

DEEPEND

DEEP PELAGIC NEKTON DYNAMICS OF THE GULF OF MEXICO

Cruise Report

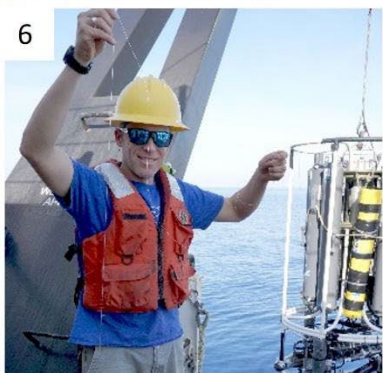
R/V Point Sur cruise DP07



Photo credit: 2021 DEEPEND/Danté Fenolio

25 April – 06 May 2021

DEEPEND DP07 Cruise Participants on the R/V *Point Sur*



Name	Institution	Role
1. Dr. Tracey Sutton	NSU	Chief Scientist
2. Dr. Tammy Frank	NSU	Taxonomist
3. Dr. Heather Judkins	USFSP	Taxonomist
4. Dr. Jon Moore	FAU	Taxonomist
5. Dr. Heather Bracken-Grissom	FIU	Geneticist
6. Dr. Kevin Boswell	FIU	Acoustician
7. Dr. Danté Fenolio	SA Zoo	Photographer
8. Dr. Isabel Romero	USFSP	Biogeochemist
9. April Cook	NSU	Project Manager
10. Ashley Marranzino	NSU	Scientist
11. Daniella Milanese	NSU	Scientist
12. Matt Woodstock	FIU	Scientist
13. Drew Mertzlufft	NSU	Scientist
14. Gray Lawson	CSA	MOCNESS Operator

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**Report of
DEEPEND Cruise DP07
25 April – 06 May 2021; USM R/V *Point Sur*, Gulfport, MS
Chief Scientist: Tracey Sutton**

This report was prepared by: Tracey Sutton, Kevin Boswell, April Cook, Danté Fenolio, Tammy Frank, Matthew Johnston, Heather Judkins, Gray Lawson, Jon Moore, Isabel Romero, and Michael Vecchione

A DEEPEND (Deep Pelagic Nekton Dynamics)
Consortium Report

Available online from the DEEPEND website,
www.deependconsortium.org



Acknowledgements

This was the seventh DEEPEND cruise in the Gulf of Mexico. The success of this cruise was due to the outstanding efforts of the Captain and Crew of the R/V *Point Sur*, LUMCON Marine Operations, the University of Southern Mississippi Department of Marine Science, Continental Shelf Associates, Okeanus Science and Technology, Sea-Gear Corporation, the San Antonio Zoo, and all members of the science party. This cruise was supported by the National Oceanic and Atmospheric Administration's RESTORE Science Program under award NA19NOS4510193 to Nova Southeastern University.

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1 Purpose of Cruise

The DEEPEND Consortium is an ocean-realm field project supported by the NOAA RESTORE Science Program. The foci of the DEEPEND Consortium are: 1) develop a quantitative, taxonomically comprehensive assessment of the deep-pelagic faunal assemblages of the northern Gulf of Mexico (GoM hereafter) in the region of the *Deepwater Horizon* oil spill (DWHOS), 2) quantify long-term trends in pelagic life in the GoM since the DWHOS; 3) assess/postulate the drivers of these trends; and 4) translate this information into products useful for GoM resource management and stakeholder purposes. The specific goals of this seventh cruise include: 1) quantitative assessment of deep-pelagic fish, macrocrustacean, cephalopod and gelatinous zooplankton assemblage structure, abundance, and distribution; 2) quantitative acoustic profiling of the fine- and mesoscale distributions of oceanic nekton; 3) collection of nekton samples for petrochemical and other laboratory analyses; 4) collection of *in situ* biophysical oceanographic data; and 5) collection of photographic and video content for scientific, outreach & education efforts. The strategy for DP07 was to sample a transect of historical stations, as well as new stations developed in conjunction with ongoing deep-benthic and marine mammal restoration activities.

As with previous DEEPEND cruises, sampling/sensing was conducted aboard the R/V *Point Sur*. Scientific participants on this cruise (see frontispiece) included: expert taxonomists in the major deep-pelagic nekton faunal groups, acousticians, geneticists, technicians, and graduate student trainees. Specimens were identified at sea using traditional taxonomic approaches. After the cruise, molecular analyses and expert taxonomic evaluation and description of any putative new records or undescribed species will be completed in association with the DEEPEND Taxonomic Working Groups.

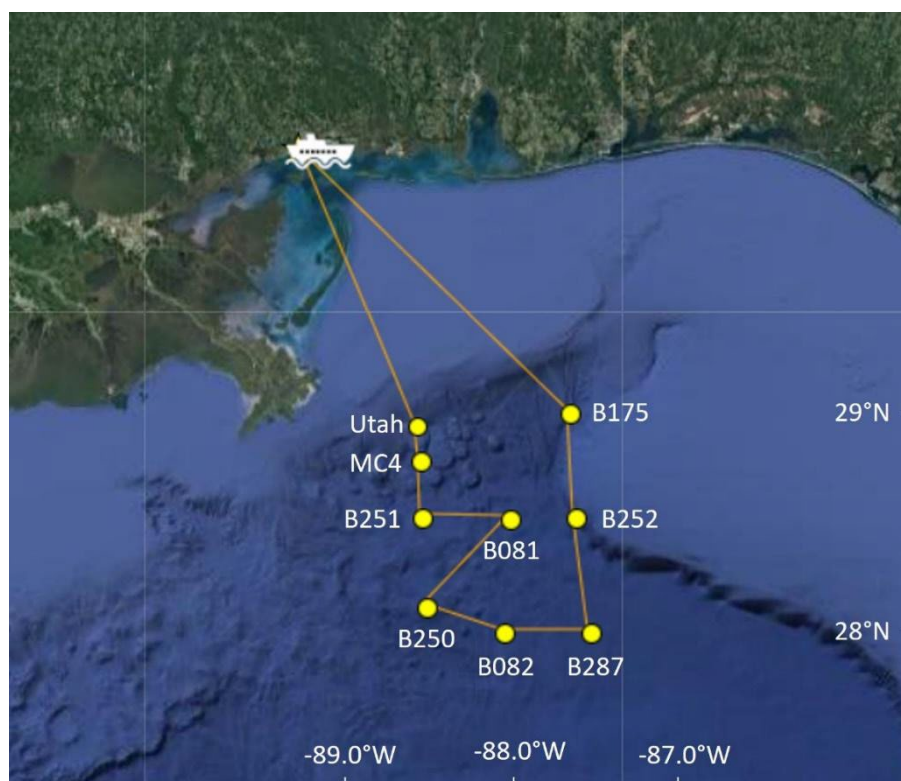


Figure 1. Track of DEEPEND cruise DP07 (25 April - 06 May 2021) relative to seafloor topography.

2 Narrative

Ship's cruise number: PS_21_13_Sutton

DEEPEND cruise number: DP07

All cruise activity times presented as 24-h clock notation in Central Daylight Time (UTC – 5 h). A map of standardized station names and station order is presented in Figure 2. The naming conventions for trawl samples remained the same as those used in DP01, DP02, DP03 DP04, DP05, and DP06:

Example: DP07-25APR21-MOC10-B175N-200-N0.

Key: Cruise No. – Date – Gear Type - SEAMAP station code + (N = night, D = day) - Trawl No. - Net No.

Trawl numbers are cumulatively increased across all sampling years and are not restarted each cruise.

25 April 2021: We left Gulfport at 0026 and arrived at Station B175N (29°00.033'N, 87°30.050'W) at 1402 and lowered the acoustic transducer. A CTD cast (CTD_199) of Station B175 at night was conducted at 1753 to a maximum depth of 510 m. The MOCNESS gear was deployed at 2115 for Trawl 200 at station B175N and fished to a maximum depth of 1510 m. The lanyard on net 0 broke which prematurely released net 1 which fished most of the downcast. Nets 0 and 1 will be considered “meat” samples.

26 April 2021: The MOC-10 gear was recovered from Station B175 at 0317. The codends were emptied and processing began. A daytime CTD cast (CTD_200) of Station B175 was conducted at 0335. The MOC-10 gear was deployed at 0924 (Trawl 201) and recovered onto deck at 1512. The lanyard broke on nets 0, 1, and 5 which will all be considered “meat” samples. The nets were fished to a maximum depth of 1500 m. We stayed at station B175 to repeat these tows due to the broken lanyards and conducted a nighttime CTD cast (CTD_201) at 1541. The MOC-10 gear was deployed (Trawl 202) at 2105 and fished to a maximum depth of 1507 m. Net 1 opened and closed at 1507 m so it did not fish. Nets 2-4 fished standardized depth bins and net 5 fished from 600 m to the surface.

27 April 2021: The MOC-10 gear (Trawl 202) was retrieved at 0326. We conducted a daytime CTD cast (CTD_202) of station B175 at 0504 to a depth of 200 m. The MOC-10 gear was deployed (Trawl 203) at 0906. Nets 1-5 were fished to a maximum depth of 1500 m. The MOC-10 was recovered at 1444. The acoustic transducer pole was pulled out of the water and the ship transited to station B252 (28°30.075'N, 87°29.944'W). The transducer was lowered at 1837. A nighttime CTD cast (CTD_203) was conducted at 1928 to a depth of 250 m with the Simrad Wide-Band Autonomous Transceiver (WBAT) system attached with multiple frequency transducers operating in sequence. The MOC-10 gear was deployed at station B252 (Trawl 204) at 2102 to a maximum depth of 1505 m.

28 April 2021: The MOC-10 gear (Trawl 204) was retrieved from station B252 at 0249. A daytime CTD cast (CTD_204) was conducted to a maximum depth of 250 m. The MOCNESS was deployed for a daytime trawl (205) at station B252 at 0919. The trawl was at the surface for a while prior to deployment which resulted in a large mass of sargassum in net 0 and net 1, however, the nets seemed to have fished well. The MOC-10 fished to a depth of 1506 m and was retrieved at 1458. The acoustic transducer was removed from the water before leaving station B252 for B287 at 1510. The ship arrived at station B287 (28°00.145'N, 87°29.891'W) at 1756 and the acoustic transducer pole was lowered into the water. A nighttime CTD cast (CTD_205) was conducted at 1803 to a maximum depth of 1500m with the WBAT attached. The MOCNESS was deployed at station B287 for a night trawl (206) at 2114 and fished to a depth of 1502 m.

29 April 2021: The MOC-10 trawl (206) was retrieved from station B287 and brought onboard at 0257. A daytime CTD cast (CTD_206) was conducted at 0507 to a maximum depth of 250 m. The MOCNESS was deployed for a daytime trawl (207) at 0927 and fished to a depth of 1500 m. The trawl was retrieved at 1458 and brought on deck. The acoustic transducer pole was brought up and the ship transited from station B287 to station B082 (27°59.958'N, 87°59.958'W). The ship arrived on station (B082) at 1941. The transducer pole was put back down into the water and a nighttime CTD was conducted (CTD_207) at 1957 on station B082 to a depth of 1500 m. The nighttime trawl (208) at station B082 was deployed at 2126 and fished to a depth of 1501 m.

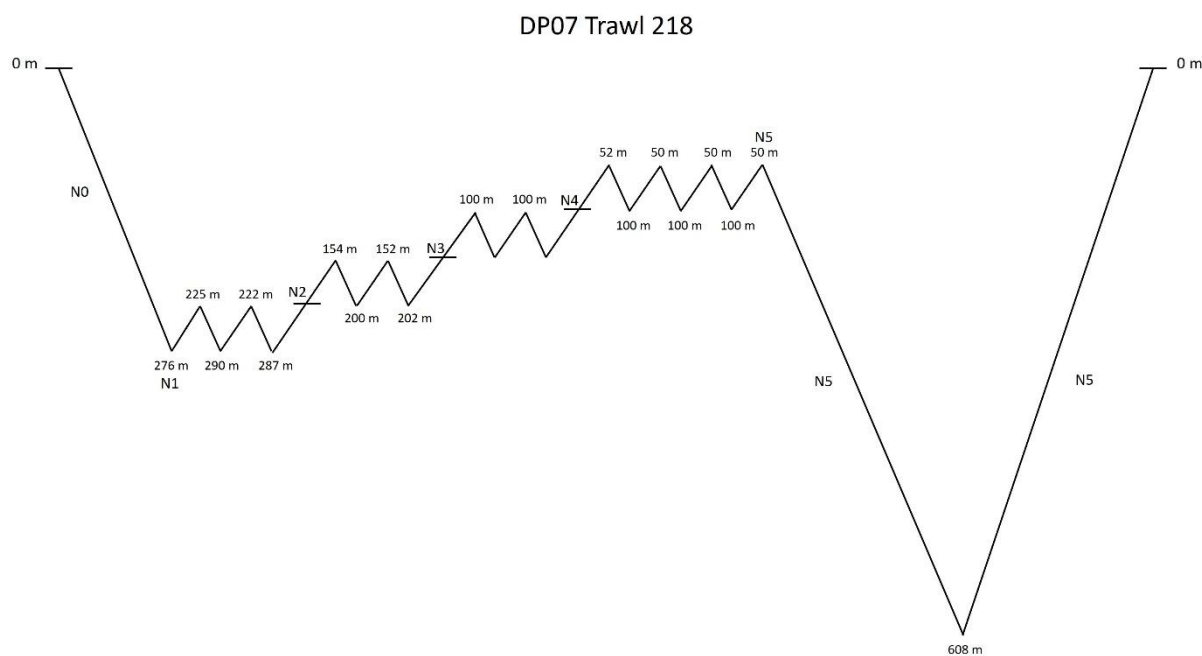
30 April 2021: The MOC-10 gear (Trawl 208) was retrieved and brought onboard at 0303 for processing. A daytime CTD was conducted (CTD_208) at 0501 to a maximum depth of 250 m. The MOCNESS was deployed at 0950 for a daytime trawl (209) to a depth of 1505 m at station B082 and then retrieved at 1523. The small boat was deployed at 1554 to film the MOCNESS retrieval and brought back on board at 1554. The transducer pole was pulled out of the water and the ship transited from station B082 to B250. The ship arrived at B250 (27°59.957'N, 88°29.888'W) at 1909 and the transducer pole was lowered back into the water. A nighttime CTD (CTD_209) was conducted at 1925 to a depth of 1500 m. The nighttime trawl (210) was deployed at station B250 at 2103.

