ENVIRONMENTAL MONITORING AND ASSESSMENT PROGRAM
NEAR COASTAL COMPONENT
1992 VIRGINIAN PROVINCE EFFORT

FIELD OPERATIONS
and
SAFETY MANUAL

by

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APPENDIX A

EQUIPMENT LIST AND CHECK LISTS

Equipment List

Each team is provided with the following equipment and supplies. This list can serve as a daily checklist to assure the crew is properly equipped.

Four wheel drive pickup truck (1)
- camper shell (1)
- bed liner (1)
- front bumper winch (1)
- CB radio (1)

Mobile laboratory (1)
- work bench (1)
- shelves for storing supplies
- marine band VHF radio (1)
- cellular telephone (1)
- GRiD computer with printer, power cables, phone cord and keyboard skin (1)
- bar code reader (1)
- first aid kit (1)
- jumper cables (1)
- tool box (1)
- Hach DO test kit with spare BOD bottles (2)
- flashlight (1)
- 10 pound fire extinguisher (1)
- CB radio (1)

24 foot Chesapeake-style boat
- 155 hp commercial Johnson engines (2)
- trailer with power winch, spare tire and spare rollers (1)
- mast and boom assembly (1)
- hydraulic winch & capstan (1)
- self-contained power supply for winch (1)
- windshield wipers
- marine band VHF radios (2)
- Loran navigation instrument (1)
- GPS navigation instrument (1)
- compass (1)
- hand-held compass (1)
- Radar unit (1)
- depth finder (1)
- spare propellers (2)

GRiD computer with printer, power cables, phone cable and keyboard skin (1)
bar code reader (2)
anchor with chain and line (2)
first aid kit (1)
fire extinguishers (2)
oar (1)
personal flotation devices with lights (1 per person)
survival suits (1 per person)
ring buoy (1)
life sling (1)
Emergency Position and Information Radio Beacon (1)
boat hook (1)
tool box including cable cutter and Nicopress tool (1)
garbage pail (1)
emergency eye wash (1)
jumper cables (1)
binoculars (1)
hardhats
spotlight (1)
flashlight (1)
flares (1kit)
fish totes
nautical charts
spare oil
spare shackles
siezing wire
spare Nicopress sleeves
spare cable for winch
fenders
spare line

Sampling gear

trawl net with doors (2)
Young-modified Van Veen grab sampler (2)
grab stand (1)
Sea-Bird CTD with data cable (1)
Hydrolab DataSonde 3 units (3)
Go-Flo water sampling bottles (2)
spare parts for the *Go-Flo* bottles
0.5 mm stainless steel sieve (2)
sieve box (2)
Stainless mixing beaker for sediments (3)

Stainless spoons (3)
Teflon spatula for sediments (3)
fish cutting and measuring board (2)
refractometers (2)
field thermometers (4)
Hach DO test kit with spare BOD bottles (1)
YSI DO meter
dissecting kits
pingers for all deployed gear
filet knives
coolers
fish scales (2)
Petersons fish guide (2)
Petersons guide to shells (2)
other fish keys

Supplies

sediment chemistry sampling bottles
sediment AVS bottles
sediment metals bottles
sterile plastic syringes
sediment toxicity sampling bottles
bottles for benthic species composition and biomass
cubitainers - 1 and 5 gallon
zip lock bags - multiple sizes
cheesecloth for wrapping preserved fish
cores for grain size samples
625 ml containers for suspended solids samples
spare parts for CTD and DataSonde 3
spare DataSonde 3 low flow membranes
aluminum foil
Dietrich's fixative
formalin
long forceps for fish preserved in Dietrich's
wide mouth funnels (3)
centimeter ruler (3)
Alconox detergent
gloves
paper towels
Kimwipes®
alkaline batteries - AA and D
pH 7 and 10 buffers
salinity standard

Federal Express shipping labels
3.5" high density diskettes with mailers
data sheets (packs including bar code labels)
field notebooks (log)
plastic clipboards (2)
number 2 pencils
pens and waterproof markers
waterproof tags for fish
shipping boxes - multiple sizes
strapping tape
"blue ice bottles"
dry ice
insulated gloves
buckets for fish preserved in Dietrichs (2)
buckets for sorting fish (10)
boating yellow pages (depends on the team)
tap water
DI water
squirt bottles
brushes for cleaning gear
scissors
hole punches
whirlpacks - multiple sizes
tubing for *Go-Flo* bottles
dessicant packages for DataSonde 3
sodium sulfite for zeroing DO
protective glasses
Viton gloves
particle masks
Mercury clean-up kits
gear lube
outboard engine oil
grease guns
computer-generated maps
this manual (2)

