

WELLS (WEL) National Estuarine Research Reserve Water Quality Metadata
January-December 2003
Latest Update: July 1, 2021

I. Data Set & Research Descriptors

1). Principal investigator & contact persons:

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2). Entry verification:

The data are directly downloaded in the YSI-PC6000 format (as a .dat file) and the Comma Delimited format (as a .csv file) from the dataloggers to a PC lap-top. The data are reviewed using the PC6000 software (Eco-Watch). Graphs and basic statistics are then generated with the Eco-Watch program and the information is printed out for each data file. These graphs are used to determine any obvious data outliers and sonde and/or probe malfunction. All downloaded data files from the dataloggers (both raw unedited .dat and .csv files) are then transferred via disk to a Dell Inspiron 4100, where all files are reviewed and formatted for CDMO and stored. Here the raw unedited .csv data files are imported into Microsoft Excel 2000. After a complete month of data has been recorded, each file is ready to review, which requires several steps. The NERR CDMO QA/QC Excel macros are used for all data.

The CDMO cdmomac3.xls macro will allow the user to automatically format column widths to the correct number of decimal places based on 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 data logger is designed to measure (i.e. 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. In addition, in November 1999 a graphing capability was added to this macro allowing users to produce single parameter and missing data point graphs on a monthly basis.

A data file is created (from the merged raw unedited .csv data files) in Excel format with a full month of data. The first step is to make sure that the parameter columns are in the correct order, specified by the NERR CDMO. If any parameters are not collected due to probe failure or other causes, the cells with this missing data are filled in with periods (.) and documented and explained in the appropriate section of the metadata. Secondly, missing dates and times are inserted in the data file where data were not collected due to maintenance, sonde failure, etc., and the cells with this missing data are filled in with periods (.) and documented and explained in the appropriate section of the metadata. The first NERR CDMO QA/QC Excel macro is then run to determine if there are any missing dates and times; and if so these missing dates and times are inserted. Next, the second NERR CDMO QA/QC Excel macro is used to find and filter all data readings outside the sonde specification measuring range for each parameter. Here the outlier data generated by the second macro are examined and determined as either explained or unexplained anomalies, as specified by NERR CDMO Operations Manual (Version 4.0). All anomalous data (explained and unexplained) are documented and explained in the appropriate sections of the metadata. The explained anomalous data are then removed from the data file and replaced by periods. The unexplained anomalous

data are investigated for validity based on weather data, field observations, instrument diagnostics, and Eco-Watch printouts. If these data are rejected from the file then these are removed and replaced by periods. Lastly, the third and final NERR CDMO QA/QC Excel macro is used to reformat all the columns in the data file to the correct number of significant digits. After this last step, once the file has been completely formatted and edited as specified by NERR CDMO, the file is saved as a Tab delimited (.txt) text file and sent by FTP to the CDMO (where all periods were later removed for data dissemination purposes and left blank). The metadata form is also submitted with the data file to the CDMO, sent also as a text file (text only with line breaks). Jim Dochtermann and Scott Orringer are responsible for this task of entry verification with the analyses of suspect and anomalous data. Michele Dionne supervises, proofs and answers questions with the evaluation of suspect and anomalous data.

The use of the newest (Version 3.0) National Estuarine Research Reserve (NERR) System-Wide Monitoring Program (SWMP) YSI 6-Series Multi-Parameter Water Quality Monitor Standard Operating Procedures began in December 2000 when they became available.

3). Research objectives:

The Webhannet River estuary is located in proximity to heavily used beaches in Wells, Maine. It has a shoreline that is highly developed with residential and commercial structures. The estuary receives water from a 14 sq. mi. watershed that is well forested. We are measuring variations in hydrologic variables in the Webhannet River estuary at the Head of Tide and at the Inlet. Data from Head of Tide will integrate surface and ground water inputs (from both point and non-point sources) from the freshwater watershed into the estuary. Data from the Inlet will integrate surface and ground water inputs from the freshwater watershed and the estuarine watershed. Differences in data between

the Head of Tide and the Inlet will indicate inputs from the estuarine portion of the watershed (on the ebb tide), and inputs from the Gulf of Maine on the flood tide. The instruments will track runoff events via salinity, and will measure pollutant-carrying sediment particles via turbidity. Our working hypothesis is that the freshwater watershed is the primary source of sediment and therefore potential NPS pollutants in the estuary. These two variables will indicate the potential for non-point source pollutants to enter the estuary, and whether they are of upland, estuarine, or Gulf of Maine origin. Other variables measured by the data loggers (DO, temperature, pH, specific conductivity, and water level) will provide important baseline data to track changes in the estuary's physicochemical parameters over the long term. These variables can be affected by changes in human water use, and by natural or human induced changes in inlet and river channel morphology, climate, and organic loadings. The Inlet site is heavily impacted at the Wells Harbor dock and is our long-term monitoring site. The Head of Tide site is relatively unimpacted, located just east of the Route One Bridge, and is our roving site. We also collect data at the Mile Road site, which is our creek site, as well as the Little River Mouth site, which is our comparative system site.

4). Research Methods

The Wells NERR YSI monitoring program began in April 1995 at one site (Head of Tide site-HT) and May 1995 at a second site (Inlet site-IN) in the Webhannet River estuary. Two additional sites were added in 2002, Mile Road (ML) site began in March in the Webhannet River estuary and Little River Mouth (LM) in April in the Little River Estuary. The four data loggers are installed with bottom moorings, as described below. Both data loggers have 1/4 inch black vector mesh placed on the outside (using rubber bands) of the sonde guard to prevent fouling and unwanted animals. All deployment structures (PVC tubes) described below are labeled with the Wells NERR information.

*IMPORTANT CHANGES TO NOTE AT THE INLET SITE (IN) where our telemetry unit is stationed: A new vented level YSI 6600 with its new vented level cable was deployed to collect its first data on 5/4/99 at 12:00. The YSI telemetry unit began collecting its first data on 3/16/98 at 10:30:00.

The Inlet site (IN) deployment methods are different than the other sites (HT,ML,LM), due to the installation of a YSI telemetry unit. A 23 foot, 4 inch diameter high grade PVC tube was installed against a dock piling. Four steel flat bars with bolts were used to attach this 23 foot PVC tube against the dock piling. A 3 by 1.5 inch PVC transducer was glued on the inside bottom of the PVC tube to allow the sonde to sit exactly 1.0 meter (3.28 ft) off the bottom. Several vertical holes, representative of the sonde guard, were cut out the circumference near the bottom of the PVC pipe to allow water flow to the probes. An "L" shaped steel bar with two end-holes is placed through two created slits about a half of foot from the top of the PVC tube. A stainless steel wire (1/16") is attached to the sonde bail using two stainless steel clips; and to one end of the "L" shaped steel bar for sonde deployment and retrieval. A marine lock is attached through the other end of the "L" shaped steel bar to hold the bar, wire, and sonde in place and for security. A PVC threaded cap screws in to the threaded top of the PVC tube, also for security. A hole was created in the PVC cap to allow the sonde to hook up with the telemetry unit using the 50 foot cable. The collection of data parameters at the Inlet (IN) site are slightly different then at the roving sites, due to the telemetry unit installation. Two to four week variable sampling periods were chosen due to limitations created by the life of the dissolved oxygen membrane and probe fouling. Battery power is not needed anymore within the sonde itself (although, battery power is needed during calibrations and downloading) at the time of deployment at this site because of the telemetry unit's solar battery power. Measurements of temperature, specific conductivity, salinity, percent

saturation, dissolved oxygen, depth, pH, and turbidity are recorded at 30 minute intervals throughout the deployment period. Time, date, and battery voltage are no longer programmed to be recorded by the sonde, since these parameters are already programmed with the Eco-Watch Program (see YSI's Eco-Watch Users Guide).

