Cruise Report

R/V *Point Sur* cruise DP02

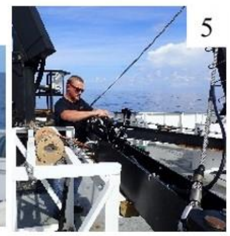
08-21 August 2015

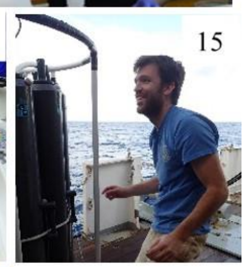
DEEPEND

DEEP PELAGIC NEKTON DYNAMICS OF THE GULF OF MEXICO

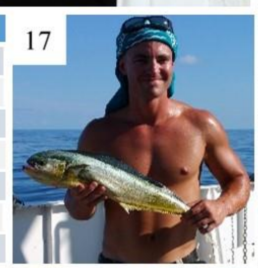
DEEPEND DP02 Cruise Participants on the R/V *Point Sur*

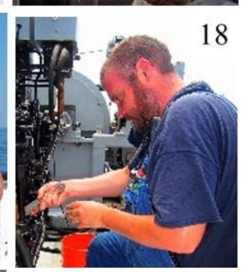
Science Party	Institution	Role
1. Alisha Stahl		Teacher at Sea
2. Charles Kovach	USF CMS	CTD/bio-optics lead
3. Danté Fenolio	SAZ	Outreach/filming lead
4. Espen Rekdal	BBC	
5. Gray Lawson	CSA	MOCNESS operator
6. Heather Judkins	USF	Cephalopod taxonomy
7. Jon Moore	FAU	Fish taxonomy
8. Joseph Warren	Stonybrook	Hydroacoustics
9. Katie Bowen	NSUOC	Fish genetics
10. Lacey Malarky	NSUOC	Database management
11. Laura Timm	FIU	Crustacean genetics
12. Max Weber	TAMUG	Fish genetics
13. Tammy Frank	NSUOC	Crustacean taxonomy
14. Tracey Sutton	NSUOC	Chief Scientist
15. Travis Richards	TAMUG	

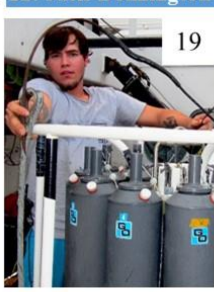




Ship's Crew		
16. Nicholas Allen	LUMCON	Captain
17. Justin Collett	LUMCON	Chief Mate
18. Joshua Jansen	LUMCON	Engineer
19. Jamison Chauvin	LUMCON	Deck Hand
20. Marshall Kormanec	LUMCON	Technician
21. Alex Forsythe	LUMCON	Head Stewart
22. Jack Bonnington	LUMCON	Assistant Stewart







Report of

DEEPEND Cruise DP02
08-21 August 2015; USM R/V *Point Sur*, Gulfport, MS
Chief Scientist: Tracey Sutton

This report was prepared by: Tracey Sutton, Kevin Boswell, April Cook, Lacey Malarky, Katie Bowen, Nina Pruzinsky, Sergio deRada, David English, Ron Eytan, Danté Fenolio, Tammy Frank, Chuanmin Hu, Matt Johnston, Heather Judkins, Charles Kovach, Gray Lawson, Joe Lopez, Jon Moore, Brad Penta, Travis Richards, Nicole Sandoval, Alisha Stahl, Laura Timm, Max Weber, and Joe Warren

A DEEPEND (Deep Pelagic Nekton Dynamics)
Consortium Report

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

Acknowledgements

This report reviews the fourth DEEPEND cruise in the Gulf of Mexico. The success of the 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, OKEANUS Science and Technology, Continental Shelf Associates, Sea-Gear Corporation, the San Antonio Zoo, the NSU Oceanic Ecology Lab, and all members of the science party. The cheerfulness, resourcefulness, and hard work of all participants were outstanding. This cruise was supported by the Gulf of Mexico Research Initiative (GOMRI2014-IV-914).

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PURPOSE OF THE CRUISE

The DEEPEND Consortium is an ocean realm field project supported by the Gulf of Mexico Research Initiative (GoMRI). The focus of the DEEPEND Consortium is to develop a quantitative, taxonomically comprehensive assessment of the deep-pelagic faunal assemblages of the northern Gulf of Mexico in the region of the *Deepwater Horizon* oil spill (DWHOS), including examination of longer-term consequences of the DWHOS on these assemblages. The project goals of this fourth cruise include: 1) quantitative assessment of deep-pelagic nekton (fishes, macrocrustaceans, and cephalopods) and gelatinous zooplankton assemblage structure, abundance, and distribution across a range of biophysical conditions; 2) quantitative acoustic profiling of the fine- and mesoscale distributions of oceanic nekton; 3) collection of nekton, plankton and microbial samples for genomics/genetic analyses to be conducted in five research labs (Nova Southeastern University, Texas A&M University Galveston, Florida International University, Smithsonian Institution/National Museum of Natural History); 4) collection of nekton, and plankton samples for stable isotope, hydrocarbon, otolith microchemistry and mercury analyses; 5) collection of particulate organic carbon samples for stable isotope analysis; 6) collection of phytoplankton filtrates (chlorophyll analysis) for remote sensing calibration; 7) collection of *in situ* biophysical oceanographic data for community analyses and assimilation into HYCODE and remote sensing models; 8) collection of fish specimens for genomic fingerprinting of bioluminescent microbial symbionts; and 9) collection of photographic and video content for Outreach & Education efforts.

Sampling was conducted aboard the R/V *Point Sur* in the northern Gulf of Mexico (Fig. 1). Scientific participants on this cruise (see frontispiece) included expert taxonomists in the major deep-pelagic nekton faunal groups, molecular specialists, technicians, an Educator-at-Sea, an acoustician, an outreach/imaging specialist, graduate students, and a professional videographer from the BBC

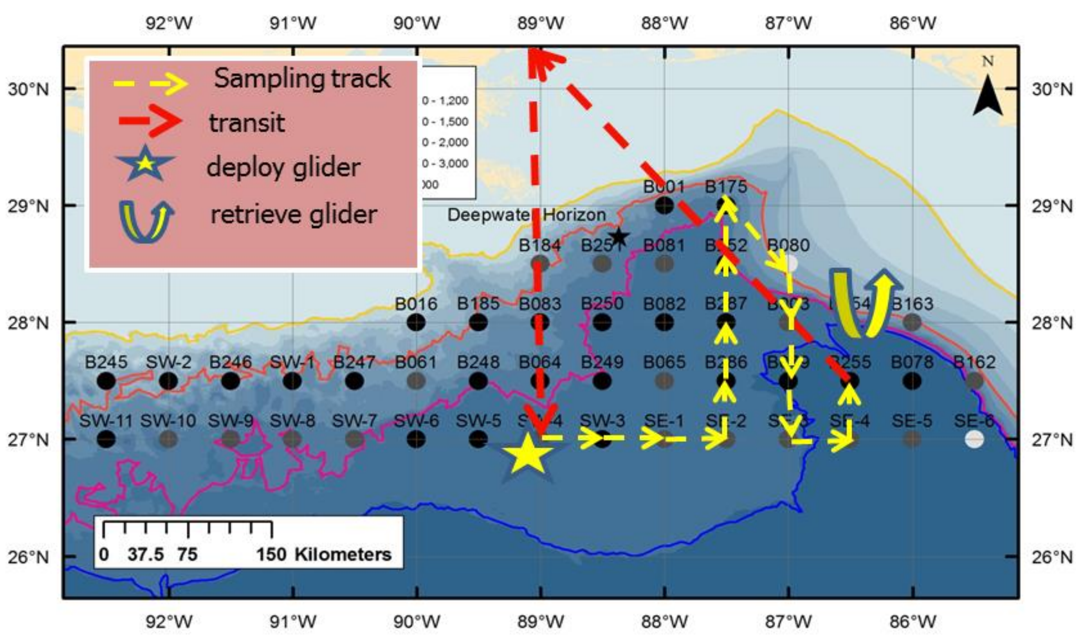


Figure 1. Cruise track of DEEPEND cruise DP02 relative to SEAMAP/NRDA station grid, 08-21 August 2015.

Natural History Unit. Specimens were identified at sea using traditional taxonomic approaches. After the cruise, species counts, molecular analyses, and expert taxonomic evaluation and description of any putative new records or undescribed species will be done in association with the DEEPEND Taxonomic Working Groups.

NARRATIVE

Ship's cruise number: PS_15_06_Sutton
DEEPEND cruise number: DP02
All cruise activity times presented as 24-h clock notation in Central Daylight Time (UDT – 5 h).

08 August 2015: We left the dock at 00:21. Once out of the channel, the ship steamed towards the first station.

09 August 2015: We arrived at Station SW-4 (27°01'N 89°W) at 01:21. The transducer was lowered into the water at 02:10, and the MOC-10 was deployed at 02:30. Nets 1-5 of Trawl 013 were fished until they were brought back on deck at 04:30. The samples were unloaded and processing began. Naming structure for trawl samples remained the same as the DP01 cruise (see below). The CTD rosette cast was made at 05:05 and reached a maximum depth of 2380 m. The optics package ran at 06:57, and a small boat with the glider was launched at 07:42. The small boat was recovered at 08:40. The MOC-10 was deployed again at 21:10. Trawl 014 reached 1500 m at 23.51.

Example: DP02-09Aug15-MOC10-SW4N-013-N1.
Key = cruise-date-gear-SEAMAP station code-night or day (N = night, D = day)-trawl number-net number
Note: trawls will be cumulatively increased across all sampling years (not restarted each cruise).
Other gear types: TT – Tucker trawl; NN – neuston net; BN – bongo net; CTD – water sample

10 August 2015: At 04:00, the MOC-10 was retrieved and the net fished properly. The CTD rosette cast occurred at 04:40. The CTD reached 1475 m at 05:32, and it returned to the boat at 06:20. The optics profiler (fish disco hereafter) was lowered to 200 m at around 07:00, and the optics package was initiated at 07:36. The MOC-10 was deployed at 09:19 (Trawl 015). At 16:00, the MOC-10 was secured on deck, and the samples were unloaded and processed in lab. Next, we reached Station SW-3 (27°01'N 89°50'W) and deployed the MOC-10 at 21:18 (Trawl 016). The MOC-10 reached its maximum depth of 1500m at 23:40.

11 August 2015: Hauling in the MOC-10 began at 01:56, and it was secured on board at 03:48. Unfortunately at 04:11, we found out that the acoustics had stopped working at 23:29 last night. The EK80 was restarted and began recording again at 04:16. The CTD rosette cast occurred at 04:17 and was retrieved at 05:41. The optics package was released at 06:11 and returned to the boat at 06:38. The MOC-10 was deployed at 09:42 and was towed until it was back on board at 15:08 (Trawl 017). The deployment of the optics package occurred at 15:29, and the CTD rosette cast was made at 16:30. We were underway to Station SE-1 (27°N 88°11'W) at 20:00 and arrived at 21:09. A drift test occurred at 21:36, and then the deployment of the MOC-10 was at 21:54.

12 August 2015: Trawl 018 was completed by 03:42, and the CTD rosette was immediately cast from 03:52 to 05:41. The optics package was also deployed at 05:24, and the transducer was calibrated at 07:07. The MOC-10 was deployed at 10:19 and retrieved at 16:06 (Trawl 019). No CTD or optics cast here. At 16:47, we transited to Station B286 (26°49'N 87°47'W). Deployment of the MOC-10 occurred at 22:04, and Trawl 020 was towed overnight.

13 August 2015: Retrieval of the MOC-10 was at 03:40, and from 03:56 to 05:28 a CTD rosette cast was made. The optics package was in the water from 05:40 to 06:06, and a water spout was spotted in the distance at 06:30. The MOC-10 was towed from 09:28 to 14:15 (Trawl 021), and the CTD rosette cast occurred from 14:33 to 15:50. The deployment of the fish disco occurred at 16:07. We were underway to the next station, Station B287 (27°58'N 87°29'W), at 16:46. The MOC-10 was deployed at Station B287 at 22:14 (Trawl 022).

14 August 2015: The MOC-10 was secured on deck at 03:56, the optics package ran from 04:15 to 04:44, and the CTD rosette cast occurred from 05:03 to 06:27. The transducer calibration was conducted at 07:14. The MOC-10 deployment (Trawl 023) was made at 09:46 and the net was hauled until 15:08 when it was brought back on board. We were underway to Station B252 (28°28'N 87°28'W) at 15:38. We tested the fire pump and ballast pump at 18:46 and conducted a drift test for the MOC-10 at 19:50. At 20:17, the CTD rosette was in the water. The cast ended at 21:37. The MOC-10 deployed at 22:02 (Trawl 024).

15 August 2015: The MOC-10 was hauled in at 01:58. The fire turn-out gear was inspected at 03:12 and it was up to date. We were underway to Station B175 (29°N 87°30'W) at 14:22. The CTD rosette was cast from 19:47 to 21:02, and the optics package was in the water at 21:16. The MOC-10 deployment at Station B175 started at 22:25 (Trawl 025).

16 August 2015: The MOC-10 was secured on board at 04:08. A CTD rosette cast was conducted at 04:58. We tested the Diesel dewatering pump at 05:15, and it operated satisfactorily. The optics package ran from 06:31 to 06:50. At 09:46, we decided to omit the last cast of Station B175 and head to Station B080 (28°33'N 87°01'W). The fish disco and CTD rosette were placed in the water at 19:37. The CTD reached a maximum depth of 1721 m, and the retrieval of the CTD rosette occurred at 20:25. At 23:59, a MOC-10 deployment (Trawl 026) was made.

17 August 2015: At 02:51, the MOC-10 was secured on deck. The CTD rosette was cast at Station B080 at 08:02, and the optics package was in the water from 08:53 to 09:26. The MOC-10 was in the water at 10:12 and was retrieved at 14:45 (Trawl 027). At 18:02, we discovered that we were out of gear for the transducer. The CTD rosette and fish disco were deployed at 19:26, and the CTD surfaced at 22:13. The MOC-10 deployed at 22:33 (Trawl 028) and towed through the night.

18 August 2015: The MOC-10 was secured on board at 03:38, and the CTD rosette cast was from 03:48 to 05:27, reaching 2881 m. The optics package ran at 05:32, and the neuston net was towed from 06:09 to 06:36. The CTD rosette was cast at Station B003 (27°56'N 86°59'W) at 08:43. At 09:49, the MOC-10 deployed at Station B003, and retrieval occurred at 14:34 (Trawl 029). We were in transit to Station B079 (27°27'N 86°59'W) at 15:13. The CTD rosette and fish disco were in the water at 18:47, and the CTD rosette was secured on deck at 20:17. At Station B079, the optics package was deployed from 20:28 to 20:59, and the MOC-10 began trawling at 21:30 (Trawl 030).

19 August 2015: The MOC-10 was secured on deck at 03:07, and the CTD and fish disco entered the water at 03:17. There was an issue with the winch at 04:00. A second CTD cast occurred at 07:56 after the issue was resolved, and the cast reached a depth of 2972 m. We noticed that 3 raskens were damaged. The deployment of the MOC-10 occurred at 09:52 (Trawl 031), and it returned on board at 15:13. We were underway to Station SE-3 (26°56'N 87°06'W) at 16:00, and the CTD rosette, fish disco, and transducer were deployed at 18:44. The CTD rosette was on deck at 20:16, and the optics package was in the water from 20:30 to 20:59. The MOC-10 deployment for Trawl 032 started at 21:48.

20 August 2015: The MOC-10 was on board at 00:06, and we were finished processing Trawl 032 around 06:01. A CTD rosette cast was made at 07:28, and it reached a maximum depth of 2884 m. The MOC-10 was back in the water at 09:50, and Trawl 033 was towed until 11:56. Next, we were underway to Station B255 (27°47'N 86°54'W). A CTD rosette cast was made at 20:56 and reached 3092 m. The MOC-10 was deployed at 22:37 (Trawl 034).

21 August 2015: The MOC-10 was retrieved at 0:56. A CTD rosette cast was made at 05:30 and reached 3109 m. Trawl 035 was conducted at 09:21 and the MOC-10 was on board at 11:49. Headed back to Gulfport.

SUMMARY

1. OPERATIONS and PROTOCOLS

1.1. Midwater Trawling.

Midwater trawling was conducted using a 10-m^2 mouth area MOCNESS (MOC-10 hereafter) unit (Fig. 2), 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 (Fig. 3), 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 (Fig. 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). 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 in order to keep the MOCNESS frame at an optimal angle (between 35-50°).

1.2. Near-Surface Sampling.

When opportunities arose (e.g., during nighttime CTD casts) neustonic and near-surface organisms were collected via long-handled dipnet for genetic and/or stable isotope analyses. Examples of species collected included common squid (Fig. 5a) and frogfishes (Fig. 5b).

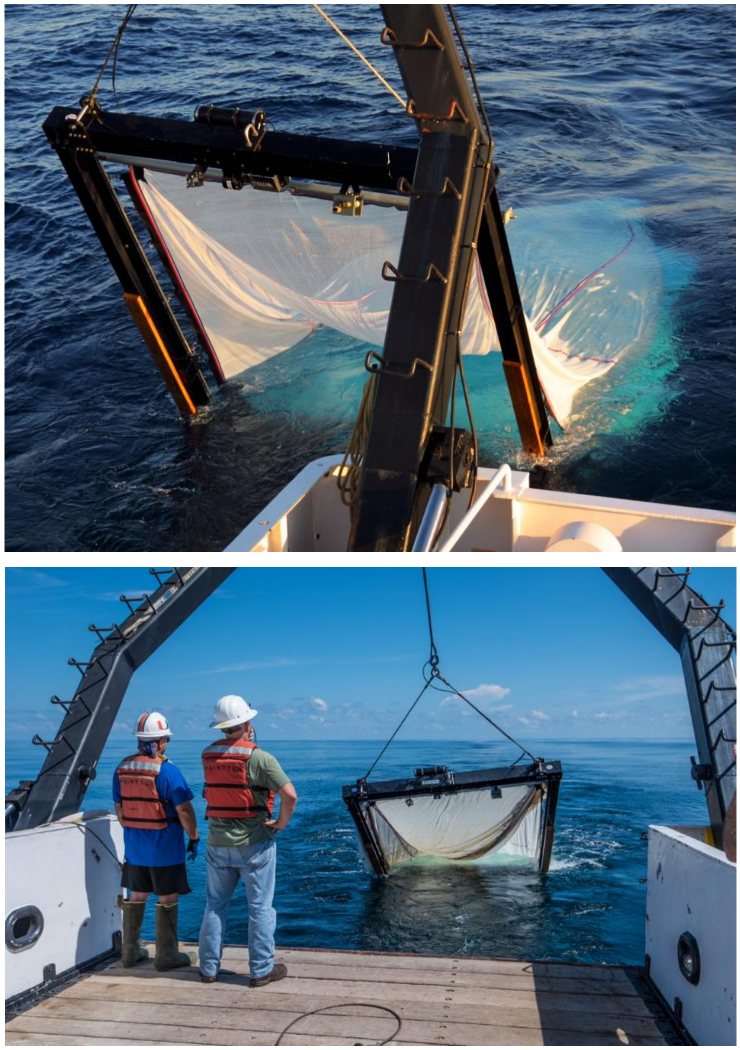


Figure 2. 10-m² MOCNESS (MOC-10) unit being deployed on the R/V *Point Sur* during DEEPEND cruise DP02.

Figure 3. MOC-10 cod ends.

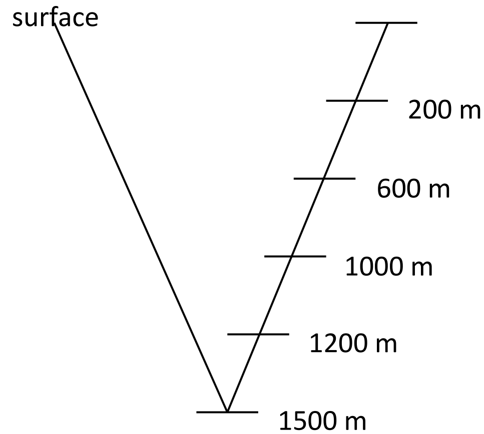


Figure 4. MOC-10 sampling depth scheme.

Figure 5. Near-surface specimens collected during DEEPEND cruise DP01. A) Common squid; b) Sargassum frogfish. Images courtesy of Danté Fenolio.

1.3. IAUCUC Permit.

All field protocols, fish handling and preservation, and removal of fish tissues were conducted in compliance with Florida Atlantic University IACUC protocol (Protocol #A15-06 Trawl surveys of deep-sea fishes) for the study of vertebrates and adhered to the USA legal requirements.

1.4. Hydroacoustics.

Multi-frequency acoustic profiling (38, 70, and 120 kHz) was conducted continuously during all MOC-10 deployments, CTD casts, and bio-optical profiler casts via a pole-mounted transducer (Fig. 6). Mechanical and electrical noise associated with operating the MOC-10 reduced the effective range of each echosounder. The 38, 70, and 120 kHz echosounders collected meaningful data to depths of approximately 1000 m, 400 m, and 100 m, respectively. An 18 kHz EK80 echosounder was not operational due to an internal conflict to the data acquisition software that could not be rectified at sea. The acoustics were calibrated using a tungsten sphere at sea following well-established procedures (e.g., Foote et al. 1987).

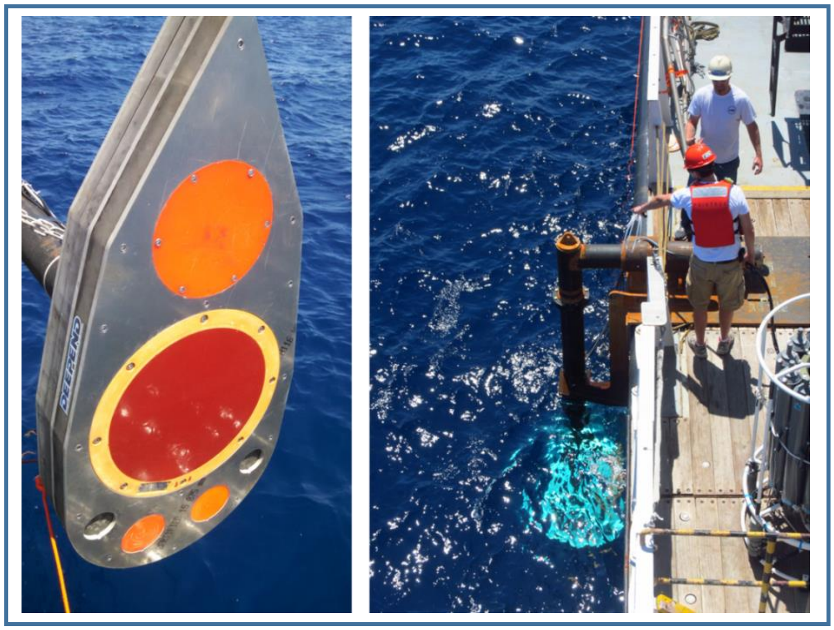


Figure 6. Hydroacoustics transducer (left) and transducer in sensing mode (boom lowered) on the R/V *Point Sur.*

1.5. CTD Profiling.

CTD profiles were conducted using the ship's CTD rosette (Fig. 7) at twelve stations. Eight stations were profiled twice, once at dawn and once at dusk, with the remainder being sampled either at dawn or dusk. One station was profiled three times due to complications with the equipment. Maximum profile depths depended on bottom depth and ranged from 1000-1700 m.

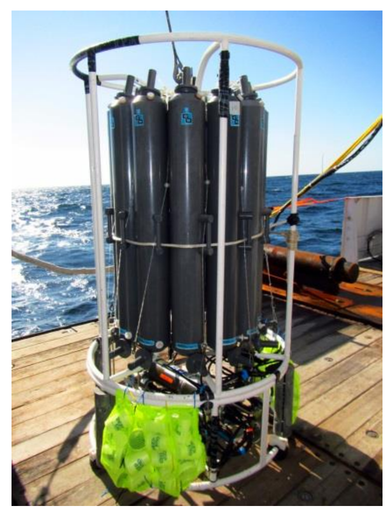


Figure 7. R/V *Point Sur* CTD rosette.