LAUNCHING CHECKLIST

1. Remove trailer tie-down strap.
2. Install scupper plugs
3. Check brass boat plug and the two plugs on the bottom of the outboard bracket.
4. Drop the engine trailering brackets.
5. Lower the speedometer pick-up unit.
6. Rotate battery switch to 1 for odd days and 2 for even days.
7. Make sure the keys are in the ignition.
8. Raise all antennas.
9. Raise the mast and boom assembly and secure all stays.
10. Make sure hydraulic hoses are not pinched.
11. Install all electronics.
12. Load all gear and supplies.
13. Remove the Briggs and Stratton exhaust cover.
14. Disconnect trailer wiring.
15. Check the ramp for obstacles.
16. Have wheel chocks and winch handle available.
17. Attach bowline.
18. Check oil and gasoline levels.
19. Launch boat.

RETRIEVAL CHECKLIST

1. Engage the front hubs on the truck, place in 4WD LOW, back down the ramp, and chock the wheels.
2. Raise engines and haul boat onto trailer.
3. Disconnect winch power cable.
4. Attach safety chain.
5. Drive up the ramp, removing wheel chocks.
6. Lower engine trailering bar.
7. Remove the scupper plugs.
8. Check gas level. Fill before next launching.
9. Lower and secure mast and boom assembly.
10. Lower and secure antennas.
11. Turn off batteries.
12. Install trailering strap.
13. Close forward hatch.
14. Remove gear and electronics as appropriate. (Electronics are ALWAYS removed at night).
15. Secure all gear not removed.
16. Install Briggs and Stratton exhaust cover.
17. Check lock on the trailer tongue.
18. Reconnect trailer lighting and check lights.
19. Check all safety chains.
20. Take out of 4WD.

APPENDIX B

HAZARDOUS MATERIALS SAFETY AND HANDLING INFORMATION

This appendix consists of Materials Safety Data Sheets for all hazardous materials carried by the lab or boat crews. The permit issued to the Environmental Research Laboratory, Narragansett for handling and generating hazardous wastes covers EMAP field operations.

The EPA Generator ID # is RID075721639

APPENDIX C

PERMIT FOR OPERATING MARINE-BAND VHF RADIO

ENVIRONMENTAL MONITORING AND ASSESSMENT PROGRAM
BOAT RADIO FREQUENCY ASSIGNMENTS

CALL SIGNS

R/V CYPRINODON	**WRH 4387**
R/V ARBACIA	**WRW 8803**
R/V MYSIDOPSIS	**WRM 8373**
R/V CHAMPIA	**WRG 3330**
MOBILE LABS	**KB 2053**

FREQUENCY ASSIGNMENTS

CHANNEL	TRANSMIT FREQ. (MHz)	TYPE OF OPERATION
6	156.300	Intership safety
12	156.600	Port operations
13	156.650	Bridge to bridge communications
14	156.700	Port operations
16	156.800	Calling, safety and DISTRESS
20	157.000	Port operations
22A	157.100	Communications with Coast Guard
67	156.375	Bridge to bridge - Louisiana
82A	**157.125**	**Working channel US govt. only**

In addition, all public correspondence channels (marine operator) can be used: 24, 25, 26, 27, 28, 84, 85, 86, and 87

APPENDIX D

PERFORMING WINKLER TITRATIONS USING THE HACH DO KIT

DETERMINATION OF DISSOLVED OXYGEN BY THE HACH KIT PROCEDURE

The method described here follows a modification of the classical Winkler procedure. A divalent manganese solution, followed by strong alkali, is added to the sample. The precipitated manganous hydroxide is dispersed evenly throughout the seawater sample which completely fills a stoppered glass bottle. Any dissolved oxygen rapidly oxidizes an equivalent amount of divalent manganese to basic hydroxides of higher valency states. When the solution is acidified in the presence of iodide, the oxidized manganese again reverts to the divalent state and iodine, equivalent to the original dissolved oxygen content of the water, is liberated. The amount of iodine is measured by titration with sodium thiosulfate.

