Trap-Camera Gear Protocols

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Southeast Regional Protocol for

Assessment and Monitoring Surveys for Reef Fish

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Introduction

Reef fish habitat in the Gulf of Mexico (GOMEX) includes not only coral reefs found in the Florida Keys, but banks, ridges and pinnacles found on the continental shelf, shelf edge and upper slope. The Southeast Assessment and Monitoring Program (SEAMAP) reef fish survey of shelf and shelf-edge banks in the GOMEX was initiated in 1992, with sampling conducted from late May to early August. The video survey evolved from a survey conducted with single-funnel fish traps that were baited with squid. The traps were highly selective and the catch rates of snapper and grouper were very low. In 1991, a single video camera was mounted outside a single-funnel fish trap facing toward the trap to determine what role fish behavior had in producing the low catch of fish. We discovered the traps were very selective and very inefficient, and we frequently observed the escapement of fish. The reef fish survey gear was switched to include video cameras in 1992, with the video camera aimed away from the trap. All camera sampling was conducted during daylight hours using single 8 mm video camera in an underwater housing. The video camera has been the primary gear since 1992, however, video camera gear has undergone changes as older camera models became unavailable and were replaced by newer models. In 1995, we switched to Hi8-mm video cameras and a switch to digital camcorders occurred in 2000.

Two types of gear have been used to deploy video cameras. A single-funnel fish trap (2.13 m long by 0.76 m square) with the camera mounted at a height of 25 cm above the bottom of the trap from 1992 to 1995. In 1995, a four-camera array was introduced with the four cameras mounted orthogonal to each other at a height of 25 cm above the bottom. The camera array was modified in 2001 to include a 5^{th} downward-looking digital camera, and was also enclosed in aluminum diamond-mesh to protect the cameras. Since the camera survey evolved from a trap survey, all video camera gear has been baited with squid. Sample duration has varied, and was one hour for surveys conducted in 1992-1995. We conducted a resampling experiment of 26 one hour videotapes in 1995 to determine the statistical cost of reducing time viewed. The estimated totals from 20 minute viewing, when extrapolated to one hour were not significantly different than the total number of fish on the one hour tapes. The number of taxa that were observed on a one hour tape was reduced by 23%. However, the reduced time viewed decreased the person-hours required to view the tapes. As a result of the resampling experiment, the view time was reduced to 20 minutes in 1996. The camera gear since 1996 has soaked on the bottom for 30 min to ensure 20 min of view time. Chevron fish traps were used to collect biological samples. Historically they were set at a randomly selected subset of the video stations with a sample size of approximately 12% of the total number of video stations. Since 2011 vertical line (bandit reels) were deployed instead of chevron traps mainly due to low catch associated with the traps. Vertical line gear is quicker to deploy and therefore we increased the stations sampled to 40% of the chosen video stations.

Protocol 1: Standardize Trap/Pot/Camera Gear by Survey

The SEAMAP reef fish survey has employed several camcorders in underwater housings since 1992. Sony VX2000 DCR digital camcorders mounted in Gates PD150M underwater housings were used from 2002 to 2005 and Sony PD170 camcorders during the years 2006 and 2007. In 2008 a stereo video camera system was developed and assembled at the NMFS Mississippi Laboratories Stennis Space Center Facility and has been used in all subsequent surveys. The stereo video unit consists of a digital stereo still camera head, digital video camera, CPU, and hard drive mounted in an aluminum housing. All of the camcorder housings we have used were rated to a maximum depth of 150 meters while the stereo camera housings are rated to 600 meters. Stereo cameras are mounted orthogonally at a height of 50 cm above the bottom of the pod and the array is baited with squid during deployment. The camera array is weighted with four, 9.07 kg lead weights attached to 24 hour magnesium releases. Four 12.25 cm plastic floats are attached at the top of the array. The array is negatively buoyant with only two weights. The floats and weights are designed to allow retrieval of gear if the line is cut.

The vertical line is composed of 300 m of 2 mm light blue 181 kg test monofilament mainline, with a 6.71 meter 181 kg test detachable backbone which is attached to the terminal end of the main line. Ten gangions constructed of 45.36 kg test twisted monofilament line are attached at intervals of 61 cm on the backbone. Each reel, or backbone, exclusively used 1 size of circle hook (8/0, 11/0 or 15/0). Hook size to be fished on a reel is determined randomly at the start of each fishing day and then rotated clockwise at each subsequent station. A 5-10 kg weight is placed at the terminal end of the backbone to insure stability and fishing throughout the water column. Hooks are baited with Atlantic mackerel (*Scomber scomberus*) cut to match the size of each hook (heads and tails excluded) and are fished on the bottom for 5 minutes.

