

CRUISE RESULTS

NOAA FRV DELAWARE II
Cruise No. DE 01-08
Northern Right Whale Survey and Tagging

CRUISE PERIOD AND AREA

The survey was conducted on the NOAA Ship DELAWARE II from August 7 - 31, 2001, beginning and ending in Woods Hole, MA. The study area encompassed the offshore waters from Wilkinson Basin to the Bay of Fundy, and over Roseway Basin on the Scotian Shelf (Figure 1.).

OBJECTIVES

The cruise objectives included: (1) to deploy VHF-linked time-depth recorders (TDRs) on right whales to examine their diving behavior relative to prey abundance and availability; (2) to conduct systematic, broad-scale oceanographic and marine mammal surveys to characterize right whale habitat; (3) to collect *Calanus finmarchicus* specimens for studies on natural toxin concentrations and energy content; (4) to support studies being conducted by the Woods Hole Oceanographic Institute (WHOI) on the reaction of right whales to vessel approaches; and (5) photographing and/or opportunistic biopsy sampling of cetaceans for individual identification, as well as genetic, toxicological and stable isotope analyses. The ship was also available to assist in any right whale disentanglement efforts. Operations during this cruise were coordinated with concurrent NEFSC aerial surveys, as well as projects being conducted by the Department of Fisheries and Oceans (DFO), the New England Aquarium (NEAq) and the Woods Hole Oceanographic Institution (WHOI).

METHODS

TDR tagging: Time-depth recorders were deployed from the bow of a 7.5 m rigid hulled inflatable boat (RHIB) using a telescoping pole. The TDR tag consisted of a Wildlife Computers MK7 Recorder that measured pressure at one second intervals. Also on the tag was a Telonics VHF radio transmitter (model CHP-1P), a Vemco acoustic transmitter (model V22P), a light-emitting diode (LED) beacon and syntactic foam floatation. The tag was attached to a

whale by a rubber suction cup. After deployment, the tag was tracked via the sonic transmitter with a directional hydrophone and VHF radio receiver. As long as the tag remained attached to the whale, the time and position of the initial resurfacing after each long dive was obtained by parking one of the RHIBs on the whale's resurfacing location. The DELAWARE II was moved to each of these resurfacing locations and a vertical cast with the CTD/OPC instrument package (described below) was made. After detachment from the whale, the tag was recovered with the aid of the VHF radio signal. Photographs of the tagged whales were forwarded to the New England Aquarium for individual identification and inclusion in the North Atlantic Right Whale Catalog.

Broad-scale Surveys: Surveys were conducted in two known right whale high-use areas: the lower Bay of Fundy and the Roseway Basin on the Scotian Shelf. Transects and oceanographic sampling station locations were the same as those occupied during DELAWARE II cruise DE-99-08 in 1999 and DE-00-07 in 2000. There were 23 stations along four transects in the Bay of Fundy, and 20 stations along four transects on Roseway Basin (Tables 1 and 2). When steaming along transects between stations, marine mammal observations and sighting conditions (Beaufort sea state, visibility, glare, etc.) were recorded using the hand-held at-sea data entry system "bart". At each station, a vertical cast was made with an instrument cage housing a conductivity/temperature/depth (CTD) instrument (Seabird model SBE-19, serial number 1468) and an optical plankton counter (OPC; Focal Technologies model OPC-1T, serial number TOW47). One broad scale unit includes an oceanographic station and 2.5 nautical miles of transect on either side of the station.

Data from the ship's Scientific Computer System (SCS) were recorded continuously during broad-scale surveys. The SCS interrogates and records data from a variety of shipboard sensors and navigation systems including hull-mounted temperature sensors, a Seabird thermosalinograph, a flow-through fluorometer, a gyro compass and a differential GPS unit.

Additional stations were sampled over both Wilkinson Basin and Jordan Basin in the Gulf of Maine during the transit to the Bay of Fundy (Table 3).