Once a week, a QC check on the performance of the YSI dissolved oxygen probe is required. This includes evaluating the calibration of the DO probe and will determine whether a membrane change is necessary. The Hach company model OX-DT Dissolved Oxygen Test Kit has been selected for use in these QC checks.

1.0 SAMPLING PROCEDURE AND STORAGE

a. Insert the tube from the Go-Flo bottle approximately 3/4 of the way down into a clean 300-ml BOD bottle. Open the top valve on the Go-Flo bottle and allow the sample to slowly enter the BOD bottle, being careful to avoid the introduction of air bubbles. Allow at least two volumes (600 ml) to overflow, then crimp the hose and gently remove it, allowing just enough water to enter the bottle to displace the volume of the hose. Make sure there are no air bubbles trapped in the BOD bottle and stopper. Three samples should be collected and fixed as described in this section. Titrate two of the three. If the results are significantly different, titrate the third and use the best two.

b. Add the contents of one manganous sulfate powder pillow and one alkaline iodide-azide reagent powder pillow.

c. Immediately insert the stopper so air is not trapped in the bottle. Firmly hold the stopper in place and invert several times to mix. **Note: A flocculent precipitate will form which will be orange-brown if oxygen is present. In salt water, the floc may not settle fully.**

d. Let the floc in the solution settle to about 1/3 of the way down the bottle. Again invert the bottle several times and wait until the floc has settled to about one-half to two thirds down. **Note: Waiting until the floc has settled twice assures**

complete reaction of the sample and reagents. At this point, samples may be stored in the dark up to 8 hours before analysis. If the sample is not to be titrated immediately, store upright and seal the top by pouring a small amount of water into the flared lip area.

NOTE:

At this point the Oxygen has reacted with the chemicals and is bound up in the flocculent.

2.0 ANALYSIS

a. When you are ready to perform the titration, remove the stopper and add the contents of one sulfamic acid powder pillow. (Do not re-mix the sample before adding the sulfamic acid). Replace the stopper without trapping air in the bottle and invert several times to mix. **Note: The floc will dissolve and leave a yellow color if oxygen is present.**

b. Attach the cartridge to the titrator body following the procedure described in the Hach manual. Insert a clean delivery tube into the titration cartridge. Remove all air from the delivery tube by turning the delivery knob to eject a few drops of titrant. Reset the counter and wipe the tip with a clean Kimwipe.

c. Use a clean graduated cylinder to measure 100 mls of sample and then transfer the sample into a 250-ml erlenmeyer flask. The erlenmeyer flask should be placed on the battery-powered mixing stand and a stir bar should be added to mix the sample. The stir bar should not be spinning rapidly enough to create a significant vortex.

d. Place the delivery tube into the solution so that the tip is submerged and swirl the flask while titrating with sodium thiosulfate to a pale yellow (straw) color.

e. Add four drops of starch indicator solution and swirl to mix. **Note: A blue color will develop due to the formation of a starch-iodine complex.**

f. Continue the titration to a colorless end point using the fine adjustment on the titrator. The titration is finished when the sample first turns completely colorless. Record the number of digits from the digital counter.

g. Calculate mg/l dissolved oxygen by multiplying the digits required x the digit multiplier (.02 for 2 - 10 mg/l dissolved oxygen). For example, a reading of 300 digits x .02 equals a DO concentration of 6.00 mg/l. Depending on the accuracy of the strength of the sodium thiosulfate solution in the cartridge, a correction factor may need to be applied (see the instructions which follow this section).

h. Record this value on the appropriate data sheet.

i. Discard the remainder of the sample and rinse all glassware with deionized water.

3.0 INSTRUCTIONS FOR DETERMINING THE ACCURACY OF THE HACH WINKLER TITRATIONS USING THE IODATE-IODIDE STANDARD SOLUTION

The accuracy of the Hach Winkler titrations can be checked by using an iodate-iodide standard solution which has a constant dissolved oxygen concentration of 10 mg/l. The periodic use of this standard solution provides a check both on the strength of the sodium thiosulfate titrant and the accuracy of the digital titrator. One titration with the iodate-iodide standard should be performed every time a new titration cartridge is used. In addition, it is good practice to check the strength of the titrant at regular intervals (every two or three days) and apply the appropriate correction factors to the titration results for the actual field samples. The procedure for performing the titration of the iodate-iodide standard and calculating the correction factor is given below.

