Kachemak Bay Research Reserve (KAC) NERR Water Quality Metadata
July - December 2001
Latest Update: August 28, 2002

I. Data Set and Research Descriptors

1) Principle Investigators & Contact Persons:

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2) Entry Verification:

The 15-minute data are uploaded to the PC from the YSI Model 6200 Data Acquisition System via modem at 60-minute intervals. The text files are imported into Excel. Data that were recorded when the instruments were out of the water are deleted from the beginning and end of each record. These data are identified by field notes that document the times in and out of the water, and by unusual depth and salinity data (usually near zero). Graphs from Excel are evaluated for suspect data, as may result from probe failure. Notes are made of any unusual data, and sensors are reconditioned as necessary.

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 (outliers). In addition, a graphing capability is included to produce a single parameter and missing data graphs on a monthly basis.

Anomalous data are evaluated to determine whether to flag or delete the suspect values. Data are flagged if they fall outside the normal values seen at

the site or outside the range of measurements and accuracy established for the sensors. Data outside the "normal" range of water quality for a particular site were investigated for validity based on weather data, field observations, QC checks, and instrument diagnostics. Data are deleted if anomalies are attributed to sensor malfunction or fouling of the sensors by aquatic organisms, debris, or sediment. Fouling of sensors is detected by comparing in-situ sensor readings with measurements. In addition, sensor readings that differ significantly (>10%) from calibration standards suggest that the sensor was fouled during deployment. After corrections are made to the Excel worksheet (*.xls) and anomalies noted in the metadata report, the edited files are exported as tab delimited (*.txt) and sent to the CDMO. Monthly raw (*.dat) files are also sent to the CDMO for archival. Carl Schoch and Katie Gaut are responsible for these tasks.

3) Research Objectives:

The YSI electronic data loggers are programmed to measure the water temperature, specific conductivity, dissolved oxygen, pH, and turbidity conditions at 15-minute intervals. Presently, two instruments are located in Kachemak Bay. One is located on the north side of the bay at the end of the Homer spit. The second is located on the southern side of the bay in Seldovia.

The circulation in Kachemak Bay is driven primarily by the 10 meter tidal flux. Regional circulation is characterized by generally cyclonic ocean currents in the Gulf of Alaska flowing onto the shelf off of Cook Inlet. Nutrient rich bottom water is upwelled and mixed with surface water. These enriched waters stream into Kachemak Bay, the inflow tending to stay along the southern shore and the Seldovia instrument, while water flowing out of the bay stays along the north shore and the Homer instrument. These trapped coastal flows separate the bay into two distinct ecosystems.

As the inflowing water proceeds up the bay, fresh water runoff from the surrounding ice fields and watersheds dilute the salinity and increase the sediment load in the path of the Homer instrument. The inflowing water, in the path of the Seldovia instrument, therefore, initially supports a marine system

while the north out flowing water is more estuarine. The Kachemak Bay water quality instruments capture this difference with deployments along the north and south shores. Additional instruments deployed seasonally will monitor the degradation of the marine water along and across the axis of the bay. These data will be used to supplement studies on primary productivity, larval distribution, settlement, recruitment, growth rates, community dynamics, and biodiversity in the bay.

4) Research Methods:

Two YSI 6600 Sonde Probes connected to 6200 Data Acquisition Systems were used for data collection. The Data Acquisition System was connected via modem to a computer at the Research Reserve. The data is collected in 15-minute intervals, stored on the 6200 DCP and interrogated, or downloaded, by our office computer once an hour. Both instruments are housed in ABS pipe mounted vertically on the ferry docks of Homer and Seldovia. The pipes are positioned to ensure that the sensors are approximately 1 meter above the bottom.

Calibration and deployment occurred monthly at both sites, using methods outlined in the YSI Operating and Service Manual. After cleaning the data loggers, the dissolved oxygen (DO) membrane is replaced and allowed to stretch for 12 hours before the DO sensor is calibrated in water-saturated air. The pH, conductivity, depth, and turbidity sensors are calibrated using the following standards purchased from YSI (except depth): pH 7 and 10, conductivity standards of 50 mS/cm, turbidity standards of 0 and 100 NTU, respectively, and depth of 0.

