**Elkhorn Slough (ELK) NERR Water Quality Metadata**

**January 2010 to December 2010**

**Latest Update:** March 8th, 2011

Note: This is a provisional metadata document; it has not been authenticated as of its download date. Contents of this document are subject to change throughout the QAQC process and it should not be considered a final record of data documentation until that process is complete. Contact the CDMO ([cdmosupport@belle.baruch.sc.edu](mailto:cdmosupport@belle.baruch.sc.edu)) or Reserve with any additional questions.

**I. Data Set and Research Descriptors**

**1) Principal investigator(s) and contact persons**

Kerstin Wasson, Research Coordinator Elkhorn Slough NERR

[kerstin.wasson@gmail.com](mailto:kerstin.wasson@gmail.com) 1700 Elkhorn Rd

John C. Haskins, Water Quality Scientist Watsonville, CA 95076

[john@elkhornslough.org](mailto:john@elkhornslough.org) (831) 728-2822

Rikke Kvist Preisler, Estuarine Ecologist

[rikke@elkhornslough.org](mailto:rikke@elkhornslough.org)

Brent Hughes, Wetland Ecologist

[brent@elkhornslough.org](mailto:brent@elkhornslough.org)

**2) Entry verification**

Deployment data are uploaded from the YSI data logger to a Personal Computer (IBM compatible). Files are exported from EcoWatch in a comma-delimited format (.CDF) and uploaded to the CDMO where the data undergo automated primary QAQC and become part of the CDMO’s online provisional database. Excessive pre- and post-deployment data are removed from the .CDF file prior to upload with up to 2 hours of pre- and post-deployment data retained to assist in data management. During primary QAQC, data are flagged if they are missing or out of sensor range. The edited file is then returned to the ELK Reserve where it is opened in Microsoft Excel and processed using the CDMO’s NERRQAQC Excel macro. The macro inserts station codes, creates metadata worksheets for flagged data, and graphs the data for review. It allows the user to apply QAQC flags and codes to the data, remove remaining pre- and post-deployment data, append files, and export the resulting data file (compiled as a quarterly, and consequently as an annual file) to the CDMO for tertiary QAQC and assimilation into the CDMO’s authoritative online database. Where deployment overlap occurs between files, the data produced by the newly calibrated sonde is generally accepted as being the most accurate. For more information on QAQC flags and codes, see Sections 11 and 12. Persons responsible for sonde calibration and deployment were John Haskins, Brent Hughes, Gui Lessa, Miguel Rodriguez, Mrugesh Patel, Lizz Johnson, and Rikke Preisler. Persons responsible for data management and QA/QC are John Haskins, Brent Hughes, Miguel Rodriguez, and Rikke Preisler.

**3) Research objectives**

The goal of the research and monitoring of water quality at Elkhorn Slough NERR is to establish baselines for water quality parameters for Elkhorn Slough by using South Marsh as the control site while monitoring the two impacted sites (Azevedo Pond and North Marsh) for possible future problems. Additionally, in order to identify oceanic influence on the water quality parameters at Elkhorn Slough, we monitor a fourth site, Vierra Mouth (VM). Water quality measurements are recorded every 15 minutes over a three to four week period at the four sites in Elkhorn Slough. One site, South Marsh (SM), is in a relatively un-impacted side channel of the slough and the second site, Azevedo Pond (AP), is in a pond that receives fertilizer and pesticide runoff from an adjoining strawberry field. The third site, North Marsh (NM), was added in April 1999 and is located in an area where there is both agricultural and non-agricultural runoff. The fourth site, Vierra Mouth, is located at the mouth of the slough and is used to identify oceanic influence. This site was added March 14, 2001.

**4) Research methods**

The Elkhorn Slough water quality monitoring program began in July 1995. All four sites described above are monitored simultaneously. Prior to YSI deployment at SM, a 20-foot length of 4-inch diameter PVC pipe was placed in the slough to house the YSI. Holes were drilled in the pipe to remove 10% of the pipe's surface area and to allow water flow across the YSI. The pipe was positioned vertically in the slough with one end pushed into the soft bottom sediments and the other end secured to a permanent dock. A bolt in the pipe maintains the YSI exactly one foot (30cm) above the bottom. This setup is exactly the same at North Marsh except that the PVC pipe is secured to shore. Prior to YSI deployment at AP, a supportive framework of rope and PVC was placed at the site to house the YSI. The structure maintains the YSI exactly one foot (30cm) above the pond bottom. At Vierra Mouth, the installed PVC pipe housing the YSI sonde is the same as at South Marsh. Every 15 minutes over a 30-day period, measurements of specific conductivity, salinity, dissolved oxygen, temperature, depth, turbidity, and pH are recorded. At South Marsh, in additionally chlorophyll is recorded.

