

CRUISE RESULTS

NOAA FRV ALBATROSS IV
Cruise No. AL 01-08
Northern Right Whale Habitat Survey

CRUISE PERIOD AND AREA

The survey was conducted on the NOAA Ship ALBATROSS IV from July 23 to August 3, 2001, beginning and ending in Woods Hole, MA. The study area encompassed the offshore waters from Wilkinson Basin to the Bay of Fundy (Figure 1.)

OBJECTIVES

The primary objectives of the cruise were to conduct oceanographic sampling in areas of right whale habitat and to assess the feasibility of methods for several ECOHAB studies (Ecology and Oceanography of Harmful Algal Blooms, NOAA Coastal Oceans Program). Specific goals included: (1) paired Optical Plankton Counter (OPC) casts and depth-stratified Multiple Opening and Closing Net Environment Sampling System (MOCNESS) tows in regions of high *Calanus finmarchicus* abundance to calibrate the OPC; (2) OPC casts and MOCNESS tows while on station over a 24 hour period to track diel vertical migration of *C. finmarchicus*; (3) OPC casts at 26 stations (grid with 5 nmi spacings) completed within 36 hours for a snapshot of *C. finmarchicus* distribution in the lower Bay of Fundy; (4) *Alexandrium* distribution mapping; (5) live *C. finmarchicus* and *Alexandrium* specimen collection for studies on grazing rates of the former on the later; and (6) *C. finmarchicus* specimen collection for studies on toxin concentrations, lipid condition, and carbon and nitrogen content.

Secondary goals included: (1) studies to determine the reaction of right whales to vessel approaches (in collaboration with the Woods Hole Oceanographic Institution); (2) logging of marine mammal sightings during oceanographic operations; and (3) photographing and/or opportunistic biopsy sampling of cetaceans for individual identification, as well as genetic, toxicological and stable isotope analyses.

METHODS

OPC Calibration: A one-meter MOCNESS (MOC1) with 150 micron mesh nets was used to collect zooplankton at five discrete depths to "calibrate" OPC-derived abundance estimates of zooplankton-sized particles. The OPC (Focal Technologies model OPC-1T, serial number TOW47) was housed in an instrument cage along with a conductivity/temperature/depth (CTD) instrument (Seabird model SBE-19, serial number 2879). Two vertical casts with the OPC were made in rapid succession near feeding right whales beginning one hour before slack current. These casts were then followed by a MOCNESS tow that passed through the OPC stations during the nets' trip back to the surface. Three of the five nets were tripped within a narrow depth range that corresponded to the highest copepod concentrations as indicated by the OPC. Following the MOCNESS tow, two more OPC casts were made at the original position. Zooplankton samples from each net of the MOCNESS were preserved in a 10% formalin-seawater solution and to be sorted and enumerated at the lowest possible taxonomic level.

Diel Vertical Migration: To track any diel vertical migration of copepods, OPC casts were made every half hour at a geographically fixed location over a 24-30 hour period. MOCNESS tows were made every 6-12 hours at the same location. Bulk MOCNESS samples were preserved in 4% formalin-seawater solution.

Broad-scale Survey: A snapshot of the hydrography and the distribution of copepod patches throughout the lower Bay of Fundy were examined by making vertical CTD/OPC casts over a grid of 23 stations spaced 5 nmi apart. The station locations were the same as those occupied during the DELAWARE II (cruise DE 00-07) in 2000 within the Bay of Fundy (Table 1). Additional stations were sampled over both Wilkinson Basin and Jordan Basin in the Gulf of Maine during the transit to and from the Bay of Fundy (Table 2).

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 GPS unit.

Alexandrium mapping: Water samples were collected at 20 stations during the broad-scale survey to locate patches of *Alexandrium*, a dinoflagellate known to produce saxitoxins. Preliminary counts were made on board, and samples were preserved in 1% formalin-seawater solution for later analysis.

