Name_____ Lab 1

INTRODUCTION TO LAB AND FIELD EQUIPMENT USED IN MARINE BIOLOGY

See Digital Field Trip

Examine the different pieces of equipment and after each is demonstrated, answer the questions using information from the demo and the paper provided.

1.What are the 4 major chemical components of seawater?

2.How is salinity measured chemically? Physically?

3. Of what use is a hydrometer, which measures specific gravity, in maintaining a seawater aquarium?

4. When testing for dissolved Oxygen, what effect does (a) salinity and (b) temperature increases have on the solubility of Oxygen in seawater?

5. What does the Secchi Disk measure and explain how it is used?

6. What conditions for Secchi Disk measurements should be followed?

7. What are two methods that can be used to preserve plankton?

8. When reading a test result during titration, where do you read the result in relation to the plunger?

9. Explain how you would tell your partner to drag a seine net if he missed this class and you ended up in the water with him!

http://www.mathinscience.info/public/0%20How%20to/oceanography_studies/seinenet.pdf

10. Examine the screen. What could this be used for?

11. Examine the Peterson Dredge. This is used to make bottom samples. What organisms could you find here?

DILUTION'S THE SOLUTION!??

Objective:

Discussion of whether a substance can be so diluted that it's "no longer there."

Materials:

10 small test tubes food coloring dropper water

Procedure:

1. Put 10 drops of food coloring in one test tube.
2. Put 9 drops of water into each of the other 9 test tubes.
3. Take one drop of food coloring out of the first tube. Add the one drop to the second tube. Explain that you now have a tube in which the food coloring is one part in 10, or one-tenth.
4. Take one drop of the 1/10 solution and add it to the third tube. Explain that you now have a tube in which the food coloring is one part in 100, or one-hundreth. (multiply fractions...new solution 1/10 times the 1/10 solution or 1/100).
5. Continue until you have diluted down to the last tube.

Discussion:

1. What was the concentration of food dye for the last four tubes?

a. b. c. d.

2. In the last few tubes, was the dye visible?
3. If not, where was it? _____Was it there? _____
4. Would this be an example to support ocean dumping because a few million gallons of sewage would easily dilute in the billions of gallons of seawater, wouldn't it????

Field Tools

Visibility

The Secchi Disk provides a convenient method for measuring light penetration below the water surface. By using a Secchi Disk, one can determine the transparency or limit of visibility of the water and estimates of light transmission can be derived. The limit of visibility is approximately, the region of transmission of 5% sunlight (Reid 1961). Once the limit of visibility is established calculations can be made to determine the lower limits of the euphotic zone which is usually three times the Secchi Disk depth (Welch 1948).

High commetrations of dissolved substances such as fats, proteins, and carbohydrates, and particulate organic matter such as phytoplankton, zooplankton, detritus and colloidal substances which are found in the highly productive coastal waters, cause most of the light to be absorbed within the first few meters of water. On the other hand, some of the clearest ocean water with low concentrations of dissolved substances and particulate organic matter may have a Secchi Disk reading of 40 meters a more.

It most be remembered that all the light received at the water surface does not penetrate or

enter the water. A large portion of the solar radiation is reflected. This depends upon the angle of the incidence of the light rays striking the water. Also, it is important to consider the types or kinds of light penetrating the water surface. In natural waters blue light or light with short wavelengths generally penetrate father than light possessing longer wavelengths such as red or orange light. When considering productivity, the penetration of biologically active wavelengths such as red and blue, which are used in photosynthesis, must be measured. Although the Secchi Disk provides a convenient method for measuring the limit of visibility, it is imperative the observer list the conditions under which the Secchi Disk readings are made. "clear sky, sun directly overhead shaded protected side of boat under a sun shade under minimal waves or ripples"
Any necessary departure from the conditions should be specifically stated
in the records.'
The LaMotte Secchi Disk (1062 & 0171) can be used to measure turbidity and and water color.
http://www.mlswa.org/secchi.htm