1.6. Water Collection.

Seawater was collected via CTD-mounted Niskin bottles (twelve 12-L bottles) from three or four depths, with multiple bottles per depth, and distributed according to the plan shown in Figure 8. Five additional seawater samples were collected from the ship's flow-through system (intake depth = 3 m).

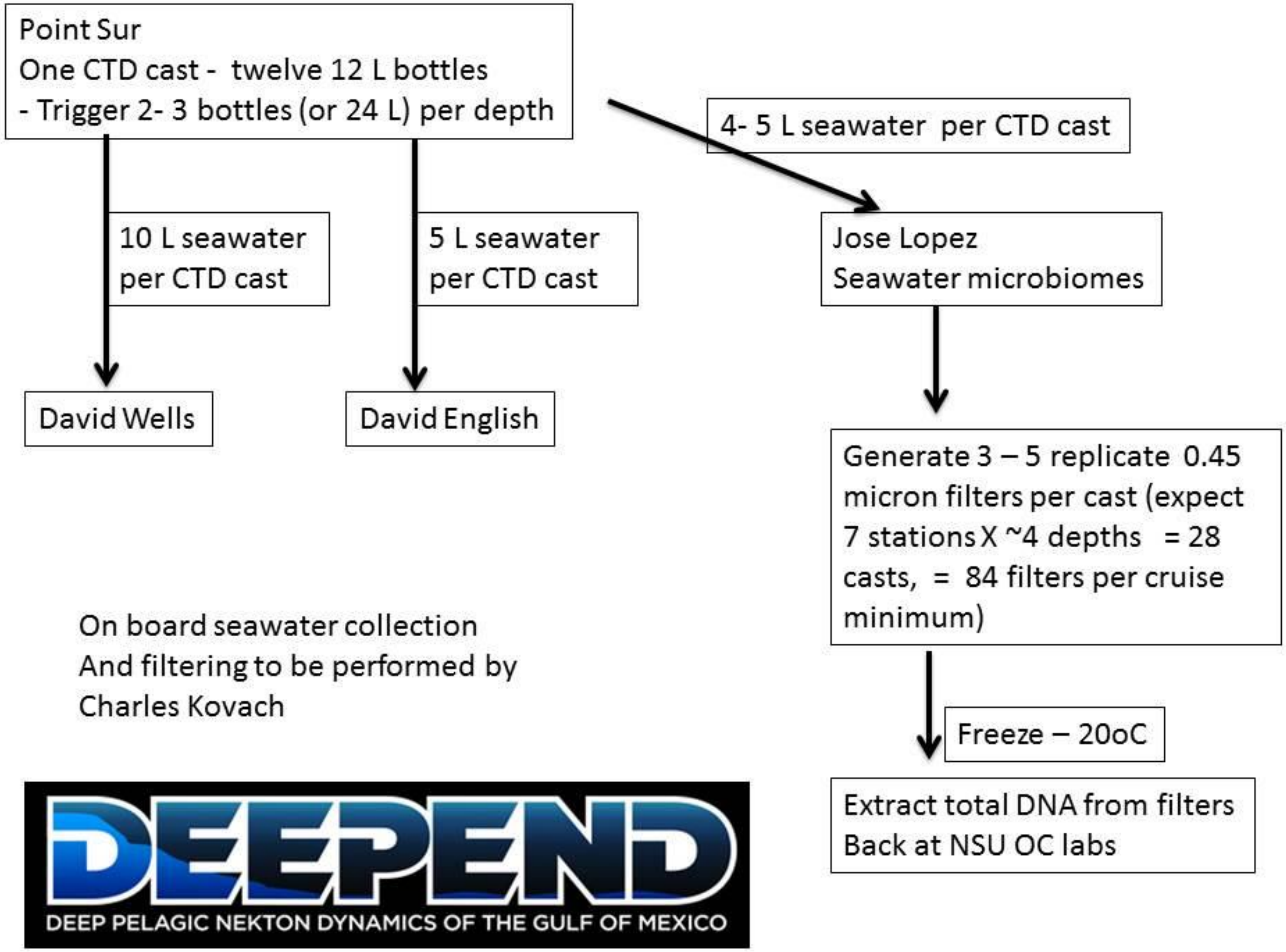


Figure 8. Distribution and processing of water samples collected during DP02.

1.7. Bio-Optical Profiling and Remote Sensing Reflectance Measurement.

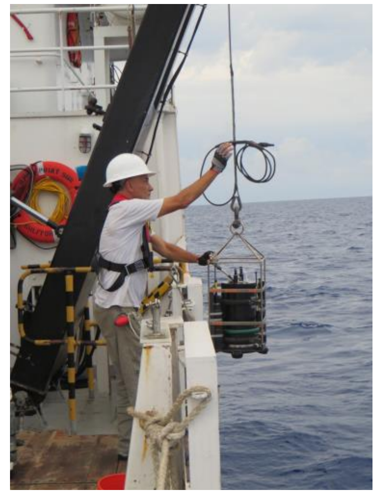


Figure 9. HS6 bio-optical profiler.

Water column optical properties were measured with a bio-optical profiler containing a HOBILabs HS6 and 2 WET Labs ECO instruments (Fig. 9). Profiles were collected at six stations, with one station sampled twice. The HS6 records depth and the backscattering of light at six wavelengths (420, 442, 470, 532, 590, and 700nm) at a scattering angle of ~ 140°. The ECO instruments, a WET Labs ECO BBFL2 and an ECO BBSB, were secured to the HS6's instrument cage. The BBFL2 measures backscattering of red light (650nm) at ~120°, and the stimulated emission of light at wavelengths where chlorophyll_a and dissolved organic material (CDOM) are known to fluoresce. The BBSB measures the backscattering of green light (532nm), also at ~1s20°.

1.8. Sampling on Station.

Sampling and sensing operations on station were organized around daytime and nighttime MOC-10 trawling (Table 1). Each MOC-10 deployment took approximately 6 h. MOC-10 sample processing occurred between MOC-10 deployments, as were CTD and bio-optical profiler 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 transit time, when transducer boom was raised.

1.9. Sample Processing Protocol.

Microbial genomics samples.

Carboys were rinsed with Millipore or DOI water and rinsed with the sample water from 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 molecular processing. Flowthrough seawater was retained in rinsed amber bottles, and stored at 4C for chemical nutrient analysis.

Nekton, micronekton, and macroplankton samples.

Upon MOC-10 recovery individuals 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

Table 1. DEEPEND Cruise DP02 daily schedule. Personnel listed by initials

	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	0:00
	Night MOC; acoustics			CTD		transit							Day MOC; acoustics			CTD		ad hoc sampling				Night MOC; acoustics		
						water filtering												water filtering						
TS				X	X	X	X	X	X							X	X	X	X	X	X			
JM				X	X	X	X	X	X							X	X	X	X	X	X			
TF				X	X	X	X	X	X							X	X	X	X	X	X			
HJ				X	X	X	X	X	X							X	X	X	X	X	X			
CK				X	X	X	X	X	X							X	X	X	X	X	X			
DF				X	X	X	X	X	X							X	X	X	X	X	X			
ER				X	X	X	X	X	X							X	X	X	X	X	X			
LM				X	X	X	X	X	X							X	X	X	X	X	X			
TR				X	X	X	X	X	X							X	X	X	X	X	X			
LT				X	X	X	X	X	X							X	X	X	X	X	X			
MW				X	X	X	X	X	X							X	X	X	X	X	X			
KB				X	X	X	X	X	X							X	X	X	X	X	X			
AS				X	X	X	X	X	X							X	X	X	X	X	X			
JW	X	X	X							X	X	X	X	X	X							X	X	X
GL	X	X	X							X	X	X	X	X	X							X	X	X

with the net from which samples were collected. Nalgenes were taken inside the ship's lab as they were washed down and stored cold in a Koolatron 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 all 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 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) for fishes lateral muscle tissue was dissected from the specimens' right side and then stored in 95% non-denatured alcohol; 2) for macrocrustaceans whole specimens were stored in RNALater and frozen; 3) for pteropods whole specimens were stored in 100% isopropanol; and 4) for cephalopods tissue samples were stored in RNALater and frozen. A subset of cephalopod specimens for genomic analysis was stored in liquid nitrogen. Fish specimens from which tissue was taken (i.e. vouchers) were individually marked with a paired tag matching that of the tissue sample and fixed in formalin.

For stable isotope (SIA), otolith microchemistry (OM), mercury (Hg), and polycyclic aromatic hydrocarbon (PAH) analyses whole specimens and/or tissue samples were frozen at -20°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. Specimens for the remaining analyses (SIA, OM, Hg) were individually bagged and frozen with the corresponding sample labels.

2. WATER COLUMN STRUCTURE AT THE STATIONS

Detailed hydrographic analyses are currently ongoing, but the predominant mesoscale oceanographic feature during DEEPEND cruise DP02, as in DP01, was a large anticyclonic Loop Current eddy (LCE) in the southwest quadrant of the DEEPEND sample grid. This feature was manifest in sea-surface velocity (Fig. 10). Hydrographic structure at depth is currently being characterized via analysis of CTD (Figs. 11-22) and MOC-10 sensor data. Depths of the chlorophyll maximum varied from 50 m to 100 m (Fig. 23).

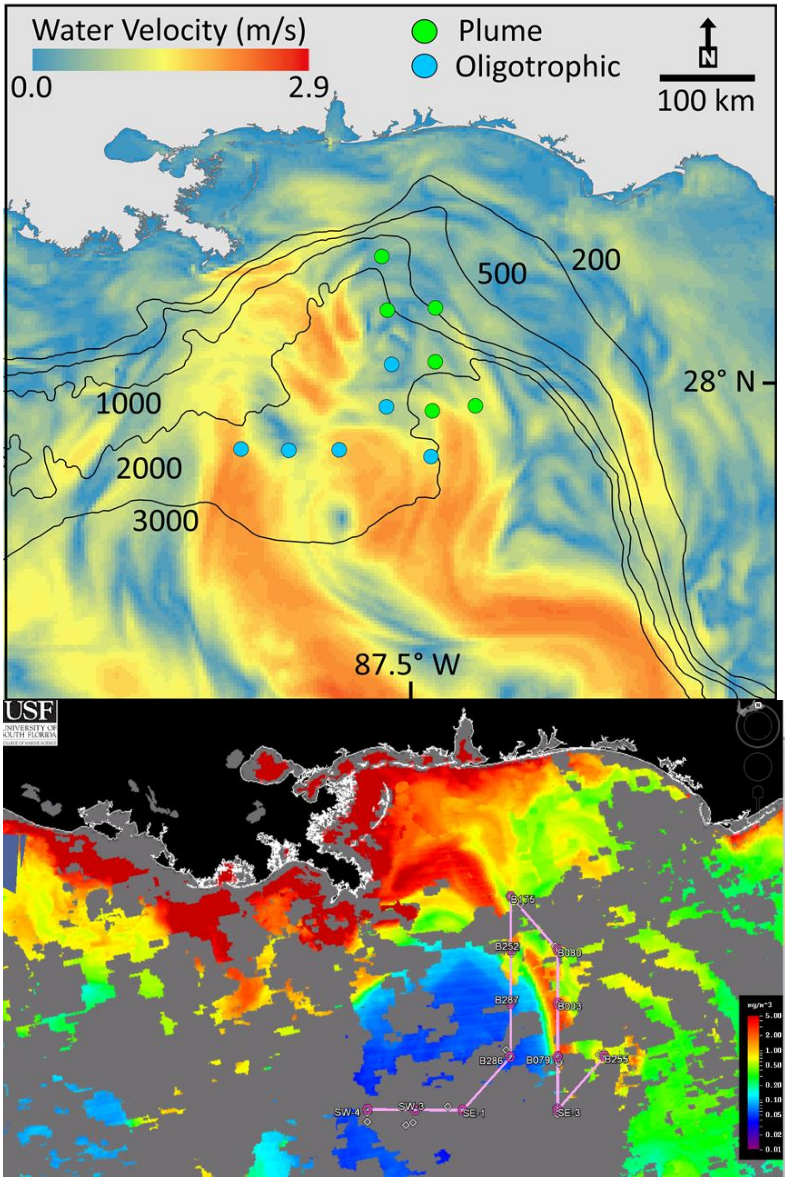


Figure 10. Top: physical oceanographic conditions during DEEPEND cruise DP02 (cruise stations indicated by circles, with chlrophyll characterization based on lower panel). Bottom: MODIS/Aqua 7-day composite Chla image between 9 - 15 August 2015 showing the Loop Current intrusion (blue water) and the Mississippi River plume. DP02 cruise track overlain.

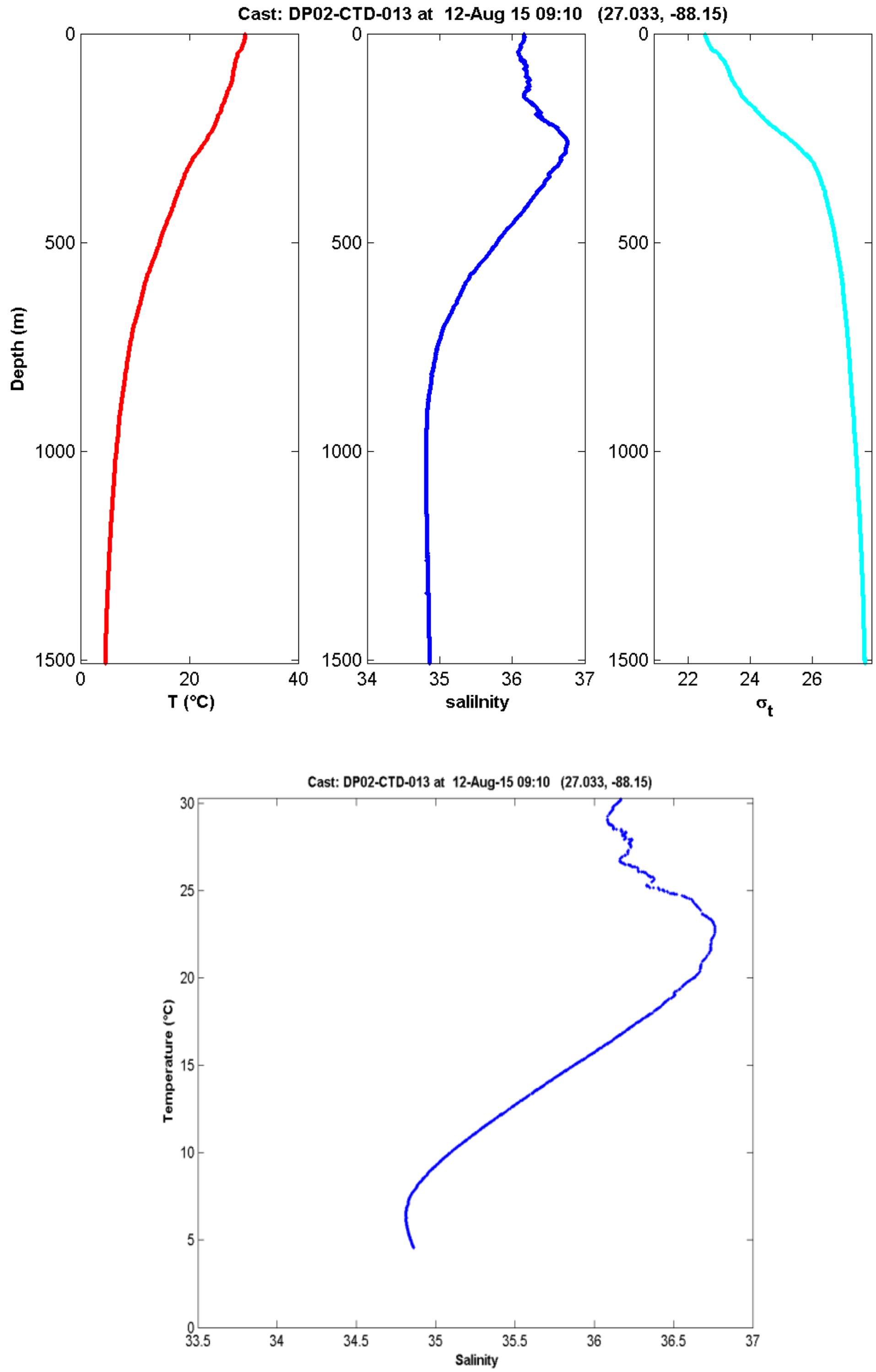


Figure 11. Full-depth CTD profile data – DEEPEND cruise DP02 station SE1 (Day).

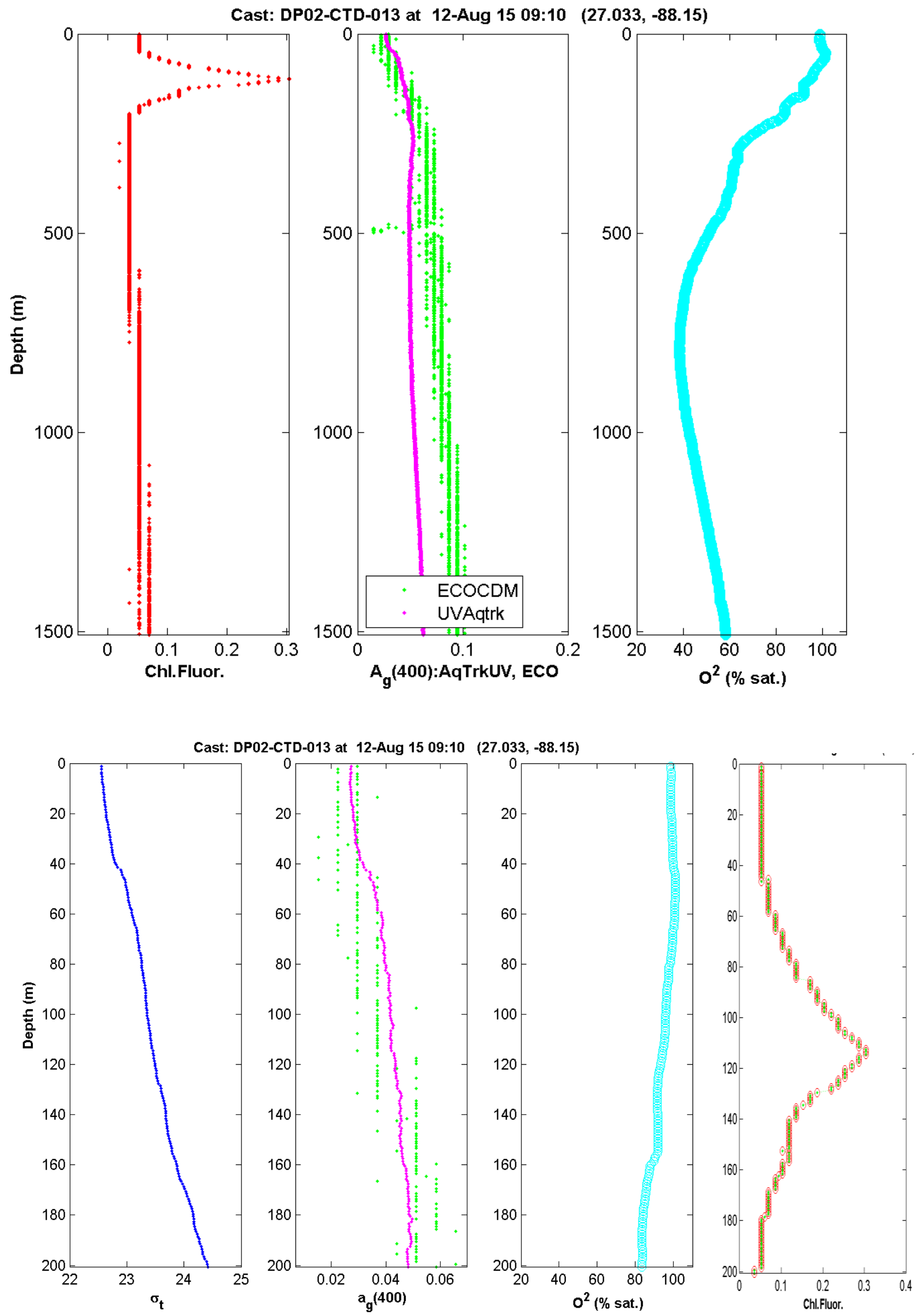
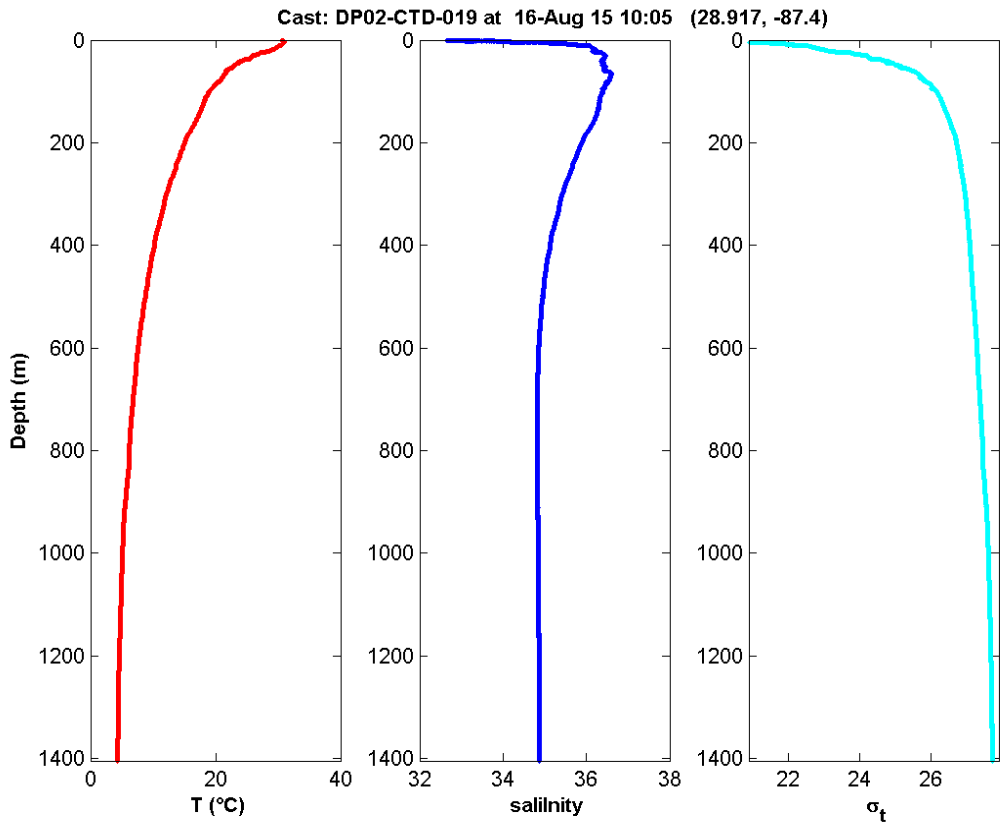


Figure 12. CTD data - 0-200 m expansion; DEEPEND cruise DP02 station SE1 (Day).