The other sites, Head of Tide (HT), Mile Road (ML), and Little River Mouth (LM) are deployed similarly, except for sonde height off the bottom (see below). These sites use a 5 foot, 4 inch diameter high grade PVC tube. The PVC tube is attached to a 12 foot, heavy steel sign post using a stainless steel bolt at the bottom of the tube, a stainless steel cable wrap at the top, and several thick electrical cable ties in between. The steel sign post was pounded in about 6 feet into the river bottom, such that the bottom of the PVC tube was flat on the river bottom. The PVC tube has one 3 by 1.5 inch PVC transducer glued on the inside bottom of the PVC tube to allow the sonde to sit exactly at a certain height off the bottom (see below). Several vertical holes, representative of the sonde guard, were cut out the circumference near the bottom of the PVC pipe to allow water flow to the probes. An "L" shaped steel bar with two end-holes is placed through two created slits about a half of foot from the top of the PVC tube. A stainless steel wire (1/16") is attached to the sonde bail using two stainless steel clips; and to one end of the "L" shaped steel bar for sonde deployment and retrieval. A marine lock is attached through the other end of the "L" shaped steel bar to hold the bar, wire, and sonde in place and for security. A flotation buoy is tied to the PVC tubes incase the deployment structure ever gets dislodged. The deployment depth for these sites is such that the probe-end of the data logger is secured 0.30 meters (1.0 ft) off the bottom.

Two to four week variable sampling periods were chosen for the data sonde

due to limitations created by the life of the dissolved oxygen membrane, probe fouling, and limited battery power. Measurements of temperature, specific conductivity, salinity, percent saturation, dissolved oxygen, depth, pH, and turbidity are recorded at 30 minute intervals throughout the deployment period.

After the deployment period, the data logger is brought back into the Wells Reserve Laboratory for downloading, cleaning, and calibration. These procedures are carried out to the methods described in the YSI Operating Manual. Calibration standards are needed and used for only specific conductivity (10 mS/cm), pH (buffer solutions of pH 4, 7, and 10), and turbidity (100 NTU). Conductivity and pH standards are purchased from Fisher Scientific. Turbidity standards are purchased from Advanced Polymer Systems, Inc. (Redwood City, CA). The dissolved oxygen membranes are replaced and sit 6-24 hours before each deployment. After approximately 6-24 hours of down time for cleaning, maintenance and recalibration, the YSI Data logger is redeployed for another sampling period. Also, with our extra data sonde, we have been reducing the amount of time of missing data from calibrations and maintenance.

The use of the newest (Version 3.0) National Estuarine Research Reserve (NERR) System-Wide Monitoring Program (SWMP) YSI 6-Series Multi-Parameter Water Quality Monitor Standard Operating Procedures began in December 2000 when they became available.

5). Site location and character

The Wells National Estuarine Research Reserve is located in York County, within the Town of Wells, on the coast of southern Maine and faces the Atlantic Ocean. The Wells NERR is approximately 31 km (20 miles) south of Portland, Maine and 110 km (70 miles) north of Boston, Massachusetts. The Reserve encompasses 1,690 acres along the Gulf of Maine coastline of tidally-flushed wetlands, riparian and transitional upland fields and forests within the Little

River Estuary and the larger Webhannet River Estuary. Both estuaries arise in the sandy glacial outwash plain about eight miles inland. Both rivers empty into Wells Bay, a sandy basin stretching for approximately ten miles along the Atlantic coast. Bordering each river's inlet are double spit barrier beaches attached to the mainland. The backbarrier system in the Webhannet River Estuary is approximately 5 sq. km and is composed of large intertidal marshes (predominantly *S. patens* and *S. alterniflora*), intertidal sand and mud flats, and tidal channels. The watershed for the Webhannet River estuary covers an area of 35 sq. km and has a total of 6 streams, brooks or creeks, which enter the estuary. These tributaries flow across sand and gravel deposits near the headwaters and the impermeable sandy muds of the Presumpscot Formation in the lower reaches. The watershed for the Little River estuary covers an area of 84 sq. km and has a total of 2 tributaries. The backbarrier system in the Little River Estuary is approximately 2.51 sq. km and is composed of large intertidal marshes (predominantly *S. patens* and *S. alterniflora*), intertidal sand and mud flats, and tidal channels. The Webhannet River is connected to the ocean via Wells Inlet, which has a spring tidal prism of 28,200,000 cub. m (Ward 1993). The Little River is connected to the ocean by an unstructured, double spit system and is one of the few tidal inlets along the southern Maine coast that is not stabilized by either natural outcrops or artificial jetties. The force and volume of tidal action affect the salinity level of both rivers. In the Wells region, the annual mean wave height is almost 20 inches. These estuarine systems are dominated by semi-diurnal tides having a range of 8.5 to 9.8 feet. The volume of freshwater influx into both estuaries is moderate to low (on the order of 0.5 cubic meters/second), especially in the summer, because of the rivers' relatively small drainage areas and the presence of deep glacial deposits. The relatively low flows from these two rivers taken in with the 20 inch per year average runoff of the area surrounding the estuaries combine to

form a fresh water flow which is dwarfed by tidal flushing. Twelve-foot tides dwarf the freshwater flow into the Webhannet estuary, which has a drainage area of 14.1 square miles. The Merriland River and Branch Brook meet south of Route 9 to form the Little River which drains an area of 10.75 sq. miles. The Webhannet estuary, fed by both Blacksmith and Depot Brooks, is adjacent to the harbor and greatly developed land. It offers a valuable opportunity for comparison with the relatively pristine Little River estuary. The land use of the Webhannet estuary include a total of 15% for wetland, fresh water, and tidal marsh; a total of 63.7 % for woodland; and a total of 18.6% for developed land compared to a total of 5.7% development in the Little River estuary (WNERR RMA 1996; Holden 1997).

The following information regarding annual weather patterns in the area was supplied by Maine State Climatologist Professor Gregory A. Zielinski extracted from "Monthly Station Normals of Temperature, Precipitation, Heating and Cooling Degree Days 1971-2000", Climatology of the United States No. 81, National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC. and "Daily Normals of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000", Climatology of the United States No. 84: "Average monthly temperatures range from 21.6F in January to 66.7F in July with daily highs averaging just below freezing in January and lows around 11F. Daily highs in July average around 76F and daily lows around 57F. The sea breeze often keeps daily highs lower during the summer than areas inland. Annual average temperature is 44.6F. Annual precipitation is 47.07 inches, including the water equivalent of snowfall, with monthly averages ranging from 3.01 inches in July to 4.77 inches in October. August receives just 3.02 inches on average. Annual snowfall is around 66 inches." According to Zielinski, "cool ocean temperatures keep down the number of afternoon showers and especially thunderstorms resulting in low summer precipitation amounts."

There are three sampling sites in the Webhannet River estuary. These are located at the Head of Tide, Mile Road, and at the Inlet. The tidal range at each of these sites is 2.6-2.9 meters.

The Head of Tide site (43 deg 17' 54.25227" Latitude, 70 deg 35' 13.82728" Longitude) is located 4 miles south of the Wells Reserve, just downstream of the Webhannet Falls (freshwater) and 10 feet east of Route One. Route One is used heavily with traffic all year, especially during the summer tourist months. This site has soft mud, sand, and a rocky substrate, and the low and high tide depth is relatively shallow. The salinity range here is 0-31 ppt, with a mean of 3.6 ppt. These headwaters of the Webhannet are relatively undeveloped. This site is located just 10 feet east of the Route One bridge, and is our roving site.

The Mile Road site is located 3.5 miles south of the Wells Reserve, on Mile Road roughly 300' north of the bridge (N43 deg 18.300' Latitude, W 70 deg 34.583 Longitude). This site has soft mud and a rocky substrate, and the low and high tide depth is relatively shallow. The salinity range here is 3.6-33.4 ppt, with a mean of 27.0 ppt.

