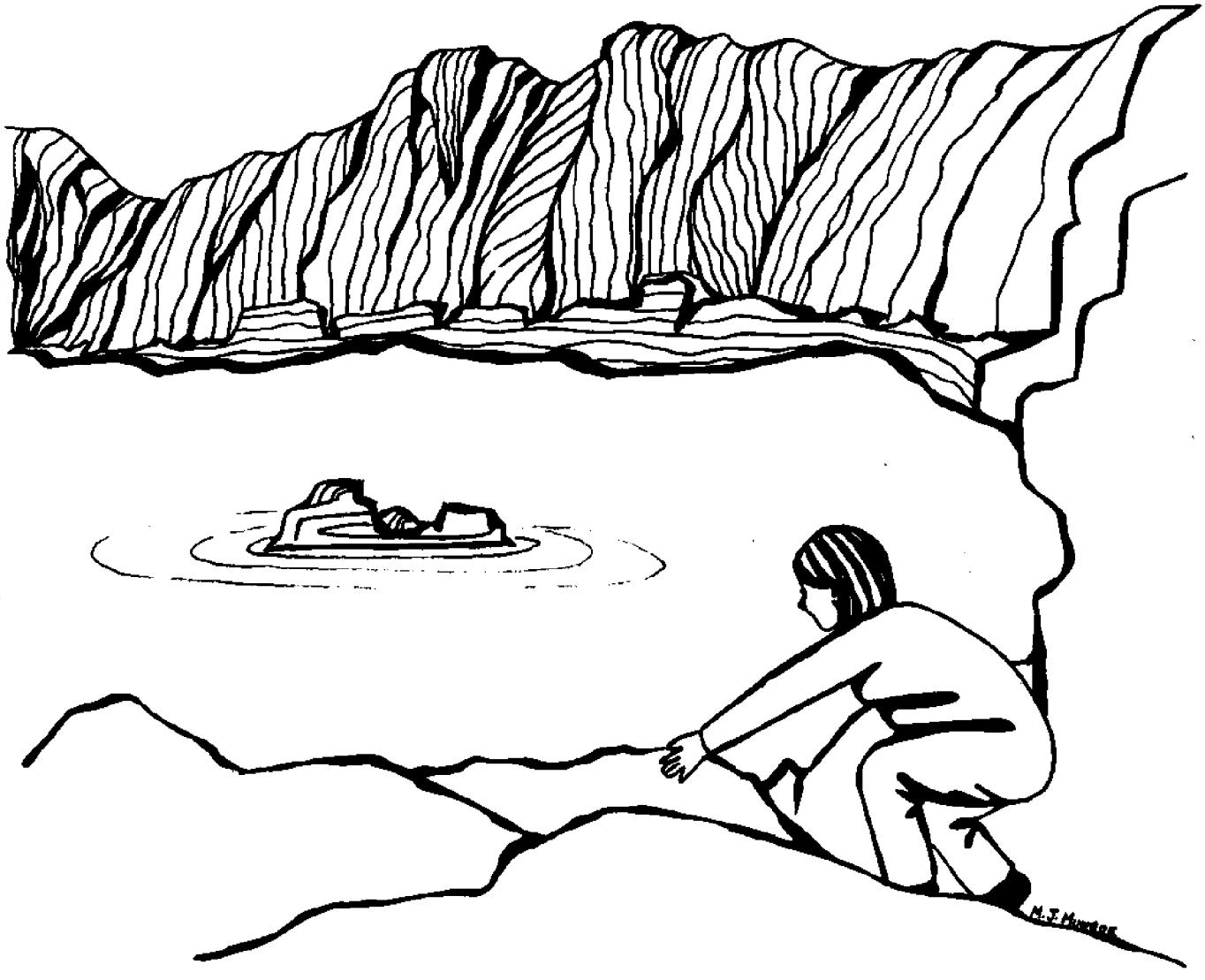
New Hampshire's Coast



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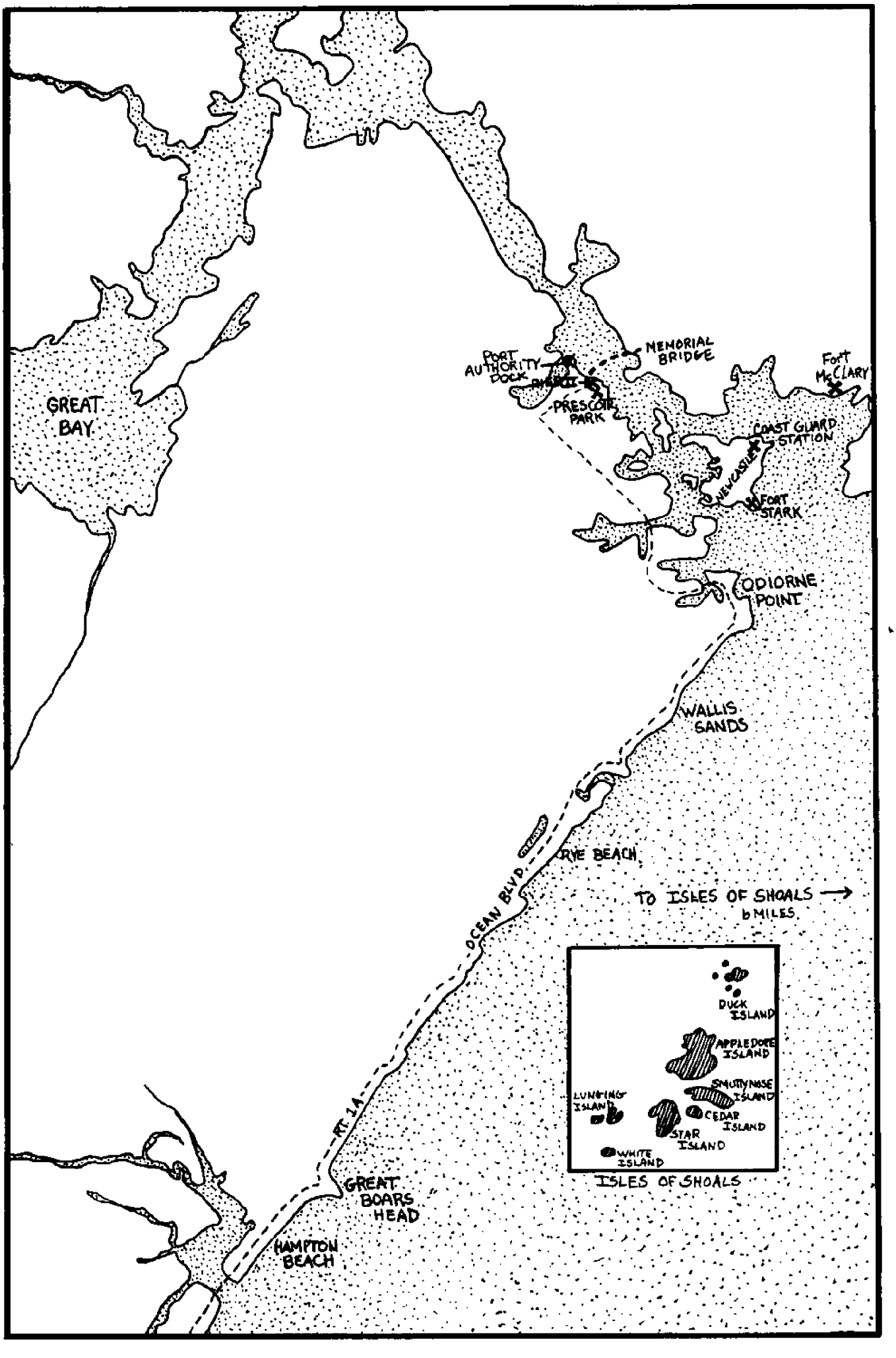
GREAT BAY
PORT AUTHORITY DOCK
MEMORIAL BRIDGE
PRESCOTT PARK
Fort McCLARY
COAST GUARD STATION
NEWCASTLE
FORT STARK
ODIORNE POINT
WALLIS SANDS
RYE BEACH
OCEAN BLVD.
RT. 1A
TO ISLES OF SHOALS →
6 MILES
DUCK ISLAND
APPLEDORE ISLAND
SMUTTYNOSE ISLAND
LUNGING ISLAND
CEDAR ISLAND
STAR ISLAND
WHITE ISLAND
ISLES OF SHOALS
GREAT BOARS HEAD
HAMPTON BEACH

NEW HAMPSHIRE'S COAST

A Guide to Tidepooling, Field Trips and Activities

Published jointly by

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and

the New Hampshire Cooperative Extension Service

UNH-SG-AB-104

July 1977

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Available from the UNH Marine Advisory Program, Kingsbury Hall, University of New Hampshire, Durham, N.H. 03824, 603-862-1889, for $1.50.

As one travels the New Hampshire coast along Route 1-A--Ocean Boulevard--the many different types of beaches become apparent to even the most casual observer. Geological conditions, winds, waves and tides have shaped our coast and have given us a wide variety of beach types, including sand, mud, ledge, cobble and glacial till. For example, long low straight stretches of beach are sandy if exposed, while sheltered, low areas such as Hampton-Seabrook Harbor have mud, silt or sand mixed in every combination--from pure, coarse sand to fine, silty mud.