1 May 2021: During trawl 210, the net descended faster than usual so when it came back toward the surface no one was awake to assist in the net retrieval. Gray held the net at 100 m for an extra 25 minutes. This resulted in trawl 210 net 5 not being comparable to any other trawl and was thus labeled a “meat” sample. Trawl 210 fished to a maximum depth of 1502 m and was retrieved at 0300. A daytime CTD cast (CTD_210) was conducted at 0500 to a depth of 250 m. The MOC-10 gear was deployed (Trawl 211) at 0910 and retrieved at 1445. Nets 1 – 5 were fished to a maximum depth of 1503 m. The transducer boom was pulled out of the water at 1458 and the ship began transiting to the next station. The ship arrived on station B081 (28°30.029'N, 88°00.003'W) at 1851. A nighttime CTD cast (CTD_211) was conducted at 1903 to a maximum depth of 1500 m. The WMBAT was attached and held at several different depths for periods of observation. The MOC-10 gear was deployed (Trawl 212) at 2102.

2 May 2021: The MOC-10 gear (Trawl 212) was retrieved at 0245. Nets 1-5 were fished to a maximum depth of 1505 m. A daytime CTD cast (CTD_212) was conducted to a depth of 1500 m at 0356. The MOCNESS was deployed for a daytime trawl (Trawl 213) at 0914. Nets 1-5 fished to a depth of 1505 m and the gear was retrieved at 1502. The MOCNESS software advanced net 5 to net 6 around 150 m during the retrieval, however, net 5 fished correctly. The data from net 5 and net 6 were added together to reflect the information collected while net 5 was fishing. The acoustic transducer was removed from the water and the ship began transiting at 1514 from station B081 to station B251. The ship arrived on station B251 (28°29.882'N, 88°30.419'W) at 1939 and the transducer was lowered back into the water. A nighttime CTD cast (CTD_213) was conducted at 1944 to a depth of 1500 m. The MOC-10 gear was deployed for a nighttime trawl (Trawl 214) at 2125 on station B251.

3 May 2021: The MOC-10 gear (Trawl 214) was brought on deck at 0312. Nets 1-4 were fished to a maximum depth of 1507 m. Net 5 did not open which indicates that net 4 fished from 600 m to the surface. A daytime CTD cast (CTD_214) of Station B251 was conducted at 0541 to a maximum depth of 1500 m. The MOC-10 gear was deployed (Trawl 215) at 0923 and retrieved on deck at

4 May 2021: The MOC-10 gear (Trawl 216) was retrieved at 0120. Nets 1-5 were fished to a maximum depth of 811 m. The MOCNESS software advanced net 5 to net 6 around 150 m during the retrieval, however, net 5 fished correctly. The data from net 5 and net 6 were added together to reflect the information collected while net 5 was fishing. A daytime CTD cast (CTD_218) of Station MC-4 was conducted at 0623 to a maximum depth of 800 m. A daytime MOCNESS trawl (Trawl 217) was deployed at station MC-4 at 1054 and retrieved on deck at 1414. The nets fished the same depth scheme as Trawl 216 (above). This trawl will be considered quantitative, non-standard which means these trawl samples will need to be binned together for comparison to typical quantitative, standard trawl samples. The acoustic transducer pole was raised at 1419 and the ship transited from station MC-4 to station Utah. The ship arrived at station Utah (29°01.446'N, 88°22.933'W) at 1602 and the transducer pole was lowered back into the water. An acoustic survey transect was conducted at 1710 along the projected trawling path. A nighttime CTD cast (CTD_215) was conducted at 1832 to a maximum depth of 200 m. A nighttime trawl with the MOC-10 gear was deployed (Trawl 218) at station Utah at 2216. This trawl targeted the DSL and therefore does not follow the typical depth sampling scheme (see Figure 2). Each net was fished up and down several times through a particular depth layer (tow-yo). This trawl will not be considered a comparative, quantitative trawl.



5 May 2021: The MOC-10 gear (Trawl 218) was retrieved at 0400. A large group of sharks (mainly silky sharks) were observed following the ship during this retrieval. The outside seam of net 3 was torn and the lanyard on net 4 was broken at some point while it was open. Net 5 fished some unknown amount of time within net 4's depth stratum. During the upcast of net 5, the net response tripped and advanced to net 6. The volumes for both net 5 and net 6 were added together to reflect the correct volume sampled by net 5. A daytime CTD cast (CTD_216) of station UTAH was conducted at 0428 to a maximum depth of 600 m. The daytime MOCNESS trawl (Trawl 219) was deployed at 1029 towing down the slope at station Utah. This was another tow-yo trawl (see Figure 3) that did not follow the typical depth sampling scheme and was labeled “non-standard.” The trawl was retrieved at 1523. A nighttime CTD cast (CTD_217) was conducted at 1535 to a maximum depth of 600 m at station Utah. The final MOC-10 trawl (Trawl 220) was a nighttime trawl deployed at 2107 at station Utah and followed the same depth sampling scheme as its counterpart daytime trawl (219, see Figure 3).

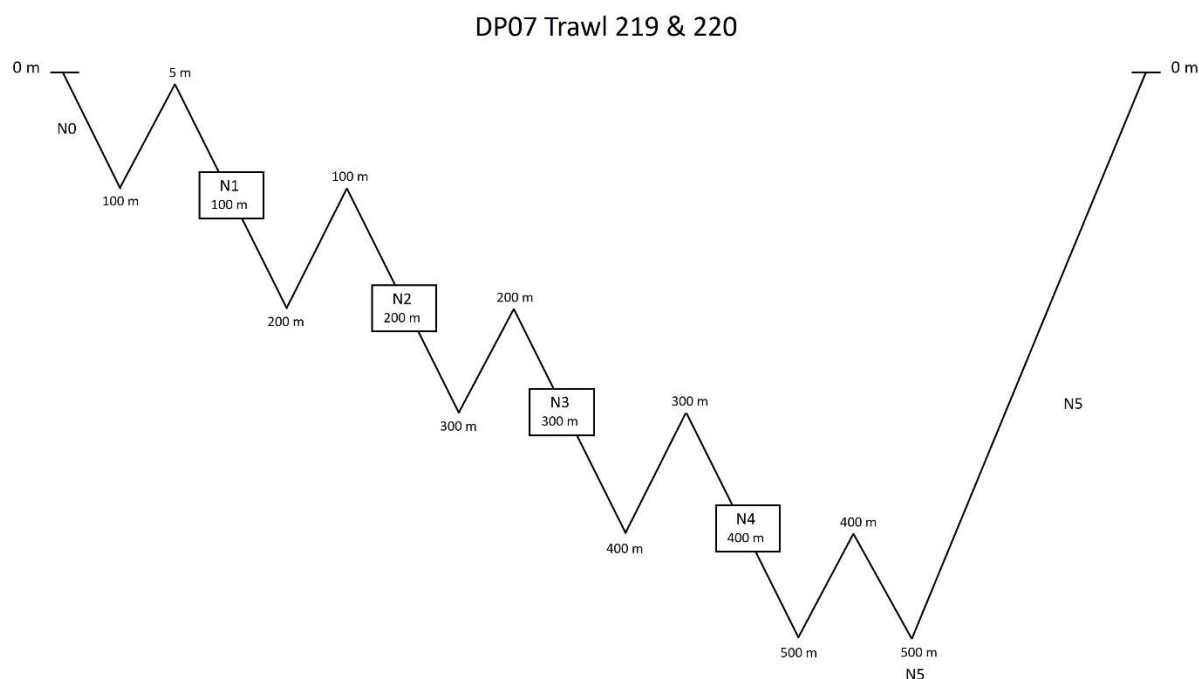


Figure 3. Sampling profile for Trawl 219 and 220 at station Utah.

06 May 2021: The MOC-10 gear (Trawl 220) was retrieved in rough seas which caused the frame to flip over. The retrieval took about 17 minutes to complete, and the net was on deck at 0235. The software rebooted during the net 5 upcast and the .TAB file was invalid. The acoustic transducer pole was pulled out of the water and the ship headed back into port arriving at 1005.

3 Operations and Protocols

3.1 Midwater Trawling

Midwater trawling was conducted using a 10-m² mouth area MOCNESS (MOC-10 hereafter) unit (Figure 4), leased from OKEANUS Science and Technology (Houma, LA), rigged with six 3-mm mesh nets manufactured for DEEPEND by Sea-Gear Corporation (Melbourne, FL). Each net was fitted with a removable PVC cod end (Figure 5), numbered consecutively to correlate with depth sampled. Sampling was conducted to 1500 m, bottom depth allowing. The first net (Net 0) was fished from the surface to 1500 m, Net 1 from 1500 to 1200 m, Net 2 from 1200 to 1000 m, Net 3 from 1000 to 600 m, Net 4 from 600 to 200 m, and Net 5 from 200 m to the surface (Figure 4) This was the same depth scheme used during the NOAA NRDA Offshore Nekton Sampling and Analysis Program.

Each station was sampled twice, with one deployment centered at solar noon (1000 h -1600 h) and one centered at midnight (2200 h – 0400 h). The ship's speed was kept minimal, between 1 and 2.5 kn. Winch deployment and retrieval speeds (non-zero) ranged from 5-25 m min⁻¹, with 15 m min⁻¹ typical. The MOCNESS operator stayed in constant radio contact with the winch operator to keep the MOCNESS frame at an optimal angle (between 35-50°).



Figure 4. 10-m² MOCNESS (MOC-10) unit being retrieved (left) and codends being retrieved (right) on the R/V *Point Sur* during DEEPEND cruise DP06. Photo: DEEPEND 2018/Danté Fenolio.

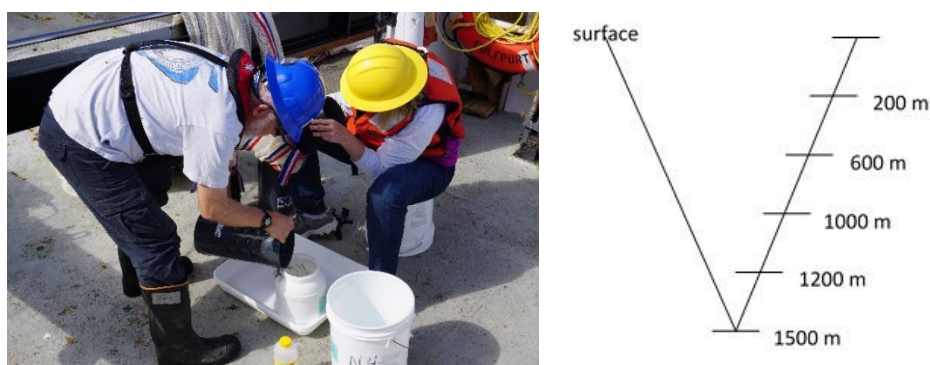


Figure 5. (Left) MOC-10 codend being collected into a cold-water bucket, and (right) depth sampling scheme.

3.2 Permitting

An E5 categorical exclusion from the National Environmental Policy Act was granted to this project on April 1, 2020. A Letter of Acknowledgement was received from NOAA Fisheries on July 8, 2020, acknowledging the proposed work and providing an exemption from the use of a turtle excluder device. The National Marine Fisheries Service Highly Migratory Species Management Division issued a Scientific Research Permit (HMS-SRP-21-07) allowing the collection of 70 unspecified tunas and 70 unspecified billfish species. All field protocols, fish handling and preservation, and removal of fish tissues were conducted in compliance with Nova Southeastern University IACUC protocol (Protocol #2020.01.TS3-A1 DEEPEND RESTORE midwater trawling) for the study of vertebrates and adhered to the USA legal requirements.

3.3 Hydroacoustics

Multi-frequency (18, 38, 70, and 120 kHz) acoustic data were collected continuously during all MOC-10 deployments, CTD casts, and while in transit between stations via a pole-mounted transducer (when possible, Figure 6). Mechanical and electrical noise associated with operating the MOC-10 reduced the effective range of each echosounder. The 18 and 38 kHz echosounders characterized the full water column backscatter (~3000 m) and the 70, and 120 kHz echosounders collected meaningful data to depths of approximately 400 m, and 150 m, respectively. The echosounders were calibrated using tungsten and copper spheres at sea following standardized procedures (e.g., Foote et al. 1987).

3.4 CTD Profiling

Twenty CTD profiles were conducted using the ship's CTD rosette (Figure 6) at nine different station locations. All but one station (MC4) was profiled two or more times, once at near-dawn and once at near-dusk. The maximum depth of deployment varied by station and solar cycle. The WBAT was attached to the CTD for some of the deployments which altered the typical speed of deployment and/or recovery. In most cases, the downcast followed a standard cast at 10m s⁻¹; however, the upcast was modified to focus at specific depth intervals so that the attached WBAT could acoustically sample the migrating layer and collect high-resolution acoustic backscatter on the individuals within the sampled volume.

3.5 Water Collection

Seawater was collected via CTD-mounted Niskin bottles (twelve 12-L bottles) from four to five depths, with multiple bottles per depth, and distributed according to the plan shown in Figure 8. Carboys were rinsed with Millipore or DI water and rinsed with the sample water from the Niskin bottle. Water from CTD rosette Niskin bottles was then drawn into the clean carboy using a sterilized tube. In the ship's lab, sterilized forceps were used to place PALL GN-6 0.45 um onto a filtration rig. Seawater was filtered at each station with a 1.1 cfm/25.5" Hg-60psi/115V vacuum pump. Triplicate filters were generated at each depth, and then stored at -20C for future processing.

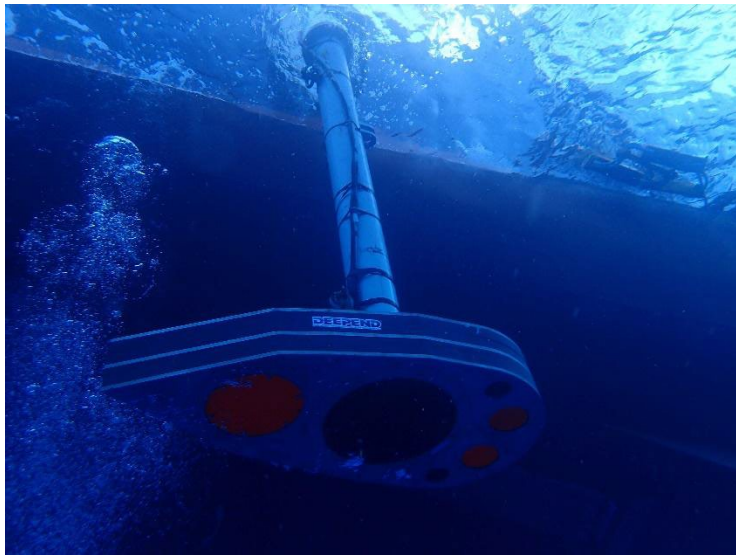


Figure 6. Hydroacoustics transducer in sensing mode (underwater) on the R/V *Point Sur*.