The Inlet site is located 1.5 miles south of the Wells Reserve, at the Wells Harbor pier (43 deg 19' 12.44804" Latitude, 70 deg 33' 13.82728" Longitude). The mouth of the Webhannet estuary forms an extensive wetland/salt marsh area which is surrounded by development. Wells Harbor, which was most recently dredged in 1971, has moorings for approximately 200 commercial fishing and recreational boats. The mouth of the river flows between two jetties to the Atlantic Ocean. This channel was dredged in 1974. This site has a predominately sand substrate and is characterized by strong current during incoming and outgoing tides. The maximum depth of the Inlet site is 3 meters. The salinity range here is 7-35 ppt, with a mean of 31 ppt. The Inlet site is heavily impacted at the Wells Harbor dock and is our long-term monitoring site.

The Little River Mouth site is located .4 miles of the Wells Reserve. Due to problems with heavy sediment movement in the inlet of the Little River, we

were forced to relocate the site (see 2002 metadata). We designated a new location for the 2003 sampling season (N 43 deg 20.413 Latitude, W 70 deg 32.441 Longitude). It is located just off the bank of the marsh, in the main channel of the river, upstream from the previous year's sites. The first location attempted in 2002 (N 43 deg 20.176 Latitude, W 70 deg 32.497 Longitude) was located in the main channel of the river, just inland of a spit, beside a bank. The second location attempted in 2002 (N 43 deg 20.083 Latitude, W 70 deg 32.585 Longitude) was located 1/8 mi. southwest of the first site, within an inlet, just inland of a spit. The second site was located in an area of much lower current than the first site and often drains completely during low tides. It was also placed within a pool next to incipient low marsh peat that retains calm water during low tides. Both sites were abandoned in 2002. The tidal range of the Little River estuary is 2.6-3.0 meters (Mariano and FitzGerald, 1988). The Little River sites existed in a shallow and relatively pristine system with a sandy to mud bottom and a salinity range of 0-32 ppt. There are two major freshwater inputs, the Merriland and Branch Brook Rivers, which converge to form the Little River.

6). Data collection period:

The Webhannet River Head of Tide (HT) site data collection was re-deployed (after being pulled in every December from 1995-2001) on March 18, 15:30 and pulled after December 16, 11:00 for the winter months to prevent ice damage. This site gets a large amount of ice coverage from December through late March. The Webhannet River Mile Road (ML) site data collection was re-deployed (following a CICEET project) on March 18, 16:30 and pulled after December 16, 10:30 for the winter months to prevent ice damage. This site gets a large amount of ice coverage from December through late March. The Webhannet River Inlet (IN) site data collection began January 1, 2004 00:00. The IN datalogger is ongoing throughout the year and is considered our long-term monitoring site, as this site remains relatively ice-free. The Little River Mouth (LM) site data

collection began March 25, 14:00 and ended December 30, 13:00 for winter months to prevent ice damage. This site gets a large amount of ice coverage from December through late March.

Deployment and retrieval dates and times, model YSI 6-series sonde used for

2003:

BEGAN	ENDED	SONDE MODEL
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Head of Tide Site

03/18/03, 15:30	04/10/03, 12:00	6600
04/10/03, 12:30	05/06/03, 14:00	6600
05/06/03, 14:30	05/29/03, 13:30	6600
05/29/03, 14:00	07/11/03, 08:30	6600
07/11/03, 09:00	08/05/03, 11:00	6600
08/06/03, 17:00	09/08/03, 10:00	6600
09/09/03, 10:00	10/08/03, 13:00	6600
10/09/03, 13:30	11/12/03, 14:00	6600
11/13/03, 16:00	12/16/03, 11:00	6600

Mile Road Site

03/18/03, 16:30	04/09/03, 10:30	6600
04/10/03, 12:00	04/24/03, 12:00	6600
04/24/03, 12:30	05/21/03, 10:00	6600
05/21/03, 10:30	07/01/03, 08:30	6600
07/01/03, 09:00	08/04/03, 09:30	6600
08/05/03, 11:00	08/26/03, 15:00	6600
08/27/03, 16:30	09/30/03, 09:00	6600
10/02/03, 10:30	11/06/03, 14:30	6600
11/07/03, 15:30	12/02/03, 14:00	6600
12/03/03, 15:00	12/16/03, 11:00	6600

Inlet Site

12/10/02, 16:30	01/06/03, 14:00	6600
01/08/03, 16:00	02/03/03, 13:30	6600
02/04/03, 14:00	03/05/03, 13:00	6600
03/06/03, 14:00	03/31/03, 11:30	6600
04/01/03, 10:00	05/14/03, 10:00	6600
05/15/03, 10:00	06/02/03, 12:00	6600
06/03/03, 14:00	06/30/03, 12:30	6600
07/01/03, 12:30	07/23/03, 07:30	6600
07/24/03, 09:00	08/25/03, 09:00	6600
08/27/03, 12:00	-crash-	6600
10/02/03, 17:30	10/28/03, 11:30	6600
10/29/03, 12:30	12/10/03, 12:00	6600
12/11/03, 14:00	12/31/03, 17:00	6600
12/31/03, 17:30	01/22/04, 11:30	6600

Little River Mouth Site

03/25/03, 14:00	04/17/03, 08:30	6600
04/17/03, 09:30	05/20/03, 11:30	6600
05/20/03, 12:00	06/19/03, 11:00	6600
06/19/03, 11:30	07/07/03, 12:00	6600

07/07/03, 12:30	08/04/03, 11:00	6600
08/05/03, 12:30	09/03/03, 12:00	6600
09/04/03, 13:30	10/15/03, 09:30	6600
10/16/03, 11:00	11/19/03, 13:30	6600
11/20/03, 15:00	12/30/03, 13:00	6600

7). Distribution

According to the Ocean and Coastal Resource Management Data Dissemination Policy
for the NERRS System-wide Monitoring Program,

NOAA/ERD retains the right to analyze, synthesize and publish summaries of the NERRS System-wide Monitoring Program data. The PI retains the right to be fully credited for having collected and processed the data. Following academic courtesy standards, the PI and NERR site where the data were collected will be contacted and fully acknowledged in any subsequent publications in which any part of the data are used. Manuscripts resulting from the NOAA/OCRM supported research that are produced for publication in open literature, including refereed scientific journals. Will acknowledge that the research was conducted under an award from the Estuarine Reserves Division, Office of Ocean and Coastal Resource Management, National Ocean Service, National Oceanic and Atmospheric Administration. The data set enclosed within this package/ transmission is only as good as the quality assurance and quality control procedures outlined by the enclosed metadata reporting statement. The user bears all responsibility for its subsequent use/misuse in any further analyses or comparisons. The Federal government does not assume liability to the Recipient of third persons, nor will the Federal government reimburse or indemnify the Recipient for its liability due to any losses resulting in any way from the use of this data.

NERR water quality data and metadata can be obtained from the Research Coordinator at the individual NERR site (please see section 1. Principal investigators and contact persons), from the Data Manager at the Centralized Data Management Office (please see personnel directory under general information link on CDMO homepage) and online at the CDMO homepage <http://cdmo.baruch.sc.edu>. Data are available in text tab-delimited format, Microsoft Excel spreadsheet format and comma-delimited format.