Copepod grazing rates: To determine feeding rates of *Calanus* copepodites, water was collected using niskin water sampling bottles, and copepodites were collected by vertical hauls of a 1 m² plankton net fitted with 150 micron mesh. The water was placed in nalgene bottles along with a known number of copepodites. The bottles were then placed in a 1m³ seawater tank for 18-24 hours, after which the contents were preserved in 1% formalin-seawater solution for later analysis.

Toxin levels: A subset of the plankton samples from MOCNESS tows were taken for phycotoxin analysis. *C. finmarchicus* copepodites, principally C5 stage, were sorted into cryovials and frozen at -20 C for storage awaiting extraction and HPLC analysis on shore.

Energy content: 15 - 25 individual C5 *Calanus* were picked from depth strata three to five of each of the above mentioned MOCNESS tows, as well as from an independent set of four stations in the south and east part of the study area. Samples were frozen at -70 C for later analysis of their lipid content and caloric value using thin-layered chromatography and flame ionized detection. At five stations, a 10 ml subsample of the tow was taken and preserved in liquid nitrogen for complementary calorific analysis.

Carbon and nitrogen content: *Calanus* copepodites were sorted from selected depths from MOCNESS tows, placed in tin boats and dried over dessicant for later analysis. Carbon and nitrogen content will be determined with a Carlo Erba Carbon and Nitrogen Analyzer.

Marine mammal sightings: When conditions allowed, marine mammal observations were conducted during transits to stations following standard NMFS sighting survey protocols. Marine mammal observations were also made while at stations, with the locations of right whales relative to the ship updated every 10 - 15 minutes. Observers scanned with both naked eyes and 7x50 binoculars. Sightings data were entered using the hand-held at-sea data entry system "bart".

RESULTS

OPC Calibration: A total of 6 OPC calibration stations were sampled at times of slack current, for a total of 24 vertical OPC casts and 6 MOCNESS tows (36 net samples). Plankton samples collected for OPC/MOCNESS calibration will be analyzed by Baumgartner.

Diel Vertical Migration: Two diel vertical migration (DVM) studies were conducted, the first lasting 27 hours, and the second 29 hours. A total of 109 vertical OPC casts were made, and 7 MOCNESS tows (42 net samples). Plankton samples collected during the DVM tows will be analyzed by Campbell.

Broad-scale Surveys: The 23 broad scale stations in the Bay of Fundy were sampled in 20 hours for a snapshot of copepod distribution. The stations in Wilkinson Basin and Jordan Basin were sampled successfully only during the return transit to Woods Hole. The OPC data collected during the surveys will be compiled by Baumgartner.

Alexandrium mapping: Forty water samples were collected to determine *Alexandrium* concentrations.

Copepod grazing rates: Four grazing experiments were conducted. The experiments generated 60 samples (100 ml each) for analysis.

Toxin levels: Approximately 64 samples were taken for subsequent analysis.

Carbon and nitrogen: About 200 samples were taken for subsequent analysis.

Lipid condition: A total of 1115 individual C5 *Calanus* were picked from 14 MOCNESS tows to examine their lipid and caloric content.

Vessel approaches: No controlled vessel approaches to right whales were done in collaboration with the Woods Hole Oceanographic Institution during this cruise.

Marine mammal sighting, photographic and biopsy sampling: During 16 hours and five minutes of observation, a total of 512 sightings were recorded, of which 499 were of right whales. The vast majority of the right whale sightings, however, were undoubtedly repeated sightings of the same individuals during consecutive 15 minute scans. The other marine mammal sightings included one sighting of a fin/sei whale, one of a fin whale, one of a minke, and eight of harbor porpoise. The total number of individual harbor porpoise seen was 18. No photographs or biopsy samples of marine mammals were taken during this cruise.

DISPOSITION OF DATA AND TISSUE SAMPLES

CTD and marine mammal sighting data are archived at NEFSC. OPC data will be archived at Oregon State University, with copies to be provided to NEFSC following analysis. Plankton samples will be archived at the University of Rhode Island Graduate School of Oceanography and the University of Oregon. A subset of the copepod samples will 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. Cruise track for NOAA FRV ALBATROSS IV Cruise 01-08, Northern Right Whale Habitat Survey, conducted during July 23 - August 3, 2001.

