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Bigelow Laboratory for Ocean Sciences

NUTRIENT, CHLOROPHYLL, and HYDROGRAPHIC PROFILES at the NORTH POLE ENVIRONMENTAL OBSERVATORY, April 17-22, 2006

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The goal of this project was to begin an evaluation of nutrients and phytoplankton standing stocks in the central Arctic Ocean based on sampling at the North Pole Environmental Observatory. Six stations were sampled in April 2006, where vertical profiles of hydrographic properties (salinity, temperature, sigma-t), in-situ fluorescence, water clarity, and nutrients in the region of the NPEO were determined (Figure 1). Station locations, times, and sampling details are tabulated in file, NPB06STA.CSV, and column names and their descriptions in Appendix 1 of this report.

Vertical profiles of hydrographic, fluorescence, water clarity, and nutrients over the upper 150 m were obtained using a Seabird SBE-19 CTD (serial number 1923347-2995) combined with a fluorometer and transmissometer. The continuous CTD profiles were processed using standard SeaSoft software with the results being binned into 0.5 m depth intervals. The Wetstar model WS3S miniature flow-through fluorometer (serial number 646P) had an excitation wavelength of 460 nm and an emission wavelength of 695 nm. The fluorometer was calibrated in the laboratory with aqueous solutions of resorufin (Christensen, 2006a). The fluorescence of resorufin was compared with the fluorescence of purified chlorophyll-a (from the algae Anacystis nidulans) dissolved in buffered acetone (10 ml of 1% (weight per volume) magnesium carbonate per L of 90% acetone). These chlorophyll solutions showed a fluorescence of 40.0 times that of resorufin for the same molar concentrations. The output of the fluorometer was first converted to fluorescence of resorufin (μmol/L) and then to that of chlorophyll-a (expressed in μg-chl/L) using this factor and the molecular weight of chlorophyll-a (893.5 g/mole). The Wet Labs C Star model transmissometer (serial number CST-959PR) measures water clarity with red light (660 nm) over a 25 cm pathlength. The transmissometer is calibrated by measuring the voltage output of the light beam through clean dry air at temperatures from -4^{o}C to 18^{o}C and by completely blocking the light beam to measure the

zero-light voltage at the same temperatures (Christensen 2006b). Percent transmittance and beam attenuation coefficient (1/m) was calculated as described in Christensen (2006b). The continuous vertical profiles for all stations are tabulated in the file, NPB06CTD.CSV, and column names and their descriptions in Appendix 2 of this report..