8). Associated researchers and projects

WELLS NATIONAL ESTUARINE RESEARCH RESERVE RESEARCH AT THE RESERVE for 2002

(Please visit our website: www.wellsreserve.org/research.htm for further information on the Wells NERR research program):

The Research Program at the Wells NERR conducts and supports research, monitoring, workshops, and research/resource management planning of relevance at local, regional and national levels. The overall aim of our work is to produce science-based information needed to sustain or restore Gulf of Maine coastal habitats and resources, especially those found in salt marsh estuaries and watersheds. During 2000-2001 twenty-three different studies (involving 79 scientists, students, and staff from the Reserve, 26 academic institutions and 19 resource management groups) focused on several related themes: 1) the quality of water resources in salt marsh estuaries and watersheds 2) land conservation strategies to protect coastal watersheds 3) factors controlling salt marsh accretion, erosion and plant community vigor 4) the value of salt marsh as habitat for fish, shellfish and birds, and 5) restoration of salt marsh habitat degraded through human actions.

Estuarine Water Resource Quality

Water quality is monitored continuously at several stations with automated instruments as part of a NERRS systemwide monitoring program, as well as bimonthly at 15-20 stations through our WET volunteer monitoring program. The WET program also monitors two important biological parameters: fecal coliform bacterial contamination (an indicator of human health risk) and phytoplankton productivity (an indicator of estuarine health). These data have 1) allowed us to identify several bacterial "hot spots" that we will be working to eliminate, 2) are used to identify and open areas safe for shellfishing, and 3) have uncovered a relation between tides and low dissolved oxygen (a stressful condition for marine life) that needs further study. Our water quality work has contributed to the designation of several Priority Watersheds in coastal Southern Maine by the Maine Department of Environmental Protection.

Coastal Conservation Strategies

The Coastal Mosaic Project is a new program developed in response to requests for support from the conservation community to increase the quantity, quality and ecological integrity of conserved lands in our region. Research staff organize and facilitate meetings, workshops, and communications for 18 partner conservation groups. A key element of the Project is the Conservation Resource Center, a Reserve staffed GIS facility with a growing database able to provide maps of property, natural features and other data needed to develop effective conservation goals and strategies. The Project is nearing completion of conservation lands maps for 13 Southern Maine coastal towns, and is undertaking an initiative to develop coastal watershed conservation strategies for 12 coastal watersheds within these towns. The Reserve has a particular interest in educating communities about the ecologic and economic benefits of land conservation, especially along estuarine and riverine shorelines.

Salt Marsh Habitats and Communities

Factors that control the dynamics and vigor of salt marsh plant communities and marsh peat formation consequently determine the ability of a salt marsh to persist in the face of sea level rise. Through a combination of experimental manipulations and long term monitoring, a number of multi-year studies are currently producing data to answer questions concerning the sustainability of salt marsh habitats in this region. These studies are looking at nutrient-plant relations, plant community responses to physical and hydrologic disturbance, and the relative contribution of short-term natural events (e.g. storms) and human activities (dredging, tidal restriction) on patterns of sediment accretion and erosion. The Reserve's marshes and beaches are already among the best studied sites in the U.S. with regard to long term accretion and erosion (over thousands of years).

HABITAT VALUE FOR FISH, SHELLFISH AND BIRDS

The Reserve combines long-term monitoring with periodic surveys and short-term experiments to identify species and measure trends and changes in populations of fish, crustaceans, clams and birds. We have 10 years of data on upland and shore birds with which to assess the status of resident and migratory avian populations, and 8 years of wading bird data that we use as a gross level indicator of salt marsh health, which appears to be stable. Our periodic larval, juvenile and adult fish surveys have produced the best available data for fish utilization of salt marsh estuaries in the Gulf of Maine. In the coming year we plan to develop a long-term monitoring program for finfish that will be coordinated with other sites within the Gulf of Maine and along the east coast. Since 1994 we have been conducting surveys and field experiments to look at the survival and growth of hatchery seed, juvenile and adult softshell clam with regard to habitat characteristics and predation by the invasive green crab.

Salt Marsh Degradation and Restoration

Salt marsh ecosystems in the Gulf of Maine have sustained themselves in the face of sea-level rise and other natural disturbances for nearly five thousand years. Since colonial times large areas of salt marsh (up to half of the total area) have been lost through diking, draining and filling. Today, the remaining marshland is fairly well protected from outright destruction, but during the past 100 years, and especially since the 1950's, salt marshes have been divided into fragments by roads, causeways, culverts and tide gates. Most of these fragments have severely restricted tidal flow, leading to chronic habitat degradation and greatly reduced access for fish and other marine species. Since 1991, the Wells Reserve has been studying the impact of these restrictions on salt marsh functions and values, and the response of salt marshes to tidal restoration. We have been working to promote an awareness of the damage being done and the benefits of salt marsh restoration throughout the Gulf of Maine.

Research Program Update:

In addition to the Reserve-sponsored projects outlined above, numerous visiting investigators will be involved in on-site research. Topics include: the effects of land use, sea level, and climate on estuarine productivity; the relationship between soil nutrients and plant community patterns; the influence of soil salinity on plant community interactions; the effect of tidal restriction on marsh peat accretion; the comparative ecology of fringe marshes and back barrier marshes; habitat use by upland birds, and the ecology of lyme disease.

- The Wells NERR Research Dept. is working on the following projects: "Ecological processes, energy pathways, and the impact of human activities on Maine marsh-estuarine secondary production: a salt marsh panne model". We used stable isotopic tracers (^{15}N additions and naturally abundant ^{13}C) coupled with secondary production measurements (nekton, invertebrates) to track energy flow on the high marsh surface in southern Maine salt marsh systems. The project is still under way.

"Ecological Functions of Fringing Salt Marshes Susceptible to Oil Spills in Casco Bay, Maine". We examined the ecological function of 9 different fringing marsh systems in Casco Bay that ranged from undisturbed to disturbed. Physical parameters measured included sedimentation rates, total suspended solids, and tidal range. Biological parameters included primary production, macroinvertebrate community composition and secondary production (4cm sediment cores), and resident and transient nekton community composition (fyke net). The project is still under way.

"BENTHIC HABITAT CORRELATES OF JUVENILE FISH DISTRIBUTION IN THE BIGELOW BIGHT AND ADJACENT ESTUARIES: LINKAGES BETWEEN FISH, HABITATS, SUBSTRATE AND HUMAN ACTIVITY". This project was a collaboration between the Wells N.E.R.R. and several members of the local fishing community. Through the use of beam trawls, gill nets, fish traps, van veen ponar, and a sediment profile imager (SPI camera), we are attempting to correlate benthic habitat type to juvenil groundfish an dinvertebrate assemblages in estuarine, nearshore, and offshore habitat. Stations were also established near dredge spoil dump sites as well as sweage outflow to determine the impacts of human activity on the coast to benthic habitat. The project is still under way.

- The Wells NERR Research Dept. also completed the work on the following project:
In partnership with the York Rivers Association and the Town of York, the Wells Reserve conducted a survey of the York River watershed. In this survey, volunteers looked for sources of pollution within a 250-foot buffer of the river and its tributaries (erosion, trash and debris and runoff from roads and lawns could have a negative impact on water quality). Most pollutants entering water

bodies come from such undefined sources. Therefore, this type of survey is the best way to begin to address the problems of pollution in a water body. The idea of the project was to work with the community and landowners to help them understand the problems that come from these types of pollution and learn activities they might be able to do on their own land that would help prevent this pollution from entering the water. The results of the survey will become part of a Watershed Management Plan to improve and restore the water quality of the York River.

•The Wells NERR Research Dept. is involved with the following CICEET* Projects-

I. Project Title: Estuarine Responses to Dredging: Analysis of Sedimentary and Morphological Change in Back Barrier Marsh to Aid Local Management and Develop a Regional Management Tool Principal Investigator (s): Michele Dionne, Wells NERR, ME; Duncan Fitzgerald, Boston University; Joe Kelley, University of Maine; David Burdick and Larry Ward, University of New Hampshire

Management Issue: Coastal management tool for assessing the impacts of dredging in estuaries. Project Summary: An adequate supply of sediment is essential for maintaining salt marshes. Human activities, such as channel dredging and tidal restriction due to road construction, can alter water flows in estuaries and result in dramatic changes in salt marsh sediment supply, affecting the speed of salt marsh erosion. The objective of this project is to determine the impact of dredging and tidal restriction on salt marshes in the Wells NERR. A digital coastal management guide will be created on CD ROM, providing coastal managers with useful conceptual models for predicting the impacts of dredging and other activities that affect water flow and sediment deposition in salt marshes.

