Name_____

ESTUARY ESSENTIALS

While the Hudson looks like and is called a river, it is more than that. If you were to taste Hudson River water near West Point at the end of the summer, it would probably taste a little bit salty. A body of water in which fresh water from a river meets salt water from the ocean is called an estuary. The Hudson River is a good example of an estuary.

In the activity described here, you will look at what happens when salt and fresh water meet. Your teacher has made up a colored salt water solution which you will put into clear fresh water.

Do you think that the fresh and salt water will mix, forming a solution lighter in color than the salt water alone, or might they stay separate, forming layers in the container? Write a description or draw a picture of what you predict will happen.

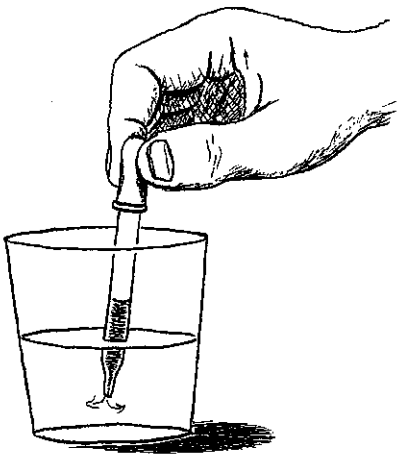
Materials

- 2 small wide-mouthed jars or clear plastic cups
- 1 medicine dropper

Your teacher will fill one jar about one-third full of colored salt water, the other one-third full of clear fresh water.

Creating an Estuary

Use the medicine dropper to gently add colored salt water to the clear fresh water. When doing this, place the point of the dropper under the surface of the fresh water, and squeeze the salt water out slowly. Add all the salt water to the fresh. Do not stir or swirl the water while you do this.



What happens? (It might be easier to see if you place a piece of white paper behind the container.) Write a description or draw a picture of what you see in the container.

Is this what you predicted would occur?

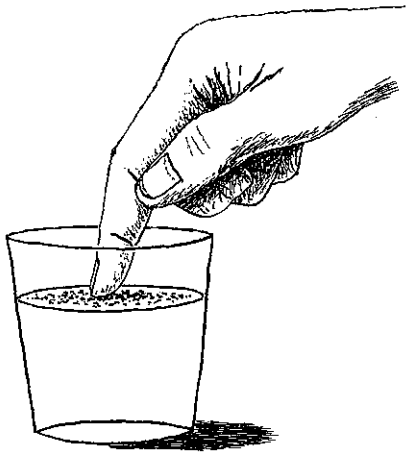
Why did it turn out this way?

Action Along the Salt Front

The place where salt and fresh water meet in an estuary is called the **salt front.** Because of currents in the Hudson River, the salt front isn't as distinct there as it is in your container.

The presence of the salt front is partly responsible for the great production of living things in estuaries. You probably know that all living things ultimately depend on plants for the food energy they need. This is true in estuaries as much as in lakes or forests. Plants have their needs, too. They depend on a good supply of sunlight and of **nutrients** — chemical substances which aid their growth much like vitamins aid ours.

The next activity should show how the salt front makes it possible for an estuary to produce huge numbers of tiny, floating plants and the many animals that depend on them.



If you successfully created a salt front in your container, your teacher will now sprinkle a bit of pepper into it. The pepper represents plant nutrients entering the estuary. Gently tap the sides of the container or lightly push the pepper underneath the surface to help it to sink. Watch what happens as it drifts down through the water. Wait for several minutes before drawing conclusions; pieces of pepper come in different sizes, and they will behave in different ways as they sink.