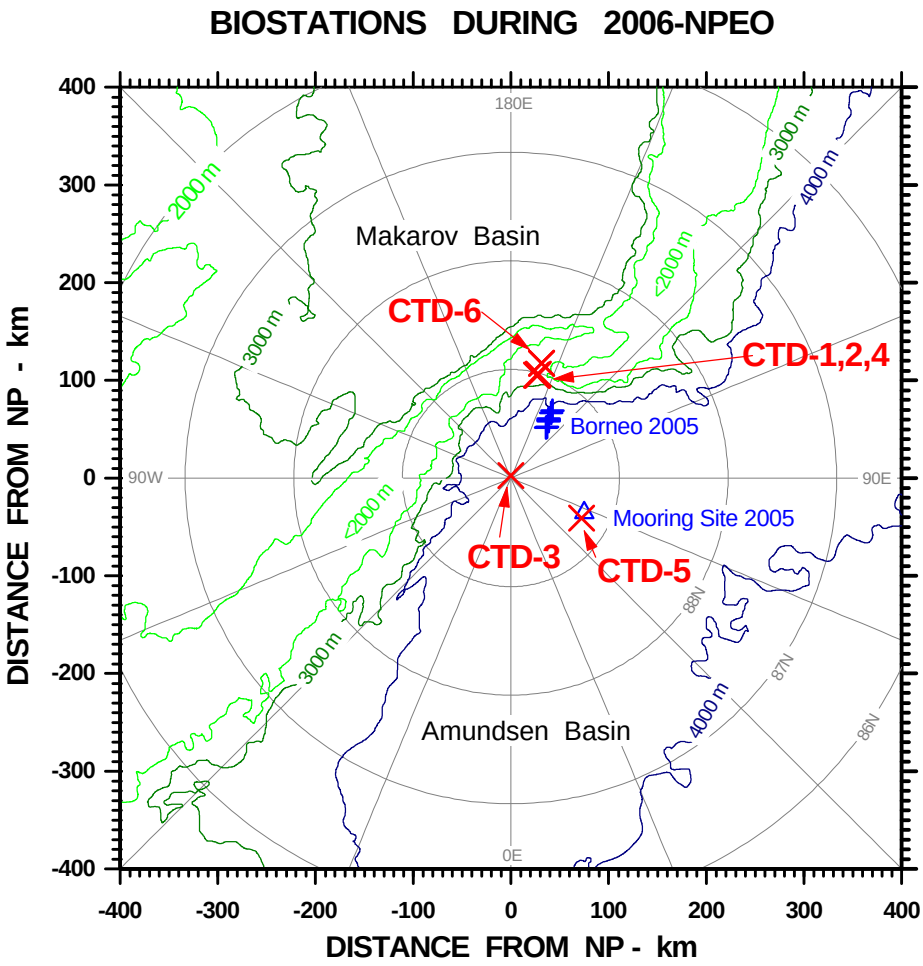

Figure 1. Locations sampled during NPEO 2006 and showing previous years' locations.

Nutrients and ^{18}O / ^{16}O ratios of the seawater were determined on samples collected with Niskin water bottles at 8-9 depths over the profile distances. These samples were frozen in tightly sealing bottles for return to Maine for measurement. Nutrients were measured by autoanalyzer. Nitrate and nitrite concentrations were measured by the methods of Armstrong et al. (1967) and Pavlou (1972). Ammonium was measured using the method of Koroleff (1970) and Slawyk and MacIsaac (1972). Phosphate was measured by the method of Murphy and Riley (1962) and Pavlou (1972). Dissolved silicate was measured by the method of Armstrong et al. (1967). The oxygen isotope data was measured at the Stable Isotope Facility at the University of Maine at Orono. The discrete vertical profiles for all stations are tabulated in the file, NPB06BTL.CSV, and column names and their descriptions in Appendix 3 of this report.

REFERENCES

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Appendix 1. Column listings in the data file, NPB06STA.CSV. The file is an ASC-II comma-separated-value file. Header-3 are headers found in row 8. Header-4 are headers found in row 9. Header-5 are headers found in row 10. Columns with alphanumeric data have blank values of "--", while columns of numerical data have blank values of -9, -99, or -999. All Borneo CTD samplings occurred through ice-holes within 5 m of each other.

Column #	Header-3	Header-4	Header-5	Description
1	CRUISE#	NP-	#	Cruise number: year in units position - cruise identifier in tenths place
2	STATION	--	#	Sequential biological station number
3	NAME	SITE	NAME	Site name or location
4	TASK	--	NOTE	Site task
5	|	|	|	Section Separator
6	YEAR	GMT	YYYY	Sampling year at the station beginning
7	MONTH	GMT	MM	Sampling month at the station beginning
8	DAY	GMT	DD	Sampling day at the station beginning
9	HR	GMT	HH	Sampling hour at the station beginning
10	MIN	GMT	MM	Sampling minute at the station beginning
11	SEC	GMT	SS	Sampling second at the station beginning
12	JDAY	GMT	DECDAY	Julian day and time in decimal days at the station beginning
13	LAT	NORTH	DECDEG	North Latitude in decimal degrees at the station beginning
14	LONG	EAST	DECDEG	East Longitude in decimal degrees at the station beginning
15	|	|	|	Section Separator
16	DAY	GMT	DD	Sampling day at the station end
17	HR	GMT	HH	Sampling hour at the station end
18	MIN	GMT	MM	Sampling minute at the station end
19	SEC	GMT	SS	Sampling second at the station end
20	JDAY	GMT	DECDAY	Julian day and time in decimal days at the station end
21	LAT	NORTH	DECDEG	North latitude in decimal degrees at the station end
22	LONG	EAST	DECDEG	East longitude in decimal degrees at the station end
23	|	|	|	Section Separator
24	DISTANCE	FROM CTD1	KM	Distance from the CTD location of CTD-1 (beginning locations)
25	DRIFTRATE	LAST CTD	CM/S	Rate of drift between the current CTD cast and the previous CTD cast using beginning positions
26	DRIFTRATE	DURING CAST	CM/S	Rate of drift between the beginning and end of the current CTD cast
27	ICE	THICKNESS	CM	Thickness of ice-pack at the station
28	DEPTH	CTDMAX	M	Maximum depth of the CTD cast
29	NOTES	--	NOTE	Notes about the station

