Padilla Bay (PDB) NERR Water Quality Metadata

Bay View Channel site: January to December 1997
Joe Leary Slough site: January to December 1997
No Name Slough site: January to December 1997

Latest update: 30 March 2000

I. Data Set and Research Descriptors

1. Principal investigator and contact persons

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2. Entry verification

The data are downloaded from the YSI 6000s to an IBM compatible PC. Graphs of all data are printed using PC6000 software and are examined for suspect, anomalous, or outlying data. Files are converted to Macintosh Excel files and edited for transfer to the NERRS CDMO. Files are merged to contain one full month of data. Missing data (from maintenance and downloading down time) are inserted into the spreadsheet and are denoted by a period (.). Suspect data are deleted and replaced by periods (.). After formatting the data, some files are more closely checked for anomalies in DeltaGraph Pro® in lieu of CDMO Excel macros. Edited and raw files are archived on a Macintosh hard drive at Padilla Bay NERR. This process of entry verification was completed by Robin Cottrell, Nicole Rutherford, Heather Defenderfer, and Douglas Bulthuis for the 1997 data. Final verification of this metadata documentation were completed by Douglas Bulthuis.

3. Research Objectives

The Bay View Channel YSI 6000 has been set out to detect and monitor short-term variability and long-term changes in Padilla Bay. The Joe Leary Slough YSI 6000 has been set at the mouth of the slough to measure the effects of tidal "closure" of the tide gates on water in the slough and to detect long-term changes in water quality in the slough associated with implementation of a

non point source pollution watershed action plan. The No Name Slough YSI 6000 has been set at the mouth of No Name Slough to detect seasonal and long-term changes in water quality of the slough associated with residential development in the watershed and changes associated with experimental farming methods designed to reduce non-point source pollution to No Name Slough. Measurements are taken every 30 minutes at all three sites unless otherwise noted in data anomalies.

4. Research methods

A YSI 6000 was deployed in Joe Leary Slough in a vertical position, 0.25 m above the bottom of the slough, in a 4 in. diameter PVC pipe which has holes and slits drilled in it to allow water circulation around the probes. The PVC pipe is attached to a steel pipe which was driven into the sediment. During the course of examining the data during the first half of 1997, it was noted that on some occasions the dissolved oxygen (and to a lesser extent turbidity and pH) seemed to change during the course of deployment. Accumulation of sediment and restricted flow through the holes of the PVC pipe were suspected but could not be independently confirmed. On June 25, 1997, the PVC pipe was removed and larger holes cut in the pipe in the vicinity of the sensors. Thus, after June 25, 1997, there was probably greater flow of Joe Leary Slough water past the sensors. Data from January 1 through June 25 should be interpreted with some caution because of the possibility of restricted water flow past the sensors.

A YSI 6000 was deployed in Padilla Bay in a tributary of Bayview Channel. It was deployed using the same design as that in Joe Leary Slough, except that the PVC pipe was attached to two steel pipes. The depth of the YSI was -1.1 m (depth below MLLW) and about 0.75 m above the bottom along the sloping edge of a small channel draining the surrounding intertidal flats.

A YSI 6000 was deployed in No Name Slough using the same design as that in

Joe Leary Slough, except that the PVC pipe was attached to a piling supporting a pump house in front of the tide gates. The YSI 6000 sensors are about 0.20 m above the bottom.

In all cases, measurements of temperature, specific conductivity, salinity, percent saturation of dissolved oxygen, depth and pH are recorded every half-hour. At the end of each sampling period, the YSI 6000 is brought back into the laboratory for downloading, cleaning, and recalibration.

All calibrations are conducted according to the protocols in the YSI 6000 Operation and Service Manual. For the conductivity calibration a conductivity standard of 50 mS/cm was used. The pH calibration is a 2-point calibration using standard pH buffer solutions with a pH of 7 and 10. The KCl solution and Teflon membrane on the dissolved oxygen probe are changed prior to each YSI 6000 deployment and the new oxygen membrane is allowed to soak overnight in water before calibration.

5. Site location and character

General Padilla Bay (48° 30' N; 122° 30' W) is a shallow embayment in northern Puget Sound. The tide flats are dominated by the eelgrass Zostera marina, which covers approximately 3,000 ha. Zostera japonica, a recent invader to the region, now covers about 350 ha of the bay. Tides are mixed semi-diurnal with a mean range of 1.55 m. Salinity varies from about 15 to 30 PSU.

Padilla Bay is an "orphaned" estuary in that the Skagit River no longer empties directly into it. Most of the land in the 9300 ha Padilla Bay watershed is agricultural, and is drained by four sloughs which empty into the bay. The salinity in Padilla Bay reflects both the sloughs that flow into the bay and the greater Puget Sound-Georgia Basin estuary in which Padilla Bay is located. Major freshwater flows into this area of the Puget Sound-Georgia Basin estuary come from the Fraser and Nooksack Rivers to the north and from the Skagit River to the south.

Joe Leary Slough Site (48° 31' 05" N; 122° 28' 25" W) Joe Leary Slough drains land which is predominantly annual crop agriculture and pasture land with some low density housing. The slough is characterized by high fecal and nutrient inputs, high turbidity, and low dissolved oxygen concentrations. During the summer, there is low flow and the depth ranges from 0.5-1.5 m. During winter flooding, the slough can reach a depth of 4 m. There is a dam at the mouth of the slough with twelve 4 ft diameter outfall pipes that have one-way hinged tide gates. Saline water from Padilla Bay seeps through the tide gates during high tide. The bottom of the slough is composed of very soft sediment, which is periodically dredged. A YSI 6000 is deployed on the freshwater side of the tide gates at a depth of about 0.25-m above the bottom.