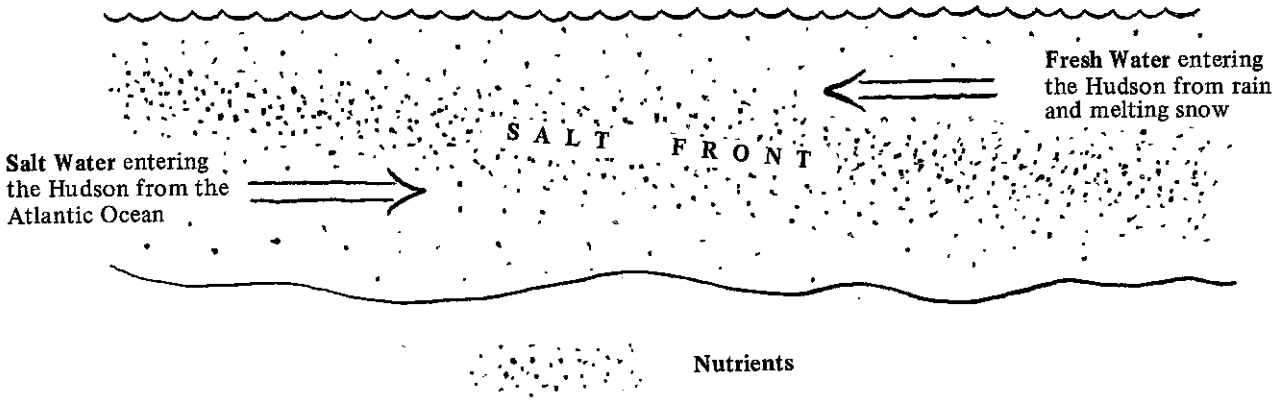
Do any particles sink at a slower or faster rate when they enter the salt water? Do any sink only part way? If they only sink part way, where do they stop?
Draw or write a description of what you observe.

Discussion

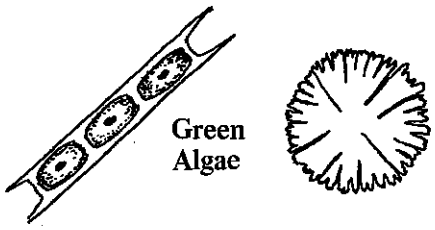
The results of these demonstrations show the different **densities** of fresh and salt water. Salt water is denser than fresh water; a given volume of salt water will be heavier than the same volume of fresh water.

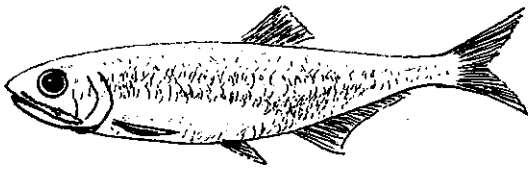
If you were patient in observing the pepper sinking through the fresh and salt water layers, you probably noticed that a few pieces of pepper moved more slowly through the salt water than through the fresh. You should also have seen some bits of pepper stop at the top of the salt water layer, floating on it as though they were floating on the surface.

In an estuary there is a change in water density at the salt front. Nutrients entering the salt layer move more slowly through the dense salt water. They are concentrated at the salt front instead of being washed out into the ocean. The higher density of the salt water also prevents the nutrients from quickly sinking to the river bottom. Scientists often say that the salt front in estuaries "traps" nutrients.



If the nutrients were to sink to the bottom, there wouldn't be enough light for plants to grow there and take advantage of their presence. But the trapping effect of the salt front keeps these nutrients in the estuary and at shallower depths where there is plenty of light.

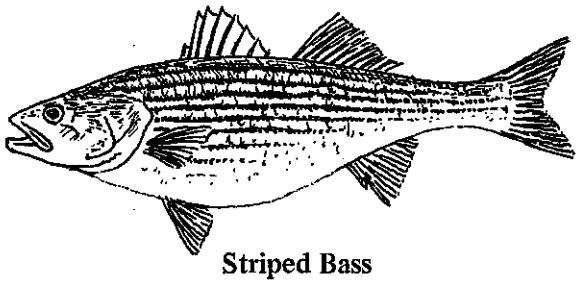




Anchovy

Tiny, drifting plants such as algae are able to grow in great numbers, providing food for tiny animals which in turn become food for larger creatures such as small fish.

With lots of plants available, estuaries can produce rich harvests of creatures higher up in the food chain — the crabs, shrimp, oysters, clams, and finfish that we humans find valuable for food and fun.