1. The titration of the iodate-iodide standard solution basically follows the same procedure as a normal Winkler titration. First, measure 100 ml of the iodate-iodide standard solution using the graduated cylinder and pour it into the erlenmeyer flask. Place the flask on the mixing stand and add a stir bar.

2. While the solution is mixing, add the contents one Sulfamic Acid powder pillow (Hach kit reagent 3). The solution will turn clear yellow. Wait a few minutes for all the sulfamic acid crystals to dissolve.

3. Titrate the solution following the instructions for the Winkler titration given in the previous section (begin at step 12, after you have prepared the digital titrator).

4. When the titration is complete, record the number on the digital titrator. The standard should be equal to 500 but this number will very due to manufacturer inconsistencies. Each batch that goes out with you in the field will be pre-tested and the expected number will be documented with that batch. If the reading is that you get is equal to the expected value, there is no need to apply a correction factor. If the reading on the digital titrator is between $\pm$ 5%, then the digital titrator readings for actual field samples must be corrected. The calculation for determining a corrected digital titrator reading involves using a simple proportion, as follows:

$$\frac{a}{b} = \frac{c}{d}$$

Where:
a = digital titrator reading following titration of iodate-iodide standard
b = the expected value following the iodate-iodide solution titration
c = digital titrator reading following titration of actual sample
d = "corrected" digital titrator reading following titration of actual sample

The equation is solved for "d" (the corrected digital titrator reading following titration of a sample). The corrected reading is then multiplied by 0.02 to give the oxygen concentration in mg/l.

Example:

With a expected value of 500. You titrate the iodate-iodide standard solution and get a reading of 480 on the digital titrator. You then titrate a normal field sample and get a reading of 350. You would correct this field sample reading as follows:

$$\frac{480}{500} = \frac{350}{d}$$

Rearranging the equation:

$$d = \frac{500 \times 350}{480}$$

$$d = 364.6$$

To get the dissolved oxygen concentration of the field sample in mg/l, multiply 364.6 by 0.02. This gives a final dissolved oxygen concentration in the sample of 7.29 mg/l.

5. If the reading on the digital titrator is outside the bounds of $\pm$ 5% of the expected following the titration of the iodate-iodide standard solution, the thiosulfate cartridge should be discarded and a new one should be used. Low readings or high readings generally indicate that the titrant is too strong or too weak to give accurate results, even if you use corrected digital titrator readings. A second source of inaccuracy in the Hach Winkler kit is the digital titrator itself. If the digital titrator readings are still out side the described bounds when the iodate-iodide titration is performed with a new cartridge, the digital titrator is suspect and a backup one should be used.

6. Whenever the digital titrator readings are "corrected" using the above equation, the calculations should be recorded on the back of the data sheet in the field, so that they can be checked when the data sheet is sent to the Field Operations Center.

4.0 DETERMINATION OF DISSOLVED OXYGEN

The following notes will hopefully enable everyone to do a dissolved oxygen titration efficiently and accurately.

- Be sure the sample bottle is clean and rinsed twice with the water to be tested. Check carefully for bubbles.

- Try to be as precise as possible when adding manganese sulfate and alkaline potassium iodide reagents; however, since these are added in excess there is some room for error. It is necessary to add the manganese sulfate first.

- You may add these two solutions to the sample in the field and then go back home to complete the test. **The test must be completed within the recommended number of hours for the procedure you are using. Keep samples in the dark until you are ready to analyze them.**

- The amount of sample to be titrated is critical. Measure carefully. The bottom of the meniscus should rest on top of the white line on the titration tube. (A meniscus is a curved upper surface of a liquid column that is concave when the containing walls are wetted by the liquid).

- The titration is also extremely critical. Once the starch has been added, titrate carefully so as not to overshoot the endpoint.

- Add a uniform number of drops of starch per sample if possible. Simply add titrant until the sample is light yellow; add starch solution and continue adding drops "very carefully" until solution just turns clear. The first complete disappearance of blue color is the endpoint. (If you see the solution turn blue again,, ignore it!)

- Record all values on the record sheet.

- Finally, if you have any further questions, please let us know. Testing for the amount of dissolved oxygen is very important and we want to know we are getting accurate numbers.