Bayview Channel Site (48° 29' 47" N; 122° 30' 07" W) Bayview Channel, a major Padilla Bay tributary/distributary, floods and drains intertidal flats including eelgrass beds, mats of macroalgae, and flats without macrovegetation. The YSI 6000 is located in a tributary channel to Bayview Channel. The tributary drains predominately eelgrass (Zostera marina and Z. Japonica) covered intertidal flats. Bottom sediments beneath the YSI 6000 are fine silt and clay overlying sand. The YSI 6000 is deployed in a black PVC pipe that is attached to two steel pipes set in the sediment. When deployed, the datasonde is located about 0.75 m above the bottom. Pollutants entering the bay include general non-point source, agricultural non-point source, and fecal coliform bacteria from agriculture, failing septic tanks and wildlife.

No Name Slough Site (48° 28' 09" N; 122° 28' 03" W). No Name Slough drains a 990 ha watershed composed of an "upland" portion of rural, pasture, woodlot, and low density housing land use on a glacial moraine; and a "floodplain" portion of intensive annual crop agriculture on drained marsh land. The slough water is characterized by periodic high turbidity, high salinity in the lower part of the slough most of the year, and algal blooms in the lower slough during the summer. During summer, there is little or no freshwater flow in the slough and depth ranges from 0.25-0.50 m. During winter flooding, water

depth at the mouth can be as high as 2 m. No Name Slough flows into Padilla Bay through 4 tide gates that have been placed in the sea dike. Saline water seeps through the tide gates, under the dike, or through the dike so that water is usually partially saline at the mouth of the slough on the "freshwater" side of the dike where the YSI 6000 is located. Two pumps are located at the mouth of No Name Slough. These pump water over the dike into Padilla Bay during times of high rainfall and high tides when water depth in the slough reaches preset depths. Bottom sediments in No Name Slough are very soft. The YSI 6000 is deployed 0.20 m above the bottom on the freshwater side of the dike on one of the piles supporting the pump house.

6. Data collection period

Data collection was continuous from January 1 to December 31 at all sites except for times of downloading, cleaning and recalibration as noted in the missing data section.

Joe Leary Slough (JL)	BayView Channel (BY)
Deployment Date/Time Retrieval	Deployment Date/Time Retrieval
12/19/96 11:30:00 to 01/16/97 14:30:00	12/06/96 11:30:00 to 01/24/97 09:30:00
01/16/97 15:00:00 to 02/04/97 11:30:00	01/24/97 10:30:00 to 01/25/97 14:30:00
02/04/97 12:00:00 to 02/12/97 17:30:00	03/19/97 11:00:00 to 05/02/97 12:30:00
02/27/97 14:00:00 to 03/13/97 12:30:00	05/02/97 13:00:00 to 06/26/97 09:30:00
03/13/97 13:00:00 to 03/27/97 12:30:00	06/26/97 10:00:00 to 07/23/97 08:00:00
03/27/97 13:00:00 to 04/15/97 14:00:00	07/24/97 08:30:00 to 08/20/97 06:00:00
04/17/97 13:00:00 to 04/30/97 09:30:00	08/20/97 06:30:00 to 09/19/97 08:30:00
05/07/97 11:00:00 to 05/22/97 09:30:00	09/19/97 09:00:00 to 10/10/97 13:00:00
05/23/97 10:00:00 to 06/11/97 13:30:00	10/10/97 14:00:00 to 11/13/97 13:00:00
06/12/97 15:30:00 to 06/25/97 12:30:00	11/13/97 14:00:00 to 11/25/97 13:30:00
06/25/97 14:30:00 to 07/16/97 12:30:00	11/25/97 14:30:00 to 01/08/98 14:30:00
07/17/97 12:00:00 to 07/29/97 14:00:00	
07/30/97 13:00:00 to 08/13/97 13:30:00	
08/13/97 14:00:00 to 08/27/97 11:00:00	

08/27/97 12:00:00 to 09/17/97 11:30:00
09/17/97 12:30:00 to 10/01/97 10:30:06
10/01/97 11:30:00 to 10/22/97 11:00:00
10/22/97 12:00:00 to 10/23/97 09:30:00
10/23/97 10:00:00 to 11/18/97 13:30:00
11/18/97 14:00:00 to 12/02/97 10:00:00
12/02/97 10:30:00 to 12/22/97 13:00:00
12/23/97 13:00:00 to 01/13/98 10:30:00

7. Associated researchers and projects
None

II. Physical Structure Descriptors

8. Variable sequence, range of measurements, units, resolution, accuracy:

Variable Name	Range of Measurements	Resolution	Accuracy
DATE	1-12, 1-31, 00-99	(Month, Day, Year)	n/a
HOUR	0-24, 0-60, 0-60	(Hour, Minutes, Seconds)	n/a
TEMP	-5 to 45 (°C)	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 (ppt)	0.01ppt	±1.0 % of reading or 0.1ppt, whichever is greater
DOSAT	0-200 (% saturation)	0.1 % air saturation	±2 % air sat.
DOSAT	200-500 (% saturation)	0.1 % air saturation	±6 % air sat.
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 (Level)	0-9.1 (m)	0.001 m	±0.018 m
PH	2-14	0.01 units	±0.2 units
TURB	0-1000 NTU	0.1 NTU	±5% of reading or 2 NTU, whichever is greater

*During 1997 records were kept of the atmospheric pressure during calibration of depth and the apparent depth after each two to four week deployment. The data indicated that depth readings could read as much as 0.28 m above or below true depth. Therefore, although the sensor may accurately read ± 0.001 m, changes in atmospheric pressure when deployed indicate depth may be ± 0.3 m.