Marine Plankton
A marine science study would nor be complete unless an important part of the aquatic community is discussed: the marine plankton. Plankton are microscopic plants and animals that are found either suspended or weakly-swimming in the sea. The plankton may be very primitive one-celled organisms or they may be composed of many cells to form complex cellular systems. Marine plankton constitute the greatest source of organic matter in the sea and for this reason nearly all other marine life is dependent upon them as food.
http://www.gvsu.edu/wri/education/instructor-s-manual-plankton-sampling-32.htm

Plankton are subdivided into two basic forms; phytoplankton and zooplankton. Phytoplankton refers to plant forms such as the bacteria, fungi, and algae that are found floating in the sea. Most of the phytoplankton have the same cellular properties as terrestrial plants, but they have no vascular tissue and show no cellular organization to form leaves, stems, or roots. Since most of the phytoplankton in the sea possess chlorophyll, they utilize the sun's energy and convert this into chemical energy through a series of complex chemical reactions. Representing the first trophic level in a complex food chain the phytoplankton *are* the primary producers of food in the oceans. Phytoplankton should be distinguished from other aquatic plant life which inhabits the sea for there arc many types of algae that are found attached to the bottom by means of a holdfast or some other anchoring structure. Attached plants are part of the benthos and include such plants as the seaweeds and kelps.

Zooplankton refers to the free floating a weakly-swimming usually microscopic, animals in the sea. Although the zooplankton encompasses a vast array, of animal life in the sea that remains permanently floating, zooplankton also includes the development slates of animal life such as the small larvae of fish, oysters, and crabs. As consumers zooplankton graze upon phytoplankton and are completely dependent upon them as a food source.
There are numerous ways marine plankton may be collected from the sea.
Probably, the device that it used most often is the plankton net. This device consists of a find-meshed bolting cloth made of nylon of other fabric which has very small pores. It is sewn to form a cone-shaped net. A rigid ring and towing bridle at the opening of the plankton set keeps the set opts as it is being pulled through the water. At the narrow end

of the set is a conical graduated tube to collect the plankton as the net is pulled through the water. In most cases the pore size of the net is small enough to retain the plankton and concentrate them into the conical collecting tube at the end of the net while the water is filtered through the net.

Some modifications and improvements of the plankton set have been made to increase its usefulness. Although the plankton net was primarily designed as a qualitative sampler, rather successful attempts to adapt the plankton act for quantitative sampling have been achieved. A quantitative sample is made by first determining the amount of water strained through the net. By either using a flow meter which is mounted in the mouth of the plankton net or calculating the volume of water filtered through the plankton set by a formula, an estimate of the number of organisms per unit volume of water can be derived. In order to take samples at different depths, it is possible to attach weights to the net in such a manner as to be able to collect samples from predetermined depths.

Plankton samples may also be taken by other mechanical devices. The VanDorn and Kemmerer samplers are quantitative samplers and are used to collect plankton samples at a designated depth. These devices consist of a hollow cylinder with a volume capacity of 1 liter or greater, two fitted rubber plungers, a measured and calibrated rope or cable, messenger, and trigger mechanism. The sampler is cocked above the water surface and allows the tube to descend to the desired depth. When the sampler reaches the desired depth, a weighted messenger is sent down the rope or cable to trigger, the closing of the fitted plungers in the cylinder and prevents the collected sample from mixing with unsampled water from intermediate regions during ascent to the surface.

After the plankton sample has been collected by using any one of the sampling apparatus above, it is best to keep a record of how the sample was collected, time, date, temperature, name of collector, exact locations, and any other relevant data for future correlation.

http://www.msc.ucla.edu/oceanglobe/pdf/PlanktonPDFs/PlanktonActivity2.pdf
http://www.glwi.uwm.edu/education/outreach/cruise/phytoplankton.php

Examination of Plankton

Since most of the plankton is too small to be observed with the naked eye, it is necessary to examine the plankton under a suitable microscope. Usually if an aliquot (a small portion) of the sample is taken and examined immediately, valuable observations are obtained as to the behavior and motility of the organisms. It is easier to identify plankton in its natural state than if the sample is kept or preserved for a period of time. Populations of plankton tend to change with time because the zooplankton are constantly depleting the phytoplankion populations. Also, if the sample are kept too long without any preservative measures; pigmented planktonic forms fade with time and make identification more difficult.

