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2003 Great Bay Water Quality (DataSonde) Monitoring Program

A Final Report to

The New Hampshire Estuaries Project

Submitted by

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Introduction

In situ water quality assessment has become an important source of data for monitoring, research and management activities in estuaries nationwide. As part of the National Estuarine Research Reserve System, the Great Bay System-Wide Monitoring Program (SWMP) produces *in situ* water quality data for four sites in and around Great Bay. This project extends the SWMP program to include year-round *in situ* data for a station at the University of New Hampshire Coastal Marine Lab pier at the mouth of the Piscataqua River and summer data for a station in the Salmon Falls (SF) River. This suite of stations provides a comprehensive *in situ* sampling array that monitors the major rivers and open estuary locations within the Great Bay estuarine system.

Project Goals and Objectives

UNH completed this project under contract to the NH Estuaries Project (Project ID #02-M-4; CE #711790). The project goals and objectives per the contract were to:

- (1) support *in situ* water quality monitoring for the April – December sampling season at the Lamprey River (LR), Squamscott River (SQ), Oyster River (OR), Great Bay (GB) and Coastal Marine Lab (CML) sites; and
- (2) fund the deployment of *in situ* water quality monitoring at the Salmon Falls (SF) for July, August and September.

The final work product was agreed to be a series of Excel data files containing monthly data records for each of these sites along with appropriate meta-data for these data.

Methods

The methods for this project followed the procedures prescribed by the National Estuarine Research Reserve Central Data Management Office (CDMO) and detailed in Small et al. (2003).

Briefly, YSI 660 DataSondes are programmed to obtain measurements of specific conductivity, salinity, dissolved oxygen, percent saturation, pH, temperature, water level, and turbidity every half-hour. The instruments are deployed continuously during ice-free seasons, except for brief periods when they are removed for cleaning, maintenance and recalibration. Pre and post-deployment calibrations are performed using the diagnostics menu of the YSI Ecowatch program and QA/QC

procedures developed by NERR Research Coordinators and YSI engineers. VWR conductivity and pH standards are used for calibration. YSI formazin is used to calibrate turbidity probes.

DataSondes are deployed approximately one meter from the bottom and recovered for data download every 2-4 weeks depending upon the time of years. Files are first examined and graphed using Ecowatch software. Missing and/or anomalous data are noted. Files are then transferred to a Macintosh computer and opened in Excel software and edited. Missing data due to routine YSI maintenance and probe failure or communication errors are inserted into the spreadsheet. Edited files are merged to contain one full month of data. Files are verified by means of CDMO Excel macros. The CDMO cdmomac3.xls macro allows the user to automatically format column widths to the correct number decimal places based on the YSI sensor specifications. It also allows the user to QA/QC each data logger generated file for missing data points, fill all cells that do not contain data with periods, and find all data points that fall outside the range of what the datalogger is designed to measure (outliers). The CDMO import.xls macro will allow PC users with 30-minute data to automatically create a monthly Excel file from a two-week deployment and insert periods for missing data. Edited files are merged to contain one full month of data. In addition, in November 1999 a graphing capability was added to this macro allowing users to produce single parameter and missing point graphs on a monthly basis. All files are graphed in Excel and examined in order that anomalous data points can be identified and removed.

Results and Discussion

Data for the DataSondes deployed as part of the NERRS SWMP program have been submitted and accepted by the NERRS CDMO. So as not to create potentially different data sets (CDMO potentially modifies the data that are submitted to them), the data and all associated meta-data for the GB, LR, SQ and OR sites are available at <http://cdmo.baruch.sc.edu/home.html> and by following the links to: (a) NERR Data; (b) NERR Data and Associated Metadata; (c) NERR SWMP Water Quality Data; and (d) Great Bay (GRB).

For the CML site, DataSondes were successfully deployed as follows:

Site/Sonde	deploy date	time	retrieve date	time
CML 99	12/16/2003	1600	1/13/2003	1700
CML 1094	1/13/2003	1730	2/12/2003	1130
CML 99	2/12/2003	1200	3/23/2003	1600
CML 1138	4/25/2003	800	5/12/2003	1600
CML 579	5/12/2003	1600	6/10/2003	1800
CML 1094	6/10/2003	700	7/7/2003	1600
CML 857	7/7/2003	1630	7/23/2003	1500
CML 100	7/23/2003	1600	8/19/2003	800
CML 100	8/19/2003	1600	9/8/2003	1500
CML 579	9/8/2003	1630	9/17/2003	1630
CML 99	9/22/2003	1430	10/17/2003	1530
CML 86AB	10/17/2003	1600	11/7/2003	1530
CML 1094	11/7/2003	1530	12/11/2003	900
CML 857	12/10/2003	930	1/9/2004	1700

For the SF site, DataSondes were successfully deployed as follows:

Site/Sonde	deploy		retrieve	
	date	time	date	time
SF 1138	7/3/2003	1400	7/25/2003	1300
SF 857	7/25/2003	1330	8/20/2003	830
SF 857	8/20/2003	1530	9/10/2003	1330
SF 1138	9/10/2003	1430	10/7/2003	1000

The CD included with this report contains the following information for the CML and SF DataSonde deployments: (a) raw data files; (b) edited data files (these are the files that should be used and distributed); and (c) meta-data, calibration and deployment files.

