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National Marine Fisheries Service
Southeast Fisheries Science Center
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Pascagoula, MS 39567

Cruise Report

Date Submitted: 11/30/2023

Platform: R/V Southern Journey

Cruise Number: 23-04

Project Title: GFISHER Reef Fish Survey

Cruise Dates: 07/17/2023 - 09/10/2023

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Introduction

R/V *Southern Journey* (F/7701) departed the Mississippi Laboratory dock July 17, 2023 to conduct the annual Gulf Fishery Independent Survey of Habitat and Ecosystem Resources (GFISHER) sampling of artificial reefs. The goal of this survey was to sample reef fish associated with oil/gas platforms (which cannot be sampled from larger NOAA Ships) and submerged high and low relief artificial reefs. Additionally, mapping with a Side Scan Sonar system (SSS) was conducted in selected areas to iteratively improve the underlying research design (i.e. site selection). The original 30 days at sea (DAS) allocated for the survey were to conduct camera deployments on artificial and natural reefs. An additional 10 DAS were procured for *Southern Journey* to pick up the natural reef sites the NOAA Ship *Pisces* did not sample earlier in the year due to ship manning issues. Thus, in total this survey was allotted 40 DAS to conduct the originally planned work, plus the remaining work for the *Pisces*. Survey area included the US Gulf of Mexico (GOM) waters of the continental shelf and shelf edge from 10 to 180 m from the Dry Tortugas off SW Florida west to the Texas coast (Figure 1). The survey operated from the NOAA Fisheries Laboratory in Pascagoula, MS.

The GFISHER survey utilized a habitat-based survey design that was allocated proportionally based upon composition within six spatial strata and six habitat strata identified in the northern GOM, and optimized to sample managed species for which the Southeast Area Monitoring and Assessment Program (SEAMAP) Reef Fish Video survey has proven to be an effective survey on natural banks. One of the primary artificial habitats available for sampling in the western GOM is oil production platforms. Some rigs are active, others have been toppled following decommissioning, and some have been removed entirely. Bureau of Ocean Energy Management (BOEM) maintains a database of information on platform status; however, the information often lags in time. In addition, state artificial reef databases were consulted for further information on platforms, but more particularly on artificial reef planning zones.

Thirty-nine sea days were completed out of the 40 days allotted for the survey. A faulty splice in the SSS/live-feed conducting cable and multiple camera systems issues caused a one-day delay to make repairs between legs I and II. Additionally, one working day was lost to weather on the leg III. Specific areas sampled during the survey are seen in Figures 2 and 3. The first two legs operated in the western GOM sampling platforms, artificial reefs and natural reefs as well as SSS mapping. The third leg sampled natural reefs off SW Florida. R/V *Southern Journey* returned to Pascagoula on September 10, 2023.

Objectives

1) Assess relative abundance of reef fish associated with platforms and artificial reefs in the GOM with live-feed and stereo camera systems.
2) Collect hydrographic profiler data at each station with a Sea-Bird SBE 911+ (Conductivity – Temperature - Depth (CTD) profiler).
3) Mapping selected areas in the western GOM with a SSS system.
4) Assess the differences in species assemblages and abundance at platforms between bottom and various depth bins off bottom.

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Methods

The GFISHER survey design divided the GOM into 3 different depth zones: a Nearshore zone from 5 to 25 m, an Offshore zone from 25 to 50 m and a Deep zone from 50 to 180 m. The GOM was additionally divided into six geographic regions: South Florida, Big Bend, North Central, East Louisiana, West Louisiana and Texas (Figure 1). These are derived from observed faunal breaks from the 30 years of work conducted by the Reef Fish Unit. This provides a sampling universe of 18 spatial strata within which sampling was allocated through a habitat-based research design that was proportional to habitat type within each spatial zone. Results of a canonical regression tree analysis (CART) and the relative frequency of individual artificial reef features identified across the northern GOM were used. A 3 x 3 stratification scheme of artificial reef habitats that consisted of three relief classes (Low-Relief; Moderate-Relief; and High-Relief) was developed and three artificial reef size classes (Small-Scale: < 25 m^2; Medium-Scale: 25 – 100 m^2; and Large-Scale: > 100 m^2) were identified. Annual artificial reef sampling effort (N = 500 sites annually) were then allocated optimally among strata based on the proportional product of fourth root transformed habitat availability and average managed species richness, with adjustments to ensure that each strata received a minimum of two sampling sites annually. Of the 500 sites selected, 244 sites were located in the northwestern GOM and were available for sampling on this survey (169 standing platforms, 64 high relief toppled rigs and 11 low relief artificial reefs). Platforms were randomly selected from BOEM database of active platforms. Artificial reef sites were randomly selected from state artificial reef program databases. With the cancelation of the fourth leg of the NOAA Ship *Pisces* survey, there were 76 natural reef sites unsampled in the eastern GOM off SW Florida. The 2023 GFISHER survey on *Southern Journey* was to sample the western GOM, near the eastern side of the MS River and the southeastern GOM off SW FL, west of the FL Keys.

Video Sampling

Video sampling of randomly preselected standing platforms and artificial reefs required different approaches and different camera systems depending upon whether the structure was a standing platform, a high relief toppled platform (> 20 m) or low relief artificial reef (usually < 5 m). Methods were originally derived from a pilot study in 2019, and refined from the 2021 and 2022 survey effort.

Selected standing platforms were sampled with a live-feed camera system in the Wrecking Ball array using the conducting cable on the SSS winch (Figure 4). The camera system had pan capabilities (i.e. horizontal) and the array was equipped with a fin that maintains camera array position pointing into the prevailing current direction. The Wrecking Ball array was baited with squid and cut mackerel. Once on station, the captain and Field Party Chief (FPC) would determine if conditions were safe to tie off to the platform stern-to. This depended on many factors including current, winds, sea state, available tie off points on the platform and overhang of the platform structure. Once the vessel was stationary, the Wrecking Ball camera array was deployed to the surface and started to record video data. The array was then lowered as close to the bottom without contact to avoid stirring up sediment into the water column while trying to keep the platform legs in view with the camera panning mechanism. Once near the bottom, the camera was panned through the viewing range returning to a point where platform legs were in view and a timer was started. If the bottom was visible, the array was held at that depth and video collected for 20 min. If the turbidity was too high (roughly evaluated as transmissivity values < 70%) or the video too dark, the array was held at that depth and video collected for 5 min. Once the bottom time elapsed, the array was raised to above the nepheloid layer and the pan mechanism panned through the viewing range returning to a point where the platform legs were in view and video recorded for 5 min. Once these initial recordings were completed, the array was raised to randomly selected 10 m (32.8 ft) depth stops and video record for 5 min. Depending on the depth of the water and the distance from the nepheloid layer and/or turbid surface layer determined the number of depth stops to be recorded. These recordings completed sampling at the platform. At the next selected platform, the array was lowered as close to the bottom without contact to avoid stirring up sediment into the water column while trying to keep the platform legs in view with the camera panning mechanism. Once near the bottom, the camera was panned through the viewing range returning to a point where platform legs were in view and a timer was started. If the bottom was visible, the array was held at that depth and

