

CRUISE REPORT
Delaware II Large Whale Survey DE05-10
July 28 - August 16, 2005

Tim Cole¹, Peter Duley¹, Nadine Lysiak², John Nicolas¹, Misty Niemeyer¹ and Chris Tremblay¹

¹Northeast Fisheries Science Center, 166 Water Street, Woods Hole, MA 02543, USA

²Boston University Marine Program, Marine Biological Laboratory, Woods Hole, MA 02543, USA

OBJECTIVES AND METHODS

The 2005 Large Whale Survey DE05-10 was conducted between July 28 and August 16, 2005, aboard the NOAA R/V Delaware II. The cruise was operated by the National Marine Fisheries Service's (NMFS) Protected Species Branch, at the Northeast Fisheries Science Center (NEFSC). Cruise objectives included charting right whale (*Eubalaena glacialis*) distribution on the Northeast Peak of Georges Bank, identifying food resources there, and photographing individual right whales encountered there for mark-recapture analyses. In addition, systematic visual and oceanographic surveys were conducted in the Bay of Fundy and over Roseway Basin to provide data for predictive modeling of right whale distribution.

Visual surveys were conducted from the ship's flying bridge from 06:00 to 17:30, weather permitting. Two observers searched for whales on either side of the ship's track using naked eye, 7x50 or 25x120 binoculars. A third observer searched directly ahead of the ship using naked eye only, and also served as the data recorder. Positions were rotated every 30 minutes or following each oceanographic sampling station. Ship speed during surveys was typically 10 knots through the water.

Marine mammal observations, sighting conditions and effort data were recorded using a custom data entry system ("Pingle") on Newton Messagepads. All marine mammal species sighted were recorded. Data included species, group size, distance, bearing, direction of movement and behavior. 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. In addition, the ship's Scientific Computer System (SCS) automatically collected a suite of environmental information every 15 seconds, including the ship's position, speed, heading and the sea surface temperature. This SCS data was merged with the time stamped effort and sighting data post-cruise. All survey data is archived in the NEFSC Oracle database system in Woods Hole.

Track lines on the Northeast Peak of Georges Bank were laid out to maximize the likelihood of encountering right whales, primarily directed over areas of past sightings. The start and end points of these lines were determined on scene, and were chosen according to right whale sighting reports and weather conditions. A systematic survey was used in the lower Bay of Fundy and over Roseway Basin. The surveys' transects and oceanographic sampling station locations were the same as those used during DELAWARE II cruises DE-99-08 in 1999, DE-00-07 in 2000 and DE-01-08 in 2001. There were 23 oceanographic sampling stations along four transects in the Bay of Fundy, and 20 stations along four transects on Roseway Basin (Table 2 and Figure 1). At each station, a vertical cast was made with a conductivity/temperature/depth (CTD) instrument (Seabird model SBE 19-03, serial number 1914914-2277 & 1468). On our second visit to the Northeast Peak (8/6-8/8), a systematic survey with 16 oceanographic stations along four lines was conducted in the vicinity of Corsair Canyon (Table 2 and Figure 1).

Plankton samples were collected at stations near right whale sightings. The plankton samples were collected using 61cm bongo frames outfitted with 333 μ m mesh nets. The nets were towed obliquely to 5m off the sea floor. The depth of the nets was measured during the tow using a Seabird SBE 19-03 CTD affixed to the tow wire, and the flow of seawater through the nets was measured using General Oceanics flow meters. All contents from one of the nets were taken to estimate copepod biomass at each station, preserved in a 1 liter jar with 50ml of 37% buffered formaldehyde. From the other net, one 25ml subsample was placed in a scintillation vial and frozen at -10° C for an analysis of natural toxin levels. A second 25ml subsample was frozen at -10° C for stable isotope analyses.

An 8-liter surface water sample was collected at bongo tow stations for whole water biotoxin analysis. The water sample was poured through a 10 μ m sieve to retain phytoplankton, and the sieve contents backwashed into a 50ml

tube pre-charge with 1.0ml Acetic Acid/formalin preservative. After 25ml of backwash had accumulated, the tube was topped off with sieved (clean) seawater. Whole water samples were refrigerated at 4°C.

Photographs were collected from the ship using a 6.3 megapixel Canon EOS D10 equipped with a 500mm 4.5 lens and an 8.2 megapixel Canon D20 equipped with a 100-400mm 4.5-5.6 lens. Time stamped JPEG images were saved onto the cameras' compact flash cards and downloaded onto a desktop computer at the end of each day and inter-matched within and between days. All images are kept in the NEFSC Protected Species Branch digital archives. Copies of all right whale images were sent to the North Atlantic Right Whale Catalogue at the New England Aquarium in Boston, Massachusetts. Copies of all humpback whale fluke images were sent to the North Atlantic Humpback Whale Catalogue at College of the Atlantic, Bar Harbor, Maine, and to the Center for Coastal Studies in Provincetown, Massachusetts.

RESULTS

Effort and large whale sightings are summarized in Table 1. Figure 1 shows the locations of oceanographic sampling conducted during the cruise. Figures 2 - 7 show survey tracks and locations of all cetacean sightings made during line transect surveys. A total of 88 survey hours were logged over 16 days of effort. Another dozen or so hours of informal watch were kept when the ship was transiting productive areas such as the Great South Channel and Grand Manan Banks. There was no survey effort on three days due to weather, and another full day was spent in transit. A total of 125 CTD casts, 11 bongo net tows (the first was a test tow) and 10 whole water samples were completed. A total of 10 individual right whales were photographed, as well as two humpback whales. One of the humpbacks photographed was entangled, and the ship spent a day (8/13) assessing the entanglement. Low visibility and Beaufort 5 conditions precluded launching the fast rescue boat to attempt to disentangle the whale. Conditions improved and the whale freed the following day by members of the Provincetown Center for Coastal Studies Disentanglement Team aboard the R/V Shearwater.