9. Coded variable code definitions
JL - Joe Leary Slough Site; BY - Bayview Channel Site; NN - No Name Slough Site.

10. Data anomalies

January 1997

JL: Water flow past the sensors may have been restricted throughout the month-see note (above) in "4. Research Methods". The cause for erratic negative and positive turbidity values from 0000 on 1 Jan through 1430 on 16 Jan is not known; the data were removed. The cause for anomalous turbidity values of 1114 at 1930 and -914 at 2100 on 29 Jan are not known; the data were removed. Erratic pH values up to 0.5 pH units lower than values recorded before or after were observed throughout January, the cause is not known. The cause for negative dissolved oxygen readings at 1300 on 14 Jan, 0900 on 15 Jan, and 1000, 1100, and 1430 on 16 Jan are not known; the data were removed. Some very low dissolved oxygen concentrations were recorded from 1 Jan through 1430 on 16 Jan; the cause is unknown; post-deployment checks of the dissolved oxygen probe indicated 90% in water saturated air following the deployment.

BY: The cause for an anomalous turbidity value of 653 at 1730 4 Jan is not known; the datum was removed.

NN: Negative temperatures were recorded from 0530 to 0730 on 26 Jan and from 0300 to 0800 on 27 Jan. The cause for erratic high and negative turbidity values a during the following times are not known; the data were removed: 0000 to 1500 on 1 Jan, 1730 6 Jan to 0300 7 Jan, 1000 to 1430 on 18 Jan, 2330 19 Jan to 0200 20 Jan, 0600 to 0730 on 23 Jan, and 2000 29 Jan to 0900 30 Jan.

February 1997

JL: Water flow past the sensors may have been restricted throughout the month-see note (above) in "4. Research Methods". Turbidity values from 1200 on 4 Feb through 1330 on 12 Feb may have been reading about 25% high because old solution had been used for calibration. High turbidity values from 1400 through 1700 on 12 February may have been related to impending battery failure; data were deleted. Dissolved oxygen data from 1400 on 27 Feb through 2330 on 28 Feb may be somewhat low: post-deployment checks of the dissolved oxygen probe indicated 80.3% in water saturated air following deployment; the probe surface also needed to be reconditioned after deployment.

BY:

NN: The cause for erratic high and negative turbidity values a during the following times are not known; the data were removed: 0630 on 1 Feb, 0630 to 1400 on 12 Feb, 0600 to 2200 on 14 Feb, 0200 to 0400 on 17 Feb, and 1100 to 1700 on 19 Feb.

March 1997

JL: Water flow past the sensors may have been restricted throughout the month-see note (above) in "4. Research Methods". Dissolved oxygen data from 0000 on 1 Mar through 0430 on 4 Mar may be somewhat low: post-deployment checks of the dissolved oxygen probe indicated 80.3% in water saturated air following deployment; the probe surface also needed to be reconditioned after deployment. The dissolved oxygen data from 0500 on 4 Mar through 1230 on 13 Mar were deleted because the probe appeared to be failing and could not be calibrated in the lab following the deployment. Low dissolved oxygen values, which

may not be accurate, were observed from 2330 on 19 Mar through 1230 on 27 Mar and negative dissolved oxygen data at 1430 on 21 Mar and 1030 on 22 Mar were deleted; the cause for the low and negative dissolved oxygen readings is unknown but may be related to low flow or accumulation of sediment near sensors; low dissolved oxygen values were associated with lower salinity and possibly higher rainfall. Low dissolved oxygen values were observed from 1200 on 29 Mar through 2330 on 31 Mar; cause is unknown; data were deleted. Negative depth readings were recorded at the following times and were probably related to changes in barometric pressure after calibration in the lab (see note above in 9. Variable identifier, data type, resolution and accuracy); 1700-1800 on 30 Mar. Negative turbidity values were recorded 1330 and 1500 on 3 March associated with very high turbidity values. The cause(s) for erratic negative and very high turbidity values from 2130 on 7 Mar through 1230 on 13 Mar and from 1100 on 14 Mar through 1230 on 27 Mar are not known; the data were removed. The cause for high and erratic turbidity values from 1200 on 29 Mar through 2330 31 Mar is not known; the data were removed.
BY: The cause for an anomalous turbidity value of -167 at 0930 25 Mar is
not known; the datum was removed.
NN:

April 1997
JL: Water flow past the sensors may have been restricted throughout the month-see note (above) in "4. Research Methods". Low dissolved oxygen values were observed from 0000 on 1 Apr through 0800 on 10 Apr; cause is unknown but may be related to low flow or accumulation of sediment near sensors; data were deleted. Negative depth readings were recorded at the following times and were probably related to changes in barometric pressure after calibration in the lab (see note above in 9. Variable identifier, data type, resolution and accuracy); 1400-1600 on 26 Apr, 1500-1730 on 28 Apr, and 1800-1830 on 29 Apr. The cause for high and erratic turbidity values from 0000 on 1 Apr through 0800 on 10 Apr is not known; the data were removed. Negative turbidity values were observed at the following times; cause is unknown but may be related to low flow or accumulation of sediment near sensors; data were deleted: 0600, 0630, 0800-0900 on 11 Apr, 0830-0930, 1030 on 12 April, 1030, 1100 on 14 April. Erratic negative and very high turbidity values from 0600 through 1400 on 15 April were removed; cause unknown. High turbidity values at 1330 and 1400 on 24 Apr may have been caused by disturbance of the datasonde when checking the deployment.
BY: The cause for an anomalous turbidity value of 384 at 1500 10 Apr is not known; the datum was removed. Slight negative values for turbidity were recorded on April 15, 18, 23, 24, 25, and 28. The cause is not known but these slight negative turbidity values probably indicate drift of the zero line during deployment.
NN: Anomalous and erratic turbidity values were recorded from 1500 on 24
April to 2330 on 30 April; a cracked probe was noted when the datasonde was retrieved; the data were removed.

