in-water training. Participants may utilize resources including, but not limited to, the most recent edition of Humann and Deloach (2014), Reef Fish ID: Florida, Caribbean, Bahamas – Interactive Edition CD/DVD field guide, the Reef Environmental Education Foundation on-line fish identification quizzes (https://www.reef.org/), the on-line guide to Greater Caribbean Fish (Robertson and Van Tassel 2019; (https://biogeodb.stri.si.edu/caribbean/en/pages), and AGRRA fish training materials (https://www.agrra.org/training-tools/fish-training/). It is the responsibility of agency and university program leaders to ensure that all participants from each respective agency or institution possess the necessary identification skills.

Habitat Characterization

All participants must be familiar with the habitat classification scheme used in the stratified survey design. They need to be capable of distinguishing habitat types and classifying the different abiotic characteristics of the habitat that are measured. Participants must understand the metrics and terms used to assess major benthic groups and show familiarity with their identification. Guides for identification of major benthic groups and commonly misidentified organisms can be found in Appendix B in SOP RF03 (SFCN 2025b). It is suggested that these guides be printed and laminated and brought into the field as a reference.

In-water Training

In-water training is intended to assess the accuracy of a diver's estimates of fish size and distance from diver, as well as measure the ability of the diver to collect habitat data (Figure 1).

