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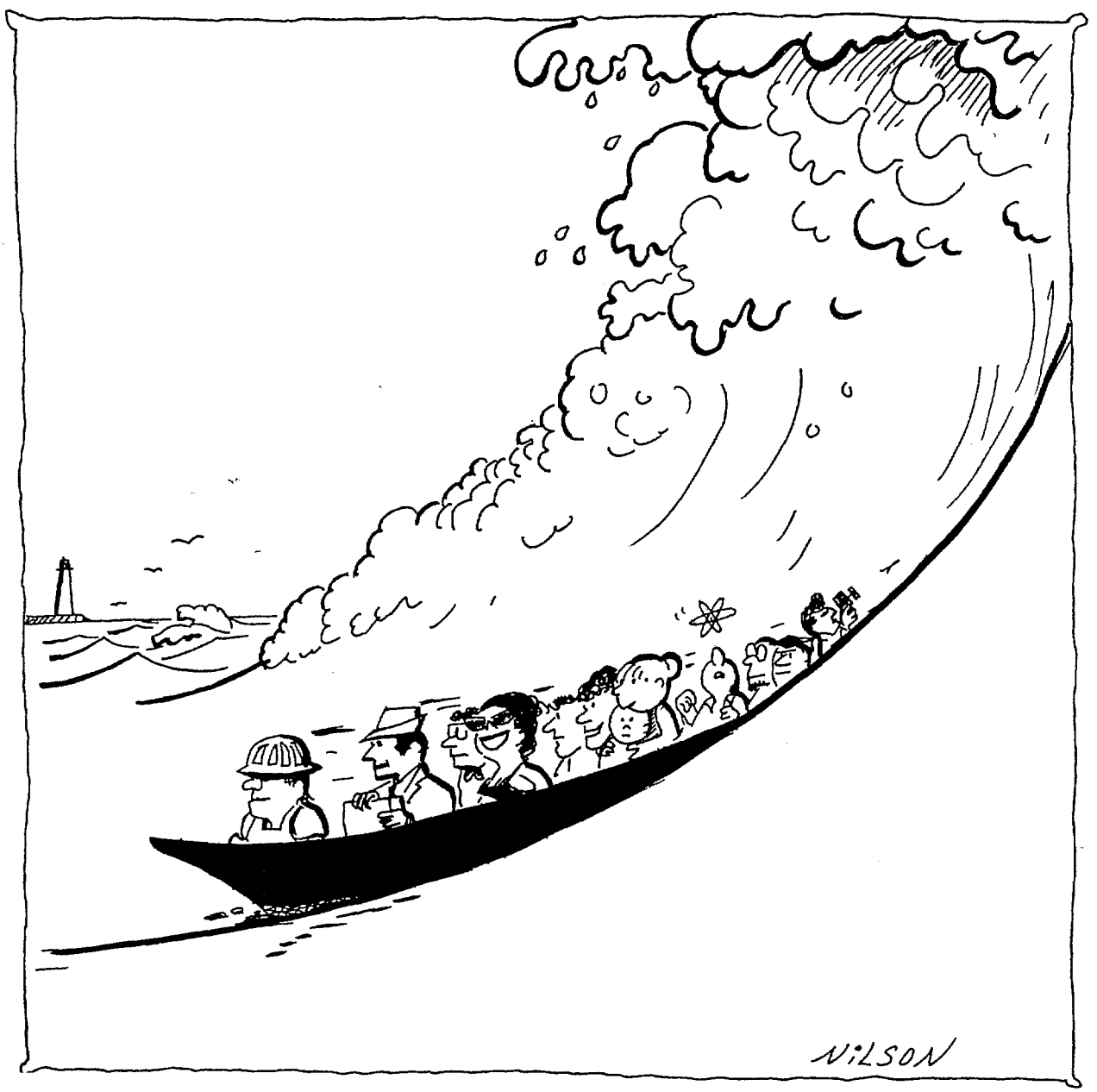
coastal issues:

A WAVE OF CONCERN



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coastal issues: A WAVE OF CONCERN

a science and social studies curriculum for high school and junior high students

original draft by

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revised by

B. Sharon Meeker

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April 30, 1991

Sea Grant Extension Program, a part of
Sea Grant College and Cooperative Extension Programs
University of New Hampshire, Durham, New Hampshire

and

New Hampshire Coastal Program

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UNIVERSITY OF NEW HAMPSHIRE
COOPERATIVE EXTENSION
Helping You Put Knowledge And Research To Work

SEA GRANT

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PREFACE

Two decades ago, the first natural history and interpretive programs were developed at the Visitor Center at Odiorne Point State Park in Rye, N. H., it has been obvious that one important part of the story of the natural and social history of the New Hampshire Coast was missing. Existing programs at the Center had done a good job of interpreting the ecology of both the rocky shore and the other coastal environments of the park. However, visitors were not seeing the issues that exist beyond the rocky shores and the sandy beaches.

New Hampshire's coastal lands are part of a larger ecosystem that includes the complex and often conflicting activities of the people who live, work and visit in New Hampshire's coastal areas. The inherent problem is a basic one: New Hampshire's seacoast is one of the faster growing sections in the state. More and more pressure for development strains the resources of local and state government to protect the natural resources and cultural heritage of the coast. Wise use and management of New Hampshire's coastal corridor is therefore imperative. The need for educational programs that contribute to a better informed citizenry is apparent.

Through several grants from the N.H. Office of State Planning's Coastal Program, the Visitor Center at Odiorne developed a coastal issues exhibit and interpretive programs. In addition, a draft coastal issues curriculum was developed for high school and junior high school students, their educators and their parents. Through an additional grant awarded to the Sea Grant Extension Program, the draft was revised and is presented at this time.

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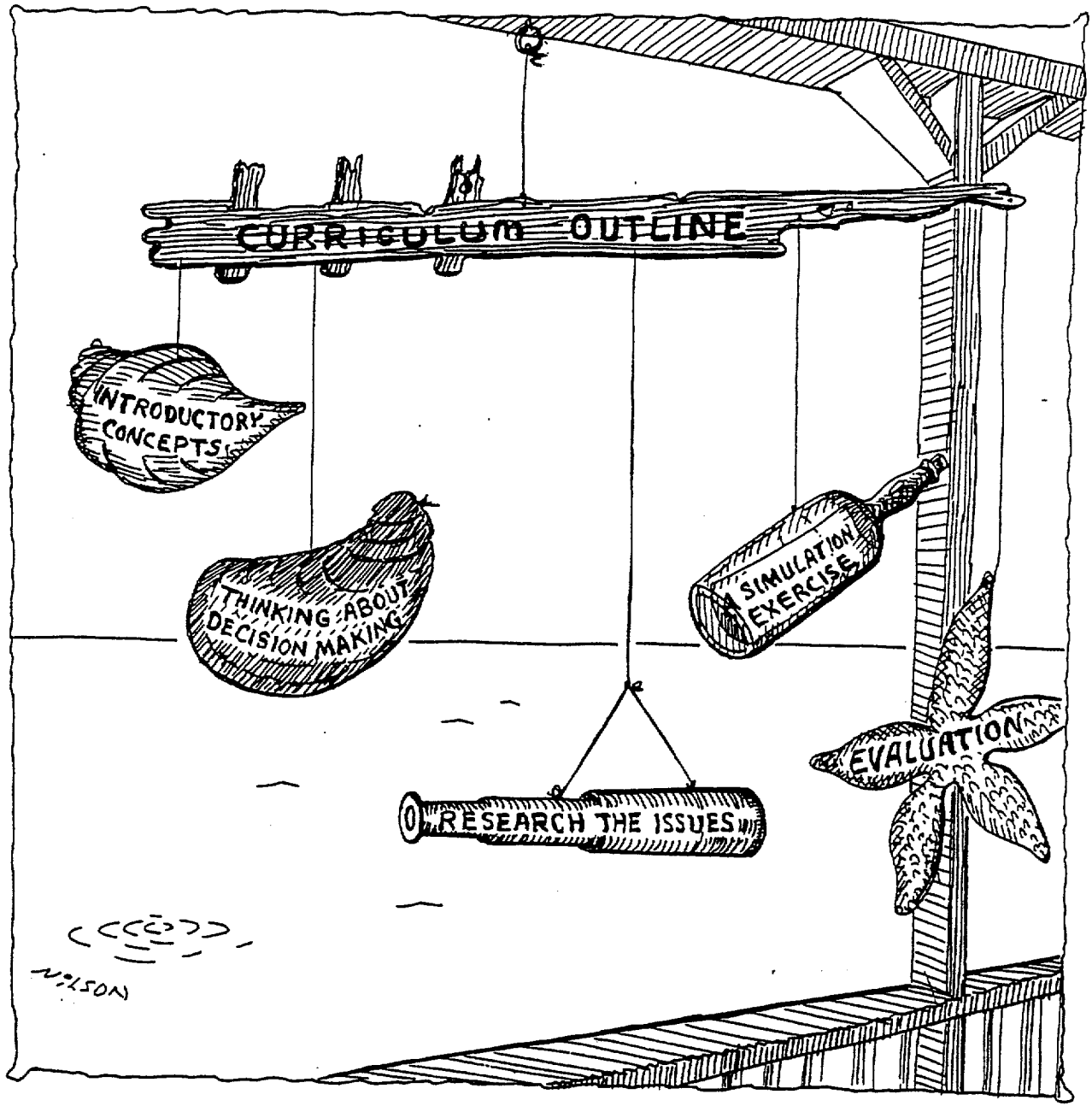
What's ahead?

Curriculum Outline



WHAT'S AHEAD? CURRICULUM OUTLINE

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INTRODUCTION

Much has been written lately on problems associated with our system of education. Our high school graduates rank behind several other countries on science and mathematics tests. Fewer and fewer students are studying science, mathematics and engineering at the college level, and by the year 2000 we can expect a serious shortage of people working in jobs that require those skills.

Another criticism of the United States' education system is that students who graduate from twelve years of study in our elementary and secondary schools are often not prepared for the society in which they must live and contribute. In a state where less than half of the graduating seniors go to college, this has equally serious implications.

How do we help students to be good decision makers when faced with complex issues such as those that exist in New Hampshire's coastal areas? There is the real necessity to teach students to apply knowledge. Educators are trying to help bridge the gap between school and the "real" world by giving students the chance to practice applying their knowledge to community issues. Learning to consider a number of possible solutions to a problem and deciding an issue on the basis of a combination of personal and collective judgement is a major life skill. In working through the exercises in this curriculum a second concept will become obvious: that there are no completely right or wrong answers, only better answers in given situations.

Using these two "building blocks" the curriculum will enable students and teachers to understand:

- the value and importance of New Hampshire's coastal resources,
- decision-making as a complex process, and
- the major critical issues that face New Hampshire's coastal communities

HOW TO USE THIS CURRICULUM

Just as the New Hampshire state coastal management process is a participatory one, the highlight of this curriculum's process is participation. Each student has a responsibility for a certain amount of information; each is expected to contribute to the decision-making and problem solving. Group process is involved, too, as individuals meet to perform different tasks. Although the curriculum is intended to be a month-long unit, the material can be expanded or compressed as needed.

