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2005 Great Bay Water Quality (DataSonde) Monitoring Program

Jonathan Pennock
University of New Hampshire - Main Campus

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2005 Great Bay Water Quality (DataSonde) Monitoring Program

2005 Great Bay
Water Quality (DataSonde) Monitoring Program

A Final Report to

The New Hampshire Estuaries Project

Submitted by

Dr. Jonathan Pennock
University of New Hampshire
Jackson Estuarine Laboratory
85 Adams Point Road
Durham, NH, 03824

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NewHampshire
EstuariesProject

Table of Contents

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 summmer 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 #05-M-3). 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 year. 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	12/2/2004	1600	1/18/2005	1630
CML	1/18/2005	1700	3/6/2005	830
CML	3/9/2005	1700	4/7/2005	1530
CML	4/7/2005	1600	5/10/2005	1430
CML	5/10/2005	1500	6/14/2005	1000
CML	6/14/2005	1030	7/12/2005	1430
CML	7/12/2005	1530	8/18/2005	1530
CML	8/18/2005	1600	9/14/2005	1530
CML	9/14/2005	1530	10/20/2005	900
CML	10/20/2005	1000	11/23/2005	830
CML	11/23/2005	900	1/20/2006	900

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

Site/Sonde	deploy date	time	retrieve date	time
SF	7/20/2005	1130	8/16/2005	930
SF	8/16/2005	1000	9/9/2005	1400
SF	9/9/2005	1430	10/19/2005	1200

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

Tamara D. Small, 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.

2005 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.

Dissolved Oxygen Qualifier: The reliability of the dissolved oxygen (DO) data after 96 hours post-deployment for non-EDS (Extended Deployment System) data sondes may be problematic due to fouling which forms on the DO probe membrane during some deployments (Wenner et al. 2001). Many reserves have upgraded to the YSI 6600 EDS data sondes, which increases DO accuracy and longevity by reducing the environmental effects of fouling. The user is therefore advised to consult the metadata and to exercise caution when utilizing the DO data beyond the initial 96-hour time period. However, this potential drift is not always problematic for some uses of the data, i.e. periodicity analysis. It should also be noted that the amount of fouling is very site specific and that not all data are affected. The Research Coordinator at the specific NERR site should be contacted concerning the reliability of the DO data because of the site and seasonal variation in the fouling of the DO sensor.

Missing or Anomalous Data CML 2005

Anomalous Data:

- From 1/24 to 1/30 pH values dropped to unusually low levels, then returned to normal for the

remainder of the deployment. Data are suspect but were retained.

- No accurate depth data from 1/18 until 4/4. During this time it was positioned on a floating dock. On 4/5 it was placed in a tube and began recording true tide data at 1430.

- Turbidity data for the 6/14 to 7/12 deployment appears aberrant. The entire turbidity data set is suspect, but was retained.

- Salinity drops and begins fluctuating more dramatically beginning October 7. This was caused by heavy rains that fell throughout the second half of the month.

Deleted Data:

Turbidity out of range and deleted:

Date	Time	Turb
4/20/05	20:30:00	2211
4/25/05	17:30:00	2223.7
6/8/05	1:30:00	740.1
6/9/05	5:00:00	593.3
6/9/05	19:00:00	714.1
12/1/05	5:00:00	1924
12/1/05	5:30:00	2350.5
12/1/05	6:00:00	2292.9

- No turbidity data 7/12 1530 to 8/18 1530. All values from this deployment were either negative or out of normal range and were deleted. The numbers ranged from –35 to 2712. The probe failed its post-deployment calibration.

- No pH data 3/9 1700 to 4/7 1430. The pH probe malfunctioned and failed post-deployment calibration.

- The DO probe began malfunctioning as soon as it went into the water on 1/18. It returned incorrect data (negative) for the remainder of the deployment.
- No DO data 1/18 1700 to 3/6 0830.

- No data 4/25 1400. All the data was aberrant (negative depth) indicating the sonde may have been lifted from the water. Data were deleted for that day/time.

Missing Data:

- No data 1/1 0000 to 1/18 1630. Sonde ceased recording because its internal clock malfunctioned.

- No data 3/6 0900 to 3/9 1630. It is unknown why the sonde stopped recording because it resumed in the lab on 3/9.

Missing or Anomalous SF Data 2005

<u>Anomalous Data</u>:

- During the first and second deployments the DO values drift upward to abnormal levels. The post deployment calibrations were acceptable, and the DO returned to normal levels when the instrument was removed from the river. The data are suspect but were retained.

- The dramatic drop in salinity values on approximately 10/9, which continues to the end of the deployment, is most likely due to an enormous amount of rain which fell in October (327.69 mm)

<u>Deleted Data</u>:

The following turbidity data were out of range and deleted.

Date	Time	Turb
8/4/20	23:00:00	1316.3
8/5/20	5:00:00	2326.2
8/7/20	19:30:00	661.6
8/8/20	17:00:00	2328.1
8/24/05	15:30:00	1565
8/25/05	21:30:00	1562.5
9/3/05	22:00:00	1564.4
9/4/05	2:00:00	1563.4
9/4/05	6:00:00	1563.2
9/5/05	1:00:00	1249.1
9/5/05	1:30:00	1560.9
9/5/05	6:00:00	1560.9
9/6/05	6:30:00	1373
9/6/05	7:00:00	1559.6
9/6/05	9:00:00	1559.3
9/8/05	1:00:00	845.2
9/8/05	5:30:00	1206.8
9/13/20	8:30:00	3799.9
9/21/20	0:00:00	3799.9
9/23/20	15:00:00	3799.9
9/24/20	23:00:00	3799.9
9/26/20	9:30:00	3792.2

- The pH probe broke mid-deployment. All pH values from 10/3 1900 to 10/19 1200 were deleted.

Missing data:

- No data on the following dates.

  8/15 0200 to 8/16 0900
  8/9 2000
  8/14 1400, 1700, 1930
  8/15 0000