At the end of each approximate 30-day period, the YSI is brought back to the lab to download the data, and cleaning, and recalibration of the sonde. Data are downloaded onto a PC and then all data are transferred to a server at the reserve ([\\eserver1](file:///\\eserver1)). Sonde body and probes are cleaned. If a DO membrane is used it is changed and allowed to re-equilibrate for at least eight hours before calibration. Calibration is performed as outlined in the YSI manual. Buffer solutions of pH 7 and pH 10 are purchased from a scientific supply house and used for two-point calibration of the pH probe. A salinity standard of 31.892 ppt was used for calibration of the conductivity probe from 1995 to 1999, and since the beginning of July 1999 a conductivity standard of 53 mS/cm was used. The turbidity probe is calibrated using a two-point calibration with DI water and 126 NTU standard. Deionized water is used to calibrate the chlorophyll probe on the sonde at SM. The DO probe was calibrated using a 1-point calibration with tapwater saturated with an airstone for at least 15 minutes prior to calibration. As of July 1998 a new YSI is calibrated in the lab before retrieving the currently deployed one, in order to replace the one in the field. This eliminates the loss of data due to cleaning and calibration. QA/QC was done according to the CDMO manual by John Haskins, Brent Hughes, Miguel Rodriguez, and Rikke Preisler using the macros provided by the CDMO. Data are then looked over more rigorously to identify and document anomalies and missing data. Additionally, in 2010 John Haskins has started using Matlab, in order to better identify anomalies in the monthly data, by overlaying the current month’s data onto all data at a site, since 1995. This method allows to more easily identify probe drift and malfunction, in addition to natural variation in the data. This method has only been used for the South Marsh site so far.

A Sutron Sat-Link2 transmitter was installed at the South Marsh station on 09/28/2006 and transmits data to the NOAA GOES satellite, NESDIS ID # 3B026768. 3B026768 is the GOES ID for that particular station. The transmissions are scheduled hourly and contain four (4) data sets reflecting fifteen minute data sampling intervals. Upon receipt by the CDMO, the data undergoes the same automated primary QAQC process detailed in Section 2 above. The “real-time” telemetry data become part of the provisional dataset until undergoing secondary and tertiary QAQC and assimilation in the CDMO’s authoritative online database. Provisional and authoritative data are available at [http://cdmo.baruch.sc.edu](http://cdmo.baruch.sc.edu/).

**5) Site location and character**

Elkhorn Slough is located on the West Coast of the United States in Central California. It connects with the Pacific Ocean in central Monterey Bay near Moss Landing, California. There are four sampling sites.

AP (Azevedo Pond)(36°50’44.64”N, 121°45’13.24”W) is in a pond that receives fertilizer and pesticide runoff from a strawberry field in year-round production. The YSI is located about 10m from a tidal control structure in front of a culvert connecting the pond to the slough. The tide ranges from 0.15 to 1.3 meters and salinity ranges from 15.2 ppt during heavy run-off to 32.7 ppt during strong evaporation. The sonde is located approximately 30 cm off the bottom, which is composed of silty mud.

NM (North Marsh)(36°50’04.75”N, 121°44’18. 33”W) is located in-between South Marsh and Azevedo Pond. This site is impacted by both agricultural and urban run-off. The tide ranges from approximately 0.11 to 0.67 meters. Salinity ranges between 18.1 and 32.5 ppt and is affected by freshwater run-off from agriculture and upland run-off. The sonde is approximately 30 cm off the bottom, which is composed of silty mud.

SM (South Marsh)(36°49’05.00”N, 121°44’21.83”W) is located approximately 3 km south of NM and is surrounded by mostly reserve land. This site receives run-off mostly from uplands with some run-off coming from cattle ranches. This site receives the least amount of pollution. The tidal range is from 0.23 to 3.12 meters and the salinity range is from 21.9 to 35.3 ppt. The sonde is approximately 30 cm off the bottom, which is composed of slightly compacted silty mud.