Striped Bass

Name _____

PLACE NAMES IN THE HUDSON VALLEY

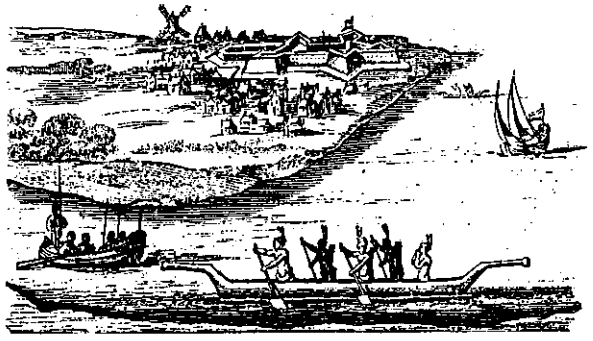
Have you ever wondered how the town you live in got its name? Words and names have histories, just like nations. The study of the history of names is called **etymology**. When we study the etymology of place names, it is called **toponymy**. This study is interesting in itself, but it can also tell us about the history of an area. The naming of places is influenced by many things. Place names might be descriptive, might recall someone who lived there, or might honor a ruler or famous person.

Often an area is renamed when it changes hands. America, especially along the East Coast, is an excellent place to see this. As you may know, three major groups occupied this area: Native Americans or Indians, the Dutch, and the English. Place names given by all three groups have survived to the present day. *New York City* is a good example of a place which changed its name as it changed its government. The Indians called it *Manhattan*, the Dutch called it *New Amsterdam*, and the English renamed it *New York*. New rulers often changed the names of major towns but left smaller settlements' names intact. There are many towns in the Hudson Valley which have names of Dutch or Indian origin.

Indian Names

Indian names tended to be descriptive, so that hunters and warriors could find their way around an unfamiliar territory. Here are some local Indian place names and their meanings:

Esopus - river
Shawangunk - southern rocks
Nyack - point
Tappan - cold spring
Ossining - stone upon stone
Minnewaska - frozen water



If you look at the charts, you might be able to recognize other Indian names by their sound and spelling. This method doesn't always work, though. *Mohonk*, which some would think is an Indian word, was actually made up by white men who wanted an Indian sounding name.

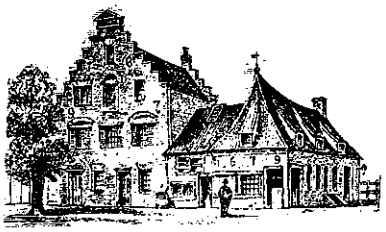
What lake on the Kingston chart has a name of Indian origin?

Dutch Names

The Dutch settled along the Hudson and Long Island Sound in the 1600s. They kept some Indian names but added many of their own. Like Indian names, those the Dutch gave were often descriptive. Here are some examples of Dutch words which can be found as part of many place names:

kill - creek
hook - point
bush - forest
zee - sea
berg - mountain

dorp - town
kinder - children
wyck or *wich* - district
beck - cliffs
rack - reach



A good example of a Dutch place name is *Catskill* (or *Kaatskill*, as the Dutch spelled it). *Kaat* refers to the wildcats in the mountains, while *kill* means creek or stream.

The Dutch also named places after people. *Peekskill* was named after a resident miller, Jan Peek. The *Bronx* was named after Jonas Bronk, while *Yonkers* comes from *Yonkeer*, meaning young master.

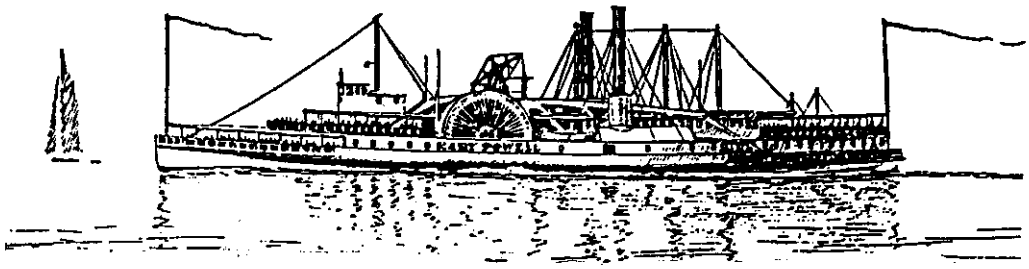
Some place names have a colorful history. *Danskammer Point* means *Devils' dance hall.* It received that name because Dutch sailors saw Indians dancing around a fire there and thought it looked like a vision of Hell. If you look at a chart of the Mid-Hudson area, you will see an area between Danskammer Point and Crum Elbow called *Lange Rack.* This is the Dutch name for the Long Reach of the River; it is so straight that with proper winds sailors would not need to change tacks (the position of their sails) for many miles.