II. Project Title: Microbial Source Tracking in Two Southern Maine Watersheds. A two year project written by Maine Sea Grant associate Kristen Whiting-Grant, and funded by Cooperative Institute for Coastal and Estuarine Environmental

Technology (CICEET), involving Wells NERR, UNH Jackson Estuarine Lab (JEL), USM Muskie School, AmeriCorps and the Maine Conservation Corps. We are pioneering the use in Maine of genetic analysis as a means of determining the source species associated with bacterial contamination in the Webhannet and Little River Estuary. Volunteers collect water samples from streams and the estuaries, staff test for and isolate E. coli. At JEL, a genetic technique (ribotyping) creates a genetic fingerprint of the bacteria which is compared to known sources. The project is still underway.

*The following information on CICEET taken directly from its website: (<http://www.ciceet.unh.edu>)

Other Onsite Research:

Michele Dionne, Wells NERR, Nancy McReel, Chuck Lubelczyk
Project Title: Effect of herbivory by deer on forest regeneration

June Ficker

Project Title: Monitoring avian productivity and survivorship

Outside Researchers:

•Theresa Theodose, Ph.D., University of Southern Maine
Project Title: Relationships between soil nutrient availability and species composition of a high salt marsh in southern Maine.

•David Burdick, Ph.D. and Roelof Boumans, Ph.D.
University of New Hampshire, University of Maryland
Project Title: Sediment dynamics in salt marshes: functional assessment of accretionary biofilters

•Peter Rand, M.D., Chuck Lubelczyk, Robert Smith, M.D.
Maine Medical Center
Project Title: Ecological determinants of the spread of the tick vector of Lyme disease and other pathogens.

II. Physical Structure Descriptors

9). Variable sequence, range of measurements, units, resolution, and accuracy:

YSI 6600 datalogger

Variable	Range of Measurements	Resolution	
Accuracy			
Date	1-12, 1-31, 00-99 (Mo,Day,Yr)	1 mo, 1 day, 1 yr	NA
Time	0-24, 0-60, 0-60 (Hr,Min,Sec)	1 hr, 1 min, 1 s	NA

Temp	-5 to 45 (c)	0.01 C	+/-
0.15C			
Sp COND	0-100 (mS/cm)	0.01mS/cm	+/-0.5%
Of			
reading + 0.001mS/Cm			
Salinity	0-70 Parts per thousand (ppt)	0.01 ppt	+/- 1%
of			
Reading or 0.1 ppt, (whichever is greater)			
DO	0-200 (% air saturation)	0.1% @air sat	+/-2%
@air			
Saturation			
DO	200-500 (% air saturation	0.1% @ air sat	+/- 6%
@			
Saturation			
DO	0-20 (mg/l)	0.01 mg/l	+/-
0.2mg/l			
DO	20-50 (mg/l)	0.01 mg/l	+/-
0.6mg/l			
Depth (shallow)	0-9.1 (m)	0.001m	+/-
0.018m			
PH	2-14 units	0.01 units	+/-
0.2units			
Turb	0-1000 NTU	0.1 NTU	+/- 5%
of			
Reading or 2 NTU (whichever is greater)			

Data columns are separated by tabs. Each file contains a two line column header at the top of the page which identifies measurements and units for each column.

10). Coded variable indicator and variable code definitions:

Site definitions: HT = Head of Tide of Webhannet River
 ML = Mile Road near mid-point of estuarine portion of

 Webhannet River
 IN = Inlet at Webhannet River Mouth
 LM = Little River Mouth

File definitions: YSI deployment site/file definition/month/year (ex:
 INWQ0703
 = Webhannet Inlet water quality data from July 2003).

11). Data anomalies:

January, 2003 Sampling Period
 Head of Tide: None to report; sonde not deployed until March.
 Mile Road: None to report; sonde not deployed until March.
 Little River Mouth: None to report; sonde not deployed until March.

Inlet:

a) For the month of January there were several negative and/or zero turbidity

values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Several values did go beyond the probe specifications (-3 to -7 NTU) but are probably still due to the possible calibration error. Data were retained.

b) There was one high positive turbidity spike (>1000 NTU) that occurred during the deployment that was not consistent with the overall data record, possibly due to an obstruction in front of the optics of the probe. This suspect datum was not deleted, as we are not absolutely sure that this value is bad (the post calibration checked out normal).

Date	Time	Turb
01/03/2003	01:00	1564

February, 2003 Sampling Period

Head of Tide: None to report; sonde not deployed until March.

Mile Road: None to report; sonde not deployed until March.

Little River Mouth: None to report; sonde not deployed until March.

Inlet: None to report

March, 2003 Sampling Period

Head of Tide:

a) No data on 3/1 0:00 to 3/18 15:00; this was the first logger deployment (3/18 at 15:30) at this site for 2003.

b) For the month of March there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.

c) All depth data from 3/18 15:30 to 3/20 10:30 is suspect due to large piece of ice completely knocking over the sonde and its deployment structure.

Inlet:

a) For the month of March there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Several values did go beyond the probe specifications (-3 to -9 NTU) but are probably still due to the possible calibration error. All data were retained.

b) There was one high positive turbidity spike (>1000 NTU) that occurred during the deployment that was not consistent with the overall data record, possibly due to an obstruction in front of the optics of the probe. This suspect datum

was not deleted, as we are not absolutely sure that this value is bad (the post calibration checked out normal).

Date	Time	Turb
03/29/2003	13:00	1144

Mile Road

- a) No data on 3/1 0:00 to 3/18 16:00; this was the first logger deployment (3/19 at 16:30) at this site for 2003.
- b) For the month of March there was one negative turbidity value. While this may be due to a small calibration error, it is within the -2 NTU specifications of the probe. Data were retained.

DATE	TIME	VALUE
03/25/2003	19:00	-0001

Little River Mouth:

- a) No data on 3/1 0:00 to 3/25 13:30; this was the first logger deployment (3/25 at 14:00) at this site for 2003.

April, 2003 Sampling Period

Head of Tide:

- a) For the month of April there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.
- b) For the month of April there were several shallow negative and/or zero depth data (198 values with a range of -0.01 to -0.11 m; mean of -0.046m). Sonde probes suspected to be underwater as other parameters check out normal. These data were not deleted.

Inlet:

- a) For the month of April there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.

Mile Road:

- a) The following are shallow negative and/or zero depth data (42 values with a range of -0.01 to -0.2 m; mean of -0.09m). Sonde probes suspected to be underwater as other parameters check out normal. These data were not deleted.

DATE	TIME
04/12/2003	13:00-14:00

04/13/2003 14:30-15:30
04/15/2003 03:30-05:00
04/15/2003 15:00-17:30
04/16/2003 03:30-06:00
04/16/2003 16:30-18:30
04/21/2003 09:00-10:30
04/21/2003 21:30
04/22/2003 09:30-11:00
04/23/2003 10:30-12:00
04/24/2003 11:30-12:00

b) For the month of April there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.

Little River Mouth:

a) For the month of April there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.
b) There was a high positive turbidity spike (>1000 NTU) that occurred during the deployment that was not consistent with the overall data record, possibly due to an obstruction in front of the optics of the probe. This suspect datum was not deleted, as we are not absolutely sure that this value is bad (the post calibration checked out normal).