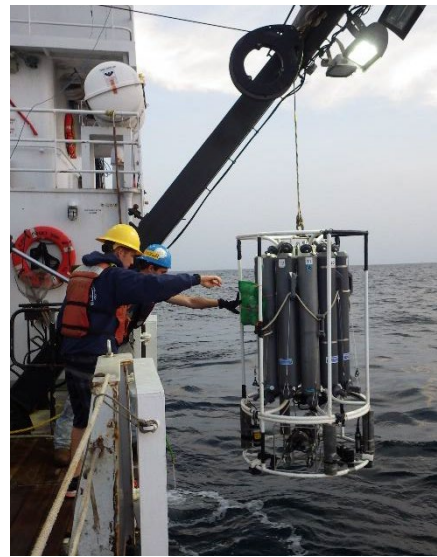


Figure 7. R/V *Point Sur* CTD rosette deployment.

3.6 Sampling on Station

Sampling and sensing operations on station were organized around daytime and nighttime MOC-10 trawling, with these centered on solar noon and midnight, respectively. Each deployment took approximately 6 h. MOC-10 sample processing occurred between MOC-10 deployments, as were CTD casts. Transit to the next station generally occurred during the morning interval after day and night MOC-10 deployments at each station. Acoustic profiling was conducted during all hours except during transits when the transducer boom was raised.

4 Sample Processing Protocol

4.1 Nekton, Micronekton, and Macroplankton Samples

Upon MOC-10 recovery, individual nets were washed down with seawater to assure all collected organisms were concentrated in the cod ends. Cod ends were disconnected from the net one at a time and the contents were poured/washed into 6-L Nalgene bottles filled with pre-chilled seawater. Each Nalgene was numbered to correspond with the net from which samples were collected.

Nalgene bottles were taken inside the ship's lab as they were washed down and stored cold in a refrigeration unit pending processing. Only one sample was processed at a time to prevent cross-sample mixing. "Net 0" (0-1500 m oblique) samples were generally processed first except in cases where live animals suitable for imaging were collected, in which case these samples were processed first. Afterwards, samples were processed in numerical order.

Processing involved the identification, enumeration, weighing (when possible) and measurement of a subset of fish, macrocrustacean, and cephalopod specimens. Once a sample was completely subsampled, then the entire remaining sample was fixed in 10% buffered formalin (v/v formalin:seawater). A running tally was kept of specimens collected for all analyses. In the individual project reports that follow, only data for those portions of samples that were taken for genetic or

biochemical analyses are included. The remaining data will be presented after the complete laboratory sample work-up.

Tissues or whole samples were taken of each taxon according to a pre-determined protocol. Sample processing for genetic analyses was as follows:

- 1) fishes were preserved whole, or the lateral muscle tissue was dissected from the specimens' right side and then stored in 99% non-denatured alcohol
- 2) macrocrustacean whole specimens were stored in 99% non-denatured alcohol, RNALater, and/or were frozen
- 3) pteropods and heteropods were stored whole in 70% ethanol
- 4) cephalopod tissue samples were stored in RNALater

Fish specimens from which tissue was taken for genetic analysis (i.e., vouchers) were individually marked with a paired tag matching that of the tissue sample and fixed in formalin.

For polycyclic aromatic hydrocarbon (PAH) analyses, whole specimens and/or tissue samples were frozen at -80°C. Prior to PAH sample collection, reusable 20-ml VOA vials were washed with water and detergent, rinsed three times with deionized water then combusted in an oven at 450°C for 4-5 hours. Aluminum foil was combusted as well in an oven at 450°C for 4-5 hours and used to cover the inside of each VOA vial plastic cap. Samples were deposited in each vial and then frozen. Prior to lipid extraction (i.e. PAHs) samples will be freeze-dried. Lipid extraction of freeze-dried samples will be conducted under high temperature (100°C) and pressure (1500 psi) with a solvent mixture 9:1 v:v cyclohexane : dichloromethane using an Accelerated Solvent Extraction system (ASE 2001, Dionex) following modified EPA methods.

4.2 Water Column Structure at the Stations

Detailed hydrographic analyses are currently ongoing, but the predominant mesoscale oceanographic feature during DEEPEND cruise DP07, as in DP01-DP06, was a large anticyclonic Loop Current eddy (LCE) located in the southwestern portion of the DEEPEND sample grid however we did not encounter the feature during this cruise. This feature was manifest in a positive sea-surface height anomaly (Figure 7; <https://www.aoml.noaa.gov/phod/dhos/altimetry.php>).

Hydrographic structure at depth via analysis of CTD sensor data for each station is presented in Figure 8 - Figure 16. The influence of the Mississippi River plume on near-surface waters (~20 m depth) was evident in the shelf edge stations. Depths of the chlorophyll maximum varied from < 10 m to > 70 m, and stations with chlorophyll maximum depths < 40 m were influenced by the Mississippi River plume.

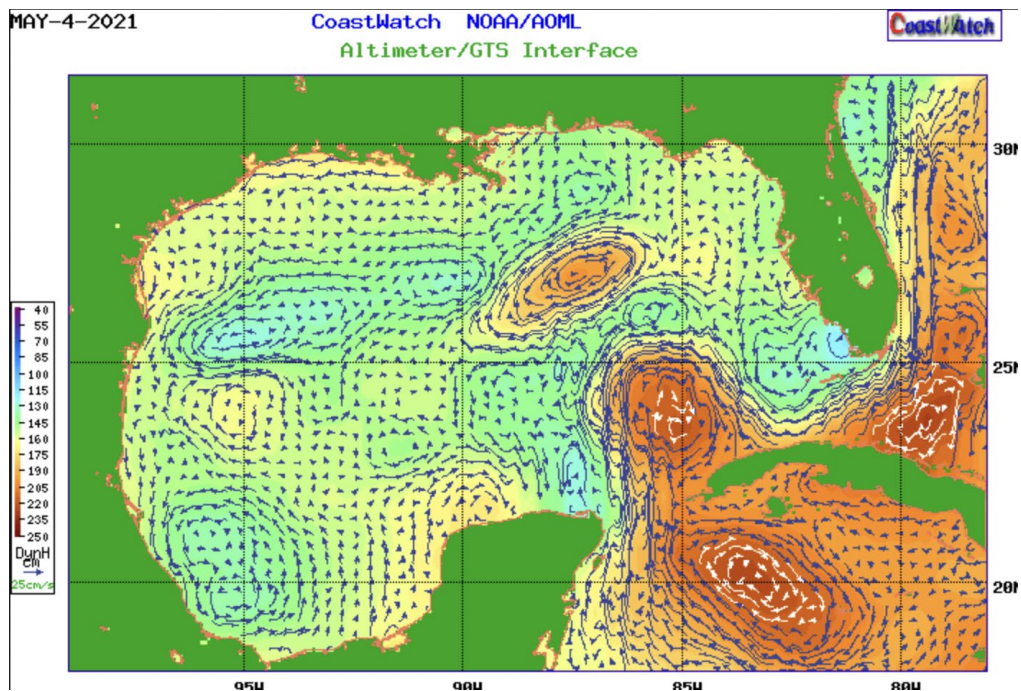


Figure 8. Geostrophic current field derived from satellite altimetry (NOAA/AOML) in the Gulf of Mexico. Colors represent the dynamic sea surface height and correspond to patterns on ocean currents. Vectors represent flow direction and magnitude.

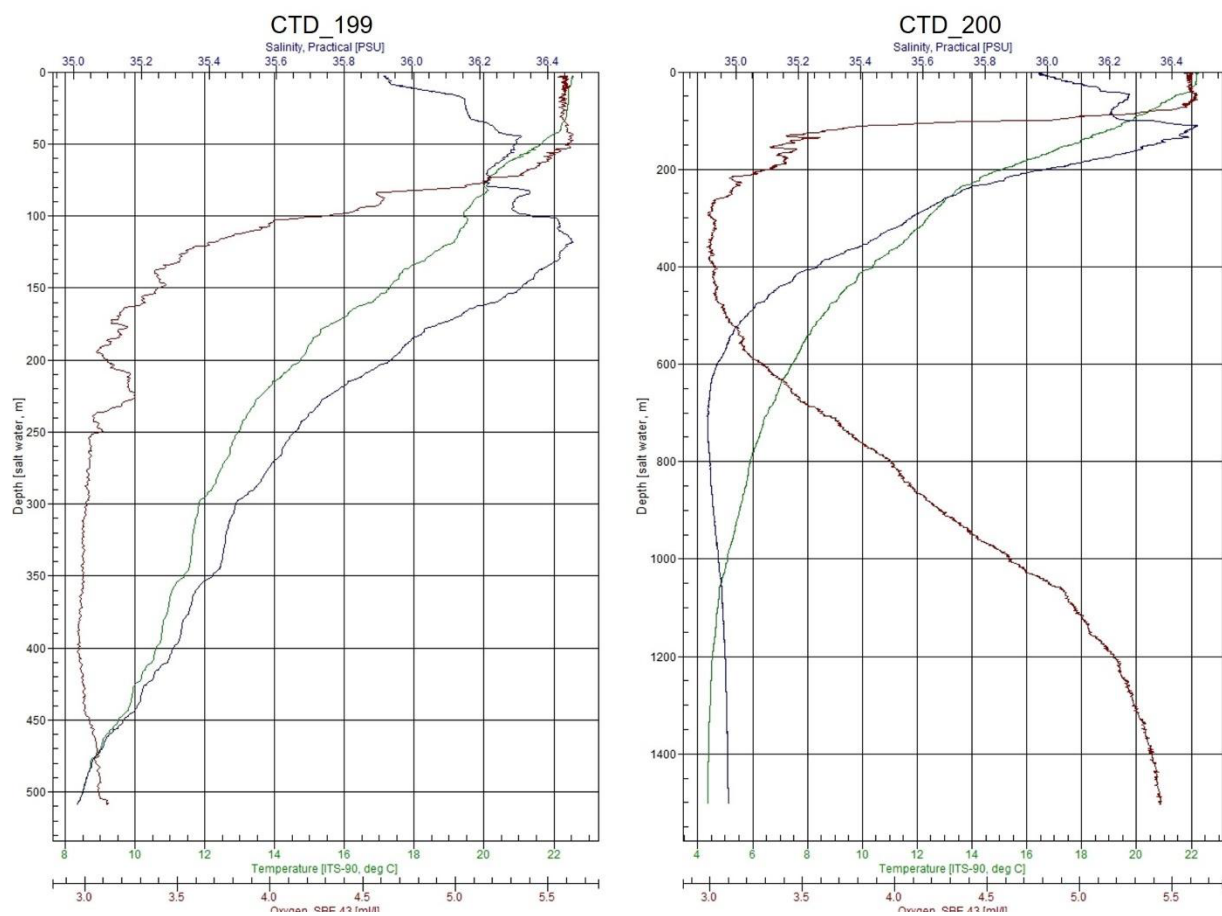


Figure 9. CTD temperature, salinity, and oxygen data from cast CTD_199 (left) and CTD_200 (right) at station B175.

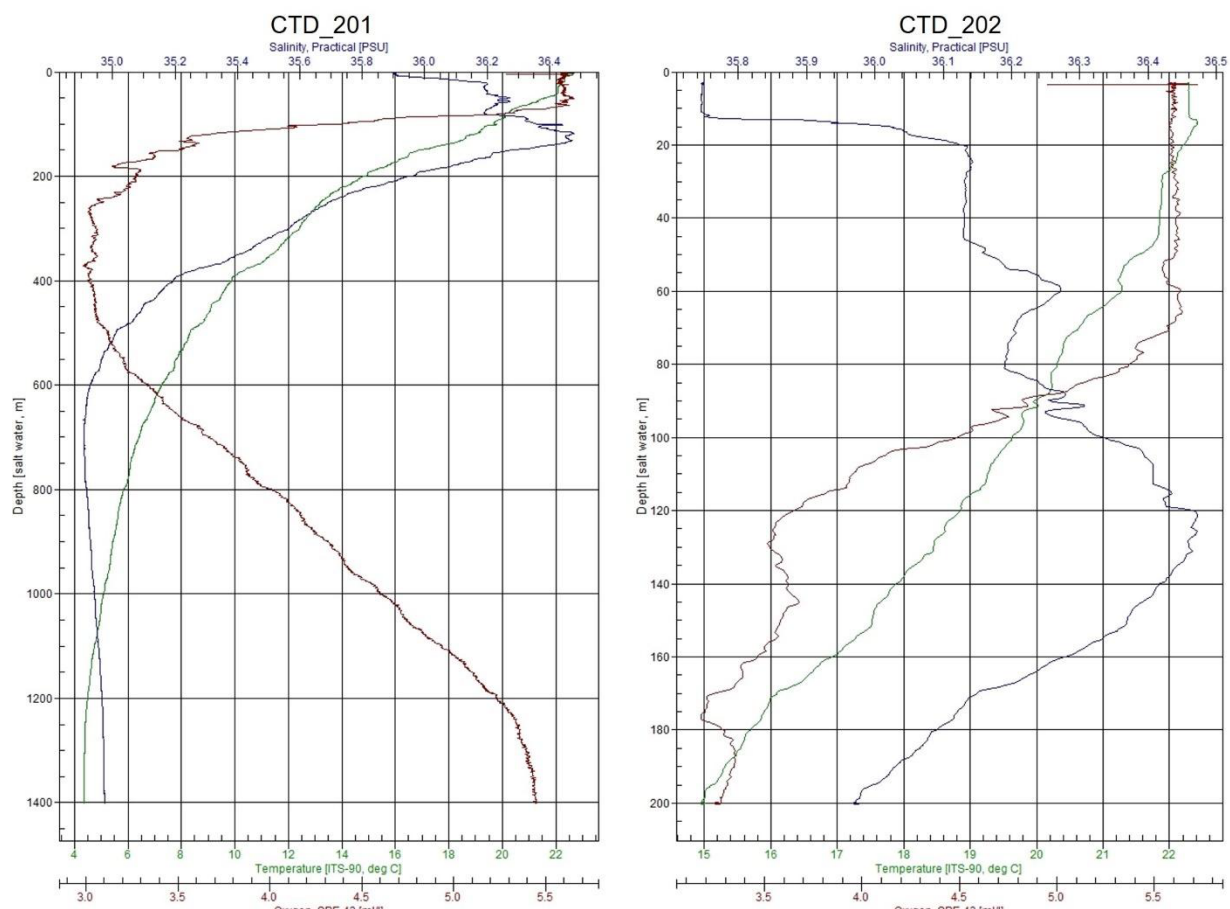


Figure 10. CTD temperature, salinity, and oxygen data from cast CTD_201 (left) and CTD_202 (right) at station B175.