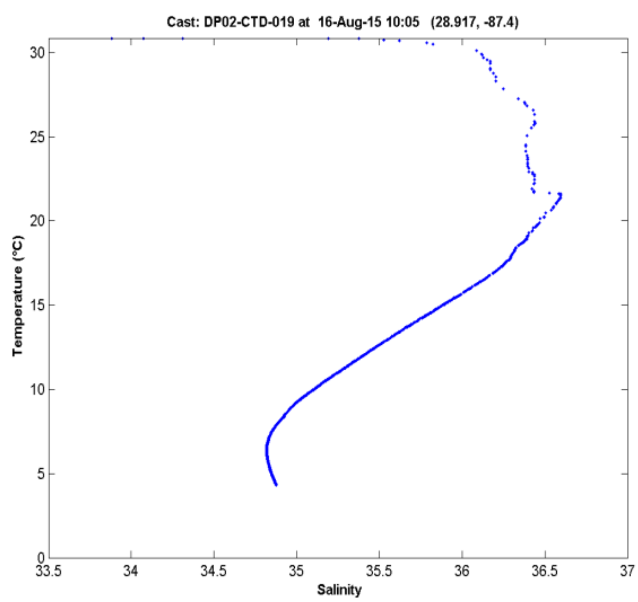
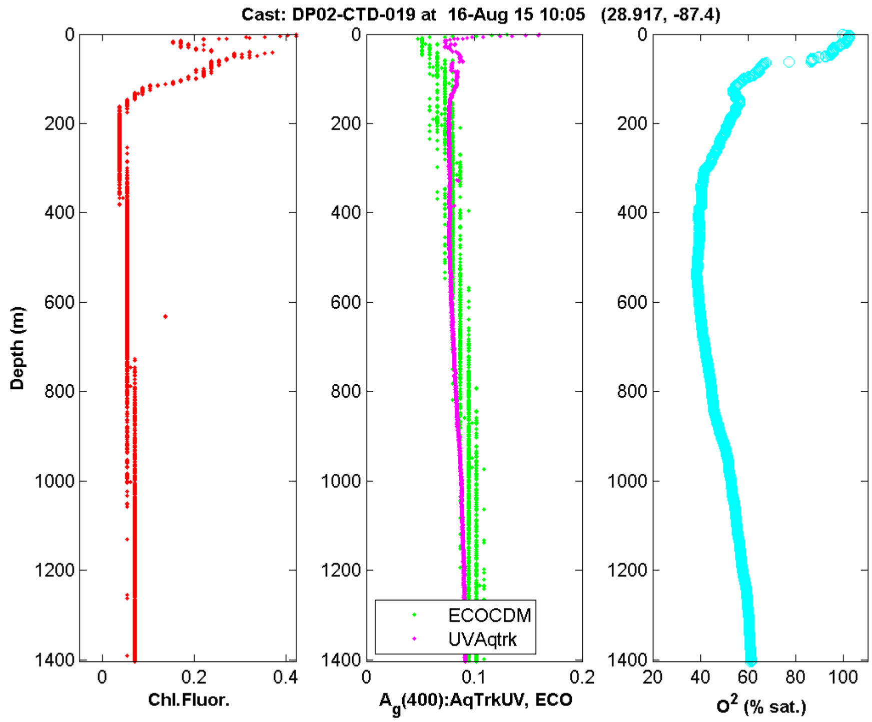


Figure 13. Full-depth CTD profile data – DEEPEND cruise DP02 station B175 (Day).



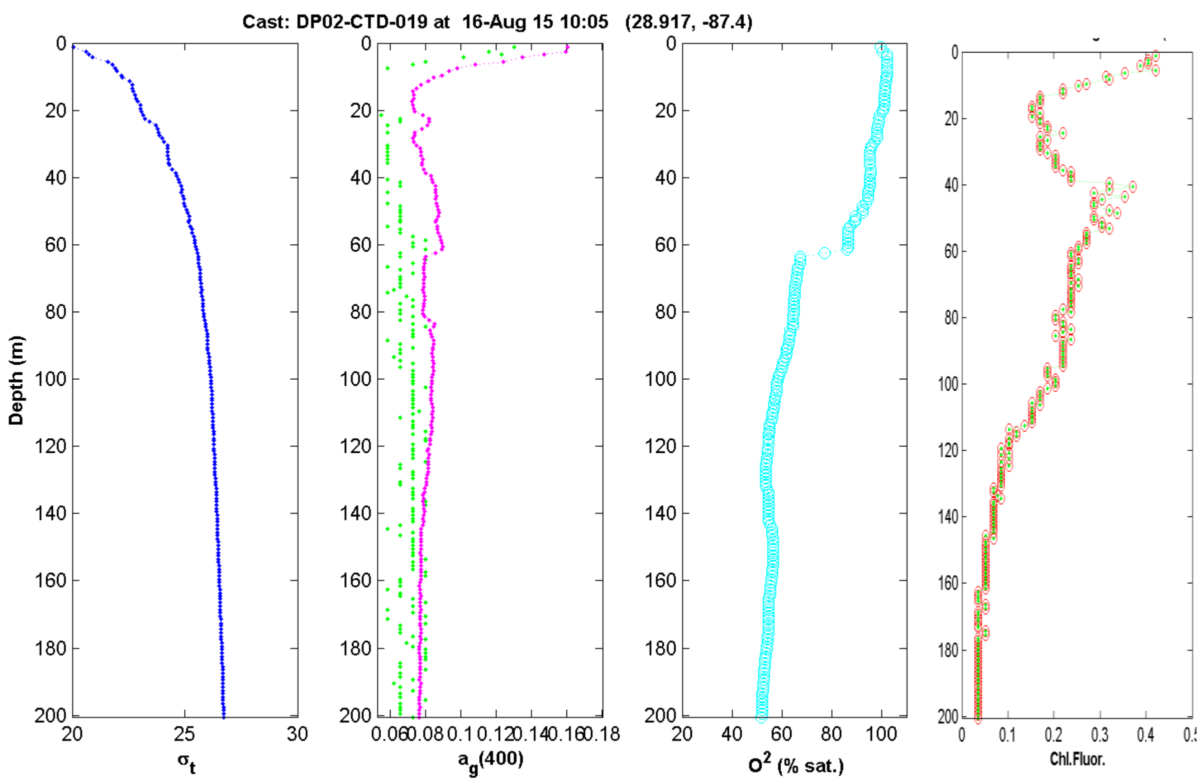


Figure 14. CTD data - 0-200 m expansion; DEEPEND cruise DP02 station B175 (Day).

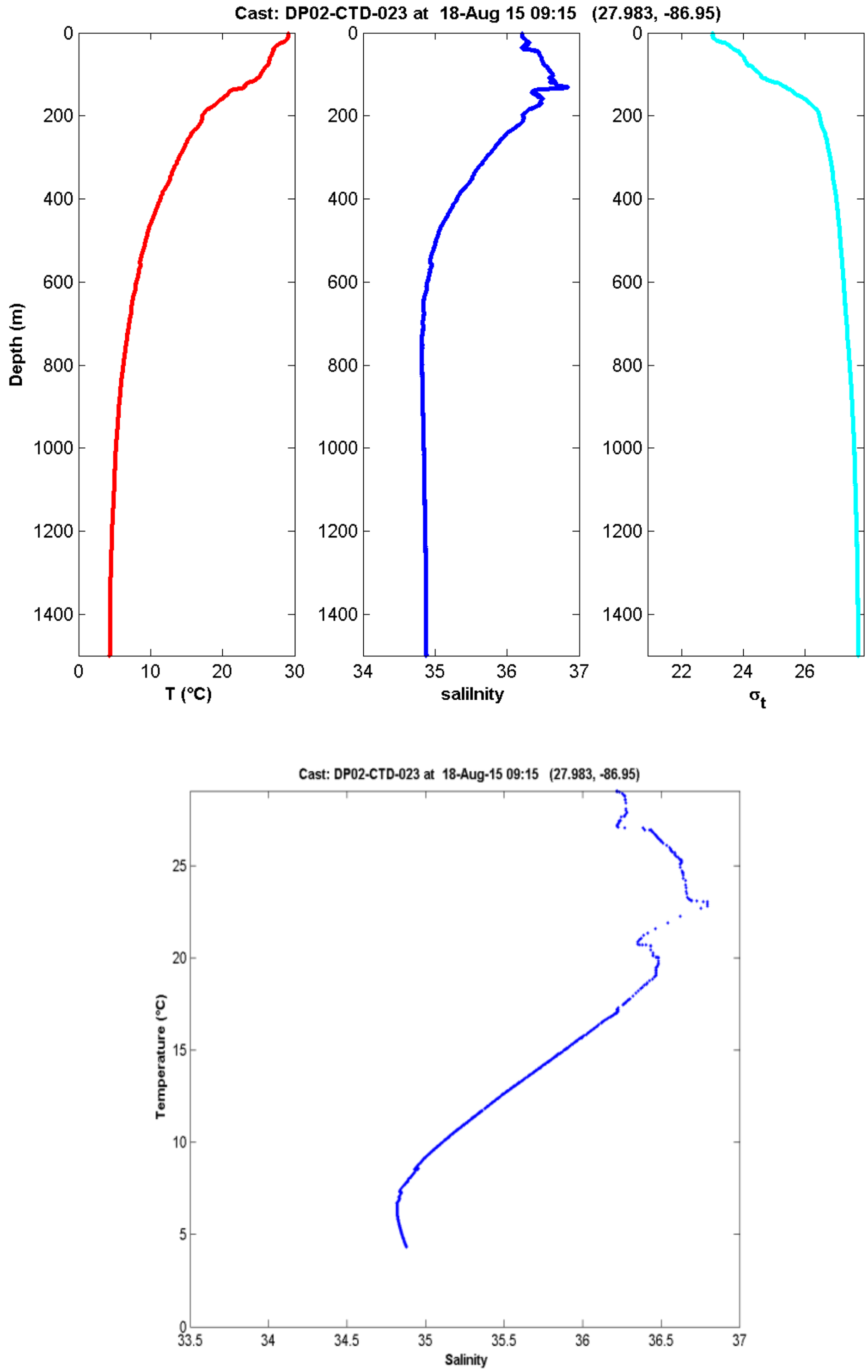
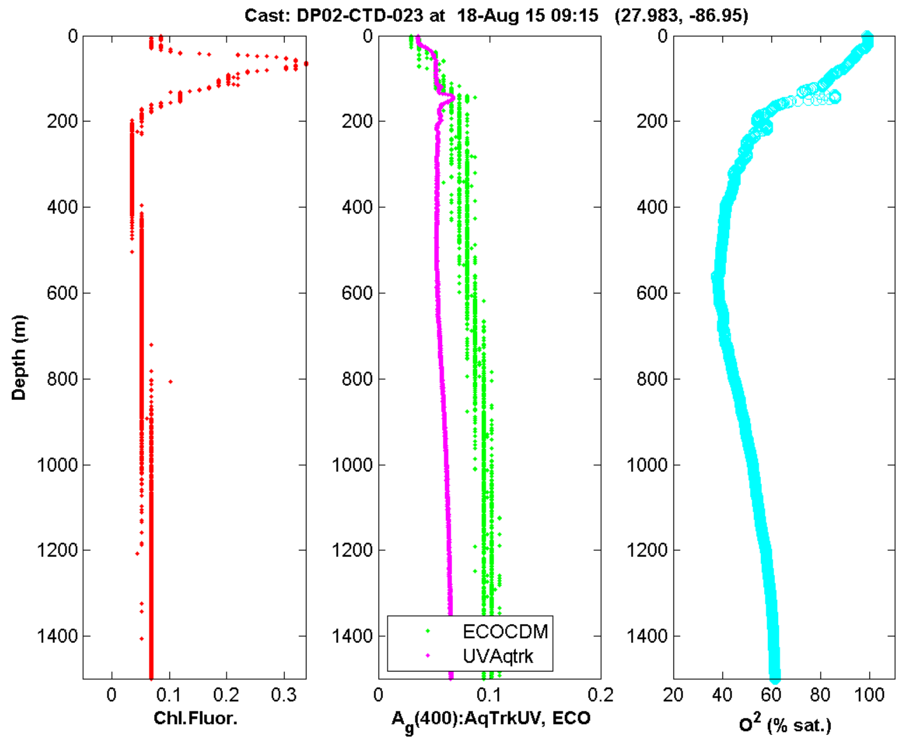


Figure 15. Full-depth CTD profile data – DEEPEND cruise DP02 station B003 (Day).



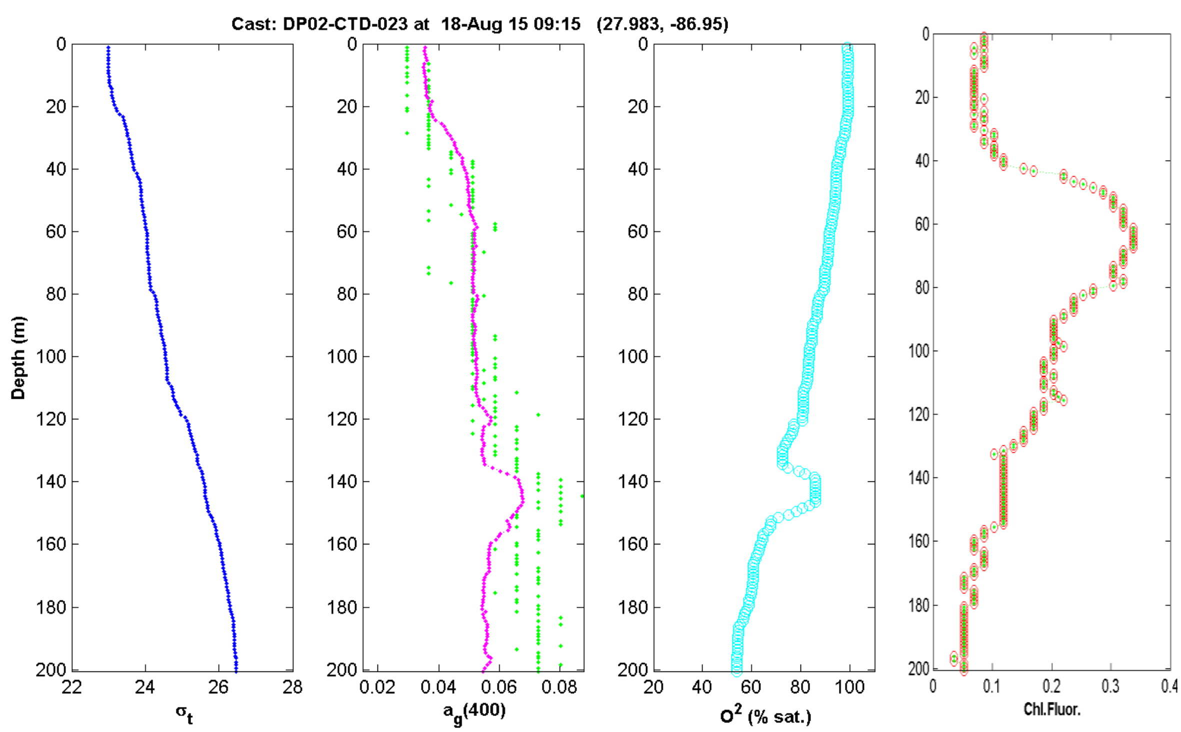


Figure 16. CTD data - 0-200 m expansion; DEEPEND cruise DP02 station B003 (Day).

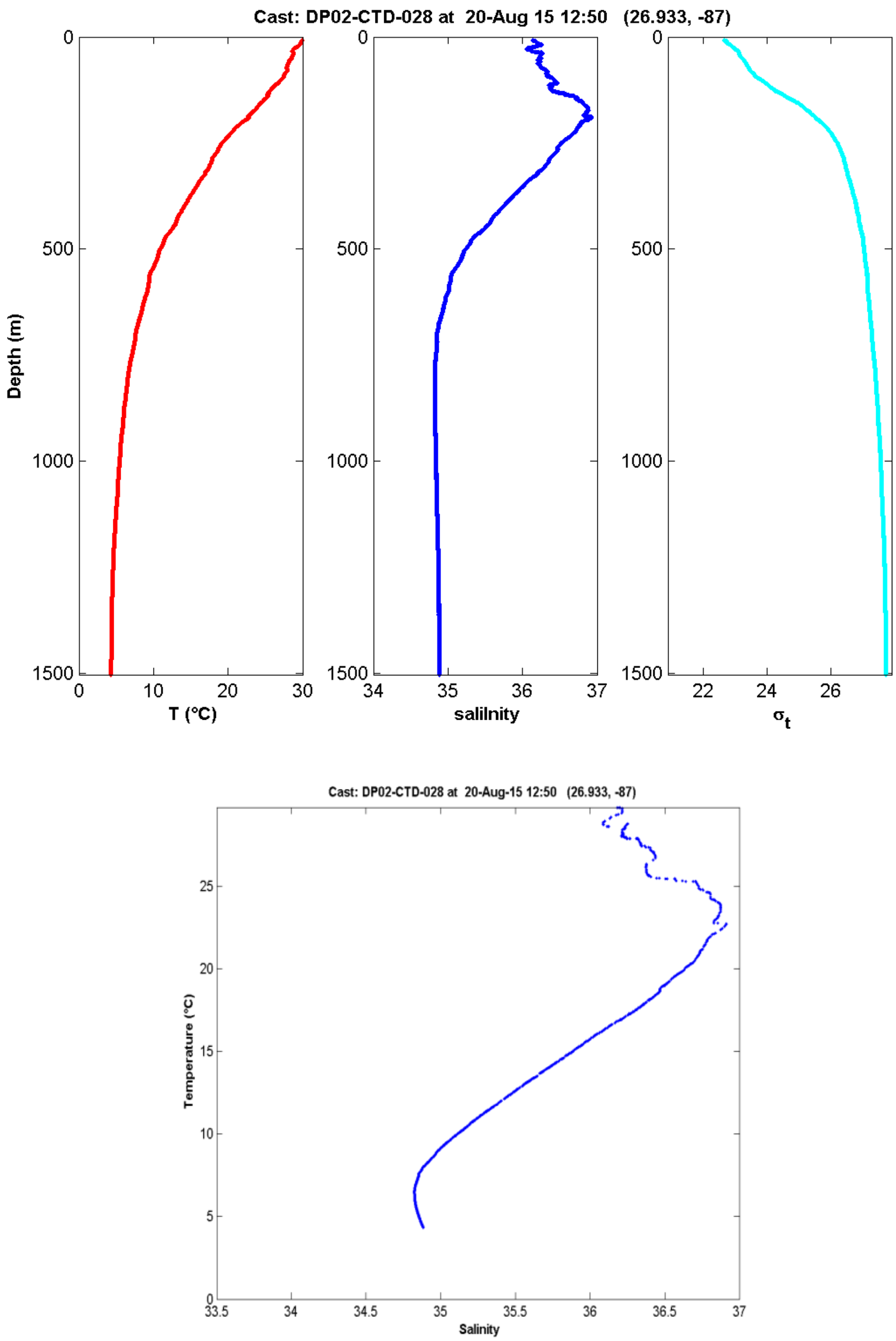


Figure 17. Full-depth CTD profile data – DEEPEND cruise DP02 station SE3 (Day).

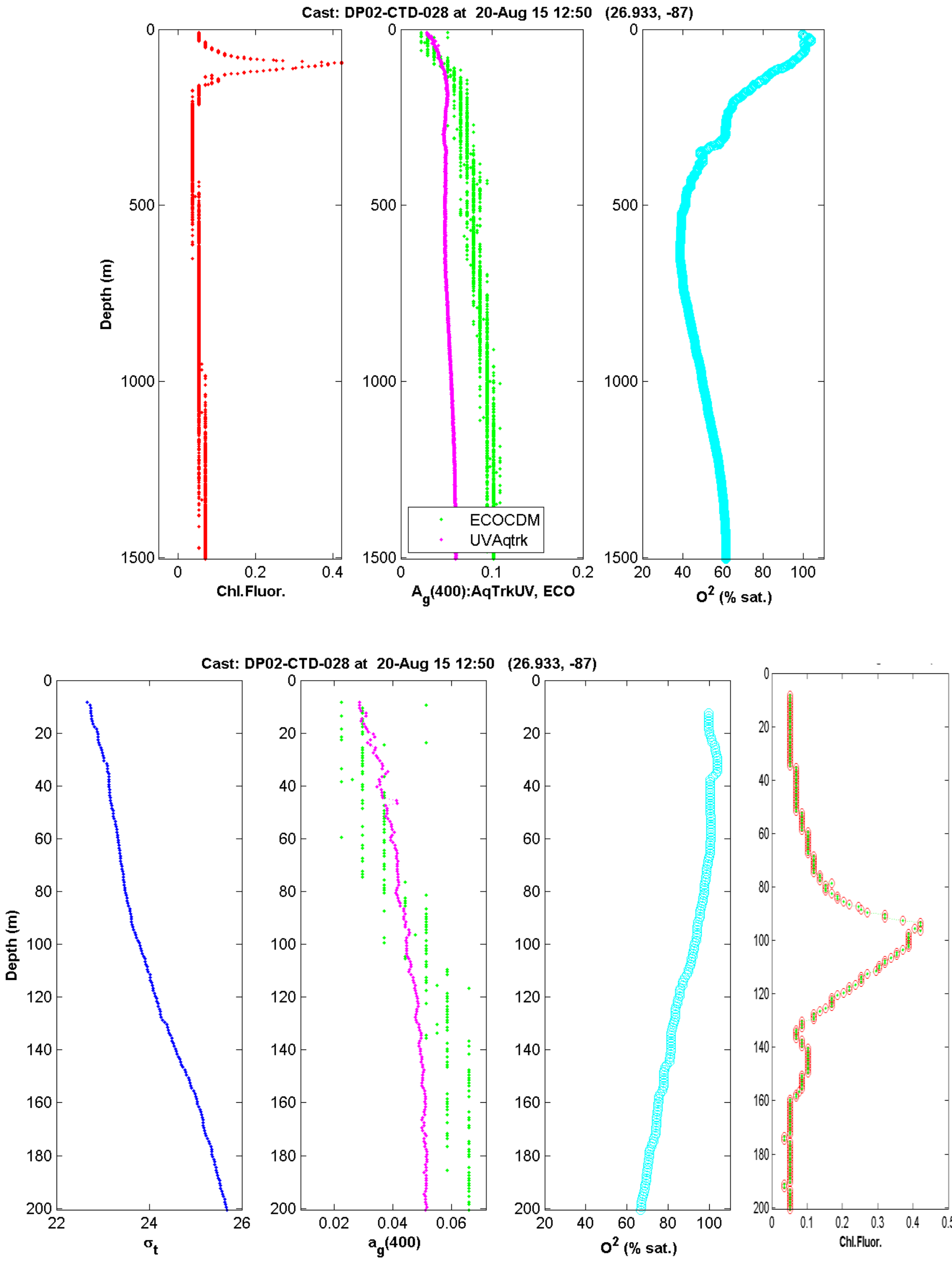
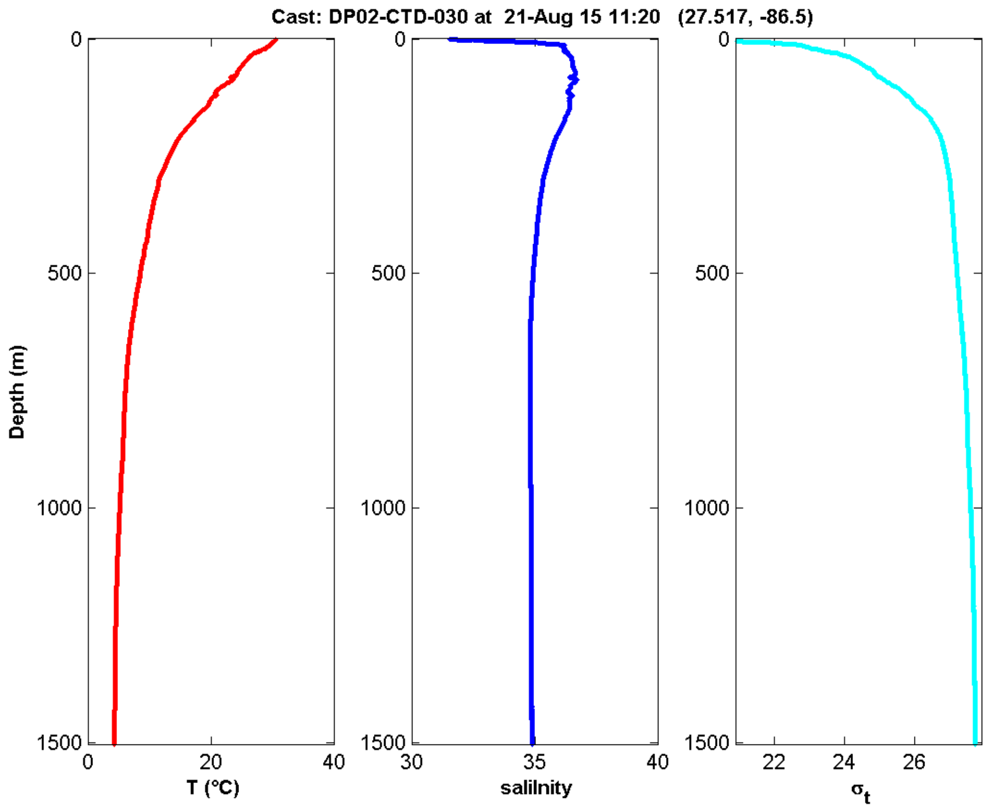


Figure 18. CTD data - 0-200 m expansion; DEEPEND cruise DP02 station SE3 (Day).