The fourth site, VM (Vierra Mouth)(36°48’39.95”N, 121°44’45.40”W), is located at the mouth of the slough and is used to identify oceanic influence. The tidal range is from 1.3 to 3.9 meters and salinity ranges from 22.5 to 36.3 ppt. The sonde is located approximately 30 cm off the bottom, which is composed of compacted mud and sand due to strong tidal currents. This site receives drainage from the entire watershed since it is at the mouth of the slough. There are several auto-wreck yards located approximately 2 km east of this site.

**6) Data collection period**

Sampling at Azevedo Pond and South Marsh began simultaneously at the end of June 1995 and data collection is ongoing. North Marsh began sampling on April 15, 1999. Vierra Mouth began sampling on March 14, 2001 at 13:00.

**Azevedo Pond**

Start Date Start Time End Date End Time

01/01/2010 00:00 01/11/2010 13:30

01/11/2010 13:45 02/16/2010 12:15

02/16/2010 11:45 03/08/2010 14:30

03/08/2010 14:45 04/05/2010 11:00

04/05/2010 11:15 05/2/2010 00:15

05/03/2010 11:30 06/1/2010 12:00

06/01/2010 11:30 06/28/2010 11:15

06/28/2010 11:30 07/19/2010 10:00

07/19/2010 09:31 08/23/2010 13:16

08/23/2010 12:30 09/20/2010 10:30

09/20/2010 09:45 10/18/2010 15:30

10/18/2010 15:00 11/15/2010 11:30

11/15/2010 11:30 12/13/2010 08:30

12/13/2010 08:30 12/31/2010 23:45

**North Marsh**

Start Date Start Time End Date End Time

01/01/2010 00:00 01/21/2010 11:45

01/21/2010 11:15 02/16/2010 14:00

02/16/2010 13:15 03/18/2010 14:30

03/18/2010 15:15 04/13/2010 12:30

04/13/2010 12:45 05/12/2010 12:30

05/12/2010 13:00 06/07/2010 09:30

06/07/2010 09:30 07/06/2010 11:00

07/06/2010 10:30 08/04/2010 11:30

08/04/2010 10:46 08/30/2010 14:16

08/30/2010 13:46 09/27/2010 09:46

09/27/2010 09:15 10/25/2010 12:30

10/25/2010 16:00 11/22/2010 15:45

11/22/2010 16:00 12/20/2010 10:45

12/20/2010 10:45 12/31/2010 23:45

**South Marsh**

Start Date Start Time End Date End Time

01/01/2010 00:00 01/04/2010 11:30

01/04/2010 11:30 01/26/2010 11:30

01/26/2010 11:00 02/22/2010 11:45

02/22/2010 11:15 03/27/2010 07:30

03/27/2010 07:00 04/21/2010 17:45

04/21/2010 17:15 05/18/2010 9:30

05/18/2010 09:45 06/15/2010 12:15

06/15/2010 12:30 07/09/2010 12:30

07/09/2010 11:45 08/02/2010 11:00

08/02/2010 10:30 09/08/2010 16:30

09/08/2010 16:30 10/11/2010 16:00

10/11/2010 16:00 10/20/2010 11:30

10/20/2010 11:30 10/27/2010 10:00

10/27/2010 10:15 11/08/2010 12:00

11/08/2010 11:45 11/09/2010 14:15

11/09/2010 14:15 12/06/2010 15:15

12/06/2010 15:15 12/31/2010 23:45

**Vierra Mouth**

Start Date Start time End Date End Time

01/01/2010 00:00 01/26/2010 12:00

01/26/2010 12:15 02/16/2010 20:15

03/02/2010 07:45 03/22/2010 11:00

03/22/2010 11:15 04/19/2010 15:15

04/19/2010 15:00 05/17/2010 11:00

05/17/2010 11:45 06/15/2010 11:30

06/15/2010 11:45 07/12/2010 10:00

07/12/2010 10:45 08/09/2010 12:00

08/09/2010 11:45 09/07/2010 10:00

09/07/2010 10:15 09/13/2010 10:15

09/13/2010 10:30 10/04/2010 11:45

10/04/2010 11:45 11/01/2010 09:45

11/01/2010 09:45 11/29/2010 11:45

11/29/2010 11:45 12/28/2010 15:15

12/28/2010 15:15 12/31/2010 23:45

**7) Distribution**.

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 this 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 or 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, Kerstin Wasson, at the individual NERR site, Elkhorn Slough NERR, (please see Principal Investigators and Contact Persons), from the Data Manager at the Centralized Data Management Office (please see personnel directory under the general information link on the CDMO home page) and online at the CDMO home page [http://cdmo.baruch.sc.edu/](http://cfcdmo.baruch.sc.edu/). Data are available in text tab-delimited format.