In terms of **content,** teaching about marine biology and oceanography is kept to a minimum. It is assumed that students will come to this course with some science background. Some knowledge of how state and local governments work is also expected.

Students are first given an overview of the marine and estuarine resources of New Hampshire and their relation to the Gulf of Maine. Next, students are involved in several exercises to help them learn this material more thoroughly. Students are then drawn through a series of sequential activities that will gradually help them focus on the process of decision-making with specific reference to the issues that involve New Hampshire's coastal area. A detailed curriculum outline gives teacher's an overview of the course plan.

CURRICULUM OUTLINE

Which way to the beach? Introductory concepts ...

Where does New Hampshire sit in the whole scheme of things? First there is an overview of the Gulf of Maine and then a look at New Hampshire's coastal resources and issues. An informational coastal tour helps flesh out these concepts for the students.

How's the water? Thinking about decision-making...

A fictional exercise in a marine setting leads students through a land-use problem. Who makes the decisions, why were those decisions made, and what were the consequences?

Get your feet wet! Researching the issues ...

This is an opportunity for students to identify the major users of the New Hampshire seacoast. Students will develop a basic profile of these users and will research some of the current problems that they face.

Take the plunge. Everyone wants a piece of the seacoast...

This is a simulation exercise in which students play the role of the users that they learned about in the previous section. They take a segment of New Hampshire's shore and develop a multi-use plan for it.

How did it go? Evaluation ...

This section contains a survey to see what students have learned. Concept-mapping and other methods may be used also.

Some Notations on Use:

Please tailor the curriculum to the needs of your students. We want to offer technical assistance wherever possible. Please do not hesitate to call on us for resources, assistance on field trips, and for classroom speakers on current coastal issues.

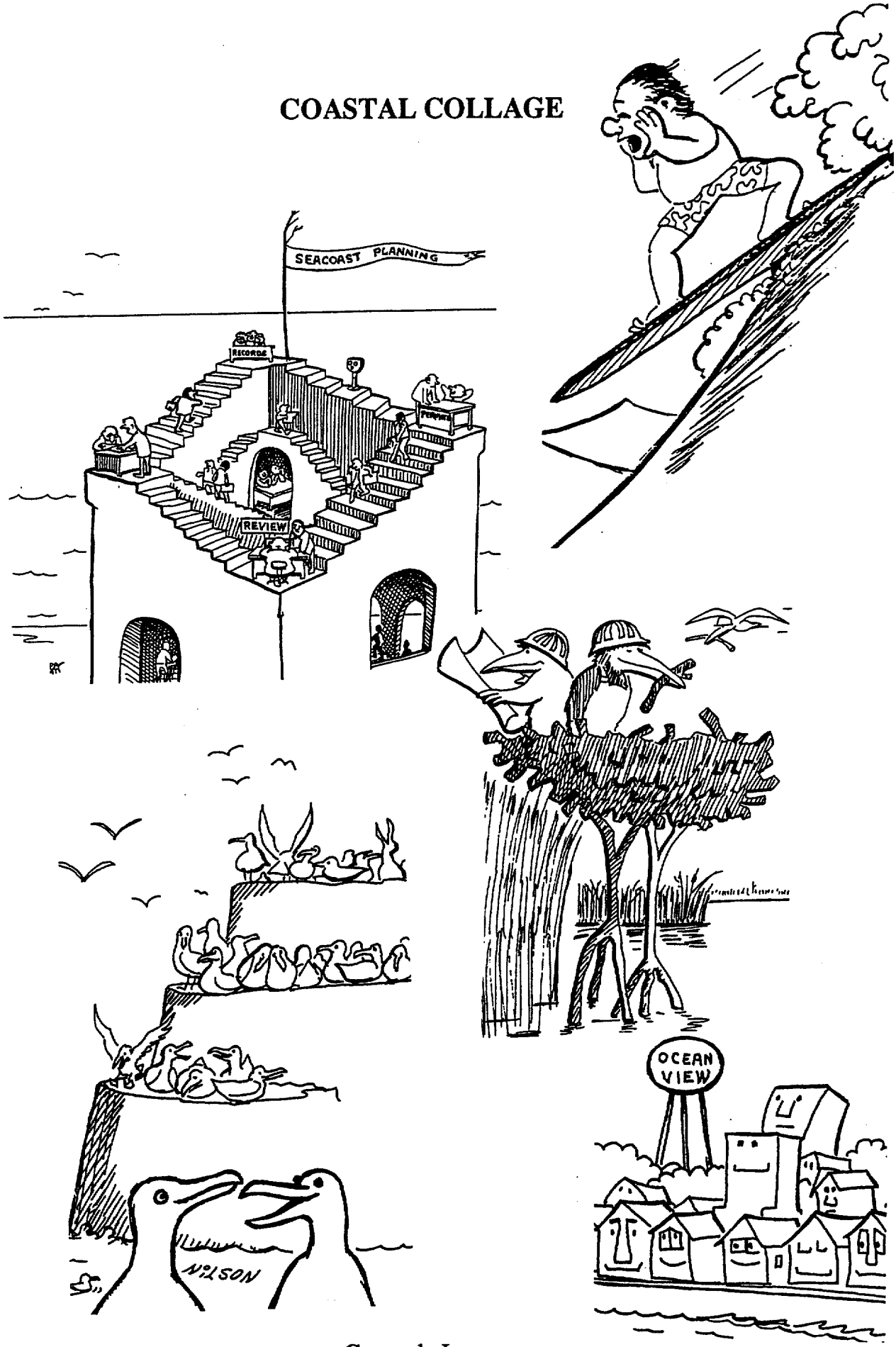
We strongly recommend that teachers consider integrating *Yankee Lands: A Land Use Curriculum* which was developed by the Antioch New England staff and colleagues. We would like to share one point that they make concerning the role that the teacher should play in this type of curriculum experience:

Too often teachers are discouraged by their students' lack of

enthusiasm for social issues. To a large extent this apathy can be overcome by teachers who are themselves concerned participants in the controversy. Teachers who will accompany groups to hearings, meetings, agency offices, etc., and who will top off the business with a bit of socializing can counteract footdragging effectively.

The participation of parents and other citizens from the community is to be welcomed. Facilitating five or six disparate groups at once can be difficult for the lone teacher, but five or six adults acting as mentors for the class, can greatly assist the process. They can be helpful with logistical support for interviewing, site inspections and field trips. Much of the information from the class will find its way into homes via the students and parents who participate. There will be a greater interest on the part of adults in issues that affect everyone's lives.

COASTAL COLLAGE



Which way to the beach?

Introductory Concepts

I: WHICH WAY TO THE BEACH? INTRODUCTORY CONCEPTS

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I: WHICH WAY TO THE BEACH?

Teachers' Guide

Concept

New Hampshire has a tiny 18-mile coastline but it increases to about 131 miles if Great Bay and the Hampton-Seabrook estuarine tidal shorelines are included. However, the resources of this coastal corridor contribute significantly to the economic, historic and social value of the state. The coastal region is one of the fastest growing sections of the state, and growth in population puts pressure on these limited, but valuable resources. Wise use and management of the coastal area is critical if we are to maintain the quality of the coast's aquatic resources and to minimize conflict among those who use them in different ways.

Objectives

1. Students will identify some characteristics of New Hampshire marine environments and relate them generally to the Gulf of Maine.

2. Students will be able to identify the marine and estuarine environments represented in New Hampshire.

3. Students will become aware of at least five of New Hampshire's coastal issues.

Lesson 1: Meet the New Hampshire Coast: A Microcosm of New England Shores.

Overview

Students are introduced to New Hampshire's coast and asked to explore relationships with the larger ecosystem of the Gulf of Maine.

Materials

Pretest: *How Well Do You Know Your Coast?*

Slide preview of the coast, *Getting a Bird's Eye View of the New Hampshire Coast".*(10 minutes)

Video: *A Sea Beside the Sea: The Gulf of Maine* (25 minutes)

Procedure

1. Give the students an overview of the course by summarizing the introductory remarks at the beginning of this book.

2. Give the pretest *How Well Do You Know New Hampshire's Coast?*

3. After completion of the pretest, discuss the answers to each question briefly with the students.

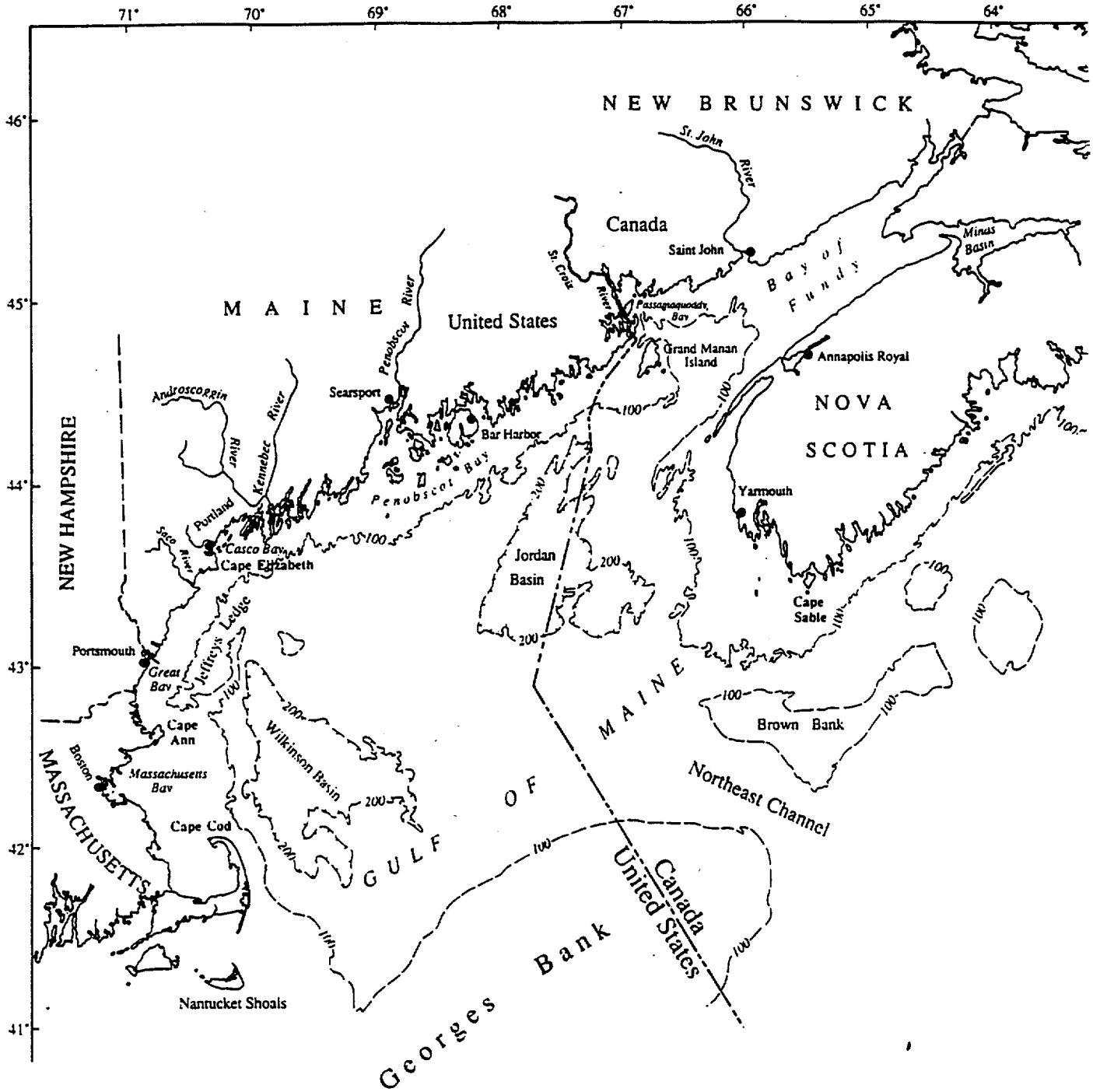
4. Ask how many students have visited the New Hampshire coast and brainstorm a list of things they remember seeing there. List their responses on the board. After you have listed several, try to determine which are natural and which are manmade. From the natural list, make a list of the nine representative marine and estuarine environments found in New Hampshire.