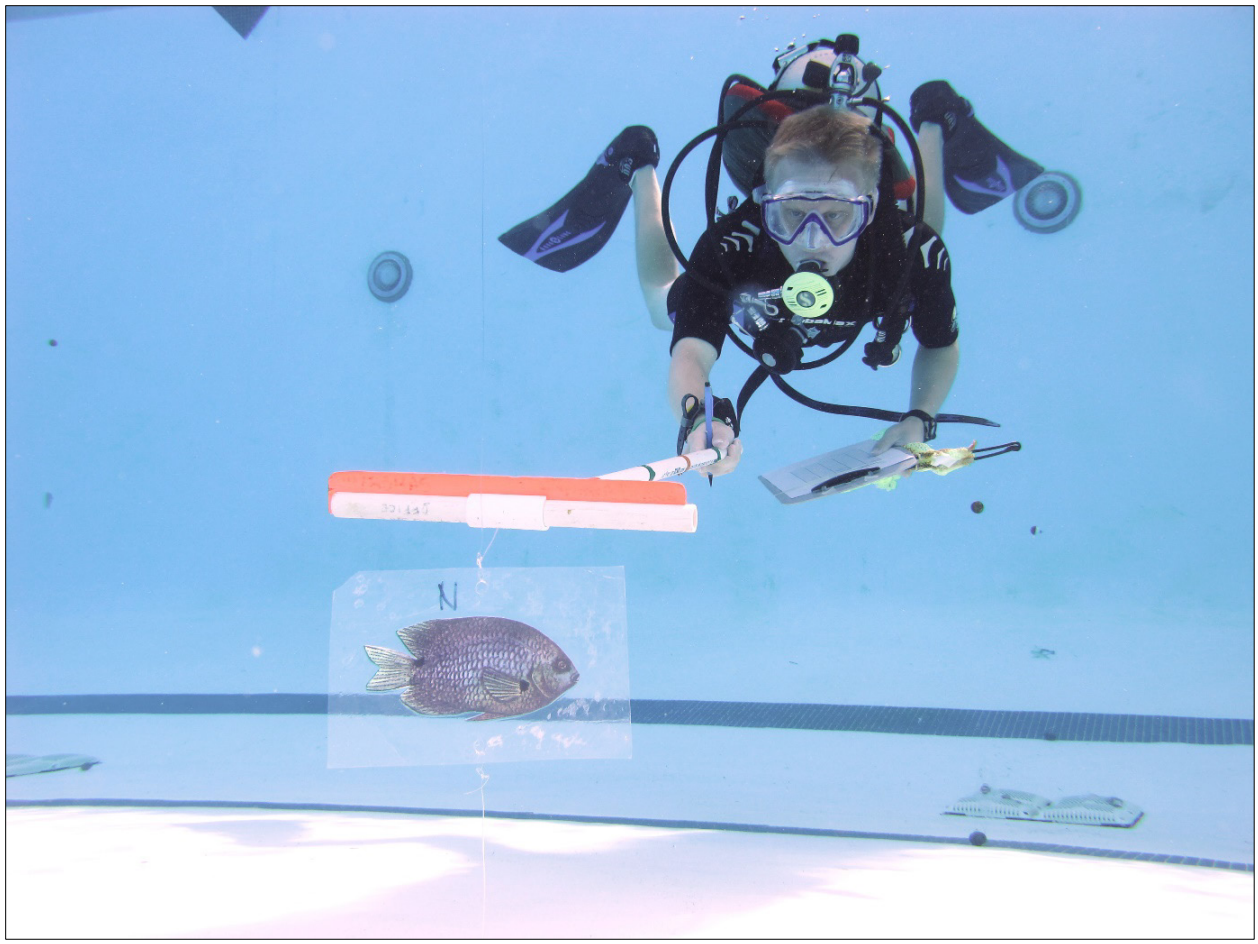


Figure 1. A trainee diver equipped with a fish survey datasheet, clipboard, pencil and a marked t-stick (APT) estimating the size of a fish model during an in-water pool training exercise (credit: Rick Riera-Gomez, University of Miami DSO).

Training occurs according to the following steps:

Fish Models

a. Models of fish that are typically observed during RVC surveys (optimally, both fishery-targeted and non-targeted species) are prepared for deployment.

b. A suitable test area is located in the field (reef habitat, relatively shallow depth) or a pool. Visibility must exceed 10 meters (32.8 feet [ft]), and the current should be minimal.

c. A measuring tape transect (30 meters [98.4 ft] or longer) is extended in a straight line within the test area. Fish models (approximately 20–30) are placed at varying distances (within the limits of visibility and at 0.5-meter [1.6 ft] intervals) from the transect tape at predetermined and marked distances along the tape.

d. For each fish model, a test administrator measures and records the (1) fish species, (2) model size (fork length to nearest centimeter), (3) distance from the mark on the transect tape to the fish model (to nearest 0.5 meter) for each model, and (4) habitat data.

e. Examinees enter the water with SCUBA gear, a reference measuring tool and clipboard. The reference measuring tool will be a marked t-stick/APT (see SOP RF03 [SFCN 2025b] for description of the APT). For each fish model, examinees estimate and record the (1) fork length (to nearest centimeter), (2) distance from the center point (to nearest 0.5 meter), and (3) complete the habitat data section of the fish/habitat data sheet.

f. The estimated fork lengths and distance from the transect tape for each model and habitat data are entered by each examinee into electronic format and compared with actual values to assess examinee-specific errors or consistent biases. An example of results is presented in Figure 2. This assessment may occur via (1) an instructor or instructors assessing each examinee's results, with subsequent reporting of results to, and discussion with, each examinee, or (2) self-assessment by examinees, with subsequent group discussion of each examinee's results.

g. In all cases, additional training is provided for examinees that exhibit consistent and considerable size estimation errors until they reach acceptable data quality standards. Potential error in precision increases with fish size and/or with distance of the fish from the surveyor. The data quality objective for estimation of size is ± 5 centimeters (2 inches [in]) for fish less than 50 centimeters (19.7 in) fork length and ± 10 centimeters (4 in) for fish greater than or equal to 50 centimeters fork length (Appendix C in SOP RF04 *Data Entry and Proofing—Version 2.0* [2025a]). The distance estimation standard objective is ± 0.5 meter at 7.5 meters (24.6 ft), hence 100% of distance estimates need to fall within this standard. Additional training is provided until the examinee has attained 100% accuracy in fish identifications. If collected, habitat data are also examined by an instructor, and they determine if the examinee needs more training.