A chevron (or arrow) fish trap with 1.5 in vinyl clad mesh is used to capture fish for biological samples. In its greatest dimensions, the trap is 1.76 m in length, 1.52 m in width and 0.61 m in depth. A 0.4 m by 0.29 m blow out panel is placed on one side and kept closed using 7 day magnesium releases. The magnesium releases are examined after each soak and replaced as needed. The trap is deployed at a randomly selected subset of video stations. The chevron trap gear is no longer deployed on the survey.

Sub-protocol 1a: Damaged gear

The condition of the vertical lines and associated gangions are checked after retrieval and any missing hooks and weights are replaced. If repairs are not possible a new set of hooks and/or gangions are used.

Sub-protocol 1b: Damaged gear

The condition of the fish trap is checked after retrieval and any dents or deformations are repaired. If repairs are not possible a new trap is used.

Sub-Protocol 1c: Gear Calibration

Any changes in chevron trap design, mesh size or bait will require experiments to compare trap designs or baits.

Standardize Buoy Line

Protocol 2: Standardize buoy line

We employ 12 strand braided, ½ in Spectra line, attached to the camera array with a stainless steel "D" shackle. At the surface, the Spectra line is attached to an aluminum, telescoping hi-flyer by another stainless steel shackle. The hi-flyer can extend to a height of 6.1 m, has a radar reflector mounted at the top, and uses a 47 cm (18.5 inc) spar buoy. An inflatable buoy is attached to the Spectra line 1 to 2 m before the hi-flyer. A mid water float may be attached to the line at mid depth to prevent tangles by keeping the line off the bottom.

We use poly-Dacron line for the chevron trap. Both the camera array and fish trap are retrieved from the bottom using a hydraulic trap hauler. The hi-flyer is first retrieved and the slack line pulled in by hand. The tension on the line is checked to determine if the gear is on the bottom. The amount of line used to set both gears is approximately twice the water depth. Line is stored in baskets on deck and is coded by color for length segments of 10 fm (18.3 m), 20 fm (36.6 m) and 50 fm (91.4 m).

Standardize Survey Operational Procedures

Protocol 3: Standardize Survey Operational Procedures

If both a video camera array and either a vertical line or fish trap are deployed at the same site, the video gear is always deployed first. The only time trap gear is deployed is when sea-conditions or vessel operations make it impossible to maintain geographic position over a site otherwise the vertical line gear is used. The video camera array is dropped at selected sample sites from the stern of the vessel. If the vessel is a stern trawler, it can be deployed off the stern ramp. If another vessel is used the camera array is suspended off the stern and a forged snap shackle is used to drop the gear into the water. Vertical line gear deployment is vessel dependent, and is normally positioned to avoid entanglement with each other as well as the wheel of the ship. The chevron traps are also deployed off the stern.

Sub-protocol 3a: Bait Standardization

Both the camera array and fish trap are baited with squid and replaced after each soak. Frozen squid is thawed prior to placement in the camera array or fish trap. On the camera array, 4-5 large squid (*Loligo* sp.) are placed in a 10 cm by 10 cm square wire mesh cage. In the fish trap, 6 to 10 squid are threaded on each of two lines, one line on each half of the trap. Vertical line hooks were baited with Atlantic mackerel (*Scomber scomberus*) cut to match the size of each hook (heads and tails excluded).

Sub protocol 3b: Standardize Soak Time

The camera array soaks on the bottom for 30 min. the trap soaks on the bottom for one hour. The start time of the soak is set when the hi-flyer is released. The end time of the soak is set when the line is hauled back. Vertical lines are fished on the bottom for 5 minutes.

Sub-protocol 3c: Standardize Processing of Fish

All fish captured using the vertical line or fish trap are identified, measurements of total length, fork length and standard length taken and each fish weighed. Otoliths or spines are taken for aging. Gonads or other samples are taken upon request.

Sub-protocol 3d: Standardize Video Tape Viewing Procedures

For each station, one video tape is selected for viewing. If all four tapes face reef fish habitat are in focus, the viewed tape is selected randomly. If a randomly selected tape has obstructed views (i.e. dark, turbid, out of focus, close to a feature), another tape is randomly selected from the remaining video tapes with unobstructed views. If no tapes can be read it is labeled as 'XX' in the data set. Tape viewers examine 20 min of the selected videotape, identifications are made to the lowest taxonomic level, but species counts are only performed on species for which NMFS has a federal management plan (FMP species).