Some headlands (points of land jutting into the ocean), such as Great Boars Head in Hampton, are composed of glacial material: boulders and smaller rocks embedded in soil. These headlands are bordered by cobble beaches made up of stones that have been rounded by glacial or wave action. The constant back and forth movement of the sea gradually wears away, or erodes, the soil surrounding the stones.

Other headlands have giant rocks and shelving ledges that rise up from the sea. Thrust up millions of years ago, the ledges have been scoured by passing glaciers, battered by the enormous force of storm-tossed waves and subjected to the effects of winter frosts and thaws.

All these natural events have combined to split the giant rocks from the ledge and, at the same time, to create many cracks, crevices and basins along the rocky shore. In the lower portion of the tidal zone, the region between low and high tide, these cracks, crevices and basins serve as nature's miniature aquaria--the tide pools. Any rocky area along our coast will offer a few good places for tide-pooling but some of the easiest to get to are along the shore in Rye, especially at Odiorne Point State Park.

The tide pool is a unique environment, demanding from its residents the utmost in adaptability. The plants and animals of the intertidal zone are subjected, both daily and seasonally, to a wide range of environmental conditions: long exposure to air at low tide; exposure to the sun and heat in the summer and extreme cold in the winter; rapid changes in the salinity (salt content) of the water during rain or snow storms; and the constant, sometimes violent, action of the waves.

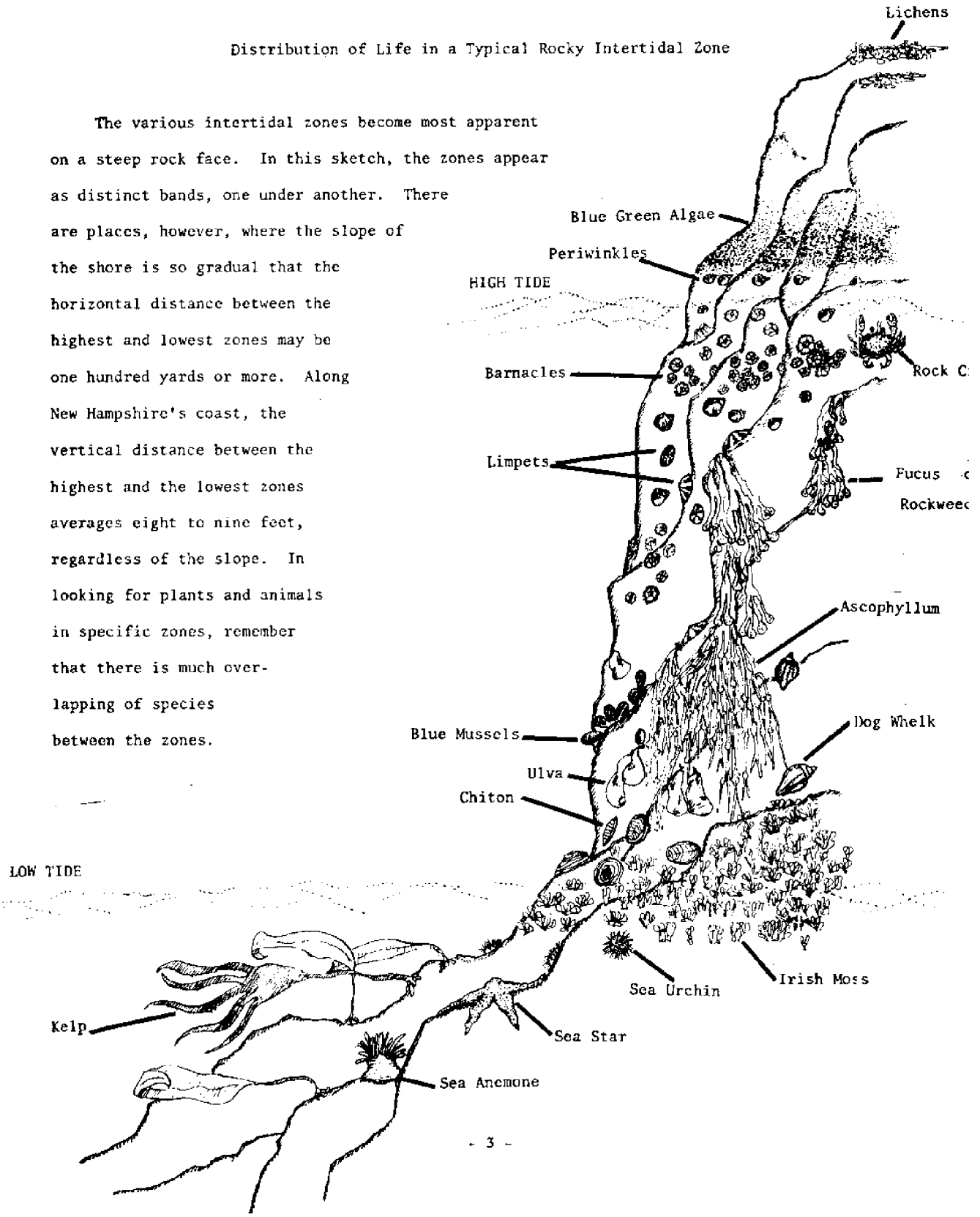
Because these plants and animals have had to adapt to these varied conditions, they are often quite different from the organisms which we see on land. Most of the plants, for example, have holdfasts instead of roots. These provide no nourishment but serve only to hold the plant to the rocks. Many of the animals have hard external skeletons or shells, and not

internal skeletons or bones. In some cases it is difficult to determine which are plants and which are animals.

Tide pools, and the surrounding rocks and ledges, shelter the widest variety of easily-observable organisms found along our coast. This guide to New Hampshire's seacoast gives an abbreviated and simplified account of some of the life to be found along our rocky shores. Many excellent guidebooks are available to make a visit to the seashore an even more enjoyable and educational experience. Some of them are listed in the bibliography at the end of this booklet. Other sections of the guide contain suggestions for seashore group activities and advice on appropriate dress and safety precautions for an educational outing at the beach.

Distribution of Life in a Typical Rocky Intertidal Zone

The various intertidal zones become most apparent on a steep rock face. In this sketch, the zones appear as distinct bands, one under another. There are places, however, where the slope of the shore is so gradual that the horizontal distance between the highest and lowest zones may be one hundred yards or more. Along New Hampshire's coast, the vertical distance between the highest and the lowest zones averages eight to nine feet, regardless of the slope. In looking for plants and animals in specific zones, remember that there is much over-lapping of species between the zones.

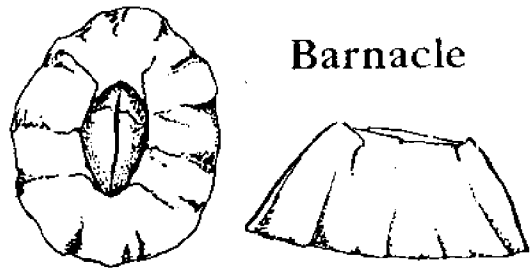


I. Intertidal Zonation and Marine Plants

Visit a steeply sloping rocky shoreline at low tide and note how the intertidal area separates into visible, horizontal bands or zones. Horizontal zonation of both plants and animals is a result of the rise and fall of the tides, which occur twice a day. Marine plants or animals that need to be under water all or most of the time are found near or below the low tide mark. Sea life that is able to withstand long periods of exposure to air is found near the high tide level. Between the extremes are plants and animals that can live out of water for varying periods of time.

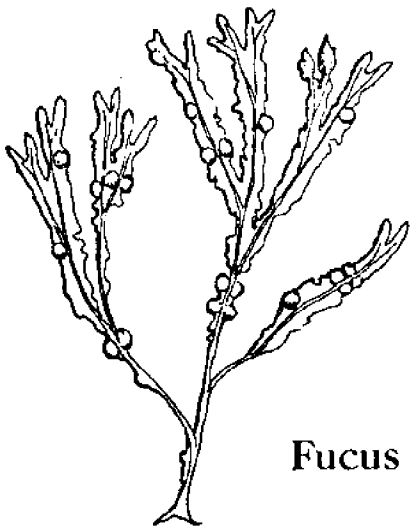
Since the plants appear to dominate the intertidal area, the various zones are generally named for the plants that grow in them. Marine plants, called algae, are grouped and identified in terms of color. Red, bluegreen and brown algae are the most common and each group includes many species.

The highest zone, near the average high tide mark, is the black, or spray, zone. The distinct black band gets its color from Calothrix, actually a microscopic bluegreen algae. The highest part of this zone is often reached by the sea water at the highest tides, during storms or from wind blown spray.



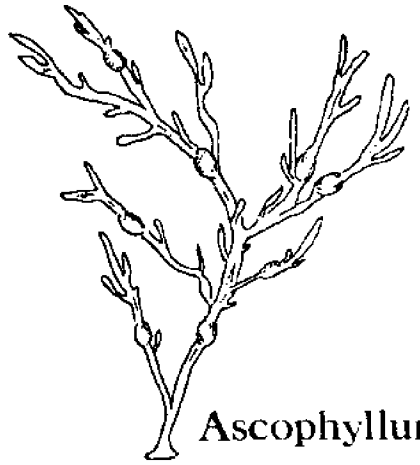
The next lowest zone, often appearing as a white band, is the barnacle zone. Barnacles (Balanus balanoides) are tiny animals that anchor their heads to rocks and then secrete a white shell around themselves. The shell opens to allow the barnacles to feed. They extend their legs like tiny fingers and pull plankton and other nutrients into the shell. When the tide recedes, the shell is closed tightly to keep in the animal's body moisture. In places, barnacles grow quite thickly. Their sharp shells can give nasty cuts and scrapes, so be careful when walking around them.