estuary	island	sandy beach
salt marsh	harbor	tidal river
brackish (salty) pond	rocky shore	mudflat

5. Show the slide program *Getting a Bird's Eye View of the New Hampshire Coast,* and ask them to look for each type of environment. (The program can be borrowed from the Marine Education Resource Center (MERC) at the Sea Grant Office.)

6. Ask them to discover relationships between the Gulf and the New Hampshire coastal region, using the two lists of manmade and natural entities, as they watch the 30-minute video-tape, *A Sea Beside the Sea.*

New Hampshire is a Part of the Gulf of Maine.



Lesson 2: What are New Hampshire's coastal resources? What are the current issues surrounding them?

Overview

New Hampshire is facing a number of critical issues related to growth:

- •pollution,
- •natural resource and habitat destruction,
- •using waterfront areas for uses that are not water-dependent
- •public access versus private property
- •ignorance and/or neglect of historic sites

Materials

Slide Program: *Coastal Issues: Children of the Waters* (available from the Sea Grant Extension Office, free of charge). A taped narration is provided and the script is included in this section of the curriculum.

Coastal Area Map

Procedure

1. Introduce students to the concept of "issue." The dictionary defines it as "a matter that is in dispute between two or more parties." Try to get students to give examples of issues that affect their own lives. Then discuss and give examples of what an issue involving the coast might be.

2. Show *Coastal Issues: Children of the Waters* .

3. Discuss briefly, listing the issues the students can derive from the slide program.

4. Reading assignment: Read *What are New Hampshire's Coastal Issues.* As they read, have them augment the list of issues they had begun following the slide program. A brief discussion should follow the reading with the students giving examples of real situations within each issue.

Lesson 3: Coastal Issues Field Trip from Great Bay to Seabrook.

Overview

The purpose of the trip is to acquaint the students with the coastal area and to provide opportunity for short, informational stops at some sites along the way.

Materials

Maps of Ceres Street and Bow Street area in Portsmouth and Bob Nilson's map of the seacoast (both are included in this section) notebooks, clipboards, pencils, a large map of the coastal area. (Several cameras and pairs of binoculars would be useful, also.)

Procedure

Hand out Bob Nilson's map of the seacoast and discuss it, noting the points of interest that you will be stopping at along the way. In their notebooks, the kids can list the informational stops and prepare to make notes as they proceed on the field trip.

A UNH Marine Docent can accompany you on your field trip for a small fee and serve as a guide. Contact the Sea Grant Extension office for assistance in planning your trip and making the necessary contacts. Following are some suggested informational stops on the coastal field trip. You may want to include others.

1. **Hilton Park** It is located at the juncture of Little Bay and the Piscataqua River on the Spaulding turnpike. Use your map to orient the students. List the many natural resources you can locate from this vantage point. Also list the ways people are interacting with their environment. Keep adding to the list at each stop.

2. **Port of New Hampshire.** Proceed toward Portsmouth after leaving Hilton Park. Turn left at the first set of lights and proceed on Gosling Road until the next intersection. Turn right on Woodbury Avenue, and drive to the Portsmouth Port Authority. There the students can view the piles of scrap metal at the Port, salt piles at Granite State Minerals and commercial and recreational ships and boats at the docks. Make arrangements ahead of time to visit

the Port briefly and talk with the Port director regarding expansion of the Port, etc.

3. **The Portsmouth Waterfront.** Driving along the Market Street Extension allows you to point out the water dependent uses being made of the waterfront. For example, salt piles indicate that the salt is brought in by ship (but one might ask if it should be stored so near the water). Contact Rockingham County extension educator Roland Barnaby and ask him to discuss water-enhanced versus water-dependent uses with the students as they take a short walk through the waterfront area. They should mark their maps to indicate the water-dependent and water-enhanced uses they observe while walking along Ceres Street and up Bow Street to Harbor Place Condomiums. Sometimes there is a fine line between the two types of uses, and there will be some disagreement among the students about their identification.

If time permits, visit the **Portsmouth Fish Pier and the Portsmouth Fishermen's Co-operative.** Meet the bus at the end of Bow Street, and proceed to the Fish Pier on Pierce Island, following the map which will lead you through historic Strawbery Banke.

4. **UNH Coastal Marine Laboratory and U.S. Coast Guard station.** Drive to the Coast Guard Station at Fort Constitution on Newcastle Island and visit the Coastal Laboratory for a brief tour of the facility. Discuss which research projects have relevance to every day life. This is a good chance to see some of the animals of the rocky intertidal displayed in aquaria there.

Some mention can be made of the historic significance of Fort Constitution and the work of the Coast Guard in addition to learning about the research at the Laboratory. The Coast Guard will usually provide a speaker for a short talk about careers and the work of the Guard. There is a self-guiding map of the fort.

5. **Odiorne State Park.** eat lunch there and explore the rocky intertidal area briefly.

6. **Coastal tour.** Drive along the rest of the coast, looking for the following:

a. Salt marshes whose source of ocean water is being curtailed by culverts under Highway 1A that are

too small. (Look for freshwater plants such as purple loosestrife and cattails that are invading these marshes.) Frank Richardson of the N.H. Wetlands Board will be asked to meet you at one of these locations to give a short update on efforts to solve this problem.

b. Buildings directly on the beach or very close to the shore.

c. Dunes that have been built on or that have eroded.

d. Point out that there have been plantings of dune grass on the inland sides of the Seabrook dunes to hold the sand in place.

7. **Homework assignment**: Have the students complete their notes, listing all the issues they can think of in connection with each informational stop.

Note: You may want to consider making this field experience a two-day trip. Off-season motel prices are considerably lower during the school year, and schools can get a good rate for a field trip such as this. This would enable you to add several features to the trip:

1. Plan an exercise where students are charged with learning all they can about a specific coastal town. This can be very structured with worksheets developed for use as guides to help the students interview people on the streets or in pre-arranged meetings.

2. Set up "challenge teams" and give them one hour to find out everything they can about the town. The teams should use the first five minutes to decide how to approach this challenge. Safety should be a consideration here. The Study should be done within a restricted geographical area where information may be found in town halls, fire stations, selectmen's offices, police stations, or libraries are easily accessible. An adult supervisor should be provided for each group. Be sure to debrief at the end and to draw up a profile of the town on a large sheet of paper. A student assignment could be to have each student find out similar things about their own town and make comparisons in a one-page summary as to size, ambience, location, attitudes of people, etc.

WHICH WAY TO THE BEACH? STUDENT MATERIALS

How well do you know coastal New Hampshire?

(An ungraded pretest. Keep in your file for reference.)

1. Top what extent do you think these features are found in coastal New Hampshire?

	Frequently	Sometimes	Never
barrier beaches			
sandy beaches			
wave-cut cliffs			
salt marshes			
estuaries			
bays			
continental shelf			
sand dunes			
historic areas			
state parks			
rivers			
islands			

2. To what extent do these conditions occur along New Hampshire's coastal area?

	Frequently	Sometimes	Never
polluted ocean water			
polluted estuarine water			
air pollution			
water-enhanced rather than water-dependent use of the shore			
lawns down to the high-tide mark			
buildings very close to the shore			
raw sewage outfalls			
too much road traffic			
neglect of historic sites			
(List others you can think of and rate their occurrence.)			

3. Check the importance of these human coastal activities.

	Very Important	Moderate Importance	Not Important
tourism			
commercial Fishing			
recreational boating			
recreational fishing/ hunting			
residences			
business/commercial			
industry			
research			
education			
agriculture			
shipping			
aquaculture			
defense activities			
energy production			
other (list and rate)			

Coastal Issues: Children of the Waters

(A slide-tape program with script).

1. New Hampshire's coast is a place of exceptional yet fragile beauty.

2. Though just 18 miles, New Hampshire's coast offers a wide variety of habitats such as:

3. dunes,

4. tidal rivers,

5. mud flats,

6. sandy beaches,

7. harbors,

8. islands,

9. rocky shores,

10. salt marshes and

11. estuaries, as well as

13. freshwater resources; both

14. surface and ground water.

15. In the early part of our settlement, the people of the Piscataqua River Basin were intrinsically tied to their water resources. Their front doors were often located literally at the water's edge.

17. The rivers were their highways. These ties were so great that people of this area actually considered themselves part of a river community and called themselves a river society.

18. Over time, we have turned our backs to the sea.

19. Events like the Jeffersonian Embargo and the Lousiana Purchase and the growth of railroads all helped to

20. focus our attention on our land resources rather than on the sea. Now, however, people are rediscovering the importance of this region.

21. The New Hampshire seacoast is one of the fastest growing

22. sections of New Hampshire. The area is attractive because it provides

23. cultural, recreational and historical resources. Further,

24. the seacoast provides prime locations for industry such as

25. fishing

26. petroleum transport and

27. tourism. Such a mixture of

28. activities puts pressure on the limited resources of this coastal corridor.

29. Conflicts among users can and do arise. Several key issues must be addressed.

30. First, natural resource areas need protection.

31. Natural areas are important because they provide a diversity of habitat essential to maintaining healthy species diversity.

32. Natural areas also offer protection from damage and

33. floods.

34. Natural areas are also essential nursery grounds and provide vital nutrients for fish and shellfish.

35. The ecological balance of the ecosystem can be easily upset by activities such as dredging or filling, catastrophic events such as

36. oil spills,

37. or simple misuse.

38. A second major concern relates to water quality.

39. Because development is occurring close to water sources, there is a growing concern over the potential for both pollution and for the need for anadequate water supply.

40. Getting people to the water is the next issue

41. at hand. Along the coast 75% of the land is under state ownership.

