

Right Whale Winter Habitat Survey DE08-03 Cruise Report

February 16 – March 11, 2008

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OBJECTIVES AND METHODS

The 2008 right whale survey DE08-03 was conducted between February 16 and March 11, 2008, aboard the NOAA R/V Delaware II. Cruise objectives included charting right whale (*Eubalaena glacialis*) distribution in the vicinity of Jordan Basin and Cashes Ledge, identifying food resources and oceanographic conditions in these areas, and photographing individual right whales for mark-recapture analyses.

Visual surveys were conducted from the ship's flying bridge or the wheelhouse between 07:00 to 17:00, weather permitting. Two observers searched for whales on either side of the ship's track and confirmed species identifications and group size estimates with 7x50 binoculars. The observers shared data recording responsibilities. Positions were rotated every 30 minutes or following each oceanographic sampling station. Ship speed during surveys was 7 to 10 knots speed over ground (SOG).

Marine mammal observations, sighting conditions and effort data were recorded using a custom data entry system ("Pingnet") on data tablets (Fujitsu Stylistic ST5111 and Motion Computing TS01). We recorded the species, group size, distance and bearing from the ship, direction of movement and behavior of all marine mammals sighted during survey periods. Sighting condition variables were recorded at the beginning of each observer rotation and when conditions changed. These variables included Beaufort sea state, visibility and glare. The data tablets also recorded data from GPS units (DeLorme Earthmate GPS BT-20), including time, position, SOG and course over ground (COG). In addition, the ship's Scientific Computer System (SCS) automatically collected environmental data from a suite of sensors every 15 to 30 seconds, including sea surface temperature, wind speed and acoustic Doppler current profiler (ADCP) data. These SCS data were stored separately from the sighting and effort data. For analysis, SCS time stamps were used to couple the environmental sensor data with sightings and effort. For this report, all updates to species identifications and group size estimates were incorporated with the original sighting positions. All survey and SCS data are archived in Oracle databases at the NEFSC in Woods Hole, MA.

Track lines over Jordan Basin and Cashes Ledge connected a grid of oceanographic stations laid over areas of right whale sightings from NOAA aerial surveys. There were 21 oceanographic sampling station locations over the western portion of Jordan Basin and 12 station locations over Cashes Ledge.

A Video Plankton Recorder (VPR) was used to sample the density of copepod species and stages at discrete depths. The sensor was towed at 2-4 knots to within five meters of the bottom. It provided a continuous, magnified video stream of plankton passing between the video lens and strobe on both the down- and upcasts. The video was fed through an image recognition program that selected candidate objects for technician confirmation and identification.

Plankton samples were collected using 61cm bongo frames outfitted with 333 μ m mesh nets. The nets were towed to within five meters of the sea floor. The depth of the nets was measured using Seabird CTDs, and the flow of seawater through the nets was measured using General Oceanics flow meters. All contents from one of the nets were preserved in a 1 liter jar with 50ml of 37% buffered formaldehyde for species identification and counting. From the other net, all contents were preserved in a 1-liter jar with 50ml of 37% buffered formaldehyde and one tablespoon of calcium carbonate for calorimetric analysis. On five tows (5, 38, 41, 47 and 60), a 25ml subsample was frozen at -10 $^{\circ}$ C for a stable isotope analysis (to be conducted by Nadine Lysak).

A Tucker trawl was used to sample for copepods within one meter of the sea floor. The one-meter square frame was outfitted with three 333 μ m mesh nets that were opened and closed in sequence using a messenger. The aluminum frame was equipped with skids to ride along the bottom. Net 1 was open during the downcast, net 2 was opened after the frame reached the bottom, and net 3 was opened for the upcast. The contents from all three nets were preserved in a 1-liter jar with 50ml of 37% buffered formaldehyde and one tablespoon of calcium carbonate for calorimetric analysis.

We deployed eight surface current drifters in the northeast corner of the survey area. Drifters #1-3 were deployed on 18-19 February and drifters #4-6 on 5 March. Each triplet was deployed along a transect perpendicular to the shore in an attempt to document the Jordan Basin Gyre. Drifters #7 and 8 were released near the Maine coast in an

effort to document the Maine Coastal Current. Each drifter was equipped with a GPS beacon that provided a position fix every hour. The NEFSC Oceanography Branch received the position data via satellite, and continuous plots of the drifters' track were generated.

RESULTS

Oceanographic sampling, visual survey effort and sightings are summarized in Table 1. Oceanographic station locations and instrumentation are listed in Table 2. Figure 1 shows the locations of completed oceanographic sampling. Figure 2 shows the marine mammal visual survey effort and locations of sightings identified to species. No odontocetes were seen. There was no marine mammal survey effort or oceanographic sampling conducted on eight days due to weather. The ship was dockside in Woods Hole February 25-27. The afternoons of February 16 and 28 were spent transiting to the study area.

A total of 49.7 hours of visual surveys was logged over 11 days of effort. Several more hours of informal watch were kept when the ship was transiting productive areas. There were 46 whale sightings, 32 of which were identified to species. Sightings were comprised of either one or two whales, except for one sighting of four finback whales. Eight right whale sightings were made in the vicinity of Cashes Ledge and three in Cape Cod Bay. No right whales were photographed for individual identification. One sei whale was seen south of Cashes Ledge. Stellwagen Bank was the most productive region, with 28 fin whale sightings, a humpback and a minke, plus vast shoals of seabirds.