The rockweed zone is probably the most familiar to seacoast visitors. Also called the brown zone, it is composed primarily of thick patches of two species of brown algae called wracks. Fucus (higher in the zone) and Ascophyllum (lower in the zone) are long, stringy



Fucus

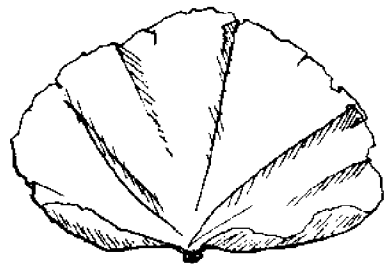
plants with small air sacs, or bladders, that allow the plants to float. The plants are able to move with the currents and waves because of the air sacs and are, in this way, protected from being smashed violently against the rocks. These plants are firmly attached to the rocks by holdfasts . Both of these rockweeds are used in clambakes, for packing materials when shipping creatures such as lobsters and for garden mulch.



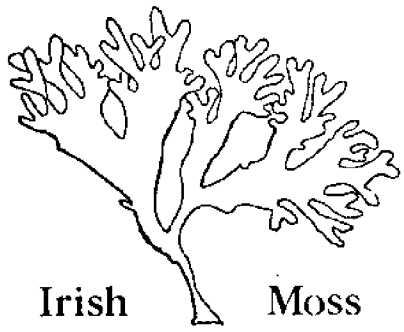
Ascophyllum

Most of the intertidal animals discussed in the next section of this guidebook can be found at low tide, hiding under the rockweed.

A green algae, Ulva lactuca, is found near and below the low tide mark. Bright green in color and appearing in thin filmy sheets, it is also called sea lettuce and can be used in salads.



Sea Lettuce



Irish Moss

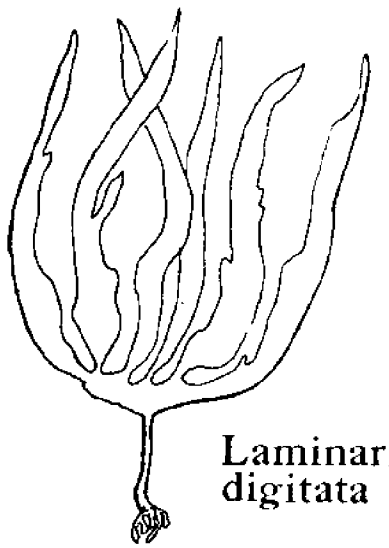
Unlike the rockweed zone, which is uncovered twice daily when the tide recedes, the Irish Moss zone is exposed only a few times each month when the lowest tides occur. Irish Moss, or Chondrus crispus, is a red algae that covers its zone like a carpet. In the higher part of its zone, its color may change to a brownish green due to the direct exposure to sunlight. When tossed upon a beach during storms, Chondrus is usually bleached white by the sun. Chondrus is a source of carrageenan that is used as a thickening agent or stabilizer in

products ranging from ice cream and chocolate milk to lipstick and paint. It is, therefore, a commercially valuable marine plant. It is also the base for an old New England pudding called blancmange (see page 21 for recipe).

The kelp zone, lowest of the zones, remains under water most of the time. It extends down as far as sufficient light is available for photosynthesis to take place. Several times each year, the upper regions of this zone are uncovered at low tide. Kelp has many forms but the most common appear as long undulating ribbons (Laminaria saccharina) or as wide, thin fingers extending from an arm or holdfast (Laminaria digitata). Kelp is often washed up on beaches during storms.

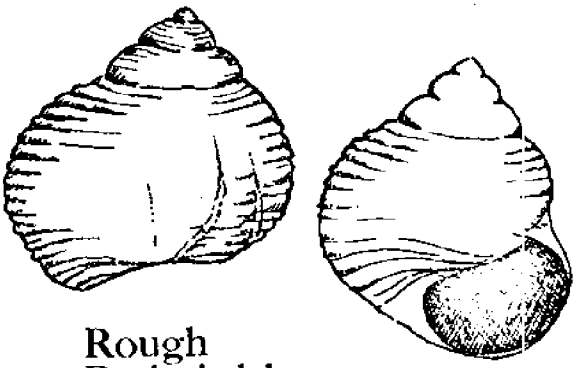
Laminaria saccharina

Many other types of plants are found in the intertidal zone, and they can easily be identified with the aid of one of the guidebooks listed in the bibliography.



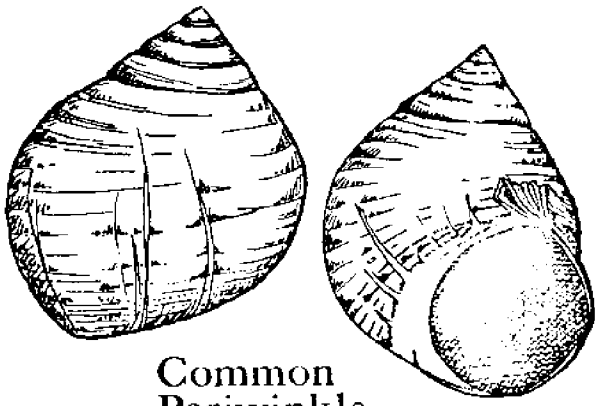
Laminaria digitata

II. Marine Animals of the Rocky Intertidal Zone



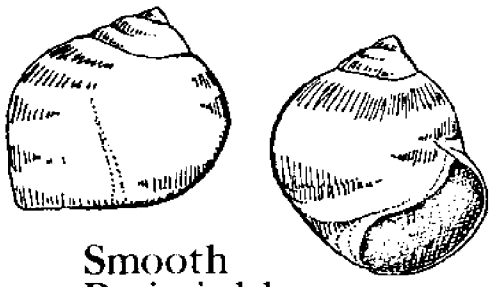
Rough Periwinkle

The most noticeable animals of the upper reaches of the intertidal zone are barnacles and periwinkles or snails with shells. The rough periwinkle (Littorina saxatilis) is a very small snail that is strongly sculptured with raised ridges and lines, usually gray or white. This animal can seal itself so tightly in its shell that it can survive more than a week without immersion in sea water. It is found near the upper limit of the barnacle zone.



Common Periwinkle

Slightly overlapping the range of the rough periwinkle, the common periwinkle (Littorina litorea) makes its home throughout the rest of the intertidal zone but it is most frequently found below the barnacle zone. It is the most common periwinkle. Its thick, cone shaped shell has a thick outer lip which is lined with black. This periwinkle is edible and is considered a delicacy in European countries.

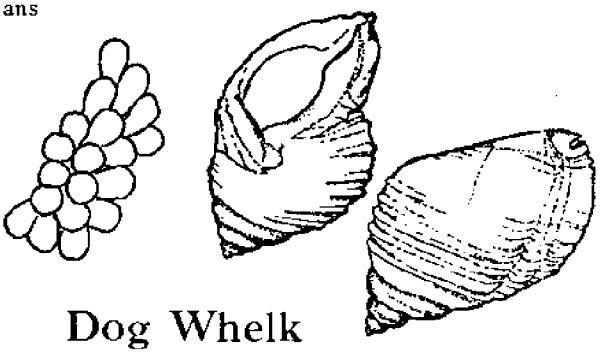


Smooth Periwinkle

The third periwinkle of our rocky shore is the pale or smooth periwinkle (Littorina obtusata). It is found in the rockweed zone, almost always among the branches of seaweed. The shell is very smooth and shiny with a flattened spire. Usually it is nearly the same color as the blattered rockweeds on which it lives. The smooth periwinkle is easy to find if one looks carefully through the living

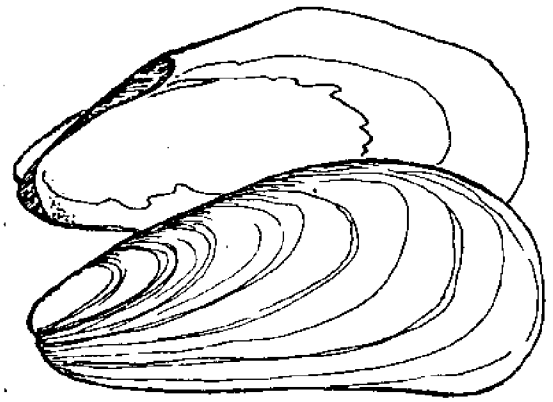
attached seaweeds. The periwinkles are quite mobile and they spend their time feeding on marine algae. Periwinkles are eaten by crabs, gulls and sea stars.

