TAKING PASSAGE ON THE

HUDSON RIVER SLOOP *CLEARWATER*

A Guide to the On-board Education Program

Written and illustrated by Steve Stanne

Adapted in part from: The *CLEARWATER* Education Packet, by Mary deWitt, Nora Porter, Diane Buckley, and others;

A Hudson Slooper's Handy Guide, by Tom Allex, Rita Hurault, Pete Seeger, and others.

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NTRODUCTION

You will be coming aboard a very special boat – the Hudson River Sloop *CLEARWATER*. *CLEARWATER* is a wooden sailboat 106 feet (32.3 meters) long, with one mast 108 feet (32.9 meters) tall. One hundred and fifty years ago such boats were a common sight on the Hudson and Long Island Sound; now *CLEARWATER* is the only full-sized Hudson River Sloop in existence. You will help to sail her: raising the mainsail and taking a turn at her tiller.

CLEARWATER is more than just a big sailboat, however. Her crew teaches people about the ecology of the River and the Harbor, and about problems created there when ecological relationships are ignored. We hope to help you understand how these environments might be made cleaner, healthier, and more productive. During your sail you will explore the water with nets, chemical test kits, and other equipment. You might be surprised by the number of living things we find.

CLEARWATER is also an organization with thousands of members. Each is a part-owner of the sloop. They offer time, energy, and membership dues to our teaching and sailing efforts. Their volunteer help is vital to the success of our programs. You will meet some of these members during your sail. Each week six come on board to assist the regular crew.

This booklet will help you prepare for your trip. It describes *CLEARWATER*, how we sail her, what living things we might find, and what will happen during your voyage. Please read it carefully before your sail. Meanwhile, we're looking forward to seeing you on the sloop. We think you'll learn a lot and have a good time doing it!

CLEARWATER: A HUDSON RIVER SLOOP

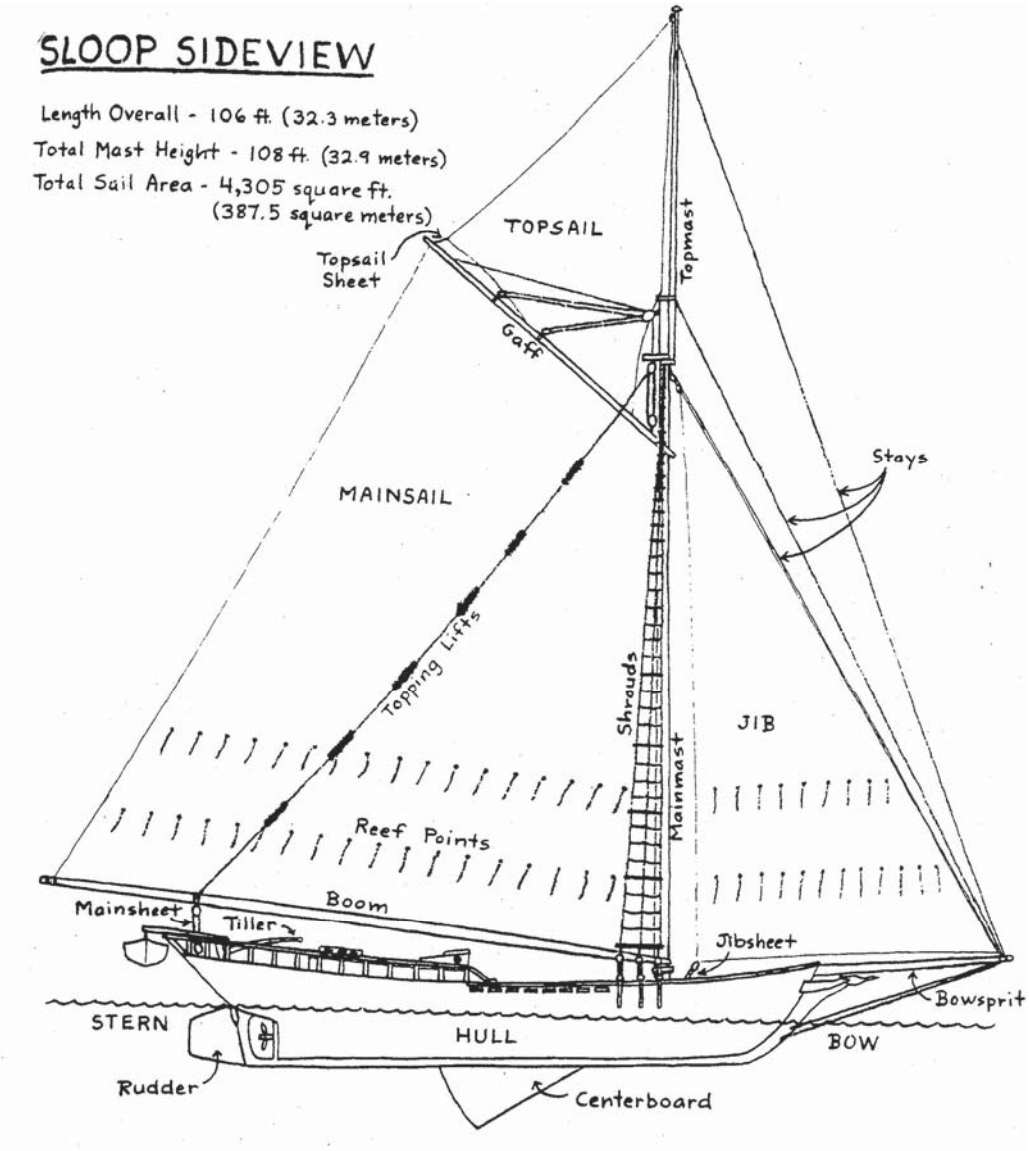
If *CLEARWATER* had been sailing on the Hudson in 1850, few people would have looked twice. More than 400 sloops used the River then. Some carried passengers. As a means of travel they were much preferred to a bumpy horse-back ride on rutted trails. Most sloops, however, carried cargo: lumber, stoned, livestock, and produce, for example.

Sloops were present on the River from the late 1600s until about 1900. In the mid-1800s they lost their passengers to railroads and steamboats, which offered faster, more regular service. Sloops continued to carry cargo until the 1900s, when they were put out of business by competition from tugboats pulling tows of barges. *CLEARWATER*, launched in 1969, is the only full-sized Hudson River Sloop in existence today.

Look at the diagram on the next page. Notice the *CLEARWATER* has one mast (with two parts – the mainmast and topmast) and three sails: mainsail, jib, and topsail. By a very simple definition, a sloop is a sailing vessel with only one mast and at least two sails. But what sets a Hudson River sloop apart from other sloops? The chief differences are the very large area of the sail and the great height of the rig (the rig includes mast, sails, and supporting lines). Winds on the Hudson are often weak in summer. In addition, these winds are commonly strongest at some distance above the water. With their large, high rig Hudson River Sloops could catch and move with even these gentle breezes. When winds blew hard the sail area could be reduced by tying a set of reef points (short lengths of rope) around the bottom of the sail. As the sail was raised only that part above the tied reef points would be exposed to the wind. This was safer in strong winds because less strain was put on the rig.

CLEARWATER'S tall rig is supported by steel cables running up to the mast: stays from the bowsprit and shrouds from the rails on each side of the sloop. Pieces of rope are tied across the shrouds to make a rope ladder. Another set of cables – the

topping lifts – support the boom. The boom and gaff are long poles to which the mainsail is laced. They are also considered part of the rig.



Ropes on a sailboat are called lines, as well as having special individual names.

For simplicity, many of the lines used in *CLEARWATER*'S rig have been left out of the drawing. You can find the sheets, however. These are lines used to control the angle of each sail in relation to the hull.

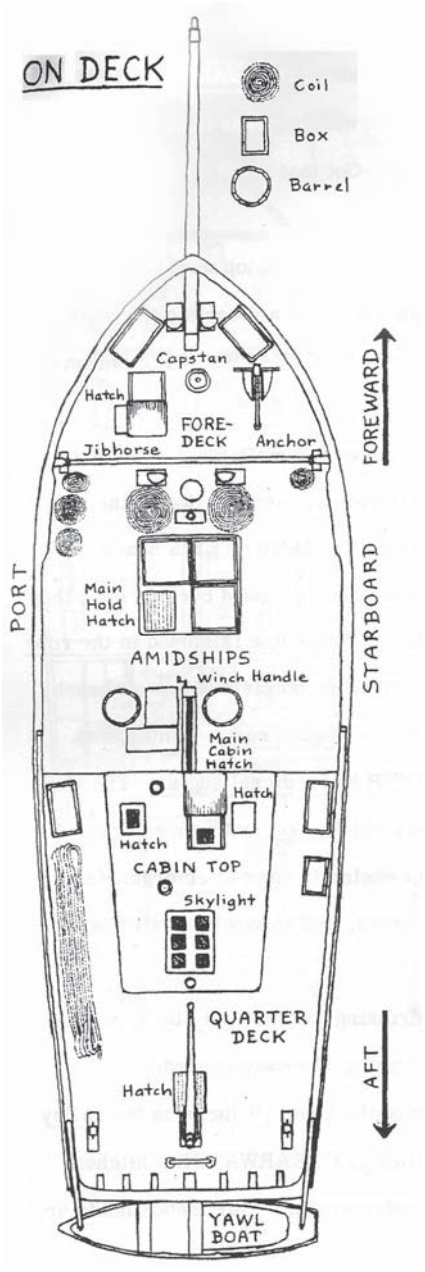
The fin underneath *CLEARWATER*'S hull is called a centerboard. It keeps the sloop from being pushed sideways by the wind. The centerboard can be raised or

lowered. This was important to Hudson River Sloops because the River has many shallow spots. By raising the centerboard, sloops could travel safely over these places.

