Marine Education

A Seagoing Educational Experience

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Texas A&M University Sea Grant College Program

Marine Education -- A Seagoing Educational Experience

by Richard K. Tinnin
Port Aransas Marine Laboratory
The University of Texas Marine Science Institute

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Preface

The University of Texas Marine Science Institute at Port Aransas has had an active program in marine education since 1974. From September to May, when there are no formal university classes underway, the Port Aransas facilities available include dormitory space for 70 students, a dining hall, three research vessels, teaching and laboratory space, a pier lab with running seawater, and a tide trap located in the Aransas Pass Ship Channel. The laboratory is ideally located to provide interested students with exposure to a wide variety of marine-influenced environments. Within a short drive of the laboratory students can explore the Gulf waters, the beach, dune and barrier island complex, the rock jetty communities, back bay and mud flat communities, submerged grass flats, and such vegetation areas as shoal grass and mangroves and their associated rookeries. Also conveniently available south of the laboratory is Laguna Madre, a good example of a hypersaline environment.

The overall purpose of the visiting class program is to enable students to gain hands-on experience with a wide variety of collecting gear and laboratory apparatus and the techniques involved in the correct use of the equipment. The program also helps students interpret the information collected to better understand the biological, physical and chemical processes at work in the marine environment and the interrelationships among them.

Richard K. Tinnin, Director
Marine Education Services

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Introduction

The University of Texas Marine Science Institute's visiting class program offers teachers and students an opportunity to study the marine environment. This includes hands-on collecting and investigating experience, as well as exercises in interpreting the collected data.

Most of the actual shipboard experience takes place aboard the R/V KATY, a 57-foot fiberglas stern-rigged trawler that can accommodate up to 25 students at a time. Cruises leave the dock at 8 a.m. or 1 p.m. (as scheduled), and generally last four hours. Classes should be on the dock prepared to board the KATY at least 15 minutes before the scheduled departure time.

Specimens collected during the cruise belong to the students; teachers should bring an ice chest and/or a plastic preserving bucket with lid and formaldehyde. The latter will be mixed with seawater to make a 10 percent formalin preservative. A large live box with running seawater is on board to bring back live specimens. Small plastic containers (baby food jar-size, but <u>not</u> glass) are ideal for preserving plankton and benthic infauna samples, but these items, and the preservative, must be provided by the class.

Teachers and chaperones are responsible for their students' conduct during the cruise. Students need to understand that a ship demands respect and is a hazardous place for those who ignore the rules of safe conduct.

Equipment Checklist

Collecting Equipment

____Ice chest for specimens

____Preserving bucket with lid and preservative

____Small plastic containers for plankton and benthic specimens

____Buckets and aerators for live specimen transport

Safety Equipment

____Rubber soled shoes (preferably tennis shoes) must be worn at all times

____Appropriate clothing (it is more than likely that students will at least get their feet wet, so they should dress accordingly.)

____Sunscreen lotion and some type of visor or hat

____Coast Guard-approved life jacket (although recommended for all students, state law requires that anyone 12 years old or younger must be wearing a life jacket before boarding the vessel.)

Optional

____Ice chest with soft drinks (fresh

water is available on board)

____Clipboards and pens or pencils

____Small, self-adhesive lables to mark specimen containers

Generally sea sickness is not a problem because the majority of the cruises are in the calmer bay waters. Dramamine tends to make students sleepy. Teachers concerned about this problem should contact the program staff for advice.

Program Outline

Before each cruise, the coordinator will meet teachers, chaperones and students to introduce the program activities.

Pre-cruise

1. Students register, board the vessel and stow gear.
2. Staff conducts orientation, describes study site and onboard sampling locations and identifies maps and reference books.
3. General information
   a. Ship safety do's and don't's.
   b. Lifesaving gear
   c. Demonstration of electronic gear

Cruise (approximately 4 hours)

1. Inshore stations
   a. Corpus Christi Ship Channel
   b. Redfish Bay I
   c. Redfish Bay II
   d. Lydia Ann Channel
2. Onboard activities at each station
   a. Secchi disc -- water color, water depth, bottom type
   b. Water sample -- Van Dorn bottle, refractometer, water chemistry test kits
   c. Water quality measurements -- Hydrolab
   d. Plankton tow -- tows on surface
   e. Otter trawl -- fish samples, crabs, shrimp, vegetation
   f. Peterson grab -- at Redfish Bay I and II for sediment type, composition and benthic infauna identification

Return Trip (approximately 45 minutes)

1. Complete data sheets.
2. Clean up and store collecting gear.

Equipment

Secchi disc	A circular, black and white disc used to measure the visibility, or clarity, of the water.
Forel or Ule color scale	Used with the Secchi disc to determine the color of the water.
Van Dorn Bottle	Used to collect a one-liter sample of water from a given depth. The water is used for salinity, dissolved oxygen and nitrate/nitrite measurements.
Refractometer	A hand-held instrument used to deter-

	mine the salinity of the water.
Hydrolab	An electronic instrument used to measure in situ (in place) water quality. The sonde unit is lowered through the water column and readings are taken at one-meter intervals to determine the pH, dissolved oxygen, temperature and conductivity.
Water chemistry kits	Used to demonstrate chemical methods to determine dissolved oxygen and nitrate/nitrite levels.
Plankton net	A cone-shaped, fine mesh net used to collect small plants and animals called plankton. The samples collected will be examined under the dissecting microscope located in the wet lab.
Peterson grab	A clamshell-like device used to collect a sample of the bottom mud or benthos.
Otter trawl	A seven-meter-wide, funnel-shaped net used to collect a sample of the fish, crabs, shrimp, etc., that live on the bottom of the bay or Gulf.
Surface radar	Located in the wheelhouse, this instrument sends out radio waves and picks them up after they have been reflected by a land mass, rock jetty, channel marker, ship or other object.
Depth recorder (fathometer)	An electronic device located in the wheelhouse that is used to measure the depth of the water.

Measurements

You may need to review procedures for certain of the systems of measurements that are involved in the cruise program.

Temperature: Water and air temperatures are measured with thermometers in degrees Celsius or Centigrade (^{o}C) or in degrees Fahrenheit (^{o}F). The data sheets require degrees Centigrade.