Natural crimson dyes of the American Indians and the royal purple of ancient Rome were obtained from glands of the purple or dog whelk (Thais lapillus). This snail can be found throughout the intertidal zone, but is most common in the lower portion on exposed shores. It feeds on mussels and barnacles by boring a hole through their shells. Though color varies greatly within the species, the most common shell color in New Hampshire is white. Yellow, red and orange shells, both with and without contrasting color bands can be found by the diligent searcher. The shell has a groove (siphonal canal) on its lip; and rounded, spiral ridges give it a corrugated appearance.



Dog Whelk

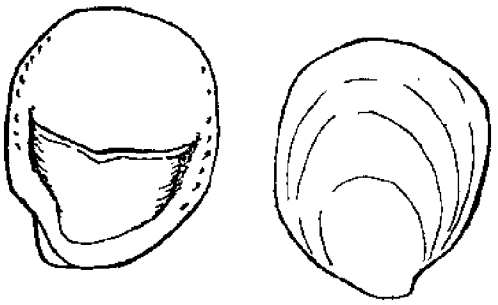
The mussel commonly found in the pools and between the ledges and rocks is the edible or blue mussel (Mytilus edulis). The general color of the shell is a deep violet-blue, but this is covered in life by a blue-black "skin." The mussel spins a coarse byssal thread which is used to hold the animal in clusters and to anchor itself to rocks. This mussel is another seafood delicacy in great demand by Europeans but Americans are also becoming interested in this tasty mollusk. Mussels can be harvested in the wild and a commercial mussel farm has begun operations in Maine.



Blue Mussel

Before collecting mussels or any intertidal species for the dinner table, be certain the waters from which you are collecting are not polluted or affected by red tide. Call the New Hampshire Fish and Game Department (603-271-2789) if you have any doubts about the site you have selected.

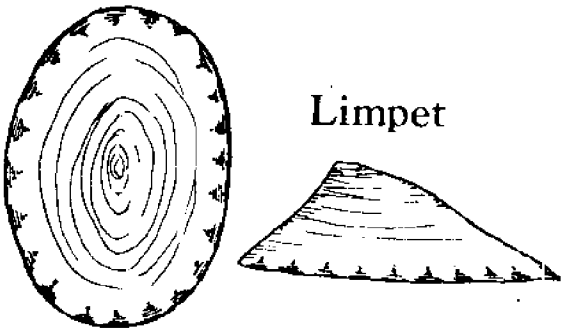
Three other mollusks (shellfish with soft bodies and no backbone) common to the rocky shore are the slipper-shell (Crepidula fornicata), limpet (Acmaea testudinalis) and the



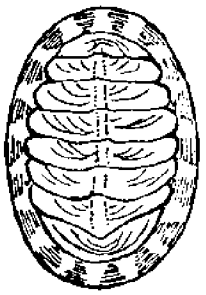
Slipper Shell

chiton (Lepidochiton ruber). The slipper-shell is found offshore and in the lower tidal zone. Its shell is characterized by a "shelf" extending about half way across the underside giving it the appearance, when it is turned over, of a ballerina's slipper. These animals are often found clinging together in groups. The slipper-shell is a filter feeder and eats plankton. It is a food source for sea stars.

The limpet is a fairly advanced mollusk while the chiton is the most common primative mollusk. If you try to remove one from a rock, it will hold on tightly by creating a suction. The limpet shell is shaped like a colored coolie's hat, while the chiton is more oval and is composed of eight plates. Both of these animals move very slowly across rocks while feeding on microscopic vegetation and other organic material. Both animals are eaten by lobsters, gulls and sea stars. The lobster (Homarus americanus) isn't discussed in this guide because it is rarely found in tidepools. It prefers deeper water.



Limpet



Chiton

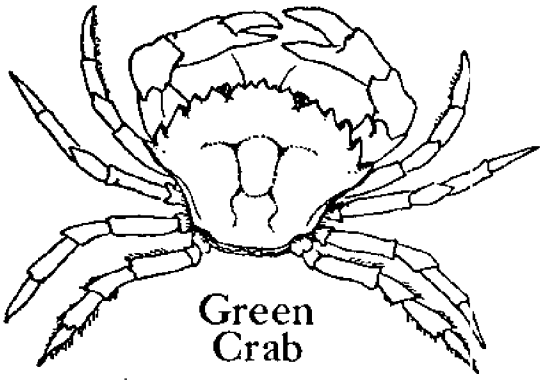
The limpet tends to return to the exact position on the same rock at low tide. For an interesting experiment, spot a limpet and its rock with a bit of paint then check at the next low tide to see if the limpet does return.

Next to the common periwinkle, the arthropods (animals with jointed legs and external skeletons) are the most visible creatures on rocky shores. The most obvious is the rock barnacle, discussed earlier.

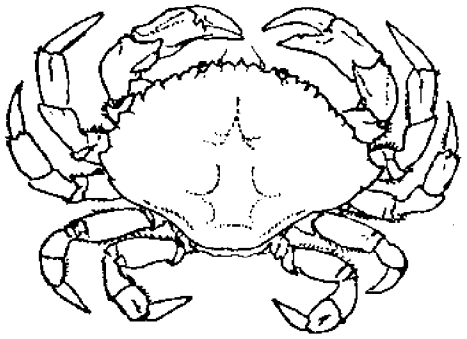
If the herring gull (Larus argentatus) doesn't find them first, you are likely to find three types of crabs during your explorations: the green crab (Carcinus maenas), rock crab (Cancer irroratus) and the jonah crab (Cancer borealis). The green crab is usually greenish in color with pointed teeth along the front edge of its shell. The rock crab is larger than

the green crab, is tan to pale red and has blunt teeth along the front margin of its shell. The jonah crab is similar to the rock crab but it is deeper purple in color and larger. It has more pointed, saw-like projections on the front of its shell.

Crabs feed on dead, injured or defenseless animals and at low tide they can often be found under rocks or piles of rockweed. The green crab is shy during the day but at night with a flashlight you can often find them climbing over rocks or seaweed. Fishermen catch them quite easily when fishing for flounder.

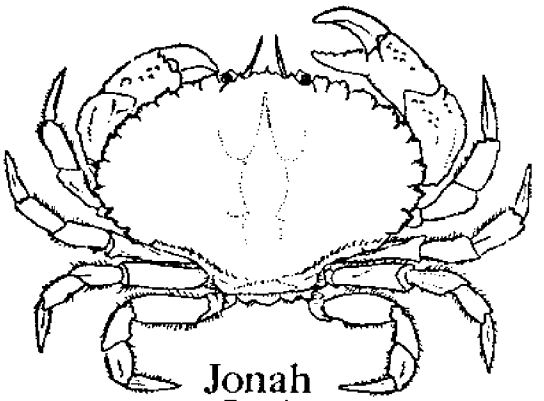


Green Crab

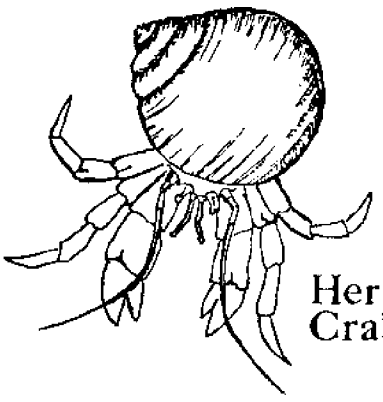


Rock Crab

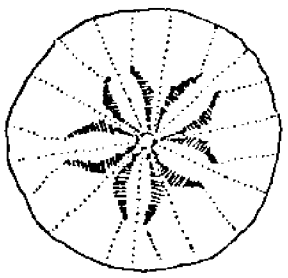
If you happen to see a periwinkle moving much faster then its neighbors, then you have probably found a fourth crab (Pagurus longicarpus), the most common shallow-water hermit crab. It uses abandoned snail shells for its home. When it outgrows its shell, it simply moves into a larger one. If you pick one up, it will recede into the shell. It can't be taken out of its shell without being torn apart.



Jonah Crab

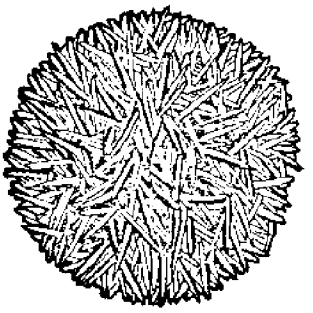


Hermit Crab

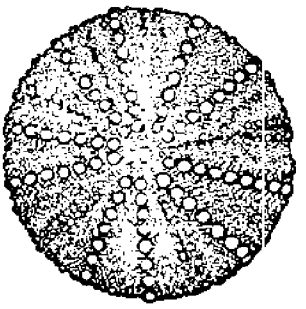


Sand Dollar

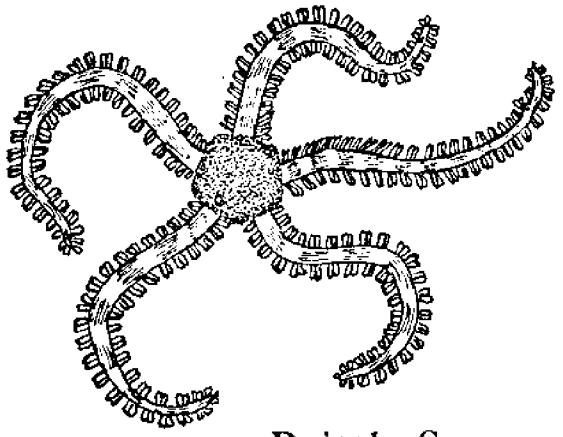
Most New Hampshire echinoderms (spiny-skinned animals) live on hard or rocky bottoms. An exception is the sand dollar (Echinarachnius parma) which lives in sand or mud. Round and flat, sand dollars sometimes cover the bottom in huge numbers. Live sand dollars are seldom found but pieces of their fragile skeletons are often found on beaches. Sand dollars are eaten by flounder, cod and haddock.