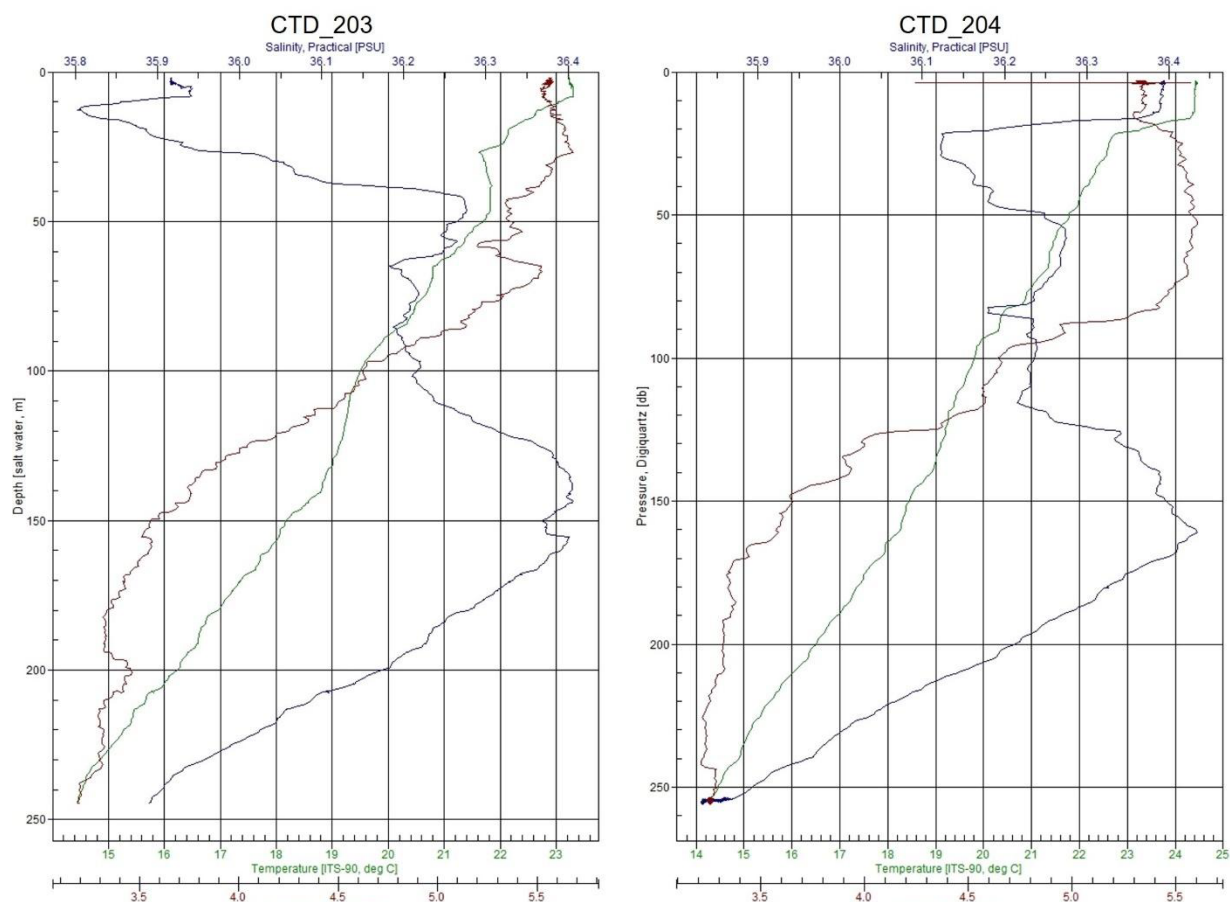


Figure 11. CTD temperature, salinity, and oxygen data from cast CTD_203 (left) and CTD_204 (right) at station B252.

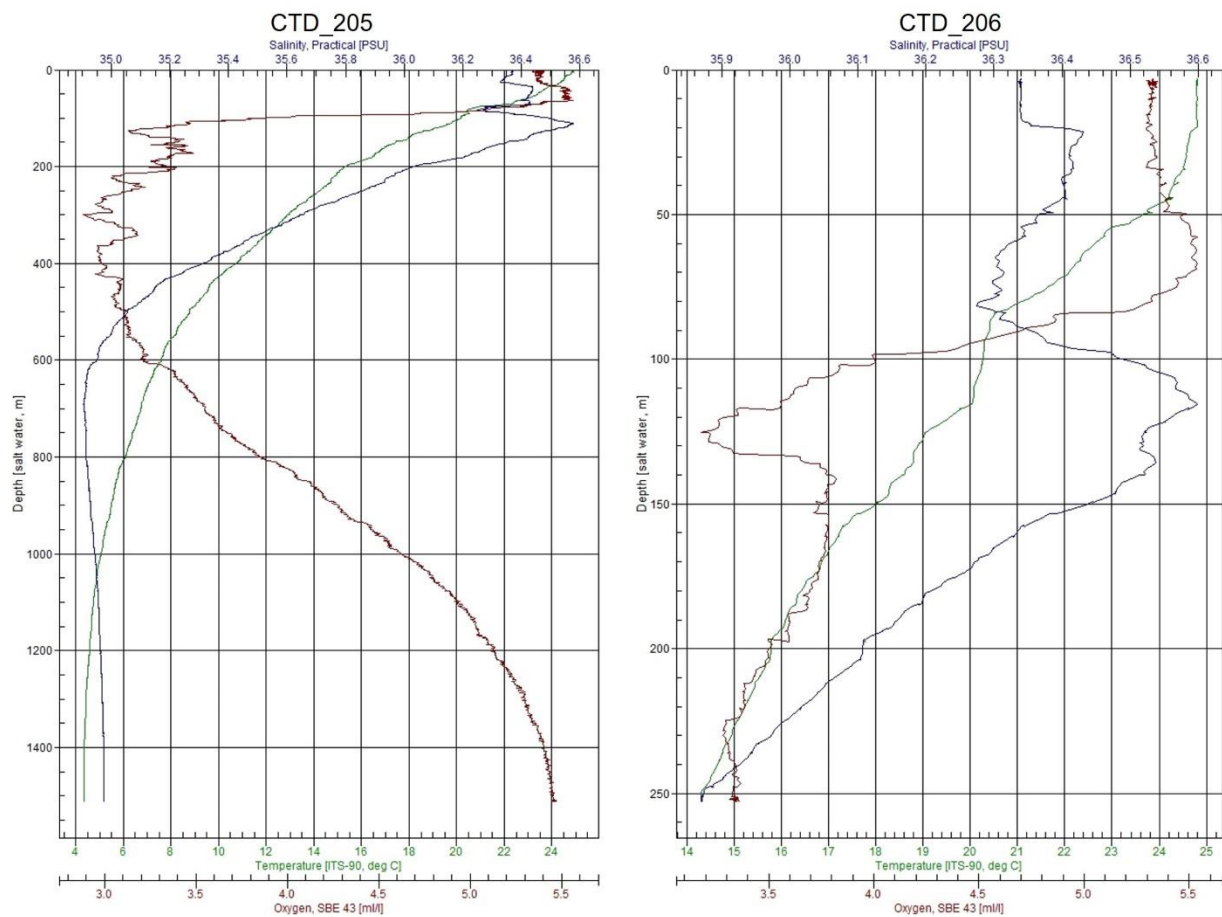


Figure 12. CTD temperature, salinity, and oxygen data from cast CTD_205 (left) and CTD_206 (right) at station B287.

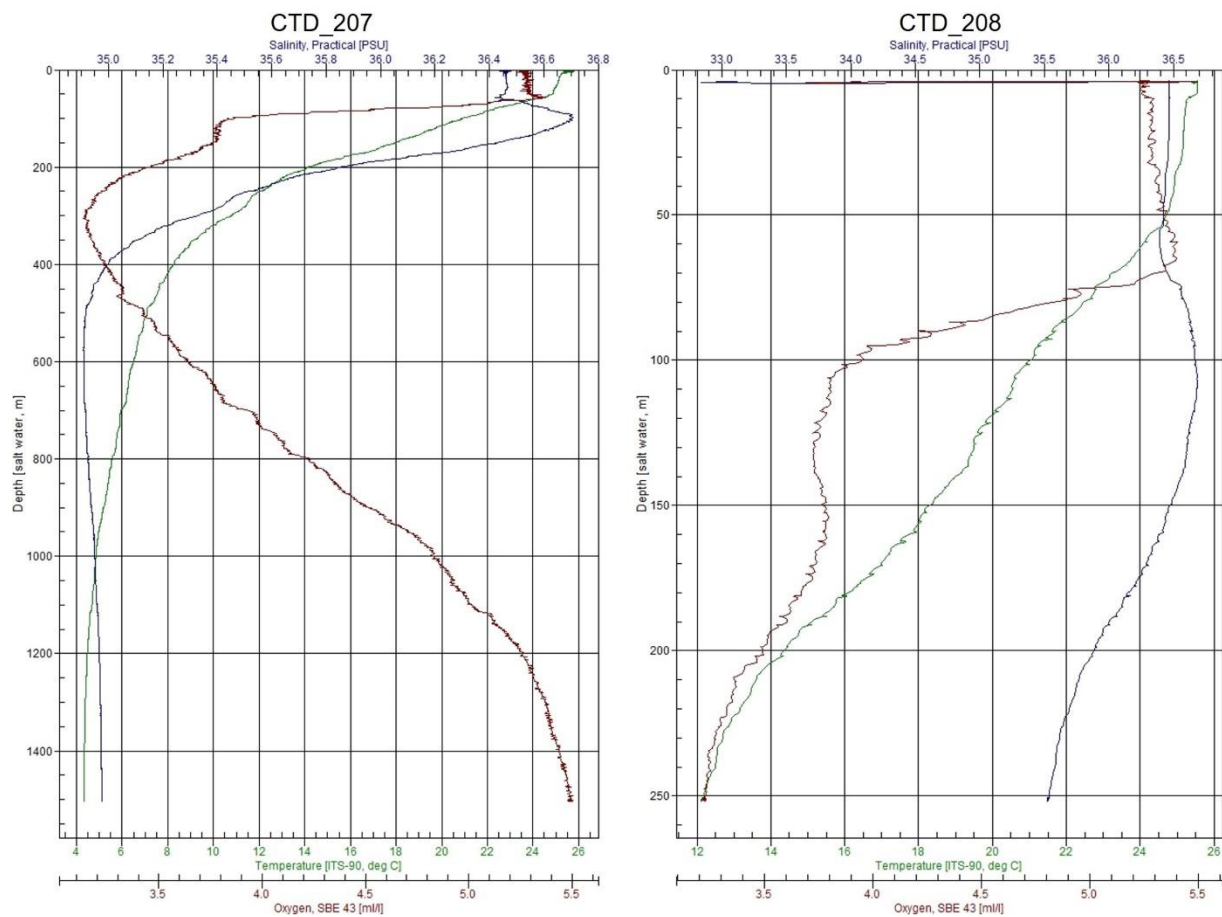


Figure 13. CTD temperature, salinity, and oxygen data from cast CTD_207 (left) and CTD_208 (right) at station B082.

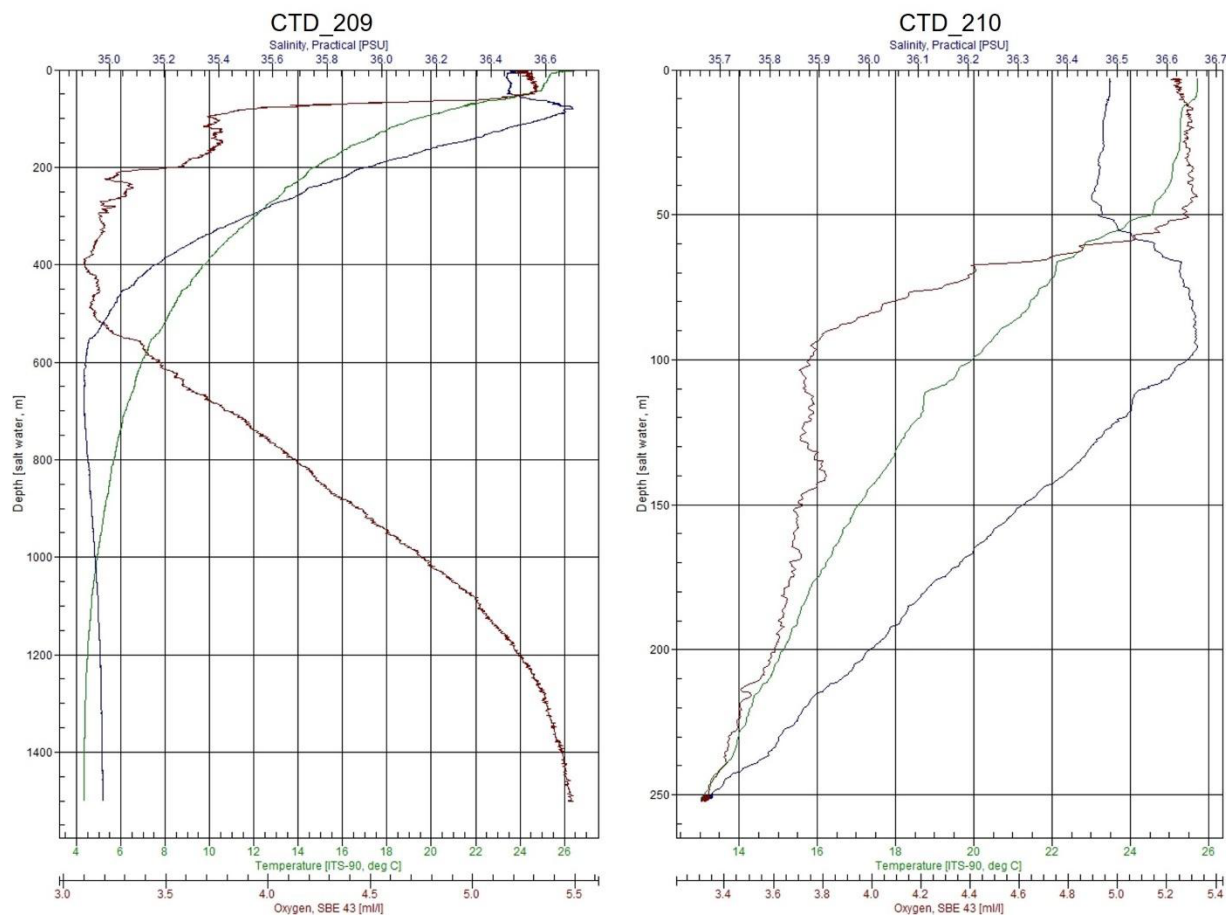


Figure 14. CTD temperature, salinity, and oxygen data from cast CTD_209 (left) and CTD_210 (right) at station B250.