ACKNOWLEDGMENTS

We thank the captain and crew of the NOAA R/V Delaware II for all their help with this work, including Steve Wagner (Master), Dan Price, Nathan Priester, Bob Carter, TK Arbusto, Mike Conway, Paul Cruwys, Oliver Owen, Brian Murphy, Grady Abney, Trevor Pacheco and Steve Weber. Brenna Kraus of the New England Aquarium provided a catalogue of unbiopsied right whale mothers and calves. We are also grateful to Jerry Conway and Rob Stephenson of the DFO for their continued assistance and cooperation regarding marine mammal research in the Bay of Fundy and on the Scotian Shelf. Maureen Taylor, Cristina Bascunan, Richard Pace and Mark Baumgartner provided invaluable shore-based support.

Table 1. Summary for the DE05-10 Large Whale Survey, July 28 - August 16, 2005. "Effort" shows the number of hours on survey (S), the number of CTD casts (C) and the number of bongo net tows and surface bucket samples (T) for each day. "Area Surveyed" lists approximate daily start and end positions, however, track lines often had acute course changes and paralleled 50-fathom contours. Loitering in an area is indicated by one central position (within 15nm). Bracketing latitude and longitude of survey grids are provided. "SS" is the Beaufort sea state and "Viz" is the visibility in nautical miles (7 = crisp horizon). "Sightings" gives both the tally of the total number of individuals seen as well as the number of sightings in parentheses--no parentheses indicates only singletons seen. Species codes include: Eg = right whale; Mn = humpback whale; Bp = fin whale; Bb = sei whale; fs = fin/sei whale. The "ID" column tallies the number of individuals photographed. "Biopsy" is the number of individuals from whom skin samples were successfully collected.

Date	Effort	Area Surveyed	SS	Viz	Sightings	IDs	Biopsy
July 28	S 2	Great Round Shoal 41°26N 69°30W to 41°26N 69°05W (transit from Woods Hole, MA)	6	5	Mn 20+*	--	--
29	S 4 T 1	Corsair & Georges Canyons 41°20N 66°08W (exploratory survey)	4-5	3-7	Eg 3 Mn 2*	Eg 1 Mn 1	--
30	S 6 C 8 T 1	Corsair Canyon & Northeast Peak 41°18N 66°06W to 42°05N 65°57W (exploratory survey)	0-3	1-7	Eg 6(2) Mn 2(1) Bp 11(8) Bb 3* fs 2	Eg 2	--
31	S 8 C 15	Roseway Basin 42°48N to 43°00N by 64°59W to 65°33W (systematic survey grid)	0-2	7	Eg 6 (5) Mn 18(16) Bp 51(42) Bb 2 fs 3	--	--
August 1	S 4 C 5 T 2	Roseway Basin 43°06N by 64°59W to 65°33W (systematic survey grid)	2-3	7	Eg 4* Mn 24(21) Bp 31(23) Bb 1	Eg 4	--
2	S 1 C 2	Bay of Fundy 44°37N 66°25W (weathered out)	2	2-0	--	--	--
3	S 7 C 12	Bay of Fundy 44°52N to 44°22N by 66°28W to 66°36W (western half of systematic survey grid)	4-1	7	Eg 12(7) Mn 6 Bp 2	--	--
4	S 7 C 11 T 1	Bay of Fundy 44°52N to 44°22N by 66°19W to 66°10W (eastern half of systematic survey grid)	3-1	7	Eg 1 Mn 13(6)		
5	--	Bar Harbor, Maine (weathered out)	--	--	--	--	--
6	S 7 C 4 T 2	Northeast Peak & Corsair Canyon 42°20N 66°48W to 41°33N 65°50W (transit and partial systematic survey)	3-2	2-6	Eg 5* Bp 2 Bb 12*	--	--
7	S 7 C 9	Corsair Canyon 41°15N to 41°27N by 65°50W to 66°18W (systematic survey grid)	5-3	7	Eg 2 Bp 5(4) Bb 3(1) fs 4(6)	--	--
8	S 6 C 7 T 2	Corsair Canyon 41°33N to 41°27N by 65°50W to 66°18W (systematic survey grid)	0-2	7	Eg 7* Mn 2 Bb 6(3) fs 10(3)	Eg 3	--

Date	Effort	Area Surveyed	SS	Viz	Sightings	IDs	Biopsy
9	S 6 C 12	Roseway Basin 42°48N to 42°54N by 64°59W to 65°33W (south half of systematic survey grid)	2-4	7-5	Eg 4(3) Mn 11(9) Bp 6(5)	--	--
10	S 1 C 2	Roseway Basin 42°48N 65°03W (fog; 1 systematic survey unit completed)	4	5-0	--	--	--
11	--	Roseway Basin 43°00N 65°33W (weathered out)	5	0	--	--	--
12	S 8 C 14	Roseway Basin 43°00N to 43°06N by 64°59W to 65°33W (3 north lines of systematic survey grid)	2	5-7	Eg 1 Mn 14(12) Bp 15(11) fs 3	--	--
13	--	Western Browns Bank 42°40N 66°34W (disentanglement support; weathered out)	5	0	Mn 1	Mn 1	--
14	S 7 C 14	Bay of Fundy 44°52N to 44°22N by 66°19W to 66°10W (eastern half of systematic survey grid)	1-2	1-3	--	--	--
15	S 7 C 10 T 2	Bay of Fundy 44°52N to 44°22N by 66°28W to 66°36W (western half of systematic survey grid)	1-2	2-7	Eg 18(9) Mn 16(9)* Bb 4 fs 2	--	--
16	--	Transit to Woods Hole, MA	--	--	--	--	--
Totals	S 88 C 125 T 11	--	--	--	Eg 69 Mn 129+ Bp 123 Bb 31 fs 24	Eg 10 Mn 2	0

*Some or all sightings made during informal survey effort.

Table 2. Station identifier, latitude and longitude of oceanographic sampling stations in the Bay of Fundy, over Roseway Basin and in the vicinity of Corsair Canyon during NEFSC Large Whale Cruise DE05-10.