Sea Urchin

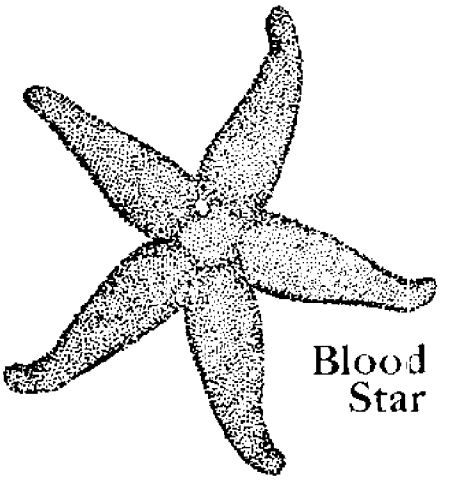


The green sea urchin has one of the longest scientific names, Strongylocentrotus drobachiensis. It is easily recognized by its globular shape, its spines (if alive) or its spine scars (if it has been battered around by the surf). Sea urchins crawl over rocky areas cutting off and eating attached brown seaweed with fine, sharp teeth. You can see the mouth parts, which form a ring called Aristotle's lantern, if you turn an urchin upside down. Gulls, lobsters and crabs eat sea urchins.



Brittle Star

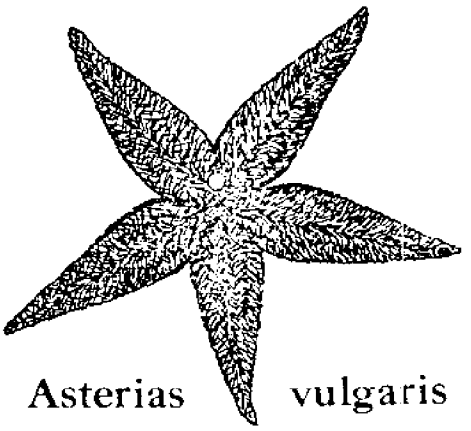
Peeking under seaweed and peering under rocks, you should soon discover all four of our sea stars. The daisy brittle star (Ophiopholis aculeata) is readily identified by its spidery legs and disc-like body. Fish, such as cod, feed on brittle stars.



Blood Star

The smooth, bright red star with a pale underside is the little blood star (Henricia sanguiolenta). The two spiny sea stars are

the most difficult to differentiate, but if the animal is flabby and the major spines are not in a line, it is usually the northern or purple sea star (Asterias vulgaris). However, if the animal is firm, has major spines arranged in a row atop each arm and has an orange eye (sieve-plate or madreporite), it is usually the common sea star (Asterias forbesi). All of these sea stars have five arms unless damage or mutation has occurred. If one of the arms is broken or torn off, the sea star soon grows another one.

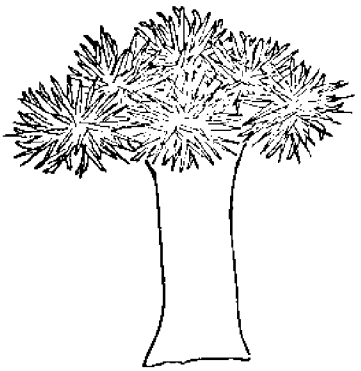


Asterias vulgaris

Asterias forbesi

If you are fortunate, you may find a sea star with a large fleshy sack protruding from its underside. This sack is the starfish stomach and it is an example of a most unusual form of feeding. When a starfish comes upon a mussel or clam, it wraps its arms around the shell, then attaches its feet to the shell by suction and tries to pull the mussel shells apart. Naturally, the mussel resists, and the two animals may remain locked together for several hours. Eventually the mussel tires and its shell opens just a bit. Then, the sea star extrudes its stomach from its mouth and forces it between the shells of the mussel. In a few hours, after the sea star has digested the mussel, the sea star pulls its stomach back into its body and moves away, leaving empty mussel shells.

Near or below the low tide mark, one may find the common sea anemone (Metridium dianthus). It is called the flower of the sea because of the petal-like tentacles that extend from its stout, cylindrical body, but actually the sea anemone is an animal. The tentacles, which can be withdrawn into its body, are used to grab dead or living food including small fish. The anemone releases a poison through its tentacles, harmless to man, that kills its prey. Sea anemone are eaten by nudibranchs, tiny snails without shells.



Sea Anemone

Many other plants and animals not mentioned here can be found in New Hampshire waters. Discovering and identifying them, with the aid of a guidebook, can be an exciting and educational adventure. Use the sample log sheet which follows this section to record the animal and plant species you see during your field trip.

Remember, however, that your visit to the intertidal zone is only temporary and that the plants and animals must continue to live in their habitat after you have gone back to yours. If you turn over a stone, put it back the way it was found. If you pick up an animal, put it down where it was found.

LOG SHEET

ORGANISM	DATE SEEN	LOCATION SEEN	HABITAT (on or under rocks, in crevices, under seaweed, other)	NOTES

III. Some Pre-Trip Considerations

Before taking a field trip to the intertidal zone, consideration should be given to timing, appropriate dress and safety. The following suggestions will help to ensure an enjoyable and safe trip to the seashore.

Safety of the group should be the first concern. Wet, seaweed-covered rocks are slippery and can be dangerous. Stepping between the rocks, rather than walking on them, makesmaintaining your balance much easier. As the tide comes in, be alert for large breakers, which can catch unwary beachcombers. Nearshore rocks, uncovered at low tide, are rapidly surrounded by water as the tide changes. Again, be alert. Cliff edges leading down to beaches are usually crumbly and should be avoided.

Plan your trip so that you arrive about one hour before low tide. Check the newspaper or a tide chart for the time of day when low tide will occur. Tide charts are available from marinas and from seacoast town chambers of commerce.

Visit the field trip site in advance of the trip to check on available parking and best access to the shoreline. Be certain to get permission from landowners before crossing private property.

Temperature on any given day will usually be lower at the seashore than inland, so be sure to take warm clothing with you. Dressing in layers of clothing, as mountain hikers do, allows you to remove or add clothing as the weather demands. Wear rubber boots or sneakers with non-skid soles. Heavy socks will keep feet warm and will protect feet and ankles from sharp rocks. Extra dry clothing, especially in cold weather, is recommended.

A few items that will be useful to have during a field trip include hand lenses for observing organisms in greater detail, thermometer for taking air and water temperatures, plastic baggies, a white plastic dishpan and buckets for collecting organisms, binoculars and field guidebooks. Do not use glass containers. A well-equipped first-aid kit, of course, is a must on any field trip.

Perhaps the most important thing to remember is that the intertidal zone is a fragile and delicate environment--the home of a variety of plants and animals whose lives depend upon one another and upon the ecological balance of their habitat. Each plant and animal makes its home in a particular area of the intertidal zone because of its particular living requirements. Although it may be tempting to gather one of everything to take home with you, doing so can drastically alter the area as well as deplete the population of organisms that would be available for study by other groups planning to visit the same site.

Always return rocks, seaweed and creatures to the exact place where they were found. Living animals will not survive for a long time in a pail of water. If they are left out of water for longer than the normal period between tides, most will dry out and die.

Empty shells, those which have been discarded by former inhabitants, may be collected without concern and used to help identify animals. But live specimens should be "taken home with you" as notebook drawings or on film in your camera. While many of the organisms can be collected for short periods of time and studied before they are returned to their environment, some creatures (such as anemones and sponges) should not be taken from the water.

IV. Intertidal Zone Group Activities

Once at the intertidal site, a number of activities can be pursued. The sketches on the preceding pages can help with identification of plants and animals discovered during the field trip and can serve as records, or logs, or each field trip taken. On the first trip to the beach, it may be enough simply to begin identifying the many different marine plants and animals that can be found in the intertidal zone. With these charts and one of the guide-books listed in the bibliography, almost everything discovered in the intertidal zone can be identified and logged.

Merely identifying the organisms, of course, doesn't tell you anything specific about them. Eventually, the group can begin to learn how each organism lives, why it lives in a certain area of the intertidal zone and how it relates to its neighbors. The activities listed below are designed to help reach these learning objectives.

1. As soon as you arrive at the field trip site, place a stake or some other type of marker at the water's edge and mark the initial water level. Before you leave, observe the change in water (tide) level.

2. Identify the different life zones that are shown on the chart (page 3). Find a nearly vertical rock face and measure the different zones. Can you tell how far up the tide reaches on the rock? on the beach? What types of creatures live in the various zones? How are they adapted to their particular zones?

3. Count the number of barnacles, mussels or periwinkles that can be found in one square foot of the tidal pool. Measure the area of the whole tidal pool and estimate the total number of barnacles, mussels or periwinkles it contains.