Copepod sampling: Copepod samples were collected at each of the sampling stations mentioned above on days when fog precluded other operations. The samples were collected using 61 cm bongo frames outfitted with 333 micron mesh nets. The nets were towed obliquely to 5 m off the sea floor. The depth of the nets was

measured during the tow using a Seabird SBE-19 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 preserved in a 5% formalin-seawater solution and will be used to estimate copepod biomass at each station. From the other net, three subsamples were taken following each tow: one 2 ml subsample was placed in a scintillation vial and frozen at -10° C for an analysis of natural toxin levels; another sample of 15 - 25 individual C5 *Calanus*, were frozen at -70° C for later analysis of their lipid content and caloric value using thin-layered chromatography and flame ionized detection; and, a 10 ml subsample of the tow was taken and preserved in liquid nitrogen for complementary calorific analysis.

Photographic and biopsy sampling: Photographs were taken with a 35 mm camera equipped with an autofocus zoom or telephoto lens, power winder and 400 or 200 ASA color slide film. Photographs of right whales' callosity patterns and scarring will be used to determine individual identity. Skin biopsies were taken using 70 kg pull crossbows to fire darts with hollow-tipped cutting heads 5 mm in diameter. The depth of penetration of the cutting heads was adjusted according to species; 15 mm to 30 mm for large whales, 5 mm to 7 mm for dolphin species.

RESULTS

TDR Tagging: Twenty five right whales were tagged with TDRs in Grand Manan Basin and two over Roseway Basin. Nineteen of the tags remained attached for over one hour, three for over ten minutes, and three for less than ten minutes. All tags were recovered following their detachment from the whales. A total of 97 CTD/OPC casts were made at the resurfacing locations of TDR-tagged right whales. On six tagging efforts, the tag detached from the whale before any vertical casts could be made.

Broad-scale Surveys: Fifty one broad-scale units were sampled on the cruise, 31 of which were in the Bay of Fundy and 20 on Roseway Basin. Some broad-scale units were sampled more than once since survey operations were conducted opportunistically as weather and other cruise priorities allowed. Roughly 30 hours of marine mammal sighting effort was logged during the broad scale surveys.

Copepod sampling: A total of 50 bongo tows were completed during the cruise, providing 48 samples for each analysis. The station locations and dates for the 48 stations from which the natural toxin analysis samples were taken are provided in Table 4.

Photographic and biopsy sampling: An estimated 30 individual right whales were recorded as photographed during the cruise; this number will likely change after an analysis of the photographs. Biopsy skin samples were collected from one pilot whale and two right whales on Roseway Basin. One small skin sample was recovered off a TDR tag after its deployment (tagging event #23).

DISPOSITION OF DATA AND TISSUE SAMPLES

CTD and marine mammal sighting data are archived at NEFSC, and all tagging and OPC data will be archived at Oregon State University, with copies to be provided to NEFSC following analysis. Right whale skin samples will be sent to McMaster University for genetic analysis. The pilot whale skin sample and subsamples from the two right whales are currently stored at -20° C at the NEFSC. Copepod samples taken for toxicology will be sent to the NMFS lab in Charleston, NC. Copepod samples will also be held at the University of Dalhousie. Analysis of plankton samples should be completed by fall of 2002.

SCIENTIFIC PERSONNEL

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Figure 1. Approximate cruise track followed during NOAA FRV DELAWARE II cruise 01-08, Northern Right Whale Survey and Tagging, during August 7 - 31, 2001.