Oxygen Solubility in Seawater

(values in mg/l)

Temp. (°C)	*Salinity (ppt)* 0	5	10	15	20	25	30	35	40
0	14.62	14.12	13.64	13.17	12.71	12.28	11.85	11.45	11.05
1	14.22	13.73	13.27	12.82	12.38	11.96	11.55	11.15	10.77
2	13.83	13.36	12.91	12.48	12.06	11.65	11.26	10.88	10.51
3	13.46	13.01	12.58	12.16	11.75	11.36	10.98	10.61	10.25
4	13.11	12.67	12.26	11.85	11.46	11.08	10.71	10.35	10.01
5	12.77	12.35	11.95	11.55	11.18	10.81	10.45	10.11	9.77
6	12.45	12.04	11.65	11.27	10.91	10.55	10.21	9.87	9.55
7	12.14	11.75	11.37	11.00	10.65	10.30	9.97	9.65	9.34
8	11.84	11.47	11.10	10.74	10.40	10.07	9.74	9.43	9.13
9	11.56	11.19	10.84	10.50	10.16	9.84	9.53	9.22	8.93
10	11.29	10.93	10.59	10.26	9.93	9.62	9.32	9.02	8.74
11	11.03	10.68	10.35	10.03	9.72	9.41	9.12	8.83	8.56
12	10.78	10.44	10.12	9.81	9.51	9.21	8.93	8.65	8.38
13	10.54	10.21	9.90	9.60	9.30	9.02	8.74	8.47	8.21
14	10.31	9.99	9.69	9.39	9.11	8.83	8.56	8.30	8.05
15	10.08	9.78	9.49	9.20	8.92	8.65	8.39	8.14	7.89
16	9.87	9.58	9.29	9.01	8.74	8.48	8.22	7.98	7.74
17	9.67	9.38	9.10	8.83	8.57	8.31	8.06	7.82	7.59
18	9.47	9.19	8.92	8.65	8.40	8.15	7.91	7.68	7.45
19	9.28	9.01	8.74	8.48	8.24	8.00	7.76	7.53	7.31
20	9.09	8.83	8.57	8.32	8.08	7.85	7.62	7.40	7.18
21	8.92	8.66	8.41	8.17	7.93	7.70	7.48	7.26	7.05
22	8.74	8.49	8.25	8.01	7.79	7.56	7.35	7.13	6.93
23	8.58	8.34	8.10	7.87	7.64	7.43	7.22	7.01	6.81
24	8.42	8.18	7.95	7.73	7.51	7.30	7.09	6.89	6.69
25	8.26	8.03	7.81	7.59	7.38	7.17	6.97	6.77	6.58
26	8.11	7.89	7.67	7.46	7.25	7.05	6.85	6.66	6.47
27	7.97	7.75	7.54	7.33	7.12	6.93	6.74	6.55	6.37
28	7.83	7.61	7.40	7.20	7.00	6.81	6.62	6.44	6.26
29	7.69	7.48	7.28	7.08	6.89	6.70	6.52	6.34	6.16
30	7.56	7.35	7.16	6.96	6.77	6.59	6.41	6.24	6.07
31	7.43	7.23	7.04	6.85	6.66	6.48	6.31	6.14	5.97
32	7.31	7.11	6.92	6.74	6.56	6.38	6.21	6.04	5.88
33	7.18	6.99	6.81	6.63	6.45	6.28	6.11	5.95	5.79
34	7.07	6.88	6.70	6.52	6.35	6.18	6.02	5.86	5.70
35	6.95	6.77	6.59	6.42	6.25	6.09	5.93	5.77	5.62
36	6.84	6.66	6.49	6.32	6.15	5.99	5.83	5.68	5.53
37	6.73	6.55	6.38	6.22	6.06	5.90	5.75	5.60	5.45
38	6.62	6.45	6.28	6.12	5.96	5.81	5.66	5.51	5.37
39	6.52	6.35	6.19	6.03	5.87	5.72	5.58	5.43	5.29
40	6.41	6.25	6.09	5.94	5.78	5.64	5.49	5.35	5.22

Benson, B.B. and D. Krause Jr. 1984. The concentration and isotopic fractionation of oxygen dissolved in freshwater and seawater in equilibrium with the atmosphere. Limnol. Oceanogr., 29(3), 620-632.