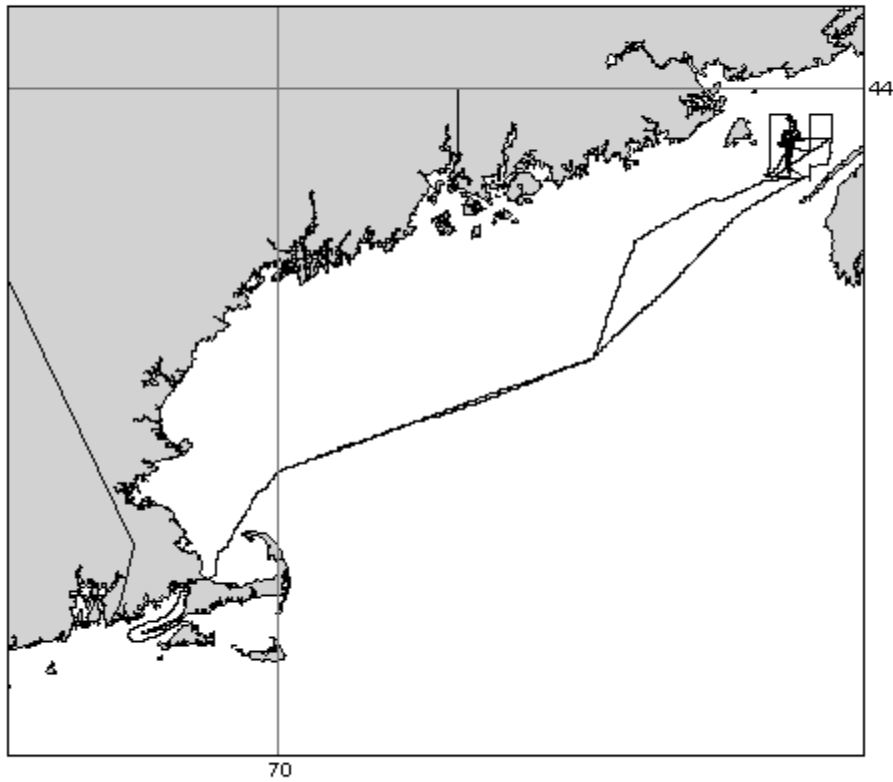


Table 1. Bay of Fundy oceanographic sampling stations

<u>Lat. (N)</u>	<u>Long. (W)</u>	<u>Sta. No.</u>
44 49.98	66 36.00	BF10
44 45.00	66 36.00	BF11
44 40.01	66 36.00	BF12
44 35.02	66 36.00	BF13
44 30.03	66 36.00	BF14
44 25.04	66 36.00	BF15
44 49.98	66 27.54	BF20
44 45.00	66 27.54	BF21
44 40.01	66 27.54	BF22
44 35.02	66 27.54	BF23
44 30.03	66 27.54	BF24
44 25.04	66 27.54	BF25
44 49.98	66 19.14	BF30
44 45.00	66 19.14	BF31
44 40.01	66 19.14	BF32
44 35.02	66 19.14	BF33
44 30.03	66 19.14	BF34
44 25.04	66 19.14	BF35
44 49.92	66 10.68	BF40
44 44.94	66 10.68	BF41
44 39.95	66 10.68	BF42
44 34.96	66 10.68	BF43
44 29.97	66 10.68	BF44

Table 2. Jordan and Wilkinson Basins station locations

<u>Lat. (N)</u>	<u>Long. (W)</u>	<u>Sta. No.</u>
42 29.26	69 59.20	WK01
42 31.98	69 51.23	WK02
42 34.69	69 43.25	WK03
42 37.41	69 35.27	WK04
42 40.13	69 27.28	WK05
42 42.85	69 19.28	WK06
43 12.95	67 50.39	JD01
43 28.55	67 44.43	JD02
43 44.14	67 38.45	JD03
43 59.74	67 32.44	JD04