Dutch names can be recognized by their spellings; any words with two "a"s together or "van" or "ver" in them are probably Dutch. You can think of Dutch names as a code; once you know the meanings of the roots of their words, you can decode many of their place names.

Look at the Castleton chart and list all creeks with Dutch sounding names. (Remember the word meaning creek in Dutch.)

Looking now at the Peekskill chart, can you find a point of land with a Dutch name?

Detail drawing from 1656 map of New Amsterdam.



English Names

When the English took control from the Dutch in the late 1600's, they changed the names of the larger towns but left the names of smaller settlements unchanged. The English wisely allowed the Dutch to keep their language and customs, while making sure the seats of government were in English hands.

The English often named places in the New World after royalty. *York, Ulster, Suffolk, Albany, Richmond,* and *Orange* were all royal names. They also named towns in America after places back in England. *Malden, Ludlow, Milton* and *Chelsea* are all towns in Britain.

The word "town" was often shortened to "ton," as it was in *Castleton-on-Hudson.* The English also named places after people or animals — as in *Bear Mountain* — or as descriptions of the place, like *Cedar Hill.* The English place names are pretty easy for us to recognize because, for most of us, English is our native language.

Can you find at least five English place names on the Kingston chart?

On the Peekskill chart, find three English place names which were probably named after people.

German Names

Of course this region was settled by immigrants of many other nationalities, and some of them left place names. *New Hamburg, New Paltz,* and *Rhinebeck* are all German names. (The Rhine is a river in Germany.) *Burgh* or *burg* means town in German. A look at a map will show many towns with German names.

Combination Names

Sometimes place names can be a combination of different languages. For instance, *Van Wies Point* (Castleton chart) is both Dutch and English.

From what two sets of inhabitants did the following names come? Decode the meaning of each name.

Tappan Zee

Esopus Meadows

Landsman Kill

Try Your Hand at Toponymy

Using the information above, see if you can figure out the meanings of these *imaginary* names. They might be Indian, Dutch, English and/or German in origin.

Tappanwyck

Kingsburgh

Esopushook

Kinderkill

Shawangunkzee

Beckburg

Make up your own names to describe these places, using the Indian, Dutch, English, and/or German words given above.

The town by the sea

A point of land near high cliffs

A river through the mountains

A town near a forest

Color Code Your Charts

You will need four different colored markers or pencils and all the charts you have been using. Decide which color will represent each nationality. For example:

Yellow - English
Blue - Dutch
Green - Indian
Red - German

Go through all the charts, searching for English place names. When you find one, circle it or color over it lightly with the yellow marker. Do the same with Dutch, Indian, and German names, using a different color for each. Some place names will be hard to identify, but you should be able to determine the origins of most. Remember: toponymy is not an exact science — toponymists rely on clues and on their instincts.

Once you have finished, you should have a fair picture of the areas different immigrant groups settled.

Which chart has the most Dutch names?

Did different groups of settlers distribute themselves pretty evenly along the Hudson?

WATER POLLUTION CLEANUP

While the Hudson River has become cleaner in the past decade or so, it remains a polluted river. Many cities, factories, and other institutions still dump wastes into the Hudson. Laws against pollution do exist but there are polluters who violate these rules and get away with it, since the laws are not well-enforced. And sometimes polluters who try to clean up find that it's not easy to do.

Today you get your chance to clean up pollution. Your teacher has prepared "polluted" water samples and collected a variety of equipment which might help you to clean up its sample. You will work with a small group of other students to try to accomplish this task.

Before You Start

Before attempting any cleanup, your group should take five minutes to plan a course of action. Select one person in your group to be a recorder. He or she is to write down your group's cleanup plan. If you find that more steps are necessary once you get into the cleanup, this person should write them down too.

You will have **twenty minutes** to get the pollution out of your group's sample. **Please keep the following rules in mind:**

1. All pouring should be done over the wash basin to avoid messy accidents.
2. The only clean water available is the half-full jar included with your cleanup equipment. You cannot use clean water from a faucet or other source. Think hard about how this limited amount of clean water should be used.
3. Waste removed from the sample should be collected in the appropriate container.
4. At the end of the activity, each group should have at least one half bottle full of "cleaned" sample to compare with the results obtained by other groups.

A final piece of advice: **don't hurry.** Take the time to think about each step, about the nature of the pollutant you're trying to remove, and about the tools available.