5) Site Location and Character:

Kachemak Bay is located approximately 150 miles south of Anchorage, on the western shore of the Kenai Peninsula. Kachemak Bay, at 59.6oNand 151.5o W, is a temperate regional fjord with hydrographic conditions unique among the NERR system estuaries. The tidal range of 9 meters is the second largest in the world and salinity ranges from near zero at stream mouths to 34.0 at the entrance to the inner Bay. The bay is 24 miles wide at its mouth and approximately 36 miles long. The head of Kachemak Bay is located to the

northeast at the Fox River Flats, and the mouth lies to the southwest, along a line between Anchor Point and Point Pogibshi. Kachemak Bay is split into inner and outer Bays by the four mile long Homer Spit that extends into the Bay from the northern shoreline. The Kachemak Bay NERR comprises the entire inner Bay and the outer Bay. Water flows between the inner and outer Bays through a narrow opening formed between the Spit and the southern shoreline. The Bay has an average depth of 25 fathoms (150 feet) and a maximum of 100 fathoms (600 ft). Fresh water introduced primarily by the Fox, Bradley, and Martin rivers and Sheep Creek at the head of the Bay, flows along the northwest shore of the inner Bay. Peak release of fresh water from Bradley Creek alone results in flows of 1200 cubic feet per second. This peak flow occurs in conjunction with the warmest summer temperatures.
The Homer YSI data logger site is located on the north side of Kachemak Bay (latitude and longitude: 59.6029°N, 151.4081°W). It is mounted 1 meter above the bottom on the ferry terminal dock in water fluctuating between 1.8 and 10.8 meters. The bottom habitat is predominantly sand. Pollutants in the area are primarily due to the excessive boat traffic at the entrance of the Homer harbor. Since monitoring began in July 2001, salinity has ranged from 20.5 to 31.7 ppt at this site.

The Seldovia YSI data logger site is located on the south side of Kachemak Bay, approximately 15 miles from the Homer instrument (latitude and longitude: 59.4413°N, 151.7186°W). It is also situated on the ferry terminal dock, one meter above the bottom and located in water fluctuating between 5 and 13.3 meters. The access to Seldovia is limited to boat or air, as the site is remotely located off the highway system. The power and phone line connection are occasionally inoperative due to the remote location and position at the end of the power grid. The bottom habitat is predominantly rocky substrate. Pollutants in the area are minimal. Since monitoring began in August 2001, salinity has ranged from 30 to 35.9 ppt at this site.

6) Data Collection Period:

Monitoring at the Homer site began on July 12, 2001 at 16:15. Monitoring at the Seldovia site began on August 17, 2001 at 15:15. Deployment and retrieval dates and times for following months are listed below:

Began	Ended
Homer Site	
07/12/01, 07:45	08/18/01, 16:15
08/22/01, 15:30	09/09/01, 15:45
09/09/01, 16:15	10/06/01, 16:00
10/10/01, 07:45	11/27/01, 08:45
11/27/01, 10:30	01/07/02, 16:15
Seldovia Site	
08/17/01, 15:15	09/08/01, 09:30
09/10/01, 19:30	10/09/01, 05:30
10/15/01, 06:45	12/04/01, 11:00
12/04/01, 11:15	12/11/01, 11:00
12/11/01, 11:30	01/11/02, 11:30

7) Distribution

According to the Ocean and Coastal Resource Management Data Dissemination Policy for the NERRS System-wide Monitoring Program, NOAA/ERD retains the rights 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 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 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 at the individual NERR site, 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. Data are available in text tab-delimited format, Microsoft Excel spreadsheet format and comma-delimited format.

8) Associated Researchers and Projects:

Additional instruments deployed seasonally monitor the degradation of the marine water along and across the axis of the bay. These data are being used to supplement studies on primary productivity, larval distribution, settlement, recruitment, growth rates, community dynamics, and biodiversity in the bay.

In August 2000 and 2001, the spatial distribution of Nereocystis leutkeana kelp beds was mapped in the Kachemak Bay Research Reserve using low altitude aerial photography. The photos were taken using a medium-format camera and a light fixed-wing aircraft to produce vertical and oblique digital imagery of individual kelp beds. These images were geometrically corrected and the kelp beds delineated. The polygon data were entered into a GIS so that estimates of areal extent and adjacency can be compared among beds and among years. Results to date indicate a >10% decline in surface area of kelp beds. This was mostly due to the inundation of rocky habitat by sand over a small subtidal bench near the Homer Spit. The variability of each kelp bed area and density will be tracked over time as an indicator of change and kelp community health. We intend to continue these surveys for a minimum of ten years to track the kelp beds through at least one major cycle of known oceanic variability (the El Nino/Southern Oscillation). The correlative work stemming from aerial surveys will help focus our experimental studies to determine the mechanisms of observed changes in population sizes and density. In order to attribute the shifts in spatial patterns to specific agents of change, on-going research by our science staff is focusing on the effects of light limitation, salinity, and herbivory on kelp growth rates.