A total of 49 vertical bongo net tows was completed. The VPR was deployed 17 times with the bongo nets attached and 9 times without the nets. On two consecutive deployments west of Cashes Ledge (February 24), the VPR was towed for one hour at a fixed depth, one tow near the surface and one near the bottom. Two vertical CTD casts were made with no other instrumentation. The Tucker trawl was deployed three times, twice over Jordan Basin and once near Cashes Ledge. Enumeration of plankton sampling has not been done as of this writing. However, a rough estimate of copepod abundance from the VPR's region of interest (ROIs) counts showed copepod abundance was greatest at VPR station 1 on Cashes Ledge, in the vicinity of right whale sightings. At VPR station 5, copepod abundance was high within 40 meters of the surface, but no ROIs were recorded below 50 meters.

The oceanographic cross sections generated from the SBE-19+ CTD data showed a typical wintertime cross-Gulf of Maine gradient in salinity, with higher salinities in the west and lower salinities to the east (Figure 3). Data from the GoMOOS buoy over Jordan Basin indicated that the water there had cooled and freshened since January (Figure 4). The lower salinities in the east increase the vertical density stratification, thereby dampening vertical mixing over Jordan Basin.

A total of 8 satellite-tracked surface drifters were deployed. Drifters #7 and 8 failed before they were released. Since this pair was stored within the lab (away from sky view) for a few weeks prior to coming on deck, there is some chance they automatically shut down prior to deployment but the exact cause of the malfunction is still a mystery. The other six units traveled a total of 26,369 kilometers. All six units took a somewhat-anomalous "short-circuit" route towards Georges Bank (Figure 5). While this pathway is probably not the dominant mode for the surface waters on Jordan Basin, it has been observed several times before. The most current plots of these and other drifters released within the Gulf of Maine can be seen at <http://www.nefsc.noaa.gov/drifter/>.

The absence of right whale sightings on Jordan Basin despite our shipboard survey effort suggests this study's timeframe was late in the season and the right whales had moved on. An aerial survey of the area on February 24 found no right whales, however, a survey of the area on January 17 found 31 right whales. Similarly, a survey of Cashes ledge on February 24 sighted only two right whales, whereas a flight made on February 2 identified 20 individuals in the vicinity of Cashes.

ACKNOWLEDGMENTS

Thanks to the captain and crew of the NOAA R/V Delaware II for all their help with this work, including Richard Wingrove (Master), Earl (Montie) Spencer, Mark Frydrych, Claire Surrey, Chris Okeefe, Grady Abney, Jack Rickets, Erin Earley, Jon Rockwell, Reggie Draugn, Jon Forgione, Lino Lius, Steven Alicandri, Richard Logan, Mark Bellino and Eric Thompson. Jon Hare and Maureen Taylor saw to all the oceanographic data collection and equipment repairs. Fred Wenzel, Lisa Conger and Beth Josephson braved the cold to look for whales. Tamara Holzwarth-Davis, Cristina Bascunan, and Richard Pace provided invaluable shore-based support.

Table 1. DE08-03 right whale winter habitat survey summary, February 17 – March 11, 2008. “Effort” shows the number of hours on survey (S), the number of VPR casts (Pr), vertical bongo net tows (T), Tucker trawls (Tu) and CTD only casts (C) attempted for each day worked. “Area Surveyed” provides the general area and the daily start and end positions. “SS” is the Beaufort sea state and “Viz” is the visibility in nautical miles (10 = crisp horizon). “Sightings” gives the tally of the total number of individuals by species (large whales only) and the number of sightings in parentheses (lack of parentheses indicates only singletons seen). Species codes are: Eg = right whale; Mn = humpback whale; Bp = fin whale; Bb = sei whale; Ba = minke whale; fs = fin/sei whale.

Date	Effort	Area Surveyed	SS	Viz	Sightings
Feb. 17	S 4 Pr 5 T 5	Cashes Ledge and Jordan Basin 42°51N 69°16W to 43°27N 68°13W	4-6	6-10	Eg 2*
21	S 2 Pr 1 B 6 Tu 1	Jordan Basin 43°53N 67°44W to 43°27N 68°12W	4-5	10	--
22	S 2 Pr 6 T 14	Cashes Ledge 42°43N 68°59W to 42°33N 69°17W	2-5	1-10	Eg 1
23	S 1 Pr 2 T 2	Wilkinson Basin 42°25N 69°49W to 42°38N 69°27W	3-4	8-10	Eg 1
24	S 7 Pr 12 T 3 C 1	Cashes Ledge and Wilkinson Basin 42°54N 69°08W to 42°19N 69°14W	3-5	8-10	Bb 1
29	S 8 C 2	Cashes Ledge 42°42N 69°20W to 42°26N 69°08W	1-4	5-10	Eg 1 Bp 1
Mar. 3	S 7 T 8 C 1	Cashes Ledge and Jordan Basin 42°53N 69°08W to 43°37N 67°50W	1-6	8-10	--
6	S 2 T 4 Tu 1	Jordan Basin and Cashes Ledge	2-3	8-10	--
7	S 4 T 7 Tu 1	Cashes Ledge and Wilkinson Basin 42°52N 68°55W to 42°38N 69°36W	2-4	6	Eg 4 (3)
8	S 6	Stellwagen Bank 42°13N 70°18W to 42°04N 70°17W	2-3	1-10	Mn 1 Bp 2 (1) Ba 1 fs 1
10	S 9 C 4 T 2	Cape Cod Bay and Stellwagen Bank 41°54N 70°17W to 42°05N 70°14W	3-5	5-10	Eg 3 (2) Bp 28(16)
Totals	S 50 Pr 26 T 49 Tu 3 C 2	--	--	--	Eg 12 Mn 1 Bp 31 Bb 1 Ba 1 fs 1

*One sighting made during informal survey effort

Table 2. Latitude, longitude, depth and instrumentation used at oceanographic sampling stations during DE0803.