When observing the plankton under the microscope it is best to put them in a petri dish, depression plate, or deep wall slide for preliminary investigations. For more exacting work after the initial observations have been made, a small sample is transferred to a regular slide with an appropriate coverslip to observe cellular characteristics under a higher magnification of the microscope.

The reporting of the number and kinds of plankton you find in the sample is left to the individual study objectives. A survey of the types of plankton can be reported and a list of

important observations can be compiled. If a quantitative examination is desired some means of calibrating the sample volume you are observing under the microscope are required. Counting plankton per unit volume of sample is accomplished by a number of scientific devices that are adapted to the microscope. Ocular micrometers, haemocytometers, Sedwich-Rafter counting cells, or Whipple micrometers serve as excellent instruments to make quantitative plankton studies.
http://www.aslo.org/lo/toc/vol_16/issue_1/0019.pdf

Plankton Sample Preservation
If an immediate analysis of the plankton sample cannot be conducted, it will be necessary to preserve the sample. Instant refrigeration and storage in the dark keeps the activity of the organisms to a minimum. Using this method, the sample can be kept a day or two without drastic changes. Preservation can be maintained for longer periods of time, weeks or months, with a formalin solution (37-42% aqueous solution of formaldehyde), by adding 40 mL of solution to a liter of sample. A few drops of chloroform, when added to a plankton sample, cause an instant kill; but chloroform has a tendency to distort cellular structure and may leach pigments from the cells of the plankton if stored for a period of time.
There is no absolutely sound preservative measure that can be used for all plankton. One of the above or other recommended procedures should be selected with care to meet the individual needs of the investigator.
Temperature
Although temperature may be one of the easiest measurements to perform, it is probably one of the most important parameters to be considered in marine science studies. Many biological, physical, and chemical principles are temperature dependent. Among the most common principles which are temperature dependent are the solubility of compounds in sea water, distribution and abundance of organisms living in the sea, rates of chemical reactions, density, inversions and mixing, and current movements.
Providing the experimenter has a good quality thermometer, the surface temperature of a body of water can be measured with ease. A mercury thermometer represents just one way temperature is measured. Depending upon the type of temperature measurement one desires, a number of adaptations to the mercury thermometer have increased its usefulness to include taking temperatures at various depths. An example is the reversing thermometer. Electronic temperature devices have become quite popular since a constant recording of temperature provides a more accurate monitoring of temperature with time and depth.
The temperatures of surface and subsurface waters are usually different. With an increase in depth, the water generally becomes colder. This results in thermal stratification of deep water and can lead to density differences. Although temperature stratification are measured regularly, the ocean water seldom varies more than 25°C, and for this reason the oceans act as a thermostat for keeping the earth's climate within certain limits.
The change of temperature with depth is more characteristic in a particular layer of water known as the thermocline. Within the thermocline the temperature changes are more extreme than layers above or below the thermocline. Below the thermocline in

the deepest regions of the ocean, the temperature of the water is usually found to be between 0°C and 4°C.

Depth

A sounding lead consists of a lead weight that is attached to a graduated line. Primarily a sounding lead is used to determine the depths of bodies of water. Precise determinations of depth are not practical when bottom sediments are soft since the depth at which the weight sinks into the bottom ooze cannot be measured accurately. Most soundings are read to the nearest foot or 0.3 meters in estuarine waters, whereas in oceanic regions the fathom is the standardized unit of measurement. Exact locations of all soundings are required for future reference.