APPENDIX E

OPERATION OF HYDROLAB DATASONDES

For the 1992 field season Hydeolabs will not be used on a regular basis. Hydrolabs will only be used as a back up to the Sea-bird CTD, in case of failure or malfuntion. The Hydrolab units will be calibrated and quality assured prior to deployment. Depth, salinity and pH will be measured at 1 meter intervals to record a profile. DO will not be recorded.

INITIAL SETUP AND COMPUTER INSTRUCTIONS

1. Attach the 6-pin female end of the data cable to the DataSonde unit. Match the raised bump on the connector to the fat pin on the unit.

2. Plug the 9 pin female connector on the Y-cable into the 9 pin male port at the back of the GRiD computer (this is identified as port "3", RS232 Serial, on the GRiD case).

3. Attach the external power cable (the round four pin metal connector) from the gel cell or the mobile lab work bench into corresponding plug on the Y-cable.

4. If hydrolab data is still not visible on the computer screen, check all connections and the external power source.

BATTERY PACK INSTALLATION AND REPLACEMENT

1. Clean the entire transmitter with soapy water and a soft brush.

2. Once cleaned and properly dried, remove the two hex head Allen screws that hold the battery pack on to the transmitter housing located at the top (6 prong end) of the unit.

3. Grasp the battery pack and, with a slight back-and-forth twisting motion, pull it from the transmitter tube.

4. Once the battery pack is free of the housing, gently pull the wiring loose from the connector inside the housing.

5. Turn over the battery pack and remove the two large hex head Allen screws

that hold the battery pack together. Remove and properly discard the spent batteries.

6. Install 10 new AA alkaline batteries, paying close attention to the polarity of the batteries and the battery pack.

7. Reassemble the battery pack.

8. Carefully examine the O-rings sealing the top of the DataSonde. Replace these if any nicks or deterioration are noted. Make sure that the surfaces of the battery pack and the inside of the DataSonde walls are clean and free of debris.

9. LIGHTLY coat the O-rings with silicone grease, reconnect the wiring (being careful to note the orientation of the prongs) and re-install the battery pack.

10. Connect the DataSonde to the computer. Momentarily disconnect it from external power to make sure that the internal batteries are operating properly. Observe the battery voltage readings, they should be followed by an "&", indicating the unit is being powered by the internal battery pack.

pH CALIBRATION

1. Rinse the probes thoroughly with deionized water and then with the pH 7.0 buffer solution. This is done by filling the calibration cup with a small amount of solution, then covering with the black rubber cap and shaking vigorously. Discard the water and pH rinses when finished.

2. Invert the DataSonde and clamp it to the ringstand (probes will now be pointed upwards). Fill the calibration cup with pH 7.0 solution until the pH reference probe is completely covered. Note that pH 7.0 should always be the first buffer calibrated.

3. Wait 1-2 minutes until the pH sensor equilibrates and the pH readings stabilize, i.e. five consecutive readings are identical (note the pH has stabilized at 7.21 units in the following figure). Press <RETURN> to calibrate pH 7.

4. The calibration command gets sent down to the hydrolab while the calibration menu remains on the upper half of the screen. At this point the hydrolab pH readings should be stable at 7.0 (notice that the hydrolab pH is now stable at 7.00 units in the following figure).

If the readings are not stable, you may need to repeat the calibration procedure.

If the Hydrolab does not accept your calibration value, an error message "Out of tolerance, calibration is not saved" will scroll by the screen. Several things could be wrong:

A. You may have used the incorrect pH solution. Be sure you have entered the correct value for the solution in the calibration cup.

B. The reference electrode may need to be refilled or replaced. Refer to the Hydrolab manual, section 3-5, the first three paragraphs.

C. The mercury batteries for the DO probe may need to be replaced. These batteries also power the pH circuits so that no warm-up is required.

5. Repeat procedures for the pH 10.0 solution. Rinse the calibration cup and probes with deionized water between each pH solution. Rinse the probes thoroughly with the pH 10.0 buffer solution. This is done by filling the calibration cup with a small amount of solution, then covering with the black rubber cap and shaking vigorously. Discard the water and pH rinses when finished.

6. Invert the DataSonde and clamp it to the ringstand (probes will now be pointed upwards). Fill the calibration cup with pH 10.0 solution until the pH reference probe is completely covered. Note that pH 10.0 should always be calibrated after pH 7.0 has been calibrated.

7. Wait 1-2 minutes until the pH sensor equilibrates and the pH readings stabilize, i.e. five consecutive readings are identical (note the pH has stabilized at 9.91 units in the following figure). Press <RETURN> to calibrate pH 10.

