



Coastal 2000 Northeast Component

Field Operations Manual



**Environmental Monitoring
and Assessment Program**

**Coastal 2000
Northeast Component**

FIELD OPERATIONS MANUAL

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CONTENTS

<u>SECTION</u>	<u>PAGE</u>
1 - Introduction	1
2 - Overview of Field Sampling Activities	3
Sampling Period	3
Sampling Design	3
Indicators of Ecosystem Health	3
Site Reconnaissance	5
Station Location	5
Sampling	5
3 - Field Data Base Management	7
Sample Tracking Procedures	7
Station and Sample Numbers	7
Use of Bar Codes	8
Electronic Data Entry	8
4 - Water Quality Measurements	10
Hydrolab DataSonde3 Unit	10
Obtaining a Hydrolab Profile	12
YSI Model 58 Dissolved Oxygen Meter and Probe	13
Light Attenuation	16
Secchi Depth	17
5 - Water Column Nutrients	18
Chlorophyll <i>a</i> and Phaeophytin	18
Dissolved Nutrients	19
Total Suspended Solids	19
Quality Control	20
6 - Sediment Collections	21
Sediment Collections	21
Field Processing of Samples for Benthic Community Assessment	22
Field Processing of Samples for Chemistry and Toxicity Testing	26
Quality Control/Quality Assurance	27
Safety Considerations	28

<u>SECTION</u>	<u>PAGE</u>
7 - Fish Trawls	29
Gear and General Protocols	29
Trawl Preparation	30
Net Deployment	31
Trawling	31
Net Retrieval	32
Safety Considerations	33
Criteria for Voiding Tows	33
Endangered Species	34
Sample Processing	34
Quality Assurance	38
Contingency Plans	39
Collection Permits	39
8 - Packaging and Shipping Samples	40
Proper Packaging Methods	40
Benthic Biology Samples	42
Sediment Chemistry Samples	42
Sediment Toxicity Samples	43
Grain Size Samples	43
Chlorophyll, Nutrients, and Total Suspended Solids	43
Fish Chemistry	43
Pathology QA Samples	44
Instructions for FEDEX Shipping with Dry Ice	44
Appendices	
A. List of supplies and equipment	45
B. Trawl net specifications	51
C. Coastal 2000 datasheets	55

SECTION 1 INTRODUCTION

As a regulatory agency, the U.S. Environmental Protection Agency (EPA) is charged with the mission to set environmental policy, obtain funds for research and development, and evaluate the efficacy of environmental regulations in preserving the Nation's natural resources. EPA's National Coastal Assessment (Coastal 2000 or C2000) is a five-year effort led by EPA's Office of Research and Development to evaluate the assessment methods it has developed to advance the science of ecosystem condition monitoring. C2000 represents the current state of evolution of EPA's Environmental Monitoring and Assessment Program (EMAP). EMAP was originally designed to provide a quantitative assessment of the regional extent of environmental problems by measuring status and change in selected indicators of ecological condition. EMAP provides a strategy to identify and bound the extent, magnitude, and location of environmental degradation and improvement on a regional scale.

Beginning in the year 2000, C2000 will attempt to assess the condition of the Nation's estuarine waters through statistically valid subsampling. Whereas the original EMAP effort was conducted primarily by EPA and contract staff, C2000 is being implemented in partnership with the 24 coastal states. This partnership recognizes that each of these entities plays an important role in estuarine monitoring. Wherever possible, existing state monitoring programs are being incorporated into the C2000 design. This provides for the maximum utilization of a limited budget, and the flexibility of allowing states to often "continue doing what they've been doing." Many of these state programs have been in existence for many years, providing a basis for possible C2000 trends analyses. Each state will conduct the survey and assess the condition of their coastal resources independently. These estimates will then be aggregated to assess the condition at EPA Regional, biogeographical, and National levels. Through this partnership EPA hopes to build infrastructure within the coastal states to improve, and make more inter-comparable, the multitude of estuarine monitoring programs throughout the country.

As stated above, C2000 is being implemented in cooperation with the coastal states. Most of the field sampling, and some of the sample analysis, will be conducted by state agencies through cooperative agreements with EPA. A common suite of "core" indicators will be measured using comparable methods:

- sediment contaminant concentrations
- sediment toxicity (*Ampelisca abdita*)
- benthic species composition
- sediment characteristics (grain size, organic carbon content, percent water)
- water column dissolved nutrients
- chlorophyll *a* concentrations,
- total suspended solids concentration,
- surface and bottom dissolved oxygen, salinity, temperature, and pH

- water clarity
- contaminant levels in fish
- external pathological condition of fish
- fish community structure

These are listed in more detail in Table 1. The goal is to collect data on all these indicators at all stations.

C2000 is designed as multi-year program. In the northeast portion of the United States (Delaware to Maine), estuarine waters will be sampled over a two-year span (2000-2001). Approximately 30 to 40 stations will be sampled per state each year. Tentatively, the following two or three years will be dedicated to other ecosystems, such as coastal waters and/or salt marshes, with the hope of returning to estuaries in years five and six.

Each major region (west coast, Gulf of Mexico, southeast coast, northeast coast, Alaska) will be coordinated through a central location. EPA's Atlantic Ecology Division (AED) is responsible for coordinating C2000 activities in the northeast (C2000-NE).

The purpose of this manual is to document suggested field data and sample collection procedures for C2000-NE. These protocols have been developed by EMAP over the past 10 years. They will be identical to, or at least comparable with, those used in other regions of the country. Individual states may prefer to use other methods, especially if they are currently being used in existing programs. This is acceptable providing that comparability can be demonstrated to the C2000-NE Field Coordinator and the QA Officer.

SECTION 2

OVERVIEW OF FIELD SAMPLING ACTIVITIES

2.1 Sampling Period

The sampling period for C2000-NE is based on the index period established for the EMAP-Estuaries effort in the Virginian Province (VP), which is the portion of coastline extending from Cape Cod, MA south to the mouth of Chesapeake Bay. This is based on the time frame in which the benthic biota are most active and hypoxia is most prevalent. The established index period is July through September. Some deviation from this period may be acceptable for areas outside the Virginian Province if the criteria for defining the index period are met.

2.2 Sampling Design

The EMAP-Estuaries sampling design on which C2000 is based combines the strengths of systematic and random sampling with our understanding of estuarine systems. It provides a design that will allow probability-based estimates of the status of the Nation's estuarine systems, the variability associated with that status, its spatial and temporal components, and the temporal trends associated with changes in these systems. The Coastal 2000 sampling design is based on a single, annual sampling season of each station during the Index Period. The design differs from previous EMAP designs in that existing monitoring programs were incorporated where appropriate. "Biased" programs, such as those designed to evaluate the effects of a treatment plant, would NOT be appropriate for inclusion. Working with the states, the C2000-NE design team was able to identify a large number of sites that are currently being monitored and meet the criteria for being unbiased in their location. Many were randomly located in the original monitoring design.

The objective of the sampling design is to provide a statistically defensible strategy for collecting information about selected indicators of ecological condition and their variability. The design is flexible to allow alternative future uses.

In developing the sampling design, a list frame was used to represent the population of estuaries in the United States. This list frame was subdivided to represent all estuarine systems within the northeast with a surface area greater than 2.6 km².

2.3 Indicators of Ecosystem Health

The primary goal of C2000 is to provide an assessment of overall ecosystem condition. To accomplish this goal, a number of "indicators" of ecosystem health will be monitored. The core set of indicators agreed upon by all entities involved in this project is listed in Table 1.

Table 1. List of core ecological indicators being measured by C2000

Water Quality Indicators

Hydrographic Profile

- dissolved oxygen
- salinity
- pH
- temperature
- depth
- light attenuation (PAR, transmittance)
- secchi depth

Water Quality Samples

- dissolved nutrients (ortho-phosphates, nitrites, nitrates, ammonia)
- chlorophyll a
- total suspended solids (TSS)

Sediment Quality

Composited Surficial Sediment

- sediment contaminants (organics and metals)
- sediment TOC
- sediment toxicity (amphipod)
- percent silt/clay

Biota

Fish/Shellfish

- community structure (species; abundance; total length, up to 30 individuals)
- tissue contaminants (organics and metals)
- external pathology (fish)

Benthos

- community structure (minimum, 2 replicates)

Habitat

- SAV (presence/absence)
 - basic habitat type (e.g., open water, tidal flat, marina, harbor, inlet, tidal river/stream, seagrass bed, rocky bottom, shelly bottom, coral reef, etc.)
 - marine debris (presence/absence)
-

2.4 Site Reconnaissance

Prior to the start of field activities, a thorough reconnaissance of the area to be sampled should be performed whenever field crews will be working in new areas. This includes determining the locations of boat ramps, hotels, and dry ice suppliers; visiting any stations that may fall in water too shallow for boats; and attempting to identify any potential problems that the field crews may face during the Index Period. Needless to say, reconnaissance may not be needed in areas with which state field crews are familiar.

2.5 Station Location

The randomly selected sampling locations for each state (or specific study area) will be provided to the field crews as coordinates of latitude/longitude in degrees-minutes, expressed to the nearest 0.01 minute (*i.e.*, 00° 00.00'). The crews will use GPS (preferably DGPS) to locate the site. Three different locations will be provided for each station. These are identified as "A", "B", and "C". The primary site is the "A" location; "B" and "C" are backups. If the primary site is not accessible, or the bottom is too rocky to obtain a sediment sample, then the crew may move to the "B" site. If that site is also unsampleable, then they should move to the "C" site. If all three are unsampleable, then the site is not sampled. If one of the sites can be sampled for only some of the indicators, then that sampling should be conducted. It is important that the crew note on the datasheet at which of these locations (A, B, or C) the samples were collected.

Crews will attempt to navigate to the location to within 0.02 nm (± 37 m) of the given coordinates. This reflects the accuracy expected from a properly functioning GPS unit of the caliber that will be used for the study. The crew will record the actual coordinates of the vessel after anchorage, NOT the initial intended coordinates, on the field data sheet.

2.6 Sampling

In order to collect data as efficiently as possible and reduce the potential for sample contamination, the samples should be collected in the order shown in Figure 1. Details about each sampling procedure can be found in following chapters. A complete list of needed supplies and equipment can be found in Appendix A. As stated in the Introduction, variations from these methods must be approved, in advance of sampling, by the Northeast Field Coordinator and the Northeast QA Officer. An overview of Quality Control/Quality Assurance (QC/QA) protocols for each sampling technique can be found after the description of each procedure. A more detailed account of QC/QA proposals can be found in the C2000 Quality Assurance Plan.

In areas where most of the bottom is expected to be rocky, and therefore unsampleable (Maine for example), the crew should attempt to obtain a grab sample as one of their first activities. If the bottom is too rocky to obtain a sediment sample, they should move to the first backup location. Any sediment sample; muddy, sandy, gravely, or shelly; is considered acceptable. Some movement (*i.e.*, changing the amount of anchor line out) around the prescribed station location is acceptable, and may be tried before relocating the station.

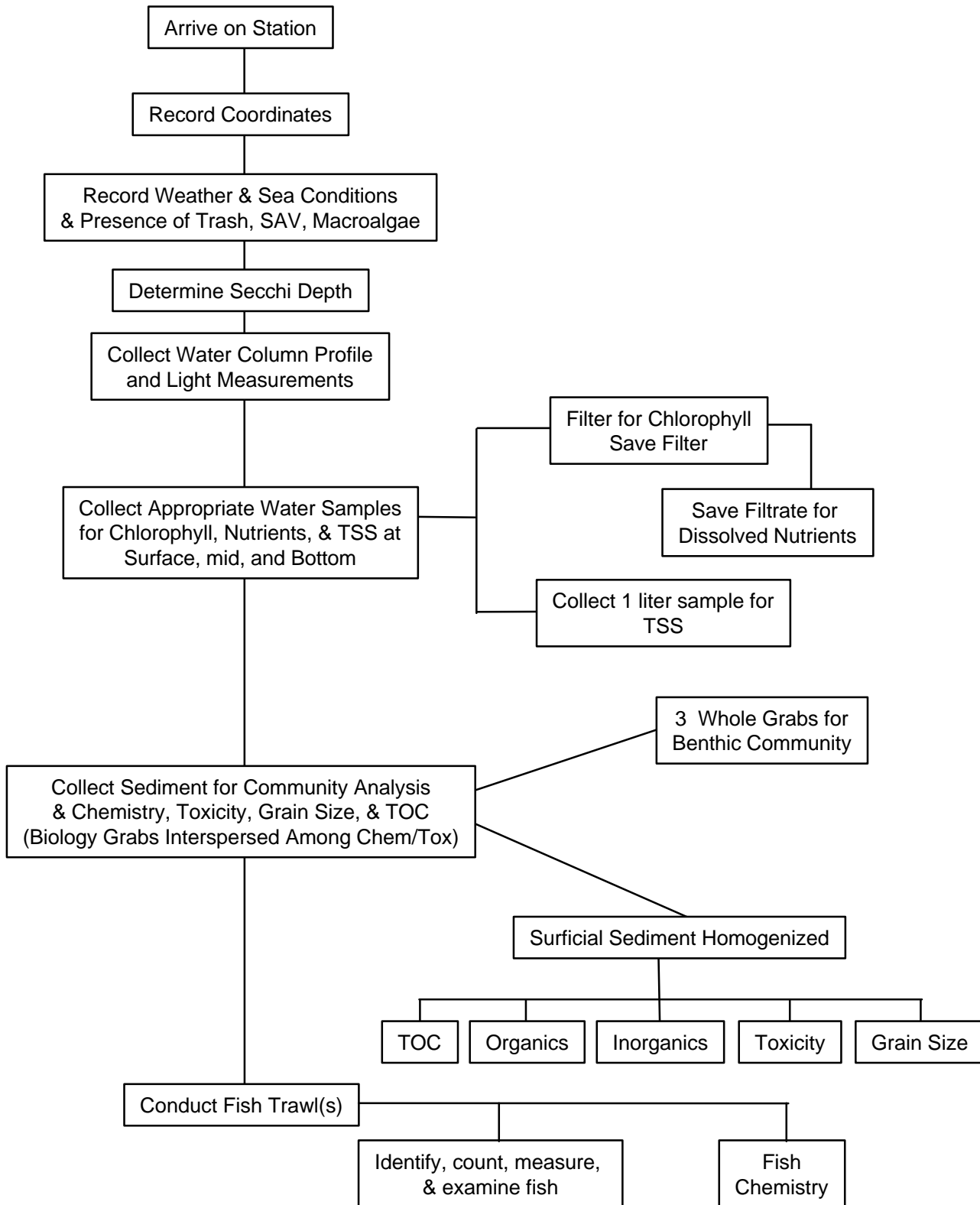


Figure 1. Flow chart of sampling activities conducted at C2000-NE stations.