Conclusions and Recommendations

The *in situ* water quality monitoring program provides important data on basic water quality parameters in the Great Bay estuary. The CML site at the mouth of the Piscataqua River provides particularly critical information on the marine 'end-member' for the Great Bay system necessary for modeling and other integrative studies. The SF site provides important information on water quality during the critical summer period when dissolved oxygen levels may potentially decrease. When combined with the NERRS SWMP DataSonde program, these instruments provide comprehensive coverage of the Great Bay estuary.

References

Small, Tamara D., Ashly D. Norman, Danna D. Swain, Jesse Friedmann and Dwayne E. Porter. (2003) CDMO NERR SWMP DATA MANAGEMENT MANUAL Version 5.0 (December 2003). NOAA National Estuarine Research Reserve, Centralized Data Management Office, Georgetown, SC.

2003 Water Quality (DataSonde) Monitoring Program Meta-Data (Appendix 1)

Research Methods

Datasondes are programmed to obtain measurements of specific conductivity, salinity, dissolved oxygen, percent saturation, pH, temperature, water level, and turbidity every half-hour. The instruments are deployed continuously during ice-free seasons, except for brief periods when they are removed for cleaning, maintenance and recalibration. Pre and post-deployment calibrations are performed using the diagnostics menu of the YSI Ecowatch program and QA/QC procedures developed by NERR Research Coordinators and YSI engineers. VWR conductivity and pH standards are used for calibration. YSI formazin is used to calibrate turbidity probes.

YSI 6600 datasondes are deployed approximately one meter from the bottom and recovered for data download every 2-4 weeks depending upon the time of years. Files are first examined and graphed using Ecowatch software. Missing and/or anomalous data are noted. Files are then transferred to a Macintosh computer and opened in Excel software and edited. Missing data due to routine YSI maintenance and probe failure or communication errors are inserted into the spreadsheet. Edited files are merged to contain one full month of data. Files are verified by means of CDMO Excel macros. The CDMO cdmomac3.xls macro will allow the user to automatically format column widths to the correct number decimal places based on the YSI sensor specifications. It also allows the user to QA/QC each data logger generated file for missing data points, fill all cells that do not contain data with periods, and find all data points that fall outside the range of what the datalogger is designed to measure (outliers). The CDMO import.xls macro will allow PC users with 30-minute data to automatically create a monthly Excel file from a two-week deployment and insert periods for missing data. Edited files are merged to contain one full month of data. In addition, in November 1999 a graphing capability was added to this macro allowing users to produce single parameter and missing point graphs on a monthly basis. All files are graphed in Excel and examined in order that anomalous data points can be identified.

Missing or Anomalous Data CML 2003

January

- No turbidity 1/13 1730 to 1/31 2330 most was negative. Deleted.
- No DO data 1/13 1730 to 1930 Data out of range. Deleted.
- All DO data from 1/13 2000 to the end of the month should be considered suspect (too high)

February

- No turbidity data 2/1 0000 to 2/12 1200. Most values were negative and deleted.
- No pH data 2/12 1200 to 2/28 2330. Data was out of range (low) and deleted.
- Suspect pH data 2/1 to 2/12. Values are somewhat lower than would be expected.
- Depth data changes after 2/22. The sonde must have shifted in the pipe, since this was a mid-deployment change.
- No DO data 2/1 0000 to 2/12 1130. Data was out of range (high) and deleted.

March

- 7 negative turbidity values were deleted.
- No data 3/15 2030 to 3/23; the instrument ceased recording for unknown reasons. The housing had been hit and damaged by a boat. The repair was not completed until 4/25.
- No data 3/23 when the housing and sonde were removed until 3/31 2330.

April

- No data 4/1 0000 to 4/25 0700. The deployment site was being repaired/replaced following crushing by a boat.

May

- 730 negative turbidity values were deleted, as well as all values greater than 100.
- Increase in turbidity at the end of May could be due to 8 days of rain at the end of the month.
- No pH data 5/1 0000 to 5/12 1600. Data was out of range (low) and deleted.
- No pH data 5/24 1700 to 5/29 1200. Data was aberrant (low) and deleted.
- No DO data 5/27 1630 to 5/29 2330. Data was aberrant (low) and deleted.