To change from ^{o}F to ^{o}C:

$5/9 \times (^{o}F - 32) = {}^{o}C$

To change from ^{o}C to ^{o}F:

$(9/5 \times {}^{o}C) + 32 = {}^{o}F$

Water Depth: The water depth is measured by a handline, bathythermograph or with the ship's fathometer. Measurement may be in feet, meters or fathoms.

1 fathom = 6 feet = 1.85 meters

1 meter = 3.37 feet

Distance and Speed: Although not needed during the cruise, distance and speed measurements are used so frequently aboard ship that the terms are listed here.

1 nautical mile = 1.2 statute miles
= 6080 feet

1 nautical mile = 1.85 kilometers

1 nautical mile = 1 minute of latitude

1 knot = 1 nautical mile per hour

Decimal System: When recording measurements, use the decimal system rather than fractions.

1/2 = 0.50; 1/3 = 0.33; 1/4 = 0.25;
1/5 = 0.20

Study Site Description

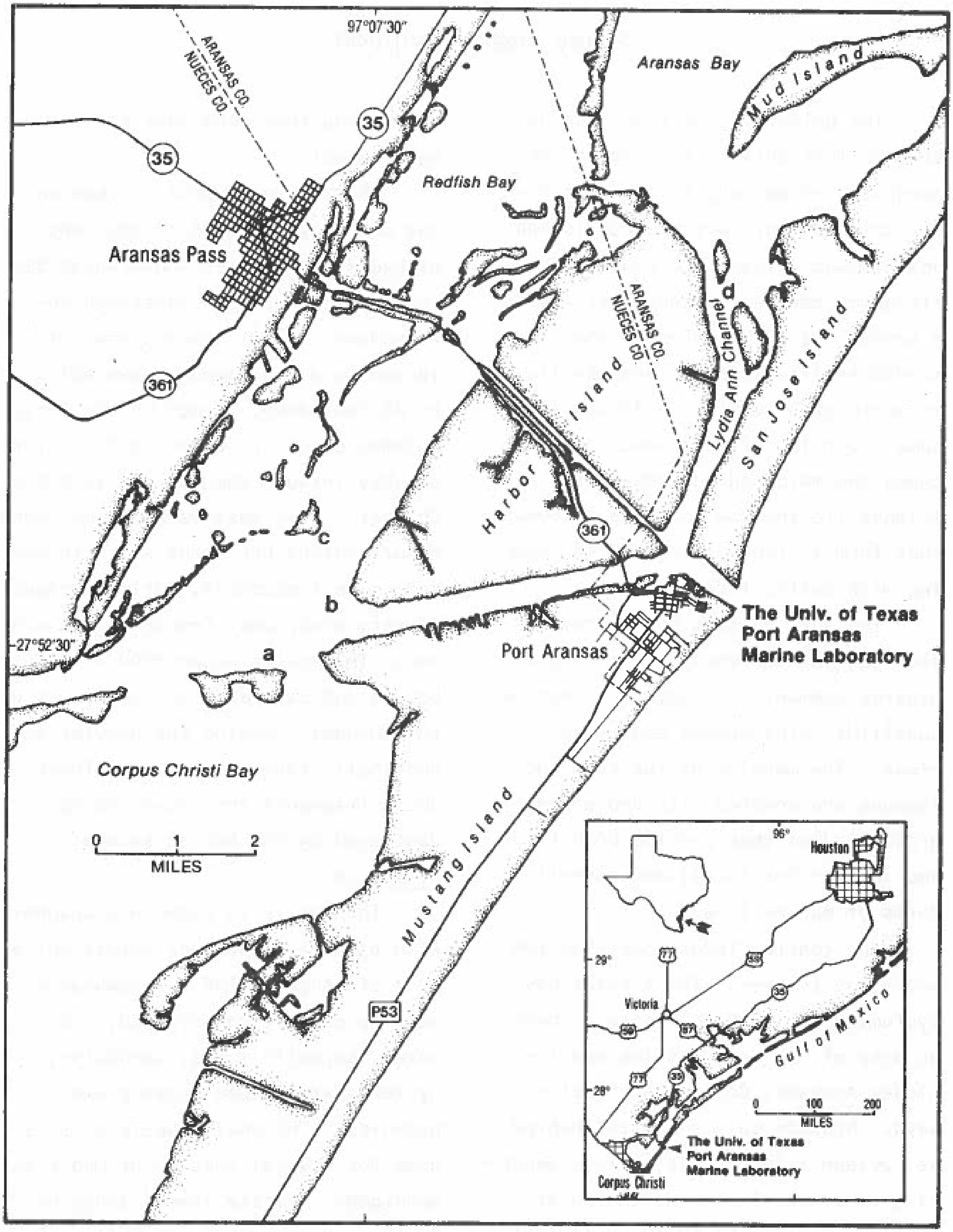
The University of Texas Marine Science Institute is located at the north end of Mustang Island. Across the ship channel to the north is San Jose Island. These are two of a string of barrier islands that form a protective ribbon of sand that stretches from south of Brownsville to north of Galveston, a distance of some 270 miles of open beach. Between the mainland and the barrier islands lie shallow bays and lagoons that form a rich nursery ground teeming with marine life.

The soft bottoms of the bays are rich in nutrients, supporting a diverse community of molluscs, marine annellids, crustaceans and benthic algae. The margins of the bays and lagoons are covered with dense seagrass meadows that provide both food and shelter for larval and juvenile forms of marine life.

The central Texas coast has two major bay systems. The Aransas Bay System, north of Port Aransas, covers an area of 157 square miles and includes Aransas, Copano and Mission Bays. Aransas Bay is located behind St. Joseph Island. Its maximum depth is 5 to 6 feet in the north end of the bay, increasing to 10 to 13 feet at the sourthern end near the Lydia Ann Channel.