Appendix 2. Column listings in the data file NPB06CTD.CSV. The file is an ASC-II comma-separated-value file. Columns with alphanumeric data have blank values of "--", while columns of numerical data have blank values of -9, -99, or -999. Header-3 are headers found in row 8. Header-4 are headers found in row 9. Header-5 are headers found in row 10.

Column#	Header-3	Header-4	Header-5	Description
1	CRUISE#	NP-	#	Cruise number: year in units position - cruise identification in tenths place
2	CTD#	--	#	Sequential CTD number
3	DEPTH-BIN	BIN-CENTER	M	Center of the depth bin in meters
4	DEPTH-AV	--	M	Average depth of binned data in meters
5	PRES	--	DBAR	Average pressure of the binned data in decibars
6	TEMP	--	DEGC	Average temperature of the binned data in degrees C
7	SAL	--	PSU	Average salinity of the binned data in psu
8	SIGMAT	--	MG/L	Average density (sigma-t) of the binned data in mg/L
9	FLUOR	[CHLA]EX	UG-CHL/L	Average fluorometer-assessed chlorophyll concentration in micrograms of extracted chlorophyll-a per liter
10	TRANS	T	PERCENT	Water clarity as assessed by percent transmittance.
11	BEAMATTN	COEF	1/M	Water clarity as assessed by beam attenuation coefficient in 1/meter

Appendix 3. Column listings in the data file NPB06BTL.CSV. The file is an ASC-II comma-separated-value file. Columns with alphanumeric data have blank values of "--", while columns of numerical data have blank values of -9, -99, or -999. Header-3 are headers found in row 8. Header-4 are headers found in row 9. Header-5 are headers found in row 10.

Column #	Header-3	Header-4	Header-5	DESCRIPTION
1	CRUISE#	NP-	#	Cruise number: year in units position - cruise identifier in tenths place
2	STATION	--	#	Sequential biological station #
3	NAME	SITE	NAME	Site name or location
4	DEPTH-BIN	BIN CENTER	M	Center depth of the vertical bin
5	DEPTH	CTD	M	CTD-measured bottle depths in meters
6	PRES	CTD	DBAR	CTD-measured pressures in decibars
7	TEMP	--	DEGC	CTD-measured temperatures in degrees C
8	SAL	--	PSU	CTD-measured salinities in psu
9	SIGMAT	--	MG/L	Density (sigma-t) values in mg/kg
10	FLUOR	[CHLA]EX	UG-CHL/L	In-situ fluorometer measured chlorophyll concentrations in micrograms of extracted chlorophyll-a per liter
11	TRANS	T	PERCENT	Water clarity assessed by percent transmittance
12	BEAMATTN	COEF	1/M	Water clarity assessed by beam attenuation coefficient in 1/meter
13	NO3	--	UMOL/L	Nitrate concentrations in micromoles/L
14	NO2	--	UMOL/L	Nitrite concentrations in micromoles/L
15	NH4	--	UMOL/L	Ammonium concentrations in micromoles/L
16	TIN	--	UMOL/L	Total inorganic nitrogen concentrations (sum of nitrate, nitrite, ammonium) in micromoles/L
17	PO4	--	UMOL/L	Inorganic phosphate concentrations in micromoles/L
18	SI	--	UMOL/L	Dissolved inorganic silicate concentrations in micromoles/L
19	O18/O16	--	PER MIL	Seawater ^{18}O isotope ratios in per mil relative to SMOW

Report Date: 12 April 2008
Report End: File: NPB06DOC.XXX