video collected for 20 min. If the turbidity was too high (roughly evaluated as transmissivity values < 70%) or the video too dark, the array was held at that depth and video collected for 5 min. Once the bottom time elapsed, the array was raised to above the nepheloid layer and the pan mechanism panned through the viewing range returning to a point where the platform legs were in view and video recorded for 5 min. Once these two initial recordings were completed, the array was raised slowly at a constant rate (0.1 to 0.2 m/s) and video the platform until it reached the surface (i.e. vertical transect). These two platform sampling procedures were alternated throughout the survey and as conditions would allow for safe deployments.

A CTD water profiler was to be deployed at each platform sampled to collect environmental parameters. Conditions dictated whether the CTD cast was conducted prior to tying off, while tied or after untying from each platform. If *Southern Journey* was not tied off to the platform, the cast was conducted within 0.25 nm of the platform.

Toppled platforms selected for video sampling were high relief structures with the tops ranging from 20 to 80 m off the surrounding bottom. These high relief structures greatly increased the potential of snagging with the buoy line or having the array fall inside the structure and hanging up (Figure 5). Therefore, the Wrecking Ball 2.0 array (a larger version of the Wrecking Ball array) was set up with SeaGIS stereo cameras to reduce the expense of lost equipment in the event the buoy line parted during retrieval and the array was lost (i.e. SeaGIS cameras are less expensive than other systems). Additionally, the array had a mounted In-Situ *Aqua TROLL 600* data logger (aka sonde, which measured depth, temperature, salinity, dissolved oxygen & pH during soak time). The SeaGIS stereo camera system consisted of two Sony 4K video cameras housed in underwater housings set a known distance apart on an aluminum bar. The Wrecking Ball 2.0 array held two SeaGIS stereo camera system and was connected to a standard drop camera buoy system (sufficient buoy line for a 2:1 depth ratio and 2 surface floats). The Captain and FPC verified the location of the structure with the vessel's echosounder and at some sites additional time was taken to determine the best direction for array deployment. Deployment direction depended on the currents, winds, relief of the structure and the way the structure was oriented on the bottom. When ready to deploy the camera array the vessel repeated the same path as during the scouting pass to allow the echosounder view to be the same and allow for deployment of the array close enough to increase the likelihood of viewing the structure, but not deploy within the structure. Once the array was deployed, the vessel moved off and conducted a CTD cast within 0.25 nm of the camera array.

Low relief artificial reefs and natural reefs were sampled with the Spherical/Satellite (SatCam) array that is deployed during SEAMAP Reef Fish Video surveys (Figure 6). The SatCam array had a mounted In-Situ *Aqua TROLL 600* data logger (aka sonde, which measured depth, temperature, salinity, dissolved oxygen & pH during soak time), and two pressure housings rated to 500 m, (one housing containing six video cameras which provide a near spherical field-of- view (FOV), and the second housing containing the satellite camera). The satellite camera was paired with camera #3 in the main housing to be able to obtain stereo measurements of fish and habitat. The camera array was baited with squid and a cut mackerel; it soaked on the bottom for 30 min per deployment. The Captain and FPC verified the location of the artificial reef structure at a selected site with its echosounder by queuing on thickening of the bottom return, which indicates hard structure, relief of the structure and returns indicating fish in the water column. Some artificial reef sites are composed of materials scattered in the vicinity of the sampling coordinates (i.e. culverts and reef modules), others may have moved from the published position due to catastrophic weather events or been covered by substrate, and others lack detailed information on location (e.g. LDWF). As mentioned above some sites required additional time to determine the optimal deployment direction and where on the site to deploy the array. Once the array was deployed, the vessel moved away and conducted a CTD cast within 0.25 nm of the camera array. Natural reefs were sampled in the same manner as during SEAMAP Reef Fish surveys, where the SatCam array is dropped on the randomly selected site position. A CTD cast was conducted within 0.25 nm of the site.

Side Scan Sonar Mapping

Bathymetric mapping was planned to be conducted at randomly selected areas after daytime video sampling was completed with a Klein 4900 dual frequency SSS. The SSS was deployed via the stern A-Frame and winch. After powering the system up and prior to deployment a "rub test" (rubbing the transducer

of the tow fish with palms of hands) was performed to confirm system readiness. During deployment, the ship was underway at a slow speed (0-2 kt) or stopped in neutral, depending on sea conditions, and the tow fish was raised by the winch and lowered to the surface of the water. Once at surface, the cable counter was zeroed and the tow fish was slowly lowered to the operating depth by the scientific party. The altitude of the tow fish was between 10-15% of the desired range. Vessel speed was maintained around 5 kt and increased slightly during turns to prevent the SSS tow fish from sinking towards the seabed. All transect lines created for mapping were composed in SonarPro software by the mapping scientist and made available to ship's bridge. Mapping scientists were in constant communication with the bridge to maintain vessel speed and heading, and to ensure obstacle avoidance.

Results

During the 2023 GFISHER survey on R/V *Southern Journey*, 179 video stations were sampled. Natural reefs were sampled with the SatCam array at 72 sites: 25 in the western GOM (Figure 2) and 47 off SW FL (Figure 3). All camera systems described above were used to sample the variety of artificial reefs selected for sampling during the survey. This included sampling 58 standing platforms with the live-feed camera in the Wrecking Ball array; 37 high relief toppled platforms with the Wrecking Ball 2.0 array holding two SeaGIS stereo camera systems and 12 SatCam array deployments at low relief artificial sites (Table 1 and Figure 2). Low relief sampling sites consisted of nine reef modules, one large vessel, one pipeline, and one rock pile (Table 1 and Figure 2). On leg I, night mapping operations were canceled due to crew manning issues resulting in mapping being conducted randomly during day camera operations. SSS conducting cable and slip ring issues arose causing day mapping operations to be suspended for the majority of leg I. On leg II, night mapping operations were canceled because of the leg I electronics issues with the SSS. Day SSS operations were limited resulting in only 3 areas (leg I and II) being mapped (Figure 2). CTD casts were suspended on leg I due to a CTD cable splice issue resulting in only 80 CTD casts being conducted (Table 1). The Sea-Bird SBE911+ CTD profiler was deployed at 80 sites, 38 of which paired with sonde data (Table 1). There were three sites where the CTD data collected was compromised due to data spikes and scan averaging issues. The unit collected compromised data on the 1st, 2nd, and 3rd cast prior to shorting out on the 5th cast. After the 5th cast, the CTD was inoperable for the remainder of the first leg (Table 1). The CTD cable splice was successfully repaired between legs I and II and was operable the remainder of the survey. Due to the CTD electronics issues on leg I, environmental sondes were utilized on leg II and III and were deployed in the SatCam and Wrecking Ball arrays 76 times, of which 38 were unpaired with CTD data (Table 1). Video, mapping, and environmental data were stored on a computer server then returned to the Reef Fish Unit at the NOAA Fisheries Mississippi Laboratories for viewing, annotation and analysis.