Station	Month	Lat	Lon	Depth (m)	VPR	Bongo	CTD	Tucker	Partial	Near whale	Comment
1	Feb 17	42.913	-69.153	185	1	1	1			1	
2	Feb 17	43.16	-68.787	178	1	1	1		1		
3	Feb 17	43.258	-68.59	182	1	1	1				
4	Feb 17	43.348	-68.398	176	1	1	1		1		
5	Feb 17	43.443	-68.218	180	1	1	1		1		
6	Feb 21	43.875	-67.703	227	1	1	1				
7	Feb 21	43.722	-67.647	239		1	1				
8	Feb 21	43.622	-67.832	245		1	1				
T1	Feb 21	43.615	-67.828	480				1			time/pos=first messenger
9	Feb 21	43.532	-68.02	212		1	1				
10	Feb 21	43.44	-68.207	181		1	1				
11	Feb 21	43.348	-68.397	183		1	1				
12	Feb 22	43.258	-68.592	179		1	1				
13	Feb 22	43.165	-68.785	173		1	1				
14	Feb 22	43.052	-68.898	164		1	1				
15	Feb 22	43.05	-69.128	141			1				mud--sample discarded
16	Feb 22	43.048	-69.355	188		1	1				
17	Feb 22	42.882	-69.353	150		1	1				
18	Feb 22	42.882	-69.13	163		1	1				
19	Feb 22	42.882	-68.902	92		1	1				
20	Feb 22	42.725	-68.908	128	1	1	1				
21	Feb 22	42.715	-69.125	151	1	1	1				
22	Feb 22	42.715	-69.352	210	1	1	1				
23	Feb 22	42.545	-69.352	230	1	1	1		1		
24	Feb 22	42.55	-69.123	211	1	1	1				
25	Feb 22	42.55	-68.902	181	1	1	1		1		
26	Feb 23	42.547	-69.532	286	1	1	1		1		
27	Feb 23	42.632	-69.422	233	1	1	1				
28	Feb 24	42.88	-69.057	194	1	1	1				
29	Feb 24	42.942	-69.077	209	1		1				
30	Feb 24	43.052	-68.905	162	1		1				
31	Feb 24	43.048	-69.127	145	1		1		1		
32	Feb 24	43.14	-69.305	208	1		1				
33	Feb 24	43.047	-69.348	190	1		1				
34	Feb 24	42.97	-69.212	211	1		1				
35	Feb 24	42.885	-69.35	150			1				
36	Feb 24	42.882	-69.127	162	1	1	1				
37	Feb 24	42.943	-69.08	205	1	1	1				
38	Feb 24	42.88	-69.06	195	1	1	1				
39	Feb 24	42.88	-69.057	190	1		1				fixed depth VPR tow
40	Feb 24	42.872	-69.043	189	1		1				fixed depth VPR tow
41	Mar 3	42.887	-69.135	166		1	1				
42	Mar 3	43.163	-68.782	177		1	1		1		CTD stopped prematurely
43	Mar 3	43.162	-68.787	173			1				
44	Mar 3	43.255	-68.595	177		1	1				
45	Mar 3	43.347	-68.407	192		1	1				
46	Mar 3	43.440	-68.213	182		1	1				
47	Mar 3	43.532	-68.020	214		1	1				
48	Mar 3	43.620	-67.832	244		1	1				
49	Mar 3	43.715	-67.635	238		1	1				
50	Mar 6	43.875	-67.705	206		1	1				
51	Mar 6	43.712	-67.635	236		1	1				
52	Mar 6	43.618	-67.827	241		1	1				
T2	Mar 6	43.607	-67.820	241			1	1	1		did not reach bottom
53	Mar 6	43.535	-68.017	215		1	1				
54	Mar 7	42.877	-68.900	90		1	1				
55	Mar 7	42.880	-69.055	202		1	1				
T3	Mar 7	42.876	-69.057	194				1			good tow!
56	Mar 7	42.882	-69.123	165		1	1				
57	Mar 7	42.715	-69.355	222		1	1				
58	Mar 7	42.630	-69.447	239		1	1				
59	Mar 7	42.627	-69.540	257		1	1			1	
60	Mar 7	42.620	-69.593	288		1	1				

Figure 1. Locations of completed oceanographic sampling stations during DE0803. Partially completed stations are omitted. GoMOOS buoy M01 position is indicated (*).