Bay of Fundy oceanographic sampling stations (sampled twice)

BF10	44° 50.0N	66° 36.0W	BF20	44° 50.0N	66° 27.5W	BF30	44° 50.0N	66° 19.1W	BF40	44° 49.9N	66° 10.7W
BF11	44° 45.0N	66° 36.0W	BF21	44° 45.0N	66° 27.5W	BF31	44° 45.0N	66° 19.1W	BF41	44° 44.9N	66° 10.7W
BF12	44° 40.0N	66° 36.0W	BF22	44° 40.0N	66° 27.5W	BF32	44° 40.0N	66° 19.1W	BF42	44° 40.0N	66° 10.7W
BF13	44° 35.0N	66° 36.0W	BF23	44° 35.0N	66° 27.5W	BF33	44° 35.0N	66° 19.1W	BF43	44° 35.0N	66° 10.7W
BF14	44° 30.0N	66° 36.0W	BF24	44° 30.0N	66° 27.5W	BF34	44° 30.0N	66° 19.1W	BF44	44° 30.0N	66° 10.7W
BF15	44° 25.0N	66° 36.0W	BF25	44° 25.0N	66° 27.5W	BF35	44° 25.0N	66° 19.1W			

Roseway Basin oceanographic sampling stations (sampled twice)

BB45	43° 6.0N	65° 29.3W	BB44	43° 6.0N	65° 22.5W	BB43	43° 6.0N	65° 15.7W	BB42	43° 6.0N	65° 8.8W	BB41	43° 6.0N	65° 2.0W
BB35	43° 0.0N	65° 29.3W	BB34	43° 0.0N	65° 22.5W	BB33	43° 0.0N	65° 15.6W	BB32	43° 0.0N	65° 8.8W	BB31	43° 0.0N	65° 2.0W
BB25	42° 54.0N	65° 29.2W	BB24	42° 54.0N	65° 22.4W	BB23	42° 54.0N	65° 15.6W	BB22	42° 54.0N	65° 8.8W	BB21	42° 54.0N	65° 2.0W
BB15	42° 48.0N	65° 29.2W	BB14	42° 48.0N	65° 22.4W	BB13	42° 48.0N	65° 15.6W	BB12	42° 48.0N	65° 8.8W	BB11	42° 48.0N	65° 2.0W

Corsair Canyon oceanographic sampling stations (sampled once)

CC44	41° 33.0N	66° 14.0W	CC43	41° 33.0N	66° 7.3W	CC42	41° 33.0N	66° 0.7W	CC41	41° 33.0N	65° 54.0W
CC34	41° 27.0N	66° 14.0W	CC33	41° 27.0N	66° 7.3W	CC32	41° 27.0N	66° 0.7W	CC31	41° 27.0N	65° 54.0W
CC24	41° 21.0N	66° 14.0W	CC23	41° 21.0N	66° 7.3W	CC22	41° 21.0N	66° 0.7W	CC21	41° 21.0N	65° 54.0W
CC14	41° 15.0N	66° 14.0W	CC13	41° 15.0N	66° 7.3W	CC12	41° 15.0N	66° 0.7W	CC11	41° 15.0N	65° 54.0W

Corsair Canyon exploratory oceanographic sampling stations (sampled once)

CTD5	41° 27.1N	66° 15.4W	CTD6	41° 27.3N	66° 10.4W	CTD7	41° 27.4N	66° 5.6W	CTD8	41° 27.6N	66° 0.6W	CTD9	41° 27.9N	65° 55.4W
CTD4	41° 24.2N	66° 12.3W												
CTD3	41° 21.2N	66° 9.1W												
CTD2	41° 18.4N	66° 6.7W												

Figure 1. Locations of completed CTD stations and bongo net tows during NEFSC Large Whale Cruise DE05-10.

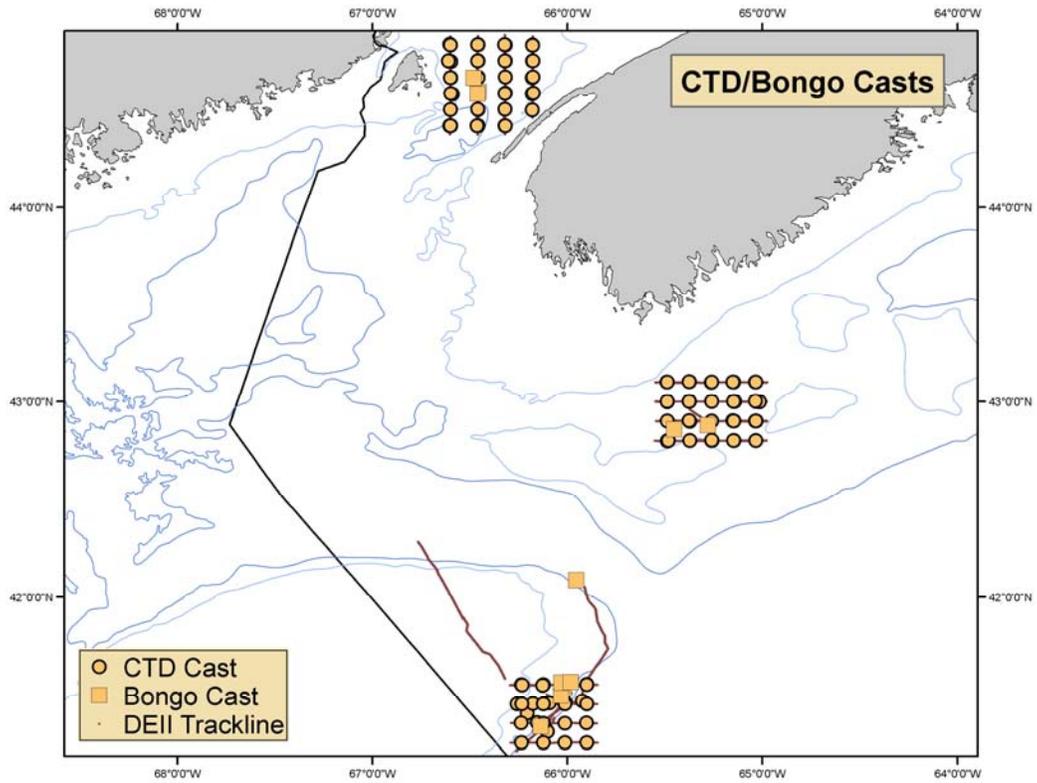


Figure 2. Right whale sighting locations during NEFSC Large Whale Cruise DE05-10.