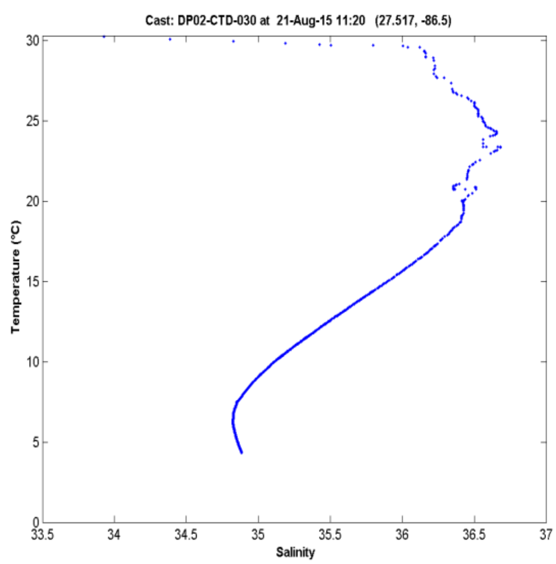
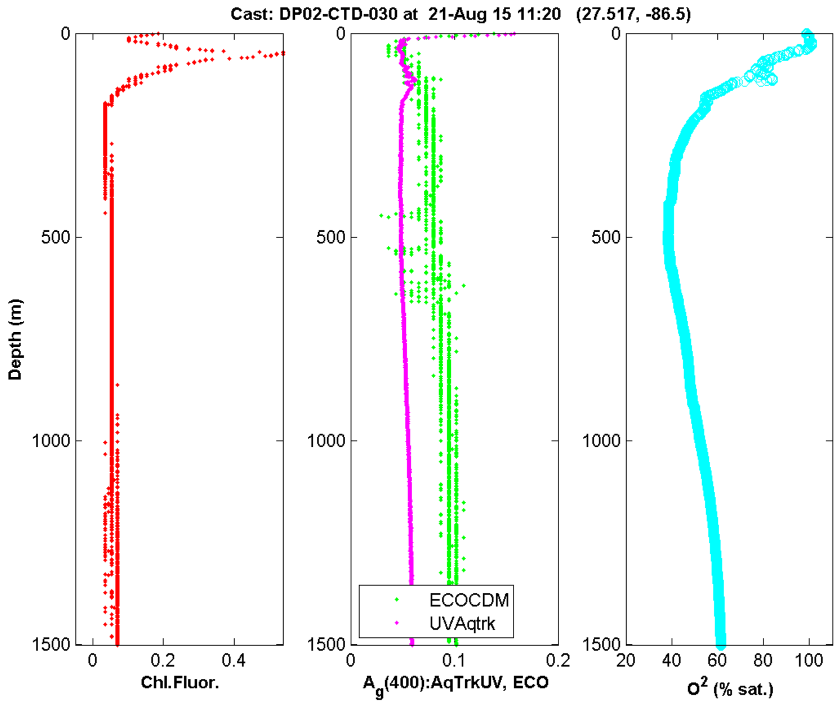


Figure 19. Full-depth CTD profile data – DEEPEND cruise DP02 station B255 (Day).



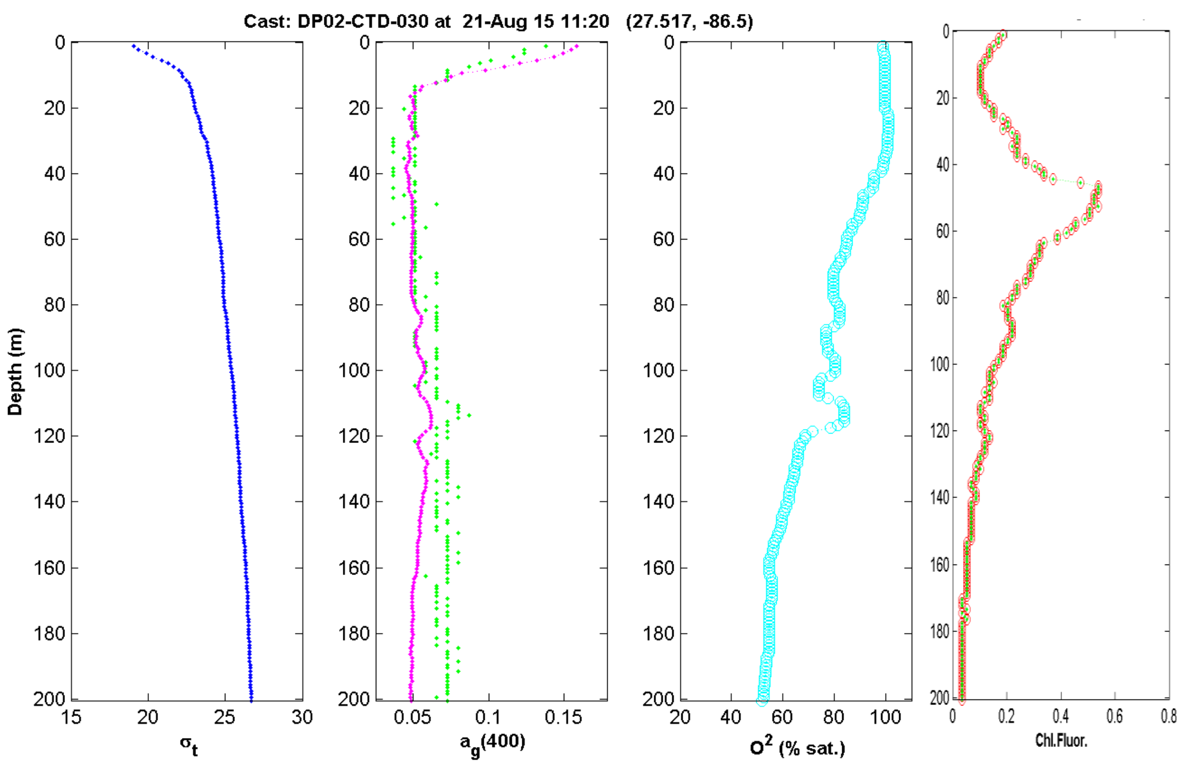


Figure 20. CTD data - 0-200 m expansion; DEEPEND cruise DP02 station B55 (Day).

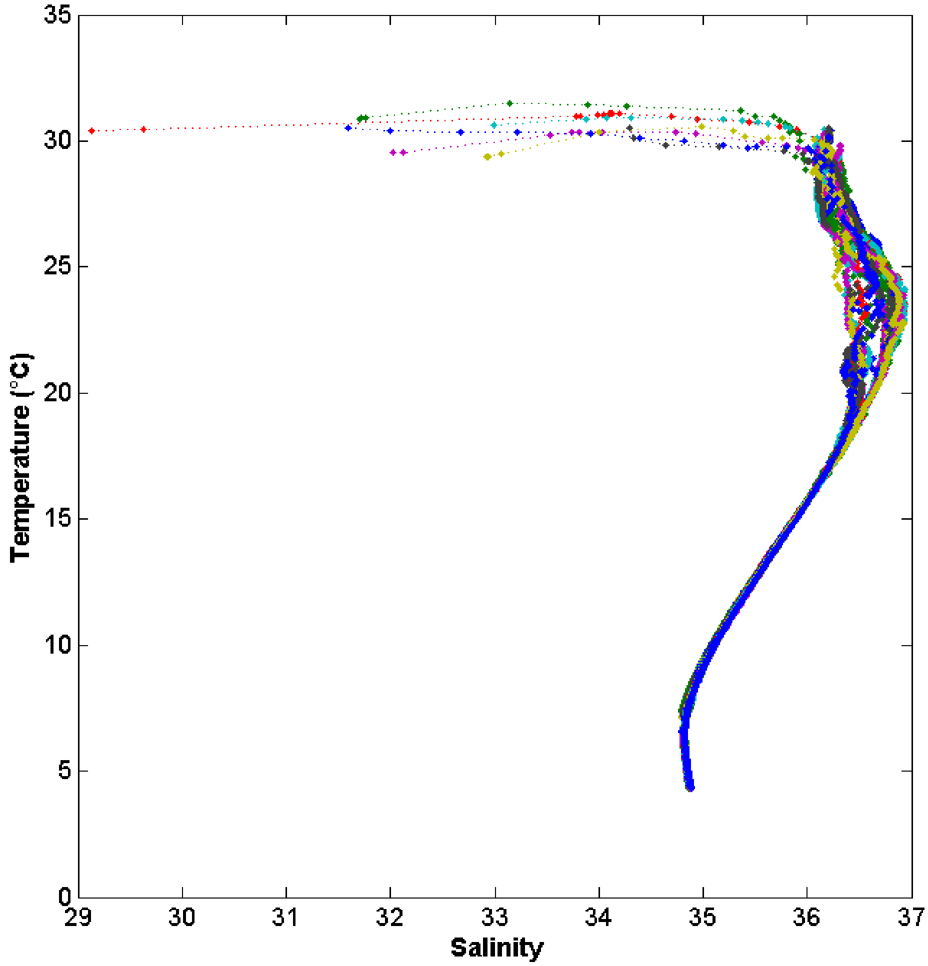


Figure 21. Temperature-salinity diagram – DEEPEND cruise DP02 - all stations.

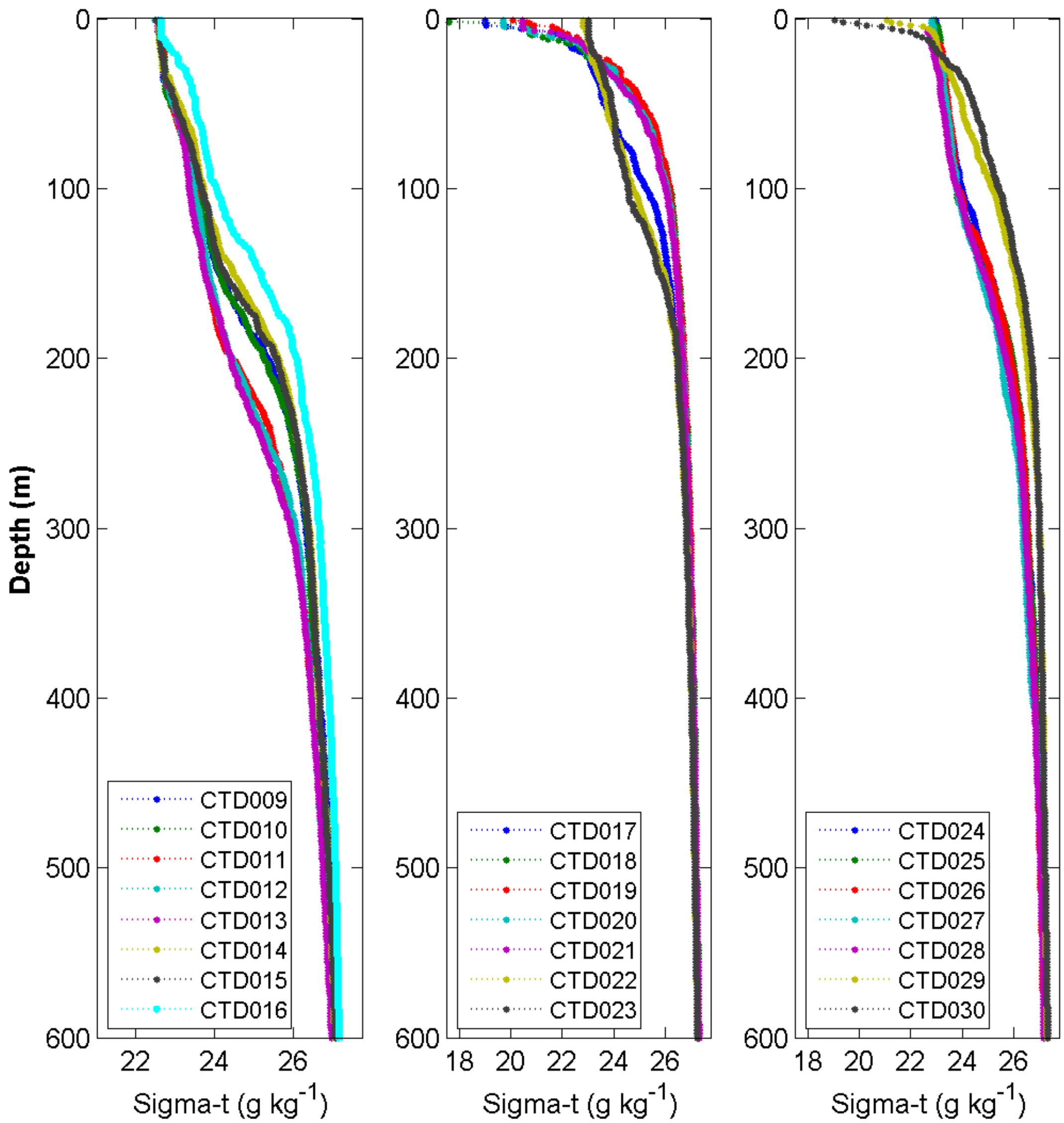


Figure 22. Seawater density profiles from early, middle, and late cruise casts – DEEPEND cruise DP02 CTD stations.

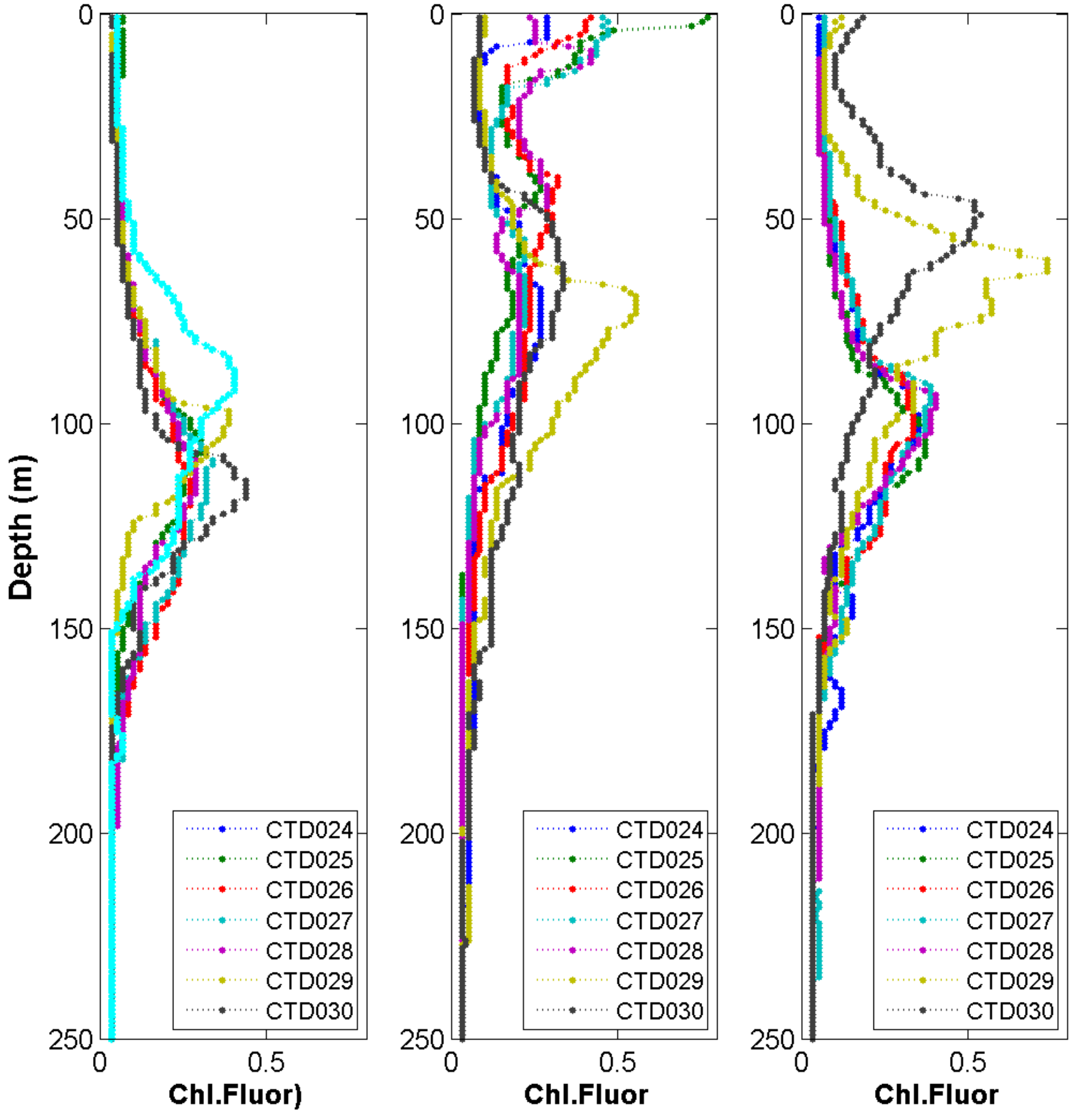


Figure 23. Chlorophyll fluorescence profiles from early, middle, and late cruise casts – DEEPEND cruise DP02 CTD stations.

3. INDIVIDUAL PROJECT REPORTS

3.1. MOCNESS Sampling.

A total of 147 trawl samples were collected during 23 deployments (Table 2, Fig. 24). Of these, 96 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 ~5 million cubic meters of water filtered. There were 23 "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 below) were taken from all trawls.

Table 2. MOC-10 trawl deployment time and location during DEEPEND cruise DP02

Trawl_No	Station	Sample Start Date	Start Time (CDT)	Start Lat	Start Lon	Sample End Date	Tow End Time (CDT)	End Lat	End Lon
013	SW-4	8/9/15	2:25	27.01	-89.00	8/9/15	3:36	26.96	-89.01
014	SW-4	8/9/15	21:10	27.02	-89.00	8/9/15	23:51	26.87	-89.00
015	SW-4	8/10/15	9:20	27.02	-89.00	8/10/15	12:09	26.87	-89.00
016	SW-3	8/10/15	21:15	27.01	-88.50	8/10/15	23:41	26.93	-88.60
017	SW-3	8/11/15	9:37	27.00	-88.49	8/11/15	12:02	26.87	-88.52
018	SE-1	8/11/15	21:52	27.00	-88.00	8/12/15	0:23	27.03	-88.16
019	SE-1	8/12/15	10:18	27.01	-87.97	8/12/15	12:58	26.97	-88.11
020	B286	8/12/15	22:10	27.49	-87.49	8/13/15	0:28	27.57	-87.55
021	B286	8/13/15	9:24	27.46	-87.47	8/13/15	11:21	27.51	-87.52
022	B287	8/13/15	22:13	27.96	-87.49	8/14/15	0:23	28.04	-87.50
023	B287	8/14/15	9:41	27.91	-87.42	8/14/15	12:07	27.96	-87.46
024	B252	8/14/15	21:59	28.47	-87.46	8/15/15	0:17	28.52	-87.56
025	B175	8/15/15	22:31	29.04	-87.52	8/16/15	1:15	28.92	-87.43
026	B080	8/16/15	21:50	28.55	-87.03	8/16/15	23:52	28.43	-86.94
027	B080	8/17/15	10:13	28.50	-86.96	8/17/15	12:22	28.40	-86.84
028	B003	8/17/15	22:30	27.91	-86.95	8/18/15	0:51	28.00	-86.96
029	B003	8/18/15	9:47	27.93	-86.96	8/18/15	11:59	27.99	-86.98
030	B079	8/18/15	21:29	27.45	-86.99	8/18/15	23:45	27.54	-87.01
031	B079	8/19/15	9:52	27.42	-86.99	8/19/15	12:14	27.51	-87.00
032	SE-3	8/19/15	21:52	26.93	-87.02	8/20/15	0:06	27.01	-86.98
033	SE-3	8/20/15	9:50	26.94	-87.00	8/20/15	11:56	27.02	-87.00
034	B255	8/20/15	22:37	27.47	-86.54	8/21/15	0:56	27.57	-86.54
035	B255	8/21/15	9:21	27.49	-86.49	8/21/15	11:49	27.56	-86.58

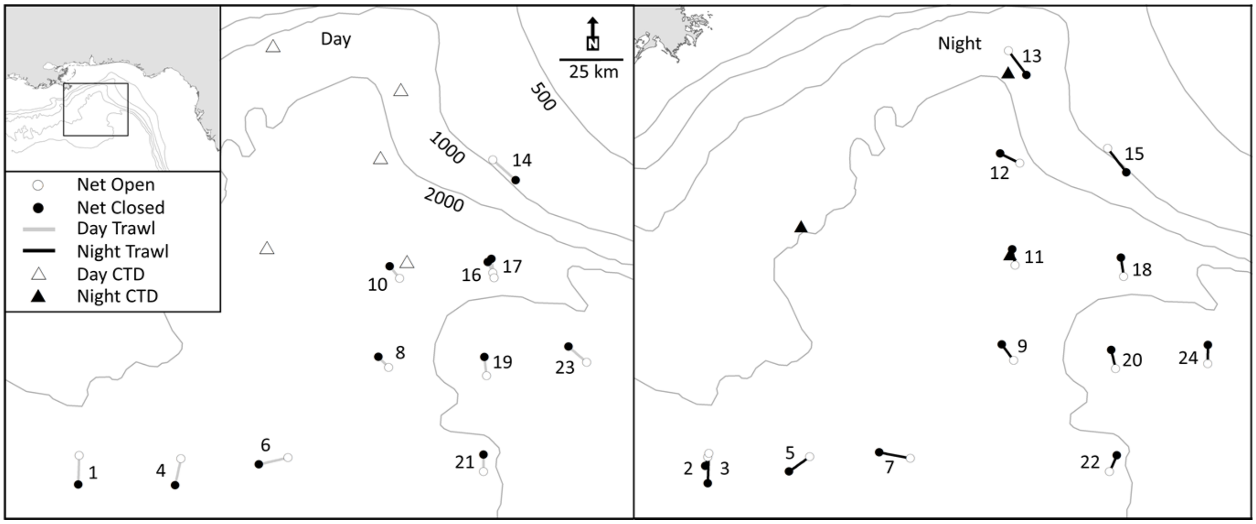


Figure 24. DEEPEND cruise DP02 MOC-10 trawl locations and trajectories.

3.1.1. Crustacea.

Approximately 5261 crustaceans were preserved in formalin for abundance and depth distribution studies (e.g., Fig. 25). This included approximately 920 oplophorids (including *Acanthephyra acanthetelsonis, A. acutifrons, A. brevirostris, A. curtirostris, A. purpurea, A. quadrispinosa, A. stylorostratis, Ephyrina ombango* and *E. benedicti, Hymenodora gracilis, Janicella spinacauda, Meningodora marptocheles, mollis* and *vesca, Notostomus elegans* and *gibbosus, Oplophorus gracilirostris* and *spinosus,* and *Systellaspis cristata* and *debilis),* 56 pandalids (dominated by *Stylopandalus richardi* and *Plesionika sp.*), 43 pasiphaeids (dominated by *Pasiphaea merriami* and *Parapasiphae sulcatifrons*), 1100 sergestids (dominated by *Sergestes sp., Sergia tenuiremis, robusta, grandis, splendens, hasjacobi and regalis*), 851 lophogastrids (dominated by the three *Eucopia* species – *sculpticauda, australis* and *grimaldi*, and four *Gnathophausia species – ingens, zoea, gracilis* and *gigas*), over 1290 euphausiids that need to be identified under a microscope, 800 benthesicymids (dominated by *Gennadas sp.)* and 22 individuals of the relatively rare disciadid *Lucaya bigelowi*.

Figure 25. *Ephyrina ombango* collected during DEEPEND cruise DP02.

3.1.2. Mollusca.

89 cephalopod specimens, representing 18 families and 31 species, were collected, along with 1566 pteropod and 21 heteropod specimens, whose analysis is ongoing (e.g., Fig. 26).

Figure 26. Cephalopod (*Abralia redfieldi*) and pteropod specimens collected during DEEPEND cruise DP02.

3.1.3. Fishes.

Thousands of fish specimens were collected, with analysis currently ongoing. A minimum total of 4,161 species were identified at sea, including at least one putative undescribed species of the dragonfish genus *Astronesthes* (Fig. 27), which was previously caught in cruise DP01 as well.

Figure 27. *Astronesthes* sp. nov. (Sutton in progress), collected during DEEPEND cruise DP01 and DP02.

3.1.4. Other Invertebrates.

All invertebrates other than macrocrustacea (gelantinous zooplankton, chaetognaths, nemerteans, polychaetes, gastropods, etc) were kept with the original sample and fixed in 10% formalin. These will be processed in detail in lab.