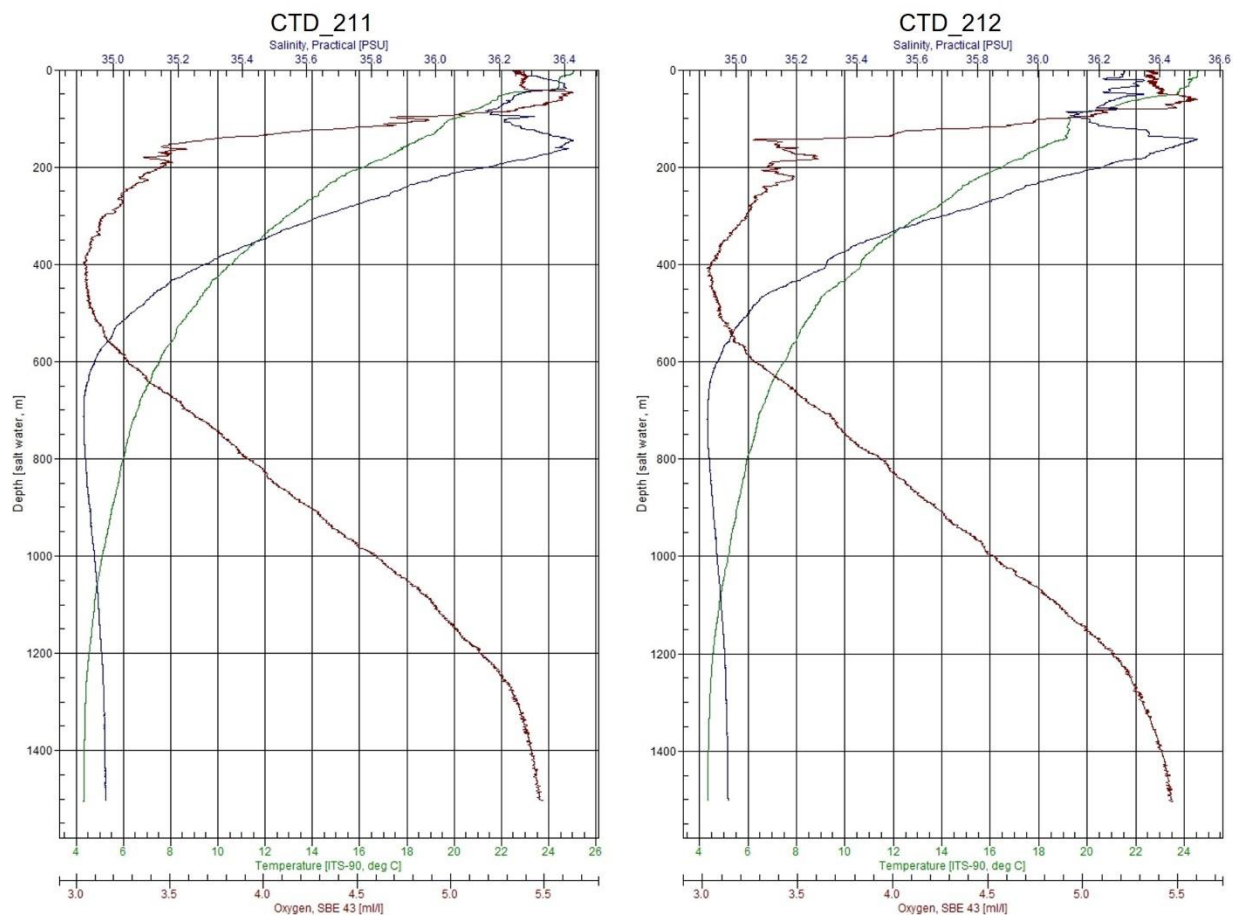


Figure 15. CTD temperature, salinity, and oxygen data from cast CTD_211 (left) and CTD_212 (right) at station B081.

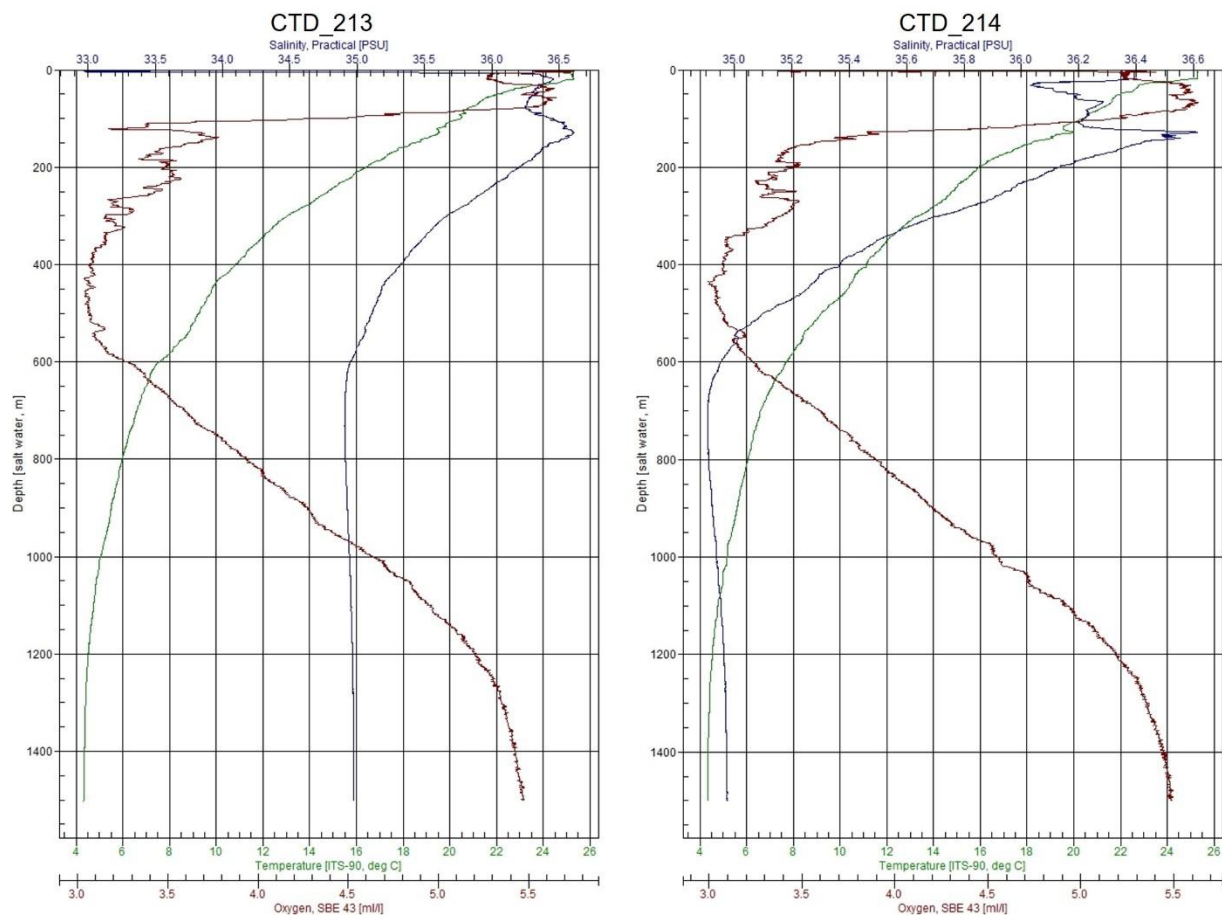
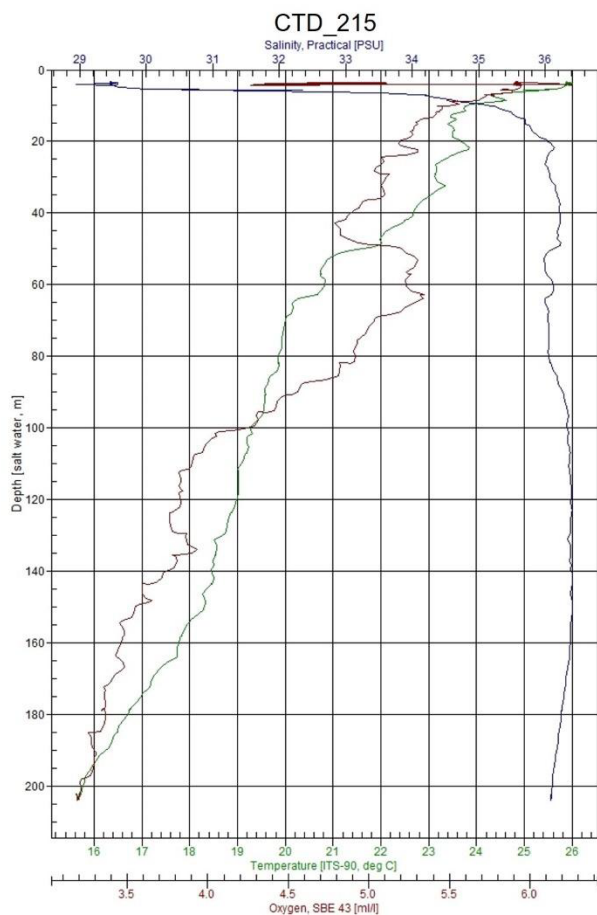
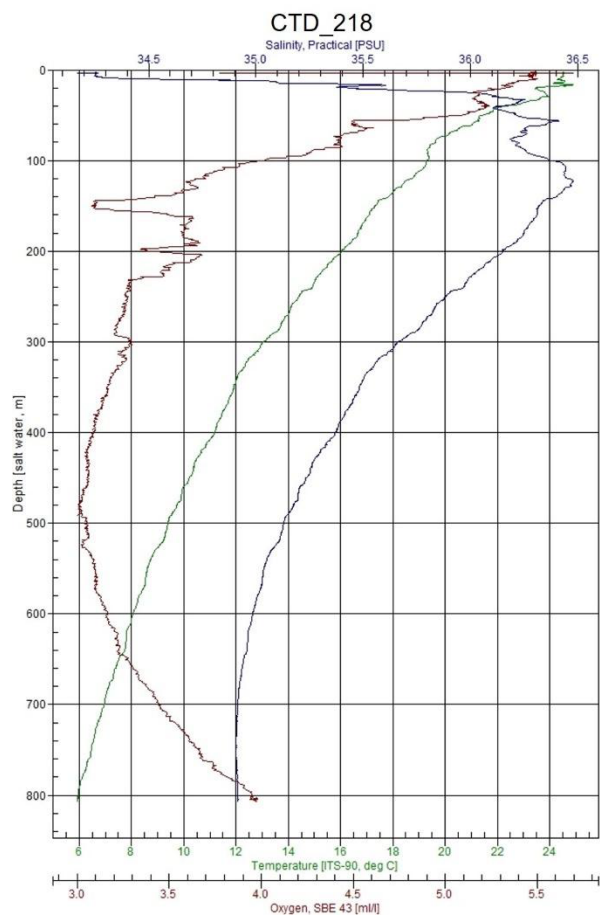


Figure 17. CTD temperature, salinity, and oxygen data from cast CTD_218 (left) at station MC4 and CTD_215 (right) at station Utah.



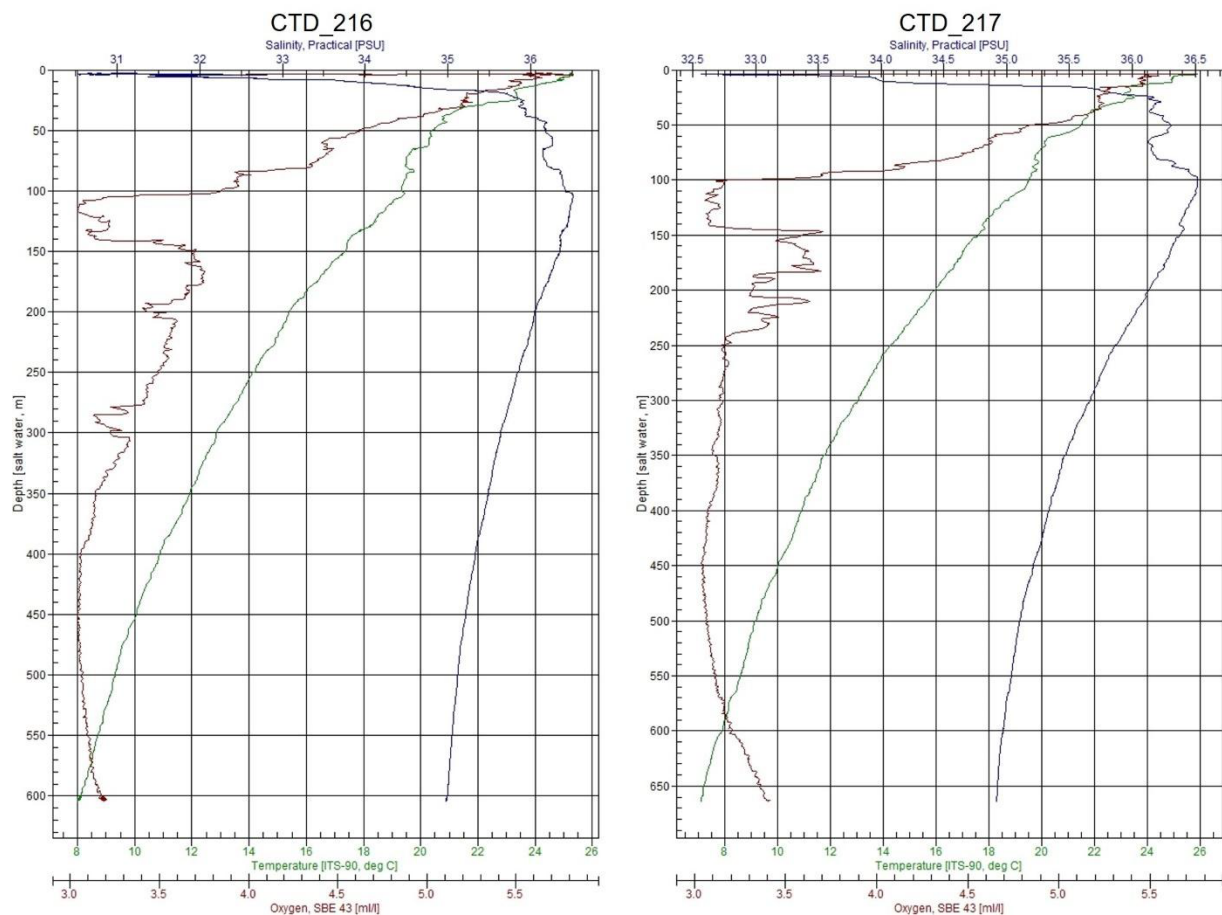


Figure 18. CTD temperature, salinity, and oxygen data from cast CTD_216 (left) and CTD_217 (right) at station Utah.