The fourth station visited on the cruise is located at the junction of Lydia Ann Channel and Aransas Bay. It represents a hard substrate environment. Trawl samples are collected in a long trough, averaging 24 to 28 feet deep, formed by the large volumes of water funneling from Aransas Bay through the narrow Lydia Ann Channel. This massive water movement occurs during hurricane storm surges and, more frequently, during passage of very windy cool fronts in the winter. The moving water scours the bottom and carries finer sediments up the channel, leaving the heavier shell and shell fragments behind. These shell fragments are slowly being destroyed by the boring sponge, *Clione* sp.

The shells in Lydia Ann Channel also provide attachment points for a host of other marine invertebrates, such as encrusting bryozoan, star coral, serpulid worms, barnacles, oyster spat, ribbed mussels and hydroids. The shell rubble also is home for several species of mud crabs, amphipods, brittle stars, snapping shrimp and tunicates, as well as a



97°07'30"
ARANSAS CO.
NUECES CO.
Aransas Bay
Mud Island
35
Redfish Bay
Aransas Pass
d
Lydia Ann Channel
San Jose Island
Harbor Island
361
c
b
-27°52'30"
a
The Univ. of Texas
Port Aransas
Marine Laboratory
Port Aransas
Corpus Christi Bay
0
1
2
MILES
Mustang Island
P53
96°
Houston
29°
77
59
35
Victoria
87
Gulf of Mexico
28°
0
100
200
MILES
The Univ. of Texas
Port Aransas
Marine Laboratory
Corpus Christi

variety of gobies, blenny's and skillet fish.

Lydia Ann Channel extends to the south between St. Joseph's Island and Harbor Island. The remainder of the channel averages 12 to 15 feet deep over a sandy-mud bottom. The Harbor Island area on the west side of the channel is the largest black mangrove marsh in Texas. The shallow sloughs and lakes within the marsh provide shelter and food for the many forms of juvenile marine life found in the area. The marsh also is home to many of the larger wading birds, such as the reddish egret, Louisiana heron, great blue heron, snowy egret, American egret and the Roseatte spoonbill.

The Aransas Pass Lighthouse, built in 1855, also is located on Harbor Island. Its beacon guided sailors across St. Joseph's Island through the many natural passes that once existed through the island. The present pass is a natural pass that has been jettied with granite boulders and deepened to 45 feet to allow ships to pass through the barrier island to the inshore ports.

To the south of Port Aransas is the Corpus Christi Bay system, made up of Corpus Christi Bay, Nueces Bay and Redfish Bay, an area of approximately 200 square miles. Corpus Christi Bay is the largest of the three with an area of 152 square miles. It has an average natural depth of 12 to 15 feet, grading up to a depth of 3 to 5 feet along the margins of the bay. The sediment is a dark, claylike mud with scattered oyster reefs located in the shallows along the shore.

Nueces Bay, one of two true riverine-influenced estuaries along the central Texas coast, is located on the northwest edge of Corpus Christi Bay. Nueces Bay is a small, shallow bay covering an area of 29 square miles. Runoff from the Nueces River and its upstream drainage basin plays an important role in nutrient cycling and regeneration throughout the Corpus Christi Bay system. Dams placed upstream, however, will reduce the flow of the river and affect both the salinity gradient of the bay and the nutrient flushing and cycling that occurs after periodic floods.

Redfish Bay is on the northeast side of Corpus Christi Bay. This small, shallow bay has an average depth of only 3 to 8 feet and covers an area of 19 square miles. The sediment varies from coarse shell along the margin of the ship channel to soupy, claylike mud in the upper parts of the bay. Redfish Bay's margins are heavily vegetated with several species of sea grasses as well as dense growths of macroalgae. Stands of submerged vegetation form dense meadows that provide both shelter and food for a host of larval and juvenile marine life. The second and third stations visited during the cruise are in this bay and serve as an example of a typical bay nursery system.

South of Corpus Christi Bay is a long, narrow body of water called the Laguna Madre. It extends some 115 miles behind Padre Island south to Port Isabel. There is very little water movement in Laguna Madre, and evaporation far exceeds the rainfall. This creates hypersaline conditions during dry years. It is not uncommon to encounter salinities in the 40 to 60 ppt range and in excess of 100 ppt in isolated ponds.

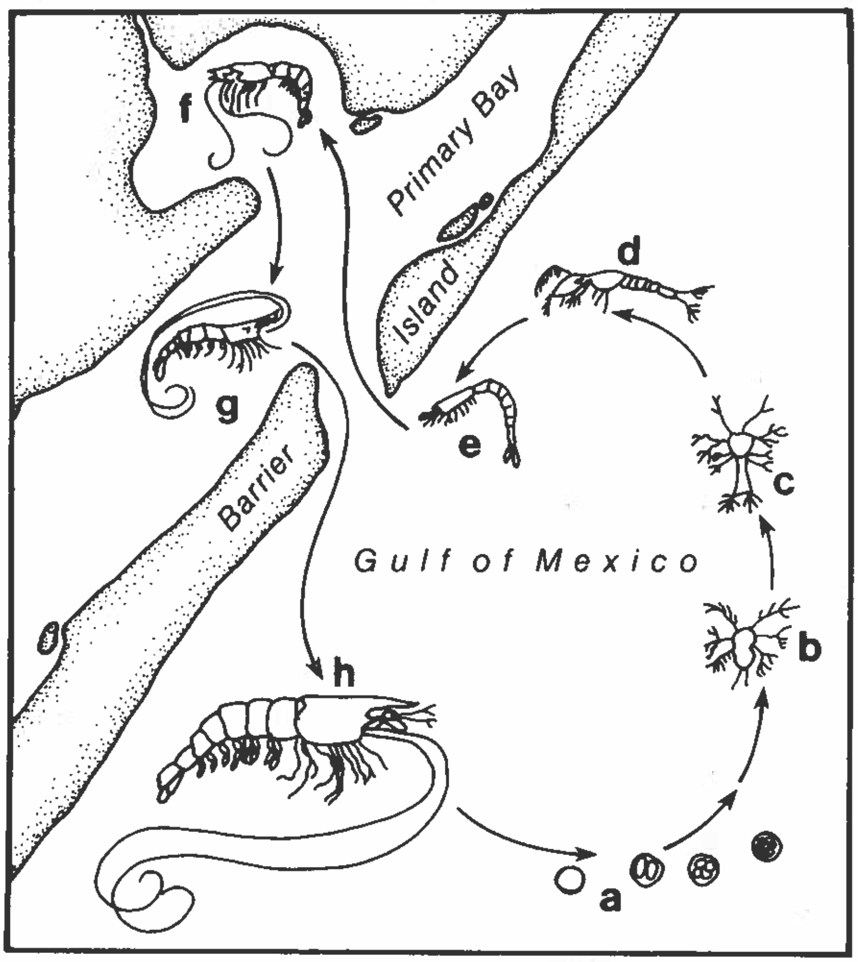
The Corpus Christi Bay and Aransas Bay systems are connected by a ship channel which runs from the west end of Corpus Christi Bay to the junction of Lydia Ann Channel. This channel is connected to the Gulf of Mexico by a natural pass through the barrier islands. The channel is maintained at an authorized depth of 45 feet. It has been dredged through a hard clay substrate and is shaped like an open "U."