SECTION 3 FIELD DATA BASE MANAGEMENT

Management of data in the field is of paramount importance. Without proper data management the quality of the data generated is questionable. Field data management consists of two categories; written data sheets and electronic data.

In general all data will be recorded on hard-copy datasheets while on-station, and entered into a computer back on shore. The use of bar code readers will facilitate the entry of sample numbers and eliminate transcription errors. AED can provide datasheets and electronic forms for data entry if desired. AED can also assist in the procurement of bar codes. C2000-NE datasheets are included in Appendix C. Although their use is not required, it is highly recommended.

It is the responsibility of the chief scientist to guarantee the quality of the data. At the end of each day it is his/her responsibility to review the data collected that day and "sign-off" on it.

3.1 Sample Tracking Procedures

A variety of water, water quality, sediment, and biological samples are collected during the C2000 sampling effort. These include physical samples (*i.e.*, sediment and nutrient samples) and non-physical samples (*i.e.*, Hydrolab and YSI cast data). It is vital that all of these samples and data be tracked from collection to the receipt of analytical results. To accomplish this purpose, all samples collected are assigned unique sample identification numbers (SAMPLE IDs) composed of the station number and a sample-type code. These numbers are used to track samples from collection to inclusion in the final National database.

3.2 Station and Sample Numbers

Because Coastal 2000 is a large-scale national monitoring program being implemented by many agencies with data feeding into a centralized database, it is critical that all stations and samples be assigned unique identifiers. All information sent to the national database must be associated with a station using the C2000 convention. Station names will include the state in which the station is located, the year of sampling, and a number. The format adopted is as follows:

SSYY-XXXX

Where,

SS is the state where the station is located,
YY is the last two digits of the year (00 for year 2000), and
XXXX is a four-digit incremental identifier, beginning at 0001.

So, for example, the first 35 stations in Massachusetts, New Hampshire, and Maine, sampled in year 2000 would be identified as:

MA00-0001 to MA00-0035
NH00-0001 to MA00-0035
ME00-0001 to MA00-0035

Note that were one state entity will be sampling in another states waters, the station number is based on the "location" not the organization conducting the sampling. This is likely to occur when one state will be responsible for an entire water body even though portions fall within the neighboring state's jurisdiction.

Sample numbers will be made up of the station code with a sample type identifier attached to the end. Sample number formats are illustrated in Table 2. All sample information sent to the national database must use this format.

3.3 Use of Bar Codes

The use of bar codes to label samples is highly recommended. Ten years of experience with EMAP has demonstrated their utility. Bar codes are preprinted for every sample that might be collected during the sampling season, with side-by-side duplicates for each sample, by a professional service. Each label contains both the bar code itself, and the printed sample number. Labels are waterproof and do not come off when frozen or immersed in formalin.

When a sample is collected, one of duplicate labels is placed on the sample and the other on the datasheet. When the data are transcribed from the datasheet into the computer, the sample numbers need not be typed in. They can just be scanned with a bar code reader. This virtually eliminates transcription error.

Bar codes also make shipping of samples easier. As a sample is placed in the shipping container, the sample ID is scanned into the computer. A packing list can then be printed out for inclusion with the shipment.

3.4 Electronic Data Entry

All information recorded on the datasheets must be entered into a computer for eventual transfer to the national database. This should be done as soon as possible, while the sampling event is "fresh" in the crew's mind. It is the responsibility of the chief scientist to ensure the accuracy of the electronic data file.

One method to facilitate this process is to use form-filler software. This software can be used to design and print hard-copy datasheets, and to create an identical electronic form. Having the computer screen as an exact copy of the field forms facilitates data entry. QA is easier as the completed electronic form can be printed out for side-by-side comparison with the original field form.

C2000-NE can provide both the field and electronic datasheets to any participate desiring them. The participant would only need to purchase the appropriate commercial software to access the C2000-NE electronic forms.

Table 2 Sample numbers assigned to each sample type. Sample number consists of the station number (state/year - number, e.g., RI00-0001 for Rhode Island, year 2000, station 1) followed by a sample type code. The list below uses station RI00-0001 as an example. For QA samples, the state identifier is replaced with "QA" and the station designator is sequential rather than being associated with a given station. The link is made in the database.

Sample Type	Type Code	Example Sample Number	Bar-Coded?
CTD Cast	CTD	RI00-0001-CTD	N
Light measurement (PAR) profile	PAR	RI00-0001-PAR	N
Surface chlorophyll	SCL	RI00-0001-SCL	Y
Surface suspended solids	SSS	RI00-0001-SSS	Y
Surface dissolved nutrients	SN	RI00-0001-SN	Y
Mid-depth chlorophyll	MCL	RI00-0001-MCL	Y
Mid-depth suspended solids	MSS	RI00-0001-MSS	Y
Mid-depth dissolved nutrients	MN	RI00-0001-MN	Y
Bottom chlorophyll	BCL	RI00-0001-BCL	Y
Bottom suspended solids	BSS	RI00-0001-BSS	Y
Bottom dissolved nutrients	BN	RI00-0001-BN	Y
Benthic infauna (1)	BI1	RI00-0001-BI1	Y
Benthic infauna (2)	BI2	RI00-0001-BI2	Y
Benthic infauna (3)	BI3	RI00-0001-BI3	Y
Sediment Toxicity	ST	RI00-0001-ST	Y
Sediment grain size	SG	RI00-0001-SG	Y
Sediment Organics	SO	RI00-0001-SO	Y
Sediment Metals	SM	RI00-0001-SM	Y
Sediment TOC	OC	RI00-0001-OC	Y
Standard fish trawl	STRL	RI00-0001-STRL	N
Non-standard fish trawl	TRL	RI00-0001-TRL	N
Fish chem. species 1 composite	FC1	RI00-0001-FC1	Y
Fish chem. species 1 individuals	FC1-1 to FC1-9	RI00-0001-FC1-1 To RI00-0001-FC1-9	Y
Fish chem. species 2 composite	FC2	RI00-0001-FC2	Y
Fish chem. species 2 individuals	FC2-1 to FC2-9	RI00-0001-FC2-1 To RI00-0001-FC2-9	Y
"Other" sample type 1	OTH-1	RI00-0001-OTH-1	Y
"Other" sample type 2	OTH-2	RI00-0001-OTH-2	Y
Quality Assurance Samples (full range of sample numbers given for C2000-Northeast)			
Fish pathology QA	PATH	QA00-0001-PATH To QA00-0500-PATH	Y
Chlorophyll QA	CL	QA00-0001-CL To QA00-0300-CL	Y
Dissolved nutrients QA	N	QA00-0001-N To QA00-0300-N	Y
TSS QA	SS	QA00-0001-SS To QA00-0300-SS	Y

SECTION 4 WATER QUALITY MEASUREMENTS

One of the activities to be performed at every station is the collection of water quality information (salinity, temperature, pH, and dissolved oxygen [DO]). At every station a vertical profile through the water column is obtained using a profiling instrument. Listed below are instructions for crews using the Hydrolab DataSonde3 datalogger (referred to as either "Hydrolab" or "DataSonde") attached to a Surveyor 4 deck unit. This is the equipment used by AED field crews. The protocols following are excerpted from past EMAP-Virginian Province field manuals. This section describes the instrument and data collection procedures. Similar procedures should be followed by field crews using other instruments.

Included in this section is the operation of a YSI model 58 DO meter. Protocols require a duplicate measurement, using a different instrument or method, at each station for the purpose of Quality Assurance. Winkler titrations are recommended for crews experienced with this procedure. If this wet chemistry method is not practical, a duplicate surface measurement can be made with a separate properly-calibrated DO meter. For the data to be acceptable, both values must agree to within 0.5 mg/L.

4.1 Hydrolab Datasonde3® unit

Obtaining a vertical profile of the water column using a Hydrolab Datasonde3® or similar unit is one of the first activities performed at every station. A Hydrolab is a sophisticated instrument designed to collect high-quality data for salinity, temperature, dissolved oxygen (DO) concentration, pH, and water depth. At each station the instrument will be used as a CTD (instrument that measures Conductivity, Temperature, and Depth - in this case, also measures pH and DO) to obtain a vertical profile of water column conditions. Training of all personnel expected to operate this instrument is necessary to assure reliable operation and acceptable data.

Below are general instructions for calibrating and deploying these units.

4.1.1 *Setup and Calibration*

The following is a brief summary of the calibration of the Hydrolab. The manual should be referred to for detailed instructions and should be read prior to calibration. During calibration, the Datasonde unit should be attached to the gel pack battery to conserve the unit's internal battery supply. Calibration should be performed every morning prior to the start of sampling.

1. To calibrate the Hydrolab Datasonde units, the software package "Procomm" will be used. Attach the DataSonde unit to the computer with the data cable, making sure the computer is reading from the correct port (com 2 on AED "Rocky" laptops) and at a baud rate of 9600bps. The first time you calibrate the Hydrolab, you will have to select the

parameters that C2000 will be using and remove any other parameters (in order to save memory and battery power). Once you are in Procomm, lines of data will be displayed (if this is not the case check the battery or refer to the manual). Pull up the menu by depressing the space bar. To select the parameters hit 'P'.

2. You can now add the following parameters by hitting the letter in parentheses for each parameter and then choosing E for (E)nable. The parameters that need to be added are:

(p)H
(S)alinity
D(O)
(%) Sat
(D)epth/Level
(B)attery

3. Then remove the following parameters by choosing (D)isable:
Specific (C)onductance/Resistivity
(R)edox

4.1.2 Calibration of the salinity sensor

The salinity sensor will be calibrated against a sample of seawater that has a known salinity [from a high quality laboratory salinometer calibrated with IAPSO Standard Seawater (a.k.a. "Copenhagen" water)]. The Hydrolab will always be equipped with the salt water cell block. Rinse the sensor & calibration cup 3 times with a small amount of the salinity standard (shaking vigorously with the calibration cap in place). Fill the calibration cup to within a centimeter of the cup's edge and make sure there are no bubbles in the conductivity cell block. From the Calibrate menu, choose (S)alinity and enter the standard value in parts per thousand.

4.1.3 Calibration of the pH sensor

Rinse the sensors and calibration cup thoroughly with deionized water prior to and following filling the cup with the standard pH buffers. Fill the calibration cup with the pH 7 standard buffer. Wait until the reading stabilizes to hit the space key, access the calibrate menu and enter the pH value. Now finish calibrating the pH sensor using the pH 10 standard. It is important that there is not a lot of drift in the measurement before entering the calibration standard value. If you cannot get the readings to stabilize, it is time to clean the sensors and check the battery power.

4.1.4 Calibration of the Dissolved Oxygen sensor

The calibration of the dissolved oxygen sensor is highly sensitive to the maintenance of the sensor itself. To make the calibration process go more smoothly, it is important to examine the DO membrane and make sure it has not dried out, become damaged or dirty, that there are no bubbles in the electrolyte, and that **you have waited at least 12 hours (preferably 24 hours) after changing a membrane to calibrate.**

With the unit turned upside down, fill the calibration cup with ambient room temperature tap water (or DI) to the O-ring line on the DO sensor, making sure all of the sensors have been well rinsed prior to this. Tightly put the calibration cap on and shake the unit to aerate the water. Remove the cap on the calibration cup and, using the corner of a kimwipe, remove all water droplets from the membrane surface. Put the calibration cap on (upside down). Wait for the readings to stabilize, and then depress the space key to access the calibration menu. Enter 760mm for the barometric pressure (if a barometer is available the exact pressure can be entered, but the range at sea level has only a minimal effect on the calculated DO reading), and then enter the DO percent saturation (100% for the standard membrane).

4.2 Obtaining Hydrolab Profile

At each station, the general procedures for collection of data are as follows:

1. Connect the Hydrolab to the end of the winch cable with a shackle and **TIGHTEN THE PIN**. Make sure a "pinger" is attached to the unit. A 50 pound weight should be hanging approximately 0.5 meter below the unit, and one float (sufficient buoyancy to float the Hydrolab without the weight) attached to the top. This will prevent the unit from impacting the bottom.
2. Remove the protective cover from the probes and connect the stirrer.
3. Connect the unit to the Surveyor 4 deck unit and initialize logging.
4. Connect the stirrer to the upper bulkhead connector.
5. Lower the unit over the side and allow it to equilibrate at the surface for at least two minutes after the unit begins logging.
6. While the unit is equilibrating, lower a YSI probe (see Section 4.3) with stirrer over the side to the same depth as the Hydrolab. Record the reading from the YSI on the CTD datasheet. This serves as a Quality Control check on the operation of the Hydrolab. A surface salinity and temperature should also be obtained with a refractometer and the YSI meter or thermometer, respectively.

Make sure that the Hydrolab surface readings agree with those from the QC check (e.g., the DO readings must agree to within 0.5 mg/L). If they agree, continue with the cast. If they do not agree, recalibrate the YSI and obtain another surface reading. If they then agree, continue with the cast. If they do not, try another Hydrolab.

7. Lower the Hydrolab according to the following schedule:

Shallow sites (< 2 m) - every 0.5 m interval;

Nominal depths (>2<10 m) - 0.5 m (near-surface) and every 1-m interval to near-bottom (0.5 m off-bottom);

Deep sites (>10 m) - 0.5 m (near-surface) and every 1-m interval to 10 m, then at 5-m intervals, thereafter, to near-bottom (0.5 m off-bottom).

Allow the unit to stabilize at each stop during descent. Save the data from each depth on the Surveyor unit and record the values on the Hydrographic Data Sheet. Once the weight hits the bottom the unit will float 0.5 meter above.

8. Repeat the process on the upcast.
9. Connect the Surveyor to the computer and download the data (this can be done back at the dock). The file should be saved as "XX00xxxxctd.csv" where XX00xxxx is the station number (e.g., MA000001ctd.csv).

4.3 YSI Model 58 Dissolved Oxygen Meter and Probe

The YSI will be used to take oxygen measurements at the surface as a Quality Control check on the Hydrolab. The following information details the maintenance and operation of the YSI Model 58 Dissolved Oxygen Meter.