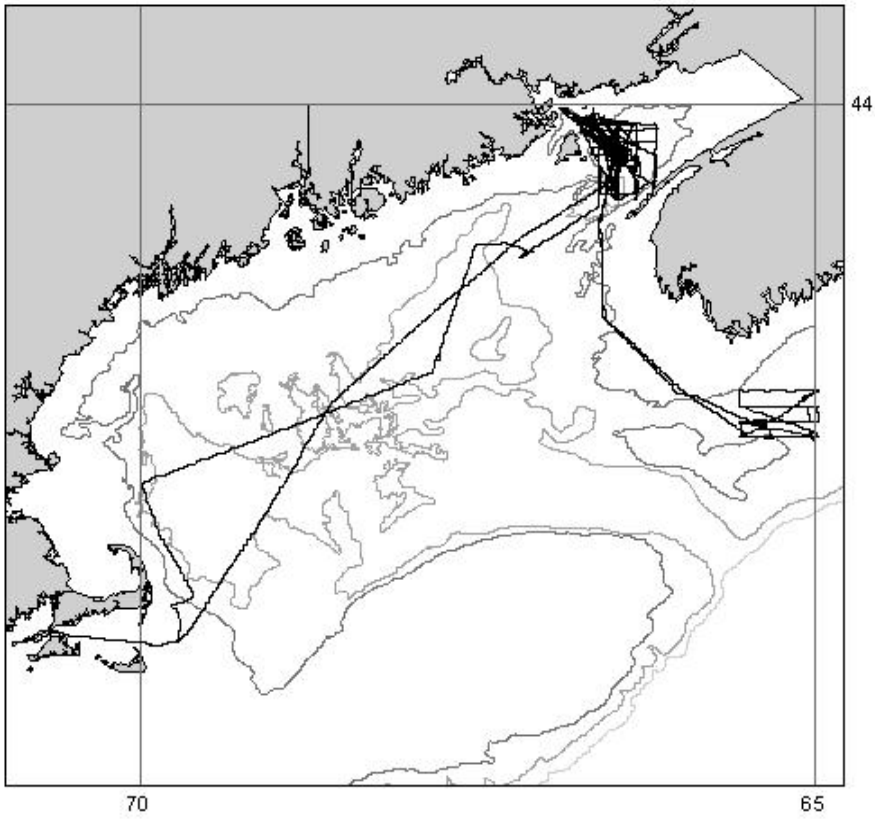


Table 1. Oceanographic sampling stations visited in the Bay of Fundy during NOAA FRV DELAWARE II cruise 01-08, during August 7 - 31, 2001.

Lat. (N)	Long. (W)	Station No.
44 49.98	066 36.00	BF10
44 45.00	066 36.00	BF11
44 40.01	066 36.00	BF12
44 35.02	066 36.00	BF13
44 30.03	066 36.00	BF14
44 25.04	066 36.00	BF15
44 49.98	066 27.54	BF20
44 45.00	066 27.54	BF21
44 40.01	066 27.54	BF22
44 35.02	066 27.54	BF23
44 30.03	066 27.54	BF24
44 25.04	066 27.54	BF25
44 49.98	066 19.14	BF30
44 45.00	066 19.14	BF31
44 40.01	066 19.14	BF32
44 35.02	066 19.14	BF33
44 30.03	066 19.14	BF34
44 25.04	066 19.14	BF35
44 49.92	066 10.68	BF40
44 44.94	066 10.68	BF41
44 39.95	066 10.68	BF42
44 34.96	066 10.68	BF43
44 29.97	066 10.68	BF44

Table 2. Oceanographic sampling stations visited in Roseway Basin during NOAA FRV DELAWARE II cruise 01-08, during August 7 - 31, 2001.

Lat. (N)	Long. (W)	Station No.
43 6.00	065 1.98	BB41
43 6.01	065 8.82	BB42
43 6.01	065 15.65	BB43
43 6.01	065 22.49	BB44
43 6.00	065 29.32	BB45
43 0.00	065 1.98	BB31
43 0.01	065 8.80	BB32
43 0.01	065 15.63	BB33
43 0.01	065 22.45	BB34
43 0.00	065 29.28	BB32
42 54.01	065 15.61	BB23
42 54.01	065 22.42	BB24
42 54.00	065 29.23	BB25
42 48.00	065 1.98	BB11
42 48.01	065 8.78	BB12
42 48.01	065 15.58	BB13
42 48.01	065 22.39	BB14
42 48.00	065 29.19	BB15

Table 3. Oceanographic sampling stations visited in Jordan and Wilkinson Basins during NOAA FRV DELAWARE II cruise 01-08, during August 7 -31, 2001.