Date	Time	Turb
04/27/2003	13:30	1130

May, 2003 Sampling Period

Head of Tide:

a) For the month of May there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Several values did go beyond the probe specifications (-3 NTU) but are probably still due to the possible calibration error. All data were retained.
b) For the month of May there were several shallow negative and/or zero depth data (162 values with a range of -0.01 to -0.06 m; mean of -0.026m). Sonde probes suspected to be underwater as other parameters check out normal. These data were not deleted.

Inlet:

a) For the month of May there were several negative and/or zero turbidity

values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Several values did go beyond the probe specifications (-3 NTU) but are probably still due to the possible calibration error. All data were retained.

b) For deployment 05/15/2003 10:00 - 06/02/2003 12:00 dissolved oxygen (% and mg/L) data should be considered suspect due to possible drift of sensor. Post calibration readings were 75.8% with no record of heavy fouling or membrane puncture. All data retained but suspect.

Mile Road:

a) The following are shallow negative and/or zero depth data. Sonde probes suspected to be underwater as other parameters check out normal. These data were not deleted.

DATE	TIME	VALUE
05/29/2003	04:00	-0.04
05/29/2003	04:30	-0.07
05/30/2003	04:30	-0.05
05/30/2003	05:00	-0.11
05/30/2003	05:30	-0.08
05/31/2003	05:00	-0.01
05/31/2003	05:30	-0.08
05/31/2003	06:00	-0.09

b) For the month of May there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.

Little River Mouth:

a) The following are shallow negative and/or zero depth data. Sonde probes suspected to be underwater as other parameters check out normal. These data were not deleted.

DATE	TIME	VALUE
05/10/2003	14:00	-0.01
05/10/2003	14:30	-0.02
05/10/2003	15:00	-0.03
05/11/2003	15:30	-0.01
05/12/2003	03:00	-0.01
05/12/2003	03:30	-0.02
05/12/2003	04:00	-0.02
05/13/2003	04:30	-0.01
05/13/2003	05:00	-0.02
05/13/2003	17:30	-0.01

b) For the month of May there were several negative and/or zero turbidity

values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.

c) There was a high positive turbidity spike (>1000 NTU) that occurred during the deployment that was not consistent with the overall data record, possibly due to an obstruction in front of the optics of the probe. This suspect datum was not deleted, as we are not absolutely sure that this value is bad (the post calibration checked out normal).

Date	Time	Turb
05/31/2003	13:30	1037

June, 2003 Sampling Period

Head of Tide:

a) For the month of June there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.

Inlet:

a) For the month of June there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Several values did go beyond the probe specifications (-3 NTU) but are probably still due to the possible calibration error. All data were retained.

Mile Road:

a) The following are shallow negative and/or zero depth data (40 values with a range of -0.01 to -0.11 m; mean of -0.04m). Sonde probes suspected to be underwater as other parameters check out normal. These data were not deleted.

DATE	TIME
06/01/2003	06:00-06:30
06/02/2003	06:30-07:30
06/03/2003	07:30-08:00
06/05/2003	09:00-09:30
06/06/2003	09:30-10:00
06/07/2003	11:00
06/08/2003	11:30
06/09/2003	12:30
06/10/2003	01:00
06/10/2003	13:00-14:00
06/11/2003	14:00-15:00
06/12/2003	02:30-04:30
06/12/2003	15:30-16:00

06/14/2003 05:30-06:00

06/14/2003 17:00-17:30

06/15/2003 06:30-07:00

06/18/2003 10:00

06/19/2003 09:00-10:00

06/20/2003 10:30-11:00

b) For the month of June there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.

c) A green crab of somewhat significant size was found inside of sonde guard, by sensors, during next month's retrieval on 07/01.

d) The following drop in dissolved oxygen data is suspect for unknown reasons as we are not sure what caused the low DO readings. Therefore data is retained but suspect.

06/04/2003 03:00 - 08:00

Little River Mouth:

a) For the month of June there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.

July, 2003 Sampling Period

Head of Tide:

a) For the month of July there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.

b) For the month of July there were several shallow negative and/or zero depth data (188 values with a range of -0.01 to -0.08 m; mean of -0.028m). Sonde probes suspected to be underwater as other parameters check out normal. These data were not deleted.

Inlet:

a) For the month of July there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Several values did go beyond the probe specifications (-3 NTU) but are probably still due to the possible calibration error. All data were retained.

Mile Road:

a) The following are shallow negative and/or zero depth data (55 values with a range of -0.01 to -0.11 m; mean of -0.038m). Sonde probes suspected to be underwater as other parameters check out normal. These data were not deleted.

DATE	TIME
07/03/2003	07:30-08:30
07/04/2003	08:30-09:30
07/05/2003	09:00-10:00
07/05/2003	22:00
07/06/2003	10:00-11:00
07/07/2003	11:00-11:30
07/08/2003	12:00
07/09/2003	00:30
07/09/2003	01:00
07/09/2003	13:00
07/09/2003	13:30
07/11/2003	02:30-04:00
07/12/2003	04:00-05:00
07/12/2003	16:00-16:30
07/13/2003	05:00-06:00
07/16/2003	07:30-08:30
07/16/2003	19:30-20:00
07/17/2003	08:00-09:00
07/18/2003	09:00-09:30
07/19/2003	09:30-10:00
07/27/2003	03:30-04:30
07/28/2003	04:00-05:30
07/29/2003	05:00-06:30

b) For the month of July there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the

-2 NTU specifications of the probe. Data were retained.

c) There was an increasing and decreasing range of high positive turbidity spikes (>1000 NTU) that occurred during the deployment that were not consistent with the overall data record, possibly due to an obstruction in front of the optics of the probe. These suspect data were not deleted, as we are not absolutely sure that these values are bad (the post calibration checked out normal).

Date	Time	Turb
07/25/2003	00:00	2048
07/25/2003	14:30	1636
07/25/2003	15:00	1419
07/27/2003	01:00	1960
07/27/2003	14:00	1724
07/27/2003	21:30	1515
07/28/2003	00:00	1255

07/28/2003	01:00	1162
07/28/2003	02:30	1632
07/28/2003	14:30	1722
07/29/2003	14:30	1355
07/29/2003	16:30	1371
07/30/2003	04:30	1098
07/30/2003	16:00	1410
07/31/2003	04:30	1565

d) A green crab of somewhat significant size was found inside of sonde guard, by sensors, during the retrieval on 07/01.

Little River Mouth:

a) For the month of July there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.

b) There was an increasing and decreasing range of high positive turbidity spikes (>1000 NTU) that occurred during the deployment that were not consistent with the overall data record, possibly due to an obstruction in front of the optics of the probe. These suspect data were not deleted, as we are not absolutely sure that these values are bad (the post calibration checked out normal).

Date	Time	Turb
07/01/2003	22:30	1017
07/07/2003	06:30	1636
07/18/2003	13:30	1078
07/19/2003	02:00	1422
07/21/2003	17:00	1898
07/24/2003	19:30	1825

c) A green crab of somewhat significant size was found inside of sonde guard, by sensors, during next month's retrieval on 08/04.

August, 2003 Sampling Period

Head of Tide:

a) For the month of August there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.

b) For the month of August there were several shallow negative and/or zero depth data (142 values with a range of -0.01 to -0.06 m; mean of -0.029 m). Sonde probes suspected to be underwater as other parameters check out normal. These data were not deleted.

Inlet:

- a) Data is missing from 8/27/03 12:00 to 8/31/03 23:30 due to sonde failure (See Section 14).
- b) For the month of August there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Several values did go beyond the probe specifications (-3 and -4 NTU) but are probably still due to the possible calibration error. All data were retained.

Mile Road:

- a) The following is a shallow negative depth datum. Sonde probes suspected to be underwater as other parameters check out normal. This datum was not deleted.

