

IMPLEMENTATION STRATEGY

We will place an array of passive autonomous hydrophones around Little Cayman Island, and subsequently track the movements of acoustically tagged Nassau grouper.

Hydrophone deployment will take place December 5th - 10th, 2004. Twenty Nassau grouper will be tagged December 10th - 15th, 2004, from a geographically diverse set of sites surrounding Little Cayman. Thirty Nassau grouper will be tagged at the west end Little Cayman aggregation site during the January - March 2005 aggregation season. We will circumnavigate Little Cayman monthly with boat-based mobile tracking equipment to validate the data collected by the acoustic array, and to survey any spatial “holes” in the passive autonomous hydrophone array. We are limiting our tagging efforts to Little Cayman because the west end Little Cayman aggregation is currently the only aggregation of appreciable size in the Cayman Islands, and because the expense and time required to include the other islands are beyond the scope of this study. However, we will search Cayman Brac and Grand Cayman every three months using mobile tracking equipment to determine if any of the grouper tagged on the Little Cayman aggregation site are from the other islands.

This project will be carried out collaboratively with the Reef Environmental Education Foundation (REEF) and the CIDOE. REEF is a non-profit organization that specializes in “citizen science” projects pertaining specifically to reef fish. Over the last two years REEF staff and scientists have led expeditions to the Little Cayman to collect information on the west end spawning in conjunction with ongoing CIDOE studies. The proposed work will extend this collaborative research while allowing for the continuation of efforts to characterize the west end aggregation spawning activity during the winter months.

Hydrophone Array Installation

We will use 15 VEMCO VR2 single channel hydrophone dataloggers to track the movement of tagged Nassau grouper. The VR2 consists of a hydrophone, receiver, ID detector, data logging memory, and battery all housed in a submersible case. The VR2 receivers have a reception radius of 500-800m, a battery life of approximately 15 months, and can store 300,000 unique tag identifications. By placing VR2 receivers at 1km increments around Little Cayman, the subsequent array will have sufficient spatial coverage to track movement over the entire Island’s coastline. Additionally, because virtually all of Little Cayman’s shelf-edge is less than 1km wide, the array will be sufficient to monitor nearly all benthic habitat suitable for Nassau grouper. We will use an ARC 8 Geographic Information System (GIS) of Little Cayman’s shoreline and shelf to determine placement of the VR2 receivers. The VR2 receivers will be suspended 5 meters from the bottom on short moorings with subsurface floatation buoys. We will drill stainless steel pins into the substrate to secure the moorings to the bottom. The VR2 receivers must be retrieved to be downloaded but can be redeployed at the same time.

The hydrophone moorings will be built and deployed December 5th - 10th, 2004 by 3 CIDOE staff and 2 REEF staff. A CIDOE boat will be used to place the moorings at predetermined locations around the island. We will take a GPS position at the point of each deployment so that we can relocate each receiver for recovery, data download and

battery replacement. REEF and CIDOE staff will recover the receivers every 3 months in order to download data; every 12 months the battery will be replaced.

Fish Tagging

We will capture and acoustically tag mature fish (>40 cm TL; Sadovy and Colin 1995) using Vemco v16-4h coded transmitter tags in collaboration with ongoing external wire tagging efforts by the CIDOE. The v16-4h tags have a battery life of 900 days with a ping interval of between 60-182 seconds. Pings are randomized within this interval range in order to minimize signal collision when multiple tags are present. We will use baited-trap capture techniques to capture fish. We will use procedures outlined in Adams et al. (1998) for surgically implanting the acoustic tags. Fish will be anesthetized with Tricaine Methanesulfonate (MS-222) prior to surgery and will be continuously given reduced anesthetic through rubber tubing inserted into their mouths during surgery. A 25mm incision will be made in the abdomen just behind and to the side of the pelvic fins in order to insert the sterilized acoustic tag. During the surgery, we will measure total length (cm), weight (gm) and take a gonadal biopsy to determine sex and reproductive status. Surgical sutures will be used to close the wound following tag insertion, and anti-bacterial paste will be applied to minimize the likelihood of infection. Following surgery, fish will be briefly held in a boat-mounted pen in order to recover from the anesthetic. All fish will be released at the site of their capture following recovery.

The tagging of Nassau grouper at sites around Little Cayman prior to the winter aggregation months will take place December 10-15th, 2004, after the hydrophone array has been put in place. If we cannot capture and tag 20 animals during this time, we will continue the off-aggregation tagging effort in June 2005 after downloading data from the VR2 receivers. Tagging on the aggregation will be somewhat opportunistic based on when Nassau grouper show up to spawn, but we will make efforts to tag January 28th-February 2nd, 2005 and February 27th-March 2nd, 2005. We will use a CIDOE boat to fish the baited traps and conduct surgeries. One CIDOE staff and one REEF staff will operate the boat and surgery station. CIDOE and REEF divers will identify sites for trap placement, and will monitor fish traps to minimize trap-based mortality.

Mobile Tracking

We will use mobile tracking gear in addition to the hydrophone array because: 1) the spatial complexity of Little Cayman's reefs is likely to yield "holes" in the acoustic array where tagged fish can reside undetected, and 2) fish tagged on west end little Cayman aggregation site may subsequently move to one of the other Cayman Islands. The reefs of Little Cayman are rugose, and on the west end shallow reefs lead to a deep-water drop-off within 1km of shore. Given Little Cayman's complex marine habitats we anticipate that the acoustic "line-of-sight" between tagged fish and autonomous hydrophone receivers will be obscured at times. If a tagged individual resides in a location that is largely obscured from the acoustic array, it is possible we will not detect the presence of the fish for long periods of time. In order to minimize bias associated with incomplete spatial coverage of the hydrophone array CIDOE staff will search Little Cayman's near-shore waters with boat-based mobile tag tracking equipment each month of the project. The data gathered using the mobile gear will also be useful in validating the data

collected by the acoustic array. Although we do not anticipate that fish tagged on the Little Cayman west end aggregation site will return to Cayman Brac or Grand Cayman, CIDOE staff will use the mobile tag tracking gear to search Cayman Brac (20km from Little Cayman) and Grand Cayman (110km from Little Cayman) every three months.

Mobile tag tracking requires a Vemco VR60 receiver wired to a VH65 omni-directional hydrophone towed behind a CIDOE boat. At a depth of 10m and a speed of 8km/hour, the VH65 hydrophone can detect tags at 1km. CIDOE staff will search each island by circumnavigating it once at a distance of 1km from shore while towing the VH65 hydrophone.