All the inshore stations visited on the cruise are behind the barrier islands. As the name implies, barrier islands provide an effective barrier to storm surge during hurricanes, and, recently, prevented the oil from IXTOC I from entering the productive bay systems.

Barrier islands are cut by natural passes that allow Gulf waters to exchange and mix with bay and lagoon waters. Aransas Pass is one such natural pass. It has been jettied with large granite boulders and artificially deepened to 45 feet to allow large vessels to pass between the open Gulf of Mexico and the ports and harbors located on the mainland. Collectively, these channels provide a highway to move goods and materials by ships and barges. They also serve as a highway for nutrients and marine life to move between the bay nursery grounds and the shallow, productive continental shelf off the Texas coast. During virtually every month of the year, some form of adult marine life--fish, shrimp or crab--

is migrating from the shallow bays and lagoons through channels and barrier islands into the shallow Gulf shelf to spawn either offshore or in the mouth of the channel. The native Gulf white shrimp, Penaeus Setiferus, is a typical example.

After hatching from an egg, shrimp begin life offshore as larvae (stages a through d). Being poor swimmers, they are carried by tides and currents through passes into shallow bays and lagoons (e). As postlarvae (f), they take up residence in the rich nursery grounds. Shrimp are omnivorous bottom feeders, and their food consists of algae, molluscs, marine worms and small crustaceans. P. setiferus reach adult size after nearly a year in the sheltered bays (g), and begin their annual spring migration back to the open Gulf, using channels and passes through the barrier islands (h). Adult shrimp feed on organic material that they find in the surface layer



of offshore sediments. This organic material, called detritus, is made up of rotting vegetation swept out of bays by tides. It also includes remains of other marine plants and animals that have a role in the marine food chain.

This is a typical estuarine life cycle. It is exhibited by the majority of important commercial and sport species of fish, crabs and shrimp found off the Texas coast.

Turbidity and Water Color

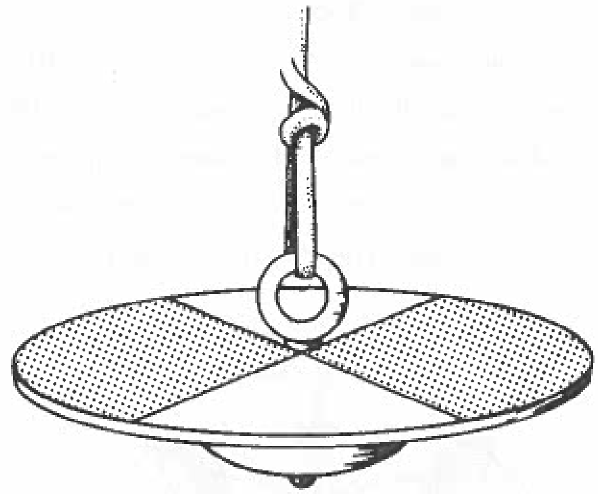
Purpose: Using the Secchi disc to determine turbidity

The Secchi disc is a flat, circular, black and white disc used to determine the turbidity, or clarity, of water. It measures the depth of light penetration, an essential factor for plant growth and primary productivity in the sea.

Procedure: The disc is easy to use. A line marked in one-meter increments is attached to a ring in the center of the disc. When the boat is on location and all forward motion has stopped, lower the disc over the side with the attached line, being careful to keep track of the amount of line below the surface of the water. When the disc can no longer be seen at all, slowly pull it back up until it is just barely visible. Record the depth of the disc in meters on Data Sheet 1 under Turbidity. This is an indication of how well light can penetrate the water.

Purpose: Determining water color with the Forel or Ule scale

This two-sided, clear plastic scale has 12 color patches embedded in it. Each color is numbered and



Secchi disc

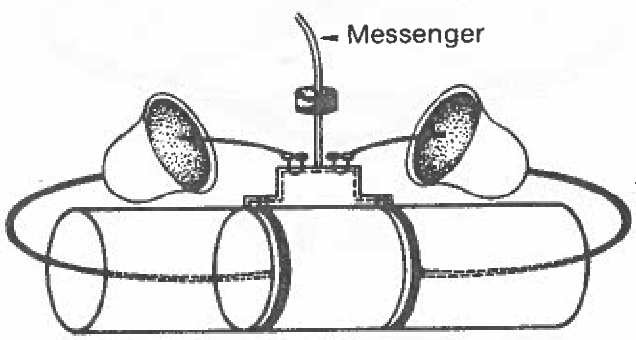
represents a particular water color. The Forel scale varies from green to deep blue and is used for open ocean water. The Ule scale colors vary from green to brown and is used for inland and estuarine waters.

Procedure: To use the Ule scale, first lower the Secchi disc one meter into the water on the shady side of the boat. Hold the Ule scale so that the surface of the Secchi disc can be seen through the spaces between the color patches. Match the color of the water above the disc with the patch of the same color and record the number under the Water Color heading on Data Sheet 1.

Water Sampling and Water Quality

Purpose: Water sampling with a Van Dorn Bottle

The Van Dorn Bottle consists of a weighted, hollow cylinder, the ends of which are sealed by two stoppers connected by a rubber strap that extends through the cylinder body.