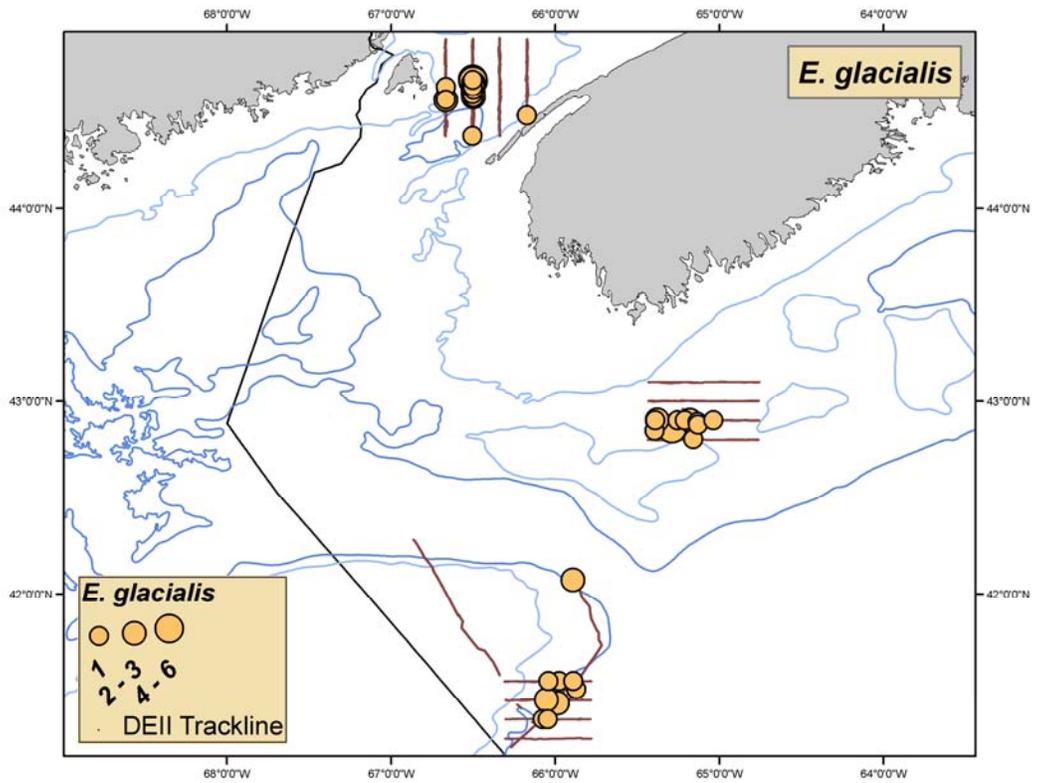


Figure 3. Humpback and minke whale sighting locations during NEFSC Large Whale Cruise DE05-10.

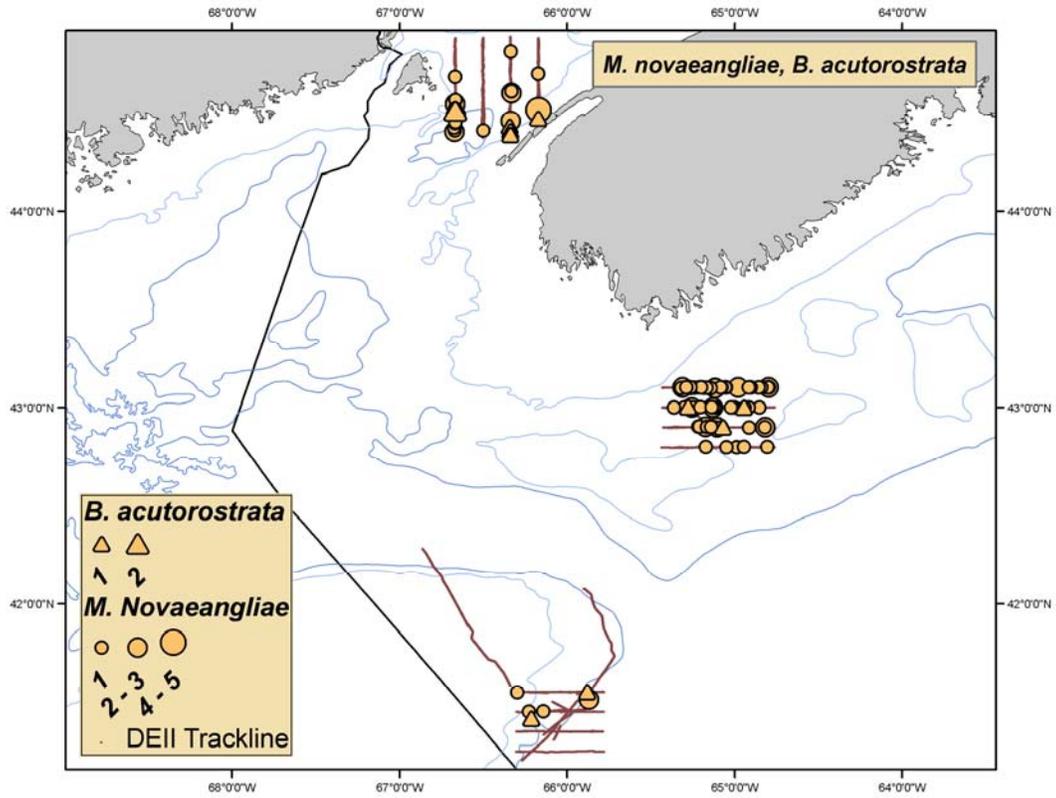


Figure 4. Fin and sei whale sighting locations during NEFSC Large Whale Cruise DE05-10.