**8) Associated researchers and projects** (link to other products or programs) **–** Describe briefly other research (data collection) that correlates or enhances the data collected by data loggers. At a minimum, mention the SWMP MET and NUT data sets.

Elkhorn Slough NERR encourages research from many areas, the following are current projects related to or near the water quality stations.

### The following researchers are working directly with us here at the Elkhorn Slough NERR

Monique Fountain conducts fish seines in order to determine short- and long-term changes in fish populations and fish communities.

Susie Fork conducts field survey monitoring of shorebirds; egret and heron rookery, bird nestboxes, raptors, and invertebrate populations.

Rikke Preisler and Susie Fork conduct crab trapping in order to track crab populations, especially invasions by non-native European crabs.

Eric Van Dyke works on remote-sensing using GIS to analyze habitat change and NERR biomonitoring pilot studies for Tier 1, emergent vegetation.

Kerstin Wasson monitors oyster recruitment and conducts experiments to determine the status and trajectory of native oyster populations.

Beth Watson uses sediment cores and paleo-ecological analysis to determine the marsh plant communites historically found at Elkhorn Slough.

Antonia D'Amore and Valentine Hemingway in affiliation with the University of California, Santa Cruz conduct frog surveys and measurement of pond attributes by tracking threatened amphibian populations, incl. their diseases, predators, and movements.

John Haskins, Brent Hughes, and Rikke Preisler conduct water quality research currently focusing on eutrophication in the slough and are managing the SWMP weather monitoring and the SWMP nutrient programs that are used in conjunction with eutrophication research.

**The following researchers are affiliated with other institutions.**

Anderson, Brian; UC Davis, seine for topsmelt - study pesticide levels in indicator fish.

Carlisle, Aron; Litvin, Steve; Stanford University conduct fish seines in order to determine short- and long-term changes in fish populations and fish communities. Additionally, voucher specimens are used for stable isotope analysis in order to determine allochtonous input in food resources.

Crews, Phil; Loveridge, Steven; UC Santa Cruz, collect yellow sponge - extract anti-cancer drugs from sponges.

DeRivera, Catherine; Koetke, Seth: deploy and retrieve crab traps in order to compare invasive green crab abundance at sites with (Bodega Bay) and a site without (Elkhorn) eradication efforts.

Dowd, Wes; Stanford University, enter Parsons Slough by boat under Rail Road bridge to maintain acoustic receivers - investigate movement of leopard sharks in response to salinity changes.

Eby, Ron; Maldini, Daniela; Scoles, Robert; Okeanis, drive to Hummingbird Island; go to observation blind near Parsons Rail Road bridge by boat or on foot examine marine mammal use of Parsons complex.

Endris, Charlie; Aiello, Ivano: conduct field topographic surveys using high resolution laser scanner. The goal of this research is to track subtle changes in sediment deposition and erosion related to Parsons Sill project.

Fabian, Chris: collects Batillaria snails to assess effects of ocean acidification on Batillaria. Batillaria is used as proxy for other snails.

Francis, Chris: studies the diversity and activity of (de-) nitrifying microbial communities

Fresquez, Carla; UC Santa Cruz, assess high marsh, collect soil cores, clear small areas of bare ground - investigate invasions of upland weeds into the high marsh.

Fuller, Timothy; California State University Monterey Bay, collect specimens of invasive orange sponge elucidate genetics and potential hybridization of *Hymeniacidon sinapium*, the orange sponge.

Gunvalson, Megan: To determine recreational user impacts on marine mammals Gunvalson observes marine mammals from main channel off of Yampah Island

Hammerstrom, Kamille; Moss Landing Marine Laboratories, deploy eelgrass seeds and transplants by diving; coffee-can cores and sieving of mud; from shore and boat (for subtidal)- eelgrass restoration science project

Hemingway, Valentine; UC Santa Cruz, collect snails and water samples from ponds, survey amphibians - examine threats posed by chytrid disease and trematode malformations to amphibians.

Hughes, Brent; UC Santa Cruz, conducts surveys and experiments with algal biomass and seagrass populations and additionally quantifies eutrophication indicators.

