Great Bay Coast Watch

Monitoring Water Quality and Phytoplankton in New Hampshire Coastal Waters

June 30, 2002

Submitted by Bonnie S. Meeker and Ann S. Reid, NH Sea Grant and UNH Cooperative Extension Program, University of New Hampshire.

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Contents

Great Bay Coast Watch – Monitoring Water Quality and Phytoplankton in New Hampshire Coastal Waters

Introduction

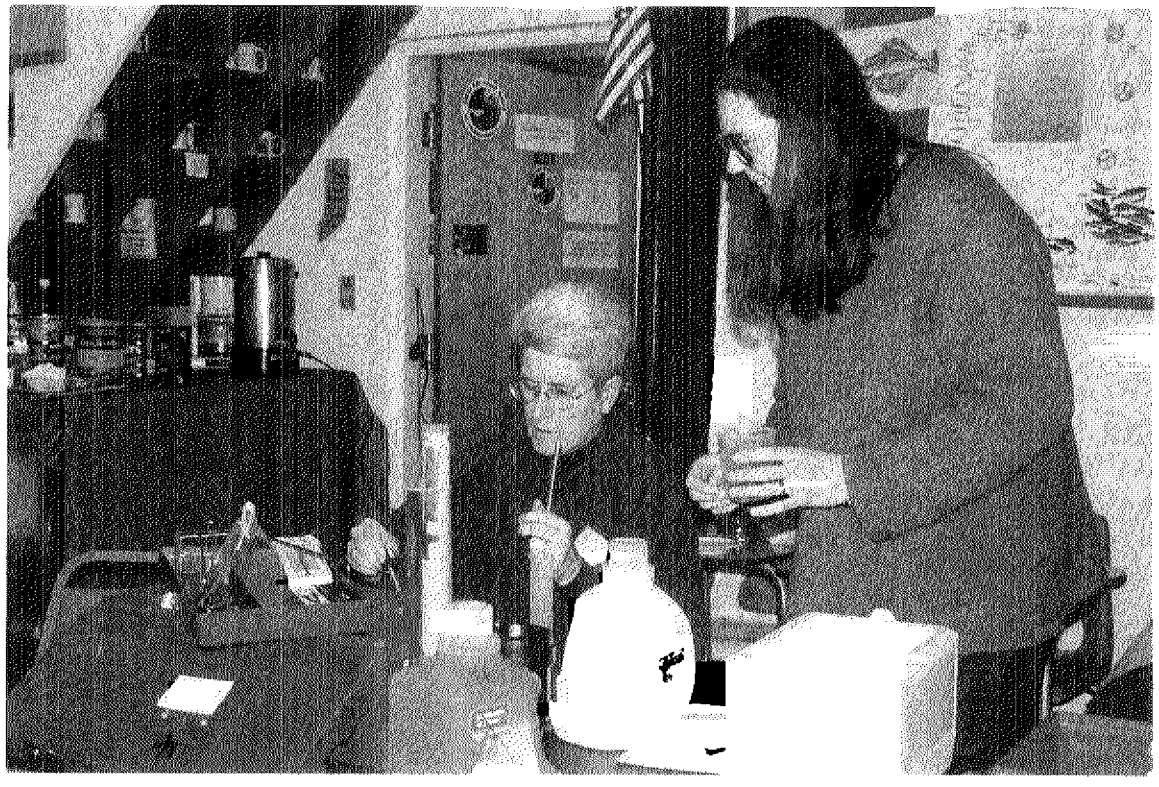
The Great Bay Coast Watch (GBCW) was founded in 1990 as part of the University of New Hampshire Cooperative Extension/Sea Grant outreach. The GBCW mission is to protect the long-term health of New Hampshire's coastal environment through volunteer monitoring and education programs. This year the New Hampshire Coastal Program (NHCP) funded the Watch in part to continue water quality and phytoplankton monitoring and to expand educational and outreach efforts.

Currently GBCW volunteers monitor 21 sites for water quality parameters on a monthly basis from April to November. At each site visit, GBCW volunteers measure water temperature, pH, salinity, dissolved oxygen, transparency, and collect a sample for fecal coliform analysis. Following a quality assurance/quality control plan approved by the Environmental Protection Agency, volunteers are checked twice a season on sampling procedures. GBCW now has a long-term database monitoring the overall health of the Great Bay Estuarine System with results from over 4000 monitoring visits.

In 1999 GBCW volunteers completed training and started the first New Hampshire harmful algae bloom (HAB) monitoring effort. HAB events continue to increase in U.S. coastal waters. Most species of algae or phytoplankton are not harmful and serve as an important energy source at the base of the food chain. However, a small number of species can produce toxins that when present in large quantities may concentrate in shellfish. Harvested and consumed by humans these now toxic shellfish can cause sickness and death. Many coastal states now rely on volunteers to collect water quality data and assist scientists and shellfish managers in monitoring for blooms of potentially toxic phytoplankton species. Currently GBCW volunteers are trained to identify four target species that are toxic or capable of becoming toxic. They include *Alexandrium spp.*, *Dinosphysis spp.*, *Prorocentrum lima* and *Pseudonitzchia.*

The main Objectives of this project were:

1. Recruit and train additional volunteers for water quality monitoring and phytoplankton sampling
2. Continue quality sampling and data collection
3. Continue education and outreach efforts through monthly meetings, community presentations, and development of fact sheets



New volunteers – Janet Lucco and Kathy Watson – participate in GBCW training session

Activities and Achievements

GBCW trained 25 new volunteers.