In the 1800s, ship wheels were used to steer many boats. However, they were not accurate enough for use on Hudson River Sloops, which often operated in very tight quarters when docking. A tiller connected directly to the rudder was preferred and used on most of these sloops. Though accurate, steering with a tiller sometimes takes a great deal of effort, as you may learn yourself!

From bow to stern (front to back) *CLEARWATER*'S deck is divided into three main areas: foredeck, amidships, and quarterdeck. These are shown in the diagram on this page. On original Hudson River Sloops much of the amidships and quarterdeck space would have been piled high with cargo.

On the foredeck is a capstan, a mechanical device used to haul the anchor or other heavy objects. Running across this area is a pole known as the jib-horse. A steel ring attached to the jib slides along this pole. As the jib moves across the foredeck this ring is pulled back and forth, often with great force. Stay clear of the jibhorse!



Several hatches and a skylight open to allow access below deck. These covers are closed in rainy weather or opened to let light and air in during fair weather.

Coils of line are made in certain places after we raise our sails. Please don't disturb these coils; they allow line to flow out without tangling.

Barrels and boxes on deck are used for storage. Lifejackets, extra line, and brine (salt water) used to wash the deck are some of the items kept in them. The centerboard fits into a slot in the hull. It is raised and lowered by turning a winch handle, a job you may be assigned during your trip.

The cabin top is a nice place to sit, but don't stand on it! The boom won't stop for you as it swings across the deck.

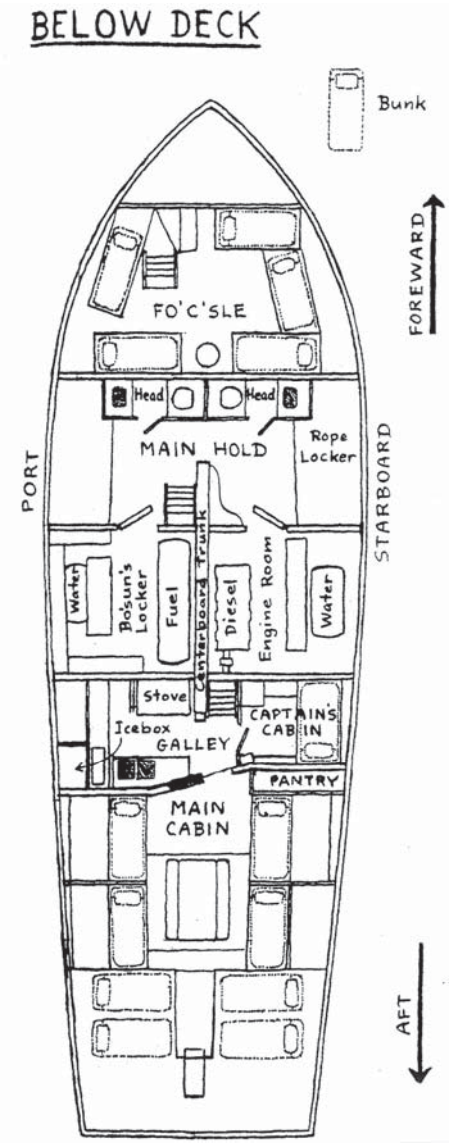
Hanging from *CLEARWATER*'S stern is our yawlboat. It is equipped with oars and can be lowered to the water in order to row passengers or cargo to shore or another vessel.

Sailors' names for things can sometimes be confusing. For instance, they often refer to starboard and port or forward and aft when showing direction. Imagine that you are standing on *CLEARWATER*'S deck, facing the bow. "Starboard" indicates that side of the boat to your right. "Port" indicates that side to your left. "Forward" means in the direction of the bow. "After" means towards the stern. Got that all straight? Now let's go below.

Most of the space below deck on a Hudson River Sloop would have contained cargo. The traditional sleeping quarters for a sloop's crew would have been in the fo'c'sle (short for forecastle). *CLEARWATER*'S permanent crew has bunks in this area.

The main hold gets its name because it has the main place for holding cargo. Ours is divided into several small compartments. Notice the two heads. "Head" is the sailor's name for toilet. *CLEARWATER*'S heads do not empty into the water. Their contents are stored in closed buckets until they can be emptied at a sewage treatment

plant. Extra line is stored in the rope locker. The bo'sun's locker is a carpentry shop complete with workbench and many tools. The last compartment is our engine room.



Unlike any original Hudson River Sloop, *CLEARWATER* has a diesel engine. The U.S. Coast Guard requires that a sailing vessel which takes out as many passengers as our boats does be equipped with an engine in case of emergencies. Our diesel helps us to maneuver in tight spots, and to meet sometimes equally tight schedules.

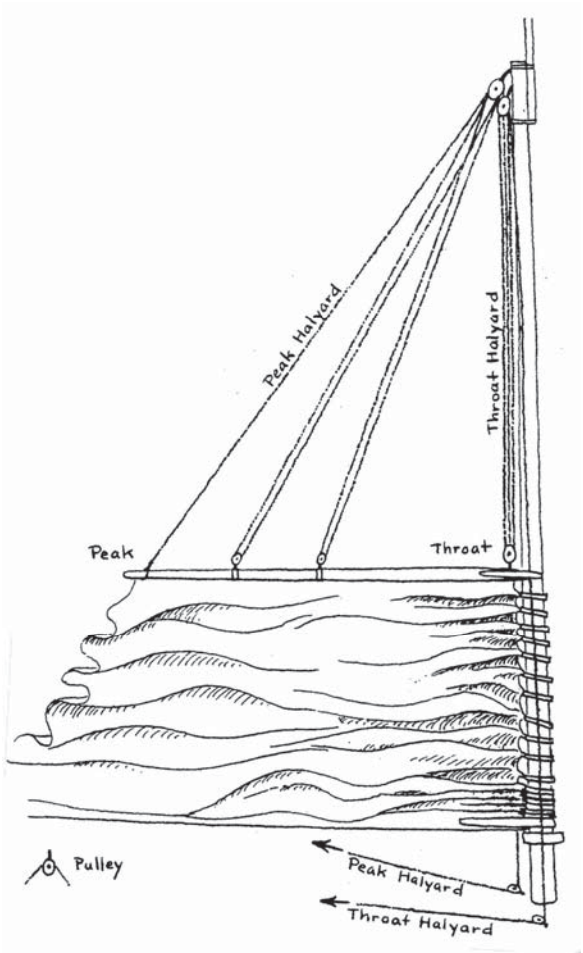
Also in the hold are water tanks for drinking water, a fuel tank, and the centerboard trunk, which forms the slot holding the centerboard. Aft of the hold is the main living area on the boat. It includes the galley, main cabin, and captain's cabin. The galley is *CLEARWATER*'S kitchen. We use a propane stove to do our cooking. Meals are eaten in the main cabin. It can get pretty crowded there around suppertime. In addition to being a dining room, the main cabin is a living room for the entire crew and a bedroom for the weekly volunteer crew. The only crew member with a private cabin is the captain. This privilege is reserved because the captain must bear more responsibility than any other crew member.

On your trip you will get a chance to tour the area below deck. Remember that it is the crew's home. We welcome visitors but ask that they be considerate. Don't dig

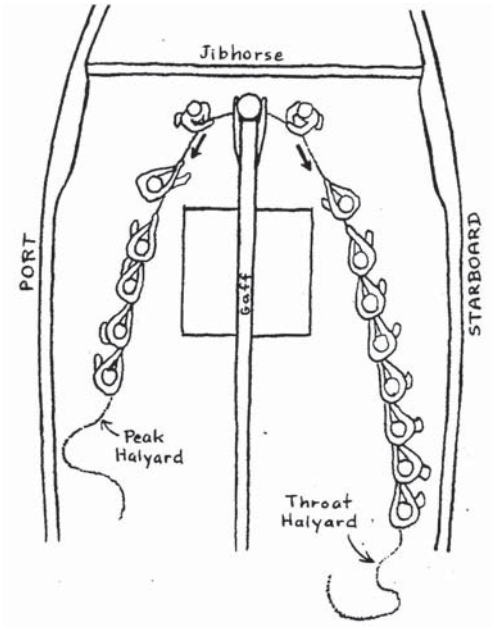
into private belongings or mess things up. It may not always look it, but we work hard to keep the cabin clean.

RAISING *CLEARWATER*'S MAINSAIL

One of the most exciting (and exhausting) activities you'll do on board is raising the mainsail. *CLEARWATER*'S mainsail measures 2,910 square feet (262 square meters) in area and, including the boom and gaff, weighs about 3,000 pounds. The lines used for hauling up sails are called halyards. Two are used to raise the mainsail. One – the peak halyard – will be strung out along the port side of the deck, the other – the throat halyard – along the starboard side. These two lines first run through pulleys on deck. From there they go up along the mast and through more complicated pulleys which make your work in lifting the sail a little easier. The peak halyard then runs back and forth several times between those pulleys and two more near the peak end of the gaff. The throat halyard travels back down to a pulley attached to the throat end of the gaff.