Survey Participants

Leg 1: 7/17 - 7/31/2023 Pascagoula, MS to Galveston, TX (15 DAS)

Name	Title	Organization
Jack Prior	Field Party Chief	MSU/NGI
Kevin Rademacher	Fisheries Biologist	NMFS Pascagoula
Jim Johnson	Electronics Tech.	NMFS Pascagoula
David Saksa	Captain	NMFS Pascagoula
Keith Bates	Day Mate	TESA Pascagoula
Warren Brown	Night Mate	NMFS Pascagoula
Joseph Chorney	Watch Stander	Alabama DCNR
Travis Sterne	Watch Stander	Texas PWD

Leg 2: 8/4 – 8/17/2023 Galveston, TX to Pascagoula, MS (14 DAS)

Name	Title	Organization
Paul Felts	Field Party Chief	NMFS Pascagoula
Sara Thomas	Fisheries Biologist 1	TESA
Ken Wilkinson	Electronics Tech.	NMFS Pascagoula
David Saksa	Captain	NMFS Pascagoula
Keith Bates	Day Mate	TESA Pascagoula
Warren Brown	Night Mate	NMFS Pascagoula

Leg 3: 9/1 – 9/10/2023 Pascagoula, MS to Pascagoula, MS (10 DAS)

Name	Title	Organization
Paul Felts	Field Party Chief	NMFS Pascagoula
Kevin Rademacher	Fisheries Biologist	NMFS Pascagoula
Jim Johnson	Electronics Tech.	NMFS Stennis
David Saksa	Captain	NMFS Pascagoula
Keith Bates	Day Mate	TESA Pascagoula
Warren Brown	Night Mate	NMFS Pascagoula

Table 1. Stations from 2023 GFISHER survey on R/V *Southern Journey* (LF = Live Feed camera, SG = Stereo Camera, SC = SatCam, S = Environmental Sonde, CTD = Environmental Profiler).

Station	Date	Latitude	Longitude	SITE ID	HABITAT	Block	Depth(m)	GEAR
001	7/18/2023	28° 37.17	090° 14.59	ELO-024	Toppled Platform	248	43.7	SG, CTD
002	7/18/2023	28° 34.84	090° 23.55	ELO-022	Standing Platform	249	36.6	LF, CTD
003	7/18/2023	28° 34.58	090° 25.07	ELO-021	Toppled Platform	249	35.7	SG, CTD
004	7/18/2023	28° 25.48	090° 52.37	ELO-014	Standing Platform	210	41.0	LF, CTD
005	7/19/2023	30° 55.18	093° 48.21	WLD-087	Standing Platform	104	108.3	LF
006	7/20/2023	26° 39.27	096° 33.84	TXD-058	Natural Reef	20	92.0	SC
007	7/20/2023	26° 39.15	096° 33.96	TXD-057	Natural reef	20	91.3	SC
008	7/21/2023	26° 16.87	097° 03.05	TXN-010	Reef Modules	12	20.8	SC, CTD
009	7/21/2023	26° 45.93	096° 41.32	TXD-062	Natural Reef	27	85.2	SC
010	7/21/2023	26° 45.99	096° 41.62	TXD-064	Natural Reef	27	82.3	SC
011	7/21/2023	26° 46.03	096° 42.35	TXD-065	Natural Reef	27	80.3	SC
012	7/21/2023	26° 46.36	096° 43.65	TXD-066	Natural Reef	27	72.6	SC
013	7/21/2023	26° 46.92	096° 44.86	TXD-069	Natural Reef	27	69.5	SC
014	7/21/2023	26° 46.91	096° 45.82	TXD-070	Natural Reef	27	67.7	SC
015	7/21/2023	26° 50.56	096° 58.81	TXO-097	Standing Platform	34	44.3	LF
016	7/22/2023	26° 56.14	096° 45.16	TXD-074	Toppled Platform	33	76.7	SG
017	7/22/2023	27° 02.52	096° 43.09	TXD-033	Natural Reef	39	73.6	SC
018	7/22/2023	27° 02.71	096° 43.01	TXD-034	Natural Reef	39	72.8	SC
019	7/22/2023	27° 32.87	096° 28.27	TXD-046	Natural Reef	62	69.5	SC
020	7/22/2023	27° 32.37	096° 28.03	TXD-040	Natural Reef	62	59.2	SC
021	7/22/2023	27° 32.49	096° 27.90	TXD-042	Natural Reef	62	75.6	SC
022	7/23/2023	27° 38.82	097° 00.47	TXN-009	Reef Modules	66	22.6	SC
023	7/23/2023	27° 50.78	096° 31.18	TXO-055	Natural Reef	121	37.5	SC
024	7/23/2023	27° 50.99	096° 31.12	TXO-057	Natural Reef	121	37.2	SC
025	7/23/2023	27° 51.06	096° 30.49	TXO-056	Natural Reef	121	37.8	SC
026	7/23/2023	27° 51.56	096° 30.53	TXO-058	Natural Reef	121	37.0	SC
027	7/23/2023	28° 02.53	096° 34.57	TXN-007	Standing Platform	162	22.6	LF
028	7/23/2023	28° 04.41	096° 34.00	TXN-008	Standing Platform	162	21.4	LF
029	7/24/2023	27° 50.36	096° 01.71	TXD-056	Standing Platform	118	61.3	LF
030	7/24/2023	28° 09.00	095° 29.72	TXO-053	Toppled Platform	155	45.9	SG
031	7/25/2023	28° 35.67	094° 48.78	TXO-052	Large Vessel	275	33.8	SC
032	7/25/2023	28° 06.09	094° 30.72	TXD-025	Toppled Platform	150	57.2	SG
033	7/25/2023	28° 07.69	094° 12.81	TXD-026	Toppled Platform	148	35.9	SG
034	7/25/2023	28° 13.59	094° 03.51	TXD-029	Toppled Platform	188	59.2	SG
035	7/26/2023	28° 24.70	093° 53.28	WLD-120	Standing Platform	228	51.3	LF
036	7/26/2023	28° 25.69	093° 48.94	WLO-020	Toppled Platform	227	50.7	SG
037	7/27/2023	29° 20.23	092° 59.32	WLN-003	Standing Platform	555	16.8	LF
038	7/27/2023	29° 33.72	093° 07.59	WLN-015	Standing Platform	587	13.1	LF
039	7/27/2023	29° 30.81	093° 17.50	WLN-013	Standing Platform	588	13.1	LF
040	7/27/2023	29° 30.33	093° 17.71	WLN-012	Standing Platform	588	13.0	LF
041	7/27/2023	29° 30.15	093° 17.52	WLN-011	Standing Platform	588	12.9	LF
042	7/27/2023	29° 33.45	093° 28.33	WLN-014	Standing Platform	589	12.5	LF