4.3.1 Initial Setup of The YSI

1. The YSI Model 58 has two separate sets of batteries, one for the oxygen meter and the other for the stirrer. Both sets consist of 4 D-size Alkaline batteries. These are accessed by removing the four screws on the back panel then carefully pulling the meter back away. The upper battery holder is for the oxygen meter, the lower holder for the stirrer batteries. Note that the stirrer batteries will probably require more frequent replacement, whereas the meter batteries will most likely last throughout the entire field season. Observe correct polarity whenever changing batteries in either holder.
2. When the YSI meter batteries are low, the LOWBAT warning will show **continuously** on the display (the LOWBAT warning may flash momentarily as the meter knob is turned off, but this is normal). The initial appearance of LOWBAT indicates about 50 hours of meter battery life. The normal life for the meter batteries is about 1000 hours.

To check the YSI stirrer batteries, turn and hold the STIRRER knob to the BATT CHK position. If the LOWBAT warning shows **continuously** on the display then the stirrer batteries should be changed. The initial appearance of the LOWBAT warning in the BATT CHK position indicates 5 hours or less of stirrer battery life. The normal life for the stirrer batteries is about 100 hours.

3. While the meter is still open, observe the position of the sliding switch in the upper right hand corner of the meter. This switch sets the meter sensitivity for the type of membrane on the oxygen probe. The switch should be in the middle position, set for a 1 mil ("standard") membrane.
4. Close the meter housing and gently tighten the corner screws. **DO NOT OVER TIGHTEN** these screws, as they are easily stripped. As you close the meter, work the rubber gasket so that the outer edge overlaps both halves of the housing.

4.3.2 *Changing the YSI Probe Membrane*

The procedure for changing the YSI probe membrane is similar to that for the Hydrolab membrane. However there are some differences, so it's important to be familiar with both procedures. The YSI membrane should be changed weekly, or sooner if the probe is difficult to calibrate or is slow to respond. Visual inspection is the best indication of when to change the membrane: if the membrane is fouled, wrinkled, cut, has bubbles underneath it, or the gold cathode is tarnished...then it's time. Try to schedule membrane replacement at the end of a field day, or the night before. This allows the membrane more time to "relax" and equilibrate.

1. Prepare the electrolyte by dissolving the KCl crystals in the dropper bottle with distilled water. Fill the bottle to the top.
2. Unscrew the sensor guard, and remove the O-ring and membrane. Rinse the sensor with distilled water and then with electrolyte. Gently wipe the gold cathode ring with a kimwipe or paper towel.
3. Fill the sensor with electrolyte. If you're right-handed, grasp the sensor in your left hand with the pressure compensating vent to the right. Successively fill the sensor body with electrolyte, then pump the diaphragm with the ERASER end of a pencil or with some similar soft, blunt tool. Continue filling and pumping until no more air bubbles appear. Tap the sensor with the pencil to free any bubbles trapped on the sides.
4. Remove a membrane from the "standard membrane" package (DO NOT use the Hydrolab membranes - they are different). Secure the membrane under your left thumb. Add a few more drops of electrolyte to the sensor to form a meniscus over the gold cathode.
5. With the thumb and forefinger of your other hand, grasp the free end of the membrane.
6. Using a continuous motion, stretch the membrane UP, OVER, and DOWN the other side of the sensor. Stretching forms the membrane to the contour of the probe.
7. Secure the end of the membrane under the forefinger of the hand holding the probe.

8. Set the O-ring on the membrane above the probe, and using your thumb and index finger, roll the O-ring down over the probe until it is seated. Try not to touch the membrane surface while doing this. Gently tug at the exposed corners to remove all wrinkles, then trim away the excess membrane below the O-ring and replace the sensor guard. Inspect the membrane to make sure there are no bubbles, wrinkles, or cuts.
9. The probe should be stored in the open-ended plastic bottle provided for that purpose. Moisten the sponge or paper towel in the end of the storage bottle to prevent the membrane from drying out. The membrane needs to relax for a minimum of 12 hours following installation.

4.3.3 Calibration of the YSI Oxygen Meter

The YSI should be calibrated before sampling at EACH station, and the meter and attached probe should be turned on for at least 10 minutes prior to calibration or sampling. In practice this means turning the meter on at the beginning of the day and leaving it on (with the possible exception of very long transit periods between stations). On field days when the probe is not being used leave the meter in the % switch positions (or, in the case of the model 57, in the 0-10 MG/L position).

1. Calibration will be done in the probe storage/calibration chamber. Confirm that a moist piece of towel or sponge is present in the bottle. Remove any water droplets from the membrane surface by drying with the corner of a paper towel.
2. Set the function switch to ZERO, and when the display reading has stabilized, readjust display to read 0.00.
3. Reset the function switch to % mode. When the display reading has stabilized, unlock the O2 CALIB control locking ring and adjust the display to read 100%. Relock the locking ring to prevent inadvertent changes. Avoid exposing the calibrated probe to large thermal changes, such as from direct sunlight or lying on a hot deck.

4.3.4 Operation of the YSI Oxygen Meter

In general the YSI will be used to confirm the proper operation of the CTD.

1. Calibrate the YSI (See above; Section 4.3.3).
2. Remove the storage/calibration chamber and the sensor guard, and CAREFULLY screw the probe into the stirrer. The probe membrane should NOT touch the stirrer blades. Membrane damage occurs most often when the probe is being inserted or removed from the stirrer. If a measurement isn't to be taken immediately, wrap the stirrer-probe unit in a moist towel and set it out of the sun.
3. Set the function switch to 0.01 MG/L mode.

4. To perform a surface YSI check place the probe next to the CTD DO probe with the stirrer ON. Set the YSI salinity from refractometer reading. Record temperature from a thermometer, and DO from the YSI on the "CTD CAST DATA SHEET".
5. If using the Hydrolab to obtain a bottom water dissolved oxygen concentration:
 - A. Collect a bottom water sample in the *GO-FLO* bottle.
 - B. Draw out a small sample from the bottle and measure the salinity using the refractometer. Set the SALINITY switch to this value, and record the salinity on the "CTD CAST DATA SHEET".
 - C. Prop open the Go-Flo bottle. A Hydrolab sensor guard without the weight works well for this.
 - D. Insert the stirrer-probe unit into the GO-FLO bottle and turn the stirrer ON.
 - E. When the meter reading has stabilized, record the oxygen value on the "CTD CAST DATA SHEET".
 - F. Remove the probe, turn the stirrer OFF, rinse the probe with freshwater, replace the storage bottle, and store the unit out of sunlight.

4.4 Light Attenuation

C2000-NE crews will also obtain a vertical profile of light for the purpose of calculation of the light attenuation coefficient at each station. This can be accomplished using either a PAR (photosynthetically active radiation) meter or a transmissometer. This profile can be obtained in conjunction with the CTD profile or separately, depending upon the equipment available. PAR sensors require no field calibration, however, they should be returned to the manufacturer prior to each field season for annual calibration.

To obtain a PAR profile using an independent datalogger such as the LI-COR LI-1400:

1. Connect a deck sensor and an underwater sensor to the LI-1400. Make sure the correct calibration factors are entered for each probe. These are supplied by the manufacturer.
2. Place the deck sensor on the boat in a location where it will not be shaded.
3. Lower the underwater sensor on the SUNNY (or at least unshaded) side of the boat to a depth of about 10 cm (represents "surface").
4. Once readings stabilize, record the values from both sensors ($\mu\text{E}/\text{m}^2/\text{s}$), along with the water depth of the underwater sensor, on the datasheet. Log the values in the datalogger.

-
5. Lower the underwater sensor to 0.5 meters, allow the values to stabilize, and record the values from both sensors, along with the water depth of the underwater surface.
 6. Repeat at the following schedule:
Shallow sites (< 2 m) - every 0.5 m interval;

Nominal depths (>2<10 m) - 0.5 m (near-surface) and every 1-m interval to near-bottom (0.5 m off-bottom);

Deep sites (>10 m) - 0.5 m (near-surface) and every 1-m interval to 10 m, then at 5-m intervals, thereafter, to near-bottom (0.5 m off-bottom).
 7. If the bottom is impacted with the meter, allow 2-3 minutes for the disturbed conditions to settle before taking the reading.
 8. If the light measurements become negative before reaching the bottom, terminate the profile at that depth.
 9. Repeat the process on the upcast.

4.5 Secchi Depth

The Secchi disk is used to give a measurement of the transparency of the water column, also called the secchi depth. This measurement is made at every station and is recorded on the CTD datasheet. A 20 cm black and white Secchi disk is held by a non-stretch line that is marked in two tenths of a meter intervals. To determine the Secchi depth:

1. Slowly lower the Secchi disk on the shady side of the boat until it is no longer visible and note the depth using the markings on the line (interpolate between markings to the nearest 0.1 meter). If the disk hits the bottom, meaning the Secchi depth is greater than the water depth, note this on the datasheet.
2. Slowly raise the Secchi disk until it just becomes visible and note the depth.
3. Perform steps 1 and 2 three times, noting both readings. Record the average of the readings.

QUALITY CONTROL FOR SECCHI DISK

1. If the range of measurements for the three sets of depth readings is greater than 0.5 m, the entire process should be performed again.
2. No sunglasses or any other devices should be used to shade the eyes while this procedure is being performed.
3. The Secchi depth should be determined from the shady side of the boat during daylight hours.

SECTION 5 WATER COLUMN NUTRIENTS

Water samples will be collected at each site and analyzed for:

Chlorophyll *a*
Dissolved ammonia, nitrites, nitrates, orthophosphates, and
Total Suspended Solids.

Samples should be collected at three depths; surface, mid-water, and bottom, depending upon the depth of the water:

Shallow sites (< 2 m) - mid-depth sample only;

Nominal depths (2-5 m) - 0.5 m (near-surface) and 1 m off-bottom;

Deep sites (>5 m) - 0.5 m (near-surface), mid-depth, and 1 m off-bottom.

Water samples should be obtained, either using a pumped system or a water sampling bottle such as a Niskin or 5 *Go-Flo*® bottle, and transferred to a rinsed (3x with water from the sampling bottle) one gallon HDPE container.

5.1 Chlorophyll *a* and Phaeophytin

Chlorophyll samples must be filtered no more than 4 hours after collection. Any further delay is strongly discouraged due to the possible lysis of phytoplankton cells. Samples that cannot be filtered immediately after collection must be held at 4°C until filtered. Filtering can be accomplished by either of two methods. The first requires the use of a vacuum pump, either electric or hand operated. The second uses positive pressure. The method used must be noted on the datasheet.

5.1.1 Vacuum filtration

Immediately concentrate the algae by filtering onto two 47 mm GF/F filter pads. Process a sufficient amount of sample (*i.e.* 100-1,500 ml) to produce a green color on the filter. Record the volume filtered on the datasheet. The filtrate should be saved for dissolved nutrient analyses (Section 4.2). To avoid cell damage and loss of contents during filtering, do not exceed a vacuum of 15 psi or a filtration duration of greater than 5 minutes. Add 1 ml of saturated MgCO₃ solution (10 mg/L) during the last few seconds of filtering **AFTER THE NUTRIENT FILTRATE HAS BEEN REMOVED**. This buffers the sample to reduce the possibility of degradation. Carefully remove the filters using forceps (never touch the filter with your fingers), fold in half, and wrap in clean aluminum foil. Mark both the volume filtered and the sample number (SCL, MCL, BCL: surface, mid, or bottom chlorophyll) on the foil. Place both filters in a whirl pak and affix the appropriate bar code or hand-write the sample number. Place the package on dry ice.

Note that filter funnels should be rinsed with DI water prior to filtration. In addition, graduated cylinders should be rinsed with site water.

If too much sample is filtered (*i.e.*, there is a thick layer of material on the filter pad), it should be discarded and the filtration repeated with a smaller volume. Too much material may result in some “oozing out” when the pad is folded.

5.1.2 Positive pressure filtration

The alternative method is to use positive pressure to push a sample through the filter. A disposable, graduated 50-cc polypropylene syringe fitted with a stainless steel or polypropylene filtering assembly is used to filter the site water through 25 mm GF/F filters; the volume of water filtered must be documented. If conditions allow (based on the suspended solids load), up to 200 ml of site water should be filtered for each chlorophyll sample; for a 50-cc syringe, that equates to 4 fills. To refill when the syringe barrel empties, carefully detach the filter assembly and fill the syringe to the mark, replace the filter and continue with the filtration until the desired volume has been processed. The filtrate from this process is saved for the analysis of dissolved nutrients (see Section 4.2). After filtering the sample, add 1 ml of saturated MgCO_3 solution (10 mg/L) to the syringe (AFTER THE NUTRIENT FILTRATE HAS BEEN REMOVED) and pass this through the filter pad. This buffers the sample to reduce the possibility of degradation. Using tweezers, carefully remove the filter from its holder and fold once on the pigment side, then place it in foil as described in 4.1.1. Record the volume of water filtered on both the foil and on the field form. Mark the sample number on the foil pack, then place the foil pack in a whirlpack and label the whirlpack with the appropriate bar code. Place on dry ice. Repeat the filtering process for the second sample and store filter in the same whirlpack containing the first sample. The samples must remain frozen until time of analysis. Discard the used syringe. Rinse the filtering assembly with deionized water and store in a clean compartment between sampling stations (a small tackle box makes a good carrying kit for supplies and equipment used in this activity).

5.2 Dissolved Nutrients

Approximately 40 ml of filtrate from the above chlorophyll filtration will be collected into a pre-labeled, clean 60-ml Nalgene screw-capped bottle and stored on dry ice. Before placing sample in the freezer, affix the appropriate bar code to the bottle and record the approximate salinity (± 2 ppt) on the container. This is a convenience for the analyst who will perform the nutrient analysis. Depending on the analytical instrumentation used, matrix matching of solutions (*e.g.*, standards or wash solutions) may be required for certain of the analytes. The salinity value can be obtained from the water column data or by refractometer reading of the actual water sample taken by sampling bottle. The nutrient samples should remain frozen until time of analysis.

5.3 Total Suspended Solids

Approximately 1 liter of unfiltered seawater from the sampling bottle is poured into a 1-L polypropylene bottle and stored at 4°C to await laboratory analysis.

5.4 Quality Control

Field duplicates: A field duplicate is a sample taken at the same location and depth as a regular sample and processed for chlorophyll, nutrients, and total suspended solids. The duplicate and sample should be taken in quick succession. A field duplicate should be collected once for every 10 samples. The data from field duplicates indicates sampling precision.

Although some filtering may be done on shore, many times it will be necessary to filter while on the boat. Working with liquids on a rocking boat presents many opportunities for contamination, and therefore, special care must be taken. The following guidelines will help prevent accidents while working with the water samples:

1. After every station empty the overflow bottle and all reservoirs.
2. Rinse the filtering apparatus with DI water before putting in a new filter.
3. Only handle filters with tweezers.
4. All filters should be inspected and damaged filters should be discarded.