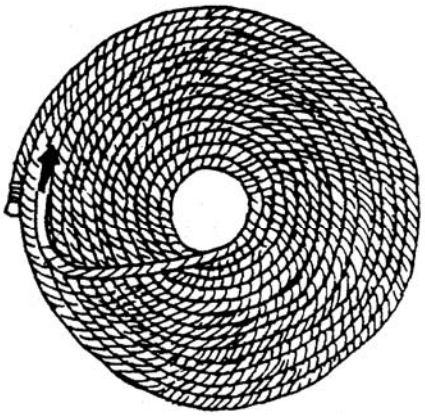
When it's time to raise sail, the crew and passengers divide into two groups. One group lines up on the port side to haul on the peak halyard, the other on the starboard side to pull on the throat halyard. The crew member at the head of the line stands facing his or her team. This person sets the rhythm, hauling down on the halyard. each time he or she pulls down, everyone else in the line pulls back.

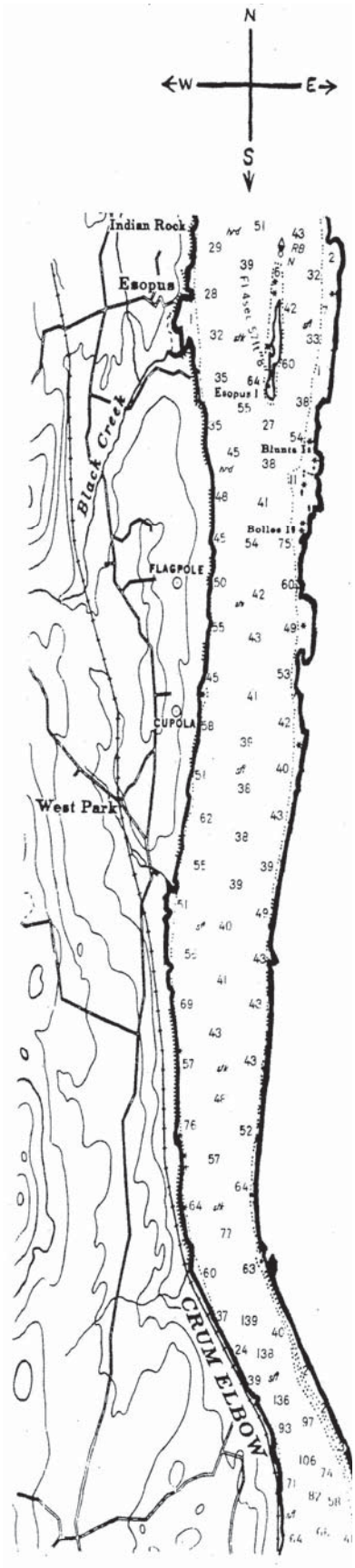


Remember these points as we raise sail:

1. <u>Listen to the crew and captain</u>. Wait until you hear their command to start hauling. The command will be "Haul on the throat!" and/or "Haul on the peak!" Occasionally the sail will not go up properly and it becomes necessary to stop hauling until the problem is solved. In this case you will hear the command "Hold the throat!" and/or "Hold the peak!" Stop hauling and hold on the halyard. Wait until you hear "Haul away throat (or peak)" before you start hauling again.
2. <u>Try to haul in rhythm with the rest of the group</u>. Singing a sea chantey helps to set and keep a rhythm. Sing, listen, and watch the crew member at the head of the line. Try to pull back when he or she pulls down.
3. <u>Stand firm in one place – don't walk backwards</u>. There is a limited amount of deck space on the sloop. If you walk backwards as you haul, the person in back of you will have to walk backwards to keep from being stepped on, and the person in back of them will also have to walk backwards, and so on until the last person ends up falling down!

Finally the mainsail is up, the halyards are secured, and the engine is turned off. *CLEARWATER* moves by wind power, which you've worked to harness. The crew will coil up the lines and they'll look similar to the picture below. Be sure not to stand in them!



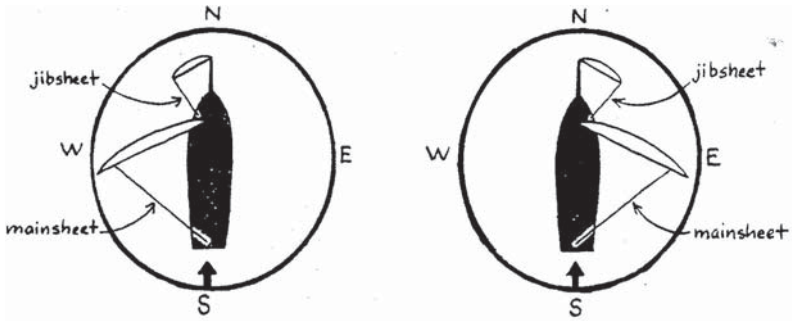


SETTING *CLEARWATER*'S SAILS

Once the sails are raised we must "set" them. Setting the sails means to adjust their angle in relation to the boat's hull. This is done by pulling in or letting out the jibsheet and mainsail. We set these sails depending on two factors: the direction we wish to travel, and the direction from which the wind is blowing.

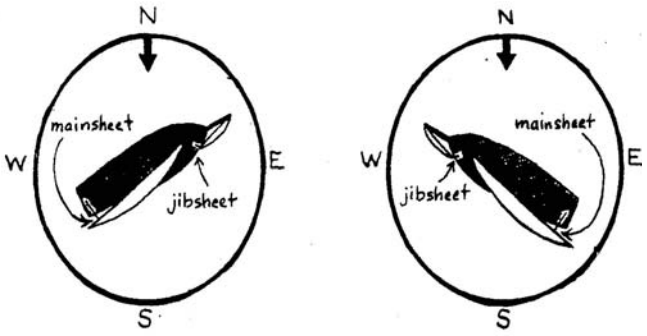
Find Esopus Island and Crum Elbow on this map of the Hudson River. Imagine that *CLEARWATER* is trying to travel north from Crum Eblow to the island. Let's see how the sloop must set her sails to react to the different wind conditions during this trip.

If the wind is blowing from the south, then *Clearwater* can run. The jib and mainsail are let out till they are almost at right angles to the hull. From above, the sloop would look something like this:



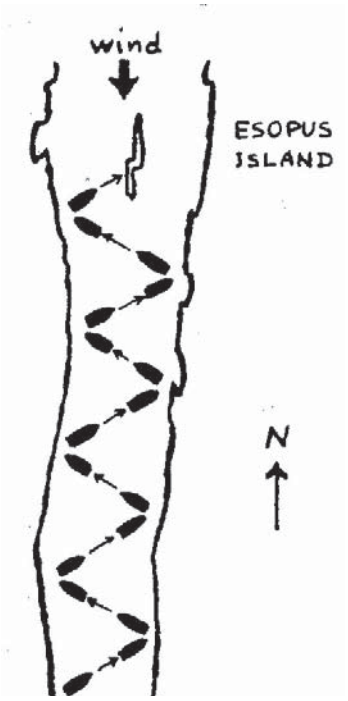
Notice that the jibsheet and mainsheet are let out a long ways.

If the wind is blowing from the north, the *CLEARWATER* must <u>beat</u> into the wind.

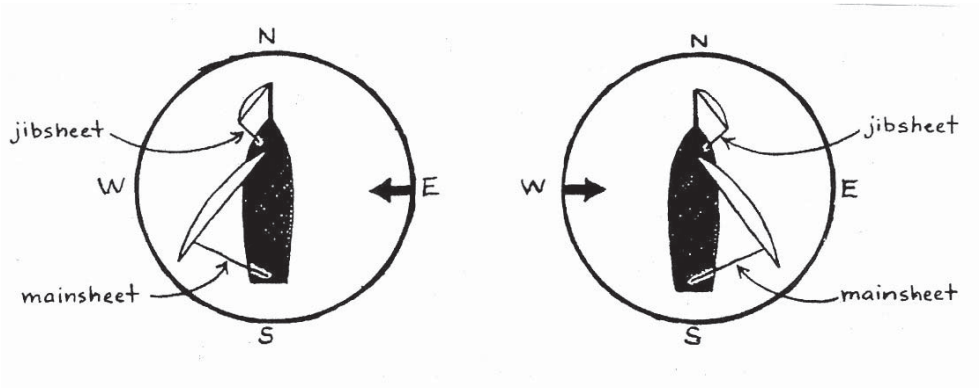


The mainsheet and jibsheet are pulled in very tightly, and the angle between the sails and hull is a very small one. Look at these drawings showing the sloop from above. Notice that the boat is not sailing directly into the wind. No sailboat can do that. They all must point to one side of the other of the direction from which the wind is coming. *CLEARWATER* must point at least 60° away from that direction (the "eye" of the wind).

Since the sloop cannot sail directly into the wind, she cannot sail straight up to the island if the wind is from the north. Pointing off at an angle from north means that she will soon hit shore. Obviously that wouldn't get us to Esopus Island. So we must <u>tack</u> (come about). This means that we swing the bow of the boat across the eye of the wing until it points about 60° to the other side of the wind's direction. Then we sail across the River till we get to the other shore and have to tack again. Our course up to the island would thus be zig-zag shown here. As you might guess, it takes longer to get where we're going if we have to beat into the wind.