4. Do a simple transect study. Stretch a piece of line from the high tide mark to the low tide mark. Identify all of the organisms you find along the line and draw a chart showing the different zones and the creatures that inhabit them. If time is limited, the "transect" can be performed on a small tidal pool.

5. Consider how tidal pool animals protect themselves from the tremendous force of the waves, keep from drying out and escape predators. How do algae (seaweeds) keep from drying out? anchor themselves to rocks? withstand waves? keep afloat?

6. Collect a sample of seawater and take it home with you. Weigh the water, and then let it evaporate to see how much salt remains. Weigh the salt to find out how much of the seawater sample is made up of salt. Do the same experiment with fresh water and note the difference.

7. Measure the height of five breaker waves. You will need a five-to-seven-foot pole, marked off in one-foot segments, and a buddy. Stand at the water's edge, holding the pole in an upright position. Your buddy faces you and moves six steps up the beach. He then looks past the pole to the horizon and moves up or down the beach until his line of sight has the crest of the breaker in line with the horizon. The point where this line of sight crosses the pole shows the height of the wave. The ocean level is about the same at the horizon as at the water's edge.

8. Collect samples from the ocean bottom. You will need a long (five-to-seven-foot) pole, a hinge and a can with holes punched in the bottom. Hinge the can to the pole so it can be lowered into the water and dragged along the ocean floor to collect a sample. The holes punched in the bottom of the can will allow the water to escape. Take samples in several places and make a log of the specimens you find in each sample. Compare them with specimens found by others performing the same experiment. Be sure to return the creatures to the water.

9. Chart local ocean currents using "drift bottles." Obtain 20 small plastic bottles. Fill them ¼ full with sand and seal them with a cork or rubber stopper. Place the bottle into a bucket of salt water to test its floating level. It should submerge to just below the surface. Add or remove sand as necessary. This will ensure that water currents, not the wind, move the bottles.

Make a postcard for each bottle requesting the following information: finder's name and address, exact spot where the drift bottle was found, date and hour that the bottle was found. Put a stamp and your address on one side of each card.

Place the postcards in the bottles and seal them. If you use corks, double seal the bottles with melted paraffin. A local fisherman or the Coast Guard may agree to launch your drift bottles at sea. Be certain to find out exactly when and where they were released.

When the postcards come back to you, look at a map and see what you can learn about which way the bottles went and how long it took them to get there. The people who return your cards should receive a note from you which tells them the results of your project.

On a limited basis, this project could be used on a large lake or a river.

10. While at the beach, collect some Irish moss to use in making a pudding called blanc-mange.

Ingredients:	1 cup Irish moss	4 cups milk
	1 tsp. vanilla	½ cup sugar

Soak Irish moss in fresh water for a few minutes; clean and drain. In a double-boiler, cook milk and Irish moss for 20 minutes, stirring occasionally. Add sugar. Cook for 10 more minutes. Strain out Irish moss (or cook in a cheesecloth sack to eliminate straining); add vanilla or other flavoring. Chill until thickened.

As a follow up project, study Irish moss and other seaweeds to see how they are used commercially.

11. Gather some seaweed. Float it in a pan of water. Then place an index card or a larger sheet of white paper beneath it and lift the seaweed out of the water. The seaweed can be carefully moved around on the paper to make a pleasing design. Cover it with a blotter, then dry it in a plant press. When this herbarium mount has dried, cover it with clear plastic wrap or clear contact paper. Identify the seaweed you have mounted and find out everything you can about its life history, characteristics and uses.

12. Take photographs of a variety of different plants and animals that can be found on a rocky beach and in tidal pools. Mount the photographs on a large piece of poster board, identifying each specimen, to make an attractive display on life in the intertidal zone. Photographic slides could be made into a short program for showing to other classes or groups.

13. Before leaving the site, ask the students to sit quietly on the rocks for a few moments with their eyes closed. Invite them to observe the sounds, scents and other sensations around them. Their reactions can be described later in a poem or short composition about their trip to the seashore. Artistic students might want to make sketches or drawings.

14. Visit the beach in summer and winter. Report on changes in waves, beach characteristics, high and low tides, plant and animal life, air and water temperatures.

15. Study the tide tables for the area and graph the heights of the high and low tides for a month, or the monthly averages for a year. Analyze and interpret the results.

16. Research and interview to report on environmental concerns of the N.H. seacoast and/or the N.H. economy as related to ocean based industries.

Additional Activities and Field Trips

1. Have each person in the group present an oral report on the life and growth development of one marine plant or animal. This activity could be done before the field trip. Then, each student could act as the expert on the plant or animal during the trip.

2. Collect newspaper clippings over a three-month period that relate to ocean or beach accidents. Discuss the kinds of accidents that can take place while beachcombing or boating and ways accidents can be avoided. Prepare a list of "Ocean Safety Hints."

3. Make Japanese Fish Prints. The technique of fish printing has been used in Japan for more than 100 years to record catches of sport fish and to compile fish biology information. The art of fish printing is a good way to gain an understanding and appreciation of the beauty and great variety of fish. The method described below can also be used to make prints of rocks, shells, flowers and other objects.

This project can be enlarged by having the students visit a fish market where they can select their own fish and ask the manager about his sources of supply, different types of fish and why prices vary for different species. Before the printing session, the students can learn about the various exterior parts of the fish and when the activity is ended, the fish could be cleaned and eaten.

Fish print materials: Obtain a very fresh fish. Flounder or rockfish are good for beginners. Fresh water fish such as perch, shiners or trout are also useable. If you buy the fish at a market, make sure it has bright red gills, clear eyes and a fresh smell. If the fish has been gutted, make sure that it has not been cut anywhere else on the body.

You will also need: newspaper, plastic modeling clay, pins, water-based ink (linoleum block ink is the best), a stiff ½" brush for each color and rice paper or newsprint.

1) Use soap and water to clean the outside of the fish as completely as possible. The cleaner the fish, the better the print. Dry the fish well.
2) Place the fish on a table covered with newspapers. Spread the fins out over some clay and pin them in this position. Continue to dry the fish.
3) Brush on a thin even coat of ink. Leave the eye blank. It can be filled in after the print is made.
4) Place a piece of newsprint or rice paper over the top of the fish.

5) Carefully lay the paper over the entire fish. Use your fingers to gently press the paper over the surface area of the fish. Be careful not to move the paper too much since this results in double prints. Then remove the paper and you have a fish print. A small brush can be used to paint the eye.

A collection of fish prints can be made displaying various types of fish. The prints can also be framed and displayed in the home or used as a project for fairs.

4. Make a driftwood mobile. Materials scavenged from beaches can be used for various art projects. Driftwood and shells can be hung and arranged into attractive mobiles.

You will need: nylon fishing line or thread, driftwood, shells, screw eyes.

Select a long slender piece of driftwood to act as the main beam to which other pieces of wood and shells can be attached. Hang wood pieces or shells from main beam in a balanced pattern. The screw eyes can be screwed into the main beam to form an attachment for the line. When completed, hang in an area with air currents.

5. Attractive textured paintings can be made from different colors of sand or different sizes of sand grains.

You will need: white glue, cardboard, pencil, brush, two types of sand.

1) Select a piece of cardboard the size the painting is to be.
2) Sketch a simple line drawing on the cardboard. The less complex the drawing, the better. A sailboat, fish or tree are good subjects for sand painting.
3) Paint the interior of the outline with glue. Sprinkle one color of sand over the picture. Let dry. Dust off excess sand.
4) Paint the background of the painting with glue. Sprinkle other type of sand over the painting and let dry. Dust off remaining excess sand. Frame.

Many of the same materials listed above can also be used to make a marine montage.

You will need: a piece of weathered board or shingle, animal shells, bits of sea glass (small pieces of glass washed smooth by wave and sand action), and any other interesting small objects scavenged on the seashore.

Lay the board flat, then arrange the small objects on it in an attractive, artistic manner. Either abstract or traditional designs are pleasing with these materials. After your arrangement is finalized, the pieces can be glued in place. Use a screw eye to make an attachment for hanging.

6. Visit a lobster pound or fish market and observe the different types of fish. Ask how the fish are caught; how they are delivered to the fish market; how they can be cooked;

why the price of one fish is higher than another. A short visit might be concluded with the purchase of a few different kinds of fish to be taken to the leader's home and prepared for lunch or dinner. This trip could also be combined with a fish printing session.

7. Visit marinas or boatyards, which are located throughout the state. Observe the many different types and shapes of power, sail and row boats. Notice, also, how the boats are docked or moored, how the wharves are constructed and how the boats are launched. This trip could be combined with a boat model building session.

8. Bring a big ship into Portsmouth Harbor. The road system along the Piscataqua River is such that the progress of an ocean-going vessel can be observed all the way from the open sea upriver to Portsmouth Harbor, or vice versa.

Because these large ships must use the river at slack tide to avoid the rugged currents of the river, they operate on a rigid schedule. This makes it convenient for a group leader to plan a field trip of this type.

The first step is to contact the New Hampshire Port Authority in Portsmouth (436-8500), which maintains a shipping schedule for Portsmouth Harbor. They often know of arrivals and departures days in advance, so planning the field trip should not be difficult.