Comparison training

Divers who have displayed a proficiency in species identification can train in water with veteran divers. Divers in training first conduct multiple dives observing the workflow underwater and they practice identifying fish and estimating lengths. Once they are comfortable with the work that is conducted, they shadow an experienced diver and collect all the data as if it were a true survey. After each survey the divers compare species identifications, estimated lengths, and abiotic/biotic cover and relief values. Divers are also encouraged to discuss any species that might have not been within boundaries of visual survey and estimated lengths of such species. After several of these dives have been conducted and the veteran diver is confident the new diver can accurately identify fish, the roles are reversed, and the new diver collects the data for the site while the veteran diver follows and collects separate data to validate the new diver. Both types of training dives will occur over a variety of habitat strata as fish assemblages are likely to differ. This may take several days of conducting paired counts until both the veteran and novice diver are confident the data collected meets the data quality standards.

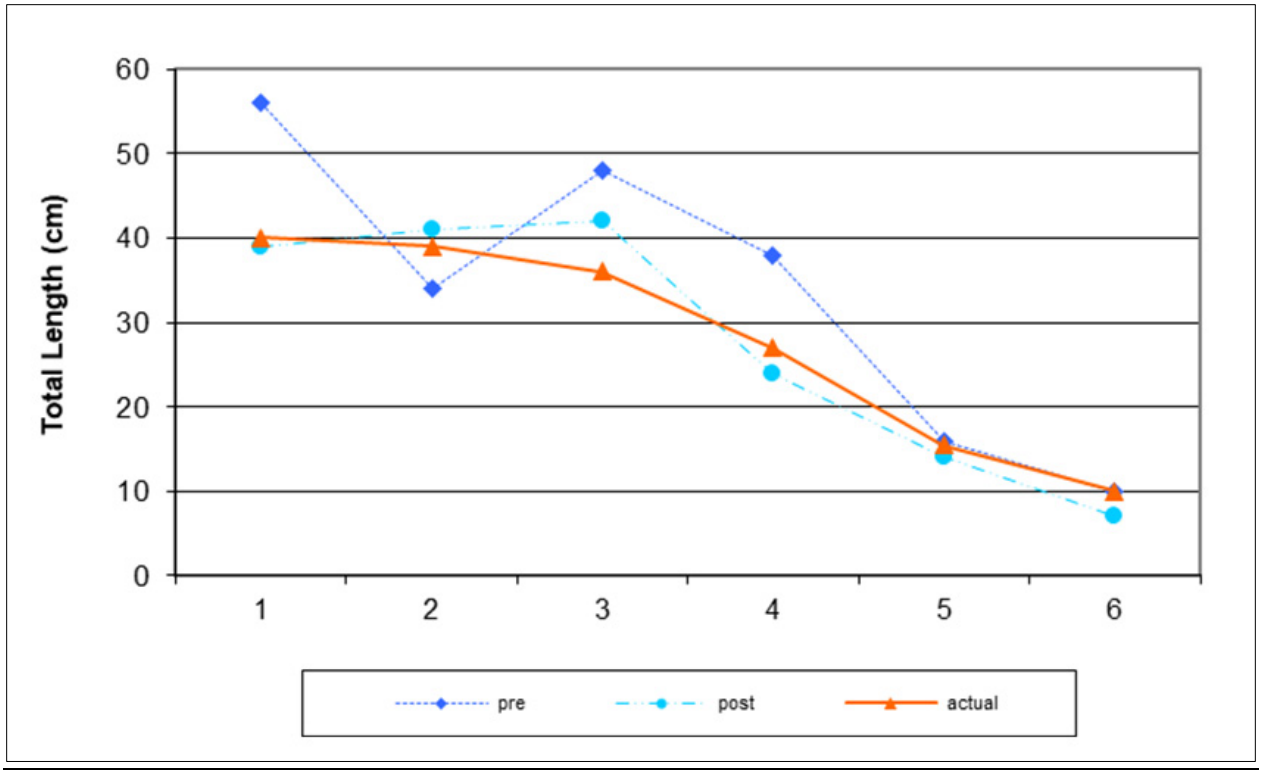


Figure 2. Comparison of pre and post training test results of estimates of fish length compared to actual size of different fish models.