May 1997

JL: Water flow past the sensors may have been restricted throughout the month-see note (above) in "4. Research Methods". The dissolved oxygen data may be low or unreliable from 1000 23 May through 2330 31 May because the sensor read 85.5% dissolved oxygen in water saturated air in a post-deployment calibration check. Negative dissolved oxygen values were recorded sporadically throughout the month and were deleted from the data set (See below "12. Missing data" for specific times and dates.)
BY: The dissolved oxygen data may be low or unreliable throughout the month because the sensor read 78.7% dissolved oxygen in water saturated air in a post-deployment calibration check. No turbidity data from 1400 on 23 May through 2330 on 31 May because erratic values were recorded and a faulty wiper was discovered at the end of the deployment.
NN: A negative depth reading was recorded at 1430 on 23 May and was probably related to changes in barometric pressure after calibration in the lab (see note above in 9. Variable identifier, data type, resolution and accuracy.) Anomalous and erratic turbidity values were recorded from 0000 1 May to 2330 31 May; a cracked probe was noted when the datasonde was retrieved; the data were removed. High diurnal dissolved oxygen fluctuations during May were associated with a filamentous algal bloom in No Name Slough.

June 1997
JL: Water flow past the sensors may have been restricted from 0000 1 Jun
through 1400 on 25 Jun-see note (above) in "4. Research Methods". The dissolved oxygen data may be low or unreliable from 0000 1 Jun through 1330 on 11 Jun because the sensor read 85.5% dissolved oxygen in water saturated air in a post-deployment calibration check. Negative dissolved oxygen values were recorded sporadically throughout the month and were deleted from the data set (See below "12. Missing data" for specific times and dates.) A negative depth reading was recorded at 1230 on 25 Jun and was probably related to changes in barometric pressure after calibration in the lab (see note above in 9. Variable identifier, data type, resolution and accuracy.) The
causes for negative turbidity values at 1230 on 7 Jun and at 2230 on 16 June are not known; the data were removed.
BY: No turbidity data from 0000 on 1 June through 0930 on 26 June because erratic values were recorded and a faulty wiper was discovered at the end of the deployment. The dissolved oxygen data may be low or unreliable from 00:00 on 01 Jun through 09:30 on 26 June because the sensor read 78.7% dissolved oxygen in water saturated air in a post-deployment calibration check. pH data from 10:00 on 26Jun through 23:30 on 30Jun may be unreliable because post-deployment calibration indicated a reading of 7.31 in pH 7.00 standard. The cause for an anomalous turbidity value of 96 at 1430 26 Jun is not known; the datum was removed. No dissolved oxygen from 1000 on 26 June through 2330 on 30 June because at the end of the deployment it was found that the oxygen membrane was punctured.
NN: Anomalous and erratic turbidity values were recorded from 0000 1 Jun
to 0900 on 4 Jun; a cracked probe was noted when the datasonde was

retrieved; the data were removed. High diurnal dissolved oxygen fluctuations during June were associated with a filamentous algal bloom in No Name Slough.

July 1997
JL: The cause for single anomalous turbidity values of 0 at 830 on 15 July
and of 177 at 1800 on 22 July are not known; these data were removed.
BY: No dissolved oxygen from 0000 on 1 July through 0800 on 23 July because at the end of the deployment it was found that the oxygen membrane was punctured. The cause for anomalous turbidity values of 115 at 1530 on 14 July and of 38 at 1930 on 18 July are not known; these data were removed.
NN: High diurnal dissolved oxygen fluctuations during July were associated
with filamentous algal blooms in No Name Slough. The cause for an anomalous high turbidity value at 0130 on 16 July is not known.

August 1997
JL: No dissolved oxygen data from 1400 on 13 Aug through 1100 on 27 Aug because the data were considered unreliable because the sensor read 78.4% dissolved oxygen in water saturated air in a post-deployment calibration check. The dissolved oxygen data may be low or unreliable from 1200 on 27 Aug through 2330 on 31 Aug because the sensor read 80.3% dissolved oxygen in water saturated air in a post-deployment calibration check. Isolated anomalous turbidity values were deleted (cause unknown) at the following times: readings of 210 at 1530 on 5Aug, 687 at 0100 20Aug, -570 at 1800 on 23Aug, -146 at 0330 on 27Aug, 166 at 1030 on 27Aug.
BY: No turbidity data from 0630 on 20 Aug through 2330 on 31 Aug because the turbidity probe failed.
NN: No dissolved oxygen data from 1400 on 20 Aug to 2330 on 31 Aug because dissolved oxygen probe was broken on retrieval.