5 Individual Project Reports

5.1 MOCNESS Sampling

A total of 124 trawl samples were collected during 21 deployments (Table 1; Figure 17). Of these, 72 samples were considered 'quantitative,' having met the criteria of: 1) proper opening and closing at prescribed depths; 2) proper flowmeter (volume) readings; 3) proper net behavior (mouth angle, net speed) during deployment; and 4) no signs of mechanical failure (tears, holes). These samples combined for a cumulative total of ~2 million cubic meters of water filtered. There were 21 "Net 0" samples that fished from the surface to max depth, which we classified as "non-standard," though flow data were taken. The remaining samples fished non-standard depth strata, had flow meter validation errors, or suffered mechanical problems. Specimens for genetic and biochemical analyses (see 5.3-5.4) were taken from all trawls.

Table 1. MOC-10 trawl deployment times and locations during DP07

Trawl No.	Station ID	Start Date	Tow Start Time (CDT)	Start Lat.	Start Lon.	Tow End Time (CDT)	End Lat.	End Lon.
200	B175	25-Apr-21	21:11	28.90	-87.47	03:11	29.05	-87.52
201	B175	26-Apr-21	09:25	28.91	-87.53	15:12	29.04	-87.47
202	B175	26-Apr-21	21:04	28.94	-87.61	03:09	29.02	-87.45
203	B175	27-Apr-21	09:06	28.90	-87.51	14:39	29.04	-87.50
204	B252	27-Apr-21	21:01	28.52	-87.50	02:44	28.38	-87.57
205	B252	28-Apr-21	09:19	29.49	-87.50	14:53	28.34	-87.59
206	B287	28-Apr-21	21:13	28.04	-87.50	02:50	27.91	-87.41
207	B287	29-Apr-21	09:23	28.02	-87.43	14:58	27.89	-87.37
208	B082	29-Apr-21	21:24	28.02	-88.01	02:57	27.91	-87.90
209	B082	30-Apr-21	09:48	28.02	-88.03	15:20	27.90	-87.96
210	B250	30-Apr-21	21:02	27.99	-88.52	02:56	28.04	-88.37
211	B250	1-May-21	09:09	28.00	-88.52	14:45	28.04	-88.37
212	B081	1-May-21	21:02	28.50	-88.03	02:41	28.49	-87.87
213	B081	2-May-21	09:14	28.50	-88.01	14:58	28.50	-87.85
214	B251	2-May-21	21:24	28.50	-88.54	02:42	28.52	-88.38
215	B251	3-May-21	09:22	28.54	-88.48	14:58	28.74	-88.39
216	MC4	3-May-21	22:04	28.88	-88.45	01:14	28.78	-88.41
217	MC4	4-May-21	10:53	28.88	-88.41	14:08	28.79	-88.34
218	UTAH	4-May-21	22:16	29.14	-88.37	03:55	28.97	-88.42
219	UTAH	5-May-21	10:29	29.14	-88.38	15:19	28.98	-88.39
220	UTAH	5-May-21	21:05	29.13	-88.38	02:18	28.97	-88.42

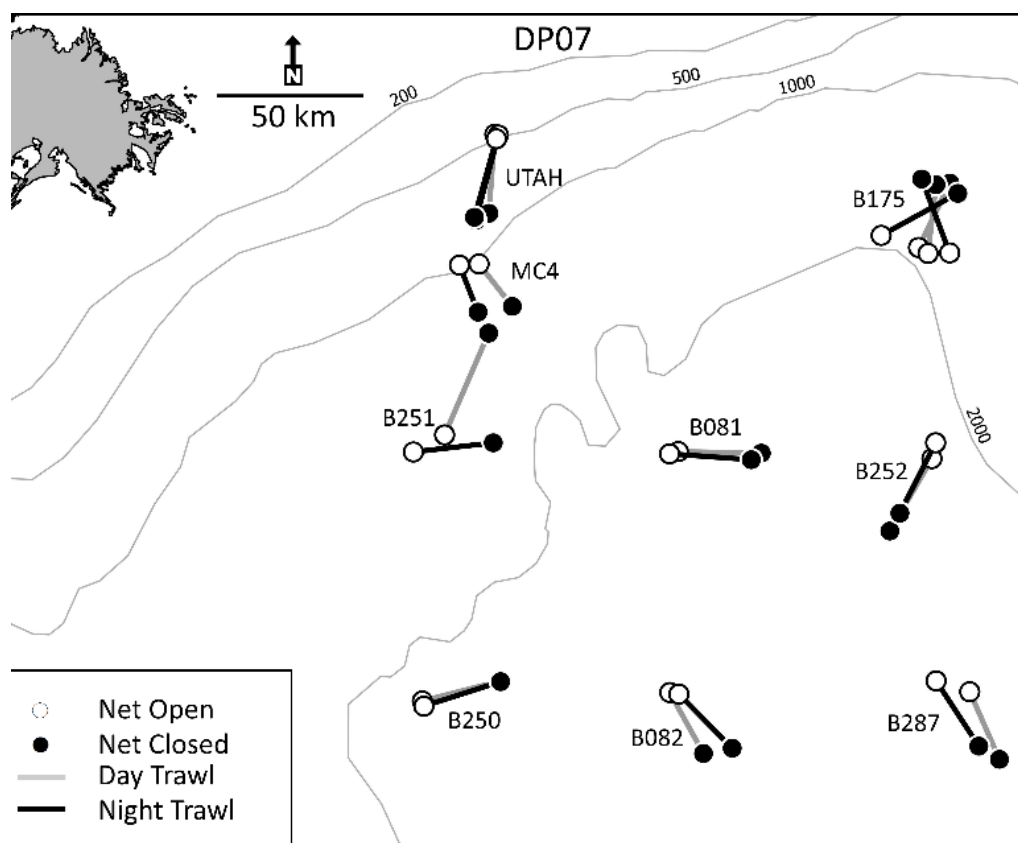


Figure 19. DEEPEND cruise DP07 MOC-10 trawl locations and trajectories, labeled by station number. Day samples are indicated by the light line, while night samples have black lines.

5.2 Faunal Accounts

5.2.1 Crustacea.

Approximately 11,860 nektonic crustaceans were sampled, sorted, and preserved from nets 0-5 in various fixatives (EtOH, formalin, or frozen). Of these, 873 were identified to lowest taxonomic level possible and preserved in 99% EtOH for studies of population connectivity and/or barcoding. Additionally, 14 of these individuals were identified to species and frozen for PAH analysis.

The remaining ~10,970 crustaceans were identified to genus and stored in 10% formalin for species identification back in the shoreside laboratory. All copepods, amphipods and isopods were collected and stored in formalin for other investigators who may want them. Numerous individuals were also photographed either by Dante for whole animal images, or Tammy under a microscope for good images of morphological distinctions to aid with future taxonomy. Figure

20 shows a *Physetocaris microphthalmal* which is suspected to be a new record for the Gulf of Mexico. Several pasiphaeid shrimp were also collected that are suspected new records for the GoM as well.



Figure 20. *Physetocaris microphthalmal* collected during DEEPEND cruise DP07. Photo: 2021 DEEPEND/Danté Fenolio.

5.2.2 Mollusca.

A total of 133 individual cephalopods were collected, with 32 species representing from 20 families. A total of 4,445 pteropods and 358 heteropods were collected and preserved in 95% ethanol for species identification and future genetic work at Dr. Judkins' laboratory at the University of South Florida St. Petersburg.

5.2.3 Fishes.

A total of 14,398 fish specimens were collected from a minimum of 219 species. Analysis is currently ongoing.

5.3 Genetic/Genomic Analyses

5.3.1 Crustaceans.

A total of 373 crustaceans (including samples collected from net 0) were preserved in 99% Ethanol or RNALater for population connectivity (Table 2) and barcoding studies (Table 3). Twelve species were collected for population genetics, while seven species were collected for barcoding studies.

Table 2. Crustacean specimens collected during DP07 for population genetics.

Species	N
<i>AcanthePHYra purpurea</i>	31
<i>AcanthePHYra stylorostratis</i>	50
<i>Eucopia sculpticauda</i>	30
<i>Nematoscelis microps/atlantica</i>	42

<i>Sergestes tenuiremis</i>	1
<i>Sergia grandis</i>	25
<i>Sergia robusta</i>	24
<i>Sergia splendens</i>	58
<i>Sergia tenuiremis</i>	27
<i>Sergis grandis</i>	1
<i>Stylopandalus richardii</i>	35
<i>Systellaspis debilis</i>	37

Table 3. Crustacean specimens collected during DP07 for genetic barcoding.

Species	N
<i>Eupasiphea serrata</i>	2
<i>Meningodora vesca/compsa</i>	1
<i>Pasiphaea semispinosa</i>	1
Pasiphaeidae	2
<i>Physetocaris microphtalma</i>	1
<i>Sergestes henseni</i>	1
<i>Sergestes paraseminudus</i>	3
<i>Sergestes paraseminudus/henseni</i>	1

5.3.2 Cephalopoda and other Pelagic Mollusca.

Nineteen species of cephalopods were collected and preserved in 99% ethanol for genetic analysis (Table 4).

Table 4. Cephalopods collected for genetic studies during DEEPEND cruise DP07.

Species	N
<i>Abralia redfieldi</i>	1
<i>Bathyteuthis</i> sp.	2
<i>Bolitaena pygmaea</i>	1
Bolitaenidae	1
<i>Brachioteuthis</i> sp.	1
<i>Cardiapoda placenta</i>	2
<i>Chiroteuthis</i> sp.	1
<i>Chiroteuthis mega</i>	1
<i>Discoteuthis discus</i>	1
<i>Japetella diaphana</i>	8
<i>Joubiniteuthis portieri</i>	1
<i>Mastigoteuthis agassizii</i>	1
<i>Megalocranchia</i> sp.	1
<i>Narrowteuthis nesis</i>	1
<i>Ornithoteuthis antillarum</i>	1
<i>Pterotrachea coronata</i>	11

<i>Pterotrachea hippocampus</i>	2
<i>Pterotrachea scutata</i>	5
<i>Pterygioteuthis</i> sp.	10
<i>Spirula spirula</i>	1
Taoniinae	1
<i>Teuthowenia</i> sp.	1
<i>Vampyroteuthis infernalis</i>	5

5.3.3 Fishes.

A total of 774 fish tissue samples were collected for genetic analysis from at least 95 species (Table 5). All tissues and voucher specimens were individually matched with paired tissue tags. Those specimens not identified to species level were primarily larval forms (e.g., leptocephalus stage) or males for which no key currently exists (e.g., ceratioid anglerfishes). A primary aim of the genetic diversity and connectivity objective was to collect indicator species for downstream population genomic analyses. The target species for this objective are notated in bold font in Table 5. The goal was to collect 30+ individuals per species. Following the cruise fish tissue samples were sent to Dr. Bracken-Grissom's lab at FIU for further genetic analyses.

Table 5. Fish taxa collected for genetic studies during DEEPEND cruise DP07.

Species	N
<i>Acanthostracion quadricornis</i>	1
Alepocephalidae	2
Anguilliformes	3
<i>Apogon</i> sp.	1
<i>Argyropelecus aculeatus</i>	48
<i>Argyropelecus sladeni</i>	1
<i>Ariosoma balearicum</i>	2
<i>Astronesthes macropogon</i>	2
<i>Ataxolepis apus</i>	1
<i>Avocettina infans</i>	1
<i>Baldwinella aureorubens</i>	1
<i>Barbantus curvifrons</i>	1
Bathylagidae	1
<i>Bonapartia pedaliota</i>	1
Bothidae	1
<i>Bregmaceros</i> sp.	17
<i>Bregmaceros atlanticus</i>	1
<i>Caulolatilus</i> sp.	4
<i>Ceratoscopelus warmingii</i>	55
Cetomimidae	3
<i>Cetostoma regani</i>	7

<i>Chaetodon</i> sp.	1
<i>Chauliodus sloani</i>	9
<i>Chiasmodon</i> sp.	2
<i>Citharichthys cornutus</i>	1
<i>Coelorinchus</i>	1
Congridae	2
<i>Cryptopsaras couesii</i>	4
<i>Cyclothone alba</i>	45
<i>Cyclothone braueri</i>	6
<i>Cyclothone microdon</i>	1
<i>Cyclothone obscura</i>	85
<i>Cyclothone pallida</i>	67
<i>Derichthys serpentinus</i>	1
<i>Diaphus</i> sp.	5
<i>Diaphus dumerilii</i>	67
<i>Diaphus mollis</i>	1
<i>Diaphus perspicillatus</i>	1
<i>Diaphus splendidus</i>	3
<i>Dolopichthys</i> sp.	1
<i>Dolopichthys dinema</i>	1
<i>Elops smithi</i>	1
<i>Eustomias lipochirus</i>	1
<i>Evermannella melanoderma</i>	1
<i>Facciolella</i> sp.	2
<i>Gadella imberbis</i>	1
<i>Gibberichthys pumilus</i>	1
Gigantactinidae	1
<i>Gigantactis microdontis</i>	1
<i>Gymnothorax</i> sp.	1
<i>Haplophryne</i> sp.	1
<i>Haplophryne mollis</i>	1
Himantolophidae	2
<i>Holtbyrnia</i> sp.	1
<i>Hoplunnis macrura</i>	1
<i>Hoplunnis tenuis</i>	1
<i>Hymenocephalus italicus</i>	1
Ilyophinae	1
<i>Labichthys carinatus</i>	1
<i>Lepidophanes guentheri</i>	29
<i>Leptochilichthys</i> sp.	2
Linophrynidae	19

Lutjanidae	1
<i>Margrethia obtusirostra</i>	1
<i>Maurolicus weitzmani</i>	16
<i>Melamphaes eulepis</i>	1
<i>Melamphaes pumilus</i>	2
Melanocetidae	2
<i>Melanocetus johnsonii</i>	1
Muraenidae	4
<i>Myctophum affine</i>	3
<i>Neobythites</i> sp.	2
<i>Nettenchelys</i> sp.	4
<i>Nezumia</i> sp.	1
<i>Notolychnus valdiviae</i>	13
<i>Notoscopelus resplendens</i>	5
Oneirodidae	2
Paralichthyidae	1
<i>Paralichthys</i> sp.	1
<i>Parasudis truculenta</i>	1
Perciformes	1
<i>Photostylus pycnopterus</i>	1
<i>Pollichthys mauli</i>	17
<i>Polyipnus clarus</i>	41
Pontinus	1
<i>Pseudomyrophis</i>	1
<i>Pseudoscopelus altipinnis</i>	1
<i>Pseudoscopelus scriptus</i>	1
<i>Scopeloberyx robustus</i>	1
Scorpaenidae	2
Serranidae	2
<i>Serrivomer lanceolatoides</i>	1
<i>Sigmops elongatus</i>	18
<i>Spiniphryne gladisfenae</i>	1
<i>Sternoptyx diaphana</i>	51
<i>Sternoptyx pseudobscura</i>	36
<i>Valenciennellus tripunctulatus</i>	9

5.4 Polycyclic Aromatic Hydrocarbon Analysis

5.4.1 Crustaceans.

A total of 23 specimens from at least five species were frozen whole for immediate or future PAH analysis. These included *Acantheephyra purpurea* (n = 2), *Acantheephyra stylorostratis* (n = 2), *Nematoselis* spp. (n = 4), *Oplophorus gracilirostris* (n = 2), and *Systellaspis debilis* (n = 2).