Johnson, Andrew: tracks sea otter movements; assesses rehabilitated animals; studies otters

Kim, Taewon: Deploy and check recruitment plates at South Marsh, Parson's, North Marsh. Goal is to examine role of temperature in fostering invasions of non-native species

Kirkpatrick, Marm; Brightman, Heidi; UC Santa Cruz, Catch waterbirds with various trapping techniques to take blood samples - examine interspecies transfer of avian influenza.

Kvitek, Rikk; Spear, Brian; California State University Monterey Bay, use small boat in Parson's complex - map Slough bathymetry to monitor changes resulting from tidal scour

Moore, Steve; Barnes, Cody; Gonzales, Alin; California State University Monterey Bay, deploy and maintain cameras on Reserve; assess boxes in which marine mammal tracks are visble - examine wildlife usage patterns using student-built time-lapse cameras and mammal track boxes.

Nelson, Joanna; UC Santa Cruz, assess marsh, collect soil and marsh samples - examine potential effects of climate change on salt marsh function.

Paytan, Adina; Bard, Don; UC Santa Cruz, aerial deposition sampling; rainwater sampling; mud and channel water sampling in order to understand atmospheric deposition of nitrogen, and mercury exchange from groundwater.

Shapiro, Karen; UC Davis, examine transport of particles on water currents - understand transport of Toxoplasmosis from land to sea otter habitat.

Van Sommeran, Sean; Pelagic Shark Research Foundation; capture, tag, measure and release sharks and rays; carry out outreach - track shark and ray abundance and diversity on reserve.

Weiss, Peter; Cook, Daniel: Use an air sampler with the goal of determining role of atmospheric deposition of mercury

**Frequent docent researchers**: Shirley Murphy (various bird monitoring programs). ; Ron Eby (marsh, bird, otter monitoring)

**Frequent interns:** Miguel Rodriguez (water quality intern), Joe Hatfield (water quality assistant),

**II. Physical Structure Descriptors**

**9) Sensor specifications –** Include the parameter description, units, sensor type, model #, range of measurement, accuracy and resolution for each sensor for all measuring devices (6000, 6600, 6600 EDS, 6600 EDS V2, or 6600 V2). ***Specify if all of your sondes are the same model and have the same configuration. If not, detail how many of each model you have, what different sensor configurations you use, and where the different models/configurations are deployed.*** See the following example and include the disclaimers below.

### YSI 6600EDS datalogger

ELK NERR deployed 6600EDS data sondes at NM, AP, VM in 2010

**Variable Name Range of Measurement (units) Resolution Accuracy**

Date 1-12, 1-31, 00-99 (Mo, Day, Yr) 1 month, 1 day, 1 year NA

Time 0-24, 0-60, 0-60 (Hr, Min, Sec) 1hr, 1 min, 1 s NA

Temp -5 to 45 (degrees Celsius) 0.01 C +/-0.15 C

SpCOND 0-100 (mS/cm) 0.01mS/cm +/-0.5% of

reading + 0.001 mS/cm

Salinity 0-70 parts per thousand (ppt) 0.01 ppt +/-1.0% of reading or 0.1

ppt (whichever is greater)

DOsat 0-200 (%air Saturation) 0.1%@air saturation +/-2% @air saturation

DOsat 200-500 (%air Saturation) 0.1%@air saturation +/-6% @air saturation

DOmg 0-20 (mg/l) 0.01 mg/l +/-0.2 mg/l

DOmg 20-50 (mg/L) 0.01 mg/L +/-0.6 mg/L

Depth 0-9.1 (m) 0.001 m +/-0.018 m

pH 2-14 (units) 0.01 units +/-0.2 units

Turb 0-1000 NTU 0.1 NTU +/-5% of reading or +/- 2 NTU (whichever is greater)

Tabs separate data columns.

### YSI 6600EDS V2 datalogger

ELK NERR deployed 6600EDS V2 data sondes at SM in 2010

**Variable Name Range of Measurement (units) Resolution Accuracy**

Date 1-12, 1-31, 00-99 (Mo, Day, Yr) 1 month, 1 day, 1 year NA

Time 0-24, 0-60, 0-60 (Hr, Min, Sec) 1hr, 1 min, 1 s NA

Temp -5 to 50 (degrees Celsius) 0.01 C +/-0.15 C

SpCOND 0-100 (mS/cm) 0.01mS/cm +/-0.5% of reading + 0.001 mS/cm

Salinity 0-70 parts per thousand (ppt) 0.01 ppt +/-1.0% of reading or 0.1ppt

(whichever is greater)