Volunteers contributed over 400 hours in the field and lab for baseline water quality monitoring at project sites in New Castle, Newington, and Portsmouth (see appendix B – volunteer hours).

Volunteers and school groups worked with Professor Dave Burdick, UNH research scientist, to analyze and present GBCW data to conservation commissions in New Castle, Portsmouth and Newington NH.

Volunteers completed quality assurance/quality control sessions twice during the field season to ensure accurate sampling procedures.

Volunteer Phytoplankton samplers contributed over 300 hours to this project while monitoring for toxic phytoplankton blooms at five coastal locations (see appendix A &B).

The phytoplankton coordinator attended a workshop at the University of Rhode Island on methods to study phytoplankton species *Prorocentrum lima* with research scientist Dr. Lucie Miranda.

Phytoplankton coordinator and volunteers attended a two-day workshop hosted by the Maine Phytoplankton Volunteer program.

The Phytoplankton project coordinator worked with students at North Hampton Middle School, summer computer program, to photograph and display phytoplankton samples using a digital camera and demonstrated the phytoplankton database.

GBCW volunteers represented the Watch at the following public events:

Apple Harvest Celebration – Dover NH
Ducker's Day – Durham NH
Exeter River Alewife Festival – Exeter NH

GBCW organized monthly educational meeting and training sessions for volunteers. Speakers and topic included the following:

Andy Chapman, NHDES, Sampling for Potential Pollution Sources in Great and Little Bays
NHCP – Findings of the Annual Coastal Clean-up
Ray Grizzle – UNH Jackson Estuarine Laboratory – Habitat Restoration at South Mill Pond in Portsmouth, NH
Joanne McLaughlin – NHCP – Volunteer assistance with identifying erosion problems in tidal areas
Doug Bogen – Clean Water Action – Air Pollution in NH
Julia Peterson, UNH Sea Grant Program – Identifying Potential Pollution Sources Around the Home
A Panel Discussion on Dredging in NH

GBCW produced the following education and outreach materials (see appendix A):

- Great Bay Coast Watch – Phytoplankton Monitoring Program 2001 Report
- Great Bay Coast Watch – Monitoring the Meadows of the Sea

Discussion

The projects supported in this grant allowed Great Bay Coast Watch to expand education and outreach opportunities and continue the development of long-term databases available for numerous users.

The watch produced two new educational brochures with funds from this grant: 1. Great Bay Coast Watch – Phytoplankton Monitoring Program 2001 Report 2. Great Bay Coast Watch – Monitoring the Meadows of the Sea. These materials are valuable for presenting current information on activities of the Watch to the public. The first allowed for a more detailed presentation of the phytoplankton data collected by the volunteers while the second is a smaller handout that explains the project in general. These brochures are used for both recruitment and education. To date they have been distributed at public presentations such as the conservation commission meetings, River Alewife Festival, and GBCW monthly meetings. Volunteers also keep a supply of the smaller brochure, "Monitoring the Meadows of the Sea", for distribution if they interact with the public while sampling.

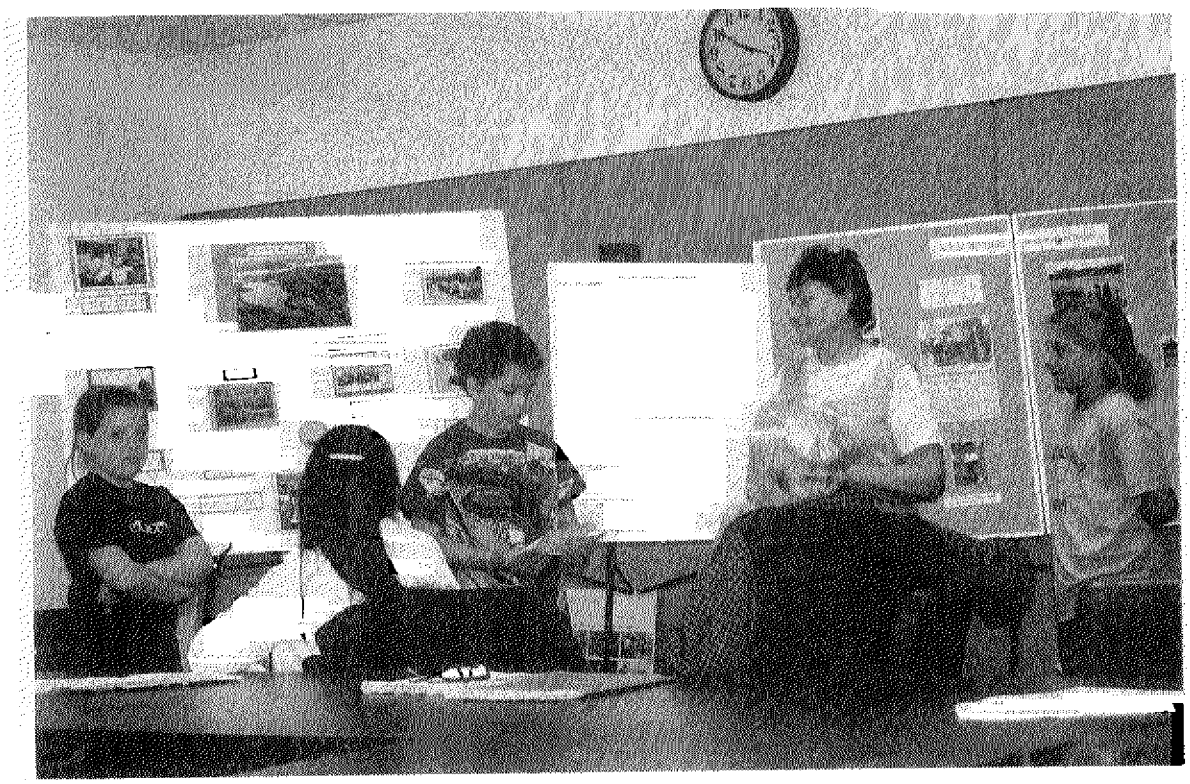
GBCW completed three community presentations to conservation commissions in New Castle, Portsmouth and Newington, NH with the assistance of local school groups, volunteers and a research scientist from UNH. This was a great opportunity to enlist local school groups in activities to promote watershed awareness. Five students, along with their teachers, from Portsmouth Middle School and the New Franklin School analyzed data from GBCW that related sites and Portsmouth NH. Two home-schooled students participated with their mother in a presentation to the Newington NH Conservation Commission. In addition two GBCW volunteers rounded out the Newington team and made an additional presentation in New Castle, NH. Volunteers found this to be a great opportunity to learn in detail about data they had collected that related to locations of interest to them, and increase awareness of Great Bay Coast Watch and local water quality issues with local decision makers. All project participants found the opportunity to develop ideas with the research scientist from UNH as a valuable learning tool.