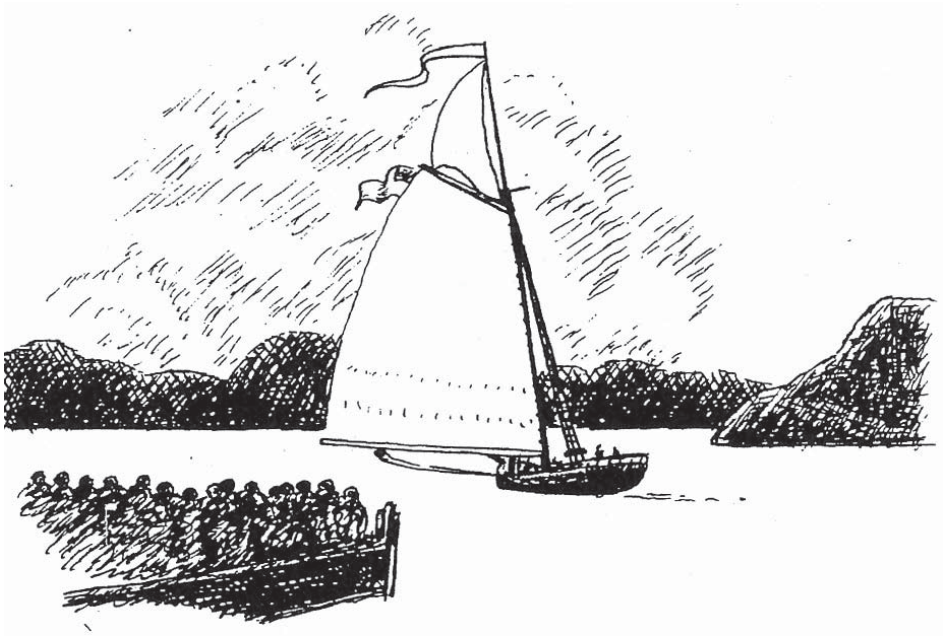


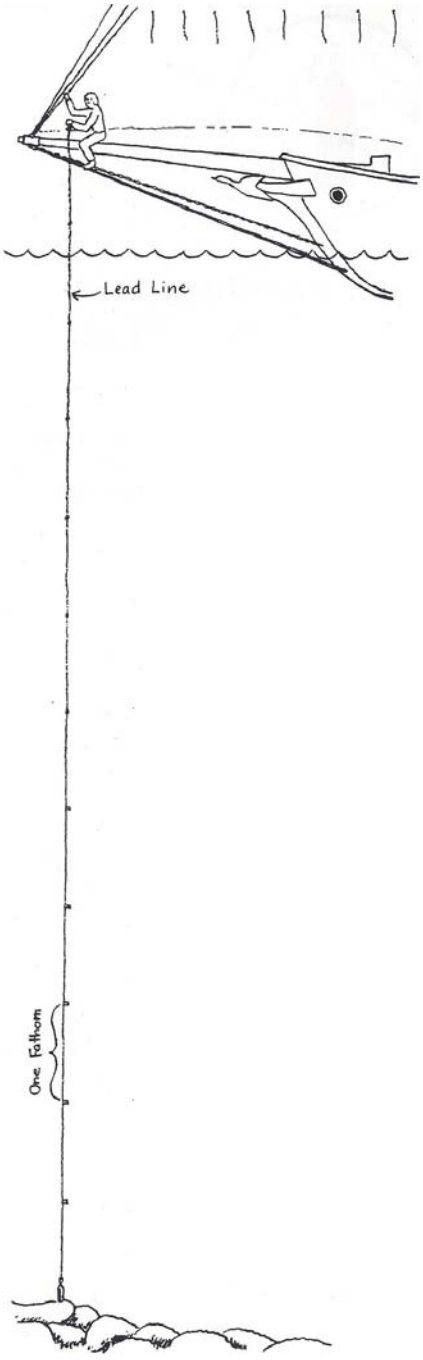
What if the wind is blowing from the east or west? In this case *CLEARWATER* would <u>reach</u> up to the island. Her sails would be set with the jibsheet and mainsheet about halfway out. The drawings on the next page show this.



When *CLEARWATER* is reaching or beating it is necessary to lower the centerboard. This fin helps to keep the sloop from being pushed sideways by the wind.

Running, beating, and reaching are known as points of sail. We may use several points of sail on the day of your trip. It will all depend on the wind and where the captain wants to go.





NAVIGATION ON A HUDSON RIVER SLOOP

Navigation is the science of determining a boat's position and safely sailing it from one position to another. Often this involves the use of instruments such as compass, sextant, radar, or GPS. With such devices a ship can pinpoint its position even on large bodies of water where the shore cannot be seen. Some of these instruments did not exist when *CLEARWATER*'S ancestors sailed the Hudson River and Long Island Sound. Even if they had existed, sloop captains would rarely have needed them. Since they were seldom out of sight of land, sloops could determine their positions by sighting shoreline landmarks such as tall buildings, mountains, and islands.

However, it's harder to see what lies underneath the water's surface. A major problem faced by sloop captains was running aground or damaging their vessels on a shoal. These shallow areas were often in the middle of the River where one would least expect to find them. In addition, many ports served by sloops were very shallow. For these reasons, captains needed a tool which would tell them the depth of the water they were about to enter. Charts (nautical maps) were helpful, but in the 1800s there were still many areas of the River and Sound that had not been charted. Thus a device called a <u>lead line</u> was used to determine water depth. A lead line consists of a piece of lead (or any other heavy metal tubing) tied to a

length of rope marked at intervals of one fathom (one fathom equals six feet). When a captain is unsure of the water's depth he or she can order a crew member to drop the lead line off the bow. When the lead hits bottom, the line to which it is attached will become slack. Feeling that and noting the marks on the line the crew member can tell how much of the line has been let out, and therefore how deep the water is. This process is called taking a sounding.

We often take soundings when we are docking at a pier we've never used before. We also take soundings before setting out our nets. It's likely that you'll see us use the lead line during your trip.

We do have one advantage over the old sloops when it comes to navigation. All of the area *CLEARWATER* sails has now been charted. Thus it's easier for us to determine how deep the water is, where dangerous rocks or shoals might be, and where to find safe channels. On the next page is part of a chart covering New York Harbor. This copy does not show the colors that you would see on a real chart. It is also one of the most complicated charts we use. New York Harbor is a very complex and busy place.

Even so, it's not hard to learn to read charts like this one. Like all maps, a chart shows the relative locations of different features – The Hudson River and Governor's Island, for example. Also on the chart are landmarks useful in determining position – the Empire State Building, for example. Can you find other well-known landmarks like the Statue of Liberty? Other important aids for determining one's location are floating buoys. There are several different kinds, all kept in place by being tied to anchors on the bottom. These mark channels or obstructions in the River and Sound.

Boats like *CLEARWATER* must be concerned about the height of bridges above the water. We wouldn't want to snap off our 108 feet tall mast by hitting it against a