ROX DOsat 0-200 (%air Saturation) 0.1%@air saturation +/-1% or 1% air saturation

(whichever is greater)

ROX DOsat 200-500 (%air Saturation) 0.1%@air saturation +/-15% of reading

ROX DOmg 0-20 (mg/l) 0.01 mg/l +/-0.1 mg/l or 1% of reading

(whichever is greater)

ROX DOmg 20-50 (mg/L) 0.01 mg/L +/-15% of reading

Depth (Shallow) 0-9.1 (m) 0.001 m +/-0.02 m

pH 0-14 (units) 0.01 units +/-0.2 units

Turb 0-1000 NTU 0.1 NTU +/-2% of reading or 0.3 NTU (whichever is greater)

Rhodamine 0-200µg/L 0.1µg/L +/- 5% of reading or 1µg/L

(Chlorophyll a) (whichever is greater)

Tabs separate data columns.

Include the following DO (unless ALL your sondes are EDS or have the ROX Optical DO sensor) and Depth data disclaimers:

**Dissolved Oxygen Qualifier:**

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

**Depth Qualifier:**

The NERR System-Wide Monitoring Program utilizes YSI data sondes that can be equipped with either vented or non-vented depth/level sensors.  Readings for both vented and non-vented sensors are automatically compensated for water density change due to variations in temperature and salinity; but for all non-vented depth measurements, changes in atmospheric pressure between calibrations appear as changes in water depth.  The error is equal to approximately 1.03 cm for every 1 millibar change in atmospheric pressure, and is eliminated for vented sensors because they are vented to the atmosphere throughout the deployment time interval.

Beginning in 2006, NERR SWMP standard calibration protocol calls for all non-vented depth sensors to read 0 meters at a (local) barometric pressure of 1013.25 mb (760 mm/hg).  To achieve this, each site calibrates their depth sensor with a depth offset number, which is calculated using the actual atmospheric pressure at the time of calibration and the equation provided in the SWMP calibration sheet or digital calibration log.  This offset procedure standardizes each depth calibration for the entire NERR System.  If accurate atmospheric pressure data are available, non-vented sensor depth measurements at any NERR can be corrected.

In 2010, the CDMO began automatically correcting depth/level data for changes in barometric pressure as measured by the Reserve’s associated meteorological station during data ingestion. These corrected depth/level data are reported as cDepth and cLevel, and are assigned QAQC flags and codes based on QAQC protocols. Please see sections 11 and 12 for QAQC flag and code definitions.

**10) Coded variable definitions –** List the sampling station, sampling site code, and station code used in the data.

**Sampling station: Sampling site code: Station code: Data Type:**

South Marsh SM elksmwq water quality data

Azevedo Pond AP elkapwq water quality data

North Marsh NM elknmwq water quality data

Vierra Mouth VM elkvmwq water quality data

**11) QAQC flag definitions**

QAQC flags provide documentation of the data and are applied to individual data points by insertion into the parameter’s associated flag column (header preceded by an F\_). During primary automated QAQC (performed by the CDMO), -5, -4, and -2 flags are applied automatically to indicate data that is missing and above or below sensor range. All remaining data are then flagged 0, passing initial QAQC checks. During secondary and tertiary QAQC 1, -3, and 5 flags may be used to note data as suspect, rejected due to QAQC, or corrected.

-5 Outside High Sensor Range

-4 Outside Low Sensor Range

-3 Data Rejected due to QAQC

-2 Missing Data

-1 Optional SWMP Supported Parameter

0 Data Passed Initial QAQC Checks

1 Suspect Data

2 *Open - reserved for later flag*

3 Calculated data: non-vented depth/level sensor correction for changes in barometric pressure

4 Historical Data: Pre-Auto QAQC

5 Corrected Data

**12) QAQC code definitions**

QAQC codes are used in conjunction with QAQC flags to provide further documentation of the data and are also applied by insertion into the associated flag column. There are three (3) different code categories, general, sensor, and comment. General errors document general problems with the deployment or YSI datasonde, sensor errors are sensor specific, and comment codes are used to further document conditions or a problem with the data. Only one general or sensor error and one comment code can be applied to a particular data point, but some comment codes can be applied to the entire record in the F\_Record column.