5.4.2 Cephalopods and Other Pelagic Mollusca.

A total of 14 cephalopod specimens from four species were collected for immediate or future PAH analysis, including *Abralia redfieldi* (n = 2), *Vampyroteuthis infernalis* (n = 9), Boitaenidae (n=1), and *Japetella diaphana* (n = 2). Additionally, nine heteropods from two species, including *Pterotrachea coronata* (n = 4) and *Pterotrachea scutata* (n = 5), and 71 pteropods were frozen for PAH analysis. All specimens were frozen as whole bodies.

5.4.3 Fishes.

A total of 564 organ/tissue samples were collected from 25 species for immediate or future PAH analysis (Table 6). Large fish specimens were dissected at sea and organs/tissues kept separate (guts, liver, muscle, skin, ovaries). Other fish specimens were frozen as whole bodies.

Table 6. Fish specimens collected for PAH analysis on DEEPEND cruise DP07.

Species	N
<i>Anoplogaster cornuta</i>	2
<i>Argyrolepecus aculeatus</i>	31
<i>Argyrolepecus hemigymnus</i>	44
<i>Ceratoscopelus warmingii</i>	22
<i>Chauliodus sloani</i>	30
<i>Conger oceanicus</i>	1
<i>Cyclothone braueri</i>	1
<i>Cyclothone obscura</i>	43
<i>Cyclothone pallida</i>	80
<i>Cyclothone pseudopallida</i>	4
<i>Diaphus dumerilii</i>	5
<i>Diaphus mollis</i>	5
<i>Gigantura chuni</i>	1
<i>Lampanyctus alatus</i>	52
<i>Lepidophanes guentheri</i>	5
<i>Melamphaes simus</i>	24
<i>Nannobranchium lineatum</i>	8
<i>Photostomias guernei</i>	1
<i>Pyrosoma atlanticum</i>	56
<i>Scopeloberyx opisthopterus</i>	14
<i>Scopeloberyx robustus</i>	32
<i>Sigmops elongatus</i>	41
<i>Sternoptyx diaphana</i>	33
<i>Sternoptyx pseudobscura</i>	28
<i>Stomias affinis</i>	1

5.4.4 Gelatinous Zooplankton.

Three species of gelatinous zooplankton, *Atolla* spp. (n = 14), *Aurelia aurita* (n = 2), and *Pyrosoma atlanticum* (n = 29), were collected for PAH analysis. Specimens were frozen whole.

5.5 Leptocephalus Identification Key

The occurrence of leptocephali in the open ocean was unusually rare during this cruise. They were collected in higher numbers near station MC4 and station Utah (over Viosca Knoll) which are much shallower. Several species of leptocephali were collected for the first time during the DP07 cruise and photographed in high resolution (e.g., Figure 19). Many of these specimens do not fit any of the known leptocephali species and may represent either newly found leptocephali species where only the adult is known or the leptocephali may represent species that are entirely unknown to science.

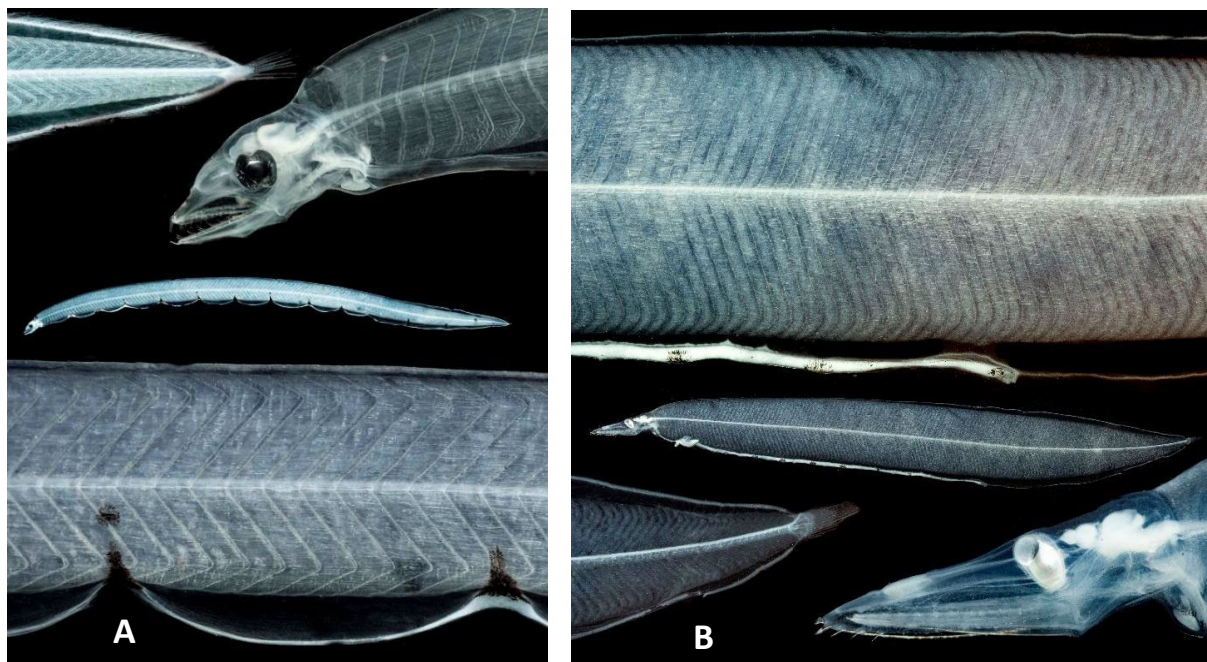


Figure 21. Image set taken of eel leptocephali (A. Ophichthinae sp. and B. Ilyophinae sp.) during the DEEPEND cruise DP07 for the Leptocephalus Identification Key Project. Photo: 2018 DEEPEND/Danté Fenolio.

5.6 Bird, Shark, and Marine Mammal Observations

During the DP07 cruise, bird, shark, and marine mammal observations were notated opportunistically by Dr. Jon Moore and the ship's first mate, Casey Hurt. Photographs were taken when possible (Figure 22). Sightings of birds included barn swallows, cave swallows, cattle egrets, snowy egrets, royal terns, sandwich terns, pomarine jaegers, black-necked stilt, laughing gulls, yellow warblers, hummingbird, brown boobies, brown pelicans, shiny cowbirds, American redstarts, common yellowthroats, yellow-billed cuckoo, sandpipers or plovers, shearwaters, magnificent frigatebirds, and either northern gannets or masked boobies. Shark and marine mammal sightings included Sperm whales, Clymene dolphins, Bottlenose dolphins, Gray Reef sharks, and Silky sharks. A detailed report can be found in Appendix A.

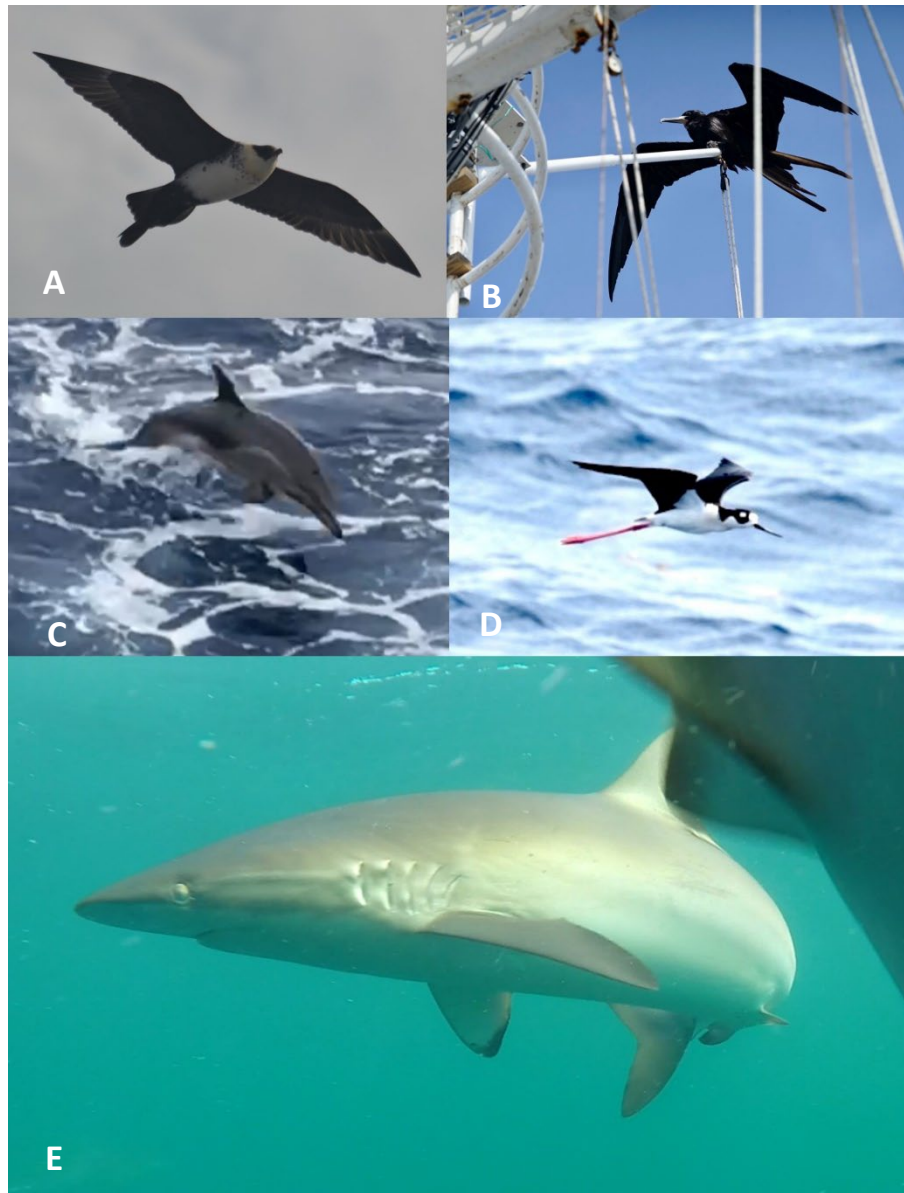


Figure 22. Seabirds, sharks, and dolphins encountered while at sea: A. Pomarine Jaeger, B. Magnificent Frigatebird, C. Clymene dolphin, D. Black-necked Stilt, and E. Silky shark.

5.7 Hydroacoustic Data

Over 400 GB of acoustic backscatter data were collected during the DP04 cruise. Four Simrad EK-series splitbeam echosounders (18, 38, 70, and 120 kHz) collected data covering 3000 m (18 and 38 kHz), and ~ 400 m (70 and 120 kHz) of the water column (Figure 6). Both narrowband and wideband (at 18 and 70 kHz) data were collected opportunistically to examine the potential to use frequency spectra to further describe the scattering responses of mesopelagic fauna. Data were collected during day and nighttime MOC10 tows at seven different stations for a total of 15 datasets (B081, B082,

B175, B250, B251, B252, B287). Passive acoustic surveys were conducted in both continuous wave and wideband form during daytime and nighttime operations to characterize the noise (electrical interference) generated by the ship and associated machinery. Additionally, all echosounders were calibrated using standard tungsten carbide and copper spheres in both narrowband and wideband (with the exception of the 18 kHz which was narrowband only) modes following standardized procedures. Acoustic data have been manually inspected and analyzed. The data packaging process has been completed and transferred to NCEI for review and archiving.

Analyses continue to support the findings from the previous DEEPEND cruises that there is a substantial amount of material transported vertically during migration phases, and differences among acoustically based taxonomic groups continue to be observed. The paper published by D'Elia et al. (2016) has set forth the process to examine the scattering layers at relevant taxonomic resolution and quantify changes in movement patterns and distribution at these scales.

5.8 Physical Oceanographic Data Collected

In situ physical oceanographic data from the CTD (Conductivity-Temperature-Density) rosette casts and the MOCNESS were collected during DP07.

5.8.1 CTD and Water Samples

The CTD and water sampling rosette was deployed 19 times at nine stations during the DEEPEND DP07 cruise (Table 7). Water samples from several sample depths were collected using Niskin bottles on the CTD rosette at most stations, and duplicate samples were collected at select stations. The water samples were processed after the cruise at the USF-Marine Environmental Chemistry Laboratory for analysis of carbon (%C, ¹³C) as a pilot study looking at benthic-water column connectivity.