June

- 538 negative turbidity values were deleted.
- No data 6/10 0630. Sonde deployment swap.
- No pH data 6/10 0700 to 6/30 2330. Data out of range (low) and was deleted.
- No DO data 6/10 0700 to 6/30 2330. Data out of range (high) and was deleted.

July

- No data 7/23 1530; sonde deployment swap.
- 690 negative turbidity values were deleted as well as all values greater than 100
- No turbidity data 7/23 1600 to 7/31 2330. Data out of range, probably due to probe malfunction.
- No pH data 7/1 0000 to 7/7 1600. Data out of range (low) and was deleted.
- No DO data 7/1 0000 to 7/7 1600. Data was aberrant, deleted.
- Salinity and specific conductivity from 7/7 1630 to 7/23 1500 is questionable. Values are quite a bit lower than prior and subsequent deployments. Data are suspect but were retained.

August

- No turbidity data 8/1 0000 to 8/5 2130. The data was out of range, probably due to probe malfunction, and was deleted.
- No data 8/19 0830 to 1530 due to sonde deployment swap.
- pH data from 8/19 1600 to 8/31 2330 is questionable and should be considered suspect because it is quite a bit lower than is typical of the site.
- No DO data 8/19 1600 to 8/31 2330. Data was very aberrant (including negative values), and was deleted. The post calibration value at the end of the deployment was 88% in water saturated air. Possible probe malfunction.
- The following DO data was deleted because it was out of range (low).
- 8/8 0000 to 0030, 8/9 2330, 8/14 2030, 8/17 2100
- No salinity or specific conductivity data 8/12 0300 to 2000. Data was extremely aberrant (low) possibly due to an obstruction on the probe and was deleted.
- No turbidity data 8/26 1130 to 8/31 2330. All values were over 1000 probably because the turbidity wiper became stuck over the optics.

- Salinity values drifted upward throughout the deployment that ended 8/19. Post deployment calibration of specific conductivity was slightly high. Data was retained.

September

- No turbidity data to 9/1 0000 9/8 1500. All values were over 1000 which indicates that the wiper became stuck over the optics.
- No turbidity data 9/8 1530 to 9/17 0430. All values were negative and deleted.
- No data 9/17 0430 to 9/22 1400. The deployment apparatus was crushed by a boat and was under repair for this period.
- No DO 9/1 0000 to 9/8 1500. Data out of range, probably due to probe failure.
- Salinity drift at beginning of September before the 9/8 deployment possibly due to fouling of the probe. Data is suspect but was retained.

October

- 383 negative turbidity values were deleted.
- DO drifted upward at the end of the deployment which ended on 10/17. Data is suspect but was retained. Post deployment calibration was 111%.

November

- 202 negative turbidity values were deleted.
- No pH data 11/7 1530 to 11/30 2330. Data was out of range (low) and deleted.
- No DO, temperature, salinity, specific conductivity data 11/7 1530 to 11/30 2330. Data was deleted due to probe failure. When the conductivity or temperature sensor fails or has inaccurate readings, salinity and DO also have to be rejected because the sensors calculations are dependent upon one another.

December

- 853 negative turbidity values were deleted.
- No DO, temperature, salinity, specific conductivity data 12/1 0000 to 12/11 0900. Data deleted due to probe failure. (see November)
- No pH data 12/1 0000 to 12/11 0900, deleted due to probable probe malfunction.

Missing or Anomalous SF Data 2003

July

- 110 negative turbidity values and those greater than 100 were deleted.
- No pH data 7/25 0830 to 7/31 2330. Data was out of range, perhaps due to probe malfunction.
- No DO data 7/25 0830 to 7/26 2230. Data was very aberrant. But since it returned to an acceptable range, it's possible something temporarily obstructed the probe.

August

- 1245 negative turbidity values were removed as well as values greater than 100.
- No data 8/20 0830 to 1500. Sonde deployment swap.
- No pH data for the month of August. The data was aberrant for both deployments. Possibly due to equipment malfunction or fouling.
- No DO data 8/2 0730 to 8/22 0800. Data out of range (low) possibly due to probe fouling.

- All temperature, salinity and specific conductivity data for the month of August are suspect. When graphed the data appears aberrant as though the probe has failed. However the probe passed post deployment calibration.

September

- 797 negative turbidity values were deleted as well as values over 100.
- No DO data 9/17 0430 to 9/28 0730. Data was aberrant, possibly due to fouling and was deleted.
- No data 9/10 1400. Sonde deployment swap.