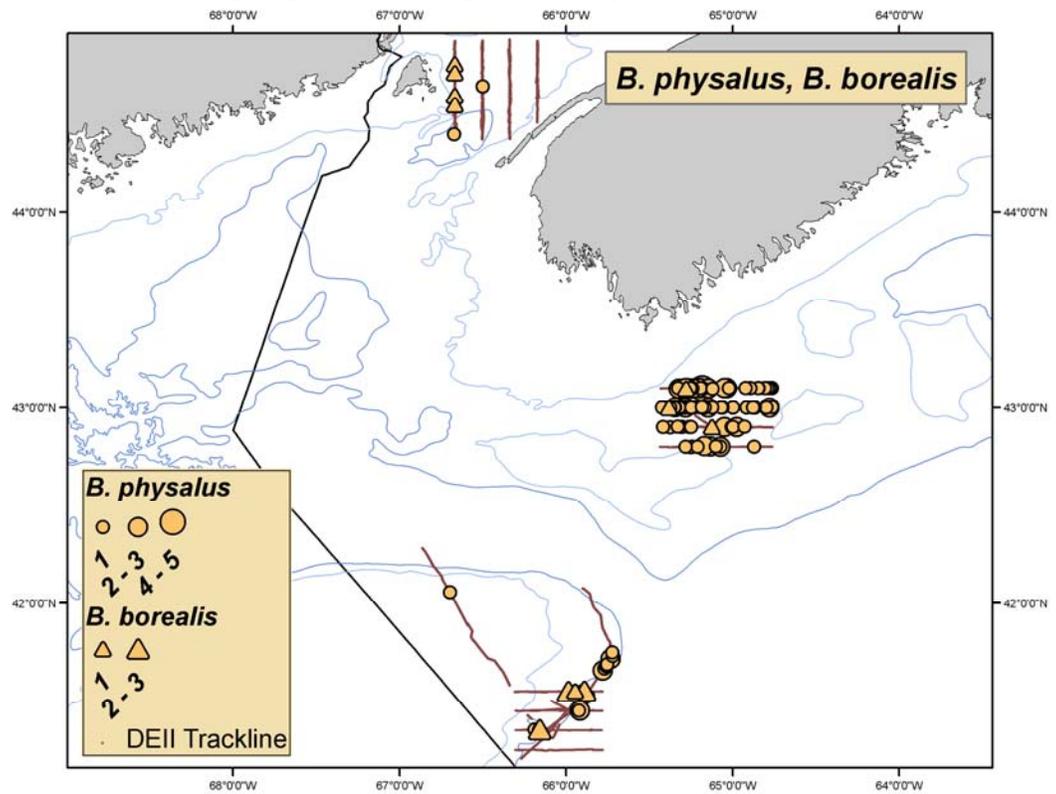


Figure 5. Odontocete sighting locations during NEFSC Large Whale Cruise DE05-10.

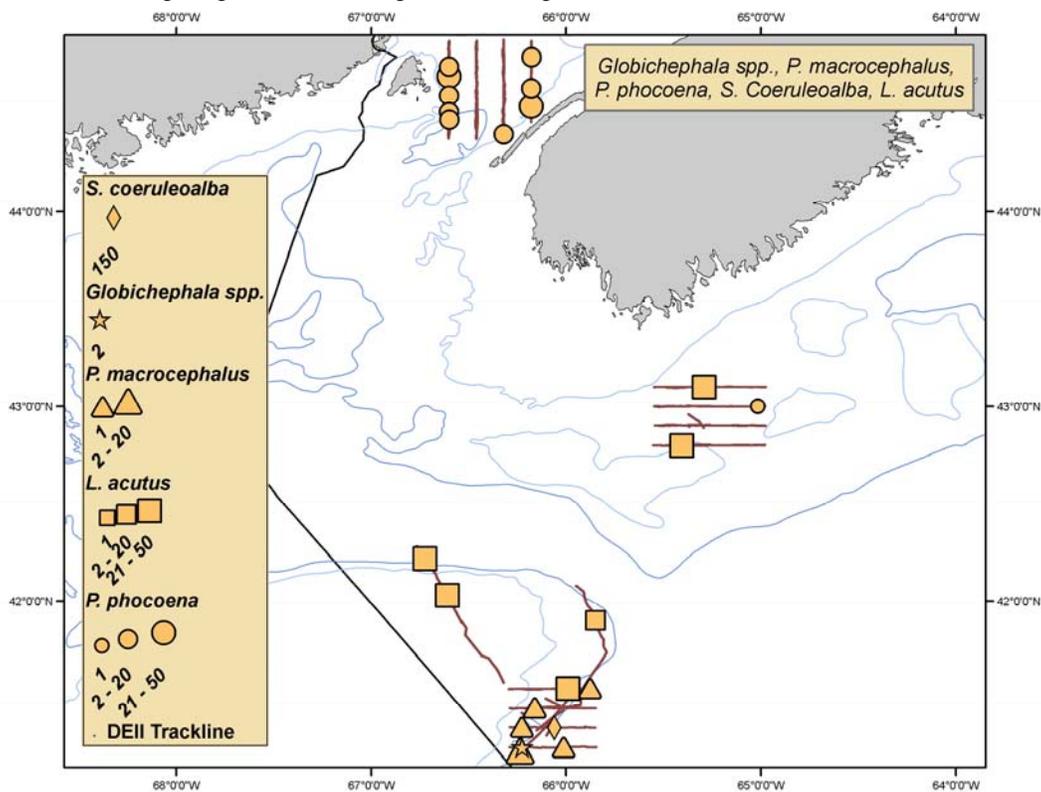


Figure 6. Common dolphin sighting locations during NEFSC Large Whale Cruise DE05-10.