The phytoplankton project continues to be a valuable observation tool of potentially harmful algae blooms. Funding for this grant began in July, 2001 and volunteers were mid-way through the current sampling season. Summer samples included lots of easily identifiable favorites, the bold, flashy, and colorful non-toxic dinoflagellate *Ceratium spp.* and the Grecian urn shaped *Dinophysis spp.* During the summer, volunteers continued to use our field microscopes for public outreach. Phytoplankton and water samples were also collected and information shared with interested onlookers. We also had contact during the season with whale watch customers, summer camp students at the Seacoast Science Center, and summer school students in North Hampton. Our microscopes continue to be a valuable bridge between tourists, local residents, and our GBCW program mission of education and research.

During the fall we found increased numbers of the cell *pseudonitzchia spp.* reported at the Parsons Creek site in Rye, and also in the Hampton and Seabrook areas. Finding the cell in samples does not necessarily mean that shellfish are in danger of becoming toxic. There are

many species of *pseudonitzchia* but only a very few produce toxins, and only then under rare nutrient conditions. So far, samples sent for analysis to the USFDA Sea Food Laboratory in Washington D.C. have contained species not known to be capable of producing toxins.

Volunteer training opportunities this season included a trip to Bigelow Laboratory for Ocean Sciences, Boothbay Harbor Maine to join members of the Maine Cooperative Extension's Volunteer Phytoplankton Monitoring Program for a spring training session. Live phytoplankton samples for identification practice were supplied by the Guillian-Pravolli Culture Center at Bigelow.



Students from the 4th grade at New Franklin School, with teacher Ann Smith, discuss GBCW data with the Portsmouth conservation commission

Appendix A – Outreach and Education Publications

Appendix B Volunteer hours and match summary

Quarter 1

		Hours	Miles
07/26/2001	Joint Meeting and BBQ	72.5	457
09/05/2001	Monthly Meeting	32	385
08/07/2001	QA/QC	49	500
08/08/2001	QA/QC	52	338
Monthly water quality sampling			
New Castle, Newington, Portsmouth sites		86	
Phytoplankton Sampling July-September		137	955
	total	428.5	2635
	match$	**$4,713.50**	**$909.80**

Quarter 2

09/15/2001	Ducker's Day Presentation	23	161
10/03/2001	Monthly Meeting	38	356
11/14/2001	Chili and Chowder festival	135	581
12/31/2001	Volunteer area leaders meeting	15	0
	kit clean-up	39	159
Monthly water quality sampling			
New Castle, Newington, Portsmouth sites		70	
Phytoplankton Sampling October and Nov.		71	549
	total	391	1806
	match $	**$4,301.00**	**$623.00**

Quarter 3

		hours	miles
01/21/2002	Volunteer Action sign-up, Portsmouth Middle school	3	
01/22/2002	Meeting for town presentations	16	
02/11/2002	Secchi disk maintenance	49	379
03/06/2002	Annual Meeting	54	555
3/8&9	Phytoplankton Workshop, Darling Marine Center	174	
03/12/2002	Phytoplankton training, Kingman Farm	28	380
03/13/2002	Introduction to GBCW	13.5	122
03/19/2002	Meeting for town presentations	8	
03/20/2002	New Volunteer Training	28	134
03/28/2002	Student Training	20	69
various	Steve Cooper, GBCW volunteer - report production	40	
3/25 & 28	Phytoplankton sampling	14	53
		3	60
	Total	450.5	1752
	match $	**$4,955.50**	**$639.48**