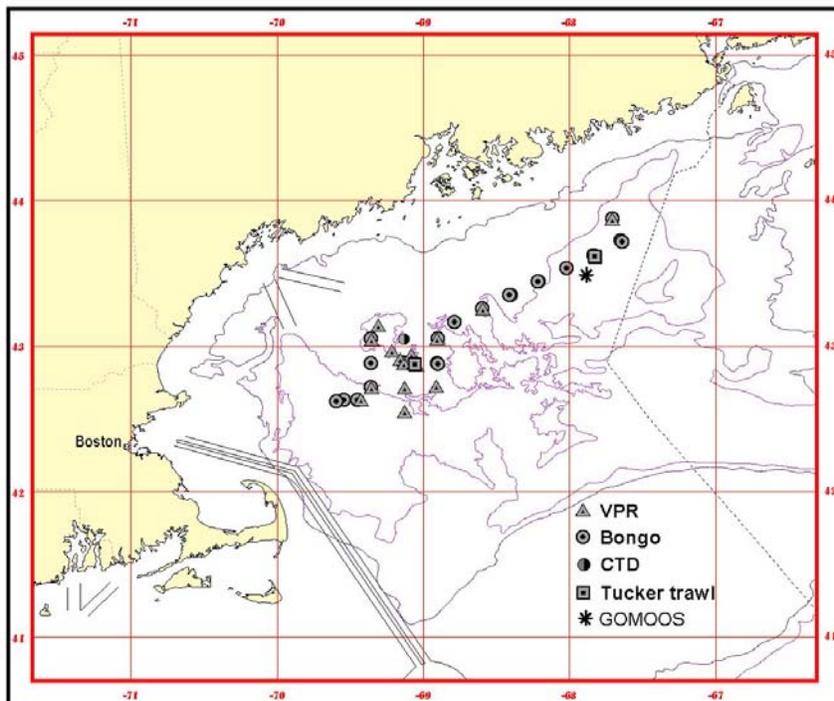


Figure 1. Visual survey effort and large whale sightings identified to species during DE08-03. Grey lines show visual survey effort for marine mammals.

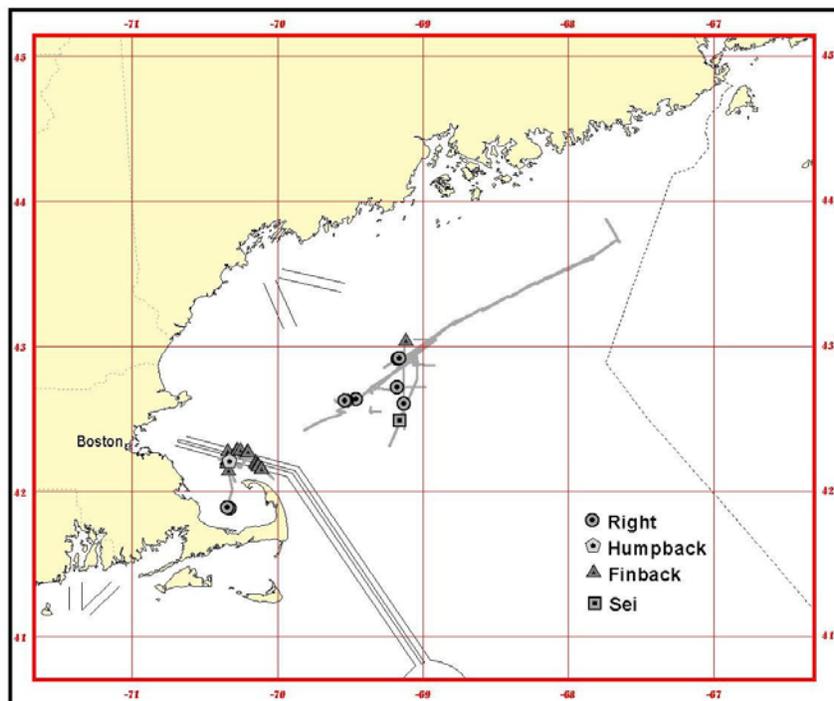


Figure 3. Vertical cross sections generated from a subset of the CTD data collected from stations running northeast from Cashes Ledge to Jordan Basin. Station identifiers are shown on the top of the X-axis. The bottom X-axis shows the distance in kilometers from the southwestern-most station in each cross section.