043	7/27/2023	29° 37.97	093° 33.96	WLN-017	Standing Platform	590	10.8	LF
044	7/28/2023	29° 30.63	094° 01.15	TXN-006	Standing Platform	593	12.6	LF
045	7/28/2023	29° 18.20	093° 55.30	WLN-009	Rock Piles	532	12.2	SC
046	7/28/2023	29° 16.08	093° 46.65	WLN-008	Standing Platform	230	15.1	LF
047	7/28/2023	29° 14.44	093° 47.69	WLN-007	Standing Platform	530	15.7	LF
048	7/28/2023	29° 11.38	094° 01.71	TXN-005	Standing Platform	533	17.1	LF
049	7/28/2023	29° 11.75	094° 02.27	TXN-004	Standing Platform	532	16.8	LF
050	7/29/2023	28° 15.52	093° 22.26	WLD-119	Standing Platform	184	58.8	LF
051	7/29/2023	28° 10.20	093° 16.93	WLD-118	Toppled Platform	183	70.4	SG
052	7/29/2023	28° 06.11	093° 18.56	WLD-112	Toppled Platform	142	78.9	SG
053	7/29/2023	28° 04.64	093° 20.00	WLD-107	Toppled Platform	143	83.9	SG
054	7/29/2023	28° 03.23	093° 18.34	WLD-106	Toppled Platform	142	93.1	SG
055	7/29/2023	28° 05.79	093° 28.70	WLD-111	Toppled Platform	143	77.0	SG
056	7/29/2023	28° 08.16	093° 33.92	WLD-113	Toppled Platform	144	67.2	SG
057	7/29/2023	28° 05.63	093° 51.98	WLD-109	Toppled Platform	146	72.4	SG
058	7/29/2023	28° 05.75	093° 52.19	WLD-110	Standing Platform	146	72.5	LF
059	7/30/2023	29° 05.64	094° 23.15	TXN-002	Standing Platform	506	17.5	LF
060	7/30/2023	29° 05.97	094° 53.00	TXN-001	Reef Modules	510	15.3	SC
061	7/30/2023	29° 05.97	094° 53.42	TXN-001	Reef Modules	510	14.1	SC
062	7/30/2023	29° 05.99	094° 53.52	TXN-001	Reef Modules	510	13.1	SC
063	7/30/2023	29° 06.06	094° 53.43	TXN-001	Reef Modules	510	15.1	SC
064	7/30/2023	29° 06.07	094° 53.36	TXN-001	Reef Modules	510	15.2	SC
065	7/30/2023	29° 05.97	094° 53.36	TXN-001	Reef Modules	510	15.0	SC
066	7/30/2023	29° 05.95	094° 53.25	TXN-001	Reef Modules	510	13.6	SC
067	7/30/2023	29° 05.96	094° 53.17	TXN-001	Reef Modules	510	14.7	SC
068	8/4/2023	29° 11.07	094° 02.89	TXN-003	Standing Platform	532	17.2	LF, CTD
068	8/4/2023	29° 11.07	094° 02.89	TXN-003	Standing Platform	532	17.2	LF, CTD
069	8/5/2023	29° 29.61	092° 38.38	WLN-006	Standing Platform	553	11.8	LF, CTD
070	8/5/2023	29° 25.89	092° 31.40	WLN-005	Standing Platform	552	11.8	LF, CTD
071	8/5/2023	29° 21.35	092° 41.10	WLN-004	Standing Platform	554	15.7	LF, CTD
072	8/5/2023	28° 54.59	092° 31.29	WLO-018	Standing Platform	470	28.8	LF, CTD
073	8/6/2023	28° 39.12	092° 47.47	WLO-014	Toppled Platform	263	36.8	SG, S, CTD
074	8/6/2023	28° 25.47	092° 38.17	WLD-043	Toppled Platform	220	56.0	SG, S, CTD
075	8/6/2023	28° 25.02	092° 38.08	WLD-041	Toppled Platform	220	56.7	SG, S, CTD
076	8/6/2023	28° 24.91	092° 29.33	WLD-039	Standing Platform	219	57.1	LF, CTD
077	8/6/2023	28° 32.09	092° 19.84	WLO-004	Toppled Platform	260	46.9	SG, S, CTD
078	8/6/2023	28° 32.46	092° 19.08	WLO-005	Toppled Platform	260	47.8	SG, S, CTD
079	8/6/2023	28° 28.27	092° 10.41	WLD-046	Standing Platform	218	53.4	LF, CTD
080	8/7/2023	28° 25.89	092° 03.83	WLD-045	Standing Platform	217	57.8	LF, CTD
081	8/7/2023	28° 25.47	091° 57.57	ELD-202	Toppled Platform	216	36.7	SG, S, CTD
082	8/7/2023	28° 32.55	091° 58.72	ELO-039	Natural Reef	258	45.6	SC, S, CTD
083	8/7/2023	28° 32.53	091° 58.91	ELO-040	Natural Reef	258	45.5	SC, S, CTD
084	8/7/2023	28° 32.71	091° 59.28	ELO-041	Natural Reef	258	45.4	SC, S, CTD
085	8/7/2023	28° 33.71	091° 59.90	ELO-042	Natural Reef	258	43.9	SC, S, CTD
086	8/7/2023	28° 33.66	092° 00.17	WLO-006	Natural Reef	259	44.3	SC, S, CTD
087	8/7/2023	28° 34.67	091° 53.15	ELO-046	Standing Platform	258	42.8	LF, CTD
088	8/7/2023	28° 36.21	091° 53.23	ELO-049	Toppled Platform	258	41.2	SG, S, CTD
089	8/7/2023	28° 36.36	091° 53.73	ELO-050	Toppled Platform	258	41.4	SG, S, CTD