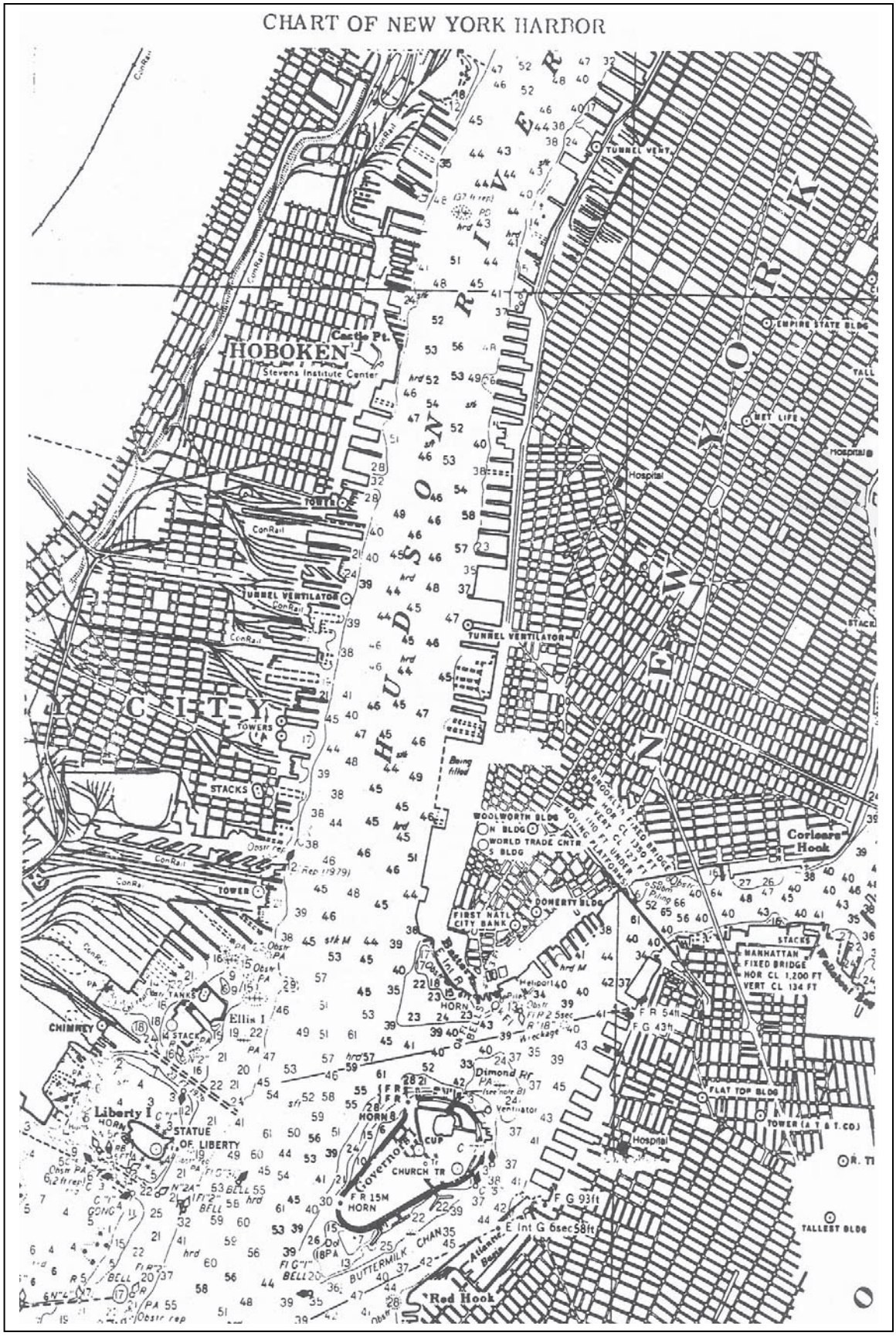


CHART OF NEW YORK HARBOR
HOBOKEN
Castle Pt.
Stevens Institute Center
HUDSON RIVER
NEW YORK
CITY
TUNNEL VENT.
EMPIRE STATE BLDG
MET LIFE
Hospital
TUNNEL VENTILATOR
ConRail
TOWER
STACKS
Boring filled
WOOLWORTH BLDG
WORLD TRADE CNTR
BROOKLYN FIXED BRIDGE
HOR CL 1350 FT
VERT CL 127 FT
MOVING PLATFORM
Corlears Hook
FIRST NATL CITY BANK
DOHERTY BLDG
MANHATTAN
FIXED BRIDGE
HOR CL 1,200 FT
VERT CL 134 FT
Ellis I
CHIMNEY
Liberty I
STATUE OF LIBERTY
Dimond Rf
FLAT TOP BLDG
TOWER (A T & T CO)
Governors I
CUP
CHURCH TR
F R 15M
HORN
F G 93ft
E Int G 6sec 58ft
BUTTERMILK CHAN
Atlantic Basin
Red Hook
TALLEST BLDG

bridge as we went under. The clearance between the water and any bridge is shown on these charts.

Scattered through the water area covered by the chart are measurements of water depth. For instance, you can see that the Hudson right off of Hoboken, NJ is about 46 feet deep. That's plenty of water to float the *CLEARWATER*. With our centerboard up we need only seven feet of water to float. Could the sloop sail all the way around Liberty Island?

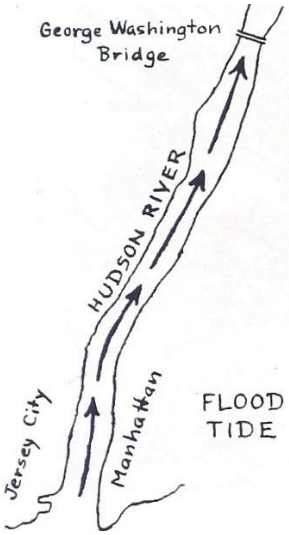
Shipwrecks, lighthouses, hidden rocks, and type of bottom (rocky, sandy, muddy, etc.) are among the many other items shown on these charts. Your teacher may be able to show you a chart of the area which you will sail during your *CLEARWATER* field trip. You will get a chance to study charts when you come aboard as well. More important, you'll be able to see in real life many of the things shown on the chart.

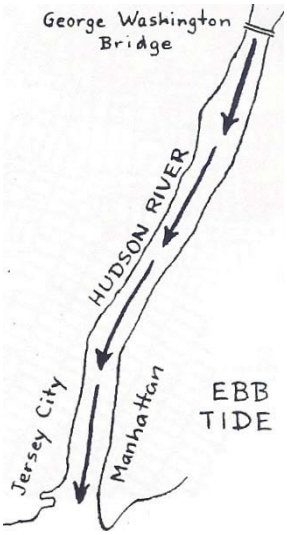
THE HUDSON RIVER AS AN ESTUARY

The part of the Hudson sailed by *CLEARWATER* is not an ordinary river. It is a special environment called an estuary. An estuary is a body of water, partly surrounded by land, where fresh and salt water mix together. In the Hudson, salt water from the Atlantic Ocean pushes up against fresh water running down from the mountains. The leading edge of this salt water, known as the salt front, can reach as far north as Poughkeepsie in years when there is little rain to supply fresh water to the River.

Estuaries are also influenced by tides, which are the regular ups and downs in water level along an ocean's shores. Tides are caused by gravity, the force which pulls on you from the center of the earth and keeps you stuck to the ground. However, they are not caused by earth's gravity. They result from the pull of the moon's gravity, and to a lesser extent, the sun's.

As the tide rises, the ocean's water level becomes higher than the level of water in the Hudson. The result is that ocean water starts to push up the River, creating a current flowing upstream – the <u>flood tide</u>. As the tide goes down, the ocean level goes below the level of water in the River, allowing water to flow out to sea on the <u>ebb tide</u>.





So odd as it may seem, the Hudson is a river that flows two ways! A log dropped into the River at Albany would take months to reach New York City. In some parts of the

Hudson, that log might float eight miles down-stream as the tide ebbed and then float back upriver seven and a half miles on the flood. The effects of tides reach all the way to Troy, 154 miles upriver from Manhattan. Even at that point far upriver, the current flows two ways and water level at high tide can be almost five feet above its level at low tide.

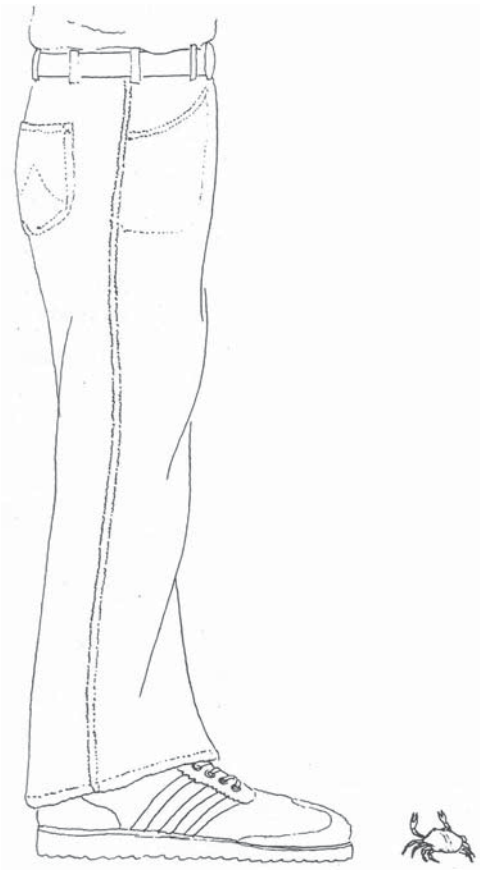
The mixing of fresh and salt water, along with the movement of tides, helps to make estuaries more productive of life than most other environments on earth. Even the richest farm fields or thickest forests do not produce such large amounts of plant and animal life as healthy estuaries do. The reason is that estuaries trap minerals and nutrients brought down river in fresh water. The upriver push of salt water keeps these materials from washing out into the ocean right away. The constant back and forth motion of the tides keeps them stirred up. If nutrients settled at the bottom of the River or sound, they wouldn't be used by plants because there's not enough light there. But with great supplies of nutrients stirred up in sunny surface waters, tiny plants grow there in great numbers. They provide food for small animals, which in turn supply food for larger animals through the food chain.

Because of the great production of tiny animals and plants, many fish come to estuaries to lay their eggs. When these eggs hatch the newborn fish will have an excellent food supply all around them. Thus estuaries are vital to the life cycles of many fish, including ones that people catch for food and fun.

On your *CLEARWATER* trip you will probably see some of this abundance of life. But in the excitement don't forget to notice the flow of the tide past the boat. It has a great deal to do with producing that.

LOOKNG FOR LIFE IN THE WATER: *CLEARWATER*'S COLLECTING EQUIPMENT

One of the best ways to teach people how productive estuaries really are is to show them the life that can be found there. On *CLEARWATER* we have a number of devices which help us to capture water life, keep it alive, and let people study it closely.



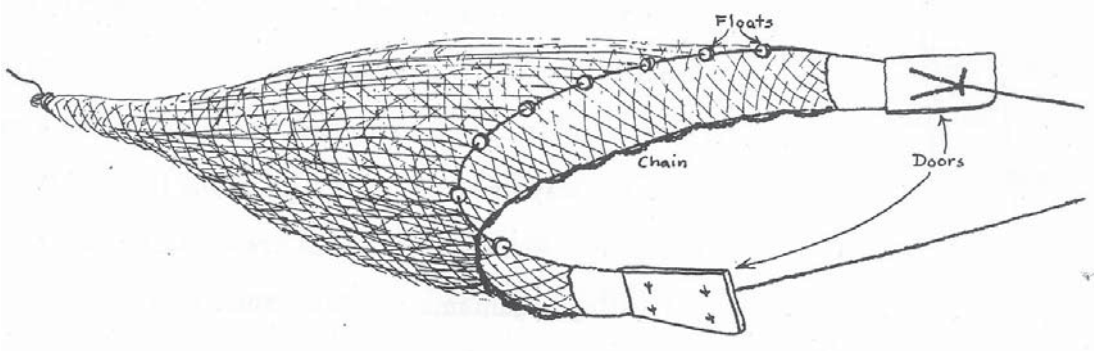
A Special Note About Respect

It is very important that the living organisms we collect are treated with respect. Remember that no matter how fierce or scary-looking a crab or fish might be, you are much bigger, stronger, and more capable of harming it than it is of harming you. Some animals do have special ways of protecting themselves. Blue crabs have strong claws; catfish have sharp spines in some of their fins. Yet they cannot take you out of your natural habitat and perhaps kill you. We certainly can do these things to them. These animals aren't out to "get you". In fact, it's really the other way around. Aren't we trying to catch them in our nets? Please listen to the crew's instructions about treating organisms carefully while studying them.