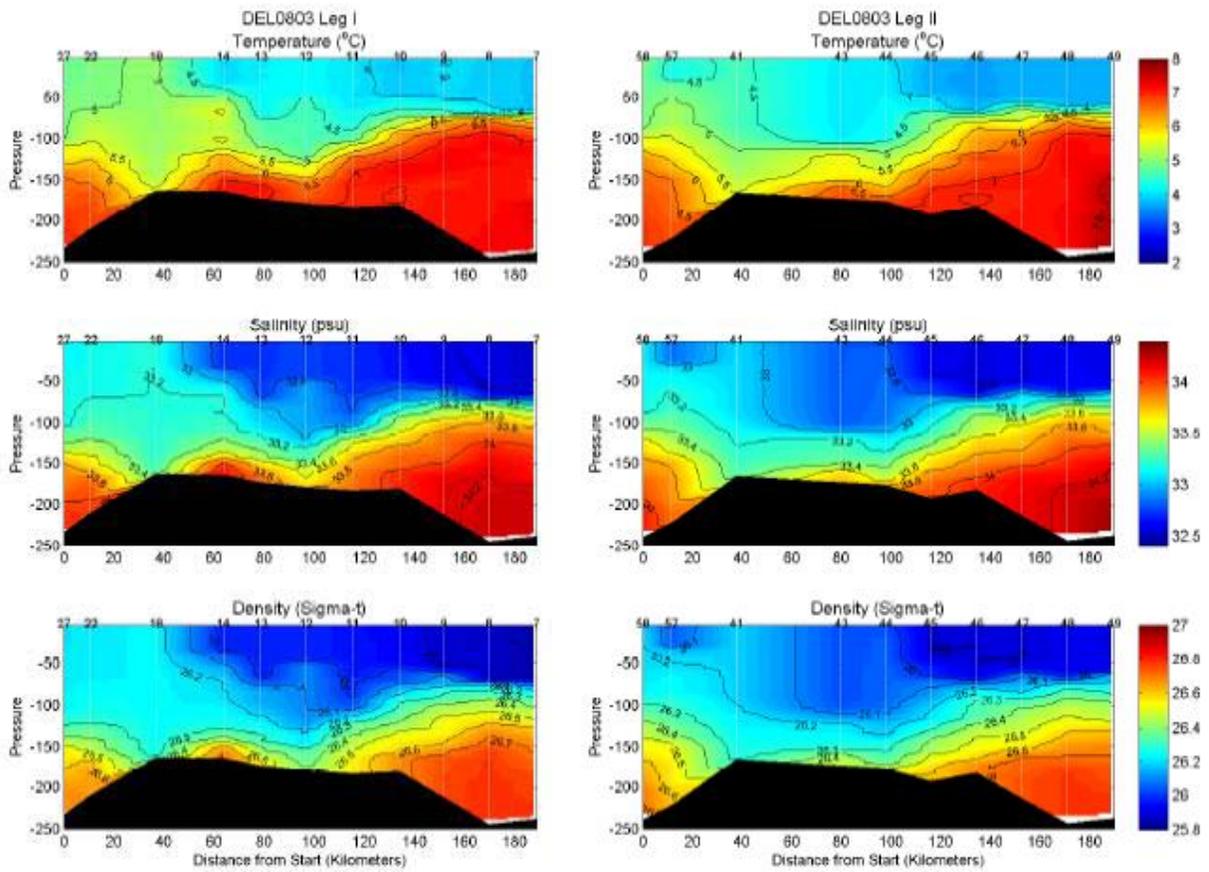


Figure 4. Oceanographic condition time series from the Jordan Basin GoMOOS buoy M01. X-axis shows Julian day.

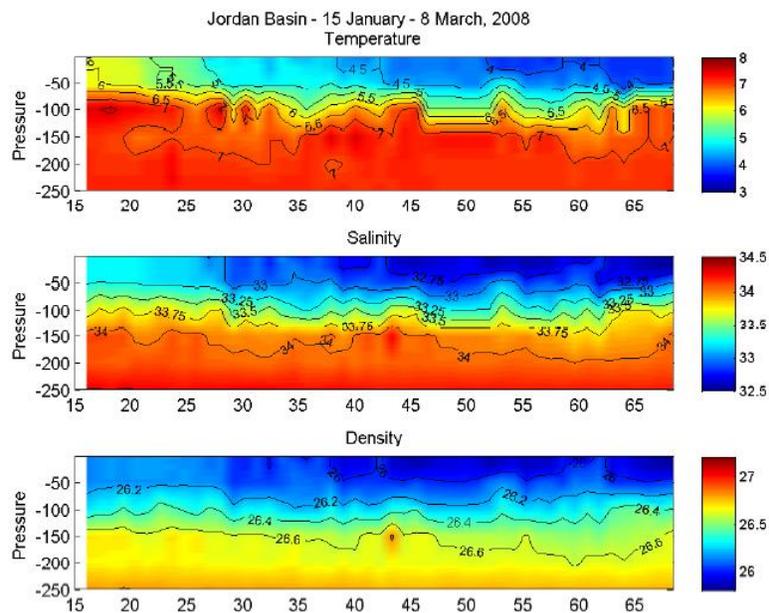
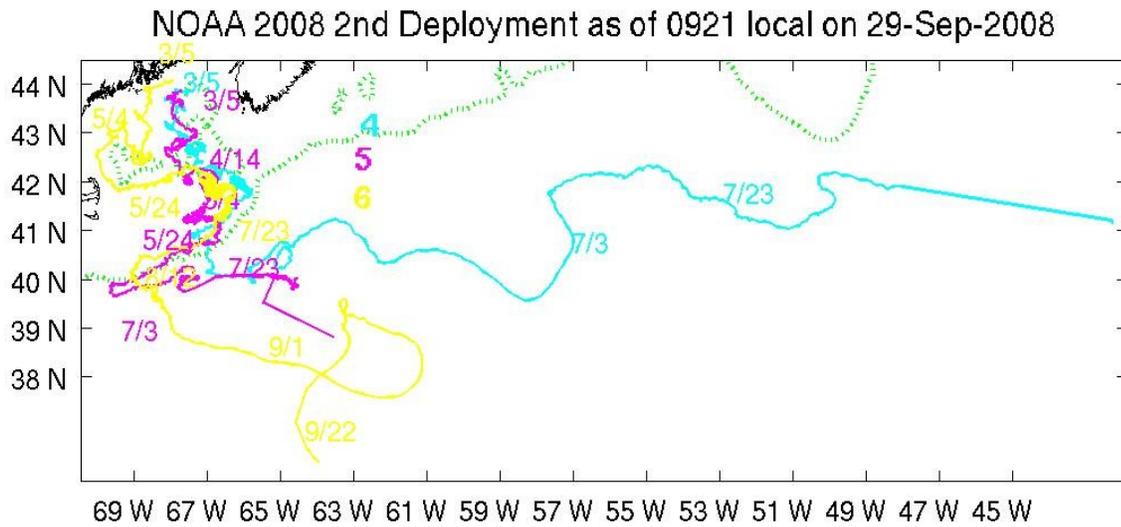
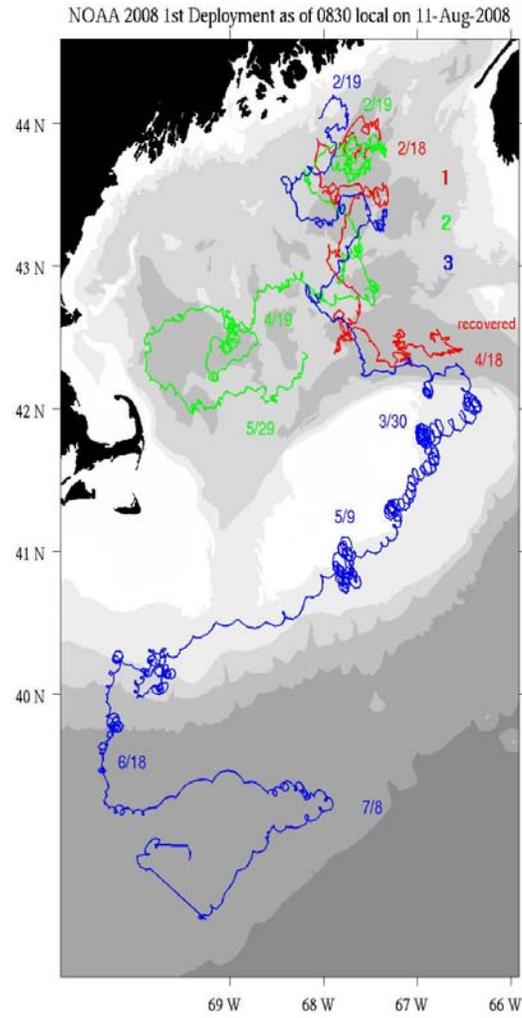