090	8/7/2023	28° 38.67	091° 56.00	ELO-052	Standing Platform	447	39.5	LF, CTD
091	8/8/2023	28° 40.24	092° 16.05	WLO-015	Standing Platform	449	39.4	LF, CTD
092	8/8/2023	28° 42.26	092° 18.91	WLO-016	Standing Platform	449	38.4	LF, CTD
093	8/8/2023	28° 46.58	092° 05.72	WLO-017	Standing Platform	448	32.5	LF, CTD
094	8/8/2023	28° 53.11	092° 04.18	WLO-019	Standing Platform	468	26.5	LF, CTD
095	8/8/2023	28° 57.84	091° 58.59	ELN-065	Standing Platform	467	21.1	LF, CTD
096	8/8/2023	29° 00.14	091° 52.59	ELN-067	Standing Platform	492	18.2	LF, CTD
097	8/12/2023	28° 24.92	091° 36.21	ELD-201	Toppled Platform	214	41.7	SG, S, CTD
098	8/12/2023	28° 24.76	091° 36.05	ELD-200	Toppled Platform	214	57.5	SG, S, CTD
099	8/12/2023	28° 24.69	091° 36.31	ELD-199	Toppled Platform	214	57.7	SG, S, CTD
100	8/12/2023	28° 25.65	091° 27.76	ELD-203	Toppled Platform	213	54.2	SG, S, CTD
101	8/12/2023	28° 26.70	091° 28.30	ELD-204	Toppled Platform	213	53.1	SG, S, CTD
102	8/12/2023	28° 28.65	091° 17.81	ELO-035	Standing Platform	255	45.0	LF, CTD
103	8/12/2023	28° 34.53	091° 17.33	ELO-045	Natural Reef	254	33.0	SC, S, CTD
104	8/12/2023	28° 35.09	091° 15.27	ELO-047	Standing Platform	254	31.4	LF, CTD
105	8/13/2023	28° 28.46	091° 02.26	ELO-033	Toppled Platform	211	37.5	SG, S, CTD
106	8/13/2023	28° 28.54	091° 02.22	ELO-034	Toppled Platform	211	36.9	SG, S, CTD
107	8/13/2023	28° 27.32	091° 01.72	ELO-032	Standing Platform	211	40.3	LF, CTD
108	8/13/2023	28° 28.88	090° 53.03	ELO-015	Standing Platform	210	36.2	LF, CTD
109	8/13/2023	28° 30.21	090° 51.81	ELO-016	Toppled Platform	252	33.0	SG, S, CTD
110	8/13/2023	28° 30.44	090° 51.50	ELO-017	Toppled Platform	252	32.9	SG, S, CTD
111	8/13/2023	28° 36.65	091° 02.10	ELN-054	Standing Platform	253	21.7	LF, CTD
112	8/13/2023	28° 39.38	090° 58.72	ELN-027	Standing Platform	252	17.0	LF, CTD
113	8/14/2023	28° 48.49	090° 54.35	ELN-030	Standing Platform	441	16.1	LF
114	8/14/2023	28° 48.24	090° 25.63	ELN-029	Standing Platform	438	19.7	LF, CTD
115	8/14/2023	28° 50.04	090° 29.98	ELN-036	Standing Platform	458	19.6	LF, CTD
116	8/14/2023	28° 53.35	090° 29.47	ELN-039	Standing Platform	458	18.4	LF, CTD
117	8/14/2023	28° 56.07	090° 26.04	ELN-042	Standing Platform	458	16.3	LF, CTD
118	8/14/2023	28° 56.21	090° 18.00	ELN-043	Standing Platform	457	18.0	LF, CTD
119	8/15/2023	29° 00.58	090° 08.79	ELN-052	Standing Platform	481	18.1	LF, CTD
120	8/15/2023	28° 56.92	090° 05.00	ELO-029	Standing Platform	456	25.6	LF, CTD
121	8/15/2023	28° 57.57	090° 01.13	ELO-030	Standing Platform	456	28.9	LF, CTD
122	8/15/2023	28° 58.43	089° 57.24	ELO-007	Standing Platform	455	30.5	LF, CTD
123	8/15/2023	29° 07.10	089° 41.62	ELN-012	Standing Platform	479	20.8	LF, CTD
124	8/15/2023	29° 08.50	089° 41.00	ELN-017	Standing Platform	479	17.9	LF, CTD
125	8/15/2023	29° 07.18	089° 36.11	ELN-011	Standing Platform	478	15.0	LF, CTD
126	8/16/2023	28° 57.02	089° 48.28	ELO-003	Standing Platform	454	43.9	LF, CTD
127	8/16/2023	28° 54.55	089° 48.50	ELO-001	Toppled Platform	454	43.7	SG, S, CTD
128	8/16/2023	28° 56.94	089° 37.67	ELD-018	Toppled Platform	453	38.2	SG, S, CTD
129	8/16/2023	28° 55.64	089° 37.25	ELD-016	Toppled Platform	453	59.0	SG, S, CTD
130	8/16/2023	28° 49.07	089° 47.42	ELD-014	Toppled Platform	434	62.1	SG, S, CTD
131	8/16/2023	28° 44.72	089° 47.99	ELD-013	Pipe Line	434	81.3	SC, S, CTD
132	8/16/2023	28° 44.57	089° 44.20	ELD-011	Toppled Platform	434	82.4	SG, S, CTD
133	9/3/2023	26° 04.49	084° 08.56	SFD-076	Natural Reef	199	160.8	SC, S, CTD
134	9/3/2023	26° 03.09	084° 05.37	SFD-072	Natural Reef	199	150.5	SC, S
135	9/3/2023	26° 03.02	084° 05.65	SFD-073	Natural Reef	199	152.0	SC, S
136	9/3/2023	25° 49.71	084° 13.73	SFD-067	Natural Reef	167	166.4	SC, S
137	9/3/2023	25° 50.42	084° 09.61	SFD-069	Natural Reef	183	159.9	SC, S, CTD