Reef fish Visual Census (RVC) training

A new diver's first RVC dives (paired surveys in their own cylinder) will occur with an experienced fish counter. The experienced fish counter provides guidance, answers questions, and helps the new diver with their fish identification skills. The new diver will also calibrate their size estimates by comparing them to non-mobile reef components that can be measured exactly. Data taken during their first few dives and until the diver demonstrates competency with all necessary data collection skills and data quality standards will be marked as "Training – Observer" dives by selecting this option from the "Sample Type" drop down list on the Sample Data screen upon entry into the RVC data entry program (SOP RF04 *Data Entry and Proofing—Version 2.0* SFCN 2025a). Reef fish entries may be entered by common name, scientific name or code (Appendix A in SOP RF03 *Field Data Collection—Version 2.0* [SFCN 2025b]). An SOP will be developed to establish acceptable data quality standards of proficiency before divers are considered qualified to collect RVC survey data. Some standards may include a maximum variance standard for size, density and species richness data between experienced divers and trainees on RVC training dives compared to historical RVC data; minimum acceptable score on a practical species identification exam (PowerPoint) and accuracy standards for underwater estimation of linear distance and fork length of fish models of a known size.

Annual Refresher Training for Previous Participants

Each year, prior to the start of annual surveys, all fish counters, including those who have previously participated in surveys, will attend out-of-water training meetings that can be held either jointly or independently depending on the needs and abilities of the agencies. These out-of-water training meetings will cover the sampling design, survey logistics, RVC methods, habitat characteristics, and data entry and proofing methods so that participants are familiar with all steps of the monitoring program. Presentations given at these training meetings will be posted online by NOAA and/or shared as PDFs so that they are accessible to all participants throughout the field season.

In-water training will be organized by each agency independently and focus on method execution, proper equipment handling, species identification and size estimation, and proper habitat characterization. Participants are encouraged to independently use computer programs and books to practice species identification.

Annual refresher training is also a good time to review historical individual diver tendencies to minimize and correct for observer effects. QA/QC comparisons of individual divers to the average values recorded by of all divers, and analysis of values recorded by dives to look for preferences is performed by the NOAA data analyst. Divers versus all function plots and diver histograms of values recorded by the diver are commonly reviewed. Diver versus all function plots are two density plots stacked on top of each other (Figure 3). The grey one (that does not change) is the density plot of all sizes that all divers combined wrote down in a season. These are all the raw numbers that are recorded (minimum, maximum and mode) on the data sheet. The second density plot (white) is all size values recorded by the individual diver. Another useful tool are diver histograms, which are frequency histogram stacked on a density plot for each diver (Figure 4). The diver histogram summarizes all the numbers that a diver wrote down for minimum, maximum and mode values. The histogram compared to the average density function for all divers may indicate a preference for even/odd numbers or if divers tend to bin sizes etc. These outputs are shared and reviewed by each agency. The agency data managers or team leads review the values recorded by the diver compared to the average values recorded by all divers and provides feedback to the individual divers to correct for tendencies. The recalibration of divers through an objective review of their tendencies is the most effective way to address observer effect, along with the standard practice of pairing of experienced observers with new observers.