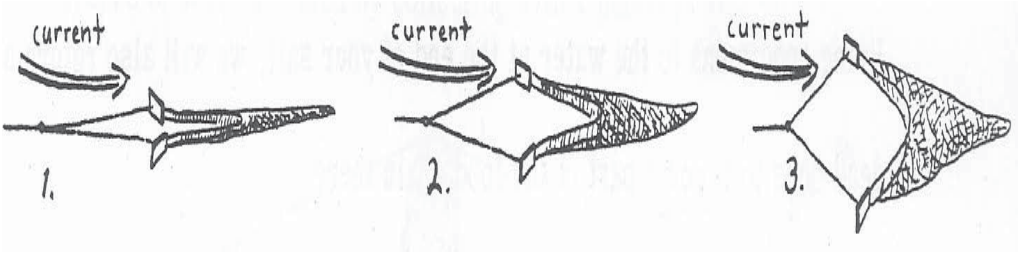
CLEARWATER tries only to borrow plants and animals from their habitats for short periods of time. Living things will be kept on board for study during your sail, but all will be released at the end of the trip. Our sails are not collecting trips for the purpose of providing pets or even classroom study animals. Students will not be allowed to take live organisms home. Teachers wishing to take specimens back to the classroom must make special arrangements with the on-board educator before the day of the sail.

THE OTTER TRAWL NET

The largest of *CLEARWATER*'S collecting devices is the otter trawl net. The moving boat pulls this net across the bottom of the River or Sound. If a fish, crab, or other animal living on the bottom doesn't dodge quickly enough, it is scooped up in the net. Because of the way we humans have treated our environment, we sometimes catch trash as well as animals. We've caught tires, soda cans, old shoes, and even a tricycle from the bottom of the Hudson. Please don't add any of your trash to the mess there!



Our otter trawl is a small version of nets used by fishing boats on the open ocean. It is 25 feet (7.6 meters) long, 25 feet wide, and 3 feet (0.9 meters) high. A row of floats along the top of a metal chain along the bottom keep the mouth of the net open vertically in the water. On each side of the net is a heavy board known as a door.



These are set in the River at an angle to the flow of water past the boat. The water's

pressure then forces the doors to spread apart, opening the mouth of the net from side to side.

The process of using this net is called “setting” the trawl. Setting the trawl must be done precisely so that the net opens properly and is not tangled in *CLEARWATER*’S propeller. Close cooperation between the crew and captain is required. It is important that you stand clear of the crew and net while this is happening. Once the net is down on the bottom we fish for ten to fifteen minutes. The crew must pay careful attention during this time because the trawl sometimes catches- “hangs down”- on rocks, sunken logs, or shipwrecks. When a hang-down occurs, the towing line and net will be under great strain. The net could be badly torn or even lost if the rope breaks; thus the crew must be ready to act quickly to relieve the strain.

When the time comes, some of you will be chosen to help haul in the net. This can be one of the most exciting parts of the day. We’re never sure of what we’ll catch. Sometimes the net comes up empty. Often there are only a few creatures- flounder, blue crabs, or perhaps a sturgeon. Once in a while there will be such a great amount of life in the net that we can scarcely haul it aboard. In that case we will keep only a few specimens, putting the rest back in the water.

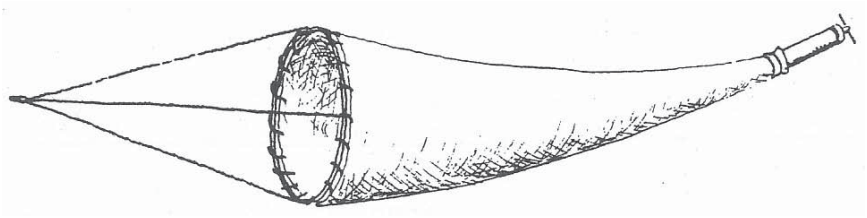
No matter how careful we are, some organisms will not live after being caught in the trawl. While it’s important to be able to collect the creatures for study, we must also remember that collecting can have this bad effect on the Hudson River or Long Island Sound environment. In addition to returning all living specimens to the water at the end of your sail, we will also return any dead ones to become part of the food chain there.

THE PLANKTON NET

Plankton are animals and plants, mostly of very small size, that cannot swim well and instead drift in the water, moved by tides, currents, and waves. They are very important organisms because they are at the beginning of food chains in the Hudson

River and Long Island Sound. We will give you a chance to study plankton by collecting with a plankton net.

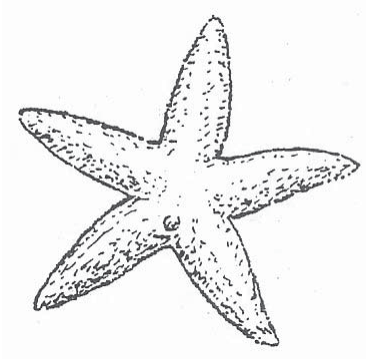
Our plankton net is about 7 feet (2.1 meters) long with a circular opening about 21 inches (53 centimeters) across. As you might guess, the mesh of this net has much smaller holes than the mesh in our trawl or dredge. Organisms so tiny that they are barely visible to the naked eye are caught by this mesh. A metal hoop forms the opening of this net. From the opening the net narrows in diameter until it reaches a plastic cylinder at the other end. This cylinder holds the plankton that are swept into the net. When the net is brought back on board we open up this cylinder and empty its contents into a bucket. You will use magnifying lenses and simple microscopes to study these organisms more closely.



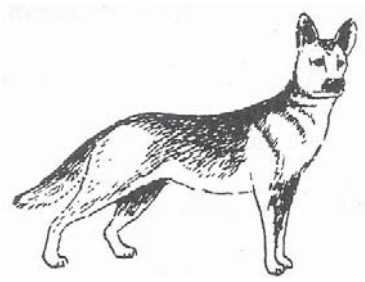
The plankton net is towed off *CLEARWATER*'S stern, usually while the boat is moving very slowly. The period of time for which the net is set out varies depending on where we are and what season it is.

LIFE UNDER A HUDSON RIVER SLOOP

Describing all the life found in the Hudson River and Long Island Sound would take several lifetimes and many, many books. In spite of pollution and other problems, there is an astounding variety of life in these waters. Scientists can list two hundred different kinds of fish and two hundred kinds of algae found in the Hudson and New York Harbor. Part of the excitement of collecting samples on *CLEARWATER* is the mystery of never knowing what you'll bring up from that great variety. But you can be sure of one thing: during your sail we'll catch organisms that we won't be able to name exactly.

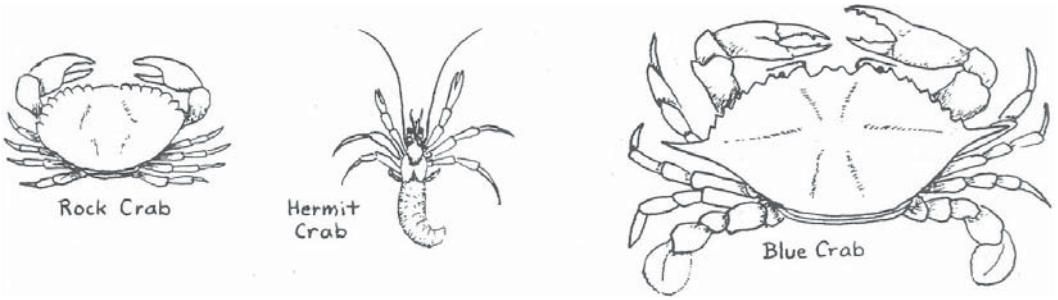


Sometimes the organism is a real mystery; we have no idea what it is and only a well-trained specialist could tell us. At other times it might be something like this animal on the left. Most of you could probably give this creature a name. It's a starfish, right? Fine. But calling it a starfish is only as exact as calling the animal to the right a mammal. You can, of course, give it a much more precise name: German shepherd dog. But it's hard to do that with the starfish, or many other organisms that we catch.



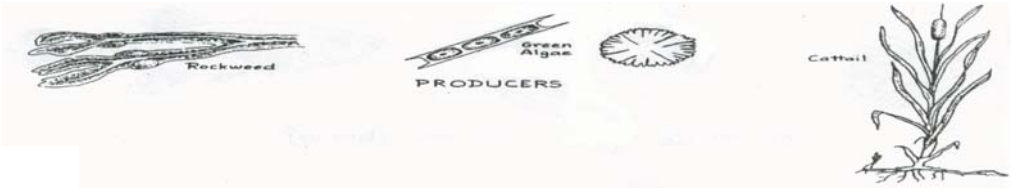
It's helpful but not always necessary to name things precisely. We can find out a great deal about a starfish without knowing exactly what kind it is. More important than finding out the exact name of an animal or plant is discovering its relationship to other organisms and habitats, along with its adaptations for survival. We might catch a mummichog, for example. That's a pretty exact name that probably means nothing to most of you. But if during your trip you see this creature and study it carefully, you will probably be able to figure out how it moves and breathes, where it lives, what it might eat, and what eats it. You won't need to know it is called a mummichog to learn these things.