Table 7. CTD rosette deployments during DEEPEND cruise DP07

Station	CTD cast ID	Cast Date	Cast Time (CDT)	Solar Cycle	Lat.	Lon.	Bottom depth (m)
B175	DP07_CTD_199	25-Apr-21	17:53	Night	29.01	-87.47	1795
B175	DP07_CTD_200	26-Apr-21	03:35	Day	29.05	-87.53	1521
B175	DP07_CTD_201	26-Apr-21	15:41	Night	29.03	-87.47	1528
B175	DP07_CTD_202	27-Apr-21	05:04	Day	28.99	-87.49	1747
B252	DP07_CTD_203	27-Apr-21	19:29	Night	28.51	-87.50	2536
B252	DP07_CTD_204	28-Apr-21	04:56	Day	28.43	-87.52	2603
B287	DP07_CTD_205	28-Apr-21	18:03	Night	28.00	-87.50	2831
B287	DP07_CTD_206	29-Apr-21	05:02	Day	27.97	-87.44	2877
B082	DP07_CTD_207	29-Apr-21	20:01	Night	28.00	-88.00	2409
B082	DP07_CTD_208	30-Apr-21	05:01	Day	27.96	-87.98	2466
B250	DP07_CTD_209	30-Apr-21	19:25	Night	28.00	-88.50	2138
B250	DP07_CTD_210	1-May-21	05:00	Day	28.00	-88.48	2201
B081	DP07_CTD_211	1-May-21	19:02	Night	28.53	-88.04	2142
B081	DP07_CTD_212	2-May-21	04:00	Day	28.50	-87.94	2352

B251	DP07_CTD_213	2-May-21	19:44	Night	28.50	-88.51	1672
B251	DP07_CTD_214	3-May-21	05:43	Day	28.49	-88.49	1750
MC4	DP07_CTD_218	4-May-21	6:19	Day	28.85	-88.45	935
UTAH	DP07_CTD_215	4-May-21	18:33	Night	29.16	-88.37	238
UTAH	DP07_CTD_216	5-May-21	04:25	Day	28.97	-88.42	786
UTAH	DP07_CTD_217	5-May-21	15:35	Night	28.98	-88.39	790

6 Outreach Activities

6.1 Dr. Danté Fenolio/DEEPEND Photography

Dr. Danté Fenolio, lead of DEEPEND's imaging project, took over 3,500 photos during this cruise. Figure 23 shows a sample of Dante's photography. He used new techniques such as white box photography to capture the true colors of the darkest deep-sea fishes. He also used alternative lighting such as ultraviolet and red lights to illuminate photophore patterns. Figure 24 demonstrates how Danté photographs the organisms aboard the R/V *Point Sur*.



Figure 23. Images of *Astronesthes gemmifer* (left), *Isistius brasiliensis* (middle), and *Valenciennellus tripunctulatus* using different lighting techniques. Photos: 2021 DEEPEND/Danté Fenolio.

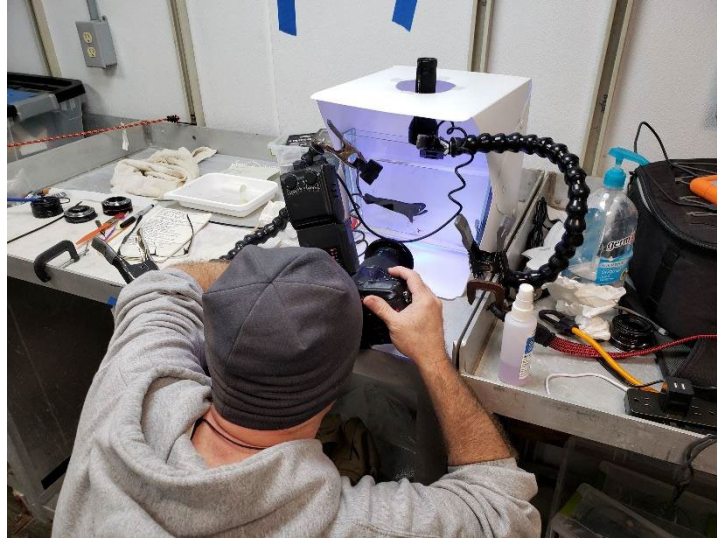


Figure 24. Dr. Danté Fenolio photographed a fish specimen during the DEEPEND cruise DP07 using a white box technique and ultraviolet lighting for the imaging project.

6.2 Video Conferencing at Sea

Dr. Sutton and April Cook hosted a video conference with one of NSU University School's Pre-Kindergarten classes. The classes were given a virtual tour of the ship, shown some of the animals collected, and were able to ask questions. Dr. Fenolio hosted two education and outreach efforts by "live-feed" from the R/V *Point Sur*. Specimens were shown to the groups and the overall research goals of DEEPEND were explained while we were at sea. The first group was "Tropical Fish Keeping UK" with a membership of 64,000 people. The interview ran just over an hour during a meeting of the society and a specimen of a cookie-cutter shark was a highlight. The second interview took place through the YouTube platform, Nature Network, with hundreds of followers. The same topics and specimens were covered as with the first interview. After the research cruise, Dr. Fenolio gave three additional Zoom presentations featuring DEEPEND research to the Universidad Autonoma del Estado de Mexico in Mexico City, Mexico, the Albuquerque Herpetological Society, New Mexico, USA, and a YouTube platform called Pondcast. These follow-up interviews and presentations represent several hundred individuals from the public as well as other scientific researchers.

6.3 DEEPEND Website

During the cruise, ten [blogs](#) were published on the DEEPEND website along with images of animals, equipment, and the DEEPEND team members. Several posts highlighted the work of DEEPEND graduate students from several different universities who are working towards their MS or PhD degrees. Other blogs gave a glimpse of life at sea and the difficulties faced by researchers in the field.

Appendix A. Bird, shark, and marine mammal observations

25 Apr 2021

3:34 PM CDT

N29° 03.500', W87° 34.631'

Blue water, clear – no clouds, 10 knot winds, 70°F

3 Barn Swallows

3 Royal Terns

2 Laughing Gulls

4:03 PM CDT

2 Yellow Warblers flying south off bow

4:23 PM CDT

N29° 02.570', W87° 31.699'

1 hummingbird flying south (went by too fast to confirm species)

4:25 PM CDT

Line of large white birds towards horizon, ground effect gliding close to water surface, pretty fast fliers, Northern Gannets or Masked Boobies?

8:01 PM CDT

N28° 59.610', W87° 28.591'

21 Barn Swallows perching on wheelhouse and superstructure

1 Rusty Blackbird flying around boat for a bit and then continued on

8:25 PM CDT

Another low line of Northern Gannets or Masked Boobies flying quickly in distance

26 Apr 2021

8:21 AM CDT

2 Barn Swallows found dead on 02 deck.

1:06 PM CDT

N28° 59.424', W87° 28.833'

Blue water, partly cloudy with high cirrus clouds, mildly breezy, ~74°F

36 Sandwich terns

1 Pomarine Jaeger

Sandwich terns were following tunas hitting small fishes at the surface and they also plunged under small clumps of sargassum. The jaeger was sitting on the ocean surface and individual terns would swoop down at it. The jaeger would fly off a short way and set back down on the water.

2:00 PM CDT

Sperm whale seen off the starboard side less than ¼ mile away. Swam along at the surface and blowing frequently (once every 30 sec to 2 min). About 7 min later it dove.

26 Apr 2021

3:20 PM CDT

Blue water, partly cloudy with high cirrus clouds, mildly breezy, ~74°F, seas 1-2 ft

N29° 02.361', W87° 28.237'

6 Laughing Gulls

40+ Sandwich Terns

1 Royal Tern

1 Pomarine Jaeger

All were going after fish driven to the surface by tuna from below. The Laughing Gulls later set down as a small raft clumped together with two other Laughing Gulls.

27 Apr 2021

1:10 PM CDT

Blue water, partly cloudy with high cirrus clouds, wind 10 knots from W, 80°F, seas 2-4 ft

N29° 00.376', W87° 30.996'

27 Sandwich Terns perched on railings and superstructure above bridge.

28 Apr 2021

8:45-9:15 AM CDT

Blue water, partly cloudy with cumulus clouds, wind 14 knots from EW 77°F, seas 4-5 ft

N28° 29.459', W87° 30.010'

7 Pomarine Jaegers (repeatedly flying towards boat and setting down on the water near boat – got good photos)

1 Black-necked Stilt flying by

7:05 PM CDT

Blue water, partly cloudy with cumulus clouds, wind 14 knots from W, 73°F, seas 4-6 ft

N28° 01.135', W87° 29.876'

2 Barn Swallows flew by

29 Apr 2021

7:45 AM CDT

1 Barn Swallow found dead on deck.

2:08 PM CDT

Blue water, clear with cumulus clouds on horizon, wind 8-10 knots from E, 82°F, seas 2-4 ft

N27° 54.192', W87° 24.054'

1 Pomarine Jaeger staying with boat by setting down on water off bow, passing by the ship, and flying to in front of the boat and setting down on the water again.

1 Cave Swallow flew by

1 Cattle Egret standing on the bow, flew off when I turned a corner

8:16 PM CDT

N28° 00.509', W88° 00.198'

Night, breezy, seas 2-3 ft seas, 73°F, light breezes

1 Barn Swallow flew by the aft deck lights.
Also saw a ~6 ft shark circling the stern in the lit waters over the side

10:30 PM CDT
Same position and conditions
3 Barn Swallows roosting on upper deck.

30 Apr 2021

8:30 AM CDT
N28° 00.064', W88° 00.881'
Blue water with sargassum, 4-5 knots wind, seas 2-4 ft seas, 73°F, mostly cloudy with cumulus
1 Brown Booby flew by
1 Brown Pelican juv, flew by
8 Barn Swallows perched about the deck
1 Shiny Cowbird perched on ladder on wheelhouse

6:25-6:44 PM CDT
N27° 59.236', W88° 25.566'
Blue water with sargassum, light breezes, seas 2-3 ft seas, 78°F, mostly cloudy
~6 Clymene Dolphins
1 American Redstart female flitting around the ship
~15 Barn Swallows perched on the superstructure of ship or up under the bow

10:36 PM CDT
N28° 00.343', W88° 00.963'
1 Royal Tern off back deck while dipnetting flying fish at night

1 May 2021

1 Yellow-billed Cuckoo photographed on ship by first mate, Casey Hurt, early in morning. I had seen a larger grayish long-tailed bird in the superstructure the evening before, but had no chance to identify it.

9:04 AM CDT
Picked up dead American Redstart female on deck

9:22 AM CDT
N28° 00.266', W88° 30.788'
Overcast, blue water, winds 17-18 knots from NE, 77°F, seas 3-5 ft
1 Royal Tern
1 Pomarine Jaeger which stole a fish from the above tern

1:17-1:33 PM CDT
N28° 01.645', W88° 24.613'
Overcast, winds 15 knots from ENE, 85°F, seas 3-5 ft
4 Snowy Egrets flew by as a group
2 Pomarine Jaegers following ship

Dropped a dead Barn Swallow over the side

6:39 PM CDT

N28° 29.072', W88° 00.579'

Overcast, winds 14 knots, 77°F, seas 2-4 ft

Dropped 4 dead barn swallows over the side

1 Common Yellowthroat flitting in amongst the low machinery and lines on the 01 deck

7:30 PM CDT

Common Yellowthroat still around on deck.

2 May 2021

4:11 PM CDT

N28° 30.032', W87° 58.300'

Overcast, squall line approaching from W, winds 20+ knots, 76°F, seas 4-5 ft

2 Royal Terns flying by the boat away from squall line

Intense squall line from the west passed by boat starting at ~4:30 PM, kicked winds up to over 20 knots, seas also increased for a few hours

5:39 PM CDT

Middle of storm, saw from a porthole ~15 sandpipers fly close by the ship.

7:05 PM CDT

N28° 30.080', W88° 31.343'

Overcast, squall line recently passed, winds 20+ knots, 73°F, seas 5-6 ft

Shearwater wheeling over waves at some distance, gone by the time I got to some binoculars in the bridge.

10:30 PM CDT

N28° 29.985', W88° 30.162'

Dark, 77°F, seas 3-4 ft

1 Laughing Gull juv flying around where deck lights were shining on water. We did have squid and flying fish attracted to boat by lights.

3 May 2021

3:10 AM CDT

N28° 31.262', W88° 22.931'

Dark, 75°F, seas 3-4 ft

2 Laughing Gulls flying around in lit area on ship's port side while we were retrieving net.

10:52 AM CDT

N28° 27.006', W88° 24.858'

Blue water, hazy, few clouds, 83°F, winds 15-17 knots from SSE, seas 4-5 ft

3 Royal Terns flying by boat

1 juvenile gull in the distance

11:45 AM CDT
N28° 29.141', W88° 26.233'
Blue water, hazy, few clouds, 83°F, seas 3-4 ft
3 Sandwich Terns flying by boat
1 Brown Pelican in water behind boat

1:14 PM CDT
N28° 27.006', W88° 24.858'
Hazy, few clouds, 82°F, seas 3-4 ft
4 Sandwich Terns flying by boat

4 May 2021

6:30-6:45 AM CDT
N28° 50.877', W88° 27.728'
Green water, hazy, no clouds overhead, winds 18-20 knots from SE, 78°F
4 Laughing Gulls
1 Magnificent Frigatebird male

10:40-11:05 AM CDT
N28° 52.767', W88° 24.62'
Green water, hazy, no clouds overhead, winds 12-14 knots from S, 80°F
2 Brown Pelicans
3 Royal Terns
2 Sandwich Terns
6 Laughing Gulls (incl. 2 juv)
1 Magnificent Frigatebird female

1:53-2:02 PM CDT
N28.801712° W88.348736°
Green water, hazy, no clouds overhead, winds 12-14 knots from S, 80°F
5 Sandwich Terns
1 Laughing Gull juv.

4:46-5:02 PM CDT
N29.071500° W88.379205°
Green water, hazy, few clouds overhead, winds 15 knots from S, 78°F
10 Sandwich Terns
7 Royal Terns
5 Laughing Gulls

5 May 2021

3:44-3:56 AM CDT
N28° 59.9201', W88° 24.1818'
Green water, after dark, 77°F

20+ Silky and possibly Gray Reef Sharks aggregated around lit areas off stern of ship, chasing flyingfishes
4 Laughing Gulls flying around
Small flock (~15) of sandpipers or plovers circling boat at edge of light visibility

After dawn

Magnificent Frigate male photographed by Casey Hurt on ship's mast in early morning.

2:45-3:51 PM CDT

Green water, hazy, lots of clouds overhead and on horizon, winds 8-10 knots, 80°F

20+ Silky and possibly Gray Reef Sharks aggregated around stern of ship

4 Laughing Gulls

3 Royal Terns

1 Sandwich Tern

8:48-9:05 PM CDT

N29° 07.304', W88° 22.570'

Green water, after dark, 78°F

6 Laughing Gulls

2 Barn Swallows

6 May 2021

11:20 AM CDT

N30.144442, W88.992548

Brown water, 80°F, partly cloudy

3 Royal Terns

8 Sandwich Terns

2 Laughing Gulls

3 Brown Boobies

4 Bottlenose Dolphins

Terns and gulls were following the boat into port and diving on fish disturbed by the ship's wake.

Boobies were sitting on the water in front of the ship and took off as it approached. Dolphins came over to ride the bow waves for a few minutes, then turned away and went elsewhere.