September 1997
JL: The dissolved oxygen data may be low or unreliable from 0000 on 1 Sep
through 1130 on 17 Sep because the sensor read 80.3% dissolved oxygen in water saturated air in a post-deployment calibration check. The times that the sensors were read and recorded were 6 seconds past the half hour from 0930 18 Sep through 2330 on 30 Sep. The cause for a single negative dissolved oxygen value at 1930 on 8 Sep is not known; the datum was removed. The cause for single anomalous turbidity value of -218 at 0300 on 24 Sep is not known; the datum was removed.
BY: From the 10th to the 30th of September the dissolved oxygen values are
lower than usual; the cause is unknown; post-deployment checks of the dissolved oxygen probe indicated 90.5% and 92.5% in water saturated air following the 2 deployments. The dissolved oxygen data from 0900 on 19 September through 2330 on 30 September should be interpreted with caution: post-deployment diagnostics of the dissolved oxygen probe after this deployment were acceptable, but the probe

failed after the next deployment. Slight negative values for turbidity were recorded on Sep 19-25 and 28-29. The cause is not known but these slight negative turbidity values probably indicate drift of the zero
line during deployment. No turbidity data from 0000 on 01 September through 0830 on 19 September because the turbidity probe failed.
NN: No dissolved oxygen data from 0000 1 Sep to 1030 10 Sep because the dissolved oxygen probe was broken on retrieval. Negative dissolved oxygen data were recorded at the following times and removed from the data record: 0700 13 Sep, 0630 20 Sep, 0730 21 Sep, 0730 and 0830 to 0900 25 Sep, and 2030 to 2100 30 Sep. No turbidity data from 1230 25 Sep to 2330 on 30 Sep because the turbidity probe was broken on retrieval.

October 1997
JL: The times that the sensors were read and recorded were 6 seconds past
the half hour from 0000 through 1030 on 1 Oct. The dissolved oxygen data may be low or unreliable from 1000 23 Oct through 2330 31 Oct because the sensor read 86.2% dissolved oxygen in water saturated air in a post-deployment calibration check, and an orange coating was observed on the membrane and probe following deployment. During periods of very low dissolved oxygen negative readings were recorded at the following times, these data were removed: 0300, 1730, 1900, 2230, and 2330 on 5 Oct; 0200, 0230, 0400, 0500, 0600, 1400, 1500, 1600, 1630, 1730, 1930, 2000, 2100, and 2200-2330 on 6 Oct; 0200, 0400, 0500, 0600-0700, 0800, 0900, 1000, 1100, 1200, 1300, 1400-1500, 1600, 1700-1730, and 2130-2330 on 7 Oct; 0000-0030 on 8 Oct; 0930, 1500, 1630, and 1930 on 14 Oct; 1230-1400, 1900, and 2100 on 16 Oct; 1330, 1430-1630, and 2200 on 19 Oct; 0400 on 20 Oct; 0500, 0730, and 1930 on 25Oct; 0300 on 26Oct; and 0100 on 30Oct. The cause for single anomalous turbidity value of 464 at 2000 on 31 Oct is not known; the datum was removed.
BY: The low dissolved oxygen data from 0000 on 1 October through 1300 on 10 October are suspect and should be interpreted with caution; post-deployment check indicated 92.2% saturation in water saturated air following deployment, the probe diagnostics were acceptable, but the probe failed one month later. Depth data erratic from 1400 10 October through 0830 on 11 October indicating the datasonde was not properly seated in deployment tube: data for all sensors removed.
NN: Dissolved oxygen data from 0000 1 Oct to 0530 10 Oct is suspect because of downward trend in concentration of dissolved oxygen and occasional negative dissolved oxygen recorded; however, the post-deployment check indicated 98.3% saturation in water saturated air following deployment. Negative dissolved oxygen data were recorded at the following times and removed from the data record: 0530 to 1330 and 1430 to 1600 on 2 Oct, 1000 to 1100 on 6 Oct, 0130-0700 and 1000 to 1500 on 8 Oct, 1030 to 1130 on 9 Oct. Numerous negative dissolved oxygen data were observed from 0600 on 10 Oct to 1000 on 15 October, data were removed from the file. No dissolved oxygen data from 1030 15 Oct to 2330 31 Oct because dissolved oxygen probe was bad on retrieval. No turbidity data from 0000 1 Oct to 1000 15 Oct because turbidity probe was broken on retrieval.

November 1997
JL: The dissolved oxygen data may be low or unreliable from 0000 1 Nov through 1330 18 Nov because the sensor read 86.2% dissolved oxygen in water saturated air in a post-deployment calibration check, and an orange coating was observed on the membrane and probe following deployment. During periods of very low dissolved oxygen negative readings were recorded at the following times, these data were removed: 0300 and 0330 on 1 Nov; 0300 on 2 Nov; 0600, 0630, and 0830-0930 on 5 Nov; 2300-2330 on 11 Nov; 0030 and 0130 on 12 Nov; 0000 and 0130 on 13 Nov; 0230, 2130, and 2330 on 14 Nov; 0100, 0200, and 0330 on 15 Nov; and 0000, 0800, and 1100 on 16 Nov. Negative depth readings were recorded at the following times and were probably related to changes in barometric pressure after calibration in the lab (see note above in 9. Variable identifier, data type, resolution and accuracy); 0100-0500 on 19 Nov, 0330 on 20 Nov, 2200-2300 on 26 Nov, 2230 on 27 Nov to 0000 on 28 Nov, 0000-0030 on 29 Nov, and 0000-0100 on 30 Nov. Erratic negative and very high turbidity readings from 0800 through 1930 on 11 Nov were deleted; the cause is not known but could be incorrect parking of wiper or debris caught on wiper. Isolated anomalous turbidity values were deleted (cause unknown) at the following times: readings of -222 at 0330 on 21 Nov, -635 at 1900 on 27 Nov, 450 at 0500 on 28 Nov, and 731 at 0600 on 28 Nov.
BY: No data for all parameters from 1400 on 25 November through 2330 on 30 November because the depth and salinity data indicated that the datasonde was “caught” in the PVC deployment tube and the probes were out of the water for part of each day.
NN: No dissolved oxygen data from 0000 1 Nov to 2200 10 Nov because dissolved oxygen probe was broken on retrieval.