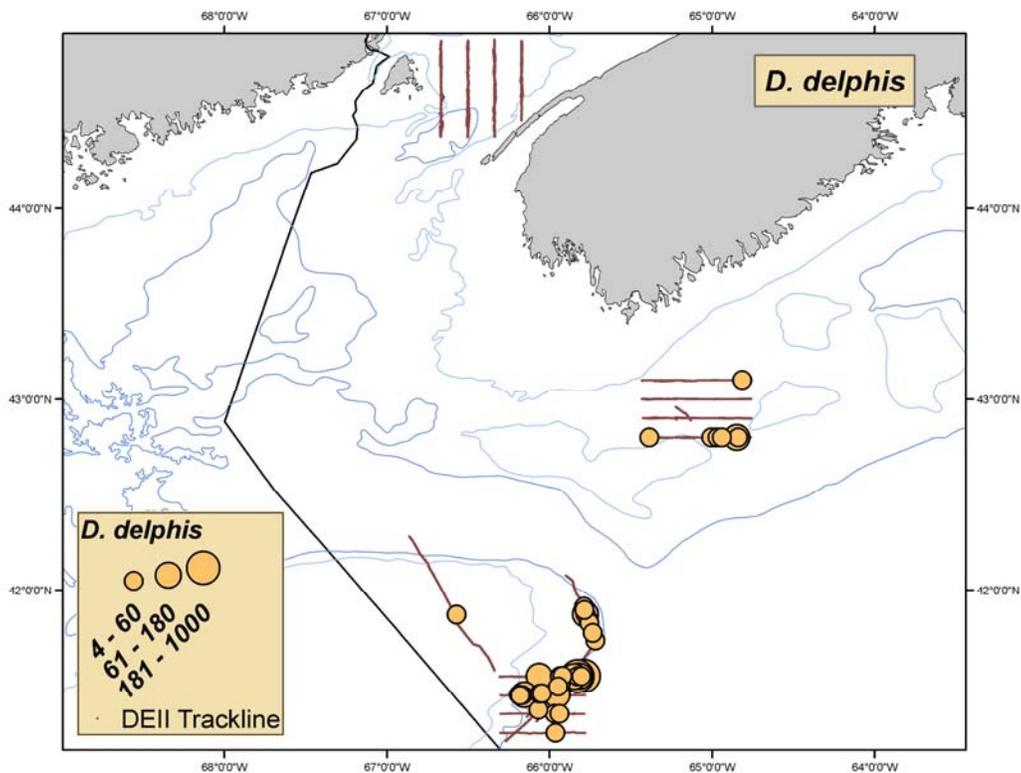
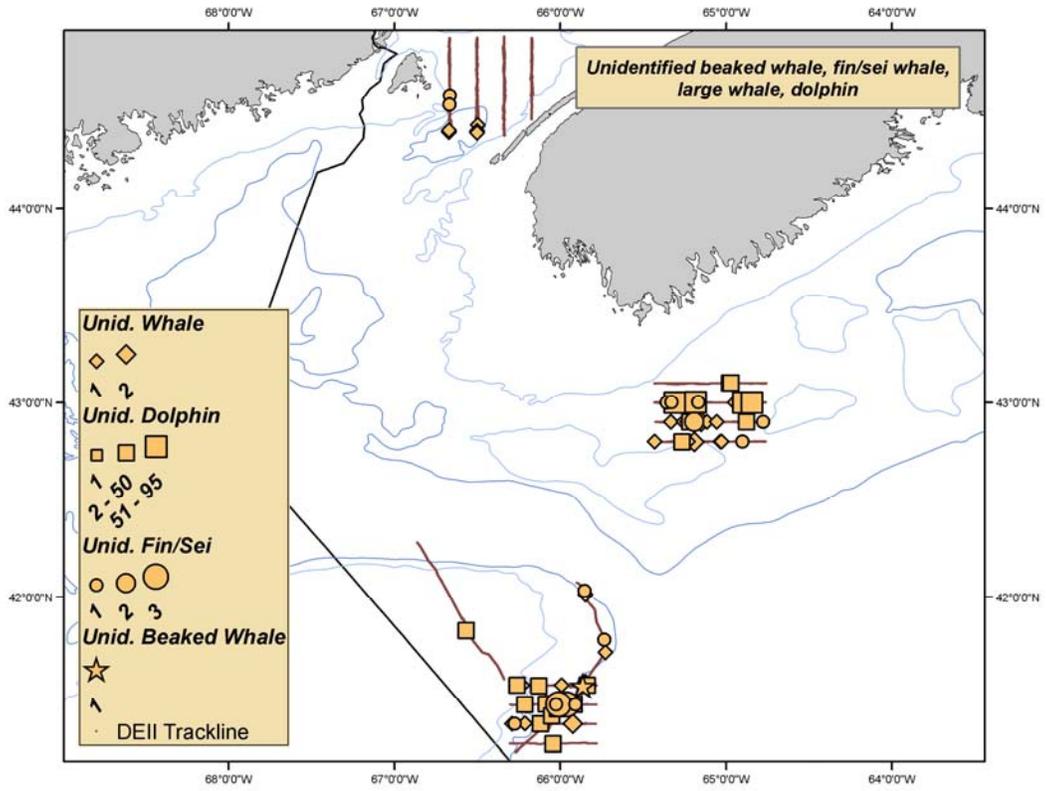


Figure 7. Unidentified cetacean sighting locations during NEFSC Large Whale Cruise DE05-10.



DAILY REPORTS

July 29: Left dock yesterday at 09:00 and headed to Southeast Part of Georges Bank. Posted an informal watch for two hours while crossing the Great South Channel. Seas 4-7' with 20k NE winds. At 15:15 4126N/6920W came across a large aggregation of humpbacks near the 50-fathom contour on east side of Great Round Shoal. Much breaching seen.

Crossed into Canadian waters @04:00 this morning in fog. At 9:30 fog cleared and we began watch on a SW course from 4132/6557 to 4112/6614, cutting across Corsair and Georges Canyons. At 11:00 we are at 4123/6604, seas continue at 4-7' in SE swell, wind N at 12k, SST 15C. Only common dolphins seen so far.

Two humpbacks seen near the head of Corsair Canyon (4120/6607). Pete got pics of flukes of one. At 17:25 Misty spotted two right whales at 4127/6603. Spent the next 90 minutes and the last of the good light trying to get colosity pics of one, but the whale was evasive. Got many shots of its completely clean flukes. The second whale moved further west and we did not get any photos of it. A third was seen breaching in the distance. No bongo tows made except for a test tow earlier in the day, to 100m in the center of Corsair Canyon (4120/6608). Only a salp and a few fish larvae collected. Also collected a surface water sample at this location.

July 30: Yesterday's right whales were less than 2nm NW of where we had 12+ right whales on August 8, 2003. We began today east of yesterday's whales, and ran into fog as we headed back to their location. So we steamed SW instead, back out of the fog and to the bottom of Corsair Canyon. Ran a series of four CTD stations 3.7nm apart along a NW line up the canyon and onto the bank. Encountered fog again when the bathymetry leveled off at 50 fathom. We then headed back east toward the right whales' location, making four more CTD casts enroute. The fog had lifted, but despite excellent sighting conditions no right whales were sighted. We then roughly followed the 50 fathom N. At 4205/6557 we came across five right whales. We photographed two of them well and did a bongo tow nearby (to 203m--10m off the bottom), which netted about 150ml of small krill with some copepods mixed in. Several sei whales were also in the area, and as we headed N out of the area we saw several seis high skim feeding against a fiery sunset. Headed to Roseway overnight.