The Cleanup Record

Record each step of your group's cleanup attempt in the spaces below. Tell what pollutant(s) this step was supposed to remove, and whether it did or not.

Step number	Technique used	What pollutant is to be removed?	Was this pollutant successfully removed?

If more steps are necessary, write them down on the back of this sheet.

When the cleanup is finished or time is up, list the pollutants below in order of how hard they were to clean up — easiest first, hardest last.

Easiest

Hardest

Name _____

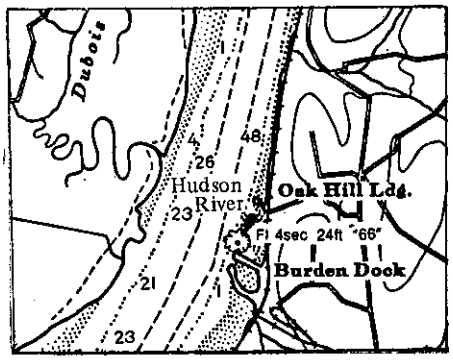
READING NAUTICAL CHARTS

Introduction

Nautical charts are maps designed so that mariners can plan a course and locate their position on the water. Like all maps, they have a scale, an indication of direction (called a compass rose) and a key or legend to symbols used. While charts do have information about the land, their chief concern is the water: its hazards, shoreline and depth.

When reading charts, keep in mind that they are practical tools designed to give sailors accurate information. To safely navigate a boat you need to understand what every symbol on the chart represents, relating the symbol to an object's actual appearance. While looking at charts can be fascinating on its own, the real test comes when you are out on the water using the chart for the purpose it was designed.

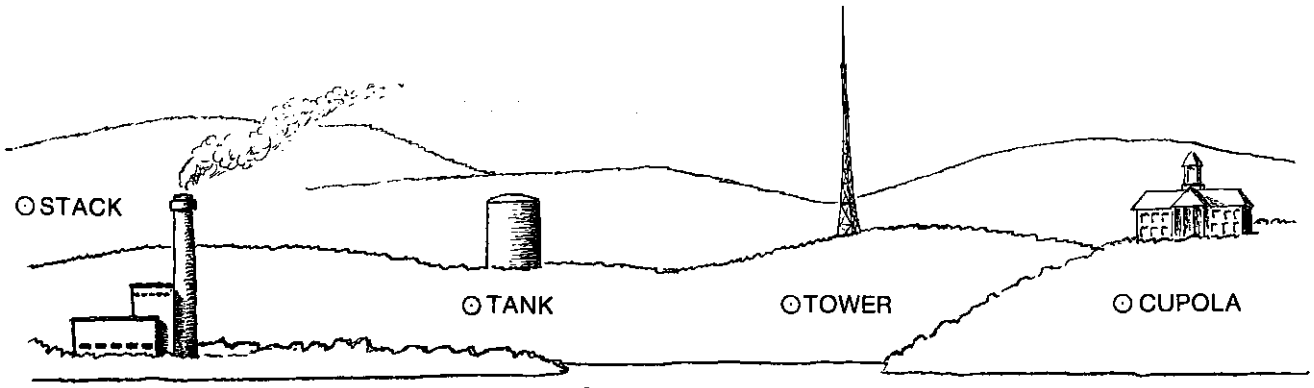
The Shoreline



If you are planning to sail on the Hudson, the first feature to notice is the line separating the land from the water. Because the River is tidal, the shoreline changes with the ebb and flood of the tide. The line on the chart represents the shoreline at average high tide. The river bottom exposed as the tide goes out is shown as a series of tiny dots set close together.

An important function of charts is to help you locate your position relative to fixed points on land and water. One way in which they do this is to pinpoint landmarks visible from the water. Look at the Kingston chart. Along the shore you will see many marks like this ⊙ with words like BELL TOWER or SPIRE written next to them. These landmarks stand out among other features on shore and sailors can use them to find their position.

How many landmarks can you find on the Kingston chart?



Depth & Bottom Type

When looking at a chart, people quickly notice the numbers scattered all over the area representing water. These numbers indicate the water's depth calculated in feet. As you know, the Hudson is tidal, so its depth is constantly changing.
Look at the Peekskill chart.

How deep is the deepest part of the River on this chart?

How deep is the shallowest part?