Quarter 4

04/23/02	Monthly Meeting	60	473
4/8&9	equipment calibration	15.5	114
4/10&11	sampling kit assembly	28.5	158
04/15/02	training session	37	242
4/17&18	Quality Assurance/Control volunteer testing	126	1347
4/17&18	QA/QC volunteer team support	55	
4/22&23	sampling kit assembly	20	
05/08/02	monthly meeting	67.5	477
05/13/02	phytoplankton training	3	20
05/18/02	public display-Exeter Alewife Festival	12	
06/05/02	monthly meeting	42	420
		466.5	3251
phyto field sampling		158	1248
monthly water quality sampling New Castle, Newington,Portsmouth sites		110	1095
Lab work-processing water quality samples for fecal coliforms		176	
volunteer assistance with reports/fact sheets production		68	
community presentations		75	188
	total	1053.5	5782
	match $	**$11,588.50**	**$2,110.43**

toal match $ **$29,840.41**

09 HP Ilton Park

P. spp. = Prorocentrum spp. A.t.=Alexandrium tamarense Ps. spp.=Pseudonitzschia spp. D. spp.=Dinophysis spp.

Date	Time	Current Speed	Wind Speed	Wind Direction	Air Temp. (C)	Transparency	Water Depth (cm)	Water Temp (C)	Water Temp. in Cylinder	Water Density	Salinity (ppt)	Tow Depth (cm)	Tow Duration (min)	Dissolved Oxygen (ppm)	Tube 1	Tube 2	Pr. spp.	A.t.	Ps. spp.	D. spp.	Dominant Species	Number of Cells	Comments	Sampler	Vol. Min.	Vol. Mk
07/01/01	10:15	O	5	S	31.5	380	450	18	20	1.021	28.5	350	3	8.9	24	23	0	0	1	5	CP	47	5 DN found scanning tube	S. Baird	130	18
07/09/01	15:40	L	3	S	21.5	343	438	13	15	1.023	29.8	350	3	8.6	21	14	0	0	0	0	CP	35		Barbara Baird, Michelle Wensman, Sam, Sophie	360	54
07/19/01	9:10	O	nt	R	20.5	430	430	12	17	1.0228	29.66	nt	3	8.4	7	10	0	3	0	1		17		Barbara Baird, Michelle Wensman	150	28
07/22/01	14:40	nt	8	W	32	338	430	17	20	1.0229	30.3	375	3	9.2	11	2	0	0	0	1	CP	13		Barbara Baird, Michelle Wensman, Sam, Sophie	180	30
08/07/01	14:20	O	0-5	SW	28	320	440	18	20	1.025	27.86	nt	4	9	17	11	0	0	0	3	CP	28		Barbara Baird	130	14
08/12/01	8:40	L	2	R	21.1	348	438	17	17.5	1.023	30.46	300	3	9	5	9	0	0	0	0		14		Michelle Wensman, Sophie, Sam	120	14
08/18/01	12:30	L	13	W	29	378	460	17	18.5	1.0248	32.86	350	3	7.8	4	5	0	0	0	2	CF	9		Barbara Baird, M Wensman	115	30
08/27/01	8:30	L	4	W	21	377	408	18	18.5	1.0228	30.26	300	3	7.7	8	8	0	0	0	0	LP	10	Lp and Twinkly	M Wensman, Sam, Sophie	90	14
09/15/01	11:10	L	7	SW	28.5	425	425	15	15	1.024	31.1	400	3	8.1	10	9	0	0	0	0		19		S Baird, Michelle, Sophie, Sam Wensman	390	30
09/19/01	17:30	L	3-5k	SW	28	418	415	16	17.5	1.0235	31.1	300	3	7.9	4	8	0	0	0	0	none	12		S Baird, M Wensman	186	30
09/22/01	17:20	O	12	ESE	22	380	480	16	17	1.0235	30.86	300	3	7.7	33	22	0	0	0	3	NZ	55	more DN out of view	S Baird	96	18
10/01/01	13:40	N	7	R	16	388	450	14	14.5	1.026	32.26	300	3	9	19	21	0	0	0	0	PM	40	about 75% PM	M Wensman, Sam, Sophie	180	14
10/08/01	18:55	O	15	WNW	9	395	445	11	11	1.026	26.75		3	8.1	14	13	0	0	0	0	GY, PM	27	DN out of view	S Baird	110	18
10/15/01	11:40	L	5	W	16	420	515	12	13.5	1.0255	32.96	300	3	9.2	84	87	0	0	0	2	PM	171	sample was full of phyto	Sam, Sophie, Michelle Wensman	318	14
05/27/02	14:00	L	10	E	21	150	300	12	14	1.0215	27.56	300	3	9.1	17	10	0	0	0	0	diatoms	27	pollen and diatoms	Michelle Wensman, Barbara Baird	210	24
06/03/02	7:30	L	25	NW	11	330	420	11	12	1.0235	29.75	400	3	8.7	13	14	0	0	0	3	TL	27		Sophie, Michelle Wensman, Barbara Baird	318	20
06/10/02	13:15	L	5	NE	28	177.5	405	17.5	20	1.0185	22.85	350	3	8.5	10	8	0	0	0	10	DN	18	In additional tube 14 DN!	B Baird, S & M Wensman	330	24
06/18/02	7:05	L	1	SE	14.5	280	450	14	15	1.0136	17.36	300	3	7.9	10	10	0	0	0	1		20		M & S Wensman	180	14
06/28/02	14:45	L	4	SE	31	330	420	16.6	20	1.021	28.5	300	3	7.6	20	11	0	0	0	13	diatoms	31		M & S Wensman, B Baird	210	29

