Jacques Cousteau (JAC) NERR Water Quality Metadata
(formerly known as Mullica River (MUL) NERR)
August through December 1996
Latest Update: April 30, 2002

# I. DATA SET AND RESEARCH DESCRIPTION

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## 2. Entry verification:

The data are uploaded to the PC from the YSI data loggers in the PC6000 format and graphs are produced and examined using the PC6000 software. The graphs are evaluated for suspect data, as may result from probe failure or the data logger being out of water. Files are then uploaded in a comma delimited format from the YSI to a PC with a csv extension. Both of these data file formats are saved and archived on site. The csv files are than opened into EXCEL and edited by removing headers, footers, spaces, and all data at the beginning and end of each data record that were recorded when the instruments were out of the water. These data are identified by field notes that document the times the data loggers were in and out of the water, and by unusual depth and salinity data (depths and salinity values are near zero). The appropriate files are merged to form complete monthly data sets and are saved as separate EXCEL files. Data that are missing because the instruments were not deployed ( as during maintenance periods) are denoted by periods (.). These times are noted in section 11(Missing Data) of this document. Any erroneous data that are identified as being caused by probe failures, as determined upon examination of the data plots, are deleted and replaced with periods and noted in section 12 (Missing Data). Sensor readings that greatly deviate from known values of standards after deployments are not necessarily believed to be the result of probe failure. These erroneous readings may be the result of biofouling. If biofouling is believed to be the reason for these data, the data are retained and noted in section 10 (Data Anomalies) of this document. Symptoms of probe failure are extreme noise in the record, unrealistically high or negative data, noisy or negative readings in standard solutions. Examples of many such failures are given in the CDMO Manual (Version 3). Finally, the CDMO Excel 5.0 macros (update version 11/96) are then run on these newly created monthly files to identify missing times and /or dates, to format column width and decimal places of each column, and to identify outliers and other erroneous data. When all the macros have been run and the data is checked and formatted properly, the monthly data files are then uploaded to the CDMO server. Roger Hoden is responsible for data management and uploading the files.

## 3. Research Objectives/Study Purposes:

The water quality of the Mullica River and Great Bay has traditionally been very clean and free of excessive nutrient loading from anthropogenic sources.

This is due to the fact that there is very little development or industry within the drainage basin of the Mullica River and its tributaries. Great Bay had a large source of nutrient loading coming from a menhaden fish processing factory which was in operation from the early 1930's to the early 1960's which affected the lower portion of the bay. The river is relatively deep, five to nine meters deep in the section that is monitored, which is much deeper then Great Bay which averages about two meters deep. The river also has a dark color due to tannins and humic compounds which are a natural product coming from the Pine Barrens and are present in large amounts within the river. It is believed that nutrients which enter the river upstream do not get utilized within the river because of the lack of light penetration. The great depth of the river and the dark color from the tannins flowing down the river from the Pine Barrens prevent the utilization of these nutrients in the river by planktonic organisms. Where the river empties into the bay, light penetration reaches the bottom of the bay and allows the utilization of the nutrients by phytoplankton making this region more productive (Durand 1979).

There are also water circulation questions which can be addressed by the use of these data loggers. Because of the close proximity of the lower station to Little Egg Inlet, the effects of an influx of ocean water can have dramatic effects on both the water quality and on the biological aspect of the region. Upwelling along the coast is a common occurrence during the summer months. The influx of this water into the bay can and does affect larval fish transport into and out of the bay. The colder ocean waters can have dramatic effects on the growth rates of many different species living in the area.

4. Research Methods (YSI Data Loggers):

The data loggers are programmed to record water quality parameters every 30 minutes. Presently, four instruments are located in the Jacques Cousteau Reserve. These monitoring sites extend from the fresh water/salt water interface at Lower Bank, approximately 25 kilometers up the Mullica River from the point where it joins Great Bay to the mouth of Great Bay, a distance of eight kilometers. Thus the data loggers cover a total of 33 kilometers in this estuarine system with two data loggers in the river, one at the interface and the other about midway down the river to the mouth. The two data loggers in the bay are located on opposite sides of the bay near the mouth of the system.