SECTION 6 SEDIMENT COLLECTIONS

6.1 Sediment Collections

Sediments are collected for a variety of analyses. Three samples are collected for benthic species composition and abundance (although only one will be analyzed this year - the remaining two will be archived for future analysis as funding becomes available); and additional sediment grabs are collected for chemical analyses, grain size determination, and for use in acute toxicity tests. The number of grabs needed may vary based on the sediment characteristics. To minimize the possibility of biasing results, benthic biology grabs should not be collected consecutively, but rather interspersed among the chemistry/toxicity grabs. While a biology grab is being processed (sieved), grabs should be collected for chemistry/toxicity.

A 1/25 (0.04) m², stainless steel, Young-modified Van Veen Grab sampler is used to collect sediments. The sampler is constructed entirely of stainless steel and has been Kynar®-coated (similar to Teflon) and is therefore appropriate for collecting sediment samples for both biological and chemical analyses. The top of the sampler is hinged so the top layer of sediment can be easily removed for chemical and toxicity analyses. This gear is relatively easy to operate and requires little specialized training.

Other gear is also acceptable, following approval by the C2000-NE Field Coordinator. The gear size must be identified on the appropriate datasheet.

Listed below is the protocol for obtaining sediment samples.

1. The sampler must be thoroughly washed with Alconox prior to use at a station, then rinsed with ambient seawater to ensure no sediments remain from the previous station.
2. Attach the sampler to the end of the winch cable with a shackle and **tighten the pin**. Attach a pinger to the grab.
3. Cock the grab.
4. Lower the grab sampler through the water column such that travel through the last 5 meters is no faster than about 1 m/sec. This minimizes the effects of bow wave disturbance to surficial sediments.
5. Retrieve the sampler and lower it into its cradle on-board. Open the hinged top and determine whether the sample is successful or not. A successful grab is one having relatively level, intact sediment over the entire area of the grab, and a sediment depth at the center of at least 7 centimeters (see Figure 2). Grabs containing no sediments, partially filled grabs, or grabs with shelly substrates or grossly slumped surfaces are unacceptable. Grabs completely filled to the top, where the sediment is in direct contact

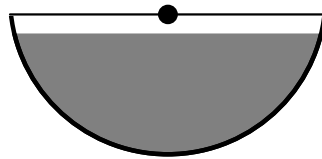
with the hinged top, are also unacceptable. It may take several attempts using different amounts of weight to obtain the first acceptable sample. The more weight added, the deeper the bite of the grab. In very soft mud, pads may be needed to prevent the sampler from sinking in the mud. If pads are used, the rate of descent near the bottom should be slowed even further to reduce the bow wave.

6. Carefully drain overlying water from the grab. If the grab is used for benthic community analysis, the water must be drained into the container that will receive the sediment to ensure no organisms are lost.
7. Enter notes on the condition of the sample (smell, texture, presence of organisms on the surface, etc.) on the data sheet.
8. Process the grab sample for either benthic community analysis or chemistry/toxicity testing as described in Figure 3 and in Sections 6.2 and 6.3.
9. Repeat steps 4-8 until all samples are collected. To minimize the chance of sampling the exact same location twice, the boat engines can be turned periodically to change the drift of the boat, or additional anchor line can be let out.

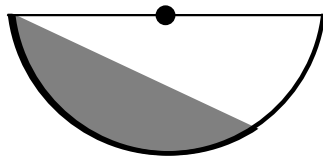
6.2 Field Processing of Samples for Benthic Community Assessment

Grab samples to be used in the assessment of macrobenthic communities are processed in the following manner:

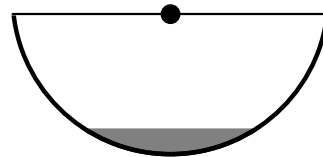
1. Assign a sample number to the sample; affix the bar coded labels to the sample jar and datasheet.
2. Measure the depth of the sediment at the middle of the sampler and record the value on the data sheet. The depth should be ≥ 7 cm. Record descriptive information about the grab, such as the presence or absence of a surface floc, color and smell of surface sediments, and visible fauna in the computer.
3. Dump the sediment into a basin and then into a 0.5 mm mesh sieve. Place the sieve into a table (sieve box) containing water from the sampling station. Agitate the tray in the sieve box thus washing away sediments and leaving organisms, detritus, sand particles, and pebbles larger than 0.5 mm. This method minimizes mechanical damage to fauna that is common when forceful jets of water are used to break up sediments. A gentle flow of water over the sample is acceptable. Extreme care must be taken to assure that no sample is lost over the side of the sieve.



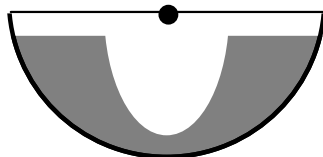
Acceptable grab
At least 7 cm deep with even surface



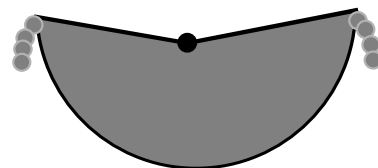
Unacceptable grab
Sloping surface



Unacceptable grab
Insufficient volume



Unacceptable grab
Wash-out



Unacceptable grab
Overfilled

Figure 2. Illustration of acceptable and unacceptable grabs for benthic community analysis. An acceptable grab is at least 7 cm in depth (using a 0.04m² Van Veen sampler), but not oozing out of the top of the grab, and has a relatively level surface.

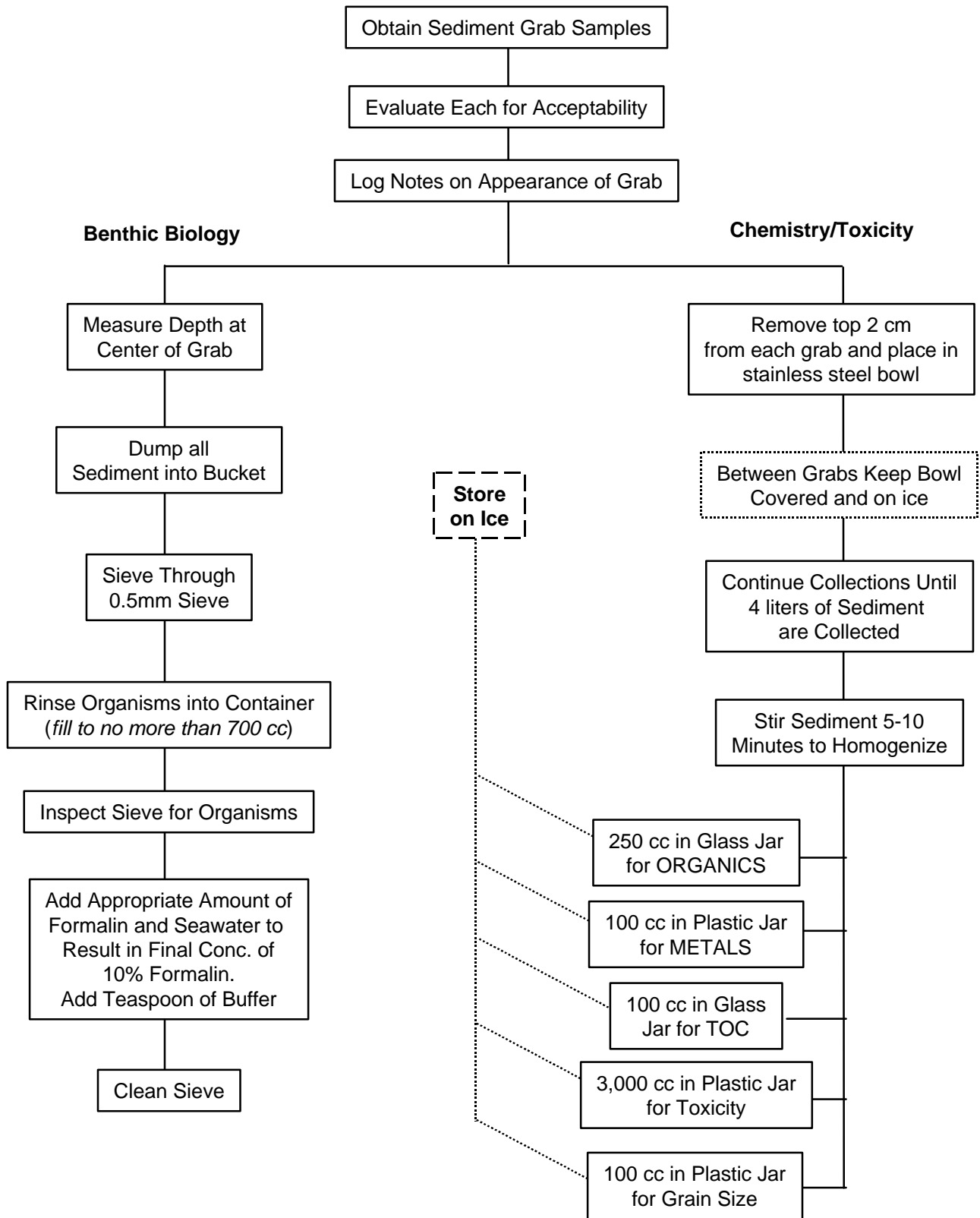


Figure 3. Flow chart for C2000-NE sediment collection and field processing.

4. Drain the water from the sieve box and gently rinse the contents of the tray to one edge. Using either your fingers or a spoon, GENTLY scoop up the bulk of the sample and place it in the plastic screw-top bottle labeled in Step 1 (which should be placed in the sieve or a bucket in case some of the sample spills over). Rinse the outside of the sample jar into the sieve, then, using a funnel, rinse the contents into the jar. The jar should be filled no higher than the 700 ml mark. If the quantity of sample exceeds 700 ml, place the remainder of the sample in a second, unlabeled container. Using a waterproof marker, write the sample number on the second container and tape the two together. Note on the datasheet that the sample consists of more than one container.
6. Carefully inspect the sieve to ensure that all organisms are removed. Use fine forceps (if necessary) to transfer fauna from the sieve to the bottle containing the proper sample number.
7. Ten percent buffered formalin is used to fix and preserve samples. A 100 % buffered, stained stock formalin solution should be mixed according to the recipe in Table 3. 100 ml of the formalin should be added to each sample jar, and a teaspoon-full of borax added to assure saturation of the buffer. FILL THE JAR TO THE RIM WITH SEAWATER TO ELIMINATE ANY AIR SPACE. This eliminates the problem of organisms sticking to the cap because of sloshing during shipment. Gently invert the bottle to mix the contents and place in the dark. If the sample occupies more than one container, tape all the sample bottles containing material from that grab together.
8. Prior to sieving the next sample, use copious amounts of forceful water and a stiff brush to clean the sieve, thereby minimizing cross-contamination of samples.

Table 3. Directions for mixing stock solutions of formalin.

Chemical	Volume Desired	Total Quantity
<u>100% formalin stock (stained and buffered)</u>		
Rose Bengal stain	8 L	1/4 teaspoon
Borax	8 L	8 heaping tablespoons
100% formalin	8 L	two gallons

6.3 Field Processing of Sediments for Chemistry and Toxicity Testing

In addition to the three grabs collected for benthic community analyses, additional grabs are collected for chemical analyses and toxicity testing. The top two cm of these grabs are removed, homogenized, and split for chemistry and toxicity testing. Because of contamination concerns these samples are removed and processed in the order described below:

1. As each grab is retrieved, carefully examine it to determine acceptability. The grab is considered acceptable as long as the surface layer is intact. The grab need not be greater than 7 cm in depth for chemistry samples, but the other criteria illustrated in Figure 2 apply. Carefully drain off, or siphon, any overlying water, and remove and discard large, non-living surface items such as rocks or pieces of wood.

NOTE: Great care must be taken to avoid contamination of this sample from atmospheric contaminants. The boat engine should be turned off or the boat maneuvered to assure the exhaust is down wind.

2. A clean stainless steel or teflon spoon is used to remove sediments from grab samples for these analyses. All items must be washed with Alconox and rinsed with ambient seawater before use.
3. Remove the top two cm of sediment using the stainless steel spoon. Place the sediment removed in a stainless pot and place the pot in a cooler on ice (NOT dry ice). The sample must be stored at 4°C, NOT FROZEN.
4. Repeat this procedure, compositing the sediment in the same stainless pot until a sufficient quantity of sediment has been collected for all samples (approximately 4 L). Stir sediment homogenate after every addition to the composite to ensure adequate mixing. Keep the container covered and in the cooler between grabs.
5. Homogenize the sediment by stirring with a Teflon paddle or stainless steel spoon for 10 minutes.
6. **ORGANICS** - Using a stainless steel spoon, carefully place 250 cc of sediment in a 500 ml glass bottle for chemical analysis. CARE MUST BE TAKEN TO ASSURE THAT THE INSIDE OF THE BOTTLE, BOTTLE CAP, AND THE SAMPLE ARE NOT CONTAMINATED. Record the sample number, wrap the jar in "bubble wrap" to protect it from breakage, and place the sample on ice (NOT dry ice). To reduce the possibility of breakage, the sample should be stored at 4°C, NOT FROZEN.
7. **METALS** - Using a stainless steel spoon, place approximately 100cc of sediment into a pre-cleaned plastic (HDPE) sampling jar. Record the sample number and keep on ice at 4°C.
8. **Total Organic Carbon** - Using a stainless steel spoon, place approximately 100cc of sediment into a pre-cleaned glass sampling jar. Record the sample number and keep on ice at 4°C.

9. **SEDIMENT GRAIN SIZE** - Using a stainless steel spoon, place approximately 100cc of sediment into a clean plastic (HDPE) sampling jar. Record the sample number and keep on ice at 4°C. Store this sample on ice (NOT dry ice).
10. **SEDIMENT TOXICITY** - Using the stainless steel spoon, fill approximately 75-85% of the 1 gallon plastic container for toxicity testing with sediment (minimum volume required is 3000 ml). Record the sample number on the bottle, and place the sample on ice (NOT dry ice). The sample must be stored at 4°C, NOT FROZEN.

6.4 Quality Control/Quality Assurance

6.4.1 Chemistry samples

There are a number of steps that can be taken to ensure the integrity of the samples collected.