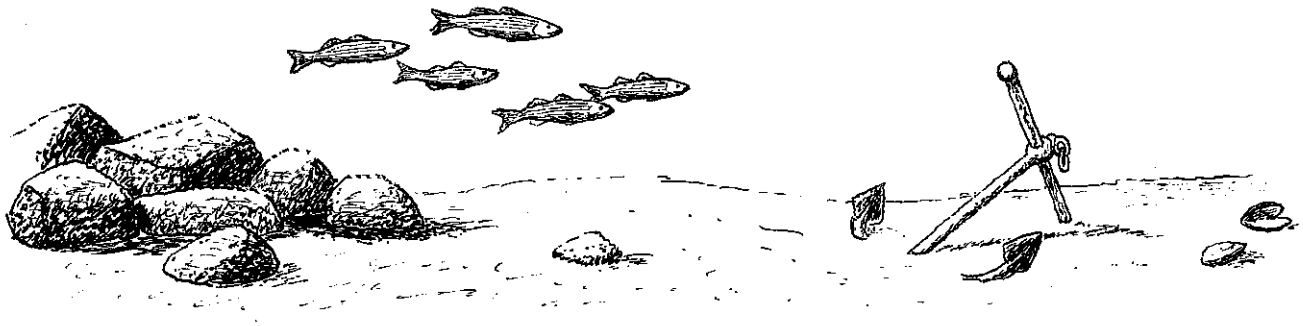
Do you think the numbers on the chart refer to the depth at low tide or high tide?
(Remember: charts will tell you the most useful information for sailors to know.)

As you can see, the Hudson is quite deep in many places. If it weren't, huge ships and barges couldn't use the River.

Charts also tell you what the bottom is like. This can be important information when anchoring or fishing. You will find abbreviations like: *hrd* for hard, *sft* for soft, *stk* for sticky and so on.

What is the bottom like near Jones Point on the Peekskill chart?

What do you think *rky* **stands for?**



Hazards

Perhaps the most important job charts do is to warn mariners of potential dangers. Obstructions are usually marked by buoys, unless they are near shore.

In some places one finds dangerous rocks which are covered and uncovered by the tide. These rocks appear as marks like this: ***. One must pay attention to these marks because the rocks may be submerged and invisible at high tide.

Can you find any submerged rocks on the Kingston chart?

Sunken wrecks are shown by this symbol: . There are a number of these in the Hudson River; while a few are the remains of old sloops or steamboats, most are abandoned barges. If a wreck is still visible, it is shown like this: .

How many sunken and visible wrecks can you find on the Kingston chart?

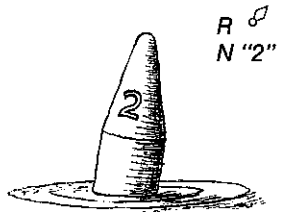
Aids to Navigation

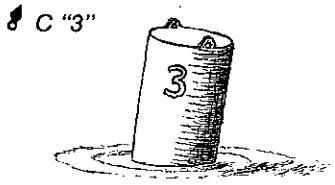
The old sloop captains had to know the River very well to avoid accidents, especially while sailing at night or in the fog. Nowadays the Coast Guard makes it much easier for the navigator by setting up a series of markers which tell where it's safe to go. On the charts these markers are identified by these symbols: ◇ .

The shape of the symbol and the writing next to it tell the navigator what to look for on the water. Interpreting the symbols on a chart is like reading a code. Once you know what the shapes and letters stand for, you can plot a safe course and keep track of your position on the water.

Buoys

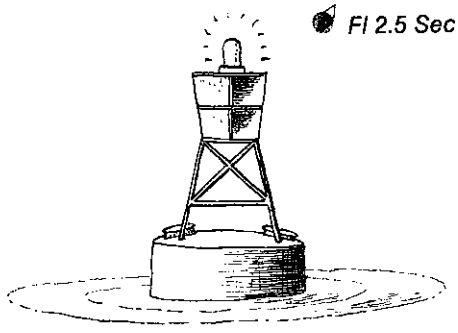
Any marker represented by a diamond is a floating **buoy**, attached to the bottom with a chain. The *N* in the code for this buoy means that it is a **nun**, which is shaped like a cone. Nuns are always red (notice the *R* in the code) and always even numbered. The number in quotes — *"2"* — shows us what is written on the buoy.