09S Seabrook

P. spp. = Prorocentrum spp. A.t.=Alexandrium tamarense Ps. spp.=Pseudonitzschia spp. D. spp.=Dinophysis spp.

Date	Time	Current Speed	Wind Speed	Wind Direction	Air Temp. (C)	Transparency	Water Depth (cm)	Water Temp (C)	Water Temp. in Cylinder	Water Density	Salinity (ppt)	Tow Depth (cm)	Tow Duration (min)	Dissolved Oxygen (ppm)	Tube 1	Tube 2	Pr. spp.	A.t.	Ps. spp.	D. spp.	Dominant Species	Number of Cells	Comments	Sampler	Vol. Min.	Vol. Mk
07/01/01	6:30	L	5	SW	23.8	366	305	13	14	1.0256	32.7	200	3	8.4	17	13	0	0	6	2	CP	30		staff	0	0
07/09/01	14:35	L	8	ESE	22	300	300	13	16	1.0256	33.06	250	3	10.1	8	6	0	0	6	0	CP	13		Roy & Marie	270	14
07/23/01	13:55	L	9	SW	32	300	350	17	19	1.023	33.2	300	3	8.4	4	4	0	0	9	2	NA	8		Roy & Marie	270	14
08/01/01	8:41	O	Q	Q	17	280	280	15			31.8	200	4	10.8	8	9	0	0	8	1	CF	17	readings by meter	staff	0	0
08/06/01	13:30	L	9	E	29	300	300	18	19.5	1.0245	32.96	250	3	8.5	9	4	0	0	9	3	TA	13		Roy & Marie	270	14
08/13/01	17:50	L	7	E	25	300	300	17	19	1.026	33.2	250	3	8.5	1	0	0	0	8	1	TA	1		Roy & Marie	270	14
08/19/01	11:56	L	0		25	350	365	14.5	14.5	1.025	32.26	2.5	3	8.4	3	6	0	0	8	5	DN	9		staff	0	0
08/27/01	7:00	M	7	SW	21	300	300	15	19	1.0250	32.8	250	3	7.8	0	0	0	0	8	0	TA	12		Roy & Marie	270	14
09/10/01	16:37	L	13	SW	29	300	300	13	15	1.0255	33.06	250	4	8.7	3	5	0	0	1	0	TA	8		Roy & Marie	270	14
09/17/01	11:10	L	9	NW	19	280	350	14	15	1.0260	33.76	280	3	8.7	2	0	0	0	2	0	TA	11		Roy & Marie	270	14
09/23/01	16:30	L	8	ESE	21	300	350	16	17	1.0260	32.9	300	3	8.7	21	28	0	0	4	0	CF	49		Roy & Marie	270	14
10/01/2001	11:05	L	10	N	13	280	328	13	14	1.0260	33.4	250	3	8.5	22	20	0	0	11	0	TA	42		Roy & Marie	270	14
10/08/2001	15:20	L	20	NW	12	250	300	10	10	1.0270	33.9	250	3	8.3	12	8	0	0	7	1	PS,TL	20		Roy & Marie	270	14
10/14/01	8:50	M	8	NE	13	360	360	13	14	1.0255	32.76	200	3	nt	13	20	0	0	3	0	TL	33		staff	0	0
10/22/2001	16:00	L	9	W	17	325	325	10	11	1.0270	34.1	300	3	7.8	10	8	0	0	1	0	TA	18		Roy & Marie	270	14
10/29/2001	9:00	L	3	W	7	300	300	9	10	1.0270	33.9	250	3	8.9	37	37	0	0	22	0	TL	74		Roy & Marie	270	14
04/09/02	9:45	L	12	SW	7	295	295	8	12	1.0255	32.36	250	3	10.8	33	24	0	0	8	0	SK	57		STAFF	0	0
04/15/02	13:45	L	7	N	10	300	300	7	8	1.0255	33.06	250	3	10.7	1	1	0	0	2	0	TL	2	Building Gone	Roy & Marie	270	14
4/29/2002	13:40	L	9	N	5	250	340	7	7	1.0254	31.45	250	3	10	1	1	0	0	2	0	CO	28	Extreme High Tide	Roy & Marie	270	14
05/06/02	7:45	L	3	S	12	300	300	8	9	1.0255	31.75	250	3	9.6	1	0	0	0	8	1	CO	23	Lots of black flags on beach	Roy & Marie	270	14
05/28/02	11:40	L	8	S	16	325	325	10	11	1.0255	32.15	300	3	9.6	0	1	0	0	8	1	TA	1		Roy & Marie	270	14
6/3/2002	18:40	L	12	NW	19	300	300	9	10	1.0265	33.26	250	3	9.3	0	0	0	0	8	0	TA	19		Roy & Marie	270	14
6/17/2002	17:10	L	7	SE	17	200	328	14	15	1.0245	31.75	250	3	8.7	4	6	0	0	8	0	TA	10	Lots of Fisherpeople	Roy & Marie	270	14
06/24/02	11:30	L	20	W	27	250	300	14	15	1.026	32.4	250	3	8.9	2	0	0	0	8	2	SK	21		Roy & Marie	270	14
7/1/2002	16:55	L	8	W	31	295	295	15	16	1.025	32.8	250	3	8.8	6	1	0	0	8	1	SK	18		Roy & Marie	270	14
7/8/2002	10:15	L	8	W	27	300	300	14	16	1.0259	33.25	250	3	9	10	12	0	0	8	0	CO, TA	22		Roy & Marie	270	14