July 31: Perfect survey conditions over Roseway Basin today, with light N winds and partly cloudy skies. Began our 20x30nm systematic survey grid at the SE corner (4248/6459) at 06:00 and completed three lines and 15 CTD stations by 18:20. Conditions remained perfect all day. Six right whales were seen in the southern part of the Basin. Fin whales and humpbacks seen throughout, but seemed more prevalent to the north of the right whales. Ended with 42 fin whale sightings totaling 51 individuals, and 16 humpback sightings totaling 18 individuals. A couple sei whales, a few minke, a handful of common dolphins and one harbor porpoise rounded things out. Will complete the final line here tomorrow, then go back to where we had right whales for bongo samples. Tuesday we will start the grid in the Bay of Fundy (wx permitting).

August 1: Completed our fourth systematic survey line (E to W along the 4306N line), which was swimming with fin and humpback whales—31 fins and 24 humpbacks sighted. After completing the line, we moved to the SE and came across two right whales at 4253/6519. A bongo tow yielded about 400ml of Calanus total, along with 300ml of salps and 100 or so krill. After the tow, we moved W and came across four more right whales at 4251/6533. Some of the crew went out in the Zodiac to photograph the whales, while others stayed back and made another bongo tow. This tow yielded closer to 800ml of Calanus, 200ml of salps and only a few krill. We stopped operations about 17:30, and in the early evening began steaming up to our SW-most station in the Bay of Fundy, where we'll be for the next several days to complete the systematic grid there. I neglected to mention that we are taking whole water samples for a biotoxin analysis being done by Greg Doucette. We collect the sample with a bucket, pouring 8 liters of surface water through a 10µm screen. We are also taking a Calanus subsample from one side of bongo net for Greg, and another subsample for a stable isotope analysis being done by Nadine Lysiak (who is aboard processing all samples). The full contents of the other bongo net are being preserved with formaldehyde and given to Mark Baumgartner.

August 2: Arrived in the Bay of Fundy in the early morning, but a thin fog layer forced us to delay surveying. At 7:45 it cleared as we had predicted, but we ran smack into it again near the Bulkhead. We waited until 10:30 for it to burn off, but in vain. So we headed NE in an effort to find a clearing. After steaming across the Basin at 7 knots, we broke through the fog and went full ahead to the starting waypoint on the N end of our easternmost survey line. We completed one survey unit southbound before a front swept in from the NW and lightning chasing us down from the flying bridge. We decided to call it a day at 15:30.

August 3: Clear skies and a fresh NW wind this morning. Started at the N end (4452N) of our survey track running down the 6628W line. No sightings were made until we drew close to our CTD station BF23 at 4435/6628, where we found nine right whales. Our westernmost line—6636W—was completed northbound and with no right whales sighted. We had five humpback sightings near the Bulkhead, one of which was a mom/calf pair. We saw only two fin whales today. No bongo tows today. Tomorrow the weather sounds promising for completing our two eastern lines here in the Bay. Then we will return to the Northeast Peak of Georges for a few days.

August 4: The wind turned light yesterday, and remained light today with clear skies. We completed the eastern half of our broadscale survey in the Bay. We stopped for an hour in the morning for a bongo tow and water sample near six right whales at 4433/6628, and then returned to our systematic grid. We saw only one other right whale--on our easternmost line at 4429/6612. We had six humpback sightings, one of which was a group of five at 4432/6611; the others were near 4430/6619. We had a couple minke whale sightings and many sightings of harbor porpoise in the glassy seas of the afternoon. There was little activity in the northern half of our survey grid. Tonight we're heading to Bar Harbor to dodge some weather. We'll arrive there tomorrow morning and will leave in the evening when the winds come NW, which will give us a smooth ride back out to the Northeast Peak in time to resume surveying Saturday afternoon, when conditions should be improved out there.

August 6: Light NW winds and a dying SSW swell this morning. A thick haze kept our visibility down to 2-3nm. Crossed the 50-fathom contour of the Northern Edge @07:15 enroute to Corsair Canyon. A couple schools of whitesided dolphins were seen along the Northern Edge. Began a 4 x 4 CTD station grid in an area bounded N/S by 4133N and 4115N, and E/W by 6550W and 6618W. Our CTD stations are spaced 6nm N/S and 5nm E/W. We completed the northern line with good survey conditions at 15:00, then backtracked to 4133/6601, where we had seen a right whale during the survey. Once stationary at this location, it became apparent that there was a lot more going on; about a dozen sei whales were in the area, including one mother and calf swimming alongside a right whale. Some of the seis were high skim feeding. Another right whale was sighted as well. We made two bongo tows in the vicinity of the first right whale, the first tow bringing up about 400ml of copepods and the second maybe 200ml. No salps and very few euphausiids were present in the samples. A surface active group (SAG) of three right whales was sighted @ 18:30 at 4131/6601. Tonight we are steaming NE to get over the north end of longline gear being set by two boats. There are two parallel lines of gear extending over 50nm, from 4107/6612 NE to 4150/6534. The fishermen informed us the gear is set only 3-6 feet below the surface. We're seeing lots of common dolphins throughout this area.

August 7: We started our southernmost survey line in the Corsair Canyon area (4115/6550 to 6618) with clear skies and N wind at 10 knots. A sperm whale, a couple pilot whales and a group of common dolphins were seen, and we managed to pass south of the long liners retrieving their set from last night. Moved up to the 4121N line and headed back east with freshening NW winds. Several fin and sei whales were seen, as well as another sperm whale and both common and striped dolphins. Two right whales were sighted at 4121/6604. Began our third line for the day running W along 4127N, but severe glare and Beaufort 4 seas caused us to stop at the second CTD station. We went in search of a right whale to do a bongo tow near, but didn't find one. The wind finally dropped out completely this evening. Tomorrow we will try to complete the two northern lines of our survey grid (which means a second sampling of our northern-most line). How long it will take is partly up to the long liners, who are again draping 50nm of gear obliquely through our planned route. We made 9 CTD casts today, four of which were to 575m...which was only half way to the bottom!