At sites Bouy126, Bouy139 in the Intracoastal Waterway, and at Chestnut Neck, YSI data loggers were deployed in the following manner. The data loggers were inserted into a 30 inch long piece of 4 inch PVC pipe. There are one inch slots cut every one inch around the diameter of the PVC pipe at the sensor end and extend for eight inches up the pipe. The PVC pipe is attached to a cinder block in the horizontal position by lashing the data logger to the cinder block with 1/4 inch plastic coated stainless steel cable. The cinder block was then attached to an Intracoastal Waterway marker, in the case of Bouy126 and Bouy139, with 1/4 inch plastic coated stainless steel cable and from a dock for Chestnut Neck. The cinder blocks were than lowered to about 30 centimeters from the bottom. The cable was than attached to the markers or dock to suspend the data loggers and cinder blocks above the bottom. The Lower Bank station was deployed in a different fashion. At this location a 20 foot length of schedule 80 PVC pipe was used. Slots one inch wide and eight inches long were cut three inches above the bottom and encircled the pipe. A one-half inch bolt was placed through the pipe slots to keep the YSI from falling through the pipe. A PVC cap was placed over the pipe with a slot for a locking mechanism to the pipe. A rope was attached to the cap with the other end fastened to the bail of the data logger for the retrial of the YSI.

Every thirty minutes (eastern standard time EST) during each sampling

period measurements of specific conductance, salinity, temperature, dissolved oxygen, (percent saturation and mg/l), water level, pH, and turbidity were recorded. At the end of each logging run a different recalibrated and programmed YSI data logger is switched with the data logger which is being replaced. The data logger is then brought back to the laboratory for downloading, re-calibration and reprogramming to be exchanged at a different location. The instruments are usually serviced (cleaned, recalibrated, and reprogrammed) every 14 days during the summer months and every 21 days during the winter. The data loggers are programmed to start recording data as soon as they are recalibrated which is, in most instances some time before they are deployed in the field. They are programmed to continue collecting data five days after the logging run has ended in the event the data loggers cannot be retrieved on schedule. Records are kept indicating which data loggers are used at each location and if there are any specific problems with each data logger or probes on the data loggers.

Uploading, cleaning, maintenance, and calibration are conducted as described in the YSI Operating Manual (section 3, 4, and 7). Calibration standards, required for pH are purchased from a scientific supply house. A two point calibration is used. The first is pH 7 followed by pH 4. The lower pH standard is used because of the more acetic properties of the Mullica River. The membrane on the oxygen probe gets changed when the membrane becomes fouled or gets punctured in the field or during cleaning. The membrane is stretched over the face of the probe and gets burned in by allowing the data logger to run in a discrete sample mode sampling every three seconds for at least eight hours. Dissolved oxygen is calibrated using a calibration cup filled with about 1/4 inch tap water, which creates a 100% water-saturated air environment for the sensor when the sond is placed in the cup. The sensors are allowed to equilibrate for at least 15 minutes in the cup before DO (% saturation) is calibrated. The standard for calibrating turbidity is purchased from a supply house and diluted to give a reading of 50 NTU (National Turbidity Units). Servicing an instrument generally takes about two hours for each data logger plus the time involved with retrieval and deployment.

5. Site Location and Character:

The Jacques Cousteau National Estuarine Research Reserve (NEER) at Mullica River/Great Bay is located on the northeast coast of the United States on the Atlantic Ocean. The estuary is near Tuckerton, New Jersey about 14 kilometers north of Atlantic City. All four locations can be characterized by having no macro algae and fast moving tidal currents. All sites are in an undisturbed area with little impact from development or pollution. There are four sampling stations:1) Buoy 126 (B126) – (39 deg 30.478’ N, 74 deg 20.308’ W) is located three kilometers from Little Egg Inlet on the eastern side of Great Bay and is 100 meters from the nearest land which is a natural marsh island. This is a naturally deep area which has never been dredged. It is located about 0.5 kilometer from an area in the intracoastal waterway which is dredged regularly. The dredged material is a course sand. The data logger at this location is attached to Intracoastal Waterway Buoy 126 and is the closest monitoring station to Little Egg Inlet. This site can be characterized by having strong tidal currents, 2-3 knots, fine to course sand bottom with an extensive blue mussel bed surrounding the area. The average depth is 2.45 meters with a range of 1.68 to 3.46 meters. The pH averages 8.0 over a year with a range of 7.5 to 8.5. Salinity averaged 28.3 with a maximum of 34 and a minimum of 15.8.
2) Buoy 139 (B139) – (39 deg 29.883’ N, 74 deg 22.873’ W) is located 4 kilometers from buoy 126 on the western side of Great Bay and is located about one to one and one-half kilometers from land. The closest land form is an