138	9/5/2023	24° 37.01	083° 19.50	SFD-022	Natural Reef	31	65.3	SC, S, CTD
139	9/5/2023	24° 31.23	083° 21.97	SFD-018	Natural Reef	32	105.6	SC, S
140	9/5/2023	24° 31.20	083° 17.69	SFD-017	Natural Reef	31	64.7	SC, S
141	9/5/2023	24° 28.79	083° 14.36	SFD-015	Natural Reef	31	105.9	SC, S
142	9/5/2023	24° 28.51	083° 13.45	SFD-014	Natural Reef	31	90.9	SC, S
143	9/5/2023	24° 27.80	083° 11.90	SFD-012	Natural Reef	31	108.3	SC, S
144	9/5/2023	24° 27.84	083° 11.21	SFD-013	Natural Reef	31	81.5	SC, S
145	9/5/2023	24° 27.36	083° 09.41	SFD-003	Natural Reef	30	80.3	SC, S
146	9/5/2023	24° 27.35	083° 09.88	SFD-005	Natural Reef	30	83.4	SC, S
147	9/5/2023	24° 27.65	083° 09.81	SFD-008	Natural Reef	30	79.9	SC, S
148	9/5/2023	24° 27.64	083° 10.35	SFD-009	Natural Reef	31	78.9	SC, S
149	9/5/2023	24° 27.75	083° 10.53	SFD-010	Natural Reef	31	81.5	SC, S, CTD
150	9/6/2023	24° 35.05	083° 30.80	SFD-020	Natural Reef	33	102.4	SC, S, CTD
151	9/6/2023	24° 36.73	083° 35.36	SFD-021	Natural Reef	33	123.5	SC, S
152	9/6/2023	24° 38.16	083° 39.27	SFD-024	Natural Reef	33	131.9	SC, S
153	9/6/2023	24° 47.23	083° 38.43	SFD-027	Natural Reef	49	64.6	SC, S
154	9/6/2023	24° 52.87	083° 40.66	SFD-500	Natural Reef	68	71.4	SC, S
155	9/6/2023	24° 55.22	083° 39.48	SFD-032	Natural Reef	67	66.8	SC, S
156	9/6/2023	24° 55.23	083° 38.01	SFD-031	Natural Reef	67	65.4	SC, S
157	9/6/2023	25° 00.58	083° 35.24	SFD-036	Natural Reef	86	73.0	SC, S, CTD
158	9/7/2023	25° 19.00	083° 39.22	SFD-041	Natural reef	105	77.4	SC, S, CTD
159	9/7/2023	25° 21.28	083° 41.84	SFD-044	Natural Reef	125	84.7	SC, S
160	9/7/2023	25° 21.43	083° 42.26	SFD-045	Natural Reef	125	83.6	SC, S
161	9/7/2023	25° 22.74	083° 42.52	SFD-501	Natural Reef	125	87.5	SC, S
162	9/7/2023	25° 38.80	084° 04.89	SFD-048	Natural Reef	147	144.8	SC, S
163	9/7/2023	25° 39.36	084° 04.59	SFD-049	Natural Reef	147	145.6	SC, S
164	9/7/2023	25° 42.46	084° 12.42	SFD-050	Natural Reef	167	165.7	SC, S
165	9/7/2023	25° 42.88	084° 13.83	SFD-051	Natural Reef	167	161.6	SC, S
166	9/7/2023	25° 43.21	084° 14.36	SFD-053	Natural Reef	167	161.6	SC, S
167	9/7/2023	25° 42.87	084° 15.74	SFD-052	Natural Reef	167	163.7	SC, S
168	9/7/2023	25° 43.36	084° 14.65	SFD-054	Natural Reef	167	161.7	SC, S
169	9/7/2023	25° 45.01	084° 14.11	SFD-055	Natural Reef	167	161.6	SC, S
170	9/8/2023	25° 46.24	084° 04.15	SFD-057	Natural Reef	166	145.5	SC, S, CTD
171	9/8/2023	25° 46.29	084° 04.79	SFD-058	Natural Reef	166	147.7	SC, S
172	9/8/2023	25° 47.02	084° 06.72	SFD-061	Natural Reef	166	150.0	SC, S
173	9/8/2023	25° 47.31	084° 06.70	SFD-066	Natural Reef	166	151.2	SC, S
174	9/8/2023	25° 47.07	084° 06.81	SFD-062	Natural Reef	166	151.9	SC, S
175	9/8/2023	25° 46.91	084° 07.38	SFD-060	Natural Reef	166	153.3	SC, S
176	9/8/2023	25° 47.06	084° 08.05	SFD-063	Natural Reef	166	150.2	SC, S
177	9/8/2023	25° 47.14	084° 08.28	SFD-065	Natural Reef	166	152.8	SC, S
178	9/8/2023	25° 46.77	084° 08.27	SFD-059	Natural Reef	166	153.4	SC, S
179	9/8/2023	25° 47.05	084° 08.73	SFD-064	Natural Reef	166	152.7	SC, S, CTD

Table 2. Sites sampled by geographic area during the 2023 GFISHER survey on R/V *Southern Journey*.

Structure type	East Louisiana	West Louisiana	Texas	South Florida	Total sampled
Platform	25	24	9	0	**58**
Toppled platform	19	13	5	0	**37**
Low Relief Art Reef	1	1	10	0	**12**
Natural	5	1	19	47	**72**
TOTAL	**50**	**39**	**43**	**47**	**179**

Table 3. Sites sampled by depth strata during the 2023 GFISHER survey on R/V *Southern Journey*.

Structure type	Nearshore 10 - 25 m	Offshore 25 - 50 m	Deep 50 - 150 m	Total sampled
Platform	32	18	8	**58**
Toppled platform	0	14	23	**37**
Low Relief Art Reef	10	1	1	**12**
Natural	1	10	61	**72**
TOTAL	**43**	**43**	**93**	**179**