1. The interior surfaces of the grab sampler (including the underside of the hinged top) must be washed with a laboratory-grade detergent and thoroughly rinsed prior to use to assure that no sediment remains from the previous station.
2. Prior to use, all Teflon and stainless steel supplies which are to come into contact with samples must also be properly cleaned. Once washed, crews must take precautions to assure that they do not become contaminated (e.g., by laying the stainless steel spoon on the deck).
3. As soon as any of the stainless spoons or bowls begin to rust they should be discarded. Equipment made from high-quality stainless steel will reduce the rate at which equipment needs to be replaced.
4. ASSURE THAT THE PROPER LABELS (e.g., BAR CODES) ARE AFFIXED TO ALL SAMPLES.
5. Excess seawater should be carefully drained from the surface of the grab by "cracking" the sampler slightly or siphoning off the water.
6. All grabs used in the composite must meet the criteria for an acceptable grab. It is especially important to make sure that the surface sediments did not wash out of the sampler.
7. Care should be taken to assure that the sediment saved for chemical and toxicological analyses is collected only from the top two cm of the grab.
8. Care must be taken to assure that the chemistry samples do not become contaminated. This requires great care in extracting the sample, homogenizing it, and placing it in the proper container. Because of the potential for contamination, the chemistry samples should be the first ones removed from the homogenate. If it is raining when the sample is collected, all activities should be conducted under a tarp to prevent contamination of the sample by rain water.

9. Great care must be taken to avoid atmospheric contamination from engine exhaust. The boat engine must be turned off or the boat maneuvered to assure the engine exhaust is down wind of the sample.
10. Exposure of the sample to the atmosphere should be minimized. Whenever possible the sample should be covered because contamination from the atmosphere, even without the engines running, can be significant.
11. Samples should be placed in a cooler on ice as soon as they are collected and recorded.
12. The grab must be suspended off the deck at all times to avoid contamination.
13. If the vessel is unable to anchor, the position relative to station should be monitored carefully during benthic collection.

6.4.2 Benthic biology

Field crews must assure that all grabs processed are acceptable according to the criteria described above, and that no organisms are lost during any step, including transferring the sample to the sieve, and during sieving. Also, samples must be properly identified and preserved to assure they are received by the processing laboratory in acceptable condition.

6.4.3 GRAIN SIZE

Samples collected for grain size analysis require no special QA steps other than carefully following the directions discussed earlier and assuring proper storage. Note that grain size samples must NOT be frozen.

6.4.5 TOXICITY

Since sediment toxicity samples are collected from the same homogenate used for sediment chemistry, the steps outlined above should be followed. In addition, because of the possibility of failure of a toxicity test, it is important that a full 3 L of sediment be collected for analysis at each station. This will provide a sufficient volume of sediment for re-testing if necessary.

6.5 Safety Considerations

All sediment grab samplers are dangerous pieces of equipment. Once the device is cocked, it could accidentally trip at any time. The operators must be careful not to place hands or fingers in a position where they could be damaged (or amputated) in the event that the device trips prematurely.

The sampler is a heavy piece of equipment (especially when full). The operators must take care when deploying or retrieving this gear under adverse weather conditions.

SECTION 7 FISH TRAWLS

After all required sediments are collected, one or more trawls are made to collect fish for species composition, relative abundance, chemical analysis, and pathological examination. Many states already have their own trawling protocols. Described below are the protocols for Coastal 2000. Existing state protocols and gear may be substituted following discussions with the C2000-NE Field Coordinator.

7.1 Gear and General Protocols

A fish trawl is a funnel-shaped net that filters fish from the near bottom waters. Fish are herded by ground wire and doors into the mouth of the funnel where fish are captured. The basic components of a trawl net are described briefly below. The actual specifications of the net used by AED for EMAP are found in Appendix B.

The doors of the net provide spreading power to the net. Water pressure against the doors force them to spread the wings of the trawl. The wings are the beginning of the webbing and form the mouth of the funnel on two sides of the net. The wings are bordered on top and bottom by a headrope and a footrope, respectively. For a single warp rig, each end of the headrope, or top line, is attached directly to the upper ring on the back of the doors. Each end of the footrope, or bottom line, is attached to the bottom ring of the doors. For strength and weight, a sweep is attached to the footrope. At the bosom, or top of the curve of the mouth, the wings attach to the body of the net. The top portion of the body has an overhanging panel, or square, which prevents fish from escaping over the top panel of the trawl. Continuing back toward the terminus of the net are the first and second bellies which are normally symmetrical top and bottom. The bellies contribute most of the body of the net, and therefore make up most of the taper. The cod-end is the rear portion of the trawl net which serves as a collecting bag for all that is captured by the trawl.

Fish are collected using a high rise sampling trawl with a 13.5-meter footrope with a chain sweep. Tow duration is 10 minutes with a towing speed of 2-3 knots against the prevailing current. Speed over the bottom should be 1-3 knot. Fish are sorted and enumerated, examined for evidence of gross pathological conditions, and selected specimens retained and properly processed for tissue chemical analysis. Subsampling of fish is conducted as necessary. The outline below describes the specific protocol to be followed during trawling operations. The procedures include: net deployment, vessel operation while under tow, net retrieval, and processing.

Types of trawls can be defined as follows:

STANDARD TRAWL - This trawl is the "quantitative" trawl performed at all stations for community structure and abundance determination. One standard trawl should be performed at EVERY station. Any fish sample type can be taken from a standard trawl. Fish are identified, measured, and examined for pathological conditions.

NON-STANDARD TRAWL - At selected stations non-standard trawls may need to be performed following the completion of a standard trawl only to obtain a sufficient number of fish for *tissue chemistry*.

The type of fish samples that will be collected are as follows:

Pathology Fish - These are fish observed by the field crew to have a gross external pathology (lump, growth, ulcer, fin rot, gill erosion, and/or gill discoloration). ALL species are examined for external pathology, therefore, pathology fish may be of any species collected. Pathology fish are collected only during the standard trawl. Any fish found with one of these conditions is preserved in Dietrich's fixative for confirmation by a specialist. These fish are Pathology fish.

Taxonomy QA fish - Fish that cannot be identified in the field are to be sent back to the appropriate agency for identification by an expert taxonomist.

7.2 Trawl Preparation

(Portions of these instructions are specific to the 24' boats at AED. Modifications may be necessary depending upon the vessel used for trawling)

1. Inspect the trawl net for holes, including cod-end liners, and mend/replace as necessary prior to departure from the dock. Inspect all hardware for wear and replace as needed. All connections should be made securely and tightened with a wrench. Do NOT rely on hand tightening shackles, bolts, or other fasteners.
2. Lead the winch wire from the drum through the turning block on the mast assembly and through the snatch block at the end of the boom.
3. Attach the bridle to the winch wire with a shackle. Wind both legs of the bridle onto the main winch drum, while maintaining tension on the wire. All bridle connections should be tightened with a wrench.
4. Arrange the net on the deck with the cod-end aft and the head rope on top. Close the end of the cod-end by using a cod-end knot. Check to make sure there is no escapement possibility through the cod end rings. The line should pass through the rings at the back of the cod end and around the net just in front of these rings. Coil the float line from the cod-end to the float, and position it on the net for easy access.
5. Attach the legs of the net to the trawl doors. The top leg of the net is the extension of the headrope and must be secured to the top aft ring of the door. The bottom leg is the extension of the sweep and must be secured to the bottom aft ring of the door. One bridle wire should be attached to each door at the towing point of the chain harness. Shackles should be used for all connections.

7.3 Net Deployment

(Portions of these instructions are specific to the 24' boats at AED. Modifications may be necessary depending upon the vessel used for trawling)

1. After all preparation steps have been completed, the chief scientist or captain should check all resources available (chart, navigational aids, land marks etc.) to determine that there are no under water hazards. Determine the direction of current flow and survey the probable trawl track for potential hazards, such as other vessels, deployed commercial fishing gear (nets, pots, etc.), shallow water, or unsuitable substrate. In addition, depth, weather, and sea conditions should also be evaluated prior to each trawl. The decision as to whether or not to collect a sample is the responsibility of the chief scientist or captain.
2. With the starboard engine in neutral, the boom should be positioned out over the starboard gunnel with a enough incline for the doors to clear the rail. Lead the bridles through the snatch block on the boom, raise the doors with the winch, and bring them to rest on the gunnel (starboard door forward, port door aft). Circle the boat slowly to starboard. When the starboard side is down current, deploy the float and safety line attached to the cod-end. Flake the net into the water from the cod-end to the wings. Check to make sure that the legs of the net are not twisted before continuing deployment. Pay out wire until the doors are well behind the engines. Swing the boom to the centerline then lower the boom, releasing tension on the snatch block (the wire should now be on the goalpost assembly). Head slowly into the current (e.g., 1 knot) and continue to pay out wire until appropriate warp length is obtained (consult Table 4 for the proper amount of wire to be released based on water depth). Great care should be taken to prevent fouling of the propeller with the net. Care should also be taken to maintain tension on the tow warp to avoid fouling the net on bottom. The starboard engine can be engaged when the gear is clear of the props and the doors spread.

7.4 Trawling

1. As soon as the required warp length is reached, the winch operator should inform the captain that the net is ready for towing. The captain then visually resurveys the trawl track, records the time, initiates the trawl clock, records the start coordinates, and begins the tow. An attempt should be made to trawl along a uniform depth contour.
2. Boat speed should be 2-3 knots. Speed over bottom, as measured by GPS or Loran position, should be between 1 and 3 knots. If it becomes apparent that these conditions will not be met, the net should be retrieved and a different trawl direction tried.

Table 4. Amount of Winch Wire to be Used for Trawling

Water depth (ft)	Ratio of line to water depth	Line out (including the 125' bridle)
10 (3 m)	7:1	Bridle only (38m)
20 (6 m)	7:1	Bridle+20' (44m)
30 (9 m)	7:1	Bridle+60' (56m)
40 (12 m)	6:1	Bridle+120' (75m)
50 (15 m)	5.5:1	Bridle+155' (85m)
60 (18 m)	5:1	Bridle+180' (92m)
70 (21 m)	4.6:1	Bridle+202' (100m)
80 (24 m)	4.2:1	Bridle+216' (104m)
90 (27 m)	3.8:1	Bridle+222 (106m)

3. During the trawl tow, the captain should monitor the depth finder for potential obstructions or sudden changes in depth. If a hazard is identified or a hang up occurs, the net should be retrieved and another tow attempted approximately 100 m from the initial trawl track. If three unsuccessful attempts are made, or 1.5 hours effort is expended, trawling operations should be aborted. If a successful 10 minute trawl cannot be accomplished, fish can still be collected from a shorter trawl for chemistry.
4. The duration of all standard trawls should be 10 minutes from the time the pay-out of warp is completed until the time hauling begins.

7.5 Net Retrieval

(Portions of these instructions are specific to the 24' boats at AED. Modifications may be necessary depending upon the vessel used for trawling)

1. After approximately 10 minutes of trawling, record the end coordinates then haul back the wire until approximately 10 meters of the bridle is still out.

2. Put the starboard engine in neutral. Throttle back and raise the boom so the wire clears the goal post assembly. Turn the boat slightly to starboard and move the boom over the starboard side (the boom should be controlled by the vang during this process).
3. Take in wire until the doors are at the block. Haul the cod end in by hand or use the capstan head to assist

7.6 Safety Considerations

Operation of the trawl can be a dangerous operation. In addition to the dangers of using the winch and capstan, improper towing procedures could capsize the boat. The net should always be towed off the stern, with the winch cable passing through the towing bracket. Towing off the side of the boat can capsize it. Care must also be taken when pulling the net in over the side. If the net is full, the total weight may be too great to use the mast and boom.

When deploying the net, the crew must be careful not to entangle themselves or other gear in the net, bridle, or winch cable. This could result in serious personal injury or damage to equipment.

All trawling operations must be conducted in a manner consistent with maintaining the safety of the crew. The captain will determine when weather or sea conditions are unsafe for trawling.

In the event of net hang-ups on bottom obstructions, the captain must consider the safety of the crew before attempting to free the gear. A means to sever the tow line should be immediately available to the crew during all trawl operations. **SEVERING THE LINE SHOULD ONLY BE PERFORMED AS A LAST RESORT AND WHEN THE LINE IS SLACK!!! SEVERING IT WHILE UNDER TENSION COULD RESULT IN WHIPLASH OF THE LINE AND SEVERE PERSONAL INJURY.**

Before deploying the trawl, the captain should ensure that other vessels do not present a safety hazard during the tow. Whenever possible, the captain shall contact nearby vessels by marine radio to make them aware of the trawling operation. In addition, the marine radio should be monitored by the crew prior to and during trawl operations. Appropriate day shapes must be flown.

7.7 Criteria for Voiding Tows

A standard tow will be considered void if one or more of the following conditions occur:

1. A tow cannot be completed because of hang down, boat malfunction, vessel traffic, or major disruption of gear.
2. Boat speed or speed over bottom is outside the prescribed, acceptable range.
3. The cod-end is not tied shut.

4. If the tow continues for more than two minutes beyond the ten-minute tow duration, or is discontinued less than eight minutes following the start.
5. The net is filled with mud or debris.
6. A portion of the catch is lost prior to processing.
7. The tow wire, bridle, headrope, footrope, or up and down lines parted.
8. The net is torn (>30 bars in the tapered portion, >20 bars in the extension or cod end, or multiple tears that, in the opinion of the chief scientist, may have significantly altered the efficiency of the net).

7.8 Endangered Species

All species considered to be rare, threatened, or endangered should be processed immediately and released alive. At the discretion of the chief scientist, photographs may be taken to document the catch.

7.9 Sample Processing

Once a catch is brought on deck, fish are identified to species, measured, counted, examined for external pathology, and processed for chemical analysis.

7.9.1 General Processing

1. After all fish have been sorted, process fish for pathological examination as described below. Sampling for pathology and Chemistry are performed concurrently with the collection of composition and abundance data. Only fish, lobster, and blue crab are recorded. Other invertebrates and trash are noted in the datasheet then discarded.
2. Measure, with a measuring board, the fork length to the nearest millimeter, of individuals of each species. If there are fewer than 30 individuals of a species, all individuals should be measured. If it is estimated that more than 30 individuals of a species were caught, a subsampling procedure should be used to measure between 30-50 individuals. Subsampling will be accomplished by randomly selecting fish from the buckets. All data are entered onto data sheets and later into the computer.