42. In Great Bay, most of the land is privately owned. Getting access to the shore is still difficult.

43. Where can you launch your boat?

44. Where can you park your car?

45. Finally, how can we balance these needs with the economic realities of the need for

46. water-dependent industries

47. heavy industrial sites,

48. and port and harbor development.

49. There are no easy answers.

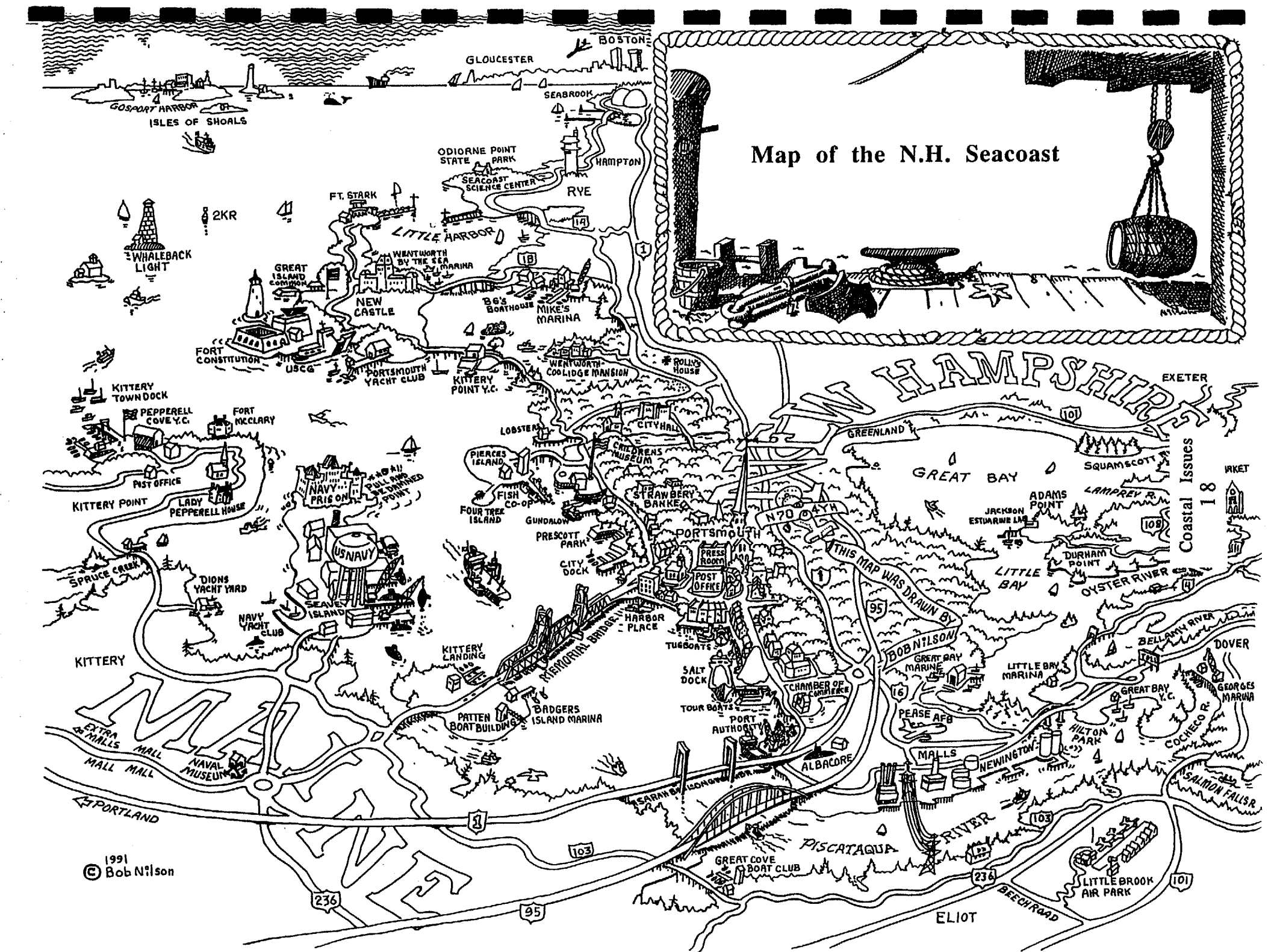
50. Conflicts are inevitable.

51. We need to look at both sides of the issue so that

52. we can rise up and

53. take part in good decision making about our coastal resources -- good decision making that will help us to again be river people,

54. children of the waters.


Map of the N.H. Seacoast
BOSTON
GLOUCESTER
SEABROOK
GOSPORT HARBOR
ISLES OF SHOALS
ODIORNE POINT STATE PARK
SEACOAST SCIENCE CENTER
HAMPTON
RYE
FT. STARK
2KR
WHALEBACK LIGHT
LITTLE HARBOR
WENTWORTH BY THE SEA MARINA
GREAT ISLAND COMMON
NEW CASTLE
B6's BOATHOUSE
MIKE'S MARINA
FORT CONSTITUTION
USCG
PORTSMOUTH YACHT CLUB
KITTERY POINT Y.C.
WENTWORTH-COOLIDGE MANSION
ROLLY'S HOUSE
KITTERY TOWN DOCK
PEPPERELL COVE Y.C.
FORT MCCLARY
POST OFFICE
KITTERY POINT
LADY PEPPERELL HOUSE
LOBSTER
CITY HALL
CHILDRENS MUSEUM
PIERCES ISLAND
FISH CO-OP
FOUR TREE ISLAND
GUNDALOW
STRAWBERY BANKE
PRESCOTT PARK
CITY DOCK
PORTSMOUTH
PRESS ROOM
POST OFFICE
NAVY PRISON
PULL AND BE DAMNED POINT
USS NAVY
SEAVEY ISLAND
SPRUCE CREEK
DIONS YACHT YARD
NAVY YACHT CLUB
KITTERY
KITTERY LANDING
MEMORIAL BRIDGE
HARBOR PLACE
TUGBOATS
SALT DOCK
TOUR BOATS
PORT AUTHORITY
CHAMBER OF COMMERCE
PATTEN BOAT BUILDING
BADGERS ISLAND MARINA
ALBACORE
EXTRA MALLS
MALL
MALL MALL
NAVAL MUSEUM
PORTLAND
SARAH MILDRED LONG BRIDGE
PISCATAQUA RIVER
GREAT COVE BOAT CLUB
NEWINGTON
MALLS
PEASE AFB
HILTON PARK
ELIOT
BEECH ROAD
LITTLE BROOK AIR PARK
SALMON FALLS R.
COCHECO R.
GEORGES MARINA
GREAT BAY Y.C.
LITTLE BAY MARINA
BELLAMY RIVER
DOVER
BOB NILSON
GREAT BAY MARINE
THIS MAP WAS DRAWN BY
LITTLE BAY
DURHAM POINT
OYSTER RIVER
ADAMS POINT
JACKSON ESTUARINE LAB
LAMPREY R.
GREAT BAY
SQUAMSCOTT
GREENLAND
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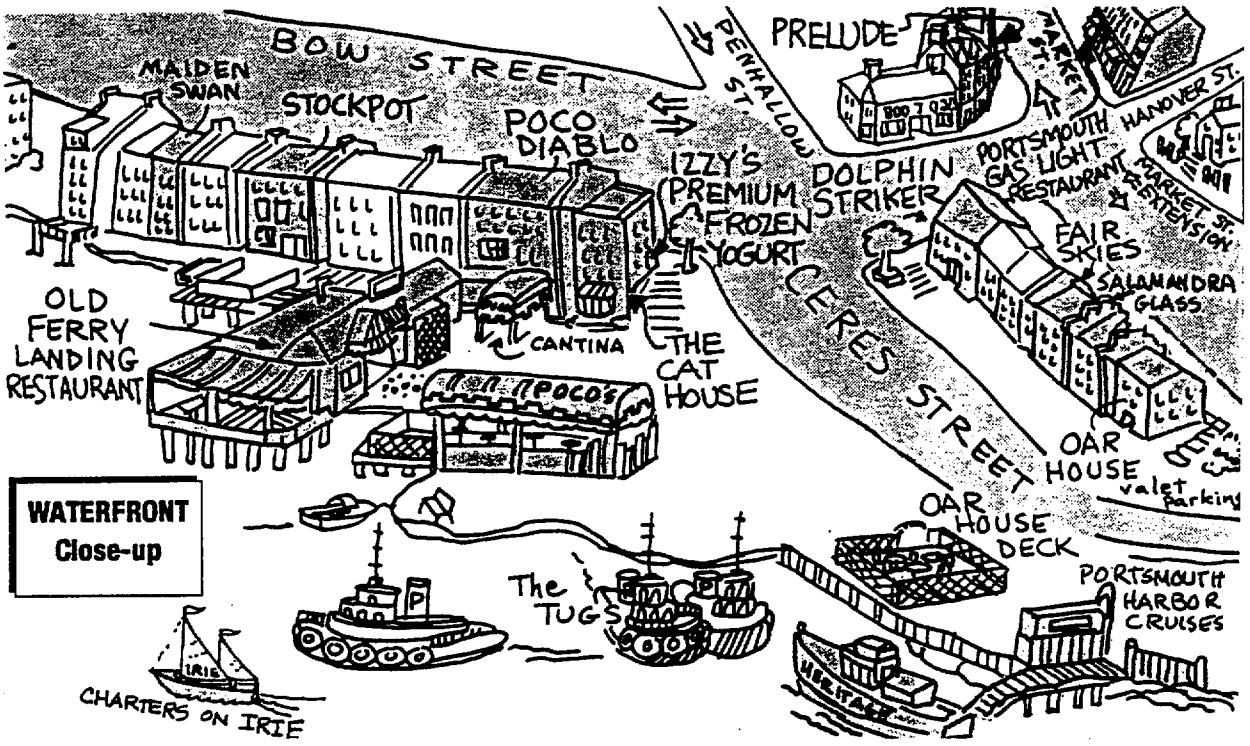
Map of Ceres and Bow Streets, Portsmouth, N.H.



Reading: New Hampshire's Coast and Its Issues

A Microcosm of the New England Shores

New Hampshire has only 18 miles of Atlantic shoreline, but if one adds the tidal coastlines along the estuaries and rivers, the miles expand to 131. Most of New Hampshire's Atlantic shoreline is intensely developed and much of it is state-owned. The public can "get to the water" easily, since 78% of the Atlantic shoreline is under public ownership. If you include **all** the tidal coastlines, 77% of the total is either owned or managed by the state.

The New Hampshire coastal zone has three areas: the Atlantic seacoast, Portsmouth Harbor and the Piscataqua River, and the tidal rivers and estuaries.

The Atlantic Seacoast

Tourists and year-round residents are attracted to this impressive mix of sand dunes, rocky shores and tidal marshes that is dominated by publicly owned parks and beaches. There has been a great deal of development on the privately owned lands. Hotels, motels and the usual beach recreation facilities stand hand in hand with family cottages, condominiums, restaurants and small shops. Public facilities seem to be concentrated in the Hampton Beach area which has city sewer services. Single family development is usually in the shoreline area that has individual sewer systems.