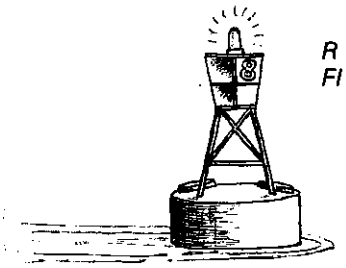


This buoy is called a **can** because it looks like one. Cans are always odd numbered and painted green. American cans were painted black until recently, when the Coast Guard started changing them to green — the international color for cans. A few cans along the Hudson may still be painted black. No color is listed in a buoy's code if it is green or black.

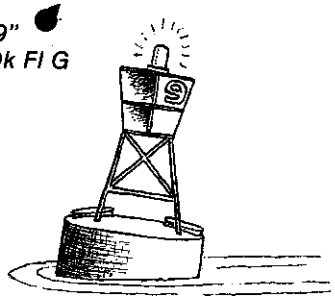
Nuns and cans are unlit and require careful lookouts to see them at night. Many buoys do have lights to make them easier to spot in the dark. A second, larger circle at the bottom of the diamond symbol means that the buoy has a light. Lights can be colored red (*R*), green (*G*), or white, and they can flash (*Fl*) or be steadily lit (this is called a fixed light — shown by the letter *F*). If the code for a lighted buoy doesn't list a color, then the light is a white one. For instance, *Fl 2.5 Sec* means Flashing White every 2.5 seconds.



What kind of light does buoy *"8"* **have? What color is it?**



R "8"
Fl R 4 sec



"9"
Qk Fl G

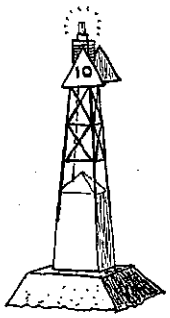
This buoy is odd numbered. What color is it likely to be painted? What color light does it have?

Buoys located near each other will have either different colored lights, different patterns of flashes, or both. This makes it possible to identify individual buoys at night when their numbers and colors are very difficult to see.

Look at the chart of Kingston and find buoy *"12"*. **Decode all the information given for this buoy.**

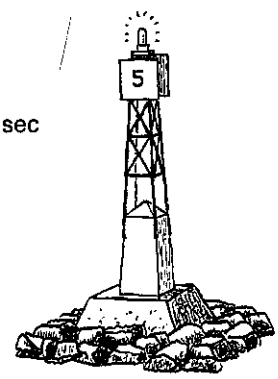
Light Towers

An exclamation point ! indicates a light on a fixed, solid foundation like the shore or a pile of rocks. These **light towers** are often given a number as well. Even numbers are on red triangles while odd numbers are on green squares.



Fl 4 sec
"10"

What kind of light does tower "10" **have?**



Fl G 2.5 sec
24 ft "5"

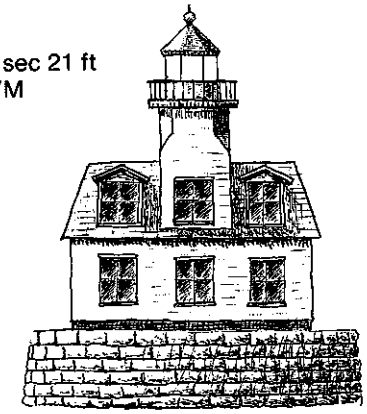
Sometimes light towers are set on a pile of stones called riprap. Riprap is indicated like this: .

The height of light towers is given in feet.

How tall is tower "5"**?**

Find light tower "21" **on the Peekskill chart and explain all the information given in its code.**

Fl 2.5 sec 21 ft
"11" 7M



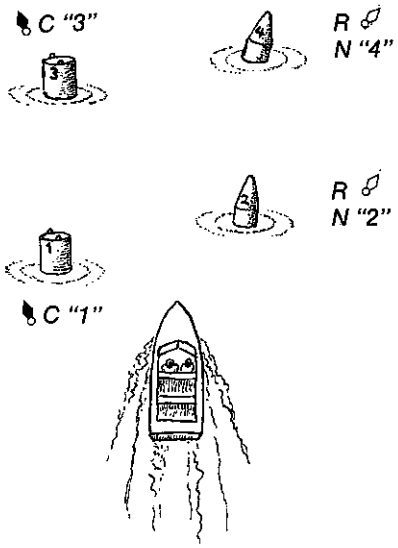
Lighthouses are also represented by exclamation points on the chart. They do not always have a number, but their code often tells how tall they are in feet and for how many miles the light is visible.

