

# Learning to See Underwater

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*The hunt begins. A team of volunteer divers identify fish in a designated area as part of the Reef Environmental Education Foundation's fish survey program.*

Caring for and about the marine environment requires a comprehensive understanding of ecosystem structure and function. It is only through concerted and persistent data collection that researchers and resource managers are able to understand these components. Unfortunately, the monumental task of surveying, recording and cataloging an immense liquid wilderness is insurmountable without help. Help, in this case, comes from thousands of recreational divers and snorkelers who visit coastal areas each year. The Reef Environmental Education Foundation's (REEF) program enlists those divers to provide meaningful information while enabling them to learn how to really see underwater.

REEF was founded in 1990 out of

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growing concern about the health of the marine environment, and the desire to provide the scuba diving community a way to contribute to the understanding and protection of marine populations. REEF achieves this goal primarily through its volunteer fish monitoring program, the REEF Fish Survey Project. The Project was developed with support from The Nature Conservancy and guidance by the Southeast Fisheries Science Center of the National Marine Fisheries Service. The REEF Fish Survey Project allows volunteer SCUBA divers and snorkelers to collect and report information on marine fish populations. The data are collected using a fun and easy standardized method, and are housed in a publicly-accessible database on REEF's Website ([www.reef.org](http://www.reef.org)). Participants in the Project not only learn about the environment they are diving in; they also collect valuable information.

## The Method

To collect data for the Project, REEF volunteers use the Roving Diver Technique, a visual survey method specifically designed for volunteer data. The only materials needed are an underwater slate and pencil, a scantron form available at no charge from REEF, and a good reference book. During a REEF survey, divers swim freely throughout a dive site and record every fish species that can be positively identified. The "hunt" for fishes begins as soon as the diver enters the water. The goal is to find as many species as possible so divers are encouraged to look under ledges and up in the water column. At the conclusion of a survey, each recorded species is assigned one of four abundance categories based on how many individuals were seen throughout the dive (single [1]; few [2-10], many [11-100], and abundant [ $>100$ ]). Following the dive, each surveyor records the species data on the REEF scansheet specific for the region the survey was conducted in. Completed scansheets are returned to REEF HQ, where they are processed and entered into REEF's database. Additional forms are available free of charge, and can be ordered over the web or by phone.

The Project started in Florida in 1993, and since then it has expanded to include the entire tropical western Atlantic (Florida, Caribbean, Bahamas, and Gulf of Mexico), southern Atlantic states (Georgia and South Carolina), the Northeast (Maine through North Carolina), the West Coast of the United States and Canada (California, Oregon, Washington, and British Columbia), the tropical eastern Pacific (Gulf of California to the Galapagos Islands), and most recently the Hawaiian Islands. By the end of 2000, over 28,000 surveys had been conducted by REEF members throughout the world.

## Putting the Data to Use

REEF's programs contribute significantly to the task of acquiring information on one of the most important aspects of

**Threatened Species Gets Some Help-** After the number of jewfish (*Epinephelus itajara*) dropped to significantly low numbers in the 1980s, they were protected from all harvest in Florida waters in 1990.

Populations have staged a gradual comeback, but there has been an increasing lobby to remove their protected status. Without landings information, resource agencies turned to the REEF database to help decide this critical management decision. Based on distribution maps of jewfish sightings from REEF surveys that were developed by Florida's Fish and Wildlife Conservation Commission and the National Marine Fisheries Service, the Gulf of Mexico Fisheries Council determined that it would not be prudent to reopen the fishery now.

**Providing Insight Into Fish Assemblages in the Florida Keys National Marine Sanctuary-** Encompassing over 9,000 km<sup>2</sup>, the coral reefs of the Florida Keys represent the third largest barrier reef in the world. To date, over 6,000 REEF surveys have been conducted within the Sanctuary and these data have provided a foundation for several papers and reports. Chris Jeffrey, a researcher with NOAA's Biogeography Office, recently used REEF data in conjunction with benthic habitat maps to investigate relationships between fishes and habitats in a GIS. A multi-site multi-species trend analysis was also recently completed by University of Washington graduate student, Brice Semmens, adapting an analysis method originally developed for Breeding Bird Survey data. REEF data collected over 7 years from 21 sites throughout the Sanctuary were used in the analysis, which highlighted sites that represented potential management concerns based on negative population trends across a large proportion of the species.

the marine ecosystem -- fish community structure. Data collected through this project have been used in many scientific publications and symposiums, by resource managers in the Florida Keys and other marine managed areas, by the State of Florida's artificial reef program, and by NOAA's Biogeography Office among others (see sidebar for some examples).