Figure 5. Tracks from drifters deployed during DE0803.



DAILY REPORTS

Monday-Wednesday (2/11-13): Weathered in--stayed dockside in WH.

Thursday (2/14): Did not leave dock due to fried circuit board in gyro. Circuit board replaced and gyro certified late Friday.

Saturday (2/16): Left dock @11:00. Officers noticed gyro misbehaving while transiting Buzzards Bay @15:00. Started back for WH, but ET identified and fixed reversed wiring in the gyro's analog-to-digital converter. We turned back around and got through the canal by 20:30. Then spent an hour recalibrating starboard radar before heading offshore.

Sunday (2/17): Two right whales spotted by Conger at 06:45 between Fippennies and Cashes Ledge. Our first deployment of VPR/bongo sampling gear made near the whales. At 2nd station (JB021), CTD real time data stream stopped 140 m down. Redid wire connections and all was well at the next station. The NOAA Twin Otter N48 passed overhead mid-morning after aborting a survey of Jordan Basin due to sea state. They also circled the area where we had the two right whales earlier, but did not resight them. At our fourth station the CTD failed again at 127m. Swapped out CTDs for the fifth station (JB024), but CTD failed again at 20m. Taylor and Hare worked through remainder of the day and into the evening troubleshooting. Maintained a northeast course to deploy drifters off Maine coast. Got the last of three drifters in at 21:15, then settled in to a slow and comfortable transit toward an anchorage in Frenchmans Bay--ETA 06:00 tomorrow. Winds currently south about 25 knots, but expecting up to 40 by early tomorrow. Preliminary review of the VPR data from near the whales indicated the copepods were more numerous nearer the bottom. Last tow at JB024--which only went to 20m--still caught a fair number of copes. Half a dozen dovkie near this last station. In 2.5 hrs on watch I saw about 40 fulmars and dovkie, 25 murre, a couple puffins and a dozen or so gulls--one Icelandic possibly. Not a lot of life, but more alcids than I've seen in awhile--one of the benefits of offshore surveys in winter.

Monday (2/18): Dropped the anchor about 09:00 just north of Bar Island in Frenchmans Bay. Wind gusting up to 60 knots. No mammal watch or small boat ops today. Jon, Maureen and Eric the ET are repotting the termination on the sea cable, which might resolve our CTD failures. Not sure when we'll get offshore again, though tomorrow we may try to find a deep spot near shore to test the new termination. The combination of wind and wave direction yesterday made it difficult to deploy and retrieve the VPR once the seas got up to 6'. Current forecast doesn't call for seas less than 8' until Wednesday.

In October 1984, a right whale was photographed where we are currently anchored. It was initially seen from the College of the Atlantic campus, which borders Frenchmans Bay. I was a freshman at COA that year, and was totally unaware that the whale was there.

Tuesday (2/19): Tested the termination while at anchor this morning. All went well when we sent the CTD down 26 m, but the true test will be to 280m over Jordan Basin tomorrow. We think the problem may be with the cable, and hopefully any short is somewhere in the 100m we removed from the spool. Today winds are 30 knots and seas 10' offshore, so we're hanging on the hook until tomorrow morning.

Wednesday (2/20): Weighed anchor at 07:00 this morning and headed out. Arrived at our northeastern station (JB017) at 11:30. Seas and wind still too high for safe deployment of the VPR, so loitered through the afternoon. Going to reassess sea conditions later this evening and possibly make a deployment.

Thursday (2/21): Started a VPR cast over station JB017 at 07:00 local. Post-processing revealed intermittent power outages on the VPR. At the next station (JB027), the VPR strobe would not turn on. After checking all connections and switching out the battery and hard drive, we moved the VPR inside and rigged a standard bongo. On the next station, we also made a tow with the Tucker trawl in 240m over Jordan Basin. Caught a few copepods, some shrimp and grass. Completed another 11 bongo stations over the next 17 hours, running down the the center JB stations and completing the northern half of our Cashes Ledge (CA) stations. Posted a marine mammal watch in the wheelhouse for several hours throughout the day, but Beaufort 5-6 sea state did not yield sightings. Outdoor temp dipped to -8C, freezing spray along the starboard side of the ship.