NOTE -

- Dog fish - stretched total length
- Skates - total length
- Rays - wing tip to wing tip, and total length
- Unforked - total length without extraneous filaments
- Blue crab - carapace width
- Lobster - Carapace length

3. Enter data on the fish data sheets. Common names are preferred.
4. All fish not measured for length (*i.e.*, those subsampled) are counted, either by direct count or weight-counts. When extremely large catches of schooling fish such as bay anchovy or other clupeids are made, abundance may be estimated by weight-counts. At least 100 individuals should be weighed in a batch, and 2 batches should be weighed to determine mean weight per individual. All remaining fish should be weighed, and the total number of fish estimated and recorded on the data sheet. If two or more obvious size classes are present in a sample (*e.g.*, young-of-year and adults), the size classes should be treated as separate species for the purpose of counting.
5. After all processing has been completed, the chief scientist should review the trawl data sheet for discrepancies and inaccuracies. When any questions have been resolved, he/she signs the data sheets as being reviewed and the remaining portion of the catch can be returned to the water. When significant mortality occurs and the trawl site is in a highly visible area, the captain may elect to retain the catch until more discrete disposal can be accomplished. Under no circumstances should the crew give fish away to the general public.

7.9.2 Processing of Fish for Gross External Pathological Analysis

I. Gross examination of fishes:

All individuals collected from a standard trawl will be identified and counted, and the first 30 individuals of each species will be measured. All individuals measured (*i.e.* the first 30) that exceed 75 mm in length will be examined for evidence of gross external pathology (lumps, growths, ulcers, fin rot, gill erosion, and gill discoloration). The examination is intended to be a rapid scan of the surface of individuals to be completed while other fish measures are being completed (*i.e.*, identifying, enumerating, measuring). This scan should take no longer than 10-15 seconds per fish. Fish determined to show evidence of a pathology are assigned a sample number and processed appropriately (see below). The type of pathology will be noted on the data sheet. These are **PATHOLOGY FISH**. **Only fish collected in "standard" trawls are saved for pathology.**

II. Selection, killing and fixation for transfer:

Proper fixation of specimens is critical to the ultimate quality of the data obtained. Fish should be examined and fixed while still alive or shortly after death (within one hour of collection). Specimens should not be frozen or kept on ice at any time.

- A. All specimens with gross lesions or other suspect conditions, as identified in Section I above, will be processed and coded individually. All these fish will be transferred as indicated below (Section III) to EPA's Gulf Ecology Division (GED) for subsequent examination.
 1. Carefully cut the entire length of the abdominal cavity open using scissors or a sharp knife. Gently insert the instrument into the abdomen near the anus and make an

incision to the operculum. Cut with a lifting motion so that the incision is made from the inside outward, taking care not to injure the visceral organs. Remove the lateral musculature from one side of the animal's visceral cavity to facilitate the fixation of the internal organs. Remove the opercula, and immerse in fixative (see step 4).

2. If the total length of the fish exceeds 15 cm, only a portion of the fish will be saved for laboratory analysis. Carefully cut, through the entire thickness of the fish, from the top of the operculum back along the spine, until a position behind the visceral cavity is reached, and then a 90° change in direction towards the anus. The head and viscera are then saved. Remove both opercula, and musculature covering the visceral cavity on one side. The head and thorax can be separated at the esophagus if needed. Any abnormalities found on the remaining portion of the fish (which is to be discarded) are excised along with the surrounding tissue, and saved with the head and visceral cavity. For fishes smaller than 15 cm, the entire fish is saved. (See Figure 4).
3. If an external growth is present, slice through the lesion with one clean cut using a sharp razor blade.
4. Place the sample (whole fish or head, visceral cavity and abnormalities excised) in an "onion bag" or a plastic zip lock bag with multiple perforations. Assign an appropriate sample number to each fish, affix the bar code to a fish tag, and attach the tag to the fish. Record this number on the data sheet, along with all other pertinent information on that fish. Place the bag in a tight sealing plastic container with sufficient fixative to completely cover the specimen. Specimens should be fixed in Dietrich's fixative for one or two days.

Dietrich's Fixative (to make ~5 gals.)

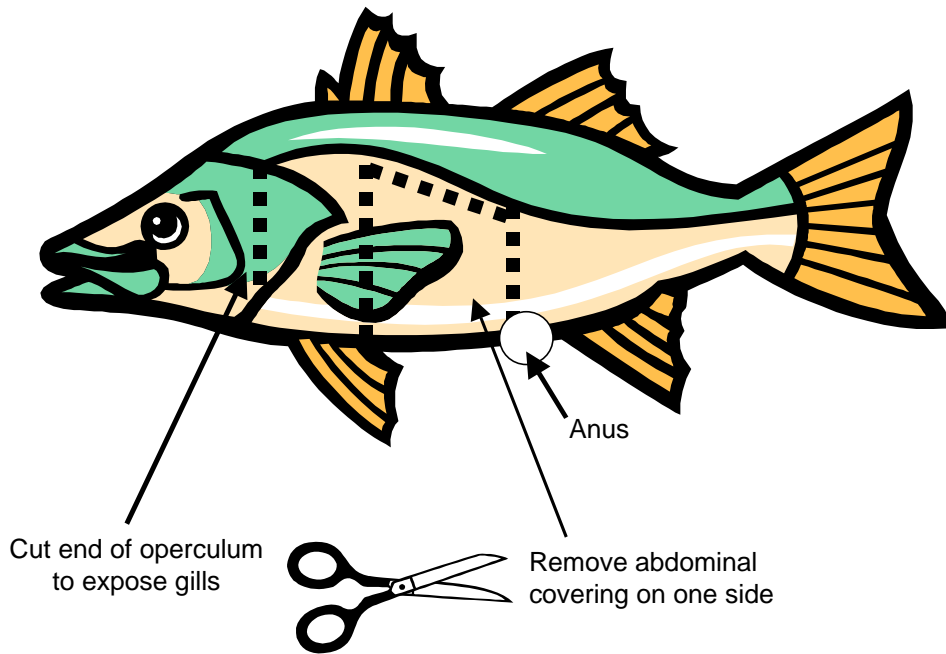
37-40% Formaldehyde	
or 100% formalin	1500 ml
Glacial Acetic Acid	300 ml
95% Ethanol	4500 ml
Distilled water	9000 ml

5. Carefully record pertinent information relating to each individual sample on the data sheet.

III. Shipping of preserved specimens:

Fish should soak in Dietrich's Fixative for at least two days prior to shipment. To ship, wrap the fish in cheesecloth dampened with Dietrich's. Place the wrapped fish in several layers of airtight plastic bags and pack in cardboard boxes or coolers. No specific temperature criteria apply.

Fish less than 15 cm in length



Fish greater than 15 cm in length

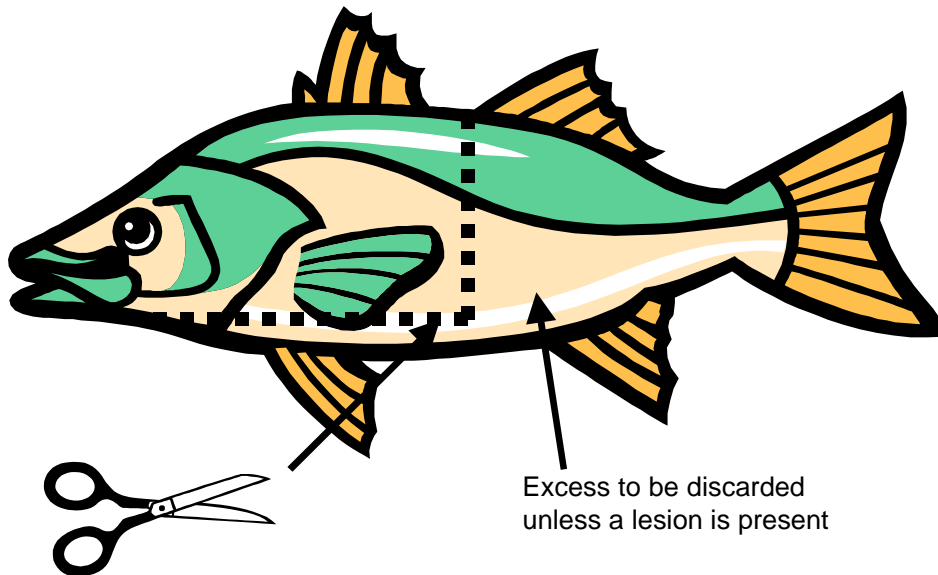


Figure 4. Description of how to expose interior organs for proper preservation of Pathology Fish.

7.9.3 Tissue Chemistry

1. For the two most abundant taxa designated as target species (Table 5), measure and retain nine individuals within the desired size range for chemical analysis. Individuals are randomly selected from all those collected until nine of the appropriate size have been selected. If no individuals in the primary size range were collected, those that are closest to the preferred size range are selected.

NOTE: Even if a tow is voided for species composition and abundance, fish collected can still be processed for chemistry.

2. Record on the datasheet the size, species, sample number (see Step 3), and any other appropriate notes.
3. Place one bar code on the data sheet. Place the twin bar code on a plastic tag and affix to the fish by placing the twist-tie through the mouth and out the operculum.
4. Wrap individual fish in aluminum foil (with the tag exposed), place all fish of that species in a single zip-lock bag, affix the "composite" bar code, and place it in a cooler on DRY ICE.
5. All samples should be placed immediately on DRY ICE for freezing. When adding new samples to the cooler containing the dry ice, samples should be rearranged to assure that these samples are in contact with the dry ice so they will freeze rapidly. One option would be to use one cooler for freezing fish, and a second for storing them. This is dependent on the equipment carried on the boat, and therefore, the amount of space available. If freezing on-board is not practical, fish must be stored on ice until the crew reaches the dock. The time before freezing should be minimized.
6. Repeat trawling (standardized methods not required) for up to 1½ hours if needed to obtain at least five individuals of at least one target species. Fish collected in these trawls are processed for chemistry only.

7.10 Quality Assurance

In order for the net to "fish" properly, the proper amount of winch cable must be let out. Consult Table 4 for the proper scope. Care must also be taken to assure that fish are not lost from the net during retrieval.

It is important that the tow time and speed be as close to the desired values as possible. Any deviations should be noted on the data sheet.

It is important not to contaminate fish which are saved for chemical analysis. Every effort should be made to keep them from coming in contact with very dirty surfaces. It is especially important to ensure that no cuts are made into the flesh.

Table 5. Listing of Target Species for Chemical Analysis (sizes are the target sizes for fish saved for chemical analyses).

SPECIES	SIZE RANGE (mm)
Catfish Species	
Channel Catfish	200 - 300
White Catfish	200 - 300
Scup	70 - 115
Summer Flounder	350 - 450
Weakfish	300 - 400
White Perch	150 - 250
Winter Flounder	100 - 200
Blue Crab	120 - 170
Lobster	

**This is still a subject
for discussion**

7.11 Contingency Plans

Considering the wide variety of environments to be sampled by C2000, it is likely that towing a net will be impossible at some stations. If, due to repeated snags, a successful trawl cannot be performed within 2 hours of starting, no further attempts should be made. This is noted on the data sheet.

In the event that a “standard” trawl cannot be obtained because of space limitations, the crew can still use either alternative gear to collect fish and shellfish for chemistry. This may include purchasing lobster or crab from local fishermen. The preferred method would be to accompany the fishermen during the collection to ensure the crabs or lobster are collected in the proximity of the station. **It is important that the crew is sure the lobsters or crabs were collected in the vicinity of the station.**

7.12 Collection Permits

Many states require scientific collection permits for the collection of fish using trawls. Permits issued for C2000 activities must be carried on each boat. A permit must be presented to any appropriate state official that requests to see it.

SECTION 8 PACKAGING AND SHIPPING SAMPLES

After samples are collected, following proper packaging and shipping procedures are critical steps in assuring the integrity of the samples. Failure to follow these procedures could result in the loss of valuable data. Each sample type requires different handling as described below. Packaging and shipping are to be performed within several days of sample collection.

Samples may be sent either to an approved state lab or one of the Coastal 2000 “national labs.” This determination is made well before the start of the sampling season. The protocols described below are specific to samples being sent to the national labs; however, it is recommended that samples being sent to local labs be processed similarly.

As samples are packaged for final shipment, the sample number of each sample must be recorded. This can be done on a hard-copy shipment form, or electronically entered into a computer. Upon completion of packaging, a unique tracking number (bar code label) is affixed to the SIDE of the cooler, and this number is also recorded on the shipment form. The number must be placed on the side, not top, so as not to interfere with the carrier’s tracking system (which also uses bar codes). In addition to the carrier’s airbill, a mailing label should also be affixed to the cooler as an additional precaution against loss. A packing list must accompany the shipment. This can be a photocopy of the completed shipment form, or a printout from the computer. Samples that are “hand-carried” require the same paperwork (less the airbill) and tracking as those shipped by commercial carrier. Since coolers need to be shipped back to the crew, a return airbill should also be included in the cooler.

All samples, except those preserved in formalin or Dietrichs, are shipped overnight. **Shipping should only take place on Mondays through Wednesdays, otherwise samples will arrive at the analytical laboratory on the weekend when there may be no one available to accept them.**

The C2000-NE Field Coordinator **must** be informed each time a shipment is sent out to one of the national laboratories. The information needed includes the name of the analytical laboratory, the shipment ID number, the carrier’s airbill number (this is especially important), and a list of the samples included in the shipment.

8.1 Proper Packaging Methods

Proper packaging of samples is critical in assuring they arrive at the receiving laboratory in good condition. Improper packaging can result in damaged or lost samples. This is costly in terms of time and money. There are several important aspects of proper packaging: assembly of the shipping box (if required), the amount of blue or dry ice needed, and proper packaging of the contents.

Each team should be supplied with several sizes of coolers. The appropriate size should be selected to minimize “dead” space.

Each team carries coolers with dry ice and blue ice to keep samples frozen or cool prior to shipment. Blue ice blocks can be frozen by placing them under the dry ice, or in a freezer for crews operating out of a home base. For dry ice, a general rule of thumb is at least 5-10 pounds, with another pound for every pound of sample (ASSUMING THE SAMPLES ARE ALREADY FROZEN). The amount of blue ice needed to keep samples cool is approximately one pound per pound of sample. This should guarantee samples arrive frozen or cool (depending on the ice type) even if the shipment is delayed a day. Frozen samples must always be shipped on dry ice, and refrigerated samples must always be shipped on blue ice packs.

Because of the need to ship fish and crabs frozen, relatively large amounts of dry ice will be needed.

In addition, it is recommended that the sample be sandwiched between refrigerant, *i.e.* dry ice should be packed both above and below the sample. **It is also important that the box contain a minimum of air space.** Therefore, packing material should be inserted above the top ice layer to fill the box.