Van Dorn Bottle

Procedure: To use the sampler, pull out the stoppers and hook them to the tripping mechanism on the side of the cylinder. Using the attached rope (which is marked in one-meter increments), lower the sampler over the side of the boat to whatever depth is desired. A bottom sample, for example, is measured one meter above the bottom.

The sampler is tripped by sending down the messenger, a heavy weight that slides down the line. After releasing the messenger, you should feel a slight jerk on the line when the bottle trips. Slowly raise the line and retrieve the sampler; avoid banging it on the side of the boat.

The Van Dorn Bottle collects water from specific depths and prevents it from being mixed or contaminated on its way to the surface. Close examination will show that water varies considerably at different places, depths, times and seasons.

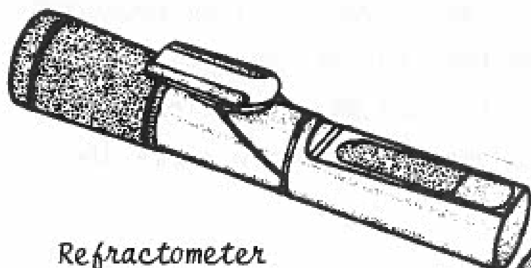
Remove the water from the sampler as needed for water quality analysis.

Purpose: Measuring water quality

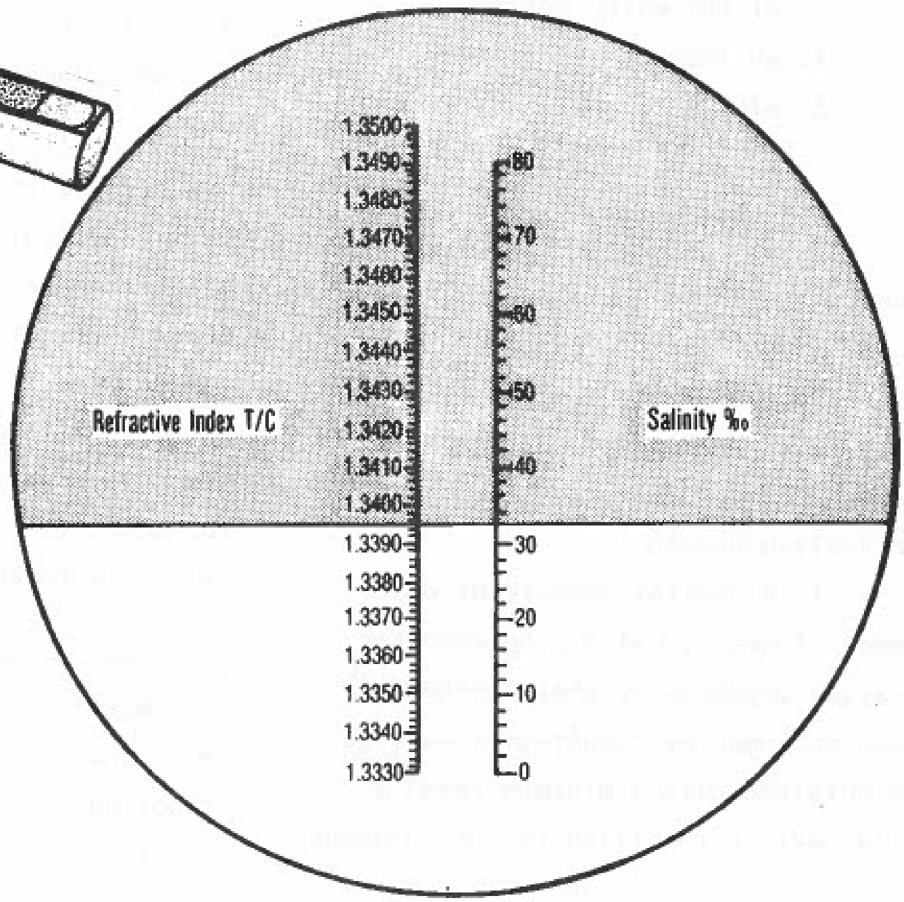
Water quality can be measured by using a refractometer, dissolved oxygen test kit, nitrate-nitrite test kit, a water sample collected with the Van Dorn Bottle, a surface water sample and a Hydrolab.

The refractometer is a hand-held instrument that enables researchers to make a quick measurement of salinity with only a few drops of the sample. This instrument is based on the physical relationship between the refractive index of water and the amount of dissolved material, such as salts and other elements, in the sample. For example, distilled water, which contains no dissolved material, would give a reading of zero. Bay or Gulf waters, depending on the amount of dissolved material in the water, would give a higher reading.

Procedure: To use the instrument, swing the coverplate over the body to expose the prism. Make sure the prism is clean; wipe with lens tissue if needed. Place 10 drops of the sample on the prism and swing the coverplate (A) over the prism (B), keeping the coverplate in contact with the prism by applying a slight pressure with your finger over the A/O symbol. Bring the eyepiece to your eye and point the refractometer toward the sun. You may adjust the eyepiece focusing by rotating the eyepiece to provide the sharpest focus on the internal scale. The reading is made at the point where the background changes from dark to light (as shown). Record the salinity as parts per thousand (S o/oo) on Data Sheet 2 under Salinity.



Refractometer



Dissolved Oxygen

Besides the minerals and salts dissolved in sea water, there also are dissolved gases in the water column. The three most abundant gases, in order, are nitrogen (N_2), oxygen (O_2) and argon (Ar_2). Oxygen is perhaps the most important since it is required by both plants and animals for respiration. It is released into the water column as a byproduct of photosynthesis. The amount of oxygen in the water fluctuates and is dependent on four factors:

1. circulation and mixing of the water column
2. pollutants
3. high nutrient loads such as the presence of raw sewage
4. physical parameters such as temperature and salinity.

Cool water holds more oxygen than warm water. Stratification of the water column by differences in salinity could trap layers of sea water which contain different levels of dissolved oxygen.