8. The calibration command gets sent down to the hydrolab while the calibration menu remains on the upper half of the screen. At this point the hydrolab pH readings should be stable at 10.0 (notice that the hydrolab pH is now stable at 10.00 units in the following figure).

If the readings are not stable, you may need to repeat the calibration procedure.

If the Hydrolab does not accept your calibration value, an error message "Out of tolerance, calibration is not saved" will scroll by the screen. Several things could be wrong:

A. You may have used the incorrect pH solution. Be sure you have entered the correct value for the solution in the calibration cup.

B. The reference electrode may need to be refilled or replaced. Refer to the Hydrolab manual, section 3-5, the first three paragraphs.

C. The mercury batteries for the DO probe may need to be replaced. These batteries also power the pH circuits so that no warm-up is required.

SALINITY CALIBRATION

1. Rinse the calibration cup with deionized water, then with two rinses of the seawater standard. (Batches of standard seawater solution will be sent out periodically from the FOC). Fill the cup with seawater standard, to just below the level of the oxygen membrane. Make sure there are no air bubbles in the conductivity cell block.

2. Monitor the salinity readings for 1-2 minutes until they have stabilized (note salinity is stable at 28.9 ppt in the following figure).

3. Manually enter the correct salinity value (ppt) of the seawater standard (29.7 ppt in this example). Hit <RETURN> to calibrate salinity.

4. Once the salinity calibration command has been sent down to the hydrolab, the computer returns to the Calibration menu. Monitor the salinity readings, they should be stable at the value of the seawater standard (note the salinity is now stable at 29.7 ppt in the following figure). If the readings are not stable you may need to repeat the salinity calibration procedures.

5. If the hydrolab did not accept the calibration value, an error message "Out of tolerance, calibration is not saved" will scroll by the screen. Check that you have entered the proper salinity value of the standard seawater solution and repeat the calibration procedures.

HYDROLAB QC CHECKS

QC (Quality Control) checks need to be done on both the retrieval and deployment units. If the deployed unit does not pass, then the backup Hydrolab will be QC checked. If neither unit passes the QC check, one of the units will have to be re-calibrated prior to deployment. Although the QC checks are identical, there are separate Hydrolab QC menus for the deployed and retrieved units.

1. Attach the data cable to the computer and the Hydrolab as described earlier.

2. Attach the open-ended calibration cup, and rinse with the pH 7.0 buffer twice. Fill the cup with buffer to below the oxygen membrane but above the reference electrode. Gently wipe the oxygen membrane dry, place the white cap over the end of the cup, and allow the pH readings to stabilize. Monitor the pH readings and enter the pH value that is being recorded by the hydrolab.

3. Grab a bucket of local seawater (or fresh water if up a tidal river). Put the hydrolab unit in the bucket and let it equilibrate. Keep the hydrolab moving slowly in the bucket. Monitor the hydrolab readings for several minutes until temperature and salinity have stabilized.

4. Determine the temperature, salinity and dissolved oxygen of the water in the bucket using a thermometer, refractometer and YSI meter, respectively. (Be sure the YSI probe has stablized and the meter is set to the proper salinity). Enter these values into the data sheet that appears in the upper half of the computer screen. At the same time, monitor the hydrolab readings and record these temperature, salinity and dissolved oxygen.

Acceptable differences are:

Temperature - 2 degrees C
Salinity - 2 ppt
pH - 0.5 units

The computer calculates the differences and gives error messages if any of the above differences are exceeded.

REPLACEMENT OF MERCURY BATTERIES

The general instructions for replacing the DataSonde probes and/or DO batteries are as follows:

1. Remove the two hex head screws at the bottom (probe end) of the unit, and gently pull the probe end from the housing with a back-and-forth twisting motion.

2. Disconnect the rectangular battery/data connector from one of the interior boards. This is the connector with the multicolored wires running all the way to the top of the housing. Release the two black latches over the connector by swinging them down, then pull the connector away from the board. You can now set the housing aside. [At this point if you are just replacing the DO batteries, remove the old batteries and install the new ones. Be careful to observe the correct polarity, and use only mercury 2.7 volt batteries. Reassemble the DataSonde using proper precautions with the O-rings.]

APPENDIX F

1992 EMAP DATA SHEETS