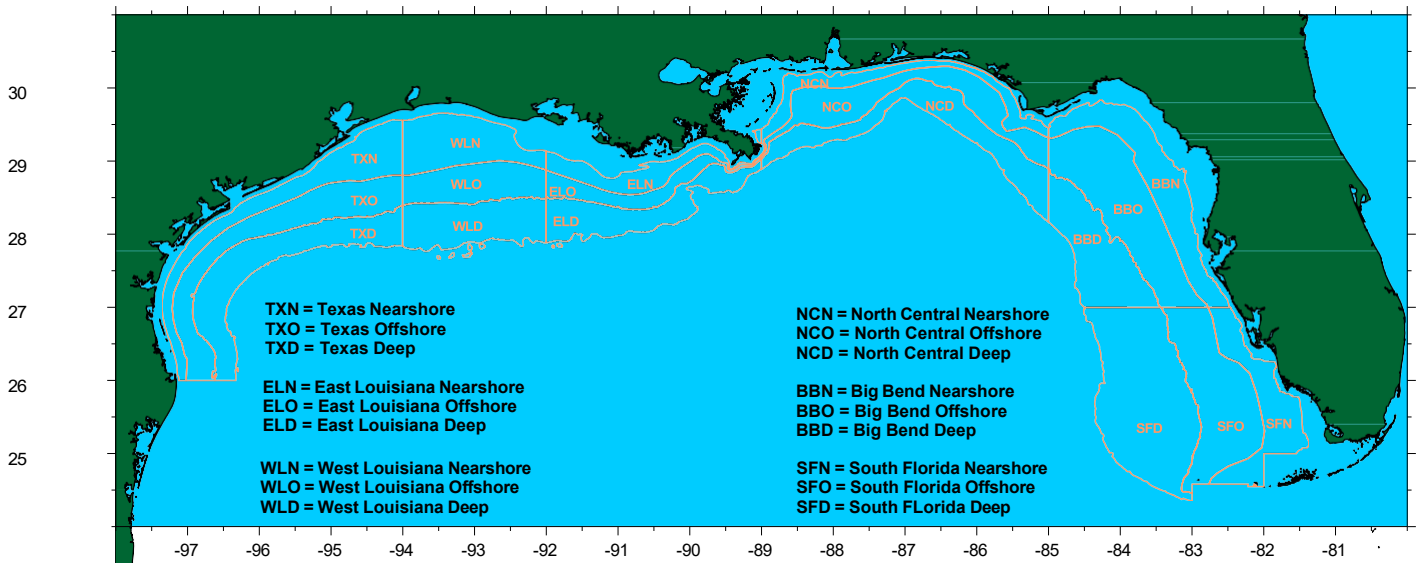

Figure 1. GFISHER sampling strata in the northern Gulf of Mexico identifying regions and depth zones.

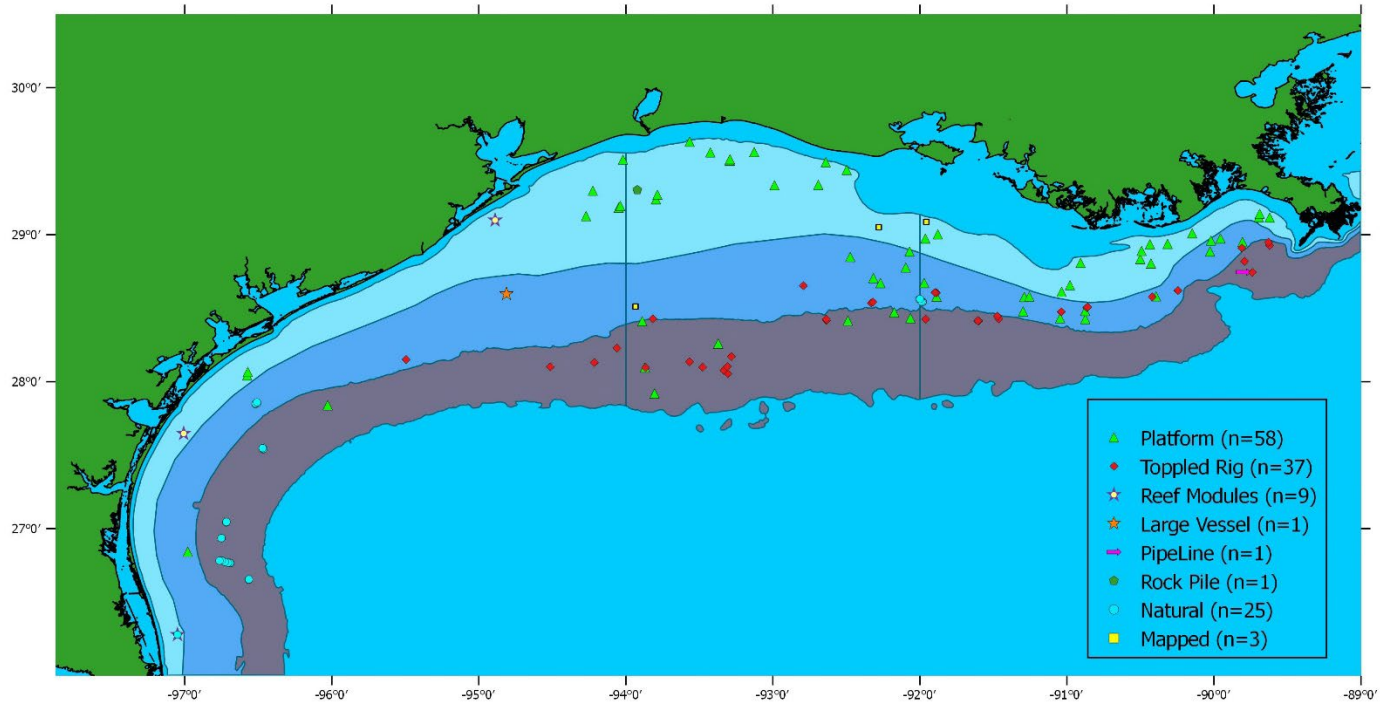

Figure 2. Sample area in the northern Gulf of Mexico during the 2023 GFISHER survey on R/V S*outhern Journey* with the types of sites sampled and areas mapped.