3.2. Genetic/Genomics Analyses.

3.2.1. Pelagic Microbial Assemblages.

Microbial communities at each station were sampled by 5-7 L CTD water collections at various depths (Table 3), which were then filtered through combusted GFF filters and PALL GN-6 0.45 micron. This sampling was designed to capture microbial eukaryotes, and then bacterioplankton, respectively, at various depths and provide a basis for comparison. A maximum of 5 L seawater was required for microbial sampling. Each filter was handled with gloves and in such a way to avoid as much contamination as possible. Following the filtering, filters were stored at -20°C for the duration of the cruise and returned to the NSU Molecular microbiology lab (Co-PI Lopez) for future DNA processing. Selected 125-ml water samples were also delivered to Dr. Piero Gardenilli for nutrient analyses. Ancillary samples of anglerfish and dragonfish “esca” (lures) were also sampled for preliminary analysis of esca microbiomes and symbionts.

3.2.2. Crustacea.

A total of 285 crustacean were collected from the various sites and stored in RNAlater® for population genetics studies. The most common species included *Acanthephyra purpurea* (29), *Acanthephyra stylorostrata* (29), *Eucopia sculpticauda* (37), *Stylopandalus richardi* (28), *Sergia grandis* (16), *Sergia robusta* (9), *Sergia splendens* (36), *Sergia tenuiremis* (20), and *Systellaspis debilis* (33). An additional 107 individuals were collected in ethanol for barcoding, and are in the process of being identified.

3.2.3. Cephalopoda and Other Pelagic Mollusca.

Twenty cephalopod species were collected for genetic barcoding, collected for population genetics studies (Table 4).

3.2.4. Gastropoda (pteropods).

After manual micronekton and nekton sorting, pteropods were removed (Table 5) and preserved in isopropanol for identification and genetic sequencing by Dr. Stephanie Bush, Monterey Bay Aquarium Research Institute. Pteropods were not counted at sea, with total numbers exceeding 1000.

3.2.5. Fishes

A total of 1,175 fish tissue samples were collected for genetic analysis from 290 species (Table 6). 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). From the total list of fish species, adequate sample size for barcoding (n = 15) was achieved for 43 species (Appendix I). Esca (lures) were also taken from *Cryptopsaras couesii* (n = 5) and *Stomias affinis* (n = 1). Following the cruise fish tissue samples were parsed between Eytan's (TAMUG) and Shivji's (NSU OC) labs according to the scheme detailed in Appendix II.

Table 3. Pelagic microbial assemblage samples collected during DEEPEND cruise DP02

DATE	SITE	IDENTIFIER	DEPTH	BOTTLE	REPLICATES
8/9/2015	SW4	CTD_009	1466m	1	3
			600m	4	3
			130m	9	3
			1m	11	3
8/10/2015	SW4	CTD_010	1500m	2	3
			650m	3	3
			110m	9	3
			1m	11	3
8/12/2015	SE1	CTD_013	1500m	1	3
			750m	4	3
8/13/2015	B286	CTD_014	1490 m	1	3
			660m	4	3
8/14/2015	B287	CTD_16	1507m	2	3
			467m	5	3
			90m	8	3
			1m	12	3
	B252	CTD_17	1500m	1	3
			462m	4	3
			70m	5	3
			1m	10	3
8/15/2015	B175	CTD_18	1500	1	3
			450	4	3
			40	7	3
			0	10	3
8/16/2015	B175	CTD_19	1404	1	3
			399	4	3
			1	11	3
8/16/2015	B080	CTD_20	800	1	3
			498	4	3
			73	8	3
			1	11	3
8/17/2015	B080	CTD_21	800	11	3
			500	6	3
			43	9	3
			43	12	3
	B003	CTD_22	1510	1	3
			457	6	3

			72	7	3
			1	11	3
8/18/2015	B003	CTD_23	1492	1	3
			565	6	3
			42	7	3
			1	11	3
	B079	CTD_24	1510	1	3
			600	4	3
			92	8	3
			1	11	3
8/19/2015	SE3	CTD_27	1499	1	2
8/20/2015	SE3	CTD_28	1500	1	2
	B255	CTD_29	1496	1	3
	B255	CTD_30	1500	1	2

Table 4. Cephalopod species collected for genetics studies during DEEPEND cruise DP02

Species	**N**
Abraliopsis atlantica	1
Bathothauma lyromma	1
Bathyteuthis sp. A	1
Bolitaena pygmaea	3
Cycloteuthis sirventi	2
Discoteuthis discus	1
Heteroteuthis dagamensis	4
Hyaloteuthis pelagica	2
Japetella diaphana	3
Joubiniteuthis portieri	1
Liguriella podophthalma	1
Lycoteuthis lorigera	1
Mastigoteuthis agassizii	3
Mastigoteuthis atlantica	3
Mastigoteuthis hjorti	1
Narrowteuthis nesisi	1
Octopoteuthis sp.	2
Ornithoteuthis antillarum	3
Pyroteuthis margaritifera	4
Vampyroteuthis infernalis	6

Table 5. Samples from DEEPEND cruise DP02 from which pteropods were removed.

Sample_ID	**Sample_ID cont.**
DP02-09Aug15-MOC10-SW-4N-013-N0	DP02-16Aug15-MOC10-B080N-026-N3
DP02-09Aug15-MOC10-SW-4N2-014-N0	DP02-16Aug15-MOC10-B080N-026-N5
DP02-09Aug15-MOC10-SW-4N2-014-N5	DP02-17Aug15-MOC10-B003N-028-N0
DP02-10Aug15-MOC10-SW-3N-016-N0	DP02-17Aug15-MOC10-B003N-028-N1
DP02-10Aug15-MOC10-SW-3N-016-N3	DP02-17Aug15-MOC10-B003N-028-N2
DP02-10Aug15-MOC10-SW-3N-016-N4	DP02-17Aug15-MOC10-B003N-028-N3
DP02-10Aug15-MOC10-SW-3N-016-N5	DP02-17Aug15-MOC10-B003N-028-N4

DP02-10Aug15-MOC10-SW-4D-015-N0	DP02-17Aug15-MOC10-B003N-028-N5
DP02-10Aug15-MOC10-SW-4D-015-N4	DP02-17Aug15-MOC10-B080D-027-N0
DP02-10Aug15-MOC10-SW-4D-015-N5	DP02-17Aug15-MOC10-B080D-027-N2
DP02-11Aug15-MOC10-SE-1N-018-N0	DP02-17Aug15-MOC10-B080D-027-N4
DP02-11Aug15-MOC10-SE-1N-018-N1	DP02-17Aug15-MOC10-B080D-027-N5
DP02-11Aug15-MOC10-SE-1N-018-N5	DP02-18Aug15-MOC10-B003D-029-N0
DP02-11Aug15-MOC10-SW-3D-017-N4	DP02-18Aug15-MOC10-B003D-029-N1
DP02-11Aug15-MOC10-SW-3D-017-N5	DP02-18Aug15-MOC10-B003D-029-N2
DP02-12Aug15-MOC10-B286N-020-N0	DP02-18Aug15-MOC10-B003D-029-N3
DP02-12Aug15-MOC10-B286N-020-N3	DP02-18Aug15-MOC10-B003D-029-N4
DP02-12Aug15-MOC10-B286N-020-N5	DP02-18Aug15-MOC10-B003D-029-N5
DP02-12Aug15-MOC10-SE-1D-019-N0	DP02-18Aug15-MOC10-B079N-030-N0
DP02-12Aug15-MOC10-SE-1D-019-N3	DP02-18Aug15-MOC10-B079N-030-N1
DP02-12Aug15-MOC10-SE-1D-019-N4	DP02-18Aug15-MOC10-B079N-030-N2
DP02-12Aug15-MOC10-SE-1D-019-N5	DP02-18Aug15-MOC10-B079N-030-N3
DP02-13Aug15-MOC10-B286D-021-N0	DP02-18Aug15-MOC10-B079N-030-N5
DP02-13Aug15-MOC10-B286D-021-N1	DP02-19Aug15-MOC10-B079D-031-N0
DP02-13Aug15-MOC10-B286D-021-N2	DP02-19Aug15-MOC10-B079D-031-N3
DP02-13Aug15-MOC10-B286D-021-N3	DP02-19Aug15-MOC10-B079D-031-N4
DP02-13Aug15-MOC10-B286D-021-N4	DP02-19Aug15-MOC10-B079D-031-N5
DP02-13Aug15-MOC10-B286D-021-N5	DP02-19Aug15-MOC10-SE-3N-032-N0
DP02-13Aug15-MOC10-B287N-022-N0	DP02-19Aug15-MOC10-SE-3N-032-N1
DP02-13Aug15-MOC10-B287N-022-N1	DP02-19Aug15-MOC10-SE-3N-032-N3
DP02-13Aug15-MOC10-B287N-022-N3	DP02-19Aug15-MOC10-SE-3N-032-N5
DP02-13Aug15-MOC10-B287N-022-N4	DP02-20Aug15-MOC10-B255N-034-N0
DP02-13Aug15-MOC10-B287N-022-N5	DP02-20Aug15-MOC10-B255N-034-N1
DP02-14Aug15-MOC10-B252N-024-N0	DP02-20Aug15-MOC10-B255N-034-N2
DP02-14Aug15-MOC10-B252N-024-N1	DP02-20Aug15-MOC10-B255N-034-N3
DP02-14Aug15-MOC10-B252N-024-N3	DP02-20Aug15-MOC10-B255N-034-N4
DP02-14Aug15-MOC10-B252N-024-N4	DP02-20Aug15-MOC10-B255N-034-N5
DP02-14Aug15-MOC10-B252N-024-N5	DP02-20Aug15-MOC10-SE-3D-033-N0
DP02-14Aug15-MOC10-B287D-023-N0	DP02-20Aug15-MOC10-SE-3D-033-N3
DP02-14Aug15-MOC10-B287D-023-N3	DP02-20Aug15-MOC10-SE-3D-033-N4
DP02-14Aug15-MOC10-B287D-023-N4	DP02-20Aug15-MOC10-SE-3D-033-N5
DP02-14Aug15-MOC10-B287D-023-N5	DP02-21Aug15-MOC10-B255D-035-N0
DP02-15Aug15-MOC10-B175N-025-N0	DP02-21Aug15-MOC10-B255D-035-N1
DP02-15Aug15-MOC10-B175N-025-N1	DP02-21Aug15-MOC10-B255D-035-N2
DP02-15Aug15-MOC10-B175N-025-N3	DP02-21Aug15-MOC10-B255D-035-N3
DP02-15Aug15-MOC10-B175N-025-N5	DP02-21Aug15-MOC10-B255D-035-N4
DP02-16Aug15-MOC10-B080N-026-N0	

Table 6. Fish species/taxa collected for genetics studies during DEEPEND cruise DP02, with taxon comments

Species/Taxon	**N**	**Comments**
Ablennes hians	1	
Acanthurus sp.	6	
Ahlia egmontis	11	
Albula vulpes	1	
Alepisaurus ferox	4	

Aluterus monoceros	12	
Anarchias similis	1	
Anguilla rostrata	2	
Anguilliformes	1	
Anoplogaster cornuta	2	
Antigonia capros	2	
Antigonia combatia	5	
Aplatophis chauliodus	1	
Aprognathodon platyventris	1	
Argyropelecus aculeatus	41	
Argyropelecus affinis	1	
Argyropelecus gigas	6	
Argyropelecus hemigymnus	1	
Argyropelecus sladeni	2	
Ariosoma anale	2	
Ariosoma balearicum	16	
Ariosoma selenops	4	
Aristostomias polydactylus	1	
Aristostomias xenostoma	3	
Astronesthes atlanticus	1	*Astronesthes indicus* group
Astronesthes macropogon	9	
Astronesthes niger	1	
Astronesthes similus	4	
Astronesthes undescribed TS1	1	Astronesthes TS1 "nigroides"
Ataxolepis apus	3	
Avocettina infans	1	
Balistes capriscus	1	
Bascanichthys bascanium	1	
Bathophilus brevis	1	
Bathophilus digitatus	3	
Bathophilus longipinnis	1	
Bathophilus pawneei	7	
Bathophilus proximus	1	
Bathyclupea argentea	1	
Bathycongrus sp. A FWNA	2	
Bathylaco nigricans	1	
Bodianus sp.	1	
Bolinichthys photothorax	14	
Bolinichthys supralateralis	3	
Bonapartia pedaliota	4	
Borostomias mononema	1	

Bothus sp.	15	
Brama dussumieri	1	
Bregmaceros atlanticus	12	
Bregmaceros mcclellandii	1	
Brephostoma carpenteri	1	
Brinkmannella elongata	1	
Callechelys muraena	2	
Cantherhines pullus	2	
Cantherhines pullus	2	
Caranx bartholomaei	1	
Caranx crysos	5	
Caranx ruber	3	
Carapus bermudensis	2	
Cataetyx laticeps	1	
Centrobranchus nigroocellatus	2	
Centrophryne spinulosa	1	
Centropyge sp.	6	
Centropyge argi	12	
Centropyge aurantonotus	13	
Ceratias sp.	1	
Ceratias uranoscopus	1	
Ceratoscopelus warmingii	57	
Cetomimus sp.	1	
Cetostoma regani	5	
Chaetodon sp.	1	
Chaetodon sedentarius	1	
Chauliodus danae	1	
Chauliodus sloani	23	
Chiasmodon niger	1	
Chiasmodon niger complex	1	Chiasmodon cf. niger
Chilorhinus suensonii	5	
Chlopsis dentatus	1	
Chlorophthalmus agassizi	5	
Chloroscombrus chrysurus	1	
Citharichthys sp.	2	
Coccorella atlantica	2	
Congridae	1	
Congridae sp. A	1	
Congridae sp. D	2	
Congridae sp. G	6	
Congridae sp. N	1	

Cookeolus japonicus	4
Coryphaena equiselis	4
Cryptopsaras couesii	5
Cyclopsetta sp.	6
Cyclothone acclinidens	5
Cyclothone alba	4
Cyclothone braueri	3
Cyclothone obscura	53
Cyclothone pseudopallida	1
Decapterus tabl	1
Diaphus brachycephalus	4
Diaphus dumerilii	6
Diaphus lucidus	6
Diaphus mollis	1
Diaphus perspicillatus	1
Diaphus problematicus	2
Diaphus rafinesquii	1
Diaphus roei	10
Diaphus splendidus	13
Diaphus subtilis	1
Diaphus taaningi	1
Dicrolene sp.	1
Diodon holocanthus	6
Diogenichthys atlanticus	1
Diretmus argenteus	1
Ditropichthys storeri	2
Dolicholagus longirostris	6
Dolopichthys sp. A	1
Dysalotus alcocki	2
Dysomma anguillare	1
Echiostoma barbatum	3
Elops smithi	1
Epigonus sp.	1
Epigonus pandionis	1
Eustomias fissibarbis	1
Eustomias hypopsilus	1
Eustomias lipochirus	1
Eustomias monodactylus	1
Eustomias schmidti	3
Eustomias variabilis	1
Eutaeniophorus festivus	1

Euthynnus alleteratus	2	
Facciolella sp.	1	Facciolella sp. JAM 3
Fistularia sp.	1	
Flagellostomias boureei	1	
Gibberichthys pumilus	1	
Gigantactis sp.	1	
Gigantura sp.	1	
Gigantura chuni	1	
Gigantura indica	3	
Gnathophis sp.	3	
Gonichthys cocco	1	
Gonostoma atlanticum	1	
Gordiichthys randalli	1	
Gymnothorax kolpos	2	
Gymnothorax miliaris	6	
Gymnothorax moringa	16	
Gymnothorax ocellatus	10	
Gymnothorax sp. A FWNA	1	
Gymnothorax sp. C FWNA	1	
Gymnothorax vicinus	8	
Hemiramphus balao	1	
Hemiramphus brasiliensis	1	
Heteroconger longissimus	3	Heteroconger halis (invalid)
Heteroconger luteolus	9	
Histrio histrio	3	
Holacanthus sp.	2	
Hoplunnis macrura	5	
Hoplunnis tenuis	2	
Howella atlantica	9	
Hygophum benoiti	16	
Hygophum macrochir	6	
Hygophum reinhardtii	2	
Hygophum taaningi	5	
Idiacanthus fasciola	3	
Ipnops murrayi	1	
Kaupichthys hyoproroides	11	
Kaupichthys nuchalis	2	
Labichthys carinatus	1	
Lampadena luminosa	7	
Lampanyctus nobilis	4	
Lampanyctus tenuiformis	1	

Lestidium atlanticum	1	
Lestrolepis intermedia	2	
Letharchus velifer	2	
Linophryne sp.	1	
Linophrynidae	10	
Linophrynidae sp. A	1	
Linophrynidae sp. B	1	
Lobianchia dofleini	1	
Lobianchia gemellarii	6	
Lobotes surinamensis	1	
Lutjanus campechanus	4	
Magnisudis atlantica	1	
Malacocephalus laevis	1	
Malacosteus niger	3	
Margrethia obtusirostra	7	
Maurolicus weitzmani	2	
Melamphaes longivelis	1	
Melamphaes polylepis	1	
Melamphaes simus	5	
Melamphaes typhlops	1	
Melanocetus murrayi	3	
Melanolagus bericoides	2	
Melanostomias tentaculatus	2	
Melichthys niger	2	
Mentodus sp.	1	
Moringua edwardsi	4	
Myctophum affine	11	
Myctophum asperum	1	
Myctophum nitidulum	1	
Myrichthys breviceps	4	
Myrichthys ocellatus	1	
Myrophis platyrhynchus	8	
Myrophis punctatus	4	
Nannobrachium cuprarium	3	
Nannobrachium lineatum	6	
Nemichthys curvirostris	1	
Neobythites marginatus	1	
Nesiarchus nasutus	3	
Nettenchelys pygmaea	1	
Nezumia sp.	1	
Notacanthoidei	1	"Tiluropsis" sp.

Notolychnus valdiviae	2	
Notoscopelus resplendens	1	
Odontostomops normalops	1	
Omosudis lowii	9	
Oneirodes sp.	1	
Oneirodes carlsbergi	2	
Oneirodes eschrichtii	1	
Oneirodes theodorittissieri	1	
Ophichthini sp. 7 FWNA	1	
Ophichthus gomesii	5	
Ophichthus gomesii	1	
Ostichthys trachypoma	1	
Paracaristius sp.	1	
Paraconger sp.	15	
Paralepis brevirostris	2	
Parexocoetus hillianus	2	
Penopus microphthalmus	1	
Perciformes	4	
Photonectes achirus	1	Photonectes cf. achirus
Photostomias guernei	1	
Photostylus pycnopterus	2	
Physiculus fulvus	2	
Platybelone argalus argalus	1	
Platytroctes apus	1	
Poecilopsetta sp.	2	
Pollichthys mauli	13	
Polyipnus clarus	6	
Polymixia lowei	7	
Polymixia nobilis	1	
Pontinus sp.	1	
Porogadus miles	2	
Pristipomoides sp.	7	
Prognichthys occidentalis	1	
Psenes sp.	1	
Pseudophichthys splendens	3	
Pseudoscopelus sp.	2	
Rhynchoconger flavus	8	
Robinsia catherinae	1	
Sargocentron sp.	2	
Scombridae	7	
Scopelarchoides danae	1	

Scopelarchus analis	4
Scopeloberyx opisthopterus	5
Scopeloberyx robustus	7
Scopeloberyx rubriventer	2
Scopelogadus mizolepis	5
Scopelosaurus mauli	5
Scorpaenidae	4
Selene sp.	3
Selene vomer	1
Serranidae	1
Spiniphryne gladisfenae	1
Stephanolepis hispidus	6
Stephanolepis setifer	8
Sternoptyx diaphana	50
Sternoptyx pseudobscura	49
Stomias affinis	9
Stomias longibarbatus	1
Stylephorus chordatus	1
Sudis atrox	1
Syacium sp.	3
Symphysanodon berryi	2
Synagrops bellus	8
Synagrops spinosus	10
Synaphobranchidae	1
Taaningichthys bathyphilus	4
Taaningichthys minimus	1
Taaningichthys paurolychnus	1
Talismania antillarum	1
Trichiurus lepturus	1
Trichopsetta ventralis	3
Uroconger syringinus	4
Uropterygius macularius	4
Vinciguerria attenuata	2
Vinciguerria nimbaria	2
Vinciguerria poweriae	1
Xanthichthys ringens	6
Xenolepidichthys dalgleishi	3
Xenomystax congroides	1
Zu cristatus	1

3.3. Polycyclic Aromatic Hydrocarbon (PAH) Analysis.

A total of 200 samples were collected for PAH analysis. Large fish specimens were dissected at sea and organs/tissues kept separate (guts/liver, muscle, skin, ovaries). Other fish specimens and all invertebrates were frozen as whole bodies (Table 7). Please also see Appendix III for cephalopod sample addenda to the PAH sample list.

Table 7. Specimens collected for PAH analysis on DEEPEND cruise DP02.