Friday (2/22): Hauled the VPR back outside at 06:30 after it had spent 18 hours indoors. Warming the unit up brought it back to life! We concluded yesterday's cold temperatures shut the unit down, draining the battery and affecting the hard drive. Kind of a design flaw. We made VPR tows at the next three stations without a hitch. On the forth tow, the CTD went out at 120m, which we took to be another termination problem. We deployed the unit again at the next station, and this time the CTD didn't go out until 55m from the surface on the upcast. At the final station (CA043), the CTD shut down at 130m on the descent. We hauled back and got to work redoing the termination. Jon, Eric and Maureen are becoming a crack termination repotting squad. A mammal watch was posted through the morning, but was called off by early afternoon due to half-mile visibility in snow. Broke for one right whale at 42 42.5N 69 11.6W, but didn't resight it after 30 minutes of standing by (forgot to report to the advisory earlier--sorry!) No other whales seen. We're currently steaming toward Cape Cod Bay to find a lee before the wind and seas pick back up as a gale fills in this evening. To date, we've completed 25 stations to varying degrees, some duplicated (in JB).

Saturday (2/23): Got into Cape Cod Bay about midnight and departed by 7:00 this morning. Heard a LNG tanker calling the Coast Guard via VHF with right whale sightings in the shipping lanes. We had the tanker on the AIS receiver and contacted them directly for the report. They were in the shipping lanes due north of Provincetown outbound at 8.5 knots. Good boys.

Made a VPR/bongo cast in Wilkinson Basin down to 267m. CTD transmission was lagging a couple seconds all the way down, then cut out completely at 122m on the upcast. Maureen and Jon resumed troubleshooting and identified the likely culprit--abrasion on the CTD's cable where it passed through the VPR wing. CTD was replaced. We continued toward Cashes Ledge with a mammal watch posted on the flying bridge, and sighted a right whale at 16:30 at 42 38.1N 69 27.2W. Followed it for nearly an hour, in which time the whale moved 1.5 nm east. Made a VPR cast in the vicinity and everything worked fine. Now steaming for the little basin just west of Cashes Ledge.

Sunday (2/24): Sampled through the night with the VPR only at our northern Cashes Ledge stations. Also hit a couple deep holes. This morning we put the bongo back on with the VPR and moved over the basin just west of Cashes Ledge. We made two vertical casts, then removed the bongos and made a horizontal tow at 30m for an hour, and a second horizontal tow at 175m for an hour. After the second tow, we headed for Great Round Shoal. Kept a mammal watch much of the day until sunset. A couple whales were sighted, but the species was positively identified for only one sei whale, sighted in the late afternoon by Fred. We completed 40 oceanographic stations and one Tucker trawl on this leg. We will be at the dock in Woods Hole about 07:00 tomorrow. Weather sounds menacing for Tuesday afternoon through Wednesday, so we may delay our departure for the second leg until Thursday.

Thursday (2/28): Departed the NEFSC dock at 15:00. Went through Nantucket Sound and across Great Round Shoal enroute to Cashes Ledge.

Friday (2/29): A half inch of ice covered the port deck forward of the wheelhouse after our overnight passage. We arrived at the Cashes Ledge station CA031 at 06:00 and began surveying NE toward station CA013 at 7 knots. We kept watch from the wheelhouse due to the -20C wind chill. After reaching the end of our line, we turned west and headed to CA012. Two whales were spotted, but we were not able to resight them to get a species identification. One fin whale was sighted by Fred. At CA012 we turned due south and increased speed to 10 knots. With partly sunny skies and a 10 knot tail wind, we moved up to the flying bridge for an unobstructed view. Despite near glassy seas and a crisp horizon, we had no mammal sightings. We ended watch a little before sunset. Headed for Cape Cod Bay tonight. Forecast for Saturday is SE winds at 35 knots, swinging NW at 35 Sunday, so looking like a couple nights on the hook.

Saturday (3/1): Anchored inside Provincetown Harbor to wait out SE gale force winds, which only showed briefly. Winds forecast to come NW late and increase to 40 knots.

Sunday (3/2): Still at anchor. Winds were NW at 35 knots early and didn't get below 20 until late in the day. Weighed anchor at 17:15 and began to make our way out to Cashes Ledge. Winds predicted to be light and variable tomorrow, then coming SW and picking up to gale force again.

Monday (3/3): Just a little roly transiting out to Cashes last night. Swell pretty much gone by 03:00. Arrived at our station a little west of Cashes Ledge (CA022) at 06:15 with calm seas and a crisp horizon. A line of clouds covered us by 10:00, and by 13:00 we were up to a Beaufort 5 from the southwest. We sampled the oceanographic stations running up the middle of Jordans Basin, keeping mammal watch in between. Completed the northeastern-most station a little before 19:00. Dropped off three drifters on our way in towards Frenchmans Bay, deploying the last one about 22:00; wind and seas made it quite a wrestle to get the drifter to the stern quarter. Next couple days have gales coming through, so we may be anchored up until Thursday.