DATE	TIME	VALUE
08/16/2003	08:30	-0.05

- b) For the month of August there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.
- c) There was an increasing and decreasing range of high positive turbidity spikes (>1000 NTU) that occurred during the deployment that were not consistent with the overall data record, possibly due to an obstruction in front of the optics of the probe. These suspect data were not deleted, as we are not absolutely sure that these values are bad (the post calibration checked out normal).

Date	Time	Turb
08/01/2003	19:00	1995
08/02/2003	02:30	1626
08/02/2003	07:00	1980
08/02/2003	09:30	1896
08/02/2003	11:00	1439
08/02/2003	14:30	1355
08/02/2003	18:30	2006
08/02/2003	22:00	2014
08/03/2003	03:00	1156
08/03/2003	08:00	1966
08/03/2003	15:30	1366
08/03/2003	19:00	1918
08/03/2003	20:30	2019
08/04/2003	05:00	1149
08/04/2003	07:00	1997
08/04/2003	09:30	2016

c) A green crab of somewhat significant size was found inside of sonde guard, by sensors, during the retrieval on 08/04. The turbidity wiper was noticed to have not been parking properly.

Little River Mouth:

- a) For the month of August there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.
- b) A green crab of somewhat significant size was found inside of sonde guard, by sensors, during the retrieval on 08/04.

September, 2003 Sampling Period

Head of Tide:

- a) For the month of September there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.
- b) There was a high positive turbidity spike (>1000 NTU) that occurred during the deployment that was not consistent with the overall data record, possibly due to an obstruction in front of the optics of the probe. This suspect datum was not deleted, as we are not absolutely sure that this value is bad (the post calibration checked out normal).

DATE	TIME	TURB
09/02/2003	03:30	1685

- c) For the month of September there were several shallow negative and/or zero depth data (565 values with a range of -0.01 to -0.23 m; mean of -0.066 m). Sonde probes suspected to be underwater as other parameters check out normal. These data were not deleted.

Inlet:

Data is missing for entire month due to sonde failure (see Section 14).

Mile Road:

- a) For the month of September there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.

Little River Mouth:

a) For the month of September there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.

October, 2003 Sampling Period

Head of Tide:

a) For the month of October there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.

b) For the month of October there were several shallow negative and/or zero depth data (711 values with a range of -0.01 to -0.27 m; mean of -0.105 m). Sonde probes suspected to be underwater as other parameters check out normal. These data were not deleted.

Inlet:

a) Data is missing from 10/01/03 0:00 to 10/02/03 17:00 due to sonde failure (See Section 14).

b) For the month of October there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.

Mile Road:

a) The following are shallow negative and/or zero depth data (27 values with a range of -0.01 to -0.15 m; mean of -0.058 m). Sonde probes suspected to be underwater as other parameters check out normal. These data were not deleted:

DATE	TIME	VALUE
10/05/2003	01:00	-0.04
10/05/2003	01:30	-0.05
10/05/2003	02:00	-0.05
10/12/2003	19:00	-0.02
10/13/2003	19:30	-0.01
10/15/2003	21:00	-0.02
10/22/2003	01:30	-0.01
10/22/2003	02:00	-0.09
10/22/2003	02:30	-0.04
10/22/2003	14:30	-0.01
10/23/2003	02:30	-0.04
10/23/2003	03:00	-0.12
10/23/2003	15:00	-0.10
10/23/2003	15:30	-0.15
10/23/2003	16:00	-0.12

10/24/2003 03:30 -0.05
 10/24/2003 04:00 -0.06
 10/24/2003 04:30 -0.06
 10/27/2003 07:00 -0.01
 10/27/2003 18:30 -0.04
 10/27/2003 19:00 -0.10
 10/27/2003 19:30 -0.13
 10/27/2003 20:00 -0.14
 10/28/2003 07:30 -0.02
 10/28/2003 08:00 -0.01
 10/29/2003 21:00 -0.03
 10/29/2003 21:30 -0.05

Little River Mouth:

a) The following are shallow negative depth data (40 values with a range of -0.01 to -0.19 m; mean of -0.089m). Sonde probes suspected to be

underwater as other parameters check out normal. These data were not deleted:

DATE	TIME	VALUE
10/19/2003	06:00	-0001
10/19/2003	06:30	-0001
10/19/2003	18:00	-0001
10/20/2003	07:30	-0001

b) The following are episodes of low dissolved oxygen and percent saturation during several tidal fluctuations that were not consistent with the overall data record. There may have been a problem with drift and the DO probe. The dissolved oxygen post-cal (81.7 %) is questionable. These suspect data were

not deleted, as we are not absolutely sure that these values are bad.

Date	Time	DO%	Domg/L
10/13/2003	13:00	-000.2	00.0
10/14/2003	01:30	-000.1	00.0
10/14/2003	02:00	-001.0	-00.1

c) All data for entire month may be suspect due to accumulation of seaweed particles around silts in sonde deployment tube (see Section 14-D).

November, 2003 Sampling Period

Head of Tide:

a) For the month of November there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the

-2 NTU specifications of the probe. Data were retained.

b) For the month of November there were several shallow negative and/or zero

depth data (34 values with a range of -0.01 to -0.08 m; mean of -0.054 m). Sonde

probes suspected to be underwater as other parameters check out normal. These

data were not deleted.

Inlet:

a) For the month of November there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.

Mile Road:

a) The following are shallow negative depth data (40 values with a range of -0.01 to -0.19 m; mean of -0.089m). Sonde probes suspected to be underwater as other parameters check out normal. These data were not deleted:

DATE	TIME
11/12/2003	20:00-21:30
11/13/2003	19:30-21:30
11/14/2003	08:00-08:30
11/14/2003	20:00-22:00
11/20/2003	01:30
11/20/2003	14:00
11/21/2003	02:30
11/21/2003	15:00
11/21/2003	15:30
11/24/2003	18:30
11/24/2003	19:00
11/25/2003	06:00-06:30
11/28/2003	21:00-22:30
11/29/2003	09:30-10:00
11/29/2003	21:00-23:30
11/30/2003	00:00
11/30/2003	10:30-11:00
11/30/2003	22:30-23:30

b) For the month of November there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.

Little River Mouth:

a) For the month of November there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.

b) All data for entire month may be suspect due to accumulation of seaweed particles around silts in sonde deployment tube (see Section 14-D).

December, 2003 Sampling Period

Head of Tide:

a) For the month of December there were several negative and/or zero turbidity

values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.
b) No data from 12/16 11:30 to 12/31 23:30. This datalogger was pulled for the year to prevent ice damage.

Inlet:

For the following dates and times, the sonde malfunctioned, therefore data is missing:

12/06 1800
12/07 0300, 0400 - 0600, 1500 - 1900
12/08 0430 - 0700, 1900 - 1930
12/09 0600 - 0730, 1830, 1930 - 2030
12/10 0330 - 0900

Mile Road:

a) The following are shallow negative and/or zero depth data (27 values with a range of -0.01 to -0.19 m; mean of -0.07m). Sonde probes suspected to be underwater as other parameters check out normal. These data were not deleted:

DATE	TIME
12/01/2003	00:00-00:30
12/01/2003	11:00-12:30
12/02/2003	00:00-01:00
12/02/2003	13:00-13:30
12/10/2003	18:30-19:30
12/12/2003	07:00-07:30
12/12/2003	19:30-21:00
12/15/2003	21:00-23:30
12/16/2003	00:00

b) For the month of December there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.
c) No data from 12/16 11:00 to 12/31 23:30. This datalogger was pulled for the year (winter months) to prevent ice damage.

Little River Mouth:

a) For the month of December there were several negative and/or zero turbidity values. While these may be due to a small calibration error, they are within the -2 NTU specifications of the probe. Data were retained.
b) No data from 12/30 13:30 to 12/31 23:30. This datalogger was pulled for the year (winter months) to prevent ice damage.
c) All data from 12/01/03 0:00 to 12/30/03 13:00 may be suspect due to accumulation of seaweed particles around silts in sonde deployment tube (see

Section 14-D).