Vial_No	Sample	Species	Sample_Type	N
00138	DP02-10Aug15-MOC10-SW4D-015-N2	*Cyclothone pallida*	body	1
00139	DP02-10Aug15-MOC10-SW4D-015-N2	*Cyclothone pallida*	body	1
00140	DP02-10Aug15-MOC10-SW4D-015-N2	*Cyclothone pallida*	body	1
00141	DP02-10Aug15-MOC10-SW4D-015-N2	*Cyclothone pallida*	body	1
00142	DP02-10Aug15-MOC10-SW4D-015-N2	*Cyclothone pallida*	body	1
00143	DP02-10Aug15-MOC10-SW4D-015-N2	*Sigmops elongatus*	tissue	1
00144	DP02-10Aug15-MOC10-SW4D-015-N2	*Sigmops elongatus*	gills	1
00145	DP02-10Aug15-MOC10-SW4D-015-N2	*Sigmops elongatus*	spleen/liver	1
00146	DP02-10Aug15-MOC10-SW4D-015-N2	*Sigmops elongatus*	ovaries	1
00147	DP02-10Aug15-MOC10-SW3N-016-N2	*Cyclothone pallida*	body	10
00148	DP02-10Aug15-MOC10-SW3N-016-N2	*Chauliodus sloani*	tissue	1
00149	DP02-10Aug15-MOC10-SW3N-016-N2	*Chauliodus sloani*	gills	1
00150	DP02-10Aug15-MOC10-SW3N-016-N2	*Chauliodus sloani*	liver	1
00151	DP02-10Aug15-MOC10-SW3N-016-N2	*Lampanyctus alatus*	body	9
00152	DP02-11Aug15-MOC10-SW3D-017-N0	*Lepidophanes guentheri*	body	2
00153	DP02-11Aug15-MOC10-SW3D-017-N0	*Lampanyctus alatus*	body	2
00154	DP02-11Aug15-MOC10-SW3D-017-N2	*Sternoptyx pseudobscura*	body	1
00155	DP02-11Aug15-MOC10-SW3D-017-N2	*Sternoptyx pseudobscura*	heart/spleen/liver	1
00156	DP02-11Aug15-MOC10-SW3D-017-N2	*Sternoptyx pseudobscura*	gills	1
00157	DP02-11Aug15-MOC10-SW3D-017-N2	*Sternoptyx pseudobscura*	body	1
00158	DP02-11Aug15-MOC10-SW3D-017-N3	*Lampanyctus alatus*	body	1
00159	DP02-11Aug15-MOC10-SW3D-017-N3	*Lepidophanes guentheri*	body	1
00160	DP02-11Aug15-MOC10-SW3D-017-N3	*Sigmops elongatus*	gills	1
00161	DP02-11Aug15-MOC10-SW3D-017-N3	*Sigmops elongatus*	liver	1
00162	DP02-11Aug15-MOC10-SW3D-017-N3	*Lampanyctus alatus*	body	2
00163	DP02-11Aug15-MOC10-SW3D-017-N3	*Sigmops elongatus*	ovaries	1
00164	DP02-12Aug15-MOC10-SE1D-019-N0	*Cyclothone acclinidens*	body	8
00165	DP02-12Aug15-MOC10-SE1D-019-N4	*Lampanyctus alatus*	body	2
00166	DP02-12Aug15-MOC10-B286N-020-N3	*Chauliodus sloani*	gills	1
00167	DP02-12Aug15-MOC10-B286N-020-N3	*Chauliodus sloani*	heart/liver	1
00168	DP02-12Aug15-MOC10-B286N-020-N3	*Chauliodus sloani*	tissue	1
00169	DP02-12Aug15-MOC10-B286N-020-N5	*Lampanyctus alatus*	body	1
00170	DP02-13Aug15-MOC10-B286D-021-N2	*Cyclothone obscura*	body	2

00171	DP02-13Aug15-MOC10-B286D-021-N3	*Sigmops elongatus*	gills	1
00172	DP02-13Aug15-MOC10-B286D-021-N3	*Sigmops elongatus*	liver	1
00173	DP02-13Aug15-MOC10-B286D-021-N3	*Sigmops elongatus*	tissue	1
00174	DP02-13Aug15-MOC10-B286D-021-N3	*Sigmops elongatus*	ovaries	1
00175	DP02-13Aug15-MOC10-B287N-022-N0	*Taaningichthys sp.*	body	1
00176	DP02-13Aug15-MOC10-B287N-022-N0	*Chauliodus sloani*	gills	1
00177	DP02-13Aug15-MOC10-B287N-022-N0	*Chauliodus sloani*	liver	1
00178	DP02-13Aug15-MOC10-B287N-022-N0	*Chauliodus sloani*	tissue	1
00179	DP02-13Aug15-MOC10-B287N-022-N4	*Diaphus mollis*	body	1
00180	DP02-13Aug15-MOC10-B287D-023-N2	*Chauliodus sloani*	gills	1
00181	DP02-13Aug15-MOC10-B287D-023-N2	*Chauliodus sloani*	spleen/liver	1
00182	DP02-13Aug15-MOC10-B287D-023-N2	*Chauliodus sloani*	tissue	1
00183	DP02-13Aug15-MOC10-B287D-023-N2	*Chauliodus sloani*	ovaries	1
00184	DP02-13Aug15-MOC10-B287D-024-N5	*Ceratoscopelus warmingii*	body	5
00185	DP02-13Aug15-MOC10-B287D-024-N5	*Lampanyctus alatus*	body	4
00186	DP02-15Aug15-MOC10-B175N-025-N0	*Sternoptyx diaphana*	body	2
00187	DP02-15Aug15-MOC10-B175N-025-N0	*Lampanyctus alatus*	body	2
00188	DP02-15Aug15-MOC10-B175N-025-N0	*Sigmops elongatus*	gills	1
00189	DP02-15Aug15-MOC10-B175N-025-N0	*Sigmops elongatus*	liver/heart	1
00190	DP02-15Aug15-MOC10-B175N-025-N0	*Sigmops elongatus*	tissue	1
00191	DP02-15Aug15-MOC10-B175N-025-N0	*Sigmops elongatus*	gills	1
00192	DP02-15Aug15-MOC10-B175N-025-N0	*Sigmops elongatus*	liver/heart	1
00193	DP02-15Aug15-MOC10-B175N-025-N0	*Sigmops elongatus*	tissue	1
00194	DP02-15Aug15-MOC10-B175N-025-N2	*Cyclothone obscura*	body	5
00195	DP02-15Aug15-MOC10-B175N-025-N3	*Lepidophanes guentheri*	body	1
00196	DP02-15Aug15-MOC10-B175N-025-N3	*Cyclothone pallida*	body	10
00197	DP02-15Aug15-MOC10-B175N-025-N4	*Argyropelecus aculeatus*	body	1
00198	DP02-15Aug15-MOC10-B175N-025-N4	*Lampanyctus alatus*	body	1
00199	DP02-16Aug15-MOC10-B080N-026-N0	*Rhynchoconger flavus*	body	2
00200	DP02-16Aug15-MOC10-B080N-026-N1	*Cyclothone pallida*	body	10
00201	DP02-20Aug15-MOC10-B255N-34-N2	*Sternoptyx pseudobscura*	ovaries	1
00202	DP02-18Aug15-MOC10-B079N-30-N0	*Sigmops elongatus*	spleen/liver/heart	1
00203	DP02-20Aug15-MOC10-B255N-34-N2	*Sternoptyx pseudobscura*	gills	1
00204	DP02-19Aug15-MOC10-SE3D-33-N2	*Sternoptyx pseudobscura*	ovaries	1
00205	DP02-19Aug15-MOC10-SE3D-33-N2	*Sternoptyx pseudobscura*	tissue	1
00206	DP02-19Aug15-MOC10-SE3D-33-N2	*Sternoptyx pseudobscura*	spleen/liver/heart	1
00207	DP02-19Aug15-MOC10-B079D-31-N3	*Sigmops elongatus*	spleen/liver/heart	1
00208	DP02-19Aug15-MOC10-SE3D-33-N3	*Sigmops elongatus*	tissue	1
00209	DP02-19Aug15-MOC10-B079D-31-N0	*Dolicholagus longirostris*	gills	1
00210	DP02-19Aug15-MOC10-B079D-31-N2	*Sternoptyx pseudobscura*	spleen/liver/heart	1
00211	DP02-19Aug15-MOC10-SE3D-33-N3	*Chauliodus sloani*	tissue	1

00212	DP02-19Aug15-MOC10-SE3D-33-N3	*Chauliodus sloani*	spleen/liver/heart	1
00213	DP02-19Aug15-MOC10-SE3D-33-N3	*Chauliodus sloani*	gills	1
00214	DP02-19Aug15-MOC10-SE3D-32-N3	*Ceratoscopelus warmingii*	body	1
00215	DP02-19Aug15-MOC10-B079D-31-N3	*Sigmops elongatus*	ovaries	1
00216	DP02-19Aug15-MOC10-B079D-31-N3	*Sigmops elongatus*	tissue	1
00217	DP02-18Aug15-MOC10-B079N-30-N0	*Chauliodus sloani*	tissue	1
00218	DP02-19Aug15-MOC10-SE3D-33-N3	*Sigmops elongatus*	spleen/liver/heart	1
00219	DP02-19Aug15-MOC10-SE3D-33-N3	*Sigmops elongatus*	gills	1
00220	DP02-19Aug15-MOC10-B079D-31-N3	*Sigmops elongatus*	gills	1
00221	DP02-19Aug15-MOC10-B079D-31-N2	*Sternoptyx pseudobscura*	gills	1
00222	DP02-19Aug15-MOC10-B079D-31-N0	*Dolicholagus longirostris*	tissue	1
00223	DP02-19Aug15-MOC10-B079D-31-N0	*Dolicholagus longirostris*	spleen/liver/heart	1
00224	DP02-19Aug15-MOC10-B079D-31-N0	*Sigmops elongatus*	ovaries	1
00225	DP02-19Aug15-MOC10-B079D-31-N0	*Sigmops elongatus*	tissue	1
00226	DP02-18Aug15-MOC10-B079N-30-N3	*Chauliodus sloani*	tissue	1
00227	DP02-19Aug15-MOC10-B079D-31-N0	*Sigmops elongatus*	gills	1
00228	DP02-19Aug15-MOC10-B079D-31-N0	*Sigmops elongatus*	spleen/liver/heart	1
00229	DP02-17Aug15-MOC10-B003N-028-N5	*Diaphus mollis*	body	1
00229	DP02-17Aug15-MOC10-B003N-28-N5	*Diaphus mollis*	body	1
00230	DP02-19Aug15-MOC10-B079D-31-N2	*Sternoptyx pseudobscura*	tissue	1
00231	DP02-17Aug15-MOC10-B003D-29-N0	*Anoplogaster cornuta*	spleen/liver/heart	1
00232	DP02-20Aug15-MOC10-B255N-34-N2	*Sternoptyx pseudobscura*	spleen/liver/heart	1
00233	DP02-17Aug15-MOC10-B003D-29-N3	*Chauliodus sloani*	heart	1
00234	DP02-17Aug15-MOC10-B003D-29-N0	*Anoplogaster cornuta*	tissue	1
00235	DP02-18Aug15-MOC10-B079N-30-N0	*Sigmops elongatus*	gills	1
00236	DP02-18Aug15-MOC10-B079N-30-N0	*Sigmops elongatus*	ovaries	1
00237	DP02-17Aug15-MOC10-B003D-29-N3	*Chauliodus sloani*	gills	1
00238	DP02-17Aug15-MOC10-B003N-028-N5	*Lampanyctus alatus*	body	3
00238	DP02-17Aug15-MOC10-B003N-28-N5	*Lampanyctus alatus*	body	3
00239	DP02-17Aug15-MOC10-B003D-29-N0	*Anoplogaster cornuta*	gills	1
00240	DP02-19Aug15-MOC10-B079D-31-N0	*Chauliodus sloani*	tissue	1
00241	DP02-17Aug15-MOC10-B003D-29-N0	*Sternoptyx diaphana*	tissue	1
00242	DP02-17Aug15-MOC10-B003D-29-N3	*Chauliodus sloani*	tissue	1
00242	DP02-19Aug15-MOC10-SE3D-33-N2	*Sternoptyx pseudobscura*	gills	1
00244	DP02-17Aug15-MOC10-B003D-29-N0	*Sternoptyx pseudobscura*	gills	1
00245	DP02-17Aug15-MOC10-B003N-028-N4	*Sigmops elongatus*	gills	1
00245	DP02-17Aug15-MOC10-B003N-28-N4	*Sigmops elongatus*	gills	1
00246	DP02-17Aug15-MOC10-B003N-028-N4	*Argyropelecus aculeatus*	spleen/liver/heart	1
00246	DP02-17Aug15-MOC10-B003N-28-N4	*Argyropelecus aculeatus*	spleen/liver/heart	1
00247	DP02-17Aug15-MOC10-B003D-29-N4	*Diaphus mollis*	spleen/liver/heart	1
00248	DP02-18Aug15-MOC10-B079N-30-N5	*Sigmops elongatus*	gills	1

00249	DP02-17Aug15-MOC10-B003N-028-N3	*Sternoptyx diaphana*	tissue	1
00249	DP02-17Aug15-MOC10-B003N-28-N3	*Sternoptyx diaphana*	tissue	1
00250	DP02-17Aug15-MOC10-B003N-028-N4	*Argyropelecus aculeatus*	ovaries	1
00250	DP02-17Aug15-MOC10-B003N-28-N4	*Argyropelecus aculeatus*	ovaries	1
00251	DP02-17Aug15-MOC10-B003N-028-N3	*Sternoptyx diaphana*	ovaries	1
00251	DP02-17Aug15-MOC10-B003N-28-N3	*Sternoptyx diaphana*	ovaries	1
00252	DP02-19Aug15-MOC10-B079D-31-N0	*Chauliodus sloani*	gills	1
00253	DP02-18Aug15-MOC10-B079N-30-N5	*Bolinichthys photothorax*	body	4
00254	DP02-18Aug15-MOC10-B079N-30-N5	*Sigmops elongatus*	spleen/liver/heart	1
00255	DP02-18Aug15-MOC10-B079N-30-N3	*Chauliodus sloani*	gills	1
00256	DP02-17Aug15-MOC10-B003D-29-N4	*Diaphus mollis*	gills	1
00257	DP02-17Aug15-MOC10-B003D-29-N0	*Sternoptyx diaphana*	spleen/liver/heart	1
00258	DP02-17Aug15-MOC10-B003D-29-N0	*Sternoptyx diaphana*	gills	1
00259	DP02-17Aug15-MOC10-B003N-028-N4	*Argyropelecus aculeatus*	tissue	1
00259	DP02-17Aug15-MOC10-B003N-28-N4	*Argyropelecus aculeatus*	tissue	1
00260	DP02-19Aug15-MOC10-B079D-31-N0	*Chauliodus sloani*	spleen/liver/heart	1
00261	DP02-17Aug15-MOC10-B003D-29-N0	*Sternoptyx pseudobscura*	spleen/liver/heart	1
00262	DP02-17Aug15-MOC10-B003N-028-N4	*Sigmops elongatus*	spleen/liver/heart	1
00262	DP02-17Aug15-MOC10-B003N-28-N4	*Sigmops elongatus*	spleen/liver/heart	1
00263	DP02-17Aug15-MOC10-B003D-29-N0	*Sternoptyx diaphana*	ovaries	1
00264	DP02-18Aug15-MOC10-B079N-30-N0	*Sigmops elongatus*	tissue	1
00265	DP02-17Aug15-MOC10-B003D-29-N4	*Diaphus mollis*	tissue	1
00266	DP02-18Aug15-MOC10-B079N-30-N5	*Sigmops elongatus*	tissue	1
00267	DP02-17Aug15-MOC10-B003D-29-N3	*Chauliodus sloani*	spleen/liver	1
00268	DP02-17Aug15-MOC10-B003D-29-N0	*Sternoptyx pseudobscura*	tissue	1
00269	DP02-17Aug15-MOC10-B003N-028-N3	*Sternoptyx diaphana*	body	1
00269	DP02-17Aug15-MOC10-B003N-28-N3	*Sternoptyx diaphana*	body	1
00270	DP02-17Aug15-MOC10-B003D-29-N0	*Sternoptyx pseudobscura*	ovaries	1
00270	DP02-17Aug15-MOC10-B003D-29-N3	*Chauliodus sloani*	ovaries	1
00271	DP02-17Aug15-MOC10-B003N-028-N4	*Argyropelecus aculeatus*	gills	1
00271	DP02-17Aug15-MOC10-B003N-28-N4	*Argyropelecus aculeatus*	gills	1
00272	DP02-18Aug15-MOC10-B079N-30-N0	*Chauliodus sloani*	spleen/liver/heart	1
00273	DP02-17Aug15-MOC10-B003N-028-N4	*Sigmops elongatus*	tissue	1
00273	DP02-17Aug15-MOC10-B003N-28-N4	*Sigmops elongatus*	tissue	1
00274	DP02-18Aug15-MOC10-B079N-30-N1	*Cyclothone obscura*	body	5
00275	DP02-18Aug15-MOC10-B079N-30-N3	*Chauliodus sloani*	spleen/liver/heart	1
00277	DP02-17Aug15-MOC10-B003N-028-N3	*Sternoptyx diaphana*	spleen/liver/heart	1
00277	DP02-17Aug15-MOC10-B003N-28-N3	*Sternoptyx diaphana*	spleen/liver/heart	1
00278	DP02-17Aug15-MOC10-B003N-028-N3	*Sternoptyx diaphana*	gills	1
00278	DP02-17Aug15-MOC10-B003N-28-N3	*Sternoptyx diaphana*	gills	1
00279	DP02-18Aug15-MOC10-B079N-30-N0	*Chauliodus sloani*	gills	1

00280	DP02-17Aug15-MOC10-B003N-028-N1	*Cyclothone obscura*	body	7
00280	DP02-17Aug15-MOC10-B003N-28-N1	*Cyclothone obscura*	body	7
00281	DP02-17Aug15-MOC10-B003N-028-N0	*Ceratoscopelus warmingii*	tissue	1
00281	DP02-17Aug15-MOC10-B003N-28-N0	*Ceratoscopelus warmingii*	tissue	1
00282	DP02-17Aug15-MOC10-B003N-028-N0	*Ceratoscopelus warmingii*	heart/liver	1
00282	DP02-17Aug15-MOC10-B003N-28-N0	*Ceratoscopelus warmingii*	spleen/liver/heart	1
00283	DP02-17Aug15-MOC10-B003N-028-N0	*Ceratoscopelus warmingii*	gills	1
00283	DP02-17Aug15-MOC10-B003N-28-N0	*Ceratoscopelus warmingii*	gills	1
00284	DP02-17Aug15-MOC10-B080D-027-N2	*Chauliodus sloani*	tissue	1
00285	DP02-17Aug15-MOC10-B080D-027-N2	*Chauliodus sloani*	liver	1
00286	DP02-17Aug15-MOC10-B080D-027-N2	*Chauliodus sloani*	gills	1
00287	DP02-17Aug15-MOC10-B080D-027-N2	*Diaphus mollis*	body	1
00288	DP02-17Aug15-MOC10-B080D-027-N1	*Lepidophanes guentheri*	body	1
00289	DP02-17Aug15-MOC10-B080D-027-N1	*Lampanyctus alatus*	body	5
00290	DP02-17Aug15-MOC10-B080D-027-N1	*Sternoptyx diaphana*	body	2
00292	DP02-16Aug15-MOC10-B080N-026-N5	*Ariosoma balearcum*	body	7
00293	DP02-16Aug15-MOC10-B080N-026-N4	*Argyropelecus aculeatus*	tissue	1
00294	DP02-16Aug15-MOC10-B080N-026-N4	*Argyropelecus aculeatus*	liver	1
00295	DP02-16Aug15-MOC10-B080N-026-N4	*Argyropelecus aculeatus*	gills	1
00296	DP02-16Aug15-MOC10-B080N-026-N4	*Diaphus mollis*	body	1
00297	DP02-16Aug15-MOC10-B080N-026-N4	*Lepidophanes guentheri*	body	1
00298	DP02-16Aug15-MOC10-B080N-026-N4	*Sigmops elongatus*	tissue	1
00299	DP02-16Aug15-MOC10-B080N-026-N4	*Sigmops elongatus*	liver	1
00300	DP02-16Aug15-MOC10-B080N-026-N4	*Sigmops elongatus*	gills	1
00301	DP02-20Aug15-MOC10-B255N-34-N4	*Chauliodus sloani*	gills	1
00302	DP02-20Aug15-MOC10-B255N-34-N4	*Chauliodus sloani*	spleen/liver/heart	1
00303	DP02-20Aug15-MOC10-B255N-34-N4	*Chauliodus sloani*	tissue	1
00304	DP02-20Aug15-MOC10-B255N-34-N4	*Nannobrachium lineatum*	gills	1
00305	DP02-20Aug15-MOC10-B255N-34-N4	*Nannobrachium lineatum*	spleen/liver/heart	1
00306	DP02-20Aug15-MOC10-B255N-34-N4	*Nannobrachium lineatum*	tissue	1
00307	DP02-21Aug15-MOC10-B255D-35-N0	*Scopeloberyx opercularis*	gills	1
00308	DP02-21Aug15-MOC10-B255D-35-N0	*Scopeloberyx opercularis*	spleen/liver/heart	1
00309	DP02-21Aug15-MOC10-B255D-35-N0	*Scopeloberyx opercularis*	tissue	1
00310	DP02-21Aug15-MOC10-B255D-35-N0	*Scopeloberyx opercularis*	ovaries	1
00311	DP02-21Aug15-MOC10-B255D-35-N1	*Lepidophanes guentheri*	body	1
00312	DP02-21Aug15-MOC10-B255D-35-N2	*Chauliodus sloani*	gills	1
00313	DP02-21Aug15-MOC10-B255D-35-N2	*Chauliodus sloani*	spleen/liver/heart	1
00314	DP02-21Aug15-MOC10-B255D-35-N2	*Chauliodus sloani*	tissue	1
00315	DP02-21Aug15-MOC10-B255D-35-N2	*Sternoptyx pseudobscura*	gills	1
00316	DP02-21Aug15-MOC10-B255D-35-N2	*Sternoptyx pseudobscura*	spleen/liver/heart	1
00317	DP02-21Aug15-MOC10-B255D-35-N2	*Sternoptyx pseudobscura*	tissue	1

00318	DP02-21Aug15-MOC10-B255D-35-N2	*Sternoptyx pseudobscura*	ovaries	1
00319	DP02-21Aug15-MOC10-B255D-35-N3	*Cyclothone obscura*	body	1
bag	DP02-11Aug15-MOC10-SW3D-017-N3	*Sigmops elongatus*	tissue	1

3.4. Mercury Analysis.

3.4.1. Fishes.

There were thirteen species of fishes collected for mercury analysis: *Benthosema suborbitale* (n = 5), *Caranx crysos* (n = 2), *Ceratoscopelus warmingii* (n=5), *Cyclothone obsurca* (n =24), *Cyclothone pallida* (n = 8), *Diaphus mollis* (n=1), *Hygophum benoiti* (n=6), *Lampanyctus alatus* (n = 10), *Lepidophanes guentheri* (n=2), *Photostomias guernei* (n = 2), *Sigmops elongatus* (n=2), *Sternoptyx diaphana* (n=2), and *Sternoptyx pseudobscura* (n=6).

3.5. Stable Isotope Analysis.

3.5.1. Crustacea.

Several vertically migratory and non-migratory crustaceans were frozen for stable isotope studies. These specimen included species from: the class Ostracoda (n = 11), the orders Amphipoda (n = 5), Calanoida (n = 7), and Stomatopoda (n = 19), and the genus *Paraeuchaeta* (n = 24).

3.5.2. Cephalopoda.

Four cephalopod species were frozen for stable isotope analysis, including *Bolitaena pygmaea* (n = 3), *Histioteuthis corona* (n = 1), *Japatella diaphana* (n = 4), and *Joubiniteuthis portieri* (n = 1).

3.5.3. Fishes.

Thirteen fish species were collected for stable isotope analysis (Table 8). These species encompassed a range of trophic levels, vertical distributions, and vertical migration habits.

Table 8. Fishes collected for stable isotope analysis. N = sample number; VM = vertical migrator or non-migrator; P = pelagic, M = mesopelagic, B = bathypelagic

Species	**N**	**VM?**	**Primary habitat**
Benthosema suborbitale	5	Y	M
Caranx crysos	2	Y	P
Ceratoscopelus warmingii	5	Y	M/B
Cyclothone obscura	24	N	B
Cyclothone pallida	8	N	M/B
Diaphus mollis	1	Y	M
Hygophum benoiti	6	Y	M/B
Lampanyctus alatus	10	Y	M
Lepidophanes guentheri	6	Y	M
Photostomias guernei	2	Y	M/B
Sigmops elongatus	2	Y	M/B
Sternoptyx diaphana	16	Y	M/B

Sternoptyx pseudobscura	6	N	M/B

3.5.4. Gelatinous Zooplankton.

Two species of gelatinous zooplankton were collected for stable isotope analysis, including the colonial tunicate *Pyrosoma atlanticum* (n = 9) and the coronate cnidarian *Periphylla periphylla* (n = 8).

3.6. Otolith Microchemistry Analysis Samples.

3.6.1. Fishes.

All fishes frozen for stable isotope analysis (see Section 3.5.3., Table 8) are available for otolith microchemistry analysis.

3.7 Leptocephali Identification Key

Samples and high-resolution photographs were taken of eel leptocephali in support of an ongoing taxonomic identification key revision.

3.8. Hydroacoustic Data Collected.

Over 325 GB of acoustic backscatter data were collected during the DP02 cruise. Four frequency (18, 38, 70, and 120 kHz) Simrad WBT echosounders collected data covering 1500 m (18 kHz), 1000 m (38 kHz) and ~ 400 m (70 and 120 kHz) of the water column (Fig. 28). Both narrowband and broadband (at 18 and 70 kHz) data were collected. Data were collected during day and night time MOC10 tows at 12 different stations (SW04, SW03, SE01, B286, B287, B252, B003, B079, B255, SE03, B080, and B175) and during transits between three station pairs (B080 to B003, B175 to B080, and B252 to B175). Additionally, all four echosounders were calibrated using standard tungsten carbide and copper spheres in both narrowband and broadband (18 and 70 kHz) modes. Data have undergone preliminary quality control inspection. Analysis of data collected during specific net tows (e.g. MOC 26) is underway.