In a healthy estuary or other body of water, balance between the oxygen produced by photosynthesis and consumed by respiration must be maintained with a minimum level of six parts per million (6 ppm) present at all times. If dissolved oxygen levels fall below this minimum to a level of 3 ppm or 4 ppm, or less, a great deal of stress is placed on the plants and animals in the immediate area. Mobile animals such as fish, shrimp and crabs will be forced to migrate to a bay where oxygen levels are higher. More sedentary animals, such as oysters and polychaete worms, suffer from the reduced oxygen levels if exposed for a long enough period of time.

Dissolved oxygen will be measured by two methods during the cruise. The first is chemical determination. The second is electronic and will be discussed later.

Procedure: Complete instructions for the dissolved oxygen test kit are printed on the lid of the kit. Follow these instructions carefully. Use the water collected by the Van Dorn Bottle. If time permits, you may also use a sample of surface water for comparison. Enter the results as mg/l on Data Sheet 2 under DO mg/l.

Nutrient Determination

Nutrients such as phosphates (PO_4) and nitrates (NO_3) are also dissolved in sea water and are essential for plant growth. Phytoplankton, and attached vegetation such as sea grasses, benthic algae and marsh plants, require nutrients as well as sunlight for vigorous plant growth. All other marine life is either directly or indirectly dependent on the primary producers (plants) for food, shelter and oxygen production. Obviously plant health and abundance are essential to the health of both the bays and the open Gulf waters. Lack of sufficient nutrients limits plant growth. Conversely, an overabundance of nutrients through pollution or sewage effluent may produce a detrimental overgrowth of the plant community; this can cause such undesirable effects as the red tides that occur off Florida so frequently.

Procedure: Complete instructions for the use of this test kit are printed on the lid of the kit. Follow the instructions carefully. Do not touch the color wheels with wet hands, and store the color wheels properly in the covers provided in the kit. Use the water collected by the Van Dorn Bottle for your sample. Enter the results on Data Sheet 2.

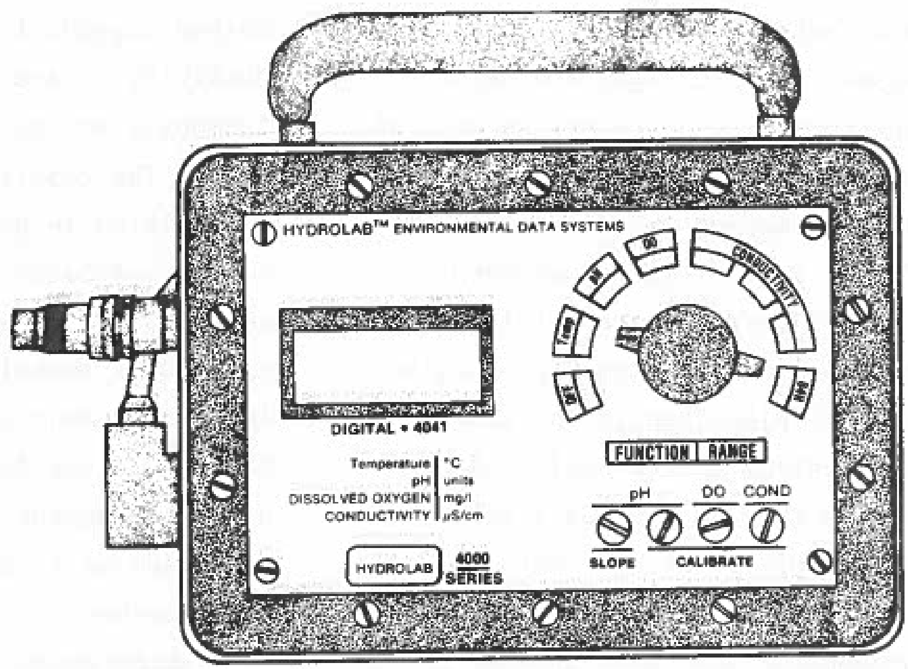
Digital Hydrolab 4041

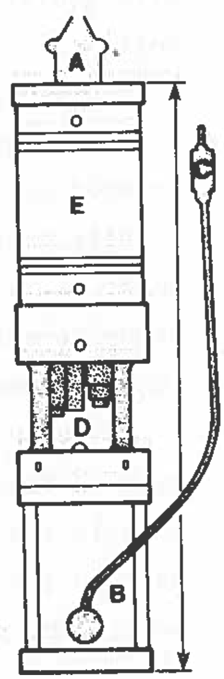
When the Hydrolab is in operation, four parameters -- pH, dissolved oxygen, temperature and conductivity -- are being measured simultaneously at the sonde (underwater) unit. The resulting signals are transmitted in parallel up the cable to the indicator unit, ready to be selected by the user via the panel switch for immediate readout. Using this instrument allows the researcher to measure the four parameters at different depths simultaneously as the sonde unit is lowered through the water column.

Temperature is measured by a high accuracy thermistor, whose resistance goes down as its temperature increases. The thermistor is the slim stainless steel tube in the bottom of the sonde unit.

Dissolved oxygen is measured by a polarographic cell. It is the probe covered by a thin membrane stretched tightly over the end. Oxygen, but no water, will diffuse through the membrane, creating an electric current that is measured by the instrument.

The pH of the water is measured by a pH-sensitive glass electrode. This is a glass tube with the small bulb on the end located in the sonde unit. The pH scale runs from zero to 14; a pH of 7 is neutral, below 7 is acidic, above 7 is basic. The pH of





A Cable to Indicator Unit
B Circulator Assembly
C Underwater Connector
D Sensor Chamber
E Clear Lexan Pressure Housing

the oceans is slightly basic, usually 8.0 to 8.4. The pH in the bays and estuaries may vary from slightly below 7.0 to 8.6. Marine life cannot survive if the pH is much outside these limits. The ocean has a buffer system that tends to neutralize acids and bases and keeps the pH fairly constant.

Saltwater's special ability to conduct electricity is used by the conductivity probe in the sonde unit to measure salinity. Salinity is a measurement of the total amount of dissolved substances in the water column. These substances split apart in the water into basic elements or ions that are electrically charged. The more ions the water contains (the saltier it is), the more current it can conduct. Temperature influences the water's ability to conduct electricity, but this instrument automatically compensates for this.