09R Rye Harbor

P. spp. = Prorocentrum spp. A.t.=Alexandrium tamarense Ps. spp.=Pseudonitzschia spp. D. spp.=Dinophysis spp.

Date	Time	Current Speed	Wind Speed	Wind Direction	Air Temp. (C)	Transparency	Water Depth (cm)	Water Temp (C)	Water Temp. in Cylinder (C)	Water Density	Salinity (ppt)	Tow Depth (cm)	Duration (min)	Dissolved Oxygen (ppm)	Tube 1	Tube 2	Pr. spp.	A.t.	Ps. spp.	D. spp.	Dominant Species	Number of Cells	Comments	Sampler	Vol. Min.	Vol. Ml.
4/8/2002	8:50	L	5	SW	5	100	100	6	7	1.027	33.4	100	5	10.1	6	7	0	0	0	0	SK	15		D Ballantone, A Stewart, J Chambers, L Beattie	240	29
4/15/2002	13:40	O	5	NE	8.5	275	510	9	9	1.0265	33	200	5	10.7	6	11	0	0	0	0	SK	19		A Stewart, L Beattie, J Chambers	180	15
4/25/2002	9:00	L	10	NE	8	250	nt	7.5	8	1.024	29.8	300	5	10.2	4	13	0	0	0	0	SK	17		A Stewart, J Chambers, L Beattie, D Ballantone	240	24
4/29/2002	13:20	L	8	NE	5	300	nt	6.5	6	1.026	32	250	5	8.4	1	1	0	0	0	0	SK	2		A Stewart, L Beattie	90	11
5/4/2002	13:15	L	8	W	12	200	200	9	10	1.025	31.3	200	5	9.2	0	2	0	0	0	0	CO	2		A Stewart, L Beattie	120	10
5/8/2002	8:15	L	3	SW	12.5	nt	nt	10	11	1.025	31.5	400	4	nt	1	17	0	0	0	0	CS	18		A Stewart, J Chambers, L Beattie	180	15
5/20/2002	17:15	L	5	N-NW	13	150	150	12	12	1.023	29.1	100	5	8.25	5	4	0	0	0	0	CD	9		A Stewart, L Beattie	80	6
6/4/2002	18:55	L	3	SE	19.5		800	12	12.5	1.025	31.8	5		10.3	2	2	0	0	0	0		4		Jack Chambers, Andy S	150	6

09 CL Coastal Lab

P. spp. = Prorocentrum spp. A.t.=Alexandrium tamarense Ps. spp.=Pseudonitzschia spp. D. spp.=Dinophysis spp.

Date	Time	Current Speed	Wind Speed	Wind Direction	Air Temp. (C)	Transparency	Water Depth (cm)	Water Temp (C)	Water Temp. in Cylinder (C)	Water Density	Salinity (ppt)	Tow Depth (cm)	Duration (min)	Dissolved Oxygen (ppm)	Tube 1	Tube 2	Pr. spp.	A.t.	Ps. spp.	D. spp.	Dominant Species	Number of Cells	Comments	Sampler	Vol. Min.	Vol. Ml.
07/05/01	12:00	L	5	nd	21.5	450	520	13	15	1.024	31.1	nt	nt	9.5	6	1	0	0	0	0	CP	7		D Chamberland, C	160	35
07/11/01	16:45	O	5	SE	18	515	515	14.5	14.5	1.025	32.5	400	4	9	4	13	0	0	0	2	CP	17	a few DN N	S Cooper, C Horrig	210	42
07/19/01	11:15	O	12	NW	nd	550	550	16	17	1.024	31.8	400	4	8.4	4	5	0	0	0	1	CP	9	DN,PM,out of \	D Chamberland,S	120	70
08/01/01	10:35	O	5	NE	28.8	425	500	16.5	26	1.021	31.3	400	3	7.6	17	17	0	0	0	0	RH	34		staff	0	0
08/08/01	13:30	O	8	N	33	400	500	20	19	1.0245	32.7	nd	nt	9.2	2	1	0	0	0	0	CP	3		D Chamberland, T	180	62
08/15/01	9:00	O	0	0	21	465	465	16.5	19	1.024	32.1	350	4	7.7	0	5	0	0	0	2	CP	5	very quiet	C Horrigan, C Wol	240	36
08/24/01	16:30	O	5	E	nt	310	740	19.5	19	1.025	33.4	300	3	6.1	0	0	0	0	0	0		0		D Chamberland, T	180	62
09/06/01	15:40	O	5	W	20	400	500	14	14	1.025	32.1	400	3.5	9.1	7	6	0	0	0	3		13	CP, DN	D Chamberland,T	240	65
09/26/01	9:00	O	5	W	17	450	470	15.5	16	1.025	32.6	400	4	7.2	8	9	0	0	0	4	CP, PM	17		Cindy Wolfe, Steve	210	41
10/03/01	12:45	O	7	SE	18	340	540	15	15	1.025	32.4	300	3	7.7	3	10	0	0	0	0	PM	13		Don Chamberland	100	80
10/17/01	13:14	nt	nt		11.5	550	560	11.5	12	1.026	33	300	3	8.6	26	18	0	0	0	0	PM	44		T Bower, C Horrig	310	49
10/26/01	8:30	O	5	S	9	500	500	10	11	1.026	32.6	300	3	8.2	3	3	0	0	0	0	PM	7		T Bower, D Chamt	120	50