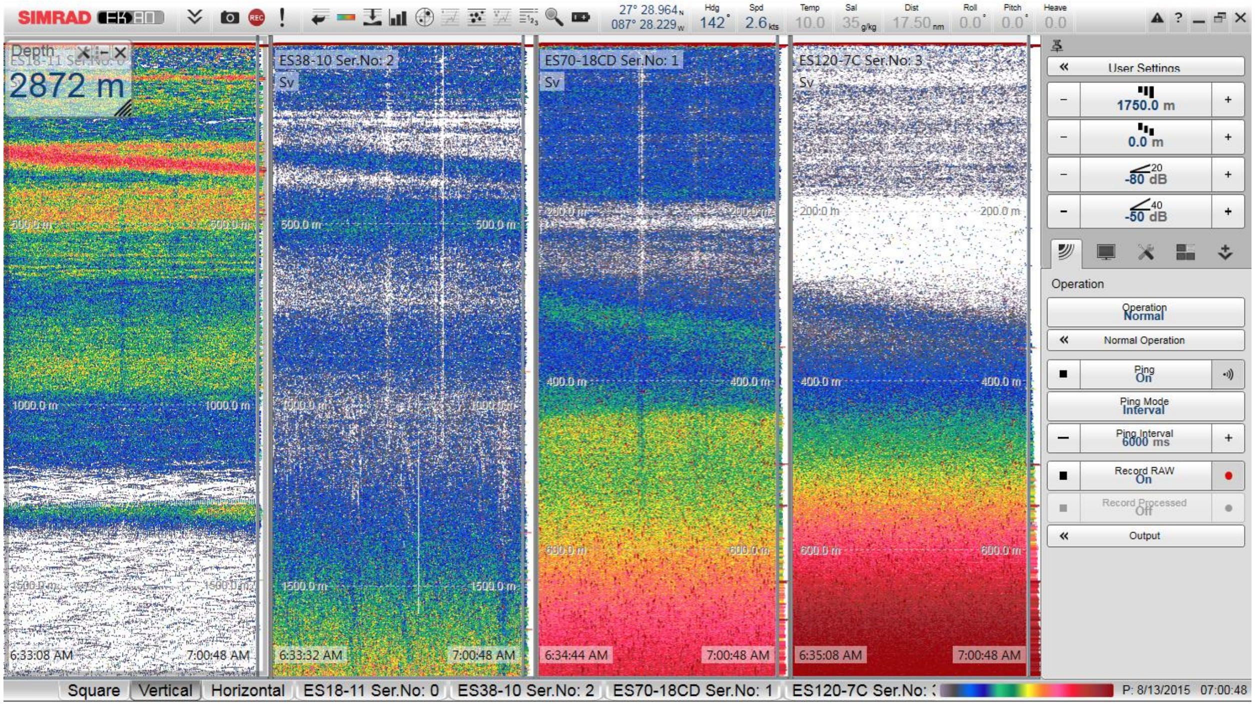


Figure 28. Backscatter data from all four frequencies during the dawn downward migration at station B286 between 0630 and 0700 local time on 13 Aug 2015. Note the different vertical scales between the two leftmost (1500 m) and two rightmost (500 m) echograms.

3.9. Physical Oceanographic Data Collected.

Several different types of *in situ* physical oceanographic data were collected during DP02. These data are summarized in Table 9.

Table 9. Physical oceanographic sampling efforts during the DEEPEND DP02 cruise

Location designation	Time (UTC) near station	CTD	HS6	Rrs
SW4	09 Aug 1000 to 10 Aug 1300	2	2	-
SW3	11 Aug 0900 to 11 Aug 2300	2	2	2
SE1	12 Aug 0800 to 12 Aug 1100	1	1	-
B286	13 Aug 0900 to 13 Aug 2200	2	2	1
B287	14 Aug 0900 to 14 Aug 2100	1	1	2
B252	15 Aug 0100 to 15 Aug 0300	1	-	-
B175	15 Aug 2400 to 16 Aug 1200	2	2	-
B080	16 Aug 2400 to 17 Aug 1500	2	2	-
B003	17 Aug 2400 to 18 Aug 1100	2	2	-
B079	18 Aug 2300 to 19 Aug 1900	3	2	2
SE3	19 Aug 2300 to 20 Aug 2000	2	2	2
B255	21 Aug 0300 to 21 Aug 1600	2	1	3

3.9.1. CTD and Water Samples.

The CTD and water sampling rosette was deployed at twenty-two stations during the DEEPEND DP02 cruise, listed in Table 10.

Table 10. CTD rosette deployments during the DEEPEND DP02 cruise

Station	Identifier	Date – Time (UTC)		Latitude (°)	Longitude (°)	Bottom depth (m)	Water Sample Depths (m)
SW4	CTD_009	9-Aug-15	11:02	26.967	-89.000	2380	1; 130
SW4	CTD_010	10-Aug-15	10:17	26.883	-88.999		1; 110
SW3	CTD_011	11-Aug-15	10:02	26.860	-88.590		1; 120
SW3	CTD_012	11-Aug-15	22:13	26.880	-88.520		1; 113
SE1	CTD_013	12-Aug-15	09:35	27.030	-88.160		1; 119
B286	CTD_014	13-Aug-15	09:45	27.560	-87.550		1; 105
B286	CTD_015	13-Aug-15	20:10	27.510	-87.520		1; 115
B287	CTD_016	14-Aug-15	10:55	28.010	-87.470		1; 90
B252	CTD_017	15-Aug-15	01:57	28.470	-87.490		1; 70
B175	CTD_018	16-Aug-15	01:13	29.001	-87.488	1721	1; 40
B175	CTD_019	16-Aug-15	10:30	28.927	-87.397		1; 42
B080	CTD_020	17-Aug-15	01:42	28.492	-86.975	822	1; 73
B080	CTD_021	17-Aug-15	13:10	28.493	-86.974		1; 43
B003	CTD_022	18-Aug-15	02:15	27.980	-86.980	2871	1; 72
B003	CTD_023	18-Aug-15	09:45	27.990	-86.960	2881	1; 42
B079	CTD_024	18-Aug-15	00:39	27.460	-86.990	2992	1; 92
B079	CTD_025	19-Aug-15	10:04	27.510	-86.990	2993	1; 105
B079	CTD_026	19-Aug-15	13:37	27.440	-86.990	2972	1; 95
SE3	CTD_027	19-Aug-15	00:35	27.016	-86.990	3015	1; 91
SE3	CTD_028	20-Aug-15	13:14	26.959	-87.003	2884	1; 97
B255	CTD_029	21-Aug-15	2:43	27.510	-86.550	3092	1; 75
B255	CTD_030	21-Aug-15	11:22	27.530	-86.510	3109	1; 52

From these deployments 48 water samples (Table 11) were collected by the USF-Optical Oceanography Laboratory for determining chlorophyll-a concentration and the spectral absorption due to total particulate material, $a_p(\lambda)$, detrital material, $a_d(\lambda)$, and colored dissolved organic matter, $a_{CDOM}(\lambda)$. Water samples from several sample depths were collected using Niskin bottles on the CTD rosette, or from the ship's flow-through (FT) system. Duplicate samples were collected at select stations.

Table 11. Summary of chlorophyll and absorption samples collected on DP02

Date (UTC)	Cast	Station	Latitude (oN)	Longitude (oW)	Surface (~1m)	Chlorophyll maxima (~40-130m)	Oxygen minima (~400-750m)	Deep (~800-1510m)
8/9/15 10:35	CTD_009	SW4	26.967	89.000	X^D	X^D	-	-
8/10/15 9:35	CTD_010	SW4	26.883	88.999	X	X^D	-	-
8/11/15 9:19	CTD_011	SW3	26.860	88.590	X	X	-	-
8/11/15 21:27	CTD_012	SW3	26.880	88.520	X	X	-	-
8/12/15 8:56	CTD_013	SE1	27.030	88.160	X	X	-	-
8/13/15 9:00	CTD_014	B286	27.560	87.550	X	X	-	-
8/13/15 19:25	CTD_015	B286	27.510	87.520	X	X	-	-
8/14/15 10:00	CTD_016	B287	28.010	87.470	X^D	X^D	-	-
8/15/15 1:19	CTD_017	B252	28.470	87.490	X	X	-	-
8/16/15 0:27	CTD_018	B175	29.001	87.488	X^D	X^D	-	-
8/16/15 10:00	CTD_019	B175	28.927	87.397	X	X	-	-
8/17/15 1:25	CTD_020	B080	28.535	87.022	X	X	-	-
8/17/15 12:40	CTD_021	B080	28.491	86.975	X^D	X^D	-	-
8/18/15 1:15	CTD_022	B003	27.980	86.980	X^D	X^D	-	-
8/18/15 9:00	CTD_023	B003	27.990	86.960	X^D	X^D	-	-
8/18/15 23:54	CTD_024A	B079	27.460	86.990	X^D	X^D	-	-
8/19/15 9:22	CTD_025	B079	27.510	86.990	X^D	X^D	-	-
8/19/15 12:57	CTD_026	B079	27.440	86.990	X^D	X^D	-	-
8/19/15 23:56	CTD_027	SE3	27.016	87.003	X	X	-	-
8/20/15 12:28	CTD_028	SE3	26.959	87.003	X	X	-	-
8/21/15 1:56	CTD_029	B255	27.510	86.550	X^D	X^D	-	-
8/21/15 10:30	CTD_030	B255	27.530	86.510	X	X	-	-

^{D}: duplicates

Both particulate (ap(λ)) and detrital (ad(λ)) absorption spectra were determined in a shore-based lab using the quantitative filter technique. A custom-built spectroradiometer (~330-880nm, <2 nm resolution) was used for measuring the spectral transmission of total particulate material collected on a glass fiber filter (Whatman's GF/F) relative to a wetted blank. The subsequent extraction of the pigments from the particles captured by the filter followed by re-measurement of both filters allows for the separation between the living (phytoplankton) and non-living (detrital) components of the total particulate material. This pigment extraction technique also enables Chl-*a* to be determined fluorometrically. Thus the same water sample is used for the determination of the ap(*λ*) and ad(*λ*) absorption spectra, as well as the Chl-a concentration.

Seawater samples, filtered first through a GF/F filter and then through a 0.2µm polycarbonate filter, are used to determine aCDOM(λ). These filtered samples are stored at 5°C for less than two weeks prior to being measured using a Hitachi U3900H UV/Vis spectrophotometer equipped with 10-cm pathlength cells and using Milli Q water as a reference. Absorption is measured from 200-800nm at 0.5nm increments.

3.9.2. Bio-Optical (HS6) Data.

At nineteen stations during the DEEPEND DP02 cruise, a HOBILabs HS6 and two WETlabs scattering/fluorescence instruments were vertically profiled through the water column to a depth of ~200m (Table 12). Both particulate (ap(λ)) and detrital (ad(λ)) absorption spectra were determined in a shore-based lab using the quantitative filter technique. A custom-built spectroradiometer (~330-880nm, <2 nm resolution) was used for measuring the spectral transmission of total particulate material collected on a glass fiber filter (Whatman's GF/F) relative to a wetted blank. The subsequent extraction of the pigments from the particles captured by the filter followed by re-measurement of both filters allows for the separation between the living (phytoplankton) and non-living (detrital) components of the total particulate material. This pigment extraction technique also enables Chl-a to be determined fluorometrically. Thus the same water sample is used for the determination of the ap(λ) and ad(λ) absorption spectra, as well as the Chl-a concentration.

Seawater samples, filtered first through a GF/F filter and then through a 0.2µm polycarbonate filter, are used to determine aCDOM(λ). These filtered samples are stored at 5°C for less than two weeks prior to being measured using a Hitachi U3900H UV/Vis spectrophotometer equipped with 10-cm pathlength cells and using Milli Q water as a reference. Absorption is measured from 200-800 nm at 0.5nm increments.

Table 12. The locations and times of HS6 (optical scattering and fluorescence) casts during the DP02 DEEPEND cruise

Location designation	Station or data file ID	Time (UTC)	Latitude (°)	Longitude (°)
SW4	DP02_HS01	09 Aug 15 12:06	27.008	-89.002
SW4	DP02_HS02	10 Aug 15 11:57	26.966	-88.995
SW3	DP02_HS03	11 Aug 15 11:24	26.898	-88.598
SW3	DP02_HS04	11 Aug 15 20:46	26.873	-88.523
SE1	DP02_HS05	12 Aug 15 10:38	27.040	-88.139
B286	DP02_HS06	13 Aug 15 10:52	27.519	-87.506
B286	DP02_HS07	13 Aug 15 21:18	27.461	-87.487
B287	DP02_HS08	14 Aug 15 09:26	28.035	-87.488
B175	DP02_HS09	16 Aug 15 02:29	29.023	-87.513
B175	DP02_HS10	16 Aug 15 11:36	28.931	-87.387
B080	DP02_HS11	17 Aug 15 00:51	28.532	-87.024
B080	DP02_HS12	17 Aug 15 14:08	28.497	-86.968
B003	DP02_HS13	18 Aug 15 00:50	27.994	-86.986
B003	DP02_HS14	18 Aug 15 10:43	27.952	-86.928
B079	DP02_HS15	19 Aug 15 01:43	27.451	-86.984
B079	DP02_HS16	19 Aug 15 08:32	27.534	-87.007
SE3	DP02_HS17	20 Aug 15 01:44	26.970	-87.011
SE3	DP02_HS18	20 Aug 15 11:51	26.972	-87.000
B255	DP02_HS19	21 Aug 15 12:45	27.493	-86.492

Because the instruments were powered by internal batteries, each could operate and record its measurements independently and allowed the instrument cage to be profiled without the need for power & communication cables between the instruments and the ship. Data were processed using a combination of the manufacturer's and custom software. The time stamps of each instrument, as well as distinct surface scattering features, were used to synchronize the instruments for each cast. Because fluorescence efficiencies vary, the measurements made by the instruments reflect relative fluorescence. But, combining these instrument values with discrete water sample measurements enables estimation of in situ fluorescence, and thus chlorophyll and CDOM concentrations at depths where discrete water samples were not collected (e.g. Fig. 29).

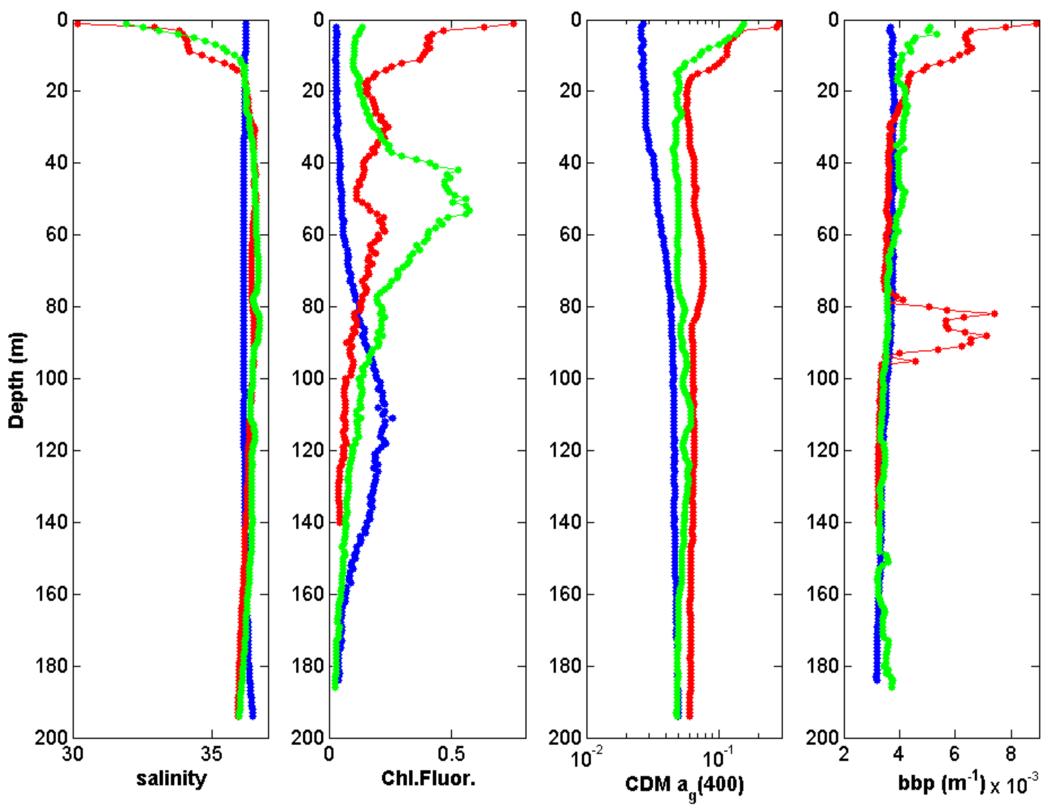


Figure 29. Salinity, fluorescence, and backscattering estimates from 3 DP02 stations. The salinity values and the absorption at 400nm due to dissolved material (CDM ag) are from RV Pt. Sur CTD casts, while the chlorophyll fluorescence and particulate backscatter (bbp) at 420nm are from HS6 casts. Measurements from a cast at station SW3 (oligotrophic surface waters) are shown in blue, from B175 (Northernmost DP02 station in the river plume) in red, and from B255 (in the Southern river plume) in green.

Changes in the spectral backscattering shape and slope measured by the HS6 (e.g. Fig. 30) can be compared to changes in the *in situ* particulates at various depths. Combining the scattering information with the fluorescence measurements allows estimation of the relative amounts of scattering from phytoplankton versus other living and non-living particles. Figure 29 shows vertical profiles of salinity, chlorophyll_a fluorescence, CDOM fluorescence, and backscattering at 420nm from either the HS6 or CTD, from casts made at three DP02 stations. While the magnitude of optical scattering below the depth of a chl. maximum usually varies with the amount of phytoplankton, the presence of a strong scattering signal at ~90m at B175 is not caused by a similar increase in chl. fluorescence at this depth.

3.9.3. Remote Sensing Reflectance Data.

Remote sensing reflectance ($R_{rs}(\lambda)$) data were collected from the deck of the R/V *Point Sur* at fourteen times during the DEEPEND DP02 cruise (Table 13). These measurements help relate the near surface water samples to the observations made by ocean color satellites. An ASD, Inc. (PANalytical) HandHeld2-Pro spectroradiometer was used to collect $R_{rs}(\lambda)$. Figure 31 shows example $R_{rs}(\lambda)$ spectra from several DP02 stations, and the difference in surface water color between the blue waters sampled at the beginning of DP02 and the less reflective, 'greener' waters associated with the Mississippi River plume.

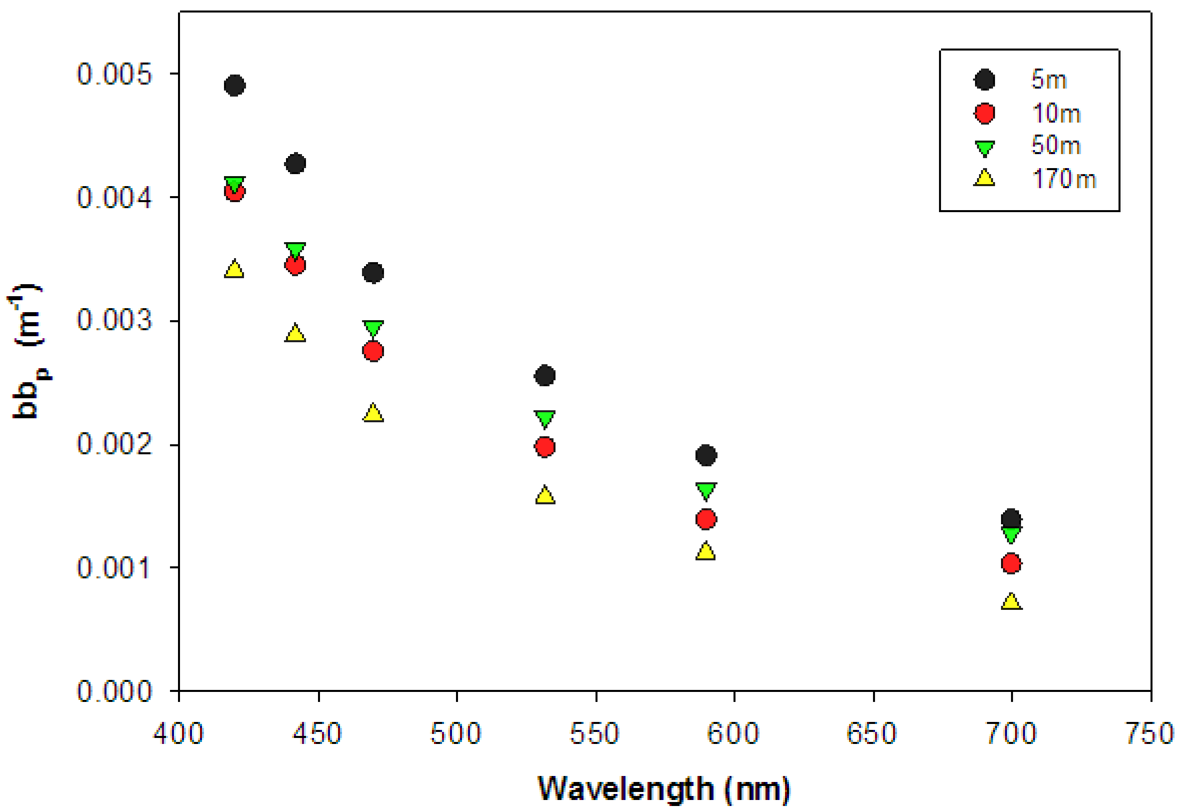


Figure 30. Examples of spectral backscattering measurements collected at several 5-m depth intervals during a cast at station B255. On this cast, a chlorophyll fluorescence maximum was observed at ~50m depth, but there was also increased scattering found in the less-saline, near-surface waters.

Table 13. The locations and times of remote sensing reflectance (Rrs) measurements made during the DP02 DEEPEND cruise

Location designation	Station or data file ID	Time (UTC)	Latitude (°)	Longitude (°)	Cloud Cover
SW3	DP02_Rrs01	11 Aug 15 15:37	26.905	-88.515	40%
SW3	DP02_Rrs02	11 Aug 15 18:42	27.51	-87.514	20%
B286	DP02_Rrs03	13 Aug 15 18:24	27.904	-87.414	40%
B287	DP02_Rrs04	14 Aug 15 14:28	27.959	-87.461	40%
B287	DP02_Rrs05	14 Aug 15 20:18	27.438	-86.989	20%
B079	DP02_Rrs06	19 Aug 15 16:17	27.494	-86.95	25%
B079	DP02_Rrs07	19 Aug 15 18:49	26.94	-87.003	60%
SE3	DP02_Rrs08	20 Aug 15 15:14	27.018	-87.001	20%
SE3	DP02_Rrs09	20 Aug 15 19:33	27.488	-86.498	-
B255	DP02_Rrs10	21 Aug 15 14:03	27.486	-86.494	10%
B255	DP02_Rrs10b	21 Aug 15 14:09	27.509	-86.517	10%
B255	DP02_Rrs11	21 Aug 15 16:02	27.558	-86.571	60%
NA	DP02_Rrs12	21 Aug 15 19:04	27.563	-86.583	10%
NA	DP02_Rrs13	21 Aug 15 20:04	27.563	-86.583	10%

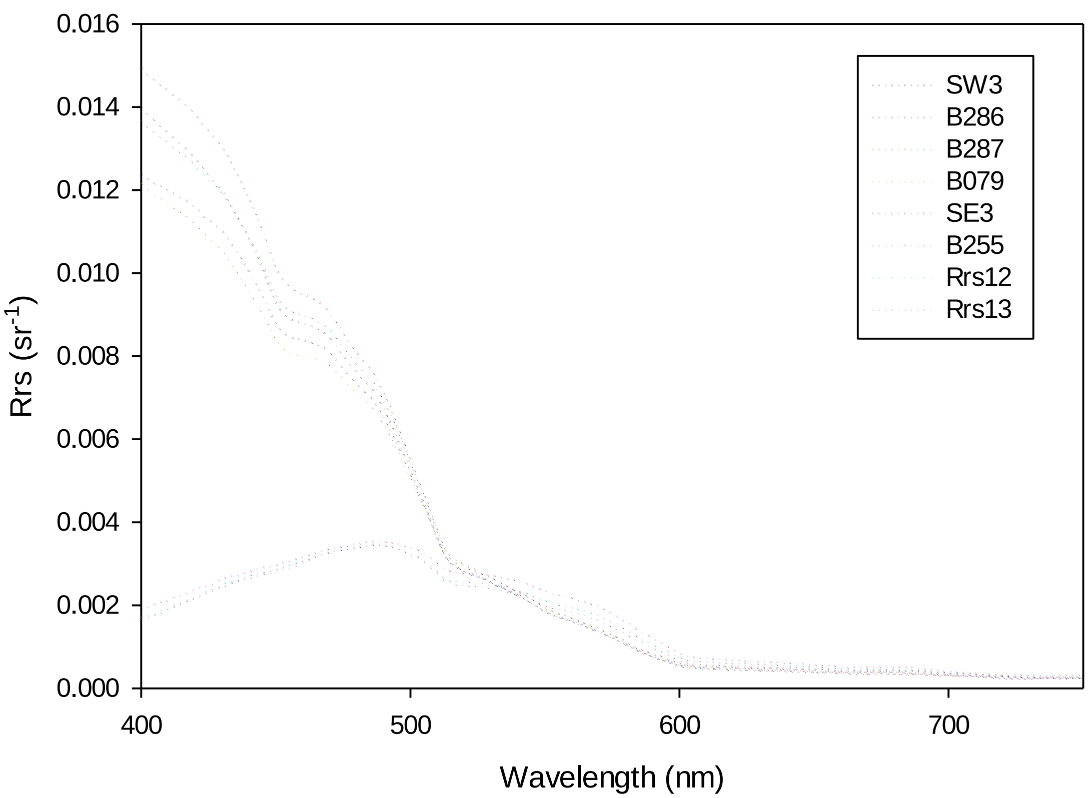


Figure 31. Remote sensing reflectance (Rrs(λ)) derived from measurements made at 15 stations between 11 Aug. and 21 Aug. 2015. Satellite observations show stations SW3 located in the most oligotrophic (low chlorophyll) surface waters, while station B255, Rrs12, & Rrs13 were found in the Mississippi River plume east of the strong Gulf of Mexico Loop Current.