General Errors

GIC No instrument deployed due to ice

GIM Instrument malfunction

GIT Instrument recording error; recovered telemetry data

GMC No instrument deployed due to maintenance/calibration

GNF Deployment tube clogged / no flow

GOW Out of water event

GPF Power failure / low battery

GQR Data rejected due to QA/QC checks

GSM See metadata

Corrected Depth/Level Data Codes

GCC Calculated with data that were corrected during QA/QC

GCM Calculated value could not be determined due to missing data

GCR Calculated value could not be determined due to rejected data

GCS Calculated value suspect due to questionable data

GCU Calculated value could not be determined due to unavailable data

Sensor Errors

SBO Blocked optic

SCF Conductivity sensor failure

SDF Depth port frozen

SDO DO suspect

SDP DO membrane puncture

SIC Incorrect calibration / contaminated standard

SNV Negative value

SOW Sensor out of water

SPC Post calibration out of range

SSD Sensor drift

SSM Sensor malfunction

SSR Sensor removed / not deployed

STF Catastrophic temperature sensor failure

STS Turbidity spike

SWM Wiper malfunction / loss

Comments

CAB Algal bloom

CAF Acceptable calibration/accuracy error of sensor

CAP Depth sensor in water, affected by atmospheric pressure

CBF Biofouling

CCU Cause unknown

CDA DO hypoxia (<3 mg/L)

CDB Disturbed bottom

CDF Data appear to fit conditions

CFK Fish kill

CIP Surface ice present at sample station

CLT Low tide

CMC In field maintenance/cleaning

CMD Mud in probe guard

CND New deployment begins

CRE Significant rain event

CSM See metadata

CTS Turbidity spike

CVT Possible vandalism/tampering

CWD Data collected at wrong depth

**13) Post deployment information** – Use this section for documentation of post calibration information for instruments deployed at each site. ***At a minimum, include: Date (specify if this is the deployment begin date or date of post calibration), SpCond, DO%, pH (7), and Turb (0 NTU).*** Depth and additional pH and Turb post cal information are also beneficial. If using the post calibration log macro, make sure to specify the standards used and edit your table as necessary.

All dates are the dates the sondes were retrieved and post-calibrated.

**Azevedo Pond**

Retrieval DO% pH pH Depth Turb Turb SpCond Batt

Date (100) (7.0) (10.0) (0.0m) (0.0 NTU) (100/123 NTU) (53 ms/cm) (V)

01/11/2010 97.0 7.8 10.64 0.0 0.1 125.9 52.45 10.0

02/16/2010 95.9 7.09 10.22 0.014 0.2 125.4 51.40 11.2

03/08/2010 99.7 7.25 10.59 0.043 0.0 101.0 52.05 9.7

04/05/2010 97.6 7.07 10.21 0.029 -0.1 113.4 52.13 12.1

05/03/2010 96.3 7.04 10.22 0.056 0.6 106.5 52.6 13.4

06/01/2010 96.6 7.17 10.07 0.008 -0.1 114.6 53.46 10.8

06/28/2010 93.5 7.08 10.23 -0.439 0.2 87.7 52.33 10.3

07/19/2010 63.8 7.32 9.77 -0.028 9.0 91.3 37.17 10.9

08/23/2010 100.2 7.13 10.17 -0.025 0.2 121.2 49.60 10.9

09/20/2010 92.3 9.48 10.95 -0.42 -0.6 133.1 52.51 9.5

10/18/2010 \*\*\*NO DATA\*\*\*

11/15/2010 100.3 7.08 10.01 0.023 -0.1 121.6 56.28 8.7

12/13/2010 97.7 6.57 6.50 0.031 -0.4 128.9 54.17 11.2

**North Marsh**

Retrieval DO% pH pH Depth Turb Turb SpCond Batt

Date (100) (7.0) (10.0) (0.0m) (0.0 NTU) (100/123 NTU) (53 ms/cm) (V)