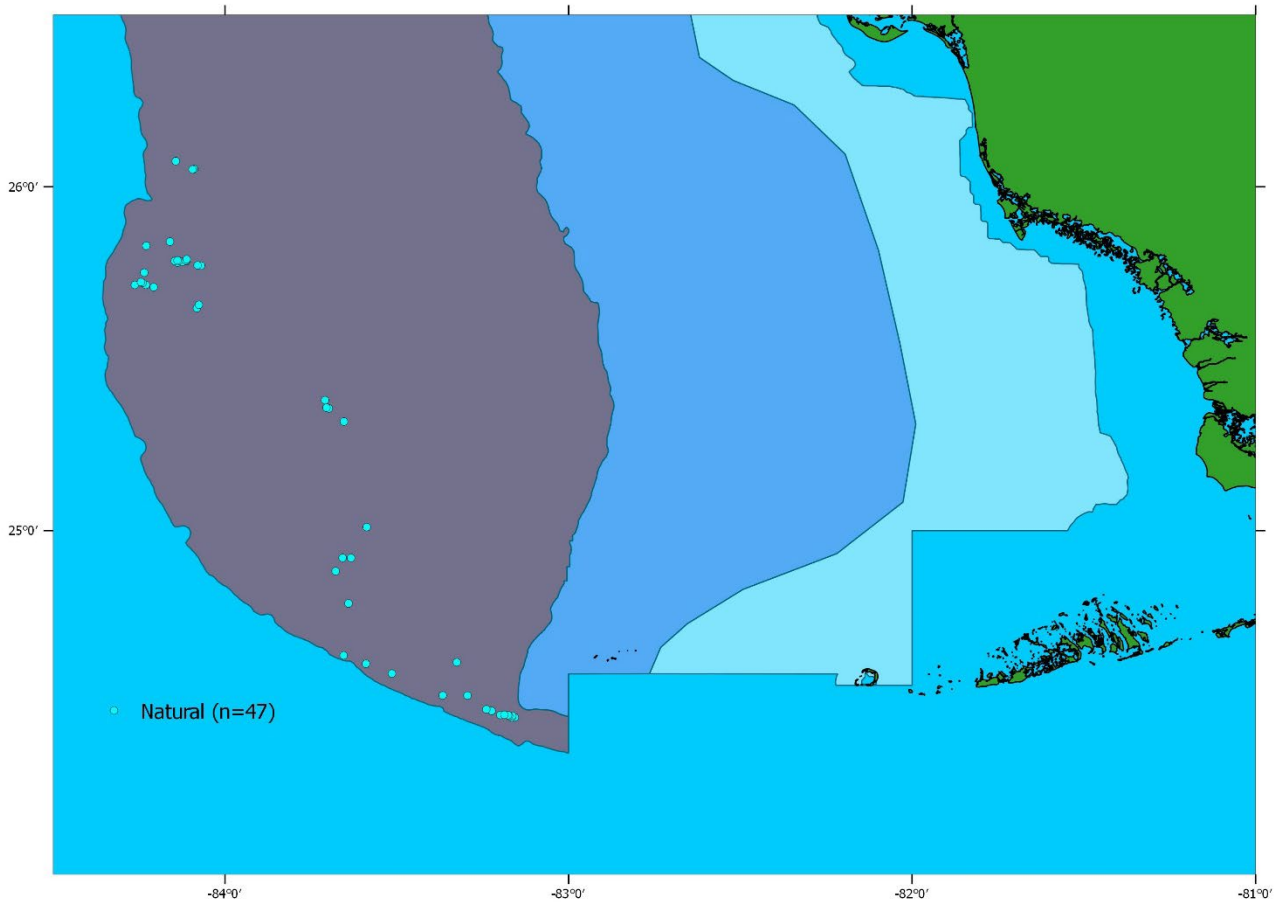

Figure 3. Natural reef sites sampled in the southeastern Gulf of Mexico during the 2023 GFISHER survey on R/V S*outhern Journey.*

Figure 4. Live Feed camera in the Wrecking Ball array with steering fin attached, used to sample standing platforms.

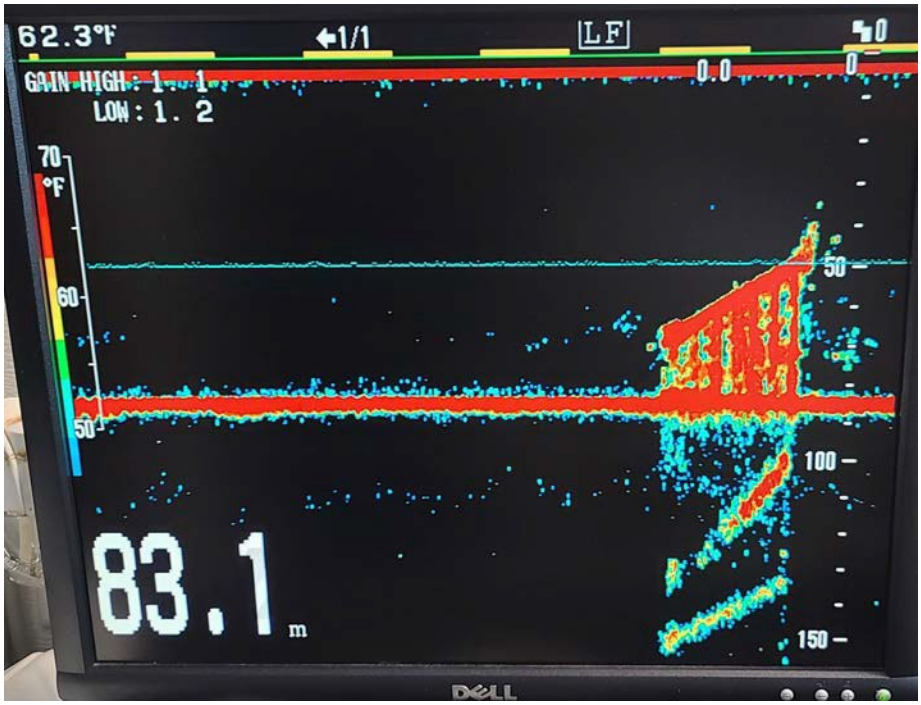

Figure 5. Echosounder image of toppled rig showing height and complexity of the artificial reef.

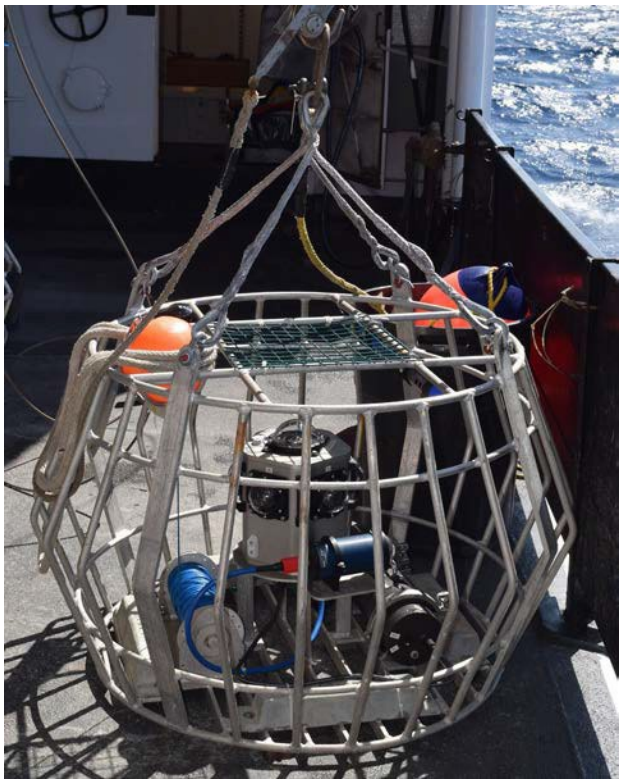

Figure 6. SatCam Array with sonde mounted, used to sample natural reefs and low relief artificial reef.

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