December 1997
JL: Negative depth readings were recorded at the following times and were
probably related to changes in barometric pressure after calibration in the lab (see note above in 9. Variable identifier, data type, resolution and accuracy); 0230-0300 on 2 Dec. Isolated anomalous turbidity values were deleted (cause unknown) at the following times: readings of 141 and 332 at 0130 and 0200 on 13 Dec 613 at 2300 on 31 Dec and negative readings at 1900 and 1930 on 28 Dec and 2130 on 31 Dec.
BY: All data suspect and need to be interpreted with caution because probes had been exposed to the air during spring lower low water. Depth data is relative because datasonde was “caught” in the deployment tube at an unknown depth. Negative depths were recorded from 0330-0400 on 7 Dec. Depth above bottom is not known but is estimated to have been about 1.75 m.
NN: Negative depths were recorded from 5 Dec to 20 Dec and from 30 to 31
Dec. Erratic negative and high turbidity data were recorded at the following times and removed from the data record: 0300 on 11 Dec, 0530 on 14 Dec, 0830 on 19 Dec, and 0130 on 23 Dec.

11. Missing data
January 1997
JL: No turbidity data from 0000 on 1 Jan through 1430 on 16 Jan because

erratic negative and high positive values throughout this period were removed. No dissolved oxygen data because readings were negative at 1300 on 14 Jan, 0900 on 15 Jan, and 1000, 1100, and 1430 on 16 Jan and were removed. Turbidity values missing at 1930 and 2100 on 29 Jan because anomalous values of 1114 and -914 were removed.
BY: Turbidity value missing at 1730 on 4 Jan because anomalous high value was removed. No data for all parameters from 1000 on 24 Jan through 2330 on 31 Jan because water seeped into the battery case and caused an electrical malfunction.
NN: No turbidity values during the following times because erratic high and
negative values were removed: 0000 to 1500 on 1 Jan, 1730 6 Jan to 0300 7 Jan, 1000 to 1430 on 18 Jan, 2330 19 Jan to 0200 20 Jan, 0600 to 0730 on 23 Jan, and 2000 29 Jan to 0900 30 Jan.

February 1997
JL: No data for all parameters from 1730 on 12 Feb through 1330 on 27 Feb because of battery failure. No turbidity from 1400 through 1700 on 12 Feb because high values may have been related to impending battery failure and were removed.
BY: No data for all parameters from 0000 on 1 Feb through 2330 on 28 Feb
because water seeped into the battery case of the datasonde and caused an electrical malfunction.
NN: No turbidity from 1300 26 Feb to 2330 on 28 Feb because no turbidity
probe was available. No turbidity values during the following times because erratic high and negative values were removed: 0630 on 1 Feb, 0630 to 1400 on 12 Feb, 0600 to 2200 on 14 Feb, 0200 to 0400 on 17 Feb, and 1100 to 1700 on 19 Feb.

March 1997
JL: Negative turbidity values were recorded 1330 and 1500 on 3 March associated with very high turbidity values- were deleted. No dissolved oxygen data from 0500 on 4 Mar through 1230 on 13 Mar because the probe appeared to be failing and could not be calibrated in the lab following the deployment; data were deleted. No dissolved oxygen data from 1200 on 29 Mar through 2330 on 31 Mar; cause is unknown but values were very low and sensor may have been buried in sediment; data were deleted. No turbidity values from 2130 on 7 Mar through 1230 on 13 Mar and from 1100 on 14 Mar through 1230 on 27 Mar; the cause(s) for erratic negative and very high turbidity values during these time periods are not known; the data were removed. No turbidity data from 1200 on 29 Mar through 2330 on 31 Mar; the cause for high and erratic turbidity values during this time is not known; the data were removed. No dissolved oxygen data at 1430 on 21 Mar and 1030 on 22 Mar; the cause for negative values at these times is not known, the data were removed.
BY: No data for all parameters from 0000 on 1 March through 1030 on 19 March because water seeped into the battery case and caused an electrical malfunction. No turbidity datum at 0930 25 March because negative value removed.
NN: No turbidity data from 0000 1 Mar to 2330 on 31 Mar because no probe was available.

April 1997
JL: No data for all parameters from 1430 15 Apr through 1230 17 Apr because of exchange of datasondes for cleaning, maintenance and calibration. No data for all parameters from 1000 Apr through 2330 30 Apr because datasondes were being exchanged for cleaning, maintenance, calibration, and repair/replacement of sensors. No dissolved oxygen data from 0000 on 1 Apr through 0800 on 10 Apr; cause is unknown but values were very low and sensor may have been buried in sediment; data were deleted. The cause for high and erratic turbidity values from 0000 on 1 Apr through 0800 on 10 Apr is not known; the data were removed. No turbidity data at the following times because negative values were deleted: 0600, 0630, 0800-0900 on 11 Apr, 0830-0930, 1030 on 12 April, 1030, 1100 on 14 April. No turbidity data from 0600 through 1400 on 15 April because erratic negative and very high turbidity values were removed.
BY: No turbidity at 1500 on 10 April because erratic value of 384 removed.
NN: No data for all parameters from 0930 8 April to 1430 on 24 April because no sonde was available. No turbidity from 0000 1 Apr to 0900 8 Apr because no probe was available. No turbidity from 1500 24 Apr to 2330 on 30 Apr because erratic values were removed; probe was cracked when sonde was retrieved at end of deployment.