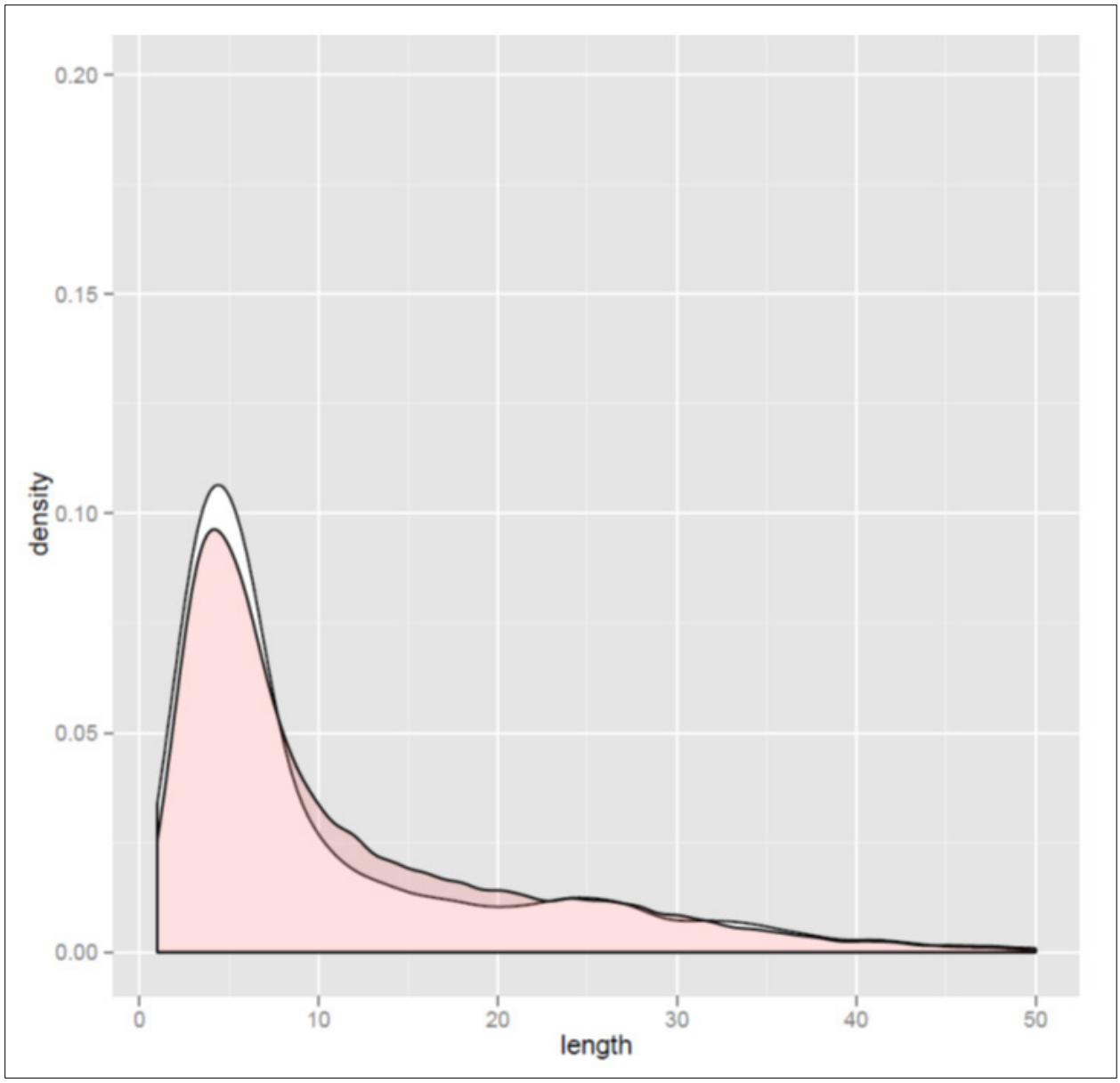


Figure 3. Density plots comparing all size values (min, max, mode) in centimeters fork length recorded by all divers (gray) versus all size values recorded by an individual diver (white).