Highway 1A separates the coast from extensive tidal wetlands which are protected by laws limiting wetland development. The highway is built in many places on dunes that have been flattened out for that purpose, but the state does own and protect the last primary dunes in New Hampshire at the end of Hampton Beach State Park. Seabrook also protects its secondary dunes on the inland side of the highway. Dunes act as barriers protecting fragile wetlands from wave damage and absorbing coastal waters during periods of flooding. The dune system is important as a habitat for many plants and animals.

Preserving New Hampshire's dunes is important.

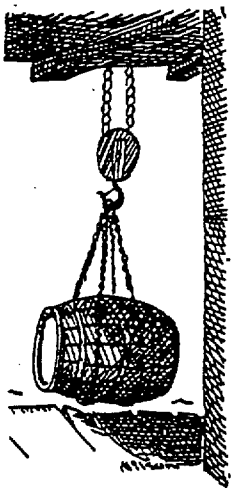
Portsmouth Harbor and the Mouth of the Piscataqua River. Here is another type of coastal landscape. The mouth of the river is broken up by several islands, one of which is Great Island where the historic town of New Castle is located. Whaleback light guides ships entering Portsmouth Harbor, the only deep-water port between Boston, Massachusetts and Portland, Maine. Portsmouth has a revitalized urban waterfront that caters to a mixture of tourism and water-dependent industry.

The state-owned commercial fish pier with its Portsmouth Fisherman's Co-op and the Port of Portsmouth terminal ensure that two key water-dependent activities will remain a viable part of the waterfront. Small shops, restaurants and historic sites have their places along the waterfront, too. The Isles of Shoals Steamship Company is another example of a water-dependent use of the waterfront that also serves tourist interests.

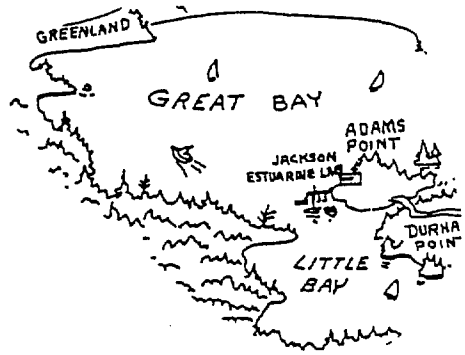
Further up the Piscataqua River, land along the shoreline is almost completely committed to water-dependent industries, mainly those related to the transport of gas and oil. The channel is maintained by the Corps of Engineers and provides the only harbor in the state suitable for oceanborne commerce.

New Hampshire has a large number of water-dependent users along its harbor and river shoreline.

The Great Bay and Hampton-Seabrook Estuaries. The Great Bay Estuary includes the upper reaches of the Piscataqua River, Great and Little Bays and seven other tidal rivers. It covers about 17 square miles and is one of the largest estuarine systems on the East Coast. It was formed as the glaciers receded, and the sea level rose, drowning several of the river valleys. The seven rivers are the Salmon Falls, Cocheco, Bellamy, Oyster, Lamprey, Squamscott and Winnicut. They drain a watershed of approximately 930 square miles, one-third of which is in Maine.



The Great Bay National Estuarine Research Reserve was officially designated in October1989 and is managed by the the N.H. Fish and Game Department. The Great Bay Reserve manager is



housed at the Fish and Game Building in Durham, N.H. Progress is being made on establishing research programs, and a small education center is being planned for a site that is owned by the Reserve on Depot Road in Stratham.

Pease Air Force Base which occupied 300 acres in Newington along the shores of Great Bay is now officially closed and has been transferred to the juridiction of the State. A federal wildlife refuge is being approved for a significant portion of it, while a small commercial airport and supporting industries are also being planned. It is one of the few places where bluffs can be found.

The Hampton-Seabrook estuary formed behind a barrier beach, with the Hampton and Blackwater Rivers supplying supplying fresh water to the system to be mixed with seawater coming in under the bridge on Highway 1-A. Bounded by beaches, sand still moves south and into the harbor in spite of the breakwater built to prevent this in the 1930's.

These tidal areas are relatively undeveloped, with the exception of three historic urban waterfronts which are each involved in urban waterfront revitalization efforts: Exeter, Newmarket, and Dover. The undeveloped estuarine areas are protected as significant wildlife and marine species habitats. Public awareness if being focused on the estuaries through the Great Bay National Research Reserve designation and various river associations' activities.

Coastal Issues and Opportunities

Historically, the state has provided legislation and programs in "piecemeal" fashion to respond to individual coastal issues such as public access, tidal wetland protection, commercial fishing, and the like. More than 60 state laws and 19 state agencies are involved in the protection, management and regulation of the coast.

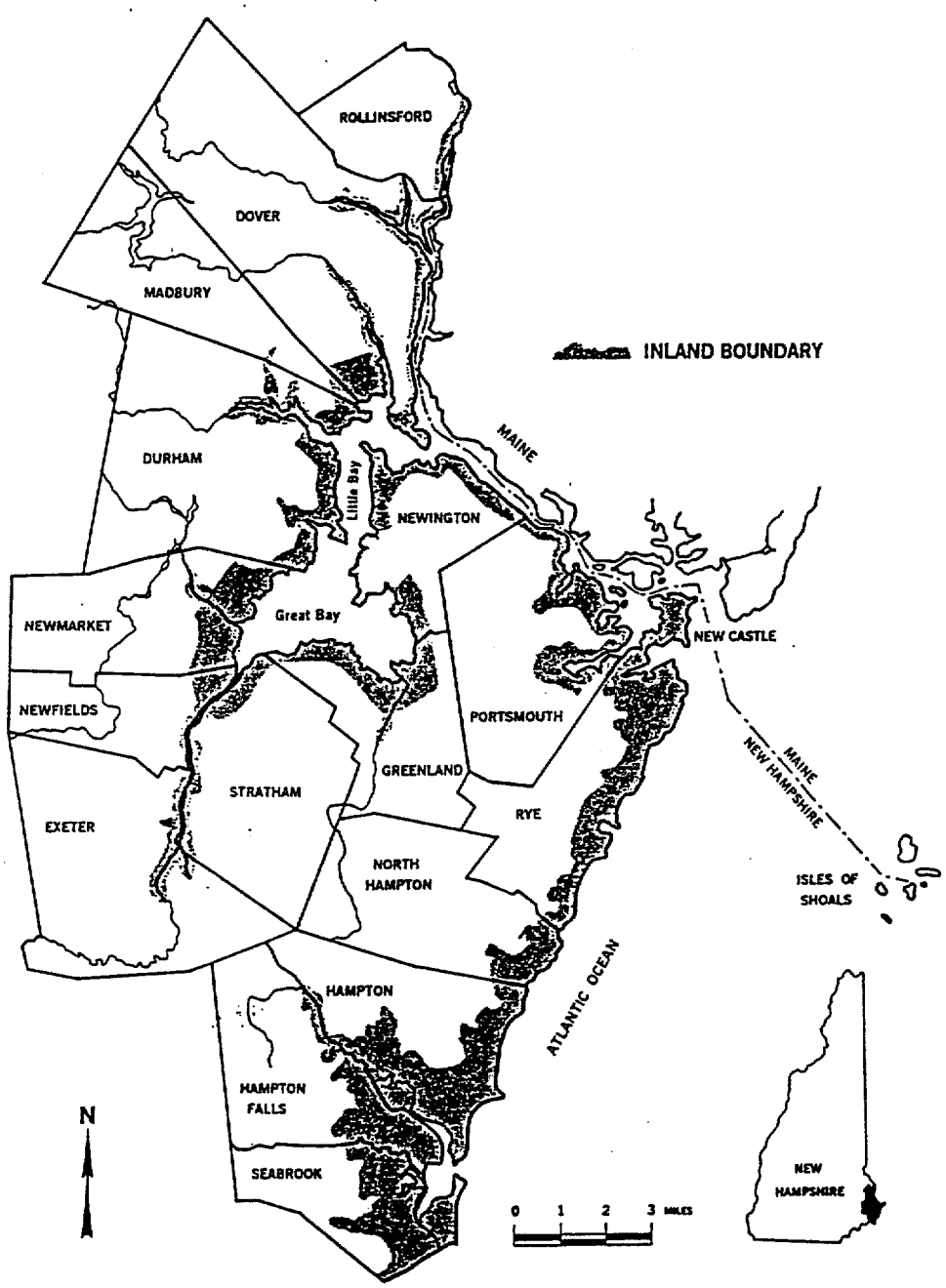
More recently, studies were made of coastal erosion and the development of the Hampton-Seabrook marshes. In 1941 there was a long-range plan developed for the Great Bay region. In the early fifties, the regional effects of Pease Air Force Base were studied, and a Portsmouth Harbor Advisory Committee was established. The sixties saw regional planning begin in the seacoast . The present coastal program received supports from the federal Coastal Zone Management Act of 1972 which was re-authorized by Congress last year.

Although coastal zone management legislation was defeated by the state legislature in 1981, a new program, relying on coordination of existing regulations was approved by the Federal Office of Ocean and Coastal Resource Management, a component of the National Oceanic and Atmospheric Administration in the Department of Commerce.

Now the coastal area is divided into two tiers. The seaward boundary is the outer limit of the territorial sea, presently 3 miles. and the inner boundary of the first tier is 1,000 feet inland from mean high water or to the limit of the Wetlands Board's jurisdiction. The second tier includes the tidal rivers and adjacent areas inland which extend to 3 1/2 feet above mean high water.

The New Hampshire Coastal Program which is administered by the Office of State Planning is most directly concerned with the management of these two tiers. Departments such as the Department of Health and Safety, the Department of Environmental Protection, and the Department of Resources and Economic Development are also a part of the management plan. The Council on Resources and Development established in 1963 acts to integrate state policies and priorities and resolve agency conflicts as they arise in the seacoast. Local master plans, set-back laws, and wetlands regulations also are important regulators of the seacoast region.

NEW HAMPSHIRE COASTAL PROGRAM



But what are the resources to be managed and issues to be met?

Coastal Resource Protection. Management of the coastal resources probably began back in colonial times local laws were passed so that many farmers could own a piece of the marsh to provide hay for their animals, and some area where seaweed washed up so that they could use it for fertilizer. Wetlands have long been considered important, but recognition of their fragility and pressures to fill and develop them have resulted in state and local protection. State laws require a permit from the State Wetlands Board and this is almost never granted. Anyone building on wetlands without a permit is subject to a fine, and they may be forced to restore the wetlands they have destroyed.

The New Hampshire Coastal Program has provided funds to aid communities in mapping their wetlands. The University of New Hampshire's Cooperative Extension Program's water resource team provides instruction in how to map wetlands.

Fish and shellfish and their habitats are protected by three state agencies under several state laws. Recreational fishing continues to increase, but commercial fishing remains at a stable rate, although it takes much more effort to catch a fish commercially than it used to due to a decline in fish stocks.