01/21/2010 95.8 7.17 10.03 -0.412 0.5 119.5 52.3 10.4

02/16/2010 94.1 7.04 10.08 -0.001 1.0 101.1 53.91 11.7

03/18/2010 99.4 6.99 10.01 -0.028 -0.2 125.4 50.65 10.9

04/13/2010 99.8 7.83 11.03 0.010 0.7 22.0 42.02 9.2

05/12/2010 99.4 7.34 10.31 -0.005 0.2 107.7 49.79 11.0

06/07/2010 96.6 8.74 10.86 0.006 0.8 113.4 52.36 11.2

07/06/2010 41.9 7.00 9.76 -0.014 11.2 89.3 27.13 9.9

08/04/2010 85.9 7.16 8.83 -0.009 1.5 1.0 50.5 6.0

08/30/2010 101.3 7.19 9.04 -0.004 0.5 110.1 52.35 11.7

09/27/2010 100.8 2.68 3.77 -0.053 0.8 105.6 52.25 10.2

10/25/2010 89.5 8.59 9.35 0.034 0.5 100.8 50.48 10.9

11/22/2010 100 7.04 9.78 0.057 0.7 115.9 46.73 11.2

12/20/2010 98.4 8.21 11.29 -0.069 0.2 127.4 54.04 11.3

**South Marsh**

Retrieval DO% pH pH Depth Turb Turb SpCond Batt

Date (100) (7.0) (10.0) (0.0m) (0.0 NTU) (100/123 NTU) (53 ms/cm) (V)

1/26/2010 99.8 7.10 10.19 -0.092 3.8 114 51.5 11.8

3/27/2010 101.6 6.83 10.18 0.066 -0.1 120.6 53.15 11.5

4/21/2010 98.8 7.17 10.49 -0.1 -0.2 116.6 52.44 10.5

05/18/2010 98.4 7.01 10.19 0.023 -0.3 102.3 54.34 12.1

06/15/2010 98.8 7.15 10.45 -.026 1.6 100.6 52.29 10.6

07/09/2010 97.7 7.09 9.86 -0.016 0.2 81.0 54.55 11.3

08/02/2010 101.5 7.12 9.63 0.002 0.7 70.8 54.13 10.5

09/08/2010 99.6 7.01 10.00 -0.036 0.1 127.3 52.30 12.4

10/11/2010 107.6 6.32 9.42 0.022 0.5 108.2 53.66 12.2

10/20/2010 100.5 7.00 10.26 0.028 0.2 110.6 52.09 11.3

10/27/2010 99.0 6.97 10.00 0.024 -0.2 127.2 56.47 12.2

11/08/2010 101.2 7.02 9.72 0.047 -3.4 123.4 51.21 11.6

11/09/2010 102.8 7.24 10.09 0.042 0.0 121.6 53.29 11.1

12/06/2010 104.4 6.96 10.04 0.113 0.8 129.6 52.90 12.4

**Vierra Mouth**

Retrieval DO% pH pH Depth Turb Turb SpCond Batt

Date (100) (7.0) (10.0) (0.0m) (0.0 NTU) (100 NTU) (53 ms/cm) (V)

01/26/2010 98.7 6.87 9.86 -0.046 0.8 129.3 50.89 9.8

03/02/2010 93.9 6.58 9.56 -0.011 4.9 122.4 54.27 NA

03/22/2010 98.3 6.83 10.08 0.040 0.3 123.2 49.74 10.6

04/19/2010 98.8 7.23 10.58 -0.004 -0.5 110.3 55.52 9.8

05/17/2010 98.8 7.37 10.30 -.030 -0.1 108.8 55.94 11.5

07/12/2010 104.2 6.87 9.74 0.000 1.8 94.8 53.22 9.0

08/09/2010 98.7 7.49 10.49 -0.019 -0.1 125.1 49.29 10.9

09/07/2010 NO DATA 5.59 5.64 -0.037 1.5 124 49.83 12.3

09/13/2010 99.5 \*\*\*NO DATA\*\*\* 0.010 0.1 102.2 54.00 10.1

10/04/2010 99.4 5.96 9.03 0.018 0.6 117.5 53.25 7.6

11/01/2010 97.3 7.11 10.24 0.082 -0.1 126.0 53.45 10.9

11/29/2010 99.7 6.87 9.88 0.123 0.4 122.9 53.64 10.6

12/27/2010 103.7 7.03 10.09 0.005 0.2 130.6 55.20 10.7

**14) Other remarks/notes –** Use this section for further documentation of the research data set. Include any additional notes regarding the data set in general, circumstances not covered by the flags and comment codes, or specific data that were coded with the CSM “See Metadata” comment code. You may include the metadata worksheets here if so desired. You may also include information on major storms or precipitation events that could have affected the data recorded at the sample sites. Include the following excerpt:

Data are missing due to equipment or associated specific probes not being deployed, equipment failure, time of maintenance or calibration of equipment, or repair/replacement of a sampling station platform. Any NANs in the dataset stand for “not a number” and are the result of low power, disconnected wires, or out of range readings. If additional information on missing data is needed, contact the Research Coordinator at the reserve submitting the data.