Date	Time	Current Speed	Wind Speed	Wind Direction	Air Temp. (C)	Transparency	Water Depth (cm)	Water Temp (C)	Water Temp. in Cylinder (C)	Water Density	Salinity (ppt)	Tow Depth (cm)	Duration (min)	Dissolved Oxygen (ppm)	Tube 1	Tube 2	Pr. spp.	A.t.	Ps. spp.	D. spp.	Dominant Species	Number of Cells	Comments	Sampler	Vol. Min.	Vol. Ml.
03/28/02	10:34	L	12	N	7	190	500+	6	7	1.0235	28.9	400	3	10.2	87	102	0	0	0	0	diatoms	189		C Horrigan, E Hutchins, C Hoffman	360	42
04/04/02	16:28	L	12-15	N	6.1	217	430	6.5	7	1.022	27	400	3	10.3	31	13	0	0	0	0	diatoms	44		C Hoffman,E Hutcl	120	38

09 CG Coast Guard Pier

P. spp. = Prorocentrum spp. A.t.=Alexandrium tamarense Ps. spp.=Pseudonitzschia spp. D. spp.=Dinophysis spp.

Date	Time	Current Speed	Wind Speed	Wind Direction	Air Temp. (C)	Transparency	Water Depth (cm)	Water Temp (C)	Water Temp. in Cylinder (C)	Water Density	Salinity (ppt)	Tow Depth (cm)	Duration (min)	Dissolved Oxygen (ppm)	Tube 1	Tube 2	Pr. spp.	A.t.	Ps. spp.	D. spp.	Dominant Species	Number of Cells	Comments	Sampler	Vol. Min.	Vol. Ml.
05/03/01	8:15	L	2	W	29.5	450	575	10.5	12	1.0228	28.45	400	3	10.6	7	13	0	0	0	0	TL, ML, SK	20		Michelle Wennersten, Brian Jerv	125	55

Date	Time	Current Speed	Wind Speed	Wind Direction	Air Temp. (C)	Transparency	Water Depth (cm)	Water Temp (C)	Water Temp. in Cylinder (C)	Water Density	Salinity (ppt)	Tow Depth (cm)	Duration (min)	Dissolved Oxygen (ppm)	Tube 1	Tube 2	Pr. spp.	A.t.	Ps. spp.	D. spp.	Dominant Species	Number of Cells	Comments	Sampler	Vol. Min.	Vol. Ml.
04/11/02	11:38	L	10	NW	8	400	nt	8.5	9	1.0235	29.2	400	3	10.3	93	118	0	0	0	0		211	sm r diatoms, seechi line to short	C Horrigan, E Hutchins, S Cooper, C Dolan	295	80
04/18/02	15:29	L	15	NE	8	540	650	11	11.5	1.023	28.8	500	3	nt	41	47	0	0	0	0		88	small round diatoms	E Hutchins, C Hoffman, C Dolan		
04/26/02	10:10		12	S	10	360	750	10	10.5	1.0235	29.3	300	3	10.1	49	32	0	0	0	0		81		L Beattie, S, S & M Wentzien, E Hutchins, C Hoffman, C Horrigan	420	87
05/04/02	6:10	L	8	NW	11	300	680	8.5	8	1.022	27.2	300	3	8.7	7	14	0	0	0	0		21		C Hoffman, E Hutchins	180	34
05/09/02	10:15	L	8	SE	11	530	125	10	10.5	1.0225	28.1	300	3	8.4	10	6	0	0	0	0		16		Emily Hutchins, Curtis Hoffman	240	33
05/16/02	14:50	L	10	W	23	nt	nt	14	14	1.0195	24.8	400	3	9.4	8	6	0	0	0	CD		12		Lorie Chamberlin	90	25
05/22/02	9:44	L	8	W	nt	340	nt	12	12.5	1.021	28.9	300	3	9	10	6	0	0	0	1		18		Cliff Horrigan, Lyn Chev, Emily Hutchins, Curtis	340	33
05/29/02	14:10	L	23	SE	14	345	600+	12	14	1.023	29.3	500	3	8.4	18	12	0	0	0	0	diatoms	29	diat line not long enough	E Hutchins, Lorie Chev	210	50
06/07/02	8:30	O	8	E	8	280	640	12	12	1.023	29.1	300	2	8.7	8	5	0	0	0	2		14	rainy day	Curtis Hoffman, C Dolan	120	13
06/20/02	9:00	L	0	-	21	400	635	15	14	1.0206	28.8	400	3	7.7	8	14	0	0	0	0		20		Lorie Chev, C Hoffman, E Hutch	195	56
07/13/02	13:48	O	12	SE	19.5	300	650	14	15	1.022	28.5	400	3	7.6	8	7	0	0	0	4	DN	19		E Hutchins, C Hoffman	180	32