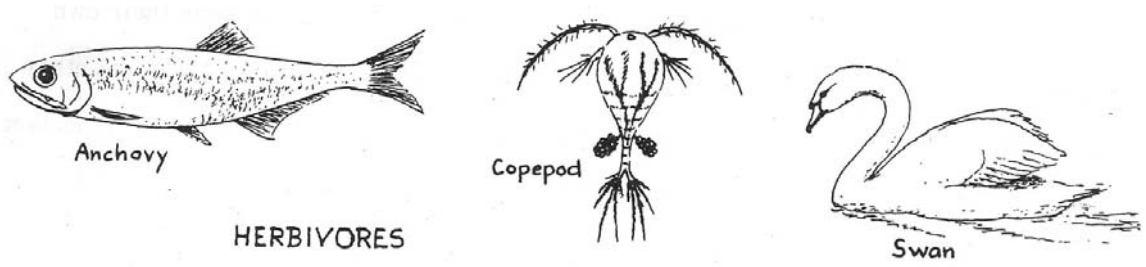
During your sail we will try to sort out the living things we catch using three different systems of classification. The first is classifying animals and plants by the way each is put together- its body structure. This is the way in which science officially classifies and gives names to organisms. For example, how do you tell if a certain creepy-crawly animal is a spider or an insect? As many of you know, you could look to see how many legs it has. Spiders should have eight legs, insects only six. This method of classification often leads to close study of an organism's structural adaptations for survival. Looking at the body structure of these crabs, for example, might tell you a lot about differences in the way each lives.



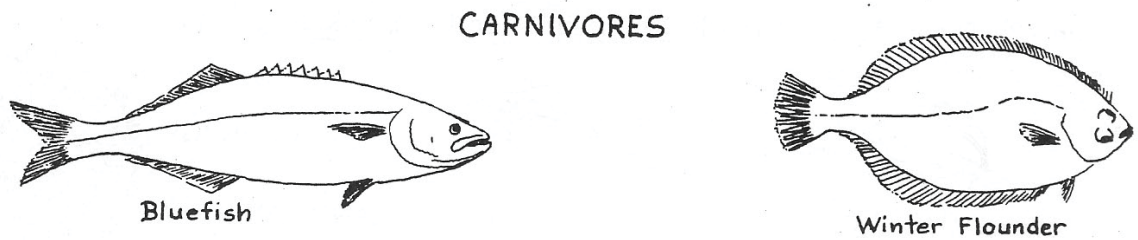
Our two other sorting methods are based on the ecology of each organism- the way it relates to its habitat and other living things around it. One of these classification systems is based on each organism's place in food chains. The starting links in virtually all food chains are green plants. Ecologists- scientists who study ecology- call green plants <u>producers</u>. That's because these plants use the energy of sunlight and some simple chemicals to produce food energy that they and all other organisms need to survive. Here are some examples of producers we might see.

Perhaps we will catch copepods. Copepods are tiny animals that eat even tinier plants. They and other animals which eat only plants belong to the vegetarian group, which scientists call <u>herbivores</u>. Below are a few herbivores we might see.

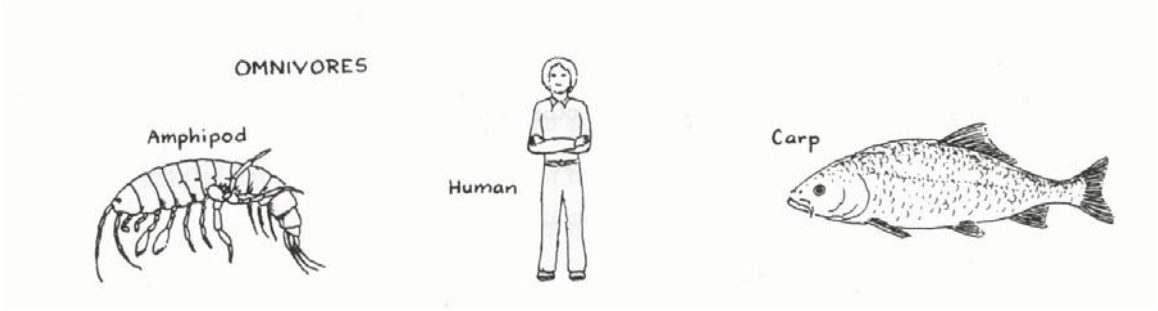




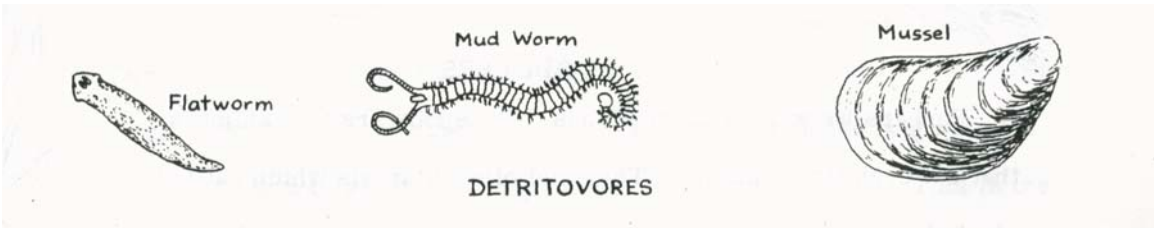
Many of you are familiar with animals that eat other animals. The meat eaters are known as <u>carnivores</u>. Most fish we catch are in this category.



Some animals, including humans, eat both animals and plants. They are classified as <u>omnivores</u>. Several are pictured below.

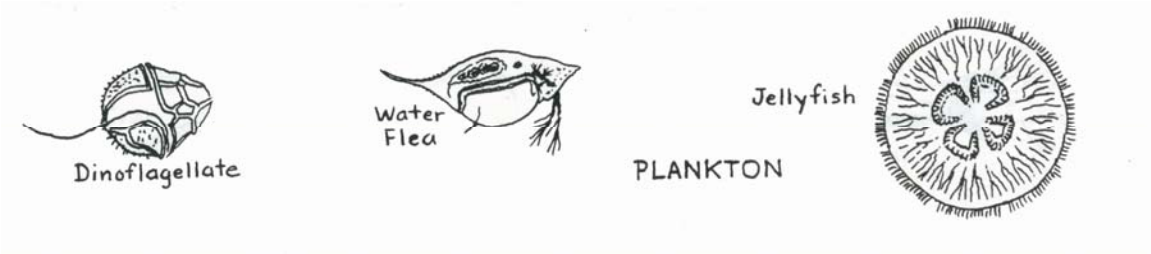


And finally, we may collect animals that eat the remains of dead animals and plants. These are called scavengers. The ecologists' name for them is <u>detritovores</u>.

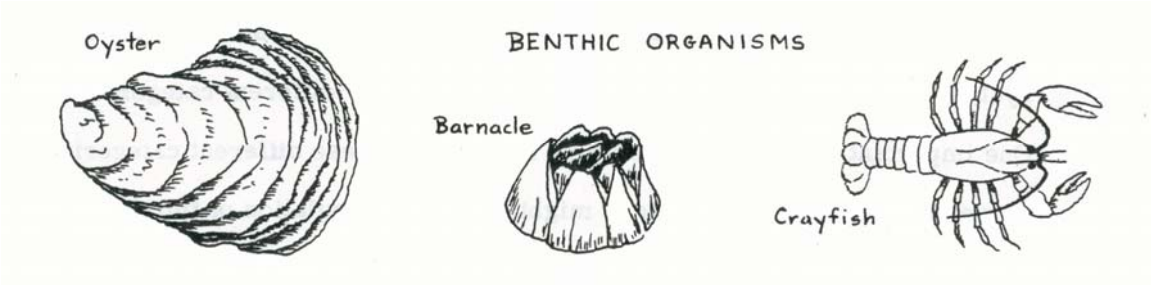


Herbivores, carnivores, ommnivores, and detritovores are all grouped together and called consumers by scientists. The can't produce their own food energy as green plants do. Instead, they must get it by consuming other organisms. Classification by position in food chains gives us a very important understanding of each organism's role in the environment of the Hudson River or Long Island Sound.

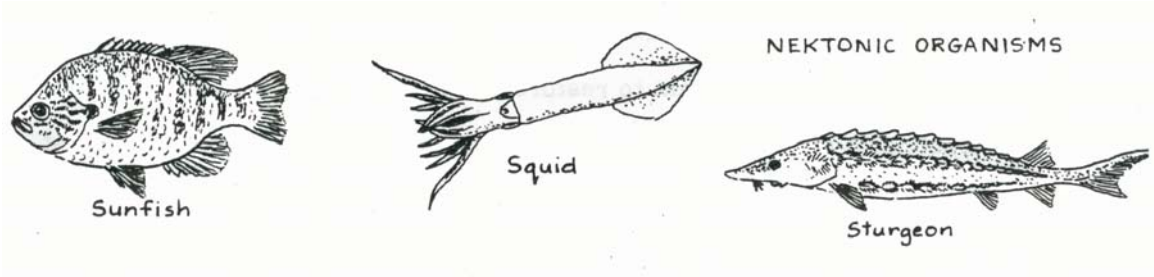
Our last system of classification, also based ecology, is to group living things by where they live. Do they drift freely in the water, unable to swim well? These drifters would be included in the plankton group.



Do they live on the bottom? These are called benthic organisms. Some are shown here.

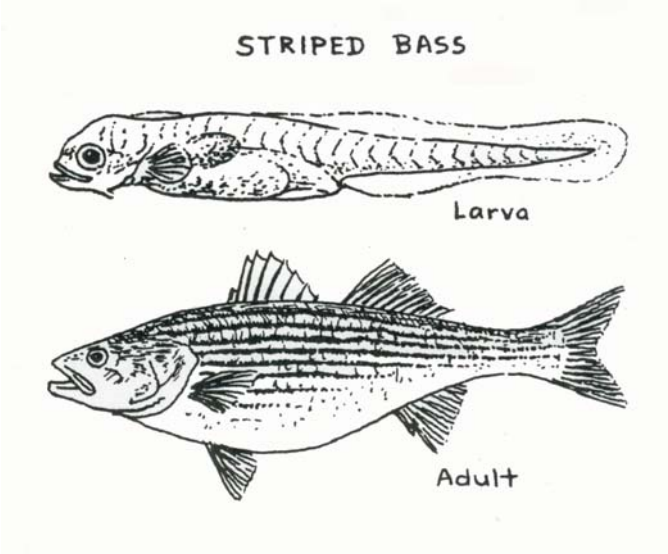


Which organisms swim freely and strongly? Fish and squid are among the members of this group, which ecologists call nektonic organisms.