In the coming year, REEF will also begin work on a Fish Species Distribution Atlas for the tropical western Atlantic. This atlas will use REEF data to map the distribution and estimated abundance of all fish species documented during REEF surveys. The exact location of each survey is known and can therefore be placed on a map. The spatial resolution of the database along with the wide geographic coverage and large amount of field time put in by REEF members all lend themselves to the creation of an atlas. The distribution atlas will provide basic but novel information on where fish species are found and will be used to measure rarity and distribution changes over time. The creation of the Reef Fish Distribution Atlas will be a significant contribution to the understanding and conservation of western Atlantic reef fishes. It is anticipated that similar atlases will be produced for the other Project areas as data collection continues.

### Really Learning to See

In addition to the usefulness of the data, REEF's educational contributions are equally significant. Participation in REEF's survey program enhances a diver's ability to discern details about the marine environment. For divers that have no training as naturalists, areas begin to blend together and the attitude that "it's just another coral reef" or "one more kelp forest" prevails. The excitement of finding a rare fish can only be appreciated if one knows it's rare. By learning

identification techniques and recording their fish observations, REEF surveyors become keen observers, true naturalists.

Divers and snorkelers are not required to attend any specific training program to participate in the Fish Survey Project, and many of them have become adept at fish identification through continued practice and self-education similar to many bird-watchers. However, REEF does offer several educational opportunities to get people started and to further their knowledge. REEF produces a standardized training curriculum for introductory fish identification and has modules for all of its project areas. These courses are taught through dive shops, dive clubs, educational institutions and public aquaria. Ten to twelve Field Surveys are also offered each year, and serve as a great way for divers to get started in fishwatching and for experienced REEF surveyors to hone their



*With slate board in hand, a volunteer counts fish at a coral reef.*

skills. These week-long trips are led by REEF staff and feature daily seminars and survey dives.

A broader outreach effort is achieved through the Great American Fish Count. In collaboration with NOAA's National Marine Sanctuary Program, REEF coordinates this annual event each July as a way to promote awareness about marine resources and to encourage immature naturalists. It also encourages divers to take up REEF surveying as a regular diving activity. Free fish identification seminars and survey dive opportunities are offered throughout the United States leading up to and during the event.

### A Program with Many Benefits

The scientific and management applications of REEF's volunteer-generated database are ever-expanding and will become more powerful as the amount of

data continues to increase. Regardless of the data applications, the awareness that comes from becoming a naturalist provides REEF surveyors continued benefit. REEF's co-founder, Paul Humann, describes fishwatching as "a passionate hobby within a hobby: it gives purpose to a dive, anyone can take it up and have an instant good time." And benefits extend beyond improving an individual diver's underwater experience. The sense of stewardship that arises from involvement in citizen science programs such as REEF's Fish Survey Program raises the public's awareness of and involvement in resource issues. Ultimately, REEF's efforts empower volunteers, and this often makes the process of marine resource management easier.

For a complete list of projects and papers that have used REEF data, visit [www.reef.org/data](http://www.reef.org/data).

## GUIDELINES FOR SUBMISSION

*UNDERWATER NATURALIST* is the Society's journal. We encourage members to submit articles, pictures, observations, comments, compliments or criticisms. Please follow these guidelines.

**SUBJECT MATTER:** Feature articles run 1,500-3,500 words (4-10 double-spaced, typed pages); please refer to back issues for guidance. For **Field Notes and Coast Issues**, submit no more than three pages of direct observations of interesting natural history found while walking, diving, or fishing in a coastal area. Topics can be of current interest, such as red tide in the Carolinas, whale deaths in New England, or mangrove preservation in the south; you can also submit a number of short observations or notes regarding a particular area. **Letters to the Editor** expressing thoughts on the magazine and its contents or general food for thought are especially appreciated.

**ART WORK:** For illustrations, black and white prints are preferred, but clear color slides or color prints with good contrast, drawings, maps and charts will also be considered. For Cover Photos, we need clear, sharp 35mm color slides or color

prints, either horizontal or vertical, of littoral subjects above or below the water. Horizontals can wrap around from front to back. Action is not necessary. (Note: Unless otherwise requested, we keep all accepted art work until it is published).

**HOW TO SUBMIT:** Typed, double-spaced manuscripts, please. If possible, please send a disk with your manuscript. Use common, not Latin, species names. We do not carry footnotes; incorporate sources in your article. We edit for clarity using Strunk and White's *Elements of Style* as our guide and favor clear wording over specialized terminology. Send your work with a stamped, self-addressed envelope; we will acknowledge its receipt.

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