Sample Collection for Chemical Analysis

When collecting water samples for analysis, enough of the sample should be collected to perform the necessary tests. For certain determinations larger sample may be required, especially if the sample has to be concentrated or extracted. Generally, a greater volume of a collected sample is more representative of an area than a small sample. The possibility of loss due to evaporation or contamination of the sample is less with a greater sample volume.

http://www.ccal.oregonstate.edu/pdf/CCAL%20sample%20collection.pdf

The following table indicates the amount of sample required for individual tests when the LaMotte test kits recommended in this manual are used.

Test Amount of Sample

Salinity 10 mL

Dissolved Oxygen 50 ML

pH 5 mL

Carbon Dioxide 20 mL

Alkalinity 10 ML

Calcium-Magnesium 12.9 mL

Phosphorus 30 mL

Nitrate 30 mL*

Nitrite 5 ML

Ammonia 30 mL*

Silica 30 mL

Iron 100 mL*

Copper 20 mL

*includes sample required for blank

In general, the best analytical results are obtained when the time interval between taking a sample and conducting an analysis is held to the minimum. For certain chemical and physical constituents of sea water, immediate analysis is required. This is especially true for pH, dissolved gases, alkalinity, and temperature. Due to the inherent reduction and oxidation reactions caused by microbial growth, the chemical composition of a sample can change in a short period of time.

It is imperative that the sample to be analyzed is truly representative of the existing conditions under which the sample was taken. For this reason, it is important to handle the sample in such a way as to prevent deterioration or contamination before the analysis is performed. Chemical data for an area is greatly enhanced when a series of tests are conducted on samples that have been collected from sites over a period of time, This permits the investigator to chart these changes and to further investigate any abnormal variance in the chemical balance of the water. Sufficient information is gathered to insure the duplication of results by another investigator. Factors such as the name of the collector, date, how the sample was collected, exact location, temperature, depth, atmospheric pressure and any other relevant data are helpful in evaluating the test results.

The selection of a storage container requires much consideration. The choice is usually limited to glass (preferable borosilicate) or plastic. Glass containers with a suitable plastic cap or stopper are used for salinity and trace constituents, but undesirable for silicate analysis. All glassware should be treated with dilute hydrochloric acid and rinsed several times with good quality distilled water to remove contaminants attached to the glass. Among the advantages of using glass containers is its ability to prevent water loss due to evaporation.

Plastic storage containers should be treated with dilute hydrochloric acid to remove ions left by the industrial process of making plastic containers, and then rinsed with distilled water.

Sample Preservation

If an immediate analysis of the sample cannot be conducted, it is essential that the sample be preserved. It must be remembered that there is no one preservative to be utilized for all chemical constituents in the sea water. There are a few recommended procedures, which preserve the sample, but no adequate substitution can be made for conducting an immediate analysis.

Use an acid or germicide to prolong storage and to protect the sample from being changed by microbial growth. Some specific procedures are recommended for the following sea water constituents.

1. Samples for dissolved oxygen are removed immediately and treated with Winkler reagents and stored under acidic conditions.
2. Analysis of some micro constituents; nitrogen, nitrate, nitrite, ammonia, and silica should be analyzed within an hour. If this is not possible the sample can be kept by freezing (0°C) for a few hours. Samples requiring a longer storage period (a few months) should be quick-frozen at -20 C and stored at this temperature.
3. Filtered phosphate sample can be kept for several weeks by adding chloroform and storing the sample in the dark.

Sampling Apparatus

Different types of sampling apparatus are required to collect sea water samples for chemical analysis. The type of sampling apparatus to be used is determined by what kind of sample is needed. Surface sampling only requires some means of gathering sea water in a suitable containers such as a bottle or bucket, while sub-surface sampling requires more sophisticated

equipment to sample at known depths and to bring the sample to the surface in an unmodified condition.