Tapes are viewed from the time when the view clears from any silt plume raised by the gear when it landed. Less than 20 min may be viewed if the duration when water is not clear enough to count fish is less than 20 min or if the camera array is dragged. If a tape contains a large amount of fish it is subsampled. There are four cases for subsampling including when: 1) there are generally a large number of fish of a given species present throughout the tape so that following individual fish is difficult; 2) large number of fish occur in pulses periodically during the tape; 3) single school of fish; and 4) multiple schools of fish. Three estimators of relative abundance are available from the video data including: 1) presence and absence; and 3) a minimum count (the greatest number of a taxon that appears on screen at one time). Presence and absence and minimum

count estimators are advantageous because they avoid the potential of multiple counting of fish. Historically video reads also included time in – time out data (TITO). This data tracks the total time an individual is present over the course of a video, from the time it appears on screen to the time it leaves the screen. Data collected in this format cannot assure that any one fish has been double counted. From TITO data both the mincount and a newly developed meancount estimator of relative abundance can be developed. Since 2008 the TITO data has not been collected.

Sub protocol 3e: Success Criteria

Video data success criteria depends on visibility, camera focus, and gear movement. Video gear sets in very turbid water (water transmissivity less than 5)%) are not used. The cameras must be in focus to identify fish. The gear must not drag or bounce on the bottom. Fish trap sets are considered successful if they are not damaged during the set.

Sample Design

Protocol 4: Sample Design

The survey area is large; therefore a two-stage sampling design is used to minimize travel times between samples stations. The first stage or primary sampling units (PSUs) are blocks 10 min of latitude by 10 min of longitude (Figure 1). The ultimate sample units within each block are potential reef sites (Figure 2). The list of potential reef sites within each block was created from bathymetric charts. Ultimate sample units were approximately 0.1 nm by 0.1 nm. Stage 1 block selection utilizes a stratified random selection procedure, in which strata are weighted by the total amount of reef contained within a block. Blocks containing a large amount of reef are selected more frequently than blocks with small amounts of reef. Sample sites within blocks are then selected randomly from the gridded reef area within a block (i.e. from a list of gridded sites). Alternatively as new reef areas are mapped during evening hours a list of reef sites from that bathymetry data is catalogued. Reef sites are then randomly selected from the list of marked sites.

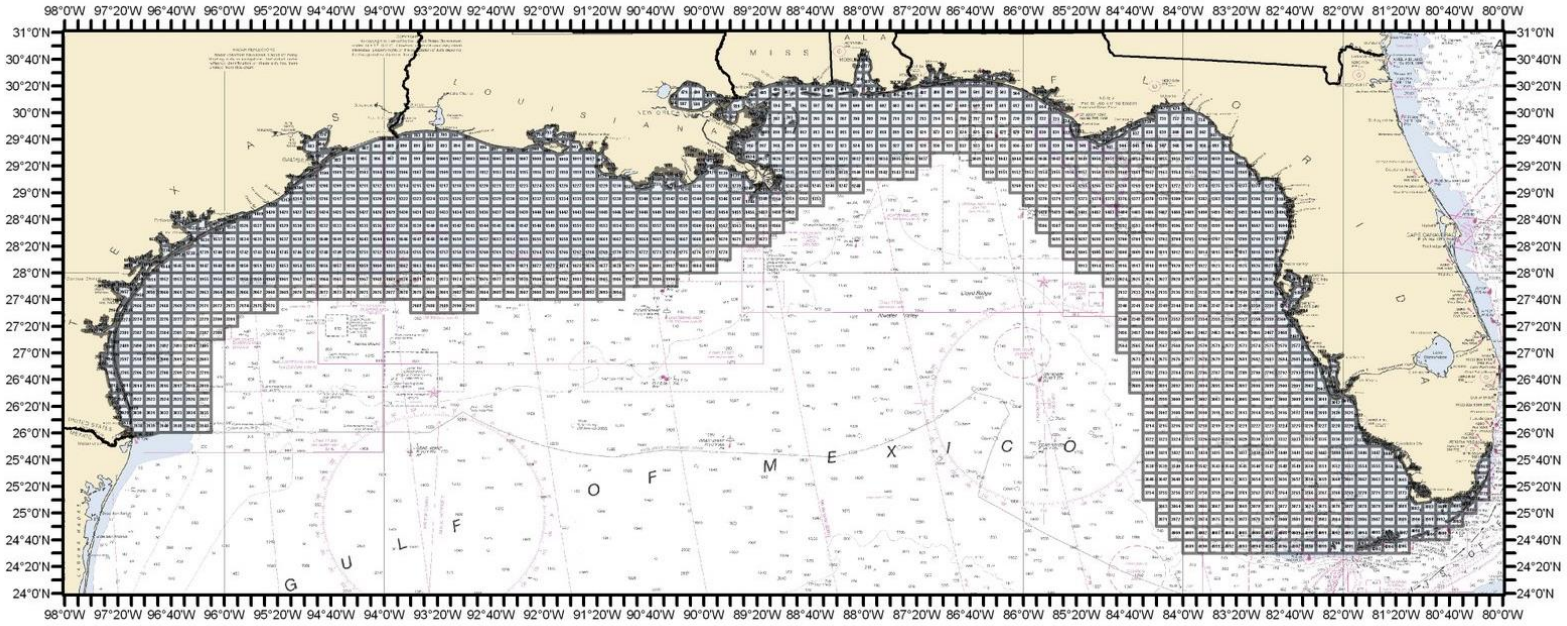

Figure 1. Map of the northern Gulf of Mexico divided into 10’ x 10’ grids from which grids containing reef were identified, and from which vertical line sampling sites were randomly selected.