Lat. (N)	Long. (W)	Station No.
42 29.26	069 59.20	WK01
42 31.98	069 51.23	WK02
42 34.69	069 43.25	WK03
42 37.41	069 35.27	WK04
42 40.13	069 27.28	WK05
42 42.85	069 19.28	WK06
43 12.95	067 50.39	JD01
43 28.55	067 44.43	JD02
43 44.14	067 38.45	JD03
43 59.74	067 32.44	JD04

Table 4. Bongo station dates and locations for natural toxin level sampling stations visited during NOAA FRV DELAWARE II cruise 01-08, during August 7 -31, 2001.

DATE M/D/Y	STATION A=2nd time station sampled B=3rd time station sampled	LATITUDE		LONGITUDE	
		DEG	MIN	DEG	MIN
8/13/01	BF22	44	40.0	066	27.5
8/16/01	BF23	44	35.0	066	27.5
8/16/01	BF24	44	30.0	066	27.5
8/16/01	BF25	44	25.0	066	27.5
8/16/01	BF35	44	25.0	066	19.1
8/16/01	BF34	44	30.0	066	19.1
8/17/01	BF33	44	35.0	066	19.1
8/17/01	BF32	44	40.0	066	19.1
8/17/01	BF34A	44	30.0	066	19.1
8/18/01	BF15	44	25.0	066	36.0
8/18/01	BF14	44	30.0	066	36.0
8/18/01	BF13	44	35.0	066	36.0
8/18/01	BF12	44	40.0	066	36.0
8/18/01	BF11	44	45.0	066	36.0
8/18/01	BF44	44	30.0	066	10.7
8/18/01	BF43	44	35.0	066	10.7
8/18/01	BF42	44	40.0	066	10.7
8/21/01	BF22A	44	40.0	066	27.5
8/21/01	BF21	44	45.0	066	27.5
8/21/01	BF31	44	45.0	066	19.1
8/21/01	BF41	44	44.9	066	10.7
8/21/01	BF40	44	49.9	066	10.7
8/21/01	BF30	44	50.0	066	19.1
8/21/01	BF20	44	50.0	066	27.5
8/21/01	BF10	44	50.0	066	36.0
8/23/01	BB15	42	48.0	065	29.2

8/23/01	BB14	42	48.0	065	22.4
8/23/01	BB13	42	48.0	065	15.6
8/23/01	BB12	42	48.0	065	8.8
8/23/01	BB11	42	48.0	065	2.0
8/24/01	BB35	43	0.0	065	29.3
8/24/01	BB34	43	0.0	065	22.5
8/24/01	BB33	43	0.0	065	15.6
8/24/01	BB32	43	0.0	065	8.8
8/24/01	BB31	43	0.0	065	2.0
8/24/01	BB21	42	54.0	065	2.0
8/24/01	BB22	42	54.0	065	8.8
8/24/01	BB23	42	54.0	065	15.6
8/26/01	BB24	42	54.0	065	22.4
8/26/01	BB25	42	54.0	065	29.2
8/28/01	BB24A	44	30.3	066	27.6
8/28/01	BB23A	44	35.1	066	27.4
8/28/01	BB22B	44	39.9	066	27.6
8/28/01	BB21A	44	45.0	066	27.7
8/28/01	BB31A	44	45.0	066	19.0
8/28/01	BB32A	44	39.8	066	19.2
8/28/01	BB33A	44	35.1	066	19.1
8/28/01	BB34B	44	30.0	066	19.0