It is also important to note whether organisms live in fresh water, salt water, or brackish water (a mixture of salt and fresh). Some spend different parts of their lives in all of these places.

This may seem quite confusing. To make it even more so, consider the striped bass. This fish begins life in freshwater as an egg, which hatches into a larva. At these stages in its life the bass drifts with the currents as a planktonic organism. As it grows in size it becomes a nektonic animal and moves into brackish water. After its second year of life it usually swims out into the ocean, becoming a salt-water fish.



"Now wait a minute," you may say. "What good is this classification system if a striped bass can be sorted into all these different categories?" One important answer is that only by knowing all these different categories do we know how different factors might affect the population of this fish. People value striped bass very highly. On the east coast of the United States the sport and food fishery for striped bass have a combined value of millions of dollars per year. Say that fisherman on Long Island Sound notice that there are less bass than there were a few years before. This fish being important to them, they want to restore its numbers. If they knew the striped bass only as a nektonic, salt-water fish, they might not be able to figure out what is reducing the population. The problem could be far away from Long Island Sound. Perhaps the planktonic eggs and larva, being unable to swim, are getting sucked into power plant cooling systems along fresh-water rivers. This might destroy many of the eggs and young fish that would have been found later as adults near Long Island.

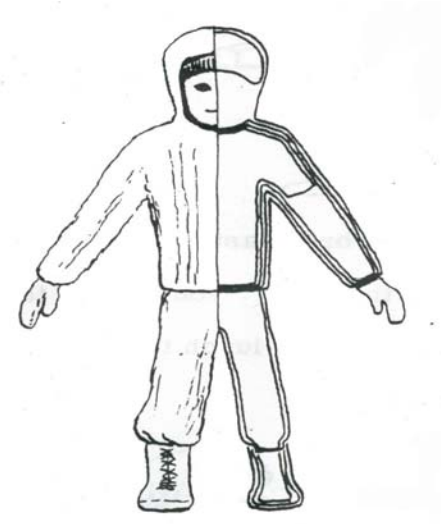
Thus on *CLEARWATER* we want to make people aware of the ecological groupings into which living things fit. In this way we can help them to understand the many ways in which human actors can affect life on the Hudson and Long Island Sound.

ITEMS TO BRING ON YOUR CLEARWATER FIELD TRIP

CLEARWATER'S ancestors were work boats. They were built to carry cargo, and crewed by sailors used to sun, wind, rain, and hard work. On our replica you won't find a heated, spacious classroom to keep you warm and dry, or power machinery to make work easier. You will be exposed to the elements and will need lots of energy to help hoist the sails and haul in the nets. Yet even though *CLEARWATER* is modeled after work boats, it's fun to sail on our huge sloop. Remembering the following items will help you enjoy the work and have more fun.

Clothing and footgear

Wear old work clothes. You'll be hauling on lines, sitting on the deck, digging in mud, and getting at least your hands wet. The last thing you want to worry about is keeping your clothes clean. On the morning of your sail take a good look at the weather. Listen to a forecast. Whatever the weather, you will be out in it. *CLEARWATER* seldom cancels its sails due to weather. If there's even a small chance of rain, bring rain gear. If it's cold, dress as if this were a ski trip. Wear clothing in layers, with a warm coat, sweater, long underwear (or two pairs of pants), scarf, hat, and mittens. If the day is warm, bring a light jacket or windbreaker anyway; its often colder over water than on land. Wear soft-soled shoes. Sneakers are great. If its cold, rubber boots with two pairs of socks underneath are good. Don't wear clogs or high-heeled shoes.



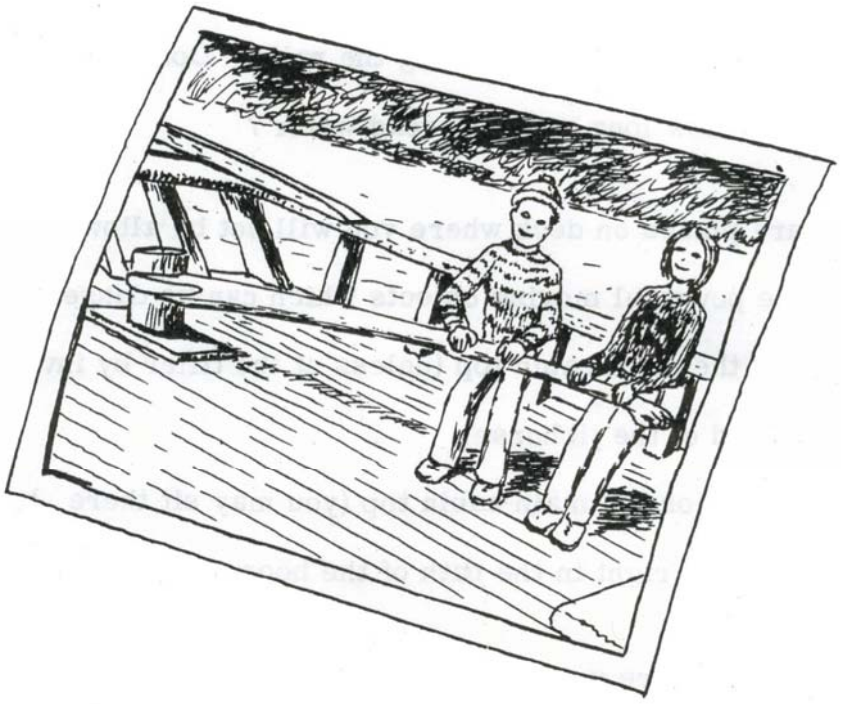
For chills and ills

On hot sunny days, sunscreen lotion can be useful in preventing sunburn. Chapstick can be helpful in both cold and hot weather. Very few passengers get seasick on *CLEARWATER*. The sloop is large and there usually aren't big waves on the Hudson and Long Island Sound. If you are worried about this, take anti-seasickness medicine at least thirty minutes before coming aboard the sloop.

Other equipment

If you have a camera, you may bring it. But always be aware of what's going on around you. There are times it's okay to take pictures and times it's better to take advantage of what's going on. Tape recorders can be used to record various sounds on

CLEARWATER. However, NO PORTABLE RADIOS OR CD PLAYERS ARE ALLOWED ON BOARD!



SAFETY ON *CLEARWATER*

Sailing on *CLEARWATER* is fun. It's wise, however, not to get so carried away that you forget these basic safety rules:

1. The captain's orders tell crew and passengers what needs to be done while sailing the sloop. Commands must be heard clearly and carried out quickly. Please don't shout or make so much noise that the crew can't hear these orders. Listen closely to the captain, crew, and teachers.

2. Don't run on the deck. It has many obstructions and can get very slippery when wet.

3. Stay within safety lines along the rails. Don't hang out over the side of the sloop.

4. There are places on the deck where you will not be allowed to go. In these areas are powerful moving objects which can be dangerous. The places are:

-aft of the main cabin top (unless at the tiller by invitation of the crew);

-forward of the jibhorse;

-standing on the main cabin top (you may sit there, but standing puts your head right in the path of the boom as it swings across the deck).

5. Be aware of where you are and what you are doing at all times. Sailing in a strong breeze requires quick reactions.

6. Respect the animals brought up in our nets. Handle them gently and be careful of those with sharp teeth, spines, and claws.

THE SCHEDULE FOR YOUR DAY ON BOARD *CLEARWATER*

You've read about *CLEARWATER* and the equipment on our boat. You've checked off all the necessities you should bring. Now you're probably wondering what's actually going to happen when you get to *CLEARWATER*'S dock.

Before boarding the sloop we may carry out some activities on the dock or shore. The class will be divided into small groups, usually with six to eight students in each. It's important that you stay in your particular group; otherwise you might miss one of the learning activities on the boat. Members of the group will board the sloop together to be greeted by a crew person who will be your leader for the day. He or she will learn your names, answer your questions, and guide you through the sailing program.

Then we board *CLEARWATER*. The captain will then talk briefly about safety. Listen carefully. A big boat like *CLEARWATER* is not a toy and can be dangerous if you don't pay attention to what is happening around you.

CLEARWATER'S engine helps us as we leave the dock and collect samples with our nets. You may be asked to help haul in the nets. Our catch will be kept alive in large bins and aquariums on deck. You will get a chance to look closely at these creatures later during the trip.

But first we must raise our sails. After our collecting is finished your class will line up along the halyards to haul the mainsail up. The jib is next, followed by the topsail if winds are light. As the sails catch the breeze we shut the motor off. *CLEARWATER* will cut through the waves powered only by the wind and tide.

During your sail your group will visit a number of learning stations on deck. Now is your chance to take a close look at fish, crabs, clams, and all the other creatures and plants brought up in our nets. You'll also have a turn at the tiller, a chance to try some simple chemical testing of water samples, and a look through the boat's main cabin. There'll be time for listening to the sounds of *CLEARWATER* under sail and a time for singing. You will meet the crew and see what it's like to live on this sloop. And hopefully you'll begin to understand the rich environment of the Hudson River and Long Island Sound, and why it's important that we work hard to clean up these estuaries. In the end, the Sound and Hudson belong not only to the fish, crabs, and plankton, but also to us. They are an important part of <u>our</u> environment.