Water quality has long been a concern of the state, and it has worked hard to strenthen its control over water quality and supply. Estuaries, long known as nutrient rich nurseries for fish and shellfish, are now becoming polluted, mainly with improperly treated sewage and run-off from the land. Shellfish beds in both Hampton and Great Bay estuaries have been closed for several years, due to pollution. With population growth comes demand for an adequate water supply, and in our state, this is a growing concern.

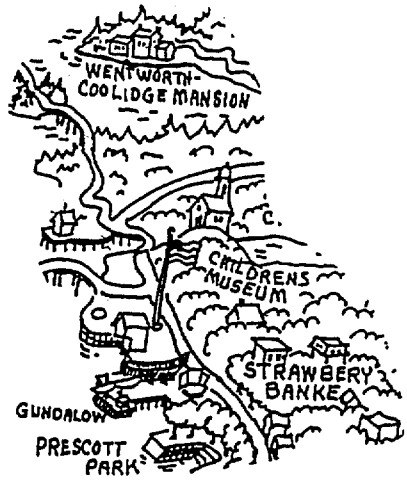
Public Access and Recreation. New Hampshire has more public access per mile on its Atlantic shoreline than any other coastal state in the nation. State beaches and parks and beaches abound and this free access to the water attracts tourists by the thousands each summer, boosting the state's economy. Bikeways along Highway 1-A and the building of a boat ramp at Odiorne have recently improved access.

Eco-tourism is becoming a popular pastime and efforts are made throughout the coastal parks to make visitors more aware of the environment. Admission fees to the parks support the state park system, and act in some cases, as a control over the numbers of people who can use a park at a given time.

Water Dependent Activities. It is because New Hampshire has such a small coastline that the state has assumed responsibility for providing for water dependent activities. Those activities include public access and recreation, commercial fishing piers, and boat ramps, moorings in each harbor. The state issues all permits for docks, piers, and seawalls and other structures. The State Port Authority is in the process of developing management plans for all the harbors in tidal waters. They have just finished the plan for the Lamprey and Cocheco Rivers and are now working on one for the Squamscott River in Exeter. The next step is for towns to adopt the plans and begin work to carry them out.

Maintaining existing channels and ensuring adequate shoreline space for water dependent uses are concerns which increase as demands from business, residential, and industrial uses compete for waterfront space. Water enhanced uses are often passed off as water dependent uses, as is witnessed by the shops, hotels and restaurants on the Portsmouth waterfront. Priorities for a place near the water are being refined as pressure mounts.

Preservation of Historic/Cultural Resources. We are all fond of learning about our "roots," and maintaining and preserving a sense of the past is important in our lives. The town of Portsmouth is well known for its historic sites such as the Sheafe Warehouse adjacent to Strawbery Banke. Rehabilitating a recognized historic resource such as the Old South Meeting House in Portsmouth (now the Childrens' Museum of Portsmouth) is a part of efforts by the state. Every town has its historical society, and often a town museum. The Tuck Museum in Hampton is one such gathering place for historic documents, period clothing, salt marsh haying tools, and other items that depict life in the community over the years. In 1981, the state amended some of its historic preservation law to more effectively address the issues of deciding

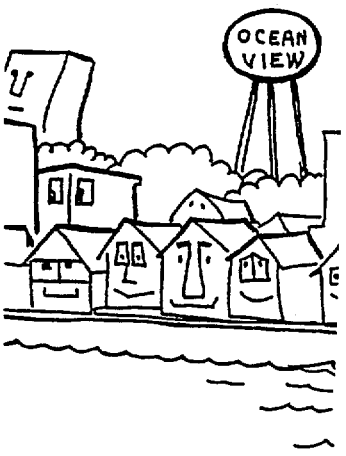


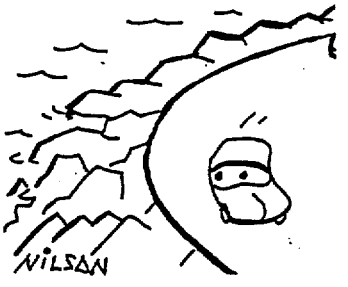
which historic properties to preserve, and which to renovate or remove.

Coastal Environmental Impacts. Concern about protecting coastal waters from such impacts as oil spills, pollution discharges, hazardous waste, erosion and sedimentation have long been a concern of the state. In the eighties, the state started an oil spill contingency program and increased its tax on oil imports to pay for it.

With New Hampshire's low coastline, flooding in the wake of storms is a problem. Protection through non-structural means such as beach renourishment and through structural methods such as maintaining seawalls continue, but the state is now prohibiting new development which might exacerbate flooding in tidal wetlands.

Managing Coastal Development. While tourism increases along the coast, many more people are wanting to become permanent residents. Seacoast community populations have grown 31% over the last 20 years. Most development within the 1000 feet of the Atlantic and Piscataqua shoreline has been single-family homes, with some apartment buildings and small businesses. Rural, unspoiled scenic qualities of land around Great Bay is being encouraged through planning and acquisition of lands for the Research Reserve. A limiting factor for development on the Atlantic shore is the fact that there is very little privately owned land left to develop. However, there are still large tracts of land along parts of the Great Bay Estuary.



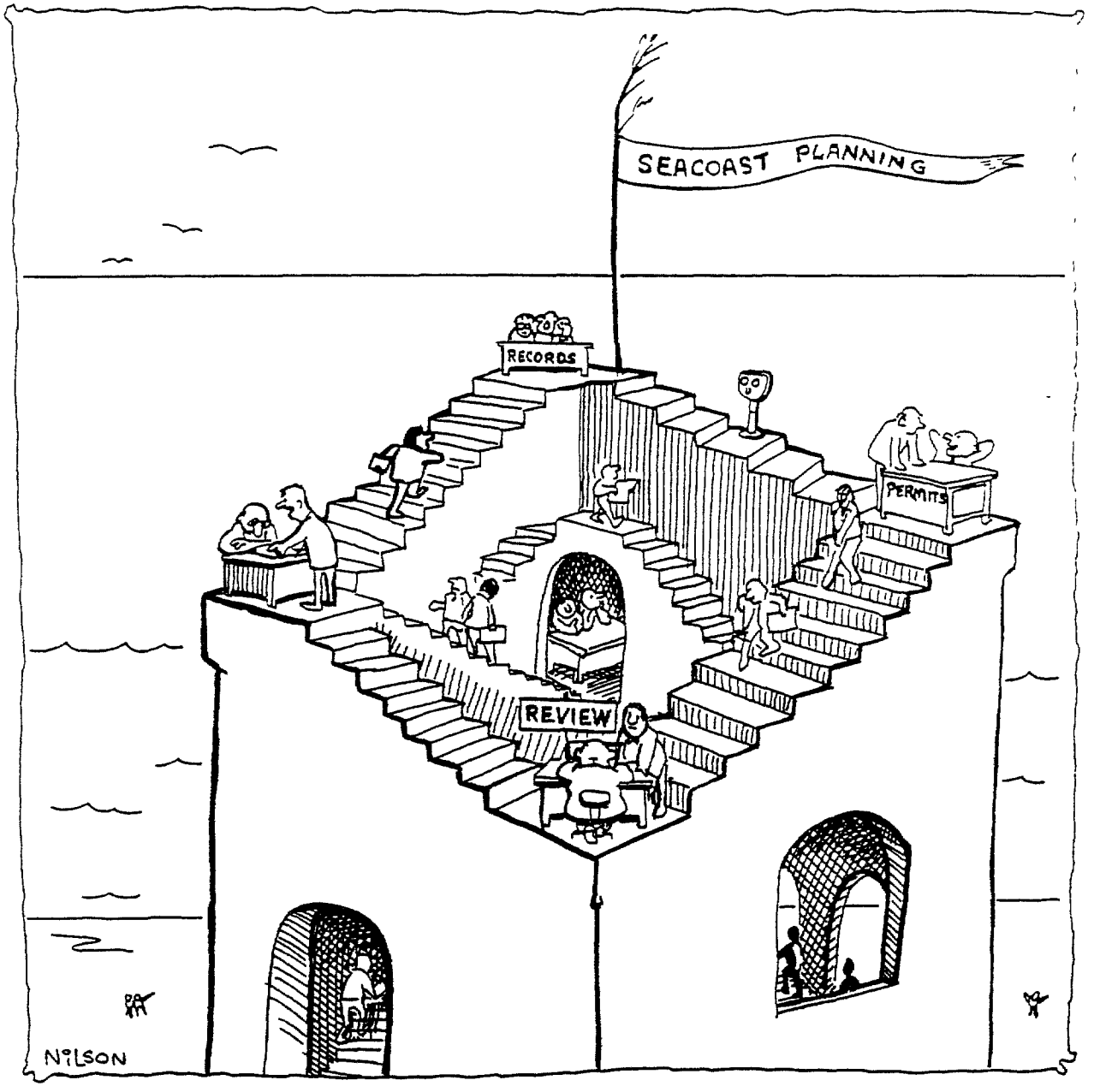


A key policy issue is striking a balance betwen resource protection and resource development. Planning assistance has been funded by the New Hampshire Coastal Program for several towns, as the towns begin to update their master plans.

In addition to protecting coastal resources against adverse impacts, the state has an interest in high cost projects such as sewage treatment plants because such projects usually require state and federal funding, in part. They also affect population distribution in the state.

How's the water?

Thinking About Decision-Making



II. HOW'S THE WATER? THINKING ABOUT DECISION MAKING.

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II. HOW'S THE WATER?

(Parts of this exercise is excerpted from *Coastal Problems and Resource Management: Teachers' Guide,* University of Hawaii.)

Teachers' Guide

Concept

Decision making is a process in which thought is given to all options for action. Then the consequences of the actions are considered, priorities are set, and choices are made. How communities plan and manage the use of their coastal resources may vary in detail. However, the basic decision-making process itself is universal, whether the decisions are being made for New Hampshire or Hawaii.

Objectives

1. To expose students to a strategy for making resource management decisions.

2. To have students understand that decisions about coastal resources usually carry both beneficial and adverse effects.

Lesson 1: Making Decisions About Coastal Areas

Overview

The emphasis in this section is on how communities make decisions about the use of coastal resources. In this lesson, students first read a short description of a coastal community where a major decision about the use of beachfront land is being considered. Students examine the several concerns community officials have in trying to reach their decision. Students then complete a planning worksheet which systematically examines the costs and benefits of the community's options.

Materials

Name tags for planners (Planner #1, #2, #3)
Scripts
Several large pictures of new cars from a magazine
Reading: *The Future of Bayshore Island*
Planning Worksheet

Procedure

1. Show the pictures of cars to the students and ask them to imagine a family trying to decide whether they should buy a new car.

2. Ask the students what factors the family members should consider before trading in their old car for a new one. List their answers on the blackboard. Students may give several important concerns they might have, such as:

   a. How much does the new car cost?
   b. Can we afford it?
   c. What would repairs cost for the old car?
   d. Are family needs for a car the same now as they will be next year? in two years?