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 3Reading 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 that identifies measurements and units for each column.

10) Coded variable indicator and variable code definitions:

File definitions: YSI deployment site/month/year (ex: ho0701 = Homer data from July of 2001).
HO = Homer SE = Seldovia

11) Data anomalies:

July 2001

Homer
a) No data were logged during the following times possibly due to a power surge or other interruption in transmission of data:
07/12, 08:00:00
07/17, 09:15:00 - 13:45:00

b) During the following times, spikes in turbidity are suspect. These reading were possibly caused by a clump of plant matter or sediment passing by the sensor optics during the sampling interval.
7/14, 22:00:00 (49 NTU)
7/27, 08:30:00 (62 NTU)
7/30, 08:30:00, 09:15:00, 19:30:00 (68, 56, 52 NTU)
7/31, 12:45:00, 13:00:00, 14:15:00, 22:45:00, 23:45:00 (56, 68, 66, 37, 45 NTU)

August 2001

Homer

a) During this month, intensive construction was being performed on the pier where the instrument was located. Large spikes in the turbidity could be a result of this disturbance during the following time periods:
8/1, 07:00:00, 07:30:00, 21:30:00 (452, 211, 70 NTU)
8/6, 23:45:00 (578 NTU)
8/17, 08:30:00 (513 NTU)
8/18, 12:15:00 - 2:30:00, 13:30:00 - 14:00:00, 16:15:00 (883, 202, 625, 880, 271, 1295 NTU)

b) Specific Conductivity and DO concentration data were not logged during the following period due to an programming/setup incompatibility between the 6200 DCP and 6600 sonde:
8/14, 06:45:00 - 8/18, 16:15:00
8/22, 15:30:00 - 8/23, 05:45:00
8/23, 18:30:00 - 8/24, 05:00:00
8/24, 17:15:00 - 8/25, 06:00:00

c) Because of heavy construction on the pier where the instrument was located, the instrument was retrieved during the following time period:
8/18, 16:30:00 - 8/22, 15:15:00

d) During deployment that began on 08/22, there was a suspected problem with DO membrane integrity or puncture on 08/25 (spikes of 288% at 23:00). All DO

data generated from this puncture during the deployment were deleted during the
following dates/times:
8/25, 06:15:00 - 9/09, 15:45:00

e) At the following time there is an unexpected dip in DO% and concentration
that is suspect:
8/13, 18:45:00 (39.8% and 3.7 ms/cm).

f) For an unknown reason, on 8/26, there are two sets of data for the entire
day. These data are duplicates and one set is deleted.

g) During the following periods, pH falls below the normal range usually
observed for this site (pH 7.8-8.2). The causes of the low readings are not
known at this time and are suspect.
8/14, 23:15:00 - 8/15, 00:00:00
8/25, 06:45:00 - 14:45:00, 20:30:00 - 22:45:00
8/26, 02:00:00 - 02:15:00

h) During the following time period there is an unexplained dip in DO % that
is suspect:
8/18, 12:00:00 - 12:30:00 (33.6, 23.8, and 44.4 %).

i) No data were logged during the following times possibly due to a power
surge or other interruption in transmission of data:
8/23, 00:15:00, 06:00:00 - 18:15:00
8/24, 05:15:00 - 17:00:00

Seldovia

a) Turbidity data showed spikes on the following times are regarded as suspect:
8/27, 19:45:00 (17 NTU)
8/31, 15:30:00, 17:00:00 - 17:30:00, 18:15:00 - 19:30:00, 20:30:00 (14-50 NTU)

b) The Specific Conductivity and DO mg/L data were not logged during the
entire deployment period due to a programming/setup incompatibility between the
6200 DCP and 6600 sonde.

c) No data were logged during the following times possibly due to a power
surge or interruption in relaying data:
8/20/01, 05:45:00 - 06:30:00
8/20/01, 07:30:00 - 08:00:00
8/21/01, 00:30:00 - 08/24/01, 17:00:00

8/25/01, 05:45:00 - 06:00:00

September 2001

Homer

a) The following records are deleted turbidity readings greater than 1000 NTU,
possibly due to debris or wiper covering the sensor optics during the sampling
interval.
09/17, 06:15:00, 06:45:00 (1725, 1652 NTU)
09/18, 10:15:00 (1726 NTU)
09/20, 07:30:00, 15:15:00 (1727, 1320 NTU)

b) The following records include turbidity spikes that are suspect:
09/17, 09:30:00 (30 NTU)
09/18, 08:45:00 (532 NTU)
09/20, 00:15:00, 07:00:00, 09:15:00 (749, 289, 473 NTU)
09/22, 23:15:00, 23:30:00 (71, 56 NTU)
09/25, 13:15:00 (42 NTU)
09/26, 17:15:00 - 17:45:00 (53,105,53 NTU)
09/28, 06:45:00 (33 NTU)

c) No data were logged during the following times due to sonde maintenance:
09/16, 09:15:00 - 10:00:00

d) An increase in DO % is suspect during the following period:
09/07, 18:15:00 - 09/08 11:45:00 (122-165 NTU)