Tuesday (3/4): Dropped anchor 06:30 this morning just north of Bar Island in Frenchmans Bay. Wind was steady out of the southwest near 30 knots with gusts to 50 in the morning, then came north and decreased to 10 by mid-afternoon. Put together the last two drifters, which we'll deploy off the coast here on Thursday. Forecast calls for a northeast gale tonight then a southerly gale tomorrow. The most current plots of the drifters can be seen at: <http://www.nefsc.noaa.gov/drifter/>

Wednesday (3/5): Still at anchor. Winds southeast around 25 knots with rain and sleet. Forecast calls for winds to shift south and increase a little more. Tomorrow still sounds promising with west winds around 20 knots in the morning, decreasing in the afternoon.

Thursday (3/6): Off the hook by 06:30 and out of Frenchmans Bay an hour later. Between 09:00 and 09:30, we dropped off the last two drifters near Great Duck Island, anticipating they will pass by Cape Cod in a couple months. We then headed to our northeasternmost station on Jordan Basin (JB017) for a bongo tow. From there we steamed southwest to JB027 for another, then to JB026 for another. We kept a marine mammal watch in between stations, but saw nothing despite great conditions. After the bongo at JB026, we attempted a Tucker trawl, but 400 meters of wire out only got the trawl down to 172 m (according to the TDR mini logger), 70 m above the bottom. After the Tucker, we carried on to JB025 for our last bongo of the day, which we finished at 18:30.

Friday (3/7): Mostly cloudy with light east winds in the morning. We made a bongo tow just east of Cashes Ledge (station CA023), then moved to the little basin just west of Cashes for another bongo and a Tucker trawl. The wire had a better angle for this Tucker trawl (maybe 30-degrees depressed from horizontal), and our wire out formula worked perfectly (according to the mini logger). Towing slower (≤ 2 knots) was the key. Messenger took about 90 seconds to reach the release mechanism with

300m wire out. Made another bongo tow at CA022, then headed southwest to CA031 for yet another. After the station we continued southwest and made another tow where we had seen a whale 10 days ago. We kept a mammal watch most of the day with nothing to show, but around 13:45 and 42 38N 69 32W, Fred spotted some right whales. We broke off and made a bongo tow near one that had been breaching. The nets came up with some mud. We spent another hour in the area, but the whales dispersed. Maybe it had been a social gathering, or perhaps our arrival prompted their departure. One whale that we followed for a couple miles seemed to be trying to keep its distance despite us trailing a half mile behind. Noisy ship? We gave up on the whales and moved to a deep spot (290m) in Wilkinson Basin and did our 63rd and final tow for this cruise. Headed to Stellwagen Bank for the morning, where we'll try to run some lines over sonabuoy arrays before the storm comes in. We'll ride out the storm in P-town Harbor.

Saturday (3/8): Overcast with light drizzle, fog in and out. By 08:00 the visibility was up to two miles. Kept watch from the wheelhouse for an hour, then moved up to the flying bridge for an hour before precipitation chased us back down to the wheelhouse. We zigzagged over the southern Stellwagen sonabuoy array until 15:00. After that the fog came in to stay. A humpback and several fin whales were sighted, plus a couple of whales that we could not close on to identify to species. We were at anchor in P-town harbor by 17:00.

Most of today's watch was in good to fair sighting conditions (and occasionally poor in fog patches). However, watching from the wheelhouse introduces about 10-degrees of obstructions (vents and the forward A-frame), plus the trackline is obscured about a third of the time behind the bow bulworks as the vessel pitches. The distance to the horizon is about five nautical miles at height of eye in the wheelhouse (13 + 6 feet), versus six nautical miles from up on the flying bridge (20.5 + 6). The calculation is the square root of the height of eye in feet * 1.17 (thanks Monty!)

After reading 'noisy ship' in yesterday's report, Captain Wingrove showed me the radiated noise test results for the DELAWARE from last April. The values for this ship are above the noise limits recommended by ICES in 1995 to prevent avoidance of vessels by fish at 20 meters. At six knots, a swish at propeller shaft rpm (130) reached 154 dB re 1 microPA at 1 meter at the 63 Hz band. At 10 knots (215 srpm), 'fully developed propeller cavitation noise' reached 160 dB at 63 Hz and was above 150 dB up to 40 kHz. It'd be interesting to see how loud we were to the sonabuoys.

Sunday (3/9): At anchor. Wind gusts to 57 knots last night. Winds still steady at 25 from the west this afternoon.

Monday (3/10): Wind chill near -20C this morning with 20 knot northwest winds. Snow clouds to our east, but clear skies everywhere else. The Sagamore Bridge appeared as a towering fata morgana as we turned west at real time sonabuoy DMF1 and began our first trackline. Sighted a right whale 10 minutes later, at ~07:45 at 41 55N and 70 14W, and two more at 08:00. A few other distant blows were seen, but were too far for species identification. By 10:00 we were surveying around the sonabuoy array on southern Stellwagen. We stopped for lunch to give everyone a little extra time near a heater. At ~12:30 we had at least five fin whales within a mile or so of 42 13.5N and 70 19.5W, including one that was side lunging at the surface. A couple more fin whales were seen a few miles north of this position. Things got quiet as we moved north towards the shipping lanes. Later in the day, we were back near the fin whales again, but this time there were at least seven. We also saw blows far to our west, illuminated by the sun and standing out against the dark hills of Manomet and Plymouth. There was more bird activity here than we had seen the entire trip combined--alcids, gannets and piles of gulls. At 17:00 we ended our survey and started for the entrance to Nantucket Sound. The wind promptly dropped. As we steamed a couple miles off the backside of the Cape, we passed two right whales cavorting in the calm seas and sunset (at 18:15 at 42 02N and 69 59W). They abandoned the activity as we came within 500m, and were not seen again.