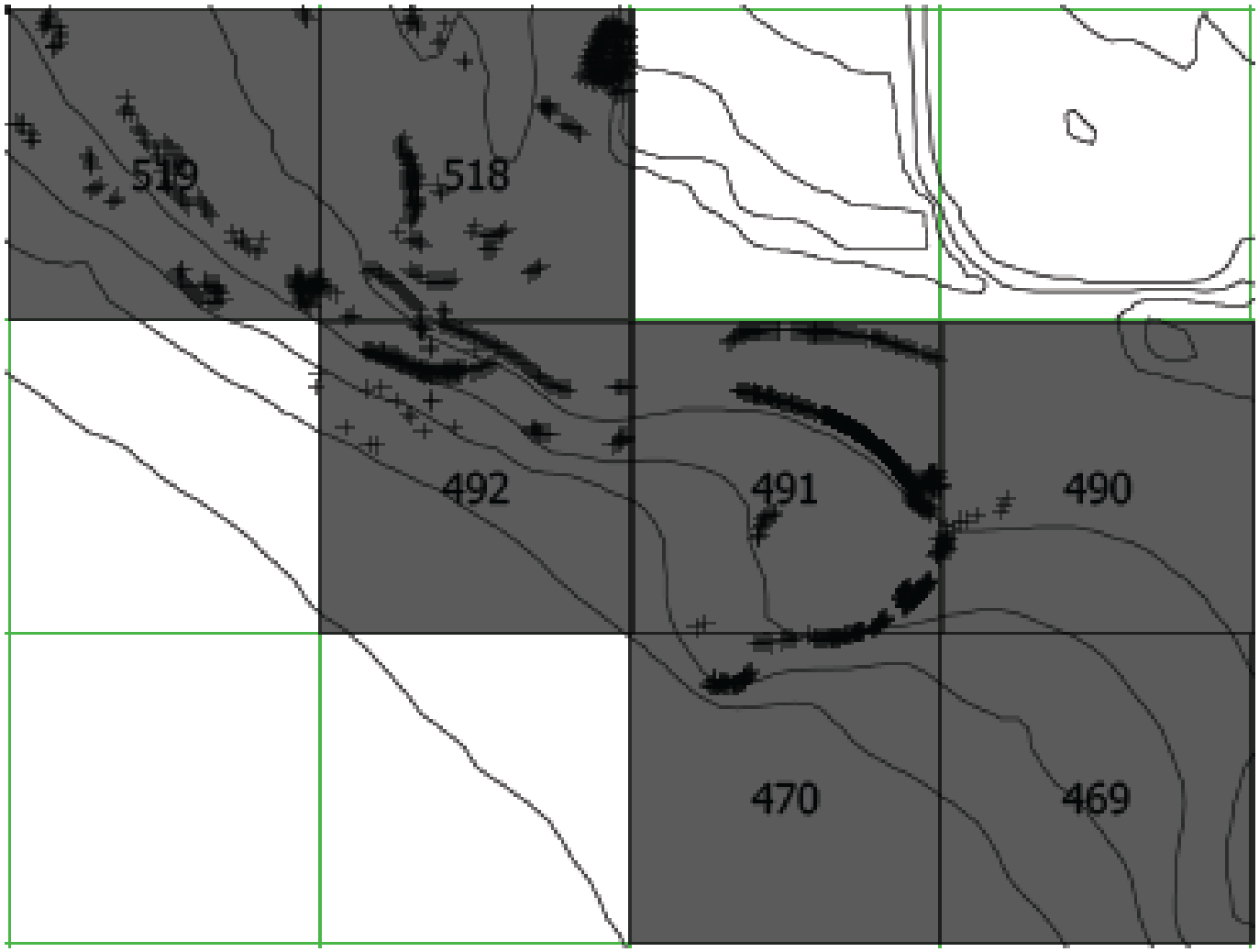

Figure 2. Map of 12 blocks located in the proximity of the Madison-Swanson marine protected area (eastern Gulf of Mexico), showing the gridded reef sites within blocks that are available for selection as primary sampling sites.