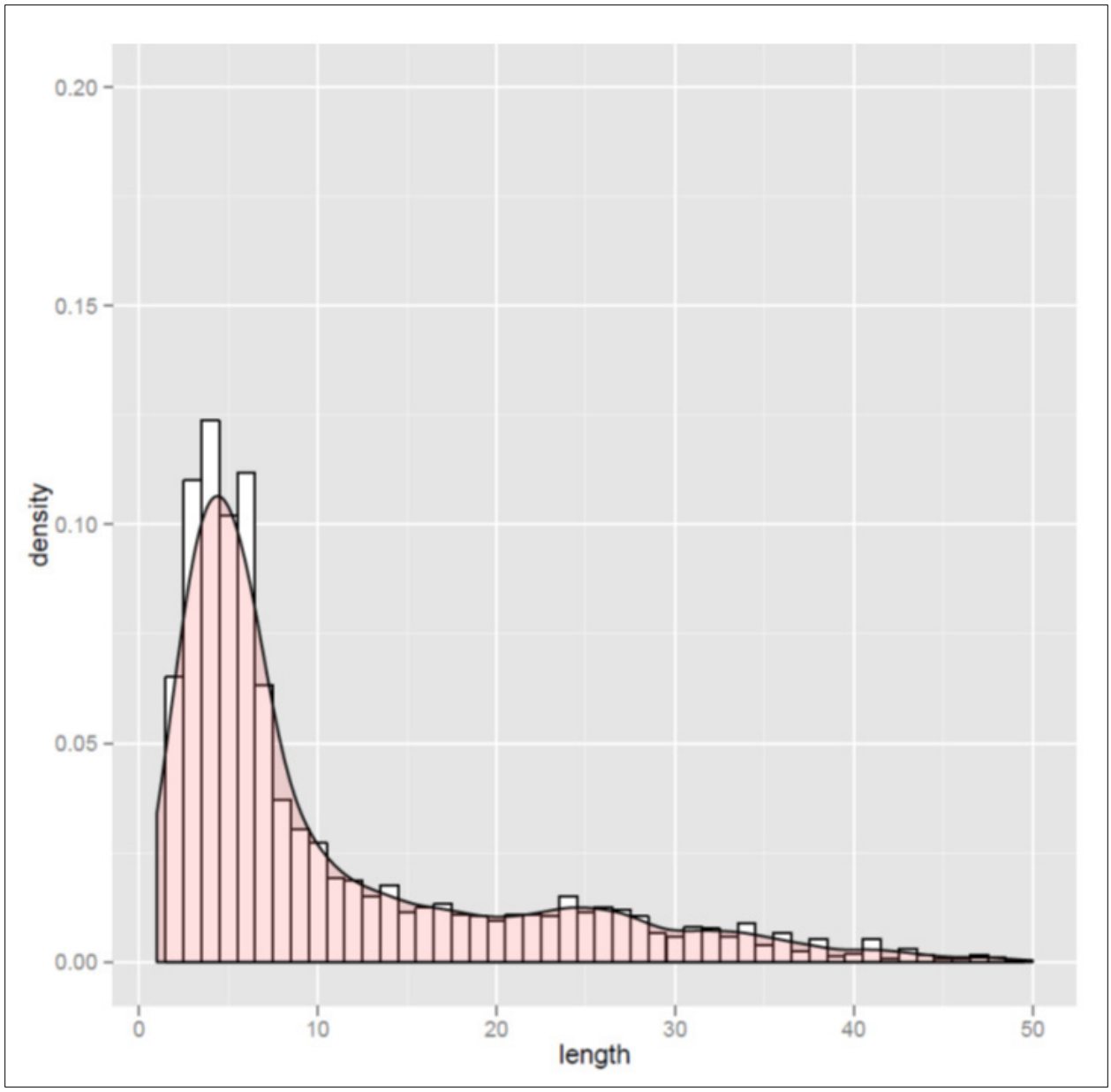


Figure 4. Diver histogram of all sizes recorded (minimum, maximum, mode) in centimeters fork length by the individual diver (white histogram) compared to the density function of the average sizes recorded by all divers (gray).

Data Entry and Proofing Training

Prior to surveying, all participants must be proficient in the use of the web-based RVC data entry program (SOP RF04 *Data Entry and Proofing—Version 2.0* [SFCN 2025a]). Designated data managers from each agency need to be familiar with the steps involved in collating the data and producing proofing reports for individual divers to check their data, and for submitting final data files for data verification (SOP RF04). This may require individual training when a new data manager is

appointed. If needed, an experienced data manager from one of the agencies will be appointed to train the new data manager in the steps involved.

Diver Training Log

A record of diver training will be maintained in both the local and regional database (Table 1). This will support evaluation of unusual data during QA/QC.