extensive salt marsh about 1.5 kilometers wide which borders the upland area. This area is dredged on a on a regular basis every five to six years to maintained the channel at a depth of eight feet by the Army Corp of Engineers. The surrounding depth of the bay is about five to six feet deep. This site is characterized by having maximum currents of about 1.5 knots with a muddy sand bottom and with little structure or shell. The average depth is 2.47 meters with a range of 1.77 to 3.29 meters. The average pH is 8.0 with a range of 7.2 to 8.5 and salinity values averaged 26.1 with a range of 12.1 to 32.8 ppt.
3) Chestnut Neck (NECK) – (39 deg 32.872' N, 74 deg 27.676' W)is located 12 kilometers up the Mullica River from the mouth of the river. The River begins at a line drawn between Graveling Point and Oysterbed Point on the northwestern side of Great Bay. The Mullica River at this location is quite wide, about 250 meters. The data logger is attached to the dock of a small marina along the southern shore of the river adjacent to the main channel. This location has never been dredged. The average depth at this location is 0.87 meters with a range of from 0.00 to 1.48 meters. The depth in the middle of the Mullica River at this location is about six meters. The pH averages 7.3 for the year with a range of from 4.4 to 8.1. The average salinity here is 14.0 with a range of 0 to 25.4 ppt. The site is characterized by having tidal currents of less then one knot, during both ebb and flood tide, with a sandy bottom.
4) Lower Bank (BANK) - (39 deg 35.618' N, 74 deg 33.091' W)is located 13 kilometers upriver of the Chestnut Neck location. The Mullica River at this site is about two hundred maters wide. The data logger is attached to a bridge going over the Mullica River which was rebuilt three years ago and is located in the center of the river. The northern bank of the river is sparely developed with single family houses and has a steep bank about five meters high. The southern shore has an extensive marsh and fresh water wetland area about three kilometer wide. This site can be characterized by having fast tidal currents, just over one knot, deep water, and fine sand sediment. The average depth is 1.65 meters with a range of 0.65 to 2.45 meters. The pH averages 5.8 with a range of 3.9 to 7.4. The salinity averages 2.2 with a range of from 0 to 15.1 ppt.

6. Data Collection Period:

Data collection at Buoy 126 and 139 began August 1996, Chestnut Neck began August 1996, and Lower Bank started October 1996. All four sites have been continuously in service since that time.

7. Associated Researchers and Projects:

A National Estuarine Research Reserve System Graduate Research Fellow, Melissa Neuman, will be working in coordination with the Research Coordinator, K. Able, and the Research Technician, R. Hoden, on a project entitled, "The effect of upwelling on the occurrence and abundance of larval fish in the Mullica River-Great Bay NERRS". This study will incorporate data collected through the NERRS ecological monitoring program and an ongoing long-term ichthyoplankton sampling program within the Mullica River-Great Bay NERRS. This research will also foster collaboration with members of the Marine Remote Sensing Laboratory at the Institute of Marine and Coastal Sciences, Rutgers University. The Research Coordinator is also the principal investigator on a project that attempts to investigate the influence of Phragmites invasion on the structure and function of brackish marsh fish nurseries in the Mullica River. This project is funded by New Jersey Sea Grant. Another ongoing sampling effort within the NERRS site is an estuarine-wide otter trawling survey that has been conducted since 1991 and has been supported by the Institute of Martine and Coastal Sciences, Rutgers University. With support from NOAA Cooperative

Marine Education and Research (CMER) Program, R. Chant (Rutgers/Institue of Marine and Coastal Sciences) is studying estuarine circulation patterns and their effects on the transport of winter flounder larvae within the NERRS.

II. PHYSICAL STRUCTURE DESCRIPTIONS

8) Sensor specifications, range of measurements, units, resolution, and accuracy:

YSI 6000 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.