A third consideration for all sample types (not just cooled or frozen samples) is proper packaging within the shipping box. While packing a shipment box, one should assume that the box will be improperly handled. All samples should be protected and sufficient packing material included to eliminate any possible movement of the samples within the box. All material that could possibly leak, such as water or sediment samples, should be sealed with sealing tape and packaged in zip lock bags. All glass sample bottles should be bubble wrapped and sealed in a zip lock bag. Any whirl paks should also be taped to ensure the metal tabs do not puncture adjacent bags, and placed in a zip lock bag.

Proper storage and shipment conditions are summarized in Table 6. Federal Express no longer requires a Dangerous Materials waybill for all shipments of formalin in concentrations of 10% or less. Federal Express does, however, require a class 9 placard, UN number, packing description and a emergency phone number for all shipments of dry ice.

Table 6. Sample holding and shipping conditions

SAMPLE TYPE	HOLDING CONDITIONS	SHIPPING CONDITIONS
Sediment Biota	Preserved in Formalin	Once per Week
Sediment Grain Size	Refrigerated	* Ship Weekly
Sediment Organics	Refrigerated	* Ship Weekly
Sediment Metals	Refrigerated	* Ship Weekly
Sediment TOC	Refrigerated	* Ship Weekly
Sediment Toxicity	Refrigerated	* Ship Weekly
Chlorophyll Filter	Frozen on Dry Ice	* Ship Weekly
Total Suspended Solids	Refrigerated	* Ship Weekly
Dissolved Nutrients	Frozen on Dry Ice	* Ship Weekly
Fish Chemistry	Frozen on Dry Ice	* Ship Weekly
Pathology QA	Wrapped in Cheesecloth	Once per Week

* Crews should attempt to ship as frequently as logistically possible. Samples must be shipped at least once per week.

8.2 Benthic Biology Samples

Samples for benthic community analyses are preserved in formalin in the field. These samples are in plastic containers with tight fitting screw-top lids. As these samples are preserved, there is no need to keep them cool. Shipment boxes should not weigh more than 50 pounds. The lid of each jar should be checked to assure that it is tight, and the lid taped with sealing tape. The bar code label of each container is then read and the samples placed in an insulated shipping box. The insulation is for protection rather than thermal regulation. As described above, a computer printout of the sample numbers included in this shipment is enclosed in the box.

The box is then sealed and an appropriate shipping label affixed. Be sure to pack all bottles upright, and to fill gaps with packing material. Overnight delivery is not required.

This shipment contains formalin; however, since the final concentration is 10% or less, Federal Express no longer requires a Dangerous Goods Airbill and Shipper Certification form.

8.3 Sediment Chemistry Samples

Following collection, sediment samples for TOC, organics, and metals chemical characterization should be refrigerated rather than frozen because freezing greatly increases the likelihood of breakage of the glass container. It is also recommended that samples be shipped cool, but not frozen, for the same reason.

Sediment chemistry samples should be shipped at least weekly, preferably early in the week. Sample bottles should be wrapped in bubble wrap to protect them from breakage, and sealed in a plastic zip lock bag. They should then be placed in an insulated box with an appropriate amount of blue ice.

Sediment chemistry samples must be shipped Next Day Service to the appropriate lab.

8.4 Sediment Toxicity Samples

Sediment samples collected for sediment toxicity testing must be kept refrigerated (4°C), NOT FROZEN. Sample must be shipped at least weekly. Of all the samples to be analyzed, the sediment toxicity samples are the most “time-critical” due to the nature of the testing and the relatively short permitted holding time (<28 days). Containers are then placed upright, along with an appropriate amount of blue ice, in an insulated box. Sediment toxicity samples are shipped Next Day Service to the appropriate lab.

8.5 Grain Size Samples

Samples for grain size analysis are collected along with each sample collected for benthic biology and sediment chemistry/toxicity analyses. Samples for grain size analysis should be kept cool (4°C), but not frozen. If these samples are contained in Whirl Packs sealed with metal wraps, tape should be placed around the ends of these wraps at the time of collection to prevent the metal tips from piercing one of the other bags. Samples should be shipped weekly. Whirl Packs should be placed in a ziplock bag and packed into an insulated box or cooler with an appropriate amount of frozen blue ice to keep the samples cool. Place a thin layer of paper between the blue ice and the Whirl Paks to keep them from freezing.

Samples should be shipped Next Day Service to the appropriate lab.

8.6 Chlorophyll, Nutrient, and Total Suspended Solids Samples

Samples should be shipped at least weekly. Chlorophyll and nutrient samples should be frozen and shipped on dry ice. TSS samples are shipped on blue ice.

Samples should be shipped Next Day Service to the appropriate lab.

8.7 Fish Chemistry

Samples should be shipped at least weekly. Samples must be frozen and shipped on dry ice.

Samples should be shipped Next Day Service to the appropriate lab.

8.8 Pathology QA Samples

These samples are preserved in Dietrich's fixative. Fish must be well preserved in Dietrich's Fixative prior to shipment. The fish should be removed from the bucket of fixative, wrapped in multiple layers of Dietrich's-soaked cheesecloth, then placed in multiple layers of airtight plastic bags. Samples then should be packaged into cardboard boxes or coolers and shipped to the appropriate lab. Overnight service is not required.

8.9 Instructions for FEDEX Shipping with Dry Ice

A. Use Regular Airbill

1. Sender's Section: Fill in the Date and Your Name.
2. Confirm the recipient's name, shipping address and phone number
3. Payment Section: Confirm that Bill Sender Box (#1) is checked
4. Services Section: Check Priority Overnight Box /your packaging, leave Freight Service and Instructions sections blank
Delivery and Special Handling Section: Check Dry Ice Box and Fill in the total weight of dry ice for the shipment.
5. Complete section 6 of the Airbill.

Note: print the weight of the dry ice in Kg, not the total box weight!

B. Proper Labeling of Shipping Boxes containing Dry Ice

1. Stick Number **9** placard label (available from FEDEX) so that clearly visible on side of box
2. On the same side of the box the following information must be printed:

Dry ice, 9, UN 1845, ___ box X ___ Kg , 904 III
Dangerous goods - Shipper's declaration not required

Note: print the weight of the dry ice in Kg, not the box!

3. Be sure that each box has an Address Label with the correct address of the receiving facility.

Appendix A

List of Suggested Supplies and Equipment

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This list provides a complete (more or less) listing of recommended supplies and equipment for Coastal 2000 sampling in the northeast states. It is intended as an aid in planning efforts.

General

Boat set up appropriately for sampling

Appropriate safety gear

Navigation equipment - GPS or Differential GPS (preferred), depth finder

Vehicle to move people around as needed

Vehicle to store gear in, including shipping coolers (only needed for crews traveling away from a base location)

Communications equipment between shore and boat (e.g., cellular telephones, VHF...)

Computer for data entry (laboratory or portable)

Bar code reader (recommended)

Bar codes for all samples - EPA can coordinate

Datasheets - EPA can provide templates

Pre-labeled station datasheet packages

Data entry software (e.g., JetForm's Formflow Filler for EPA datasheets)

Shipping containers (e.g., coolers)

Shipping labels

FEDEX (or other carrier) airbills

Shipping Bar codes

"Blue ice"

Coolers for storing samples (both frozen and chilled)

Field notebooks

Water-resistant paper for datasheets (e.g., Rite-in-the-rain)

Waterproof pens for writing on datasheets

Clipboards

Insulated gloves for handling dry ice

Bubble wrap for shipping

Shipping scale for weighing packages

"Packing list enclosed" envelopes

"This side up" labels

Class 9 placards for dry ice shipments

Strapping tape for shipping

Duct tape for everything else

Buckets and/or hose and washdown pump

Meter stick

Waterproof markers

Paper towels

Kimwipes

Latex or other gloves for handling contaminated sediments or formalin

Scissors

Suggest pingers for overboard gear in case it is lost

Water Quality Monitoring

Profiling instrument to measure depth, temperature, salinity, pH, and DO (e.g., Hydrolab DataSonde4, YSI 6000, etc., with appropriate deck unit and cabling as needed)

Back-up/QA instrumentation:

Additional DO meter (unless doing Winklers)

Thermometer

Refractometer

pH standards

Salinity standards

Spare DO membranes & electrolyte

Spare parts for profiler

Batteries

Light (PAR) or transmissometer with appropriate deck unit or datasheets and cables

Secchi disk with marked line

Water sampling bottle for nutrients

Filtration apparatus for Chlorophyll

- a) 2- 47mm filter holders
- vacuum manifold
- 4 liter overflow bottle
- 12vdc vacuum pump or hand pump
- or b) stainless steel, 25 mm filter holder
- standard luerlock syringe

47 or 25 mm GF/F filter pads (2 per sample, up to 6 per station)

Clean 60cc nalgene bottle for nutrients (3 per station)

1-L Nalgene for TSS samples (3 per station)

Storage containers for filters and other supplies

MgCO₃

Filter forceps

Graduated cylinders, 250, 100, 50, 10 ml

DI water for rinsing

Squirt bottles

Aluminum foil for wrapping samples (suggest pre-cut squares from Thomas Scientific)

Whirlpaks or ziplock bags for foil-wrapped filter pads

Dry ice for freezing samples

Sediment sampling

0.04m² Young-modified Van Veen grab sampler (or other)

Grab stand

Weights for grab (several)

Pads for grab (several)

0.5 mm stainless steel sieve

Sieve box

“Tub” or bucket for dumping sediment into

High-quality stainless mixing pot, with lid, for sediments (2)

Stainless spoons (several)

500 cc glass jars for organics (Ichem pre-cleaned)

250 cc HDPE jar for metals (Ichem pre-cleaned)

125 cc glass jar for TOC (Ichem pre-cleaned)

125 cc HDPE jar for grain size

4-L HDPE jar for toxicity (pre-cleaned)

1-L Nalgene for benthic infauna (3 per station plus spares)

Electrical tape for sealing lids of benthic containers

Formaldehyde (formalin)

Rose Bengal stain

Borax (can get at supermarket)

Centimeter ruler

Wide mouth funnel

Squirt bottle

Alconox

Scrubbing brushes

Fine forceps for picking worms from screen

Fish Sampling

13.5 m otter trawl (several)

Doors for otter trawl

Bridles

Timer

Fish measuring board

Heavy duty aluminum foil

Waterproof tags with tie strings

Taxonomy keys

Heavy duty dissecting scissors

Scalpel or sharp razor blade

Cheesecloth

5-gallon bucket for Dietrich's fixative

LARGE ziplock bags for fish composites

Onion bags

Dietrich's fixative

Formalin

Glacial Acetic acid

95% ethanol

Appendix B

Trawl Net Specifications

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C2000-NE (EMAP) Trawl Net Specifications

3:1 trawl net of 3" webbing

Headrope length = 13.5 meters

Sweep = 16.5 meters

Hanging line and headrope of ½" poly dacron with thimbles spliced into ends

Up and down lines of ½" poly dacron spliced into the headrope and hanging line

Webbing of 3" #21 twisted polyethylene (= European #312 twisted stranded) reinforced along the mouth frame with gussets

Headrope flotation of 4 small (5", 760 grams buoyancy) plastic floats

Codend of 1½" #24 nylon, 64 wide by 65 deep

Sweep of 3/16" chain with 12 feet of ¼" chain along the mouth

Bridle is 125', ¼" stainless steel wire

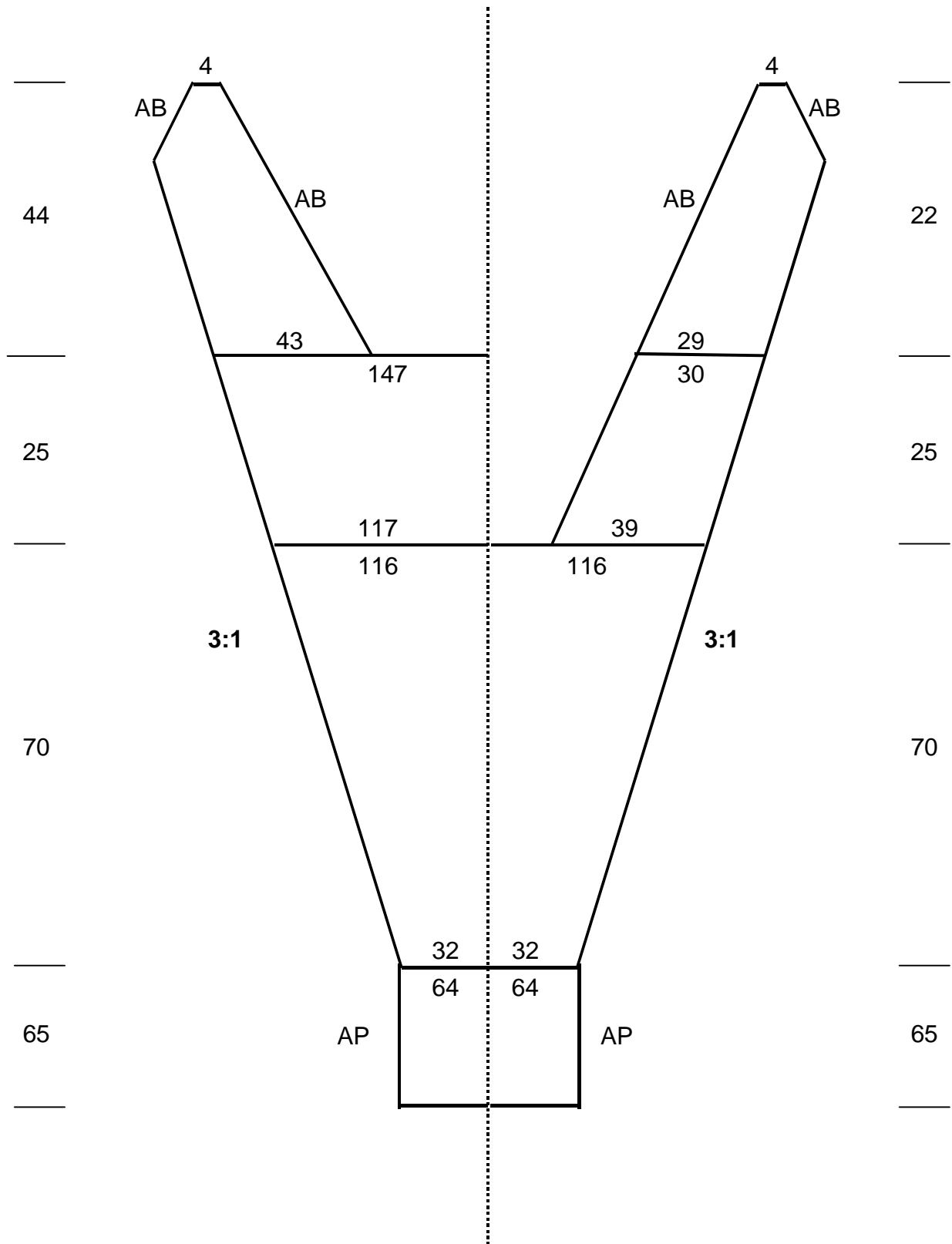


Figure B1. Diagram of EMAP trawl net. Headrope is 13.5 meters, sweep is 16.5 meters.