12). Missing data:

Missing data are denoted by a period in the data set. Periods were later removed

for data dissemination purposes and left blank. Data are missing due to equipment failure where no probes were deployed, maintenance/calibration of

equipment, elimination of obvious outliers or elimination of data due to calibration problems (both pre and post). For more details on deleted data, see

the Data Anomalies Section. To find out more details about missing data, contact the Research Coordinator at the site submitting the data.

13). Post deployment information

End of Deployment Post-calibration Readings in Standard Solutions:

Site	Date	Sp.Cond(mS)	DO (%)	Dochg(mv)	Depth(m)	pH	
		Turbidity(NTU)					
		(Std: 10.0)	(Std: 100)	(Std: Variable)		(Std:7)	(Std: 0.0)

HT	04/10/03	9.84	96.1	42.0	0.119	6.96	0.3
HT	05/06/03	9.94	98.1	46.1	-0.133	7.02	0.1
HT	05/29/03	10.39	102.6	54.3	-0.202	7.02	-0.3
HT	07/11/03	9.809	95.9	n/a	0.25	7.05	-0.1
HT	08/05/03	9.855	99.6	43.1	-0.002	7.03	-0.3
HT	09/08/03	10.13	102.3	44.1	0.092	7.03	-0.3
HT	10/08/03	9.92	95.9	46.1	-0.111	6.99	0.5
HT	11/12/03	9.79	101.1	48.2	-0.149	7.02	0.3
HT	12/16/03	9.89	103.5	n/a	0.169	7.02	-0.1

ML	04/09/03	9.98	102.0	46.1	0.141	7.02	0.0
ML	04/24/03	10.13	101.6	n/a	-0.209	7.10	0.5
ML	05/21/03	10.11	86.3	42.0	0.247	7.07	0.0
ML	07/01/03	9.61	72.2	43.1	-0.031	7.02	0.0
ML	08/04/03	9.76	94.7	44.1	-0.019	7.09	3.6
ML	08/26/03	10.40	68.0	40.0	-0.044	7.09	0.8
ML	09/30/03	9.95	94.6	n/a	0.136	7.12	-0.4
ML	11/06/03	9.92	90.4	n/a	0.032	7.00	2.5
ML	12/02/03	9.88	103.2	38.0	-0.008	7.00	-0.2
ML	12/16/03	9.98	102.2	44.1	-0.66	7.01	-0.4

IN	01/06/03	10.03	96.2	53.3	0.00	6.98	0.2
IN	02/03/03	10.02	86.9	42.0	0.00	7.08	0.1
IN	03/05/03	9.97	99.3	46.1	0.00	7.00	0.3
IN	03/31/03	10.05	99.2	47.1	0.002	7.00	1.1
IN	05/14/03	9.89	95.0	46.1	0.00	7.07	-0.5
IN	06/02/03	10.28	75.8	44.1	0.00	7.02	0.5
IN	06/30/03	10.05	94.6	46.1	0.00	6.97	-0.6

IN	07/23/03	9.88	80.2	43.1	0.00	7.03	0.2
IN	08/26/03	10.60	93.2	n/a	0.00	7.21	-0.2
IN	10/28/03	9.90	96.2	n/a	0.044	7.10	0.1
IN	12/10/03	9.81	99.7	44.1	0.215	7.05	0.1
IN	12/31/03	10.03	98.3	46.1	0.135	7.01	0.7
IN	01/22/04	10.54	83.6	n/a	-0.126	6.93	-4.0

LM	04/17/03	10.00	103.2	41.0	0.146	7.07	0.2
LM	05/20/03	9.96	99.5	45.1	-0.126	7.20	0.1
LM	06/19/03	10.48	95.8	46.1	-0.162	7.08	-0.5
LM	07/07/03	9.89	97.1	n/a	0.107	7.04	0.6
LM	08/04/03	9.93	79.8	n/a	0.006	7.15	-0.1
LM	09/03/03	10.66	63.7	49.2	0.073	7.13	0.2
LM	10/15/03	9.854	81.7	50.2	-0.256	7.11	1.5
LM	11/19/03	9.92	104.5	45.1	-0.009	7.16	0.4
LM	12/30/03	9.95	97.9	48.2	0.175	7.10	0.2

14). Other Remarks/Notes:

On 07/01/2021 this dataset was updated to include embedded QAQC flags for anomalous/suspect data. System-wide monitoring data beginning in 2007 were processed to allow for QAQC flags and codes to be embedded in the data files rather than detailed in the metadata alone (as in the anomalous/suspect, deleted, and missing data sections above). Prior to 2006, rejected data were deleted from the dataset so they are unavailable to be used at all, but suspect data were only noted in the metadata document. Suspect data flags <1> were embedded retroactively in order to allow suspect data to be easily identified and filtered from the dataset if desired for analysis and reporting purposes. No other flags or codes were embedded in the dataset and users should still refer to the detailed explanations above for more information.

A) IMPORTANT CHANGES TO NOTE AT THE INLET SITE (IN): where our telemetry unit is stationed: A new vented level YSI 6600 with its new vented level cable was deployed to collect its first data on 5/4/99 at 12:00. The YSI telemetry unit began collecting its first data on 3/16/98 at 10:30:00 (see Section 4-Research Methods). The telemetry unit failed some time between 02/03/02 and 02/26/02. Water contaminated the vented level cable and shorted out the attached vented level 6600 sonde. Both the cable and sonde were sent back for repair and

returned in September of 2002. The cable was then re-attached and the sonde deployed but there has been no communication to the field boxes since. The

vented level YSI was used all of 2003 until sometime between the deployment on

08/27/03 12:00 to the retrieval on 10/01/03 17:00 the sonde was discovered to

be damaged due to water contamination within the port connection to the telemetry cable. It was sent back for repair and all data within that time range was lost.

B) IMPORTANT CHANGES TO NOTE AT THE INLET SITE (IN): For all data collected from

10/02 17:30 through 12/31 12:30, a non-vented YSI 6600 was used.

C) IMPORTANT CHANGES TO NOTE AT THE LITTLE RIVER MOUTH SITE (LM): The deployment

for this site was the first ever for the SWMP program at the Wells NERR. We

deployed the sonde in the mouth of the Little River on 4/01/02 and upon retrieval on 4/23/02 we noticed a serious accumulation of sediment that buried

the probes of the sonde. We located another site within an inlet adjacent to the

main channel and deployed the sonde again on 5/06/02. We had several successful

deployment periods at this new site but found the sonde buried again on 7/09/02.

We needed time to re-evaluate the situation and did not deploy again at the

Little River Mouth for the rest of the year.

D) Upon retrieval of data sonde at the Little River Mouth site on 10/15/03,

11/19/03 and 12/30/03; it was noticed that there was a significant accumulation

of loose seaweed (algae) pieces surrounding the slits in the deployment tube

where water accesses the sensors. The metal stake that the deployment tube is

attached to, and the PVC tube itself, have caused scouring beneath the tube due

to occasional strong current. This has led to the creation of a small ditch

where seaweed can accumulate. The increased amount of seaweed present in the

water may be due to several large storms including Hurricane Isabelle. The

amount of seaweed present increased more by each retrieval date regardless of

attempts to clear it away (Sept/Oct was not too bad, Dec was severe).

E) The use of the newest (Version 3.0) National Estuarine Research Reserve (NERR) System-Wide Monitoring Program (SWMP) YSI 6-Series Multi-Parameter Water Quality Monitor Standard Operating Procedures began in December '00 when they became available.

F) With our extra data sonde, we have been reducing the amount of time of missing data from calibrations and maintenance for all sites. Some months have no missing data from the use of this extra sonde.