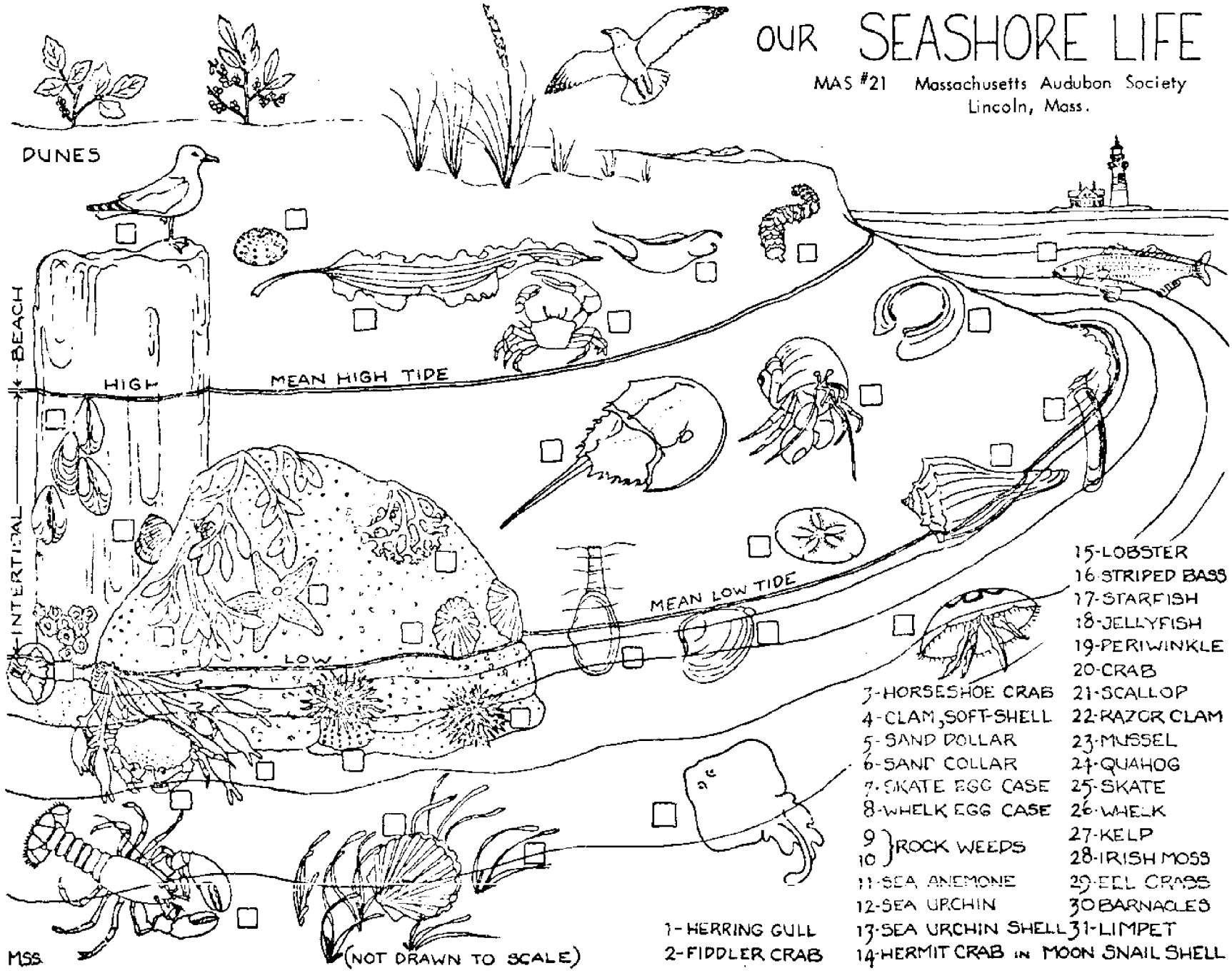
Begin your trip at the Coast Guard Station in New Castle. There, the ship can be observed entering the harbor and passing the Coast Guard's lighthouse as it starts its journey upriver.

Highway 1-A from New Castle to Portsmouth crosses several bridges, from which the progress of the ship can be observed. Prescott Park on Marcy Street in Portsmouth should be your next stop, where the ship will pass under the Memorial Bridge. You can also park directly under the bridge, next to Pier II restaurant, to get a close-range view of the passing ship. Watch the tugboats as they approach the bridge, and listen as they signal each other with toots of their horns.

Continue on to Bow and Market Streets. If the boat is docking at the Granite State Minerals, Port Authority or National Gypsum Company docks, the docking process can be observed from the road. If the vessel is delivering a load of salt to the Granite State Minerals dock, you can return the next day to watch the unloading process.

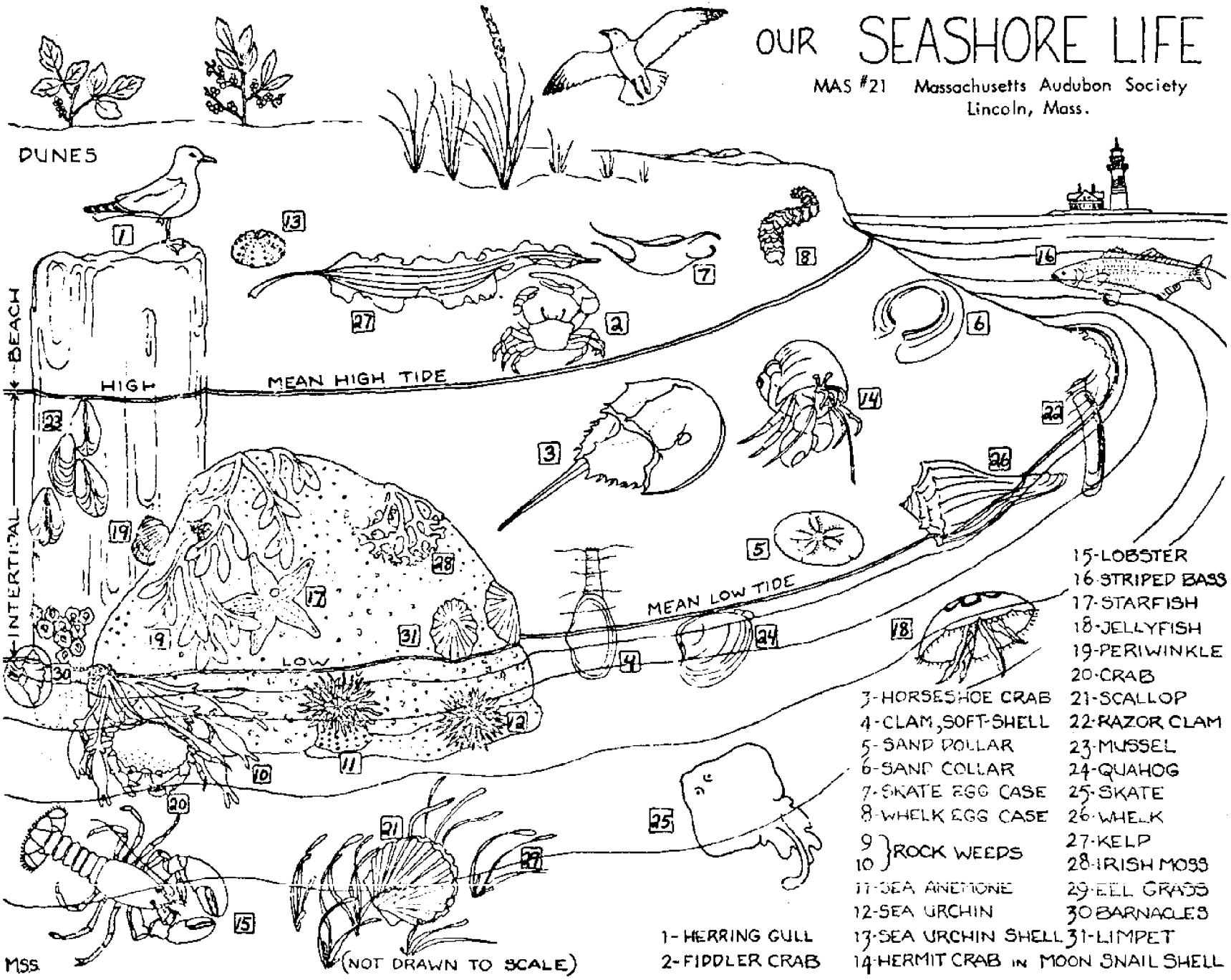
OUR SEASHORE LIFE

MAS #21 Massachusetts Audubon Society
Lincoln, Mass.



OUR SEASHORE LIFE

MAS #21 Massachusetts Audubon Society
Lincoln, Mass.



1-HERRING GULL
2-FIDDLER CRAB
3-HORSESHOE CRAB
4-CLAM, SOFT-SHELL
5-SAND DOLLAR
6-SAND COLLAR
7-SKATE EGG CASE
8-WHELK EGG CASE
9, 10 } ROCK WEEDS
11-SEA ANEMONE
12-SEA URCHIN
13-SEA URCHIN SHELL
14-HERMIT CRAB IN MOON SNAIL SHELL
15-LOBSTER
16-STRIPED BASS
17-STARFISH
18-JELLYFISH
19-PERIWINKLE
20-CRAB
21-SCALLOP
22-RAZOR CLAM
23-MUSSEL
24-QUAHOG
25-SKATE
26-WHELK
27-KELP
28-IRISH MOSS
29-EEL GRASS
30-BARNACLES
31-LIMPET

V. Potential Field Trip Sites in New Hampshire

The following list is by no means complete. There are many different places to go in this area and many people to learn from about the marine environment. This list can be used as an initial source.