9. Coded Variable Indicator and Variable Code Definitions:

B126=Buoy 126 - Northeast side of Great Bay
B139=Buoy 139 - Southwest side of Great Bay
NECK=Chestnut Neck - Mullica River
BANK=Lower Bank - Mullica River

10. Data Anomalies:

Included in this section are the month and year of data collection, the location and the file name for that month.

August 1996
Chestnut Neck - ne0896
None to report
Buoy 139 - b90896
Turbidity value is negative - 8/9/96 17:30
Turbidity value is negative - 8/10/96 17:30, 23:30
Turbidity probe became fouled and data was deleted 8/12/96 12:00 - 8/16/96 9:30
Oxygen probe failed due to fouling and data was deleted - 8/12/96 19:30 - 8/16/96 9:30
Turbidity value is negative - 8/19/96 22:30

Buoy 126 - b60896
Turbidity value is negative - 8/26/96 16:00

September 1996
Chestnut Neck - ne0996
None to report
Buoy 139 - b90996
Turbidity value was negative - 9/16/96 9:30
Turbidity value was negative - 9/23/96 19:00
Buoy 126 - b60996
Turbidity value is negative - 9/14/96 11:00
Turbidity value is negative - 9/15/96 18:00
Turbidity value is negative - 9/21/96 8:00, 19:00
Turbidity value is negative - 9/27/96 11:30
Turbidity value is negative - 9/28/96 12:30
Turbidity value is negative - 9/30/96 13:00
Depth deleted from 09/17/96 11:00-10/01/96 11:00 due to abnormally low depth.

October 1996
Lower Bank - ba1096
None to report
Chestnut Neck - ne1096
None to report
Buoy 139 - b91096
Turbidity value was negative - 10/20/96 14:30, 15:00, 18:00
No pH 10/21/96 14:30 - 10/31/96 23:30 pH probe failed, no data
Buoy 126 - b61096
Turbidity value is negative - 10/10/96 10:00
Turbidity value is negative - 10/12/96 15:30
Turbidity value is negative - 10/20/96 5:00

November 1996
Lower Bank - ba1196
Turbidity value was negative - 11/14/96 2:30, 3:30, 4:00, 4:30
Delete DO; Average DO values were 140% and none were less than 120% - 11/26/96 1630-
12/17/96 1500
Chestnut Neck - ne1196
Turbidity probe failure, data was negative and deleted - 11/5/96 7:30 - 11/26/96 7:30
Buoy 139 - b91196
No ph 11/1/96 0:00 - 11/4/96 10:00 pH probe failed, no data
Turbidity value was negative - 11/9/96 3:30
Turbidity value was negative - 11/15/96 2:00
Turbidity value was negative - 11/16/96 6:00
Turbidity value was negative - 11/27/96 4:00, 17:00
Buoy 126 - b61196
DO values deleted; first three records in deployment were higher than the rest of the deployment
possibly due to the membrane settling - 11/5/96 1000-1100
Turbidity value is negative - 11/30/96 12:30

December 1996
Lower Bank - ba1296
Delete DO; Average DO values were 140% and none were less than 120% - 11/26/96 1630-
12/17/96 1500

Turbidity value was negative - 12/6/96 17:00
Turbidity value was negative - 12/17/96 23:30
Turbidity value was negative - 12/20/96 7:30
Turbidity value was negative - 12/24/96 15:00
Turbidity value was negative - 12/25/96 10:30
     Chestnut Neck - ne1296
No data 12/20/96 23:30 - 12/21/96 1:00 - data logger was out of the water because of low
tides
Turbidity value was negative - 12/27/96 23:30
     Buoy 139 - b91296
Turbidity value was negative - 12/6/96 10:30 - 12:00
Turbidity value was negative - 12/6/96 14:30
Turbidity value was negative - 12/7/96 20:00 - 21:00
Turbidity value was negative - 12/7/96 22:00
Turbidity value was negative - 12/20/96 7:30
     Buoy 126 - b61296
DO values deleted; Values go from 103% to 143% to 277% and stay high until the end of the
deployment possibly due to a membrane integrity problem - 12/15/96 1000-12/17/96 1000

11. Missing Data:

     Included in this section are the month and year of data collection, the location, and the
file name for that month.