3. Make a short transition from this example to the topic of this lesson, by saying something like the following:

   By thinking about these kinds of questions, the family members can decide what to do. They are considering the advantages and disadvantages of trading their old car for a new one. This process is a helpful way of

organizing evidence. People who make decisions about how to use the coastal area do the same kind of analysis. By weighing the advantages and disadvantages of each option, people can better understand the consequences of their decisions. In this unit, we will be studying ways communities plan and manage the use of coastal resources.

3. Read aloud the first three paragraphs of *The Future of Bayshore Island* to the students.

4. Ask for three volunteers to act as the planning board for Bayshore City. Give them their name tags and have them sit around a table in the front of the room. Ask them to simulate a planning board meeting by reading from the scripts.

5. Hand out the "planning worksheets" and divide the students into several groups. Give them 10-15 minutes to fill out the worksheets together.

6. Convene the whole class as the Planning Board and ask each group to report their findings. List advantages and disadvantages of the proposed development under each category. Note that although this doesn't tell them exactly what to do, it does help insure that they will consider a wide range of factors.

7. Then, ask:
   a. What other information would you like to have before making a decision?
   b. Do you think the new resort should be built? Why?
   c. What are the most important factors in helping you reach this decision?
   d. How did you decide which are the most important factors?

8. Homework assignment: Write a one-page essay, telling whether you think the new resort should be built. Use information from the class discussion and your worksheet to back up your opinion.

THE FUTURE OF BAYSHORE ISLAND

Bayshore, N. H. sits on the coast of the Gulf of Maine, and is joined by two small bridges to Bayshore Island, which is a part of the town. Boston, Massachusetts is only an hour away. Manchester, N. H. is within a 45-minute drive. About 10,000 people live on the island operating small farms, tourist businesses, fishing boats and light industries. For years, its small resorts and vacation homes have brought in a few regular tourists from the nearby mainland cities. But Bayshore Island has remained fairly quiet and uncrowded, and it is this atmosphere that attracts a small number of faithful summer visitors.

However, over the past 10 years, the resort business on Bayshore has not enjoyed the boom that has hit other parts of the coast. The small hotels and beachfront cottages don't attract as many people as they once did. The economy of Bayshore Island is definitely feeling the results of "not keeping up." More people are out of work, and some residents are moving away from the island to find better chances for employment.

Recently, Heavenly Cloud Resorts, Inc. announced plans to build a large resort complex on the west shore of the island. The Bayshore selectmen have to decide whether to allow Heavenly Cloud to build the new hotel. The mayor asked the planning board to consider thr question.

Script

Planner #1: ..and if we give the go-ahead on the resort, it will really be a big help to the economy of the whole town.

Planner #2: Tourism hasn't really flourished here for years. I think the new complex will mean a real boost. Just exactly what will this mean to our economy? Do we have any figures on its economic impact?

Planner #1: The best estimates suggest that it will employ about 200 people. We need jobs in this community! And it the hotel runs at average occupancy rates, it will bring in about $2 million a year.

Planner #3: What about other businesses? Will this give them a boost?

Planner #1: Three new restaurants are already planned to go in if the hotel is built. And we think some new fast-food stores, a dive shop and maybe a boutique will want to open, too.

Planner #2: What are the chances that other hotels will go in that same area?

Planner #1: If the Heavenly Cloud Resort is successful, we think two or three more large complexes will come in. Tourists attract other tourists, you know!

Planner #3: What about tax revenues? What kind of property taxes can we expect to get out of this?

Planner #1: First, we can get some tax dollars as soon as they purchase the property. But when they build the hotel, property values will increase and the taxes will be higher.

Planner #2: That new revenue would mean a lot to our city. We could start to upgrade our fire equipment, which we would need more of with a complex like that to cover. We could resurface some of the town roads, too.

Planner #3: Speaking of highways, you know one thing we have to consider, with all these new tourists coming in, is that narrow two-lane road through the west shore area will have to be widened. It can't carry all that extra traffic. We'll have major traffic jams. That will be one cost to the city when this hotel goes in. The city will have to pay for either new roads or better police control of the traffic. What other costs connected with this hotel will the city likely have?

Planner #1: We'll need extra police protection for the beach area, and we may need to upgrade the sewage treatment facilities to handle the extra volume of water during the tourist season. These are the biggest costs the city will have to think about.

Planner #2: What's this hotel likely to do to the environment on the west shore? There's a lot of beautiful beach there, and some nice upland areas, too.

Planner #1: A lot of that will have to go. Progress, you know! I suspect that those sand dunes along the north edge of the complex area will have to be leveled. As far as water quality is concerned, the hotel people have promised to provide good sewage treatment facilities for the complex itself.

Planner #3: What about access? There are a lot of local people up in that area who go to that beach often. The mayor's office has gotten a lot of complaints about the hotel being built. With the election coming up soon, the mayor may not want to take any action that would anger people there.

Planner #2: Most of these people are worried about losing access. They're afraid that the beach will be for hotel guests only. And they are **really mad.** Listen to this letter:

"Dear Mayor, The fishermen on the west shore do not want a hotel to be built here. It will ruin the area for fishing if thousands of tourists come here. Our families won't get to go to the beach any more. All the dunes will be leveled! There isn't another spot like this on

the island. Don't ruin it for us."

Planner #3: It is true that the new hotel will change the quality of life in that area and the whole west shore will change in character. It will be more tourist-oriented, with more shops, people, and traffic. People are not going to be able to walk down the street and know everyone they meet anymore.

Planner #2: We're likely to get a lot of community opposition on the approval to build. Besides, there has been some talk from west shore residents about making that beach into a park. You know, there aren't any parks on the island at all.

Planner #1: Well, I'm not sure. I think the people over there wouldn't mind the hotel. It will help out the economy. They're smart folks. They know the hotel will mean better business and rising land values. Maybe we'd better get out there and do some interviewing to find out just what the west shore residents want.

Planner #3: Good idea, but we still have to keep in mind all the economic benefits. Just because a few people don't want the hotel doesn't mean we all have to be penalized.

Planner #2: This isn't going to be an easy decision!

STUDENT MATERIALS: PLANNING WORKSHEET

Question: Should a resort complex be built on the west shore of Bayshore Island? The worksheet will help you make up your mind. Use the planning board meeting information and your own ideas as to the disadvantages and advantages of the proposal.

ECONOMY

Advantages	Disadvantages

ENVIRONMENT

Advantages	Disadvantages

POLITICAL/SOCIAL

Advantages	Disadvantages

PLANNING WORKSHEET POSSIBLE ANSWERS

Question: Should a resort complex be built on the West Shore of Bayshore Island?

ECONOMY

Advantages	Disadvantages
-employ 200 people	-could hurt already existing tourist businesses
-$2 million tourist dollars/year	
-Other hotels will follow	
-25,000 tourists in the summer	
-land values will rise	

ENVIRONMENT

Advantages	Disadvantages
-Provide own sewage facilities	-Beach vegetation destroyed
	-uplands damaged
	-Sand dunes leveled

POLITICAL/SOCIAL

Advantages	Disadvantage
-gain in tax revenues for city/state	-city must expand highway, provide more police protection
-new fire equipment	-more fire protection needed
-more modern, richer life-style	-access problems
-mayor gains support from those favoring hotel	-end quiet life-style
	-people lose beach, fishing
	-mayor loses support from west shore residents

Are there other advantages or disadvantages to building the resort that should be considered but which do not fit into these three categories? For example: Can the park be built if the hotel is built?

Get your feet wet.

Researching the Issue

WELL, THERE GOES THE NEIGHBORHOOD!

III. GET YOUR FEET WET

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III. GET YOUR FEET WET!

Teachers' Guide

Concept

The process of developing and implementing coastal land use and management plans involves the interplay of individuals from various levels of the community. Not only must the concerns of both individuals and user groups come into play, but there must be compliance with the laws and regulations established at local, state and federal levels.

In New Hampshire and other northern New England states the concept of "home rule" is a very strong one. It influences how people feel about the rights and responsibilities of the communities in which they live. "Home rule" dominates the structure of local governments and has a very strong influence on how land and water use decisions are made in New Hampshire. The fact that the New Hampshire legislature is one of the largest governing bodies in the world reflects just how important local concerns are, even at the state level.

Objectives

1. Students will identify and become familiar with the concerns of the major user groups that make up the seacoast community of New Hampshire.

2. Students will become involved in an on-going coastal issue.

3. Students will identify and use resources that can contribute to decision making on a particular issue.

4. Students will discover that the community is a resource for gathering information about an issue.

5. Students will understand in a general way how local, state and federal regulations and laws impact the decision making process.

Lesson 2: What role does government play in managing coastal lands?

Overview

In this exercise students will be given a brief overview of the role that government must play in making decisions about the use of land and water in the coastal area.

Materials

Reading: *The Daily Splash*

Hand-out: *Making It Work - Political Systems Diagrams*

Reading: *Lamprey Village Inn Proposal*

Chart: *Example of One Form of Town Government*

Procedure

1. To begin focusing attention on the role of government in coastal management, have students read *The Daily Splash.*

2. Discuss the major concepts expressed in the reading during a discussion of the reading. List them on the chalkboard.

- public's expressed need for access to the shore
- poor initial plans by the developer for the project
- higher costs than anticipated
- local control vs. state and federal control
- needs of the existing community
- lack of coordination among agencies
- lengthy vs. quick approval time for permits

3. Use the worksheets, *Making it Work: Political Systems Diagrams,* with yours on transparencies to help students understand how the system works.

Diagram 1: Ask students to identify who the users and coastal resources are in the Seaside development. (Write on your transparency while the students fill out their worksheet.)

Diagram 2: Then refine the users into the three categories: of special interest groups, public interest groups, and the general public. Ask the students questions such as:

Which of the letters were written by people who represent a group with a special interest? (Example: Association of Concerned Developers). Do the same for public interest groups, and members of the general public. Try to have the students define these groups. Ask if there should be more categories for the public.

Diagram 3: Ask students what are the other parts of the systems diagram? Write in "regulatory agency," and explain that this includes many of the groups that the letters were complaining about:

Examples: Army Corps of Engineers must give permits for anything happening in naviagable waters such as where the marina was going to be built. Local planning board approve the project based upon input from conservations commissions, people who are going to live next to the project, and other interested parties. The state must issue permits for dredging and filling, siting of energy facilities, sewage treatment, and road construction. Regulation also includes seeing that state and local standards are met during construction and that they are maintained for the life of the project.

Diagram 4: Show the completed diagram and ask what effect the **legislature** has on Seaside. The legislature can influence decision making and regulation through the making of laws and arranging for their enforcement.

Ask if the students think that **court** action is necessary in the the Seaside development case. Who might be likely to bring suit and for what reason? (Example: The developer might sue one of the agencies for the long delay in issuing a permit.) How else can the courts function in the Seaside case? Draw several examples from the students.