Table 1. Example of diver training log spreadsheet. Results of known and estimated reef fish size and distance estimates can be added to the spreadsheet to track performance record of individual divers.

Diver Name	Agency	Initial Participant Training (date)	Refresher Training (date)	Data Entry and Proofing Training/ Review (date)
–	–	–	–	–

Contacts

Statistical design

Jerald Ault (RSMAS-UM) 305-421-4884, jault@rsmas.miami.edu

Steve Smith (CIMAS-RSMAS) 305-421-4783, steve.smith@noaa.gov

Jay Grove (NOAA-SEFSC), jay.grove@noaa.gov

Training methods

Jay Grove (NOAA-SEFSC), jay.grove@noaa.gov

Data collection methods

Jay Grove (NOAA-SEFSC), jay.grove@noaa.gov

Data entry and proofing

Jeremiah Blondeau (CIMAS-UVI), jeremiah.blondeau@noaa.gov

Caitlin Andrews (NPS) 305-252-0347, caitlin_andrews@nps.gov

Jack Olson (FWC-FWRI) 305-289-2330, jack.olson@myfwc.com

Data analysis and reporting

Jerald Ault (RSMAS-UM) 305-421-4884, jault@rsmas.miami.edu

Steve Smith (CIMAS-RSMAS) 305-421-4783, steve.smith@noaa.gov

Jay Grove (NOAA-SEFSC), jay.grove@noaa.gov

Jack Olson (FWC-FWRI) 305-289-2330, jack.olson@myfwc.com

Michael Feeley (NPS) 305-252-0347, michael_feeley@nps.gov

Interagency collaboration

Jerald Ault (RSMAS-UM) 305-421-4884, jault@rsmas.miami.edu

Jay Grove (NOAA-SEFSC), jay.grove@noaa.gov

Danielle Morley (FWC-FWRI) 305-289-2330, danielle.morley@myfwc.com

Michael Feeley (NPS) 305-252-0347, michael_feeley@nps.gov

Park Units

Thomas Kelley, Biologist, Virgin Islands National Park, 1300 Cruz Bay Creek, St. John, VI 00830. 340-693-8950. thomas_kelley@nps.gov

Vanessa McDonough, Fishery and Wildlife Biologist, Biscayne National Park, 9700 SW 328 Street, Homestead, Florida 33033. 786-335-3649. vanessa_mcdonough@nps.gov

Kristen Ewen, Biologist, Buck Island Reef National Monument and Salt River Bay National Historical Park and Ecological Preserve, 2100 Church Street #100, Christiansted, VI 00820-4611. 340-773-1460. kristen_Ewen@nps.gov

Andrew Morin, Natural Resource Program Manager, Dry Tortugas National Park, P.O. Box 6208 Key West, FL 33041. 305-242-7700. andrew_morin@nps.gov

Literature Cited

Humann, P. and N. DeLoach. 2014. Reef Fish Identification: Florida, Caribbean, Bahamas, 4th Edition. New World Publications, Jacksonville, FL.

Robertson, D. R. and J. Van Tassell. 2019. Shorefishes of the Greater Caribbean: online information system. Version 2.0 Smithsonian Tropical Research Institute, Balboa, Panamá. https://biogeodb.stri.si.edu/caribbean/en/pages

South Florida/Caribbean Network. 2025a. Data Entry and Proofing—Version 2.0. South Florida/Caribbean Network Standard Operating Procedure NPS/SFCN/SOP—RF04. South Florida/Caribbean Network, Palmetto Bay, Florida. Available at: irma.nps.gov/DataStore/Reference/Profile/2309699 (last accessed April 2025).

South Florida/Caribbean Network. 2025b. Field Data Collection—Version 2.0. South Florida/Caribbean Network Standard Operating Procedure NPS/SFCN/SOP—RF03. South Florida/Caribbean Network, Palmetto Bay, Florida. Available at: irma.nps.gov/DataStore/Reference/Profile/2309698 (last accessed April 2025).