August 1996
     Chestnut Neck - ne0896
No data 8/6/96 7:30 - data logger down for service
     Buoy 139 - b90896
No data 8/1/96 0:00 - 13:30 - data logger was initially deployed at this time
No turbidity 8/12/96 12:00 - 8/16/96 9:30 - turbidity probe fouled, data was deleted
No oxygen data 8/12/96 19:30 - 8/16/96 9:30 - oxygen probe failed
No data 8/26/96 20:00 - 8/31/96 23:30 - batteries failed and logging run was terminated
     Buoy 126 - b60896
No data 8/1/96 0:00 - 8/6/96 09:30 - data logger was initially deployed at this time
No data 8/20/96 10:30 - 13:30 - data logger was down for service

September 1996
     Chestnut Neck - ne0996
No data 9/4/96 7:30 - data logger down for service
No data 9/17/96 7:30 - data logger down for service
     Buoy 139 - b90996
No data 9/1/96 0:00 - 9/3/96 11:30 - batteries failed and logging run was terminated
No data 9/30/96 10:00 - data logger was down for service
     Buoy 126 - b60996
No data 9/4/96 10:00 - data logger was down for service
No data 9/17/96 10:30 - data logger was down for service
Depth deleted from 09/17/96 11:00-10/01/96 11:00 due to abnormally low depth.

October 1996

Lower Bank - ba1096
No data 10/1/96 0:00 - 10/10/96 13:30 - data logger first deployed at this time
Chestnut Neck - ne1096
None to report
Buoy 139 - b91096
No data 10/21/96 10:00 - 14:00 - data logger was down for service
No pH 10/21/96 14:30 - 10/31/96 23:30 - pH probe failed, data deleted
Buoy 126 - b61096
No data 10/1/96 11:30 - 14:30 - data logger was down for service
No data 10/27/96 5:30 - 10/30/96 23:30 - internal data logger error

November 1996
Lower bank - ba1196
No data 11/4/96 14:30 - 11/5/96 15:30 - data logger down for service
No data 11/26/96 14:00 - 16:00 - data logger down for service
Chestnut Neck - ne1196
No data 11/4/96 16:30 - 11/5/96 7:00 - data logger down for service
No turbidity 11/5/96 7:30 - 11/26/96 7:30 - probe failure; data was negative and deleted
No data 11/26/96 8:00 - 11/30/96 23:30 - data logger failed to log run, batteries failed
Buoy 139 - b91196
No pH 11/1/96 0:00 - 11/4/96 10:00 - pH probe failed, data was deleted
No data 11/16/96 6:30 - 11/25/96 8:30 - data logger failed to log run, batteries failed
Buoy 126 - b61196
No data 11/1/96 0:00 - 11/5/96 9:30 - data logger failed to log run, batteries failed
No data 11/7/96 15:00 - data logger failed to log
No data 11/9/97 3:30 - data logger failed to log
No data 11/11/96 18:30 - data logger failed to log
No data 11/12/96 - 19:00,19:30 - data logger failed to log
No data 11/13/96 18:00, 18:30, 20:00, 20:30 - data logger failed to log
No data 11/14/96 0:00, 8:30, 19:00, 19:30, 20:30 - 21:30 - data logger failed to log
No data 11/15/96 7:00 - data logger failed to log
DO values deleted; first three records in deployment were higher than the rest of the deployment
possibly due to the membrane settling - 11/5/96 1000-1100
No data 11/16/96 8:30 - data logger failed to log
No data 11/17/96 9:30 - data logger failed to log
No data 11/18/96 0:00 - data logger failed to log
No data 11/20/96 0:00, 2:30 - data logger failed to log
No data 11/22/96 4:30 - data logger failed to log
No data 11/26/96 10:00 - 11:30 - data logger failed to log

December 1996
Lower bank - ba1296
Delete DO; Average DO values were 140% and none were less than 120% - 11/26/96 1630-
12/17/96 1500
Chestnut Neck - ne1296
No data 12/1/96 0:00 - 12/17/96 4:30 - data logger failed to log run (batteries)
No data 12/20/96 23:30 - 12/21/96 1:00 - data logger was out of water, very low tides
Buoy 139 - b91296
None to report

Buoy 126 - b61296
DO values deleted; Values go from 103% to 143% to 277% and stay high until the end of the
deployment possibly due to a membrane integrity problem - 12/15/96 1000-12/17/96 1000