Procedure: Lower the sonde unit into the water sideways, if possible, and shake it to dislodge air bubbles trapped in the conductivity cell block. Take a surface reading. Wait until the readings stop changing (dissolved oxygen is best indicator) and record the value of each parameter by slowly moving the panel switch on the indicator unit. The underwater cable is marked off in one-meter increments. Slowly lower the sonde unit, pausing at each meter to take a new set of readings. Do not lower the unit all the way to the bottom; take a bottom reading no closer than one meter from the bottom. Check with the instructor for water depth information.

After the last reading is recorded on Data Sheet 2, carefully pull the sonde unit up, place it in the bucket of fresh water provided, turn the unit off and coil the underwater cable neatly for the next user.

Cleanup and storage: Disconnect the indicator unit and battery pack from the underwater cable and replace the protective dust covers over the connector ends. Store the indicator unit and battery pack in the protective case. Carefully rinse the underwater cable, sonde unit and circulator assembly with the fresh water hose. After rinsing, towel-dry the area of the cable immediately adjacent to the connectors. The instructor will disconnect the cable and store the units.

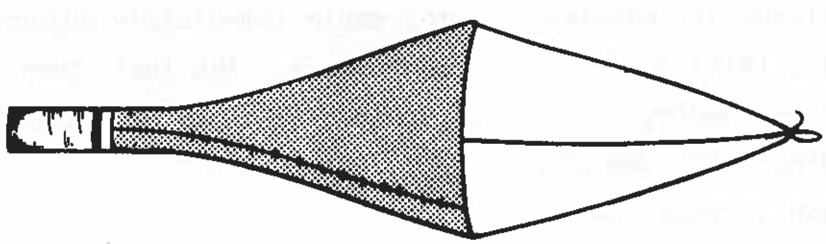
Taking a Surface Plankton Tow

Plankton are small plants and animals found floating in the surface layers of the world's oceans, bays, estuaries and inland lakes. Of special interest on this cruise will be the small marine plants, called phytoplankton, and the small marine animals, including some larval forms, called zooplankton. Phytoplankton serve as the major primary producers in the world's oceans and as the basis for the marine food web. These tiny plants are actively grazed upon by larger zooplankton and by still larger filter-feeding fish, which, in turn, are eaten by larger fish, which are harvested by man. This is an example of the food web. Researchers study plankton and the quality of the water to aid in understanding the productivity of a body of water.

Plankton are sampled by filtering water through a fine mesh net. Water passes through the net and, depending on the size of the mesh, plankton larger than the mesh openings are trapped in the net. A plankton net is cone-shaped, with a metal ring to keep the net open as it is towed. The net tapers to a small cup where the sample will collect.

Procedure: In addition to the plankton net, this activity requires collection bottles and a microscope.

To collect a sample, lower the plankton net over the stern of the vessel only when the trawl also is being towed. Let out enough line so that the net is just under the surface, and tie the end of the line securely to a cleat. Retrieve the net after ten minutes. Keeping the hose on the outside of the net, wash all the plankton from the sides of the net into the collection cup. Pour the sample into a collection jar for study, then invert the net and wash



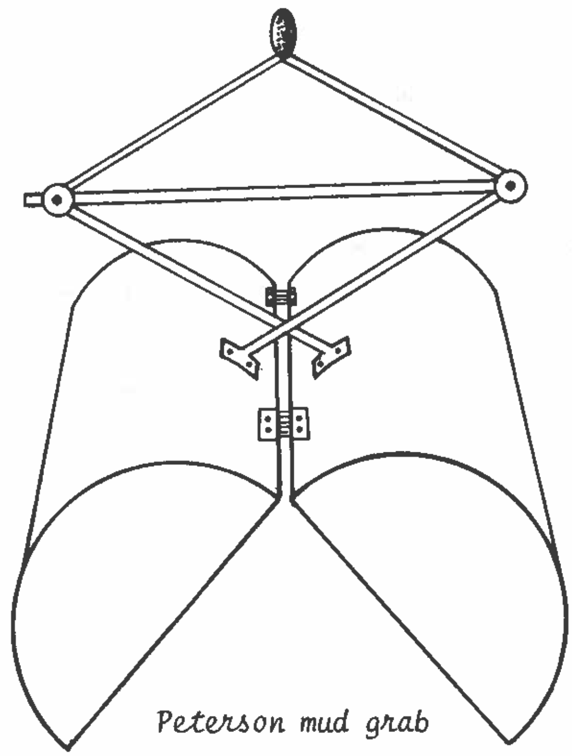
Plankton net

it thoroughly. Neatly coil the line and hang the net up to dry.

Use a pipette to remove a sample of the plankton that has settled at the bottom of the collection jar. Place this sample in a Petri dish and observe under the dissecting microscope. Observe the different forms of plankton. Using the on-board reference material, identify three types of plankton and sketch them on the back of Data Sheet 3.

Collect a Sample of the Sea Floor

A mud or bottom grab is a device used to sample the sea floor so that researchers can study both the sediment and bottom-dwelling organisms. The sea floor is called the benthos and those animals that live buried in the bottom are called benthic infauna. Benthic ecologists, researchers who study life in and on the bottom, recognize the importance of the benthic fauna as biological indicators. The ecologist can monitor the health of a given body of water by studying populations of benthic organisms over a period of time. If a pollutant, such as oil or untreated sewage, were introduced into a bay, for example, the community structure of the benthic animals would probably change, indicating that something had affected the environment.



Peterson mud grab

Procedure: This activity requires a Peterson mud grab, sieves and four strong students. Wait until the boat comes to a complete stop before taking a grab sample. Attach the line to the grab and run it through the snatch block on the A frame. Cock the sampler, hold onto the messenger and carefully lower the grab over the stern. Once it has reached the water's surface, allow the grab to free-fall to the bottom. Release the messenger so it can trip the grab. Pull the sampler back up on deck. Be careful -- it now weighs close to 45 kg (100 pounds), so do not drop it on someone's foot. After the sampler is safely on deck, empty it into the sieves. Notice the color of the mud.

Is there more than one color?

Is there a distinctive odor? Why?

What is the texture of the sediment?

Do you see any animals or plants?