09 PC Parson's Creek

P. spp. = Prorocentrum spp. A.t.=Alexandrium tamarense Ps. spp.=Pseudonitzschia spp. D. spp.=Dinophysis spp.

Date	Time	Current Speed	Wind Speed	Wind Direction	Air Temp. (C)	Transparency	Water Depth (cm)	Water Temp (C)	Water Temp. in Cylinder (C)	Water Density	Salinity (ppt)	Tow Depth (cm)	Duration (min)	Dissolved Oxygen (ppm)	Tube 1	Tube 2	Pr. spp.	A.t.	Ps. spp.	D. spp.	Dominant Species	Number of Cells	Comments	Sampler	Vol. Min.	Vol. Ml.
07/02/01	9:30	L	15-20	NW	19	100	100	11.5	12.5	1.023	29.2	0.5	4	9.3	1	7	0	0	1	1	CP	8		Andy Stewart, Lyn Beattie	70	7
07/09/01	14:45	L	5	SE	26	100	100	20	15	1.0225	32.1	100	5	9.8	3	2	0	0	5	0	PS	9		Andy Stewart, Lyn Beattie	80	7
07/16/01	7:40	L	8	NW	19	100	100	13	14	1.025	32.1	nd	nd	8.8	5	7	0	0	6	0	PS	12		Andy Stewart, Lynn Beattie	80	7
07/23/01	13:20	L	8	S	29.5	100	100	15.5	nd	nd	31	0.5	5	9.1	2	10	0	0	2	2	CP	12		D Bellantone, Lynn Beattie, A Stew	180	26
07/30/01	8:00	L	2	SE	19	200	200	18	16.5	nd	31.9	100	5	8	1	1	0	0	0	0	NZ	2		Jack Chambers, A Stewart	90	8
08/06/01	13:25	L	10	S SE	29	100	100	20	20.5	1.023	31.3	0.5	3	nt	1	1	0	0	0	2	CP	2		Andy Stewart, J Chambers, Lyn Be	120	11
08/11/01	17:40	L	15	S	28	100	100	19	19.5	1.024	32.2	100	5	8.8	3	4	0	0	4	0	PS	8		Andy Stewart, Jack Chambers, Lynn	135	11
08/20/01	12:15	H	3	ENE	29	200	200	23.5	22	1.025	34.5	100	nd	8.35	3	6	0	0	7	3	PS	11		Andy Stewart	180	8
09/27/01	16:10	M	6	N	24	150	150	16	17	1.024	31.9	100	5	7.9	1	2	0	0	0	0	CP	3		Andy Stewart, Lyn Beattie	80	7
09/03/01		L	10	S/SW	22	100	100	15.8	17	1.0248	31.9	0.5	5	9.1	4	0	0	0	1	0	CP	4		Andy Stewart, Lyn Beattie, Jack Che	120	11
09/10/01	16:40	M	6	S/SW	23	150	150	15	16	1.026	32.6	0.5	5	10.1	5	4	0	0	8	0	PS	9		Andy Stewart, Lyn Beattie, Jack Che	120	11
09/17/01	11:10	M	10	S/SE	23	200	200	14.5	15.5	1.026	32.2	0.5	5	8	9	6	0	0	15	0	PS	18		Jack Chambers, Andy Stewart, Lynn	120	11
09/24/01	17:00	M	4	S	20	200	200	18.5	18.5	1.026	32.7	100	5	8	4	3	0	0	3	1	PS	7		Andy Stewart, Jack Chambers	120	8
10/01/01	10:30		10	N	13	100	200	14	14	1.026	32.1	0.5	5	8.4	12	27	0	0	11	0	PM	39	lots of PM	Stewart, Jack Chambers, Lyn B	120	11
10/08/01	16:00	L	3	SW	16.5	200	200	11.5	13	1.0256	32.5	100	5	9.4	1	7	0	0	0	0		8		Andy Stewart, Jack Chambers	120	12
10/15/01	10:30	H	5	NW	13	200	200	12.5	13.5	1.026	32	100	5	9.55	10	2	0	0	6	0	PS	12		Lyn Beattie, Andy Stewart	120	8

Date	Time	Current Speed	Wind Speed	Wind Direction	Air Temp. (C)	Transparency	Water Depth (cm)	Water Temp (C)	Water Temp. in Cylinder (C)	Water Density	Salinity (ppt)	Tow Depth (cm)	Duration (min)	Dissolved Oxygen (ppm)	Tube 1	Tube 2	Pr. spp.	A.t.	Ps. spp.	D. spp.	Dominant Species	Number of Cells	Comments	Sampler	Vol. Min.	Vol. Ml.
03/28/02	10:10	M	10	W-NW	7.8	100	300	5	6	1.026	32	100	5	10.2	9	1	0	0	0	0	diatoms	10		A Stewart, L Beattie	120	7
04/01/02	13:30	L	20	W	11	200	200	7	15	1.0245	31.75	100	5	9.8	14	13	0	0	0	0	diatoms	27		J Chambers, A Stewart, L Beatt	135	11
04/11/02	11:15	M	4	S	22	200	200	16	16	1.0045	31.1	200	5	nt	3	3	0	1	0	1		8		David, Lynn B, Jack, Andy Stew	270	20
04/17/02	16:20	H	1	S	20	200	200	16	16.5	1.023	29.9	100	5	8.47	4	6	0	0	1	0		10		J Chambers, A Stewart	120	8
04/24/02	10:50	H	12	W	24	200	200	16	16.5	1.024	31.4	100	5	8.9	6	7	0	0	0	1	MV	13		J Chambers, A Stewart, L Beatt	180	11
07/01/02	16:30	L	0	-	31.5	200	200	18	20.5	1.023	31.3	100	5	nt	0	0	0	0	0	0		0	green being spencer things	Stewart, J Chambers, L Beatt	120	10
07/08/02	10:20	L	0-5	S	26	100	100	17.5	18	1.024	33.9	100	5	8.55	0	0	0	0	0	0		0		A Stewart, J Chambers, L Beattie	180	11