May 1997
JL: No data for all parameters from 0000 1 May through 1030 7 May and from 1000 22 May through 0930 23 May because datasondes were being exchanged for cleaning, maintenance, calibration, and/or repair/replacement of sensors. No dissolved oxygen data at the following times and dates because negative values were deleted from the data file: 0930-1300 on 8 May; 0930-1400 on 9 May, 1000-1200 on 10 May; 1730 on 11 May; 1200-1930 on 12 May; 123--2030 on 13 May;1300-2100 on 14 May; 0700-0900 and 1430-2130 on 15 May; 0630-2230 on 16 May; 0630-1330 on 17 May; 0730-1400 on 18 May; 0830-1400 on 19 May; 0830-1500 on 20 May; 1000-1500 on 21 May; 0930 on 22 May; 1400-1600 on 28 May; 1830-1900 on 29 May; 0700-0930 and 1700-2030 on 30 May.
BY: No turbidity data from 1400 on 23 May through 2330 on 31 May because erratic values were recorded and a faulty wiper was discovered at the end of the deployment.
NN: No turbidity from 0000 on 1 May to 2330 on 31 May because erratic values were removed; probe was cracked when sonde was retrieved at end of deployment.

June 1997
JL: No data for all parameters from 1400 on 11 Jun to 1500 on 12 Jun and
from 1230 to 1400 on 25 Jun because of exchange of datasondes for cleaning, maintenance and calibration. No dissolved oxygen data at the following times and dates because negative values were deleted from the data file: 0900-1230 and 1600 on 6 Jun; 0930-1300 on 7 Jun; 1000-1230 on 8 Jun; 1100-1400 and 1700 on 9 Jun; 1130-1800 on 10 Jun; and 1230-1330 on 11 Jun. No turbidity at 2230 on 16 June because erratic value of -576 was removed from data file. The causes

for negative turbidity value at 1230 on 7 Jun is not known; the datum were removed.
BY: No turbidity data from 0000 on 1 June through 0930 on 26 June because erratic values were recorded and a faulty wiper was discovered at the end of the deployment. No turbidity at 1430 on 26 June because erratic value of 96 was removed. No dissolved oxygen from 1000 on 26 June through 2330 on 30 June because at the end of the deployment it was found that the oxygen membrane was punctured.
NN: No data for all parameters from 0930 4 Jun through 1430 on 5 Jun because of exchange of datasondes for cleaning, maintenance and calibration. No turbidity from 0000 on 1 Jun to 0900 on 4 Jun because erratic values were removed; probe was cracked when sonde was retrieved at end of deployment. No turbidity from 1500 on 5 June to 2330 on 30 June because no probe was available.

July 1997
JL: No data for all parameters from 1300 16 Jul through 1130 17 Jul and from 1430 29 Jul through 1230 30 Jul because of exchange of datasondes for cleaning, maintenance and calibration. No data for all parameters at 0330 on 14 Jul because datasonde skipped a measurement for unknown reasons. No turbidity data at the following times because negative and isolated erratic high values were deleted: 0830 on 15 Jul and 1800 on 22 Jul.
BY: No dissolved oxygen from 0000 on 1 July through 0800 on 23 July because at the end of the deployment it was found that the oxygen membrane was punctured. No turbidity data at 1530 on 14 July and 1930 on 18 July because high erratic values were removed; cause unknown. No data for all parameters from 0830 on 23 July through 0800 on 24 July for cleaning and calibration of the datasonde.
NN: No data for all parameters 1330 on 30 July to 1230 on 31 July because
of exchange of datasondes for cleaning, maintenance and calibration. No turbidity from 0000 1 July to 1300 on 15 July because no probe was available.

August 1997
JL: No data for all parameters at 1130 on 27 Aug because of exchange of datasondes for cleaning, maintenance and calibration. No dissolved oxygen data from 1400 on 13 Aug through 1100 on 27 Aug because the data were considered unreliable because the sensor read 78.4% dissolved oxygen in water saturated air in a post-deployment calibration check. No turbidity data at the following times because negative and isolated erratic high values were deleted: 1530 on 5 Aug, 0100 on 20 Aug, 1800 on 23 Aug, and 0330 and 1030 on 27 Aug.
BY: No turbidity data from 0630 on 20 Aug through 2330 on 31 Aug because the turbidity probe failed.
NN: No data for all parameters from 1330 on 19 Aug to 1330 on 20 Aug because of exchange of datasondes for cleaning, maintenance and calibration. No dissolved oxygen data from 1400 on 20 Aug to 2330 on 31 Aug because dissolved oxygen probe was broken on retrieval.