Wash the sample carefully and collect the specimens for examination under the dissecting microscope. Notice that some of the benthic worms, called polychaetes, live in tubes of different-sized sediment. Shell fragments are sometimes used to stiffen the tubes. There also may be free-living polychaetes and ribbon worms as well as sea cucumbers and brittle starfish in the sediment sample. Look closely. Identify three different types of benthic infauna and sketch them on the back of Data Sheet 2.

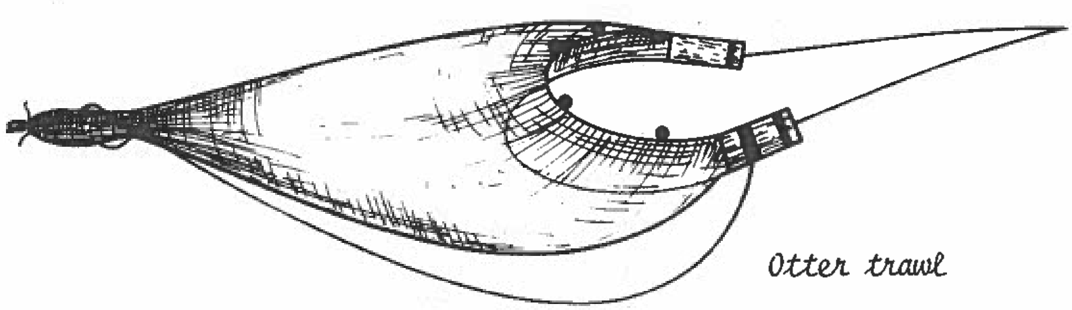
Cleanup: Remove the soft line from the A frame and the sampler and coil neatly. Wash the sampler and the deck area so that no one slips in the mud. Store the sampler in the rack on the back deck.

Collecting Fish and Macroinvertebrates

The otter trawl is a large, V-shaped net used to collect fish, shrimp, crabs or other animals that live on the bottom or in the water column just above the bottom. The trawl is approximately 7 meters wide at the mouth and approximately 10 meters long, tapering to a bag or cod end. There are rows of floats attached to the top of the mouth and a row of weights on the lead line. Each side of the net is attached to a trawl board or door. These doors serve a dual function. Water pressure on the doors causes the mouth of the net to spread apart. This same pressure causes the doors to dive, sinking the net to the bottom where it will be dragged for a period of 10 to 15 minutes.

Procedure: Once on station, tie the end of the bag and toss it into the water behind the boat. Be sure to stand clear of the cable when the net is deployed or retrieved. The net will stream out, followed by the doors. As the doors enter the water, notice how they spread apart and dive down to deploy the net. To ensure that the net is on the bottom, let out a length of cable approximately four times the depth of the water. When the trawl is retrieved, the lazy line is used to bring the cod end of the net on deck. Once the cod end is untied, the catch will spill out onto the deck for investigation.

A representative sample should be removed for preservation and further study; the bulk of the catch is returned to the water while it is still alive. Live specimens may be placed in the live box for transport back to the laboratory. Estimate the number of each type of fish and invertebrates retrieved from each particular study site.



Otter trawl

1. How does this catch compare to other stations?
2. Does depth or bottom type influence the variety of the catch?
3. Do any of the animals have special shapes, color patterns or defense mechanisms that would enable them to survive in or adapt to a particular type of marine environment?
4. Examine the mouths of several of the larger fish. Can you tell a bottom feeder from a fish-eating, carnivorous type of fish?
5. What is different about the mouth shape, armament, placement on the head, etc.?

Enter this information on Data Sheet 1.

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Data Sheet 1

Date__________ School ________________ Grade______ Teacher_____________ Recorder ___________

General Observations

Station No.	Time	Tide		Depth	Baro. Press.	Air Temp.	Wind		Turbidity	Water Color	Other
		Ebb	Flood				Dir.	Speed			

Trawl Sample #1

Station____________________ Depth_______________ Length of Trawl (minutes)____________

Fish

Name	Number	Length	
		Max	Min

Invertebrates

Name	Number	Length	
		Max	Min

Trawl Sample #2

Station____________________ Depth_______________ Length of Trawl (minutes)____________

Fish

Name	Number	Length	
		Max	Min

Invertebrates

Name	Number	Length	
		Max	Min

Data Sheet #2

Water Quality Measurements--Ship Channel Station

Dissolved Oxygen/Nutrients/Salinity

Depth	DO mg/l	NO_2	NO_3	Salinity o/oo

Hydrolab

Depth m	DO mg/l	pH	Temp °C	Cond uS/cm

Sediment Sample

Station	Depth m	# Grabs	Color	Odor	Texture/Composition %sand, shell, mud	Vegetation

Benthic Infauna

Station No._______

Station No._______

Data Sheet #3

Plankton

Plankton Tow #1

Location	Time	Tide	
		Ebb	Flood

Holoplankton (permanent)		Meroplankton (temporary)	
Foraminifera		Nauplius larvae	
Ostracod		Zoe Larvae	
Copepod		Megalops larvae	
Amphipod		Veliger larvae	
Isopod		Trochophore larvae	
Chaetongnath		Hydromedusae	
Salp		Fish eggs	
		Larval fish	
		Cirripeda	

Plankton Tow #2

Location	Tide	Tide	
		Ebb	Flood

Holoplankton (permanent)		Meroplankton (temporary)	
Foraminifera		Nauplius larvae	
Ostracod		Zoe larvae	
Copepod		Megalops larvae	
Amphipod		Veliger larvae	
Isopod		Trochophore larvae	
Chaetognath		Hydromedusae	
Salp		Fish eggs	
		Larval fish	
		Cirripeda	

Marine Bird Checklist

	Number	Location
Laughing Gull		
Herring Gull		
Ringbill Gull		
Royal Tern		
Caspian Tern		
Sandwich Tern		
Least Tern		
Foresters Tern		
Brown Pelican		
White Pelican		

Marine Bird Checklist

	Number	Location
Louisiana Heron		
Snowy Egret		
American Egret		
Reddish Egret		
Glossy Ibis		
Roseate Spoonbill		
Black Skimmer		
Doublecrested Cormorant		
Frigate Bird		
Assorted Ducks		
Others		