August 8: Could only get within 0.3nm of our first waypoint due to long line gear. We scanned around the gear for several minutes before turning back W and running along the 4133N line. We sighted hundreds of common dolphins before we reached our first CTD station. One right whale was sighted at 4132/6602, and another at 4131/6608. Further W we sighted a humpback at 4132/6615. On our next line (4127N) we had one humpback at 4127/6609 and two right whales at 4125/6600 as we headed back E. Some offshore bottlenose dolphins were seen as we neared the shelf break again. We stopped our survey effort and went to find right whales while the long liners completed hauling their gear. We launched the Zodiac to scout ahead, and they put the ship onto several right whales around 4133/6558. We made two bongo tows, the first yielding about 80 ml of what may be Pseudocalanus mixed in with an equal amount of small euphausiids. The second tow yielded only 50 ml of small euphausiids and very few copepods. We only preserved one side of the bongo on this tow. Water samples were taken at both bongo stations. Following the tows, we returned to the 4127N line but the long liners were just setting their lines again barring our way yet again. Tonight we're headed back to Roseway Basin for a second round of the survey grid there.

August 9: Roseway welcomed us back this morning with overcast skies with a gradually building SSW wind. Several fin whales, a humpback and common dolphins seen on our southern track line (4248N line from 6458 to 6530W). Four right whales were sighted at the W end of our second line at 4254/6630, and another 10 humpbacks were spread along the line to the east. After finishing the second line, we deadheaded back west to where we had the right whales earlier. They were gone from the spot, but we caught sight of a breacher five miles south and steamed to it. Unfortunately, by the time we got there (4249/6529), it was too late to start a bongo. On the equipment front, we switched out the CTD unit we'd used to date (2277) after it gave erroneous readings on our third cast of the day (#85 for the cruise). After replacing the batteries, Chris found a live euphausiid wedged in the sensor intake. We made a second cast at the same station with the backup CTD (1468), and promptly bounced it on the bottom. The third time we got it right, and the readings looked fine for the rest of the day.

August 10: Mostly cloudy today with SW winds at 15 knots. CTD 1468 had issues on our first cast, so we went back to 2277. Completed two CTD stations before the fog shut us down. We steamed back to the SW corner of our survey grid where we had right whales yesterday, hoping that a small clearing would allow us to find them and make a bongo tow or two. No clearing today. The Ship Computer System (SCS), which records data from the GPS and all the sensors (sonar, anemometers, etc.), went down briefly and it appears environmental data were not logged for some of today's first (and only complete) survey unit. There were no sightings today.

August 11: Fog persisted and the SW winds increased to 20 knots today. We ranged from the eastern to the western sides of our survey box over Roseway Basin awaiting improvement, but that does not appear likely to come until the early hours tomorrow. No effort or sightings today.

August 12: The Persied meteor shower showed through a thin veil of clouds in the pre-dawn hours. The morning brought a horizon, light winds and a three-foot swell from the S and SW. We began working westward on our northern line with the sun (and glare) at our backs. Over a dozen humpbacks and fin whales sighted on the western half of our northern lines. We moved down and started our third line (4254N), and things were again sparse on the eastern side. One right whale was sighted at 4254/6514. After completing a CTD station and the 2.5nm of survey line beyond it, we doubled back to try to relocate the right whale and conduct a bongo tow. We arrived at the sighting location at 16:30, but the whale was not seen again and no bongo tow attempted. At 17:00 we began steaming toward the west side of Browns Bank, where fishermen had reported an entangled whale, possibly a right whale. We had received the report at 13:00, but our ETA at full steam would have been around sunset. Instead we arrived at about midnight and stood by for daylight.

August 13: During the night, fog and 20 knot winds developed. The visibility was below a quarter mile until 08:30, when it backed off to 1-2nm. Pete Duley sighted the whale off our port beam--right on location--and we confirmed suspicions that it was a humpback. We spent the next three hours assessing the entanglement as best we could from the ship. Pete took digital images from the flying bridge with a 400mm lens, and we downloaded the flashcard several times to view the images on a computer screen before going back up for more shots. By noon, the fog closed in again, so we stood off about a mile from the whale and waited for the visibility to improve again. It did around 14:00, along with a slight change in wind direction that helped flatten the seas somewhat. At 14:30, we decided to launch the Zodiac, but as TK maneuvered the crane a hydraulic hose burst. An hour later--while the crew worked frantically to finish the repairs--the fog closed in again. Our plan had been to better assess the entanglement from the Zodiac, and only grapple or cut lines if it was clear to us what needed to happen and it could be accomplished safely. From what we could make out from the ship, this does not appear to be a simple entanglement; additional disentanglement equipment and a higher level of expertise may be required. The CCS crew may try to respond tomorrow, and requested we standby. Due to our schedule and the fact that the whale is anchored, I decided the ship should return to the Bay of Fundy overnight to complete our work prior to hurricane Irene's arrival.

August 14: Began our Bay of Fundy systematic survey grid in the NW corner (4450/6636). Completed two survey units before heavy haze forced us to abort our BF12 unit and move NE to BF21, which we completed northbound. We then completed our entire 6619W line southbound. Had to skip the southernmost survey unit on the next line (6611W) due to fog clinging to the coast of Digby Neck, but we had 2mn viz for the rest of the line northbound. We saw no cetaceans all day despite mostly glassy seas and decent visibility; last time through here we had lots of harbor porpoise, which would have been very noticeable in today's conditions. Perhaps it has something to do with the water being remarkably green today, emerald really.

August 15: Overcast skies and drizzle kept the visibility down around 2nm and us in the wheelhouse for several hours this morning. Began on the south end of our 6628N line. Sighted one right whale near our BF23 station (4434/6628). After completing the survey unit, we circled back to do a bongo tow near the whale but were unable to find it again. We decided to conduct a bongo tow anyway, directly over the BF23 station. We caught a total of 100ml of copepods and a dozen adult size euphausiids. On the next run between CTD stations, the rain stopped, the skies brightened, the visibility pushed out to 5nm and right whales were sighted. We completed the next survey unit and then circled back to do another bongo tow in the vicinity of about 30 whales. This bongo tow yielded closer to 400ml of copepods, and another dozen euphausiids. The R/V Stellwagen was nearby conducting vessel noise playback experiments. We skipped the last survey unit on the north end of both western lines since we had completed them yesterday. As the sun came out, we sighted three more right whales @ 4432/6636. Humpbacks and harbor porpoise were numerous in this area, but south of 4428N all was quiet. At 16:45, we began our trek back to Woods Hole. An informal watch sighted a half dozen humpbacks frolicking under a gibbous moon over Southwest Bank (4408/6704).