Water Sampling Bottle

VanDorn, Kemmerer, and Nansen samplers are also used extensively in collecting water samples for chemical analysis. With the exception of differences in the tripping mechanisms, all three samplers operate in more or less the same fashion. The sampler is lowered on a graduated rope to the desired depth, and a messenger is sent down the rope triggering the dosing of two fitted plungers which seal the sampler. Providing the sampler is completely sealed during ascent to the surface, the sample will contain a representative water sample from the desired depth. The LaMotte Water Sampling Bottle Model JT-1(1077) is this type.

http://serc.carleton.edu/microbelife/research_methods/environ_sampling/oxygen.html

Bottom Sampling Dredge

The Peterson dredge, provides a convenient method for collecting bottom sediments. It is used for collecting sediments which may contain mud, sand, ooze, and gravel, however, it is not designed to collect samples from rock bottoms. By using a bottom sampling dredge a number of different analyses can be made. Since the bottom sediments represent a good area to find macro invertebrates and benthic algae, one can easily study quantitatively and qualitatively the communities of organisms living in the bottom habitat. If a physical examination of the bottom is conducted, one may only be interested in the structural characteristics of the bottom and possibly relate this to the biological and chemical analysis. All of these different studies are made possible through the use of a bottom sampling dredge.

Whenever samples of the bottom are taken, it is imperative that every effort be made to insure that the sample are truly representative of the whole area. Much of this depends upon the judgment of the individual taking the sample and their individual study objectives. Ordinarily, as many samples as practical should be taken since one sample has no value statistically. The time interval between sampling and analysis is not critical for a mechanical or physical analysis but prompt analysis is recommended for both biological and chemical examinations.

The LaMotte Bottom Sampling Dredge (1061) is a modification of the Peterson Dredge.

Core Sampling

Vertical core samplers are used to sample bottom sediments and soil in depth. Basically, there are three types varying only in the way the samples are retrieved. The most commonly used vertical core sampler for bottom sediments in preliminary marine science studies is the hand operated model, though the explosion driven and self-surfacing models are used to some extent for special sampling in deep water or atypical sediment.

In most cases the length of the core sample will vary with the texture of the soil and the nature of the bottom sediments. Consideration must be made to the kind of analysis to be conducted. Most core sampling devices are designed to sample a small diameter of soil and bottom sediments in depth. It is conceivable that, unless the benthic fauna and flora are known beforehand, representative samples of the organisms in the soil or sediments cannot be obtained unless a large number of samples are taken.

Much of the bottom sampling for biological analyses rely primarily upon dredges, larger coring devices, or bottom scoops, which sample more surface area.
Primarily the vertical coring device is designed to study the physical nature of various soils and bottom sediments, but with the proper precautions the cores can be analyzed chemically to determine the presence or absence of biologically important compounds.

Use of Chemical Test Equipment
General Precautions _
A. Read all instructions to familiarize yourself with the test procedure before you begin. Note any precautions in the instructions.
B. Read the label on each LaMotte reagent container prior to use. Containers include precautionary notices and first aid information. Read Material Safety Data Sheets enclosed for hazardous reagents.
C. Keep all equipment and reagent chemicals out of the reach of young children.
D. In the event of an accident or suspected poisoning, immediately call the Poison Center phoneiwmber in the front of your local telephone director) or call your physician. Be prepared to give the name of the reagent in que: .Lion and its LaMotte code number. LaMotte reagents are registered with POISINDEX, a computerized poison control information system available to all local poison centers.

Protect Yourself & Your Equipment: Use Proper Analytical Technique
A. Avoid contact between reagent chemicals and skin, eyes, nose, and mouth. B. Wear safety goggles when handling reagent chemicals.
C. Use the test tube caps or stoppers, not your fingers, to cover test tubes during shaking of mixing.
D. When dispensing a reagent from a plastic squeeze bottle, hold the bottle vertically upsidedown
(not at an angle) and gently squeeze it (if a gentle squeeze does not suffice, the dispensing cap or plug may be clogged).
B. Wipe up any reagent chemical spills, liquid or powder, as soon as they occur. Rinse area with a wet sponge, then dry.
F. Thoroughly rinse test tubes before and after each test. Dry your hands and the outside of the tubes.
G. Tightly dose all reagent containers immediately after use. Do not interchange caps from different containers.