Decode the information for the Esopus Meadows light on the Kingston chart: Fl 2.5 sec 21ft "11" 7M.

Channel Markers

The purpose of buoys and lighthouses is to warn mariners of potential dangers and point out the safe way to go. If you know how to interpret buoys, you can find your way into narrow channels, avoiding rocks and shallow places.

Look at the Peekskill chart. In Peekskill Bay are two sets of buoys marking channels leading into the Peekskill docks. Notice the numbers of the buoys. *C "1"* is across from *R N "2"*. What buoy is opposite *C "3"*? Can you see how all the red, even-numbered buoys are on one side of the channel and all the odd-numbered buoys on the other?



Sailors remember this pattern with the phrase "red, right, returning." It means that if you are returning from the ocean (or other large body of water) into a channel, you always keep the red buoys on your right hand side. Fixed markers located on the right may not be colored red, but they will have an even number on a red triangle. This system applies to all channels; you can think of the Hudson as one long channel going to Albany.

Now look at the Kingston chart and find buoys *"12"*, *"14"*, and *"16"*. Notice that they are on the right hand side of the River going north.

Now find buoys *"9"*, *"11"*, *"13"* **and** *"17"*. **What side of the River are they on?**

What buoy is missing in the above sequence?

In the area where the Coast Guard might put this buoy the River is deep right up to the shore, so a buoy isn't necessary there.

Now find buoy *"18"*. Even though it is way over towards the left side of the River, you would still keep it on your right in order to stay in the channel.

Bridges

The Hudson River is spanned by many bridges, and charts contain useful information about them. Look at the Castleton-on-Hudson chart; below Castleton is the New York Thruway bridge over the Hudson, labelled HY FIXED BRIDGE. (HY means highway; FIXED means that the bridge doesn't open as a drawbridge would.) The label also has the following information: HOR CL 552 FT, VERT CL 135 FT. This tells you that the bridge's main span is 552 feet wide (HOR CL means horizontal clearance) and that its lowest point is 135 feet over the water (VERT CL means vertical clearance). Even with a mast 108 feet tall, the sloop *Clearwater* can fit under this bridge.

Do you think these measurements were taken at high or low tide? (Hint: charts tell sailors the most useful information for their circumstances. Imagine you were sailing on the *Clearwater* and the chart said VERT CL 109 FT. Would you hope the reading was taken at high or low tide?)

Now find the Bear Mt. Bridge on the Peekskill chart. Can *Clearwater* fit under this bridge?

There are many other aspects of navigation which have not been included in this lesson, but this introduction will allow you to interpret some of the most common symbols found on charts.

Name _____

Nautical Charts Worksheet

For this exercise you will need a pencil and a copy of the Barrytown chart.

Now that you are an expert on charts, you will have the job of navigating *Clearwater* through the Barrytown stretch of the Hudson River. *Clearwater* has a 108 foot mast and requires a water depth of 14 feet to travel safely. It's a foggy night and you need to study the chart carefully to be aware of the dangers ahead.

1. The captain tells you to steer for the west channel when going under the Kingston-Rhinecliff Bridge. Why can't you go under the middle of the bridge?

2. We are approaching the Kingston-Rhinecliff Bridge. It looks like we won't be able to fit under it, and the passengers are getting nervous. Can we fit? If so, by how many feet?

3. As you sail under the Bridge, what is the first buoy you should look for to keep you in the channel marked "Barrytown Reach?"

4. How tall is fixed light "31" at Turkey Pt.?

5. What color is buoy "30"? Is there a way of telling the color without looking for it on the chart?

6. Would you keep buoy "30" on your right or left? Why?

7. Just east of Glasco, there is an area called Saddle Bags. Why should *Clearwater* avoid this area?

8. If you went straight up the channel from Turkey Point you might run into Saddle Bags. There are two markers which guide you to the deeper part of the channel. What two lights should you tell the lookout to watch for?

9. There is an unlit buoy (a can) you must warn the lookout to watch for. What number is it?

10. Draw a line on the chart showing the course you would follow to navigate the *Clearwater* safely from bottom to top of the chart.