3.9.4. Glider Data.

The University of South Florida Slocum Electric 1000m Glider (Figure 32) was utilized to characterize the upper 400m of the water column. This glider is equipped with a Seabird SBE41CP CTD, two WETLabs fluorometers, two Satlantic radiometers, and an Aanderraa dissolved oxygen sensor. The fluorometers are equipped to sample for chlorophyll, CDOM, backscatter at 660 and 880nm, and turbidity. The radiance and irradiance sensors sample at four wavelengths, ~412, 443, 556, and 683nm. All sensors sample at ¼Hz. Since the gliders transit vertically at ~0.1m/s, this results in a vertical sample resolution of ~0.4m. All science and flight data is recorded on board. At the surfacing the glider sent back a parsed data set.

The glider was deployed from the R?V *Point Sur* on August 9, 2015 at ~12:45 UTC. It was deployed at SW-4, 27.0426 N, -88.9940 W within the Loop Current, near the western edge. The glider was deployed with a tether attached during system testing and the first test profile to ensure that it was properly ballasted. Following the first yo to 40m, the tether was removed. Over the next four hours the glider surfaced every 30min and performed shallow dives to 60m and then to 110m to optimize performance. By 17:00 UTC the glider was set to surface every 3 hours and profiled to 200m. This continued until August 10 at 23:00 UTC when the depth profiles were changed to 400m. During the three hours between surfacings, the glider typically made two cycles to depth and back to near the surface.

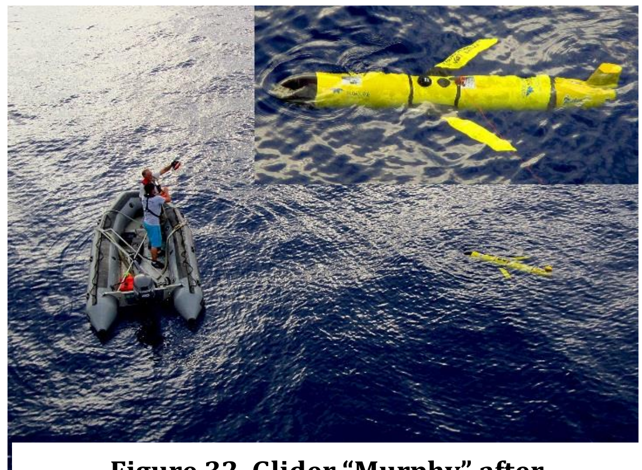


Figure 32. Glider "Murphy" after deployment and before its mission was programmed.

Due to the speed of the Loop Current, the glider was transported to the north and then east before coming back south. The farthest north position of the glider during this transit was 28.0046 N, -88.4865 W. This trajectory was not unexpected. From deployment, the glider was programmed to attempt to transit perpendicular to the current toward the edge of the higher currents in an effort to position itself to pull out of the Loop Current on the eastern side. This coincided with a significant freshwater patch noted in the satellite imagery targeted for analysis. Starting on August 14 (26.6125 N , -86.6768 W, ~50km SE of station SE-3), the glider succeeded in this effort with a salinity drop off from over 36 to ~30PPT near the surface. During transit to this point it passed less than 15km from stations B286 (8/12/15 14:00) and SE-3 (8/13/15 02:00).

The fresher water near the surface resulted in a problematic density variation for the glider to pilot through. This layer of fresher water sampled by the glider was 3-10m deep and had a density up to 10 g/l lower than the deeper water. This resulted in the glider periodically being unable to transit to the surface for communications and impeded its piloting to get out of the loop current. It did finally transit far enough east and then back north to exit the current, but communication remained inconsistent as the freshwater layer persisted.

With the limited information provided to shore by the glider, the exact reasoning of this failure to communicate could not be confirmed with certainty. While the density variation was noted, it was not clear that the glider was functioning completely normally. Due to this uncertainty and the glider's proximity to the loop current and the potential for it to be swept south again and possibly into the Florida Straits, a decision to retrieve the glider was made. Early on August 20, during a good communication surfacing, the glider was forced to stay on the surface so it could be retrieved. Since the glider was well south of the R/V *Point Sur*'s sampling, a private vessel was chartered and the glider recovered on August 22, 2015.

Due to the density stratification and the glider's inability to function normally, the data sets collected contain significant gaps. On August 15 & 16 there is a 33 hour gap between normal 400-m cycles, with a 6 hour segment of data to 50m while the glider was being tested and efforts were made to combat the performance issues. While the glider was profiling and performing well, data sets forwarded to shore were sent to the IOOS National Glider DAC and to the Naval Research Laboratory at each surfacing with the assistance of the Gulf of Mexico Coastal Ocean Observing System (GCOOS). Figure 33-37 show the physical parameters collected by the glider.

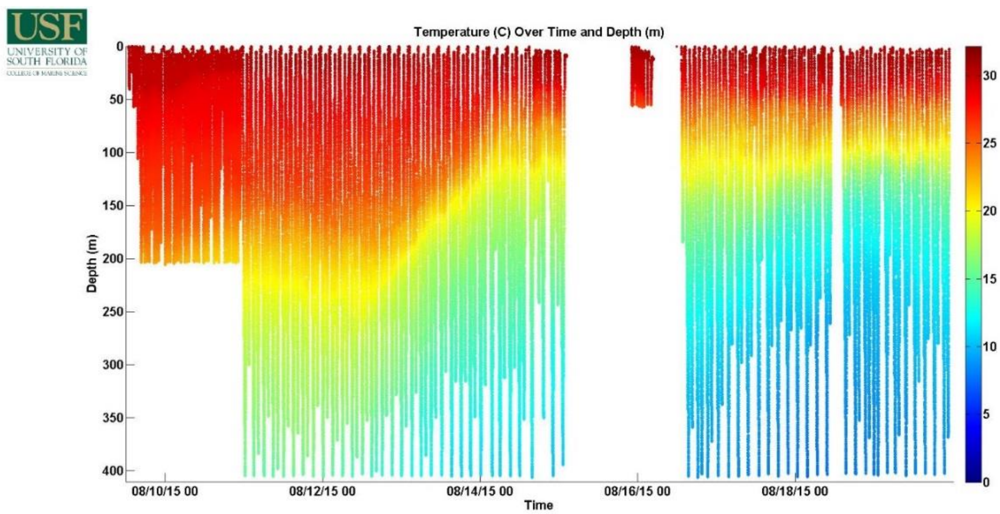


Figure 33. Temperature over time and depth collected by the glider.

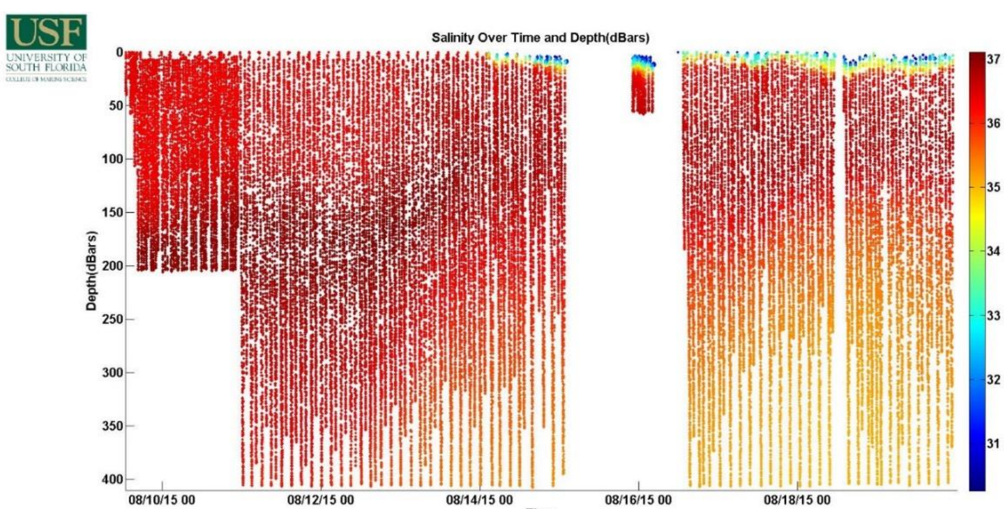


Figure 34. Salinity over time and depth collected by the glider.

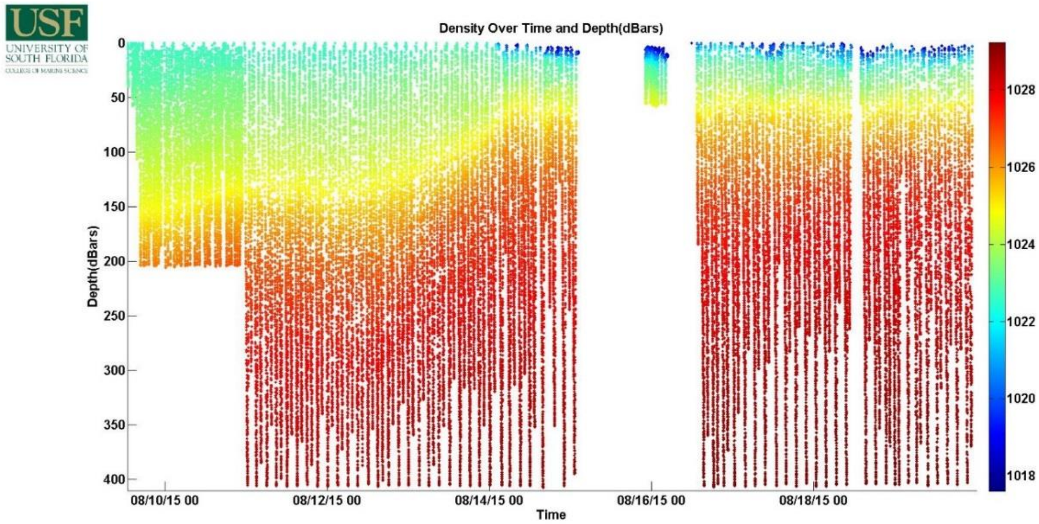


Figure 35. Density over time and depth collected by the glider.

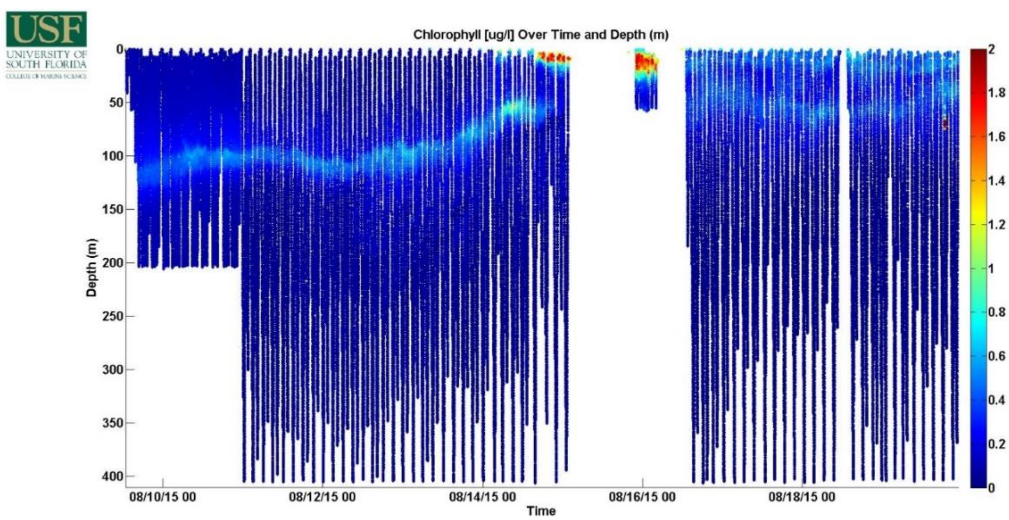


Figure 36. Chlorophyll concentrations over time and depth collected by the glider.

4. OUTREACH ACTIVITIES

Similar to DP01, much of focus of our imaging program (Dr. Danté Fenolio, Lead) for DP02 was on gathering content for education and outreach. All of the images in this report were generated by this project, as was video of live animals and MOC-10 sampling methods. Figure 37 gives a good example of a bioluminescent display by a live deep-sea shrimp, which will be used in a learning module on bioluminescence. Danté also photographed species' developmental life stages for education purposes as well. The pictures demonstrate the visual morphological differences between a species larval and adult phases (Figure 38).

The public outreach component focused on the Kids blog introduced “Squirt” (Figure 39) to the public, who will be guiding the kids through the DEEPEND adventures. Activities at sea were explained an age-appropriate level. The adult blog was maintained as well as can be expected on the second cruise by the E/O team, as internet connection was challenging. Blogs were tied to the daily shiptracker, updated daily on the DEEPEND home page (Fig. 40). Facebook, Twitter, and Instagram accounts were linked to the DEEPEND website. Styrofoam cups were also attached to deep CTD deployments and shrunk for students who will be participating ‘virtually’ on the August DEEPEND cruise through the Creep into the Deep Program (Figure 41).

Outreach efforts included all levels of students as well as the public during the first and second DEEPEND cruises. After the cruise, on February 20, 2016, 20, grade 6-12 teachers will be participating in a one-day workshop learning about DEEPEND projects (DP02 Cruise), science content and ways to incorporate our program into their classroom activities. They will bring teaching activities and graphics back to classrooms to use. Moreover, Postcards from the Deep have been added to the E/O page on the DEEPEND site for students in grade K-5 to view and share. Also, scientist trading cards have been made for students as well. Additionally, the DEEPEND Teacher-At-Sea Program for secondary teachers allowed Alisha Stahl to participate in the DP02 Cruise. She was able to write blogs on the DEEPEND website and inform her students about her hands-on experience on the two week DEEPEND cruise.

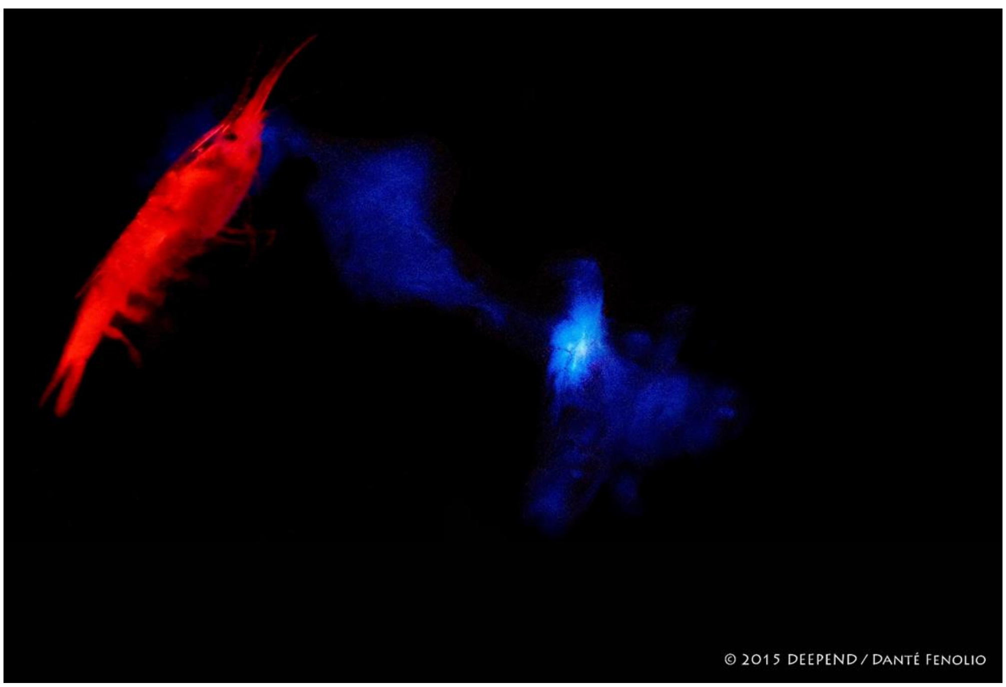


Figure 37. Still image of the expulsion of bioluminescent fluid (below) by a deep-sea shrimp (above).

Figure 38. Still image of the developmental stages of *Melanocetus* sp.

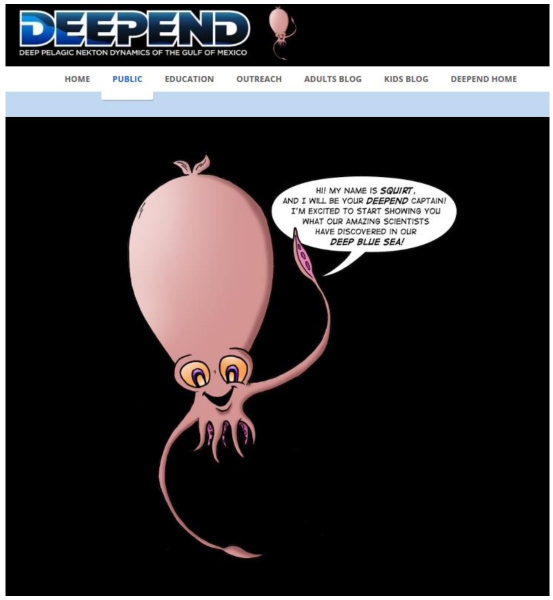


Fig. 39. "Squirt"- cartoon and animated character within the Kids Blog to explain the DEEPEND science to kids.

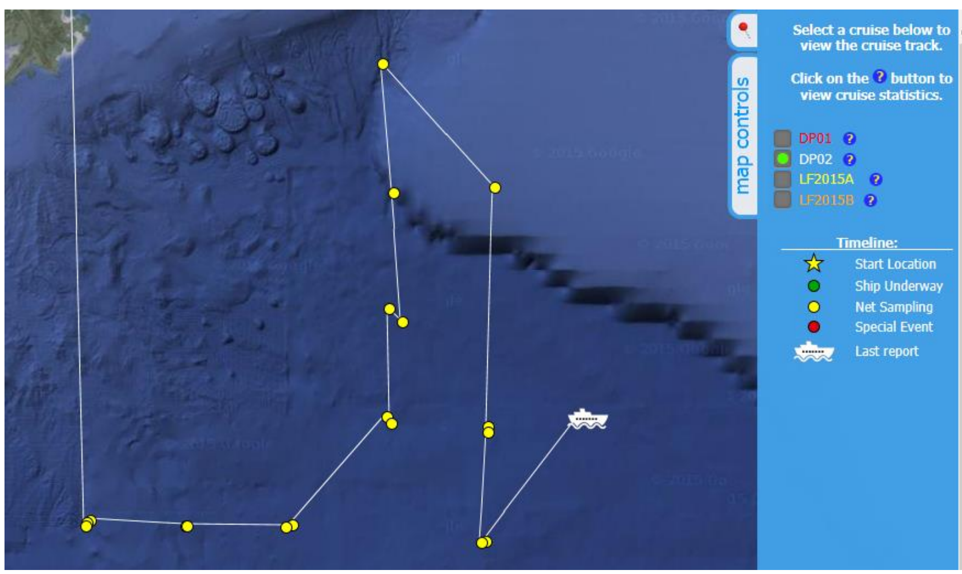


Figure 40. Real-time Shiptracker map of cruise DP02 on the DEEPEND home page.

Figure 41. Education team shrinking cups on CTD for students who will be participating 'virtually' on the August DEEPEND cruise through the Creep into the Deep Program.

5. APPENDICES

Appendix I. Fish species for which adequate (n = 15) sample size was completed for genetic barcoding.

Species/Taxon	Family
Argyropelecus aculeatus	Sternoptychidae
Argyropelecus hemigymnus	Sternoptychidae
Ariosoma balearicum	Congridae
Astronesthes macropogon	Stomiidae
Bolinichthys photothorax	Myctophidae
Bothus sp.	Bothidae
Ceratoscopelus warmingii	Myctophidae
Chauliodus sloani	Stomiidae
Chlorophthalmus agassizi	Chlorophthalmidae
Cyclothone acclinidens	Gonostomatidae
Cyclothone alba	Gonostomatidae
Cyclothone braueri	Gonostomatidae
Cyclothone obscura	Gonostomatidae
Cyclothone pallida	Gonostomatidae
Cyclothone pseudopallida	Gonostomatidae
Diaphus dumerilii	Myctophidae
Diaphus lucidus	Myctophidae
Diaphus mollis	Myctophidae
Diaphus splendidus	Myctophidae
Diplospinus multistriatus	Gempylidae
Gymnothorax moringa	Muraenidae
Hoplunnis macrura	Nettastomatidae
Howella atlantica	Howellidae
Hygophum benoiti	Myctophidae
Hygophum taaningi	Myctophidae
Lampanyctus alatus	Myctophidae
Linophrynidae	Linophrynidae
Melamphaes simus	Melamphaidae
Myctophum affine	Myctophidae
Notolychnus valdiviae	Myctophidae
Omosudis lowii	Alepisauridae
Paraconger sp.	Congridae
Photostomias guernei	Stomiidae
Pollichthys mauli	Phosichthyidae
Rhynchoconger flavus	Congridae
Scopeloberyx opercularis	Melamphaidae

Scopeloberyx opisthopterus	Melamphaidae
Sigmops elongatus	Gonostomatidae
Sternoptyx diaphana	Sternoptychidae
Sternoptyx pseudobscura	Sternoptychidae
Stomias affinis	Stomiidae
Valenciennellus tripunctulatus	Sternoptychidae
Vinciguerria poweriae	Phosichthyidae

Appendix II. Laboratory apportionment of DEEPEND fish tissue samples for genetic barcoding analyses, listed by taxon for DP01 and DP02. A total of 2299 individuals were collected for genetic analyses.

Eytan Lab		Shivji Lab	
Taxon	Order	Taxon	Order
Cetomimidae/*Ataxolepis*	Stephanobericiformes	Scombridae	Scombriformes
Chiasmodon	Perciformes	*Ceratoscopelus warmingii*	Myctophiformes
Astronesthes TS1	Stomiiformes	*Leptocheilichthys/Pycnocraspidum*	Osmeriformes
Melamphaidae	Stephanobericiformes	*Diogenichthys atlanticum*	Myctophiformes
Argyropelecus gigas	Stomiiformes	*Hygophum taaningi* vs *macrochir*	Myctophiformes
Vinciguerria poweriae vs *attenuata*	Stomiiformes	*Diaphus roei*	Myctophiformes
Polyipnus clarus	Stomiiformes	*Diaphus mollis*	Myctophiformes
male Linophrynidae	Lophiiformes	*Benthosema suborbitale*	Myctophiformes
Eustomias/Bathophilus spp.	Stomiiformes	*Nannobrachium achirus*	Myctophiformes
Photonectes spp.	Stomiiformes	Eel Leptocephali	Anguilliformes
Caristiidae	Perciformes	Asynchronous migrators	multiple taxa
Asynchronous migrators	multiple taxa	New records from MS7	various
New records from MS7	various		

Appendix III. Cephalopod samples added for PAH analysis.

DP02-10Aug15-MOC10-SW-3N-016-N1	*Grimalditeuthis bonplandi*	tissue	1
DP02-11Aug15-MOC10-SW-3D-017-N3	*Grimalditeuthis bonplandi*	tissue	1
DP02-11Aug15-MOC10-SE-1N-018-N0	*Japetella diaphana*	tissue	1
DP02-14Aug15-MOC10-B287D-023-N0	*Japetella diaphana*	tissue	1
DP02-15Aug15-MOC10-B175N-025-N0	*Japetella diaphana*	tissue	1
DP02-17Aug15-MOC10-B003N-028-N3	*Japetella diaphana*	tissue	1
DP02-19Aug15-MOC10-SE-3N-032-N0	*Japetella diaphana*	tissue	1