Appendix C

Coastal 2000 Northeast Component

Data Sheets

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The data sheets in this appendix have been designed by AED for the Northeast Coastal 2000 effort. Their use is recommended but not required. AED can provide electronic templates for these forms. Included are the following datasheets:

- Station Information Data Sheet
- CTD Cast Data Sheet
- Nutrient Data Sheet
- Nutrient QA Data Sheet
- Benthic Data Sheet
- Sediment Chemistry Data Sheet
- Standard Fish Trawl Data Sheet
- Fish Length Data Sheet (double sided)
- Sample Shipment Form
- Hydrolab Calibration Lab Data Sheet

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STATION INFORMATION DATA SHEET - C2000 NORTHEAST

LOCATION A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/>												
STATION NUMBER				DATE MMDDYY				VISIT NUMBER				
BOAT NAME												
CREW CHIEF						CREW MEMBER 1						
CREW MEMBER 2						CREW MEMBER 3 <input type="checkbox"/> LAND						
VISITOR						PURPOSE OF VISIT						
WEATHER CONDITIONS (CHECK ONE OR MORE)			SUNNY <input type="checkbox"/>		PARTLY SUNNY <input type="checkbox"/>		OVER-CAST <input type="checkbox"/>		RAINY <input type="checkbox"/>		WINDY <input type="checkbox"/>	FOGGY <input type="checkbox"/>
SEA CONDITIONS (CHECK ONE)			CALM <input type="checkbox"/>		CHOPPY <input type="checkbox"/>		ROUGH <input type="checkbox"/>					
TIME ON STATION (24 HR)						DEPTH (M)						
TIME OF HIGH TIDE (24HR)						WAS STATION MOVED <input type="checkbox"/> Yes/Explain No						
COORDINATES FROM:			DGPS <input type="checkbox"/>		GPS <input type="checkbox"/>		LORAN <input type="checkbox"/>		DEAD RECKONING <input type="checkbox"/>			
LATITUDE - DEG			MIN		-		RANGE & BEARINGS - Use COMMENTS Field					
LONGITUDE - DEG			MIN		-							
TRASH PRESENT ?			Y / N <input type="checkbox"/>			IF "Y", PLACE A CHECK BESIDE EACH KIND						
PLASTIC <input type="checkbox"/>	MEDICAL WASTE <input type="checkbox"/>		WOOD <input type="checkbox"/>		TIRES <input type="checkbox"/>		CANS <input type="checkbox"/>		PAPER <input type="checkbox"/>		OIL SLICK <input type="checkbox"/>	
OTHER: _____												
SAV Y / N <input type="checkbox"/>			MACROALGAE Y / N <input type="checkbox"/>			INTERTIDAL Y / N <input type="checkbox"/>						
COMMENTS:												
TIME OFF STATION (24 hr)						COMPLETED BY:						

CTD CAST DATA SHEET -- C2000 NORTHEAST

STATION NUMBER									
----------------	--	--	--	--	--	--	--	--	--

DATE (MMDDYY)							
---------------	--	--	--	--	--	--	--

SECCHI DEPTH (M)							
------------------	--	--	--	--	--	--	--

CAST TIME (24 HOUR)							
---------------------	--	--	--	--	--	--	--

SECCHI DISK AT BOTTOM Y / N

CTD CAST SAMPLE ID									
--------------------	--	--	--	--	--	--	--	--	--

CTD ID									
--------	--	--	--	--	--	--	--	--	--

CTD CAST FILE NAME:									
---------------------	--	--	--	--	--	--	--	--	--

CTD DEPTH (M)							
---------------	--	--	--	--	--	--	--

PAR PROFILE FILE NAME:									
------------------------	--	--	--	--	--	--	--	--	--

SURFACE MEASUREMENTS									
CTD TEMP. (0.1 DEG. C)				CTD SALINITY (0.1 PPT)			CTD DISS. OX. (0.1 MG/L)		
AMBIENT TEMP. (0.1 DEG. C)				REFRACT. SAL. (1 PPT)			YSI DISS. OX. 0.1 MG/L)		
							CTD VS. YSI DISS. OX. (DIFFERENCE, MG/L)		

MAXIMUM ALLOWABLE DIFFERENCE FOR DO QC CHECK: 0.5 MG/L OXYGEN.

COMMENTS:

COMPLETED BY:

NUTRIENT DATA SHEET- C2000 NORTHEAST																											
STATION												DATE (MMDDYY)															
SURFACE		CHL a			NUTRIENTS			TSS																			
Filtration Method		VOLUME FILTERED(mls)																									
Pressure <input type="checkbox"/>		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; height: 20px;"></td> <td style="width: 25%;"></td> <td style="width: 25%;"></td> <td style="width: 25%;"></td> </tr> </table>																									
Vacuum <input type="checkbox"/>		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; height: 20px;"></td> <td style="width: 25%;"></td> <td style="width: 25%;"></td> <td style="width: 25%;"></td> </tr> </table>																									
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BOTTOM		CHL a			NUTRIENTS			TSS																			
Filtration Method		VOLUME FILTERED(mls)																									
Pressure <input type="checkbox"/>		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; height: 20px;"></td> <td style="width: 25%;"></td> <td style="width: 25%;"></td> <td style="width: 25%;"></td> </tr> </table>																									
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STATION																								
								DATE (MMDDYY)																
SURFACE																								
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	BARCODE LABEL				BARCODE LABEL				BARCODE LABEL															
	CL				N				SS															
COMMENTS:																								

COMPLETED BY: _____

BENTHIC DATA SHEET- C2000 NORTHEAST

STATION	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	DATE (MMDDYY)	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
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PLACE A CHECK IN EACH BOX WHICH DESCRIBES THE BENTHIC INFAUNA SAMPLES. DESCRIBE THE THREE SAMPLES SEPARATELY BY PLACING A CHECK IN EACH COLUMN OF BOXES FOR EACH CATEGORY. IF "OTHER" IS CHECKED, DESCRIBE IN COMMENTS.
NOTE: MULTIPLE CHOICES MAY ONLY BE SELECTED FOR NOTES AND SURFACE BIOLOGY.

DOMIN. COLOR				DOMINANT TYPE				NOTES				SMELL				SURFACE BIOLOGY			
SMPL	1	2	3	SMPL	1	2	3	SMPL	1	2	3	SMPL	1	2	3	SMPL	1	2	3
BLACK	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	CLAY	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OOZY	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SULFUR	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	WORMS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
BROWN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MUD	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	HARD	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	GILY	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	WORM TUBES	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GRAY	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SAND	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SOFT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SEWAGE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	CRUSTACEAN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GREEN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MUDDY SAND	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SHELLS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NO SMELL	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	ECHINODERM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
RUSTY	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	PEBBLES	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	ROCKS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OTHER	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	VEGETATION	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
OTHER	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OTHER	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OTHER	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OTHER	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MOLLUSCS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
																AMPELISCA TUBES	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
																OTHER	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

GRAB SIZE 0.1 m² 0.04 m² OTHER _____

	SAMPLE 1	SAMPLE 2	SAMPLE 3
GRAB NUMBER	<input type="text"/>	<input type="text"/>	<input type="text"/>
GRAB PENET. DEPTH (mm)	<input type="text"/>	<input type="text"/>	<input type="text"/>
BENTHIC INFAUNA SAMPLE ID	BARCODE BI1	BARCODE BI2	BARCODE BI3
SAV	Y/N <input type="checkbox"/>	Y/N <input type="checkbox"/>	Y/N <input type="checkbox"/>
MACROALGAE	Y/N <input type="checkbox"/>	Y/N <input type="checkbox"/>	Y/N <input type="checkbox"/>
NUMBER OF JARS USED	<input type="text"/>	<input type="text"/>	<input type="text"/>

ALL SAMPLES TAKEN? Y/N <input type="checkbox"/>	IF YOU ANSWERED "N", PLACE A CHECK IN THE MENU BELOW TO EXPLAIN WHY NOT.
ROCKS/SHELLS <input type="checkbox"/>	HARD SAND <input type="checkbox"/>
VEGETATION <input type="checkbox"/>	OTHER-EXPLAIN IN COMMENTS <input type="checkbox"/>

COMMENTS:

COMPLETED BY: _____

STANDARD FISH TRAWL DATA SHEET C2000 NORTHEAST

DO NOT ENTER DATA FOR NON-STANDARD TRAWLS.

DATE							
MMDDYY							

STATION									
TRAWL SAMPLE ID									

TIME STARTED (24 HOUR)		:			DURATION (mm:ss)		:		
------------------------	--	---	--	--	------------------	--	---	--	--

MINIMUM DEPTH (m)		.		MAXIMUM DEPTH (m)		.	
LINE OUT (m) W/O BRIDLE				TOTAL NUMBER OF FISH SPECIES CAUGHT IN TRAWL			
SPEED THROUGH WATER		.		SPEED OVER BOTTOM		.	

Gear Code: _____

START	LATITUDE - DEG			MIN				RANGE & BEARINGS - Use COMMENTS Field
	LONGITUDE - DEG			MIN				
END	LATITUDE - DEG			MIN				
	LONGITUDE - DEG			MIN				

TRAWL SUCCESSFUL? (1=YES, 2=NO, 3=NOTATTEMPTED) <input type="checkbox"/>						IF 2 OR 3, PLACE A CHECK UNDER ONE OF THE REASONS BELOW.		
TOO DEEP	TOO SHALLOW	VEGETATION	FISHING GEAR	SUBMERG. OBJECT	NO ROOM	DAMAGED TRAWL	NET HUNG UP	OTHER (EXPLAIN)

OBJECTS IN NET?		Y <input type="checkbox"/>	N <input type="checkbox"/>	IF OBJECTS WERE PRESENT, PLACE A CHECK BELOW EACH KIND. DESCRIBE VEGETATION IN THE COMMENTS SECTION.							
PLASTIC	MEDICAL WASTE	CANS	TIRES	GLASS	PAPER	NATURAL WOOD	MODIF. WOOD	FISHING GEAR	ROCKS	VEGETATION	OTHER EXPLAIN

INVERTEBRATES IN NET?		Y <input type="checkbox"/>	N <input type="checkbox"/>	IF INVERTEBRATES WERE PRESENT, PLACE A CHECK BELOW EACH KIND. DO NOT INCLUDE JELLYFISH.							
BLUE CRABS	HORSE-SHOE CR	SPIDER CRABS	OTHER CRABS	ECHINO-DERMS	BI-VALVES	GASTRO-PODS	SQUID	SHRIMP	MANTIS SHRIMP	LOB-STERS	OTHER INVERT.

COMMENTS:

COMPLETED BY:		C2000 NORTHEAST	FTRL00hc.FRP 4/25/00	pad	FT
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C2000 - FISH LENGTH DATA SHEET												
STATION				DATE	MM	DD	YY	CHEM COMPOSITE BARCODE FC1 or FC2				
TRAWL SAMPLE ID												
COMMON NAME				TOTAL CAUGHT				SHEET NUMBER FOR SPECIES				
								___ of ___				
PATH=PATHOLOGY, CHEM=CHEMISTRY, TO=TAXON QA, PQ=PATHOLOGY QA. LOOK FOR THE FOLLOWING PATHOLOGIES ONLY: L=LUMPS, G=GROWTHS, U=ULCERS, F=FIN EROSION, GE=GILL EROSION, GD=GILL DISCOLORATION. PLACE A CHECK IN THE APPROPRIATE BOX(S).												
Seq #	Length (mm)							CHEM				
Path	Location			Path	Location			TQ				
L				F					BARCODE LABEL 1			
G				GE				PQ				
U				GD								
Seq #	Length (mm)							CHEM				
Path	Location			Path	Location			TQ				
L				F					BARCODE LABEL 1			
G				GE				PQ				
U				GD								
Seq #	Length (mm)							CHEM				
Path	Location			Path	Location			TQ				
L				F					BARCODE LABEL 1			
G				GE				PQ				
U				GD								
Seq #	Length (mm)							CHEM				
Path	Location			Path	Location			TQ				
L				F					BARCODE LABEL 1			
G				GE				PQ				
U				GD								
Seq #	Length (mm)							CHEM				
Path	Location			Path	Location			TQ				
L				F					BARCODE LABEL 1			
G				GE				PQ				
U				GD								
Seq #	Length (mm)							CHEM				
Path	Location			Path	Location			TQ				
L				F					BARCODE LABEL 1			
G				GE				PQ				
U				GD								
Seq #	Length (mm)							CHEM				
Path	Location			Path	Location			TQ				
L				F					BARCODE LABEL 1			
G				GE				PQ				
U				GD								
Seq #	Length (mm)							CHEM				
Path	Location			Path	Location			TQ				
L				F					BARCODE LABEL 1			
G				GE				PQ				
U				GD								

HYDROLAB CALIBRATION LAB DATA SHEET -- C2000 NORTHEAST

EPA TAG #							
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12 HOURS BEFORE CALIBRATION

OXYGEN ZERO READING, mg/L (MEMBRANE OFF, PROBE DRY)						
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DO MEMBRANE CHANGE?	TIME (24 HR)					DATE (MMDDYY)				
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CONDUCTIVITY PINS POLISHED? Y/N <input type="checkbox"/>	pH REFERENCE ELECTROLYTE CHANGED? Y/N <input type="checkbox"/>
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MAIN BATTERIES CHANGED? Y/N <input type="checkbox"/>	NEW VOLTAGE? (V) _____
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PRE-CALIBRATION CONDUCTED BY: _____
(LAST NAME, FIRST INITIAL)

COMMENTS: _____

CALIBRATION CHECKLIST

TIME, 24 HR (at least 12 hr after membrane change)					DATE (MMDDYY)				
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SET pH 7? (Y/N)	SET pH 10? (Y/N)
SALINITY (Y/N)	BAROMETRIC PRESSURE 760
SET OXYGEN % SAT.? (Y/N)	DEPTH (ZERO) (Y/N)

PRE-CALIBRATION CONDUCTED BY: _____
(LAST NAME, FIRST INITIAL)

COMMENTS: _____

COMPLETED BY: _____