Odiorne Point State Park. Located on Route 1-A, Rye, New Hampshire. Park telephone, 436-7406. Nature Center telephone, 436-8043.

Group admission to the park is $.25 per person. There is no charge for walking or biking into the area. The Audubon Nature Center is staffed during the summer only by a full-time naturalist, who gives tours of the park. Other features include a visitor's center, picnic areas, drinking water and restroom facilities. No lifeguards are on duty, and it is recommended that swimming be done at Wallis Sands State Park, about one mile down the coast. Tide pools are abundant along the 1½-mile shoreline; a 3,500-year-old sunken forest lies within the park's boundaries; bird and animal life is abundant and sand-filled military bunkers remain from an earlier military establishment on the point. Poison ivy is also plentiful.

Fort Foster. Located just off Route 103, Kittery, Maine. Call the Kittery Community Center at 207-439-9704.

Admission is $.50 per child, $1 per adult. Facilities include swimming and picnic areas, restrooms, playground equipment and drinking water. Accessible intertidal areas.

Fort McClary. Located on Route 103, Kittery, Maine. Telephone, 207-439-0977.

Group admission rates are available. Tours of the old military site are available upon request.

Booth Fisheries. Located off Route 101, Portsmouth. Call Robert Wight at 431-6863 for information.

Fish processing plant. Half-hour tours available at no cost. Children under 12 not admitted.

U.S. Coast Guard Station. Call 436-5043 or 436-8781 and ask for the public information officer.

Tours of the Coast Guard cutters, which are docked at the Coast Guard Station pier in

New Castle, can be arranged. Search and rescue operations are explained during the tour.

New Hampshire Port Authority. 555 Market Street (Nobles Island), Portsmouth, New Hampshire. Call 436-8500 for information.

The Port Authority is responsible for nearly all marine activity, both commercial shipping and recreational boating, in Portsmouth Harbor. Tours of the State pier and docking facilities are available, and a talk and slide-show can be arranged.

Piscataqua Marine Laboratory. 15 Pickering Street, Portsmouth, New Hampshire. Call 431-5270 for information.

Tours of the research laboratory, which is owned by Normandeau Associates, an environmental consulting firm with home offices in Bedford, New Hampshire, can be arranged. Groups of ten or less can be accommodated, and children of all ages are permitted. Research projects conducted through the laboratory include counting and identifying marine animals and plants. Preserved microscopic specimens are on display.

Shoals Marine Laboratory. Appledore Island, Isles of Shoals. Contact the University of New Hampshire Marine Advisory Program at 862-1889 for information and transportation arrangements. At least two weeks notice required. June-September only. Transportation fee.

Tours of the island facility, a field station for undergraduate education in marine science, are available on a limited basis. Groups of ten or less are preferred. For groups of high school age or older.

New England Aquarium. Located on the Central Wharf, Boston, Massachusetts. Telephone 617-742-8830.

Group rates, $1.50 per person, must be arranged in advance, recommend one adult for each ten children. Special programs are a regular feature of the aquarium. Call in advance if your group is interested in a particular marine subject.

Star Island, Isles of Shoals. Contact Viking Queen, Market Street, Portsmouth, New Hampshire. For information call 431-5500.

The Viking Queen is a large, passenger vessel that makes tour cruises around the Isles of Shoals daily during the summer. The 11 a.m. trip offers a three-hour layover on Star Island. Inquire about group rates. Late May through September. Recommend at least one adult per five children.

Strawbery Banke Boat Shop. Portsmouth, New Hampshire. For details call Ann Swallow, 436-8010.

Boat shop open weekdays November through May 1 at no charge. See wooden dories being made. During Strawbery Banke's regular summer program a special rate is available to see only

the boat shop. Strawbery Banke has also just developed a new maritime exhibit in the Lowd House.

University of New Hampshire Coho Salmon Hatchery. Newmarket, New Hampshire. Contact the UNH Marine Program office for information, 862-1383. Guided tour of the hatchery takes about 45 minutes. See young Cohos being raised for release to the ocean. Groups of ten or less preferred.

Jackson Estaurine Laboratory. Adams Point, Durham, New Hampshire. Contact UNH Marine Program office for details, 862-1383.

Half-hour tours of the University of New Hampshire's research laboratory on the shore of Great Bay. The laboratory is located on a natural area so, if time permits, the leader could take children on a walk on the shore or in the nearby salt marsh.

Portsmouth Athenaeum NR. Box 848, 9 Market Square, Portsmouth, New Hampshire.

Outstanding library and small marine museum. Ship models and other marine items relating to Portsmouth's maritime history. Open Tuesday and Thursday, 1-4 p.m. Tours for ten or less arranged by contacting Board of Directors at least two weeks in advance.

Portsmouth Public Library. Islington Street, Portsmouth, New Hampshire. For information contact Sherman Pridham, Librarian, 436-5724.

Isles of Shoals room has excellent collection of photographs, manuscripts and books about the off-shore islands.

Portsmouth has many old, restored houses. Most of them were the homes of ship captains so they have many furnishings, books, maps and charts and instruments relating to the marine tradition. The Portsmouth Chamber of Commerce, 278 State Street, Portsmouth, has a booklet describing the houses. Most of the houses are open from May 1 through September and most offer group rates.

VI. Sources of Information - Agencies, Literature and Films

Agencies

UNH Marine Advisory Program, 222 Kingsbury Hall, Durham, New Hampshire 03824, telephone 862-1889. This office is a clearinghouse for New Hampshire marine information.

New Hampshire Fish and Game Department, Bridge Street, Concord, New Hampshire 03301, telephone 271-2789.

Literature

Abbott, R.T., A Guide to Field Identification of Seashells of North America, Golder Press, 1968. Reference.

Amos, William H., Life of the Seashore, McGraw-Hill, 1966. Grades 7-12.

Bascom, W., Waves and Beaches, Anchor Books, 1964. Reference.

Carson, Rachael, The Edge of the Sea, Houghton-Mifflin, 1955. Grades 7-12.

Chapman, V.J., Seaweeds and Their Uses, Putnam, 1952. Reference.

Epstein, S. & B., The First Book of the Ocean, Franklin Watts, 1961. Grades 6-8.

Kingsbury, John, The Rocky Shore, Chatham Press, 1970. Grades 7-12.

Kohn, Bernice, The Beachcomber's Book, Viking, 1970. Grades K-8.

Milne, Lorus & Margery, When the Tide Goes Far Out, Athenaeum, 1970. Grades 7-12.

Miner, R.W., Field Book of Seashore Life, Putnam, 1950. This is the standard guide to invertebrates, the animals that dominate the intertidal zone.

Percy, Loran, A Beachcomber's Botany, Chatham Conservation Foundation, Box 317, Chatham, Mass., 1968. Excellent reference for seashore plants.

Robbins, Sarah & Clarice Yentsch, The Sea Is All About Us, Peabody Museum of Salem, Massachusetts and Cape Ann Society for Marine Science, Inc., 1973. This book and Zim's Seashores are the two best guides for beginning tidepoolers.

Ryan, Peter, The Ocean World, Puffin Books, 1973. Grades 7-12.

Stout, G.D., The Shorebirds of North America, Viking, 1967. Reference.

Waters, John, Exploring New England Shores, Stonewall Press, 1973. Grades 7-12.

Zim, Herbert, Crabs, William Morrow and Co., 1974.

Zim, Herbert, Sharks, William Morrow and Co., 1966.

Zim, Herbert, Snails, William Morrow and Co., 1975.

Zim, Herbert, Waves, William Morrow and Co., 1967.

Zim, Herbert, Seashores, Golden Press, 1955. Excellent full color guidebook useful for grades 5 through adult. Inexpensive and compact.

Zinn, Donald, A Handbook for Beach Strollers, Pequot, 1975. Grades 7-12.

Special Literature

Waters, Barbara, Oceans in the Classroom. Five excellent booklets for teachers and youth leaders working with grades K-8. Tells how to set up a marine aquarium plus many field trip and project ideas. The excellent bibliography alone is worth the price of $1.25. Order from Nancy Cox, Plymouth County Extension, High Street, Hanson, Massachusetts 02341.

Films

Free loan films can be ordered, one month in advance of need, from the following places. Write to them for catalogs.

Department of the Navy, Naval Education and Training Support Center, Atlantic Commanding Officer, Naval Station, Building 286, Norfolk, Virginia 23511.

Modern Talking Picture Service, 230 Boylston Street, Chestnut Hill, Boston, Massachusetts 02167.

Maine Department of Marine Resources, State House, Augusta, Maine 04330.

Motion Picture Service, Department of Commerce - National Oceanic and Atmospheric Administration (NOAA), 12231 Wilkins Avenue, Rockville, Maryland 20852.

Media Services, Dimond Library, University of New Hampshire, Durham, N.H. 03824.