Seldovia

a) No data were reported during the following periods possibly due to a power
surge or interruption in transmission of data.
09/11, 09:45:00-10:00:00
09/12, 09:45:00
09/16, 09:45:00 - 10:30:00
09/17, 14:45:00 - 15:15:00
09/18, 06:45:00, 10:45:00, 11:00:00
09/19, 05:45:00, 06:00:00
09/20, 06:45:00 - 07:15:00

b) Specific Conductivity and DO concentration data were not logged during
the following period due to a programming/setup incompatibility between the 6200
DCP and 6600 sonde:
09/01, 00:00:00 - 09/16, 09:30:00

c) Data recorded on 09/08, 09:45 was probably measured while probe was out of

water (salinity reading of 0.6, depth reading of 0.4, etc) and were deleted.

d) Following the sonde deployment on 09/10, 19:30, incompatibilities of programming and setup was experienced between the 6200 DCP and 6600 sonde. Due to these differences in setup, the column headings are reported incorrectly on the raw data, but properly aligned for the edited version.

e) On 09/11, a duplicate 07:30:00 reading was reported for an unknown reason. Both of the readings were deleted.

f) DO percentage reported out-of-range values during the following period most likely due to column heading mislabeling. These data were deleted.
09/11, 07:30:00 - 09/12, 09:30:00

g) Turbidity values were reported out-of-range during the following period most likely due to mislabeled column headings due to 6200/6600 setup incompatibility. These data were deleted.
09/10, 19:30 - 09/11, 09:30:00

h) From September through October, DO was higher than normal, however it was left in the dataset in order to compare the data for trends.

October 2001

Homer

a) Turbidity spikes at the following times are suspect:
10/3, 02:45:00 (823 NTU)
10/5, 23:45:00 (788 NTU)
10/6, 15:00:00 (490 NTU)
10/19, 02:00:00, 10:00:00 (237, 982 NTU)

b) After deployment of sonde, setup incompatibility between the 6200 and 6600 caused mislabeling of column headings. The ph mV was left on, causing the turbidity reading to be unreported during the following period:
10/10, 07:45:00 - 10/15, 06:00:00

c) Following the above period, the pH mV reading was disabled which allowed turbidity reading to again be reported correctly following 10/15, 06:15.

d) No data were reported during the following periods possibly due to a power surge or interruption in transmission of data.

10/14, 08:15:00 - 08:45:00

Seldovia

a) No data were reported during the following periods possibly due to a power surge or interruption in transmission of data.:
10/4, 9:45:00 - 10:00:00, 16:45:00 - 17:15:00

b) All data abruptly reported out of range during the following period due to an unknown cause and deleted:
10/8, 9:15:00 - 10/9, 5:30:00

c) From October through December, strong winds and dropping temperatures resulted in higher salinities for this site.

d) From September through October, DO was higher than normal, however it was left in the dataset in order to compare the data for trends.

November 2001

Homer

a) Turbidity spikes are suspect at the following times:
11/14, 17:30:00, 17:45:00, 18:15:00, 18:30:00 (1388, 907, 1383, 1387 NTU)
11/15, 07:30:00 (1386 NTU)
11/16, 05:30:00 (122 NTU)
11/17, 18:30:00 (1381 NTU)
11/22, 22:00:00 (425 NTU)
11/23, 00:30:00, 08:30:00 (1242, 1397 NTU)
11/28, 18:00:00 (265 NTU)

b) Suspect values for all probes are reported at the following time, most likely an error experienced while correction to programming between the 6600 and 6200 was taking place:
11/29, 13:00:00

c) Setup incompatibility between the 6200 and 6600 caused mislabeling of column headings. The ph mV, DO Charge, and Battery readings were left on from calibration, causing the DO concentration and salinity readings to be unreported during the following period:
11/27, 10:30:00 - 11/29, 13:00:00

c) Correction to the column headings caused a interruption in transmission of
data during the following period:
11/29, 13:15:00 - 14:15:00

d) No data were reported during the following periods possibly due to a power
surge or interruption in transmission of data:
11/23, 09:00:00
11/27, 17:15:00

e) Depth data were reported in feet during beginning period of deployment.
The data were converted to meters post-deployment during the following period:
11/27, 10:30:00 - 11/29, 13:00:00

f) Shift in DO on 11/27 1030 through end of the year is perhaps a result of
instrument drift from previous deployments in October and November.