September 1997
JL: No data for all parameters 1200 on 17 Sep because of exchange of datasondes for cleaning, maintenance and calibration. No data for all

parameters 0930 on 18 Sep because of removal of the datasonde for re calibration of turbidity. No dissolved oxygen reported at 1930 on 8 Sep because negative value was removed; cause unknown. No turbidity data from 1230 on 17 Sep through 0900 on 18 Sep because sensor had not been calibrated. No turbidity at 0300 on 24 Sep because single erratic value of -218 was removed from data file.
BY: No turbidity data from 0000 on 01 September through 0830 on 19 September because the turbidity probe failed.
NN: No data for all parameters at 1100 on 10 Sep because of exchange of datasondes for cleaning, maintenance and calibration. No dissolved oxygen data from 0000 1 Sep to 1030 10 Sep because the dissolved oxygen probe was broken on retrieval. No dissolved oxygen data at the following times because negative values were removed from the data record: 0700 13 Sep, 0630 20 Sep, 0730 21 Sep, 0730 and 0830 to 0900 25 Sep, and 2030 to 2100 30 Sep. No turbidity data from 1230 25 Sep to 2330 on 30 Sep because the turbidity probe was broken on retrieval.

October 1997
JL: No data for all parameters at 1100 on 1 Oct and 1130 on 22 Oct because of exchange of datasondes for cleaning, maintenance and calibration. No dissolved oxygen data at the following times because negative readings were recorded, these data were removed: 0300, 1730, 1900, 2230, and 2330 on 5 Oct; 0200, 0230, 0400, 0500, 0600, 1400, 1500, 1600, 1630, 1730, 1930, 2000, 2100, and 2200-2330 on 6 Oct; 0200, 0400, 0500, 0600-0700, 0800, 0900, 1000, 1100, 1200, 1300, 1400-1500, 1600, 1700-1730, 1830, 1930-2000 and 2130-2330 on 7 Oct; 0000-0030 on 8 Oct; 0930, 1500, 1630, and 1930 on 14 Oct; 1230-1400, 1900, and 2100 on 16 Oct; 1330, 1430-1630, and 2200 on 19 Oct; 0400 on 20 Oct; 0500, 0730, and 1930 on 25Oct; 0300 on 26Oct; and 0100 on 30Oct. No turbidity data from 1200 on 22 Oct through 0930 on 23 Oct because no functioning turbidity sensor was available. The cause for single anomalous turbidity value of 464 at 2000 on 31 Oct is not known; the datum was removed.
BY: No data for all parameters at 1330 on 10 October because of exchange
of datasondes for cleaning and calibration. No data for all parameters from 1400 on 10 October through 0830 on 11 October because depth data were erratic indicating the datasonde was not properly seated in deployment tube.
NN: No data for all parameters from 2200 to 2230 on 2 Oct and 0100 to 0130 on 14 Oct because sonde did not record at these times, cause unknown. No dissolved oxygen data at the following times because negative values were recorded and removed from the data record: 0530 to 1300 and 1430 to 1600 on 2 Oct, 1000 to 1100 on 6 Oct, 0130-0700 and 1000 to 1500 on 8 Oct, 1030 to 1130 on 9 Oct. No dissolved oxygen data from 0600 on 10 Oct to 1000 on 15 October, because numerous negative dissolved oxygen values were recorded and data for this period were removed from the file. No dissolved oxygen data from 1030 15 Oct to 2330 31 Oct because dissolved oxygen probe was bad on retrieval. No turbidity data from 0000 1 Oct to 1000 15 Oct because turbidity probe was broken on retrieval.

November 1997

JL: During periods of very low dissolved oxygen negative readings were recorded at the following times, these data were removed: 0300 and 0330 on 1 Nov; 0300 on 2 Nov; 0600, 0630, and 0830-0930 on 5 Nov; 2300-2330 on 11 Nov; 0030 and 0130 on 12 Nov; 0000 and 0130 on 13 Nov; 0230, 2130, and 2330 on 14 Nov; 0100, 0200, and 0330 on 15 Nov; and 0000, 0800, and 1100 on 16 Nov. Erratic negative and very high turbidity readings from 0800 through 1930 on 11 Nov were deleted. Isolated anomalous turbidity values were deleted (cause unknown) at the following times: readings of -222 at 0330 on 21 Nov, -635 at 1900 on 27 Nov, 450 at 0500 on 28 Nov, and 731 at 0600 on 28 Nov.
BY: No data for all parameters at 1330 on 13 November because of exchange of datasondes for cleaning and calibration. No data for all parameters from 1400 on 25 November through 2330 on 30 November because the depth and salinity data indicated that the datasonde was "caught" in the PVC deployment tube and the probes were out of the water for part of each day.
NN: No data for all parameters from 2230 on 10 Nov to 1130 on 14 Nov and
from 1500 on 17 Nov to 1630 on 19 Nov because of exchange of datasondes for cleaning and calibration. No dissolved oxygen data from 0000 1 Nov to 2200 10 Nov because dissolved oxygen probe was broken on retrieval.

December 1997
JL: No data for all parameters from 1330 on 22 Dec through 1230 on 23 Dec because of exchange of datasondes for cleaning, maintenance and calibration. No turbidity readings for the following times because isolated erratic negative and high values were removed: 0130 and 0200 on 13 Dec, 1900 and 1930 on 28 Dec, 2130 and 2300 on 31 Dec.
BY: No data for all parameters from 0000 on 1 Dec through 0430 on 6 Dec,
from 1830 on 9 Dec through 0300 on 20 Dec and 1930 on 23 Dec through 2330 on 31 Dec because the depth and salinity data indicated that the datasonde was "caught" in the PVC deployment tube and the probes were out of the water for part of each day during these time periods.
NN: No data for all parameters at 1500 on 3 Dec and from 1130 on 29 Dec to 1300 on 30 Dec because of exchange of datasondes for cleaning, maintenance and calibration. No turbidity data at the following times because erratic negative and high turbidity data were recorded and removed from the data record: 0300 on 11 Dec, 0530 on 14 Dec, 0830 on 19 Dec, and 0130 on 23 Dec.