Seldovia

a) Dissolved oxygen concentration and percentage readings show an unexplained
dip at the following times that are suspect:
11/11, 13:45:00 (8.2 mg/L, 85.2 %)

b) The following turbidity spikes are suspect:
11/06, 20:00:00 (151 NTU)
11/08, 03:15:00, 17:45:00 (433, 455 NTU)
11/12, 14:15:00 (1374 NTU)
11/19, 19:00:00 (104 NTU)
11/25, 22:15:00, 23:00:00 (78, 271 NTU)
11/28, 03:15:00 (58 NTU)
11/29, 16:15:00 (258 NTU)

c) No data were logged during the following times possibly due to a power
surge or interruption in transmission of data.
11/29/01, 14:30:00

d) From October through December, strong winds and dropping temperatures resulted
in higher salinities for this site.

December 2001

Homer

a) No data were logged during the following times possibly due to a power
surge or interruption in transmission of data:
12/17, 17:15:00

12/21, 08:00:00

b) Turbidity spikes are suspect at the following times:
12/12, 09:00:00, 09:15:00 (264, 125 NTU)
12/16, 02:00:00 (1391 NTU)
12/29, 06:00:00 (114 NTU)

Seldovia

a) Deployment of new sonde during the following period resulted in no data collection. The internal chip of the sonde was defective and returned to YSI for reprogramming.
12/4, 11:15:00 - 12/11, 11:00:00

b) Deployment of calibrated sonde during the following period resulted in no data collection. The modem connection was down and recovered after rebooting of machine on 1/11.
12/11, 11:30:00 - 1/11, 11:30:00

c) From October through December, strong winds and dropping temperatures resulted in higher salinities for this site.

12) Missing Data:

Missing data are denoted by a period in the data set. Data are missing due to equipment failure where no probes deployed, maintenance/calibration of equipment, elimination of obvious outliers, or elimination of data due to calibration (both pre and post) problems. For more details about missing data, contact the Research Coordinator at the Kachemak Bay Research Reserve.

13) Post Deployment Information

Control Sonde End of Deployment Readings:
** n/r = not recorded**

Site	Date	Conductivity (Std:50.0)	pH (Std:7)	pH (Std:10)	Turbidity (Std:100)	DO (Air Sat) (Std:100%)
HO	08/18/01	50.23	n/r	n/r	n/r	n/r
	09/09/01	n/r	n/r	n/r	n/r	n/r
	10/06/01	44.01	6.89	10.38	123.9	95.7
	11/27/01	50.0	7.04	9.96	98.6	n/r
	1/07/02	n/r	n/r	n/r	n/r	n/r

SE	09/08/01	n/r	n/r	n/r	n/r	n/r
	10/09/01	49.23	7.14	9.8	105.0	116.7
	12/04/01	55.7	6.86	9.88	97.7	101.6

End of Deployment Post-Calibration Readings in Standard Solutions:

Site	Date	Conductivity (Std:50.0)	pH (Std:7)	pH (Std:10)	Turbidity (Std:100)	DO (Air Sat) (Std:100%)	Chloro (Std:0)
HO	07/31/01	50.00	7.0	10.0	100.0	100.0	0.0
	08/31/01	50.00	7.0	10.0	100.0	100.0	0.0
	09/30/01	50.00	7.0	10.0	100.0	100.0	0.0
	11/22/01	50.0	7.0	10.0	100.0	100.0	0.1
	1/08/02	50.0	7.0	10.0	100.0	100.0	0.0
SE	08/31/01	50.0	7.0	10.0	100.0	100.0	0.0
	09/16/01	50.0	7.0	10.0	100.0	100.0	0.0
	11/22/01	50.0	7.0	10.0	100.0	100.0	-0.1
	01/12/02	50.0	7.0	10.0	100.0	100.0	0.0

14) Other Remarks/Notes

a) In conversion to excel format for editing, the following raw .dat files were
accidentally erased:
Homer: 11/13, 15:15:00 - 11/22, 08:00:00

Seldovia: 08/21, 00:30:00 - 08/24, 17:00:00
11/13, 15:45:00 - 11/22, 08:30:00

b) During the first few months of monitoring, post deployment calibration checks
were not initially made.
c) YSI standards were used for all calibrations.