4. **Homework Assignment:** Have the student make up a mock proposal for the Lamprey River Inn. Let them work in small groups on this assignment. Ask them to identify the permits needed and the local and state agencies who give them. Finally, have them identify the steps they think should be taken in the process. Ask a member of your town government to come to the class to discuss their plans and how the process works in your town.

THE DAILY SPLASH

Publisher, President
John Q. Public

§§§§§§§§§§§§§§§§§§§§§§§§§§§§§§§§
from the editor:

A few days ago, our paper printed a letter from Mr. William Eagerton complaining about how much money he is losing on his housing project. He blames it all on all the regulations he has had to comply with. Since his letter was printed, several folks have written in, some to agree with him, and others to disagree. We are going to print his letter and some of the replies.

ISN'T THERE A BETTER WAY?

to the editor:

It was just four years ago that I brought my plans for building Seaside, a 600-unit planned development along our south-east coast. The homes were to be modestly priced for young, middle-income families. A marina, boat club, private beach and a recreational center were a part of the complex.

I thought it would take two years and cost about $1 million in architect, lawyer and consultant fees to meet all the regulations and get approvals and permits. I cannot believe it! It has taken four years and four million dollars and I am just getting started on

S. R. Tanson
Office of State Planning

to the editor:

I agree wholeheartedly with Mr. Eagerton. There are too many levels of government involved! But we have to have some governmental review of projects.

J.R.Long, Selectman

to the editor:

I attended a public hearing held by the Coastwise Engineers. I was shocked to hear that Eagerton wants to build his marina alongside a major turning basin for commercial ships entering the harbor. People would have to go through the turning basin to get to their boats. Would this be safe??? I think NOT! How can the U.S. Engineers and state and local officials ignore this and go ahead and issue permits for building the marina near the turning basin? Also, we can't put national and international trade at the

mercy of a local marina! The federal government must be involved in the review process whenever navigable waters are involved.

A Concerned Citizen of the World

to the editor:

As a marine biologist, I see both positive and negative sides to having so many agencies involved in granting approvals for development such as Mr. Eagerton proposes.

On the one hand, all development projects must be reviewed by environmental experts. Otherwise, our shoreline environment would surely be destroyed. But each agency has its own narrow view and no one is responsible for considering the **total** impact of a project on the environment.

Mr. Eagerton's Seaside project was reviewed by separate agencies for sewage disposal, road improvement and flood control. In each case the project met the minimum standards for each permit. Yet the combined effect of soil washed into coastal waters along with sewage disposal and flood waters is enough to destroy many of the plants and animals that live near the shore.

We need to have a process that looks at the total environmental impact picture of each proposed development.

N.W. Wainright, Professor
Marine Biology
University of New Hampshire

to the editor:

Poor Mr. Eagerton -- poor city! We could benefit a great deal from a development like Seaside. It would create jobs and provide places for people to live who want to work here, but the project is bogged down in paperwork and red tape.

I know how Mr. Eagerton feels. Two years ago, the Civic Club wanted to build a private dock and small boat harbor to give low-income and handicapped children some boating fun. We are only half-way through the process and expect it will take another year at least before we can start to build. We have already spent thousands of dollars filling out forms. Why can't agencies on the federal, state and local level get together? Why do they all have to review the same things?

Wallace Wentworth, President, Civic Club.

to the editor:

I think we need to have a long review process to protect the citizens and environment. It would be easy to make the process a "rubber stamp" for developers. Mr. Eagerton is paying more because he submitted poor plans in the first place. If he had taken the time to develop high quality plans in the first place, he would not have had all this trouble.

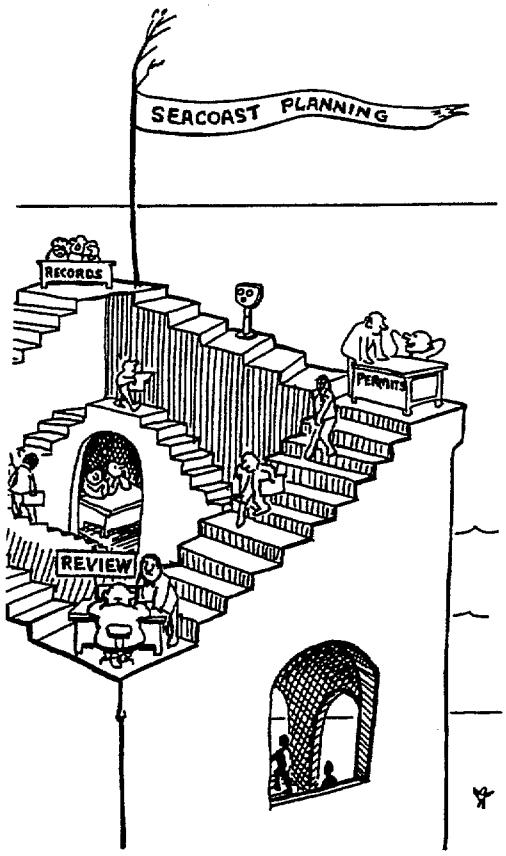
Jim Barns, President, Citizens for Better Government

MAYOR EXPRESSES CONCERN

We must ensure the health and safety of our citizens. This is best done at the town level. We have fine officials who are in the best position to evaluate a local project right here, where it will be built. How can state or federal officials know what our needs are? When they make decisions that affect our town, they are not accountable to our local people for the success or failure of their ideas.

With the Seaside project, we believed -- and experts supported our view -- that the proposed housing project would not create environmental damage. Yet the federal agencies said it would. They have been the ones causing the delays. Because of them this Seaside project has not yet been built and we have several hundred workers still out of a job.

We want to protect natural resources and our town, but Seaside looks great to us!



MAKING IT WORK: POLITICAL SYSTEMS DIAGRAMS

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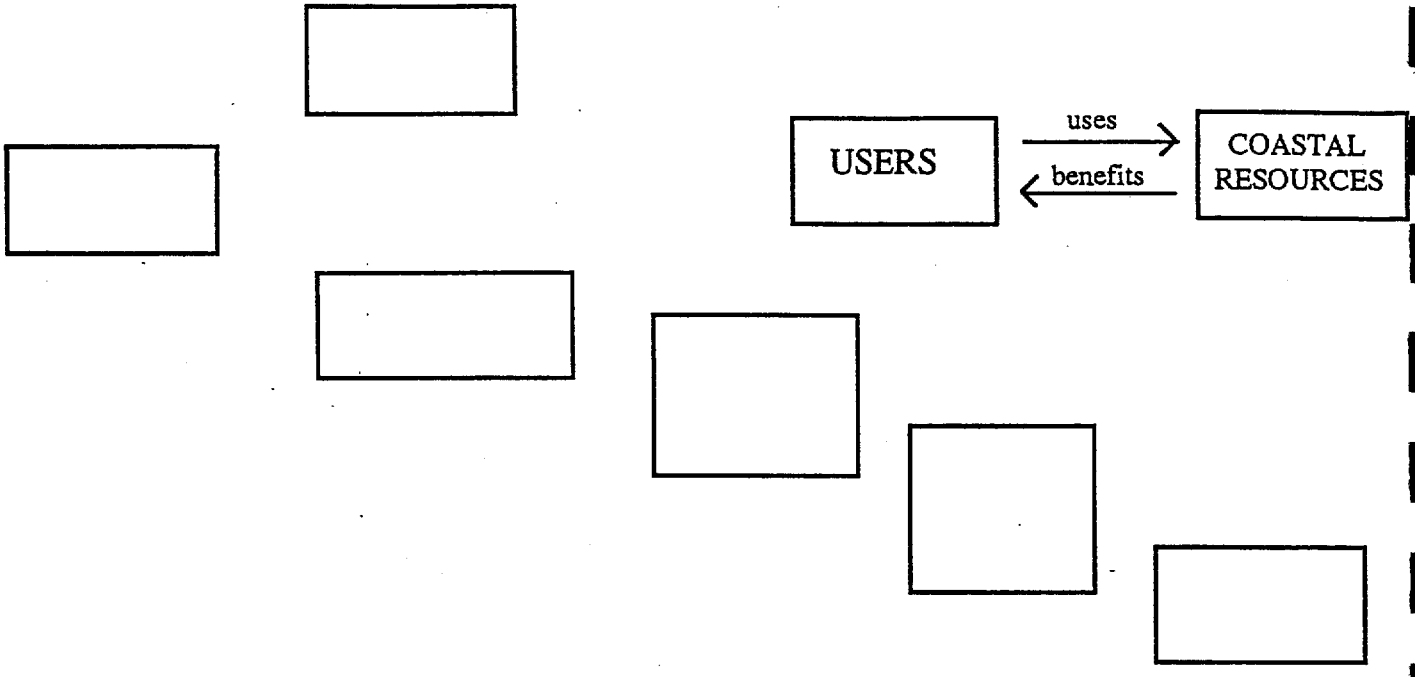
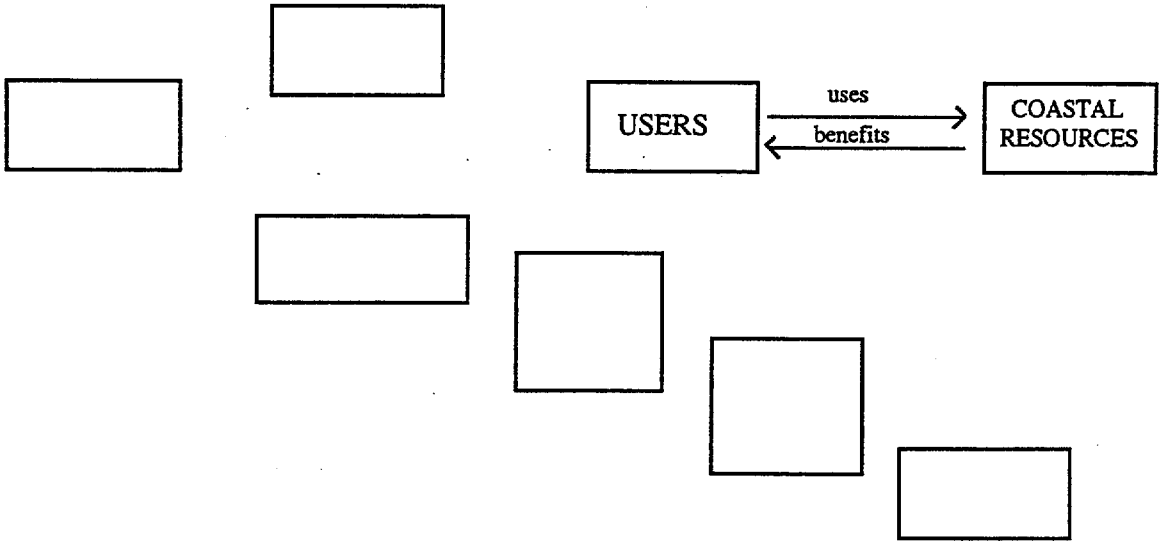


MAKING IT WORK: POLITICAL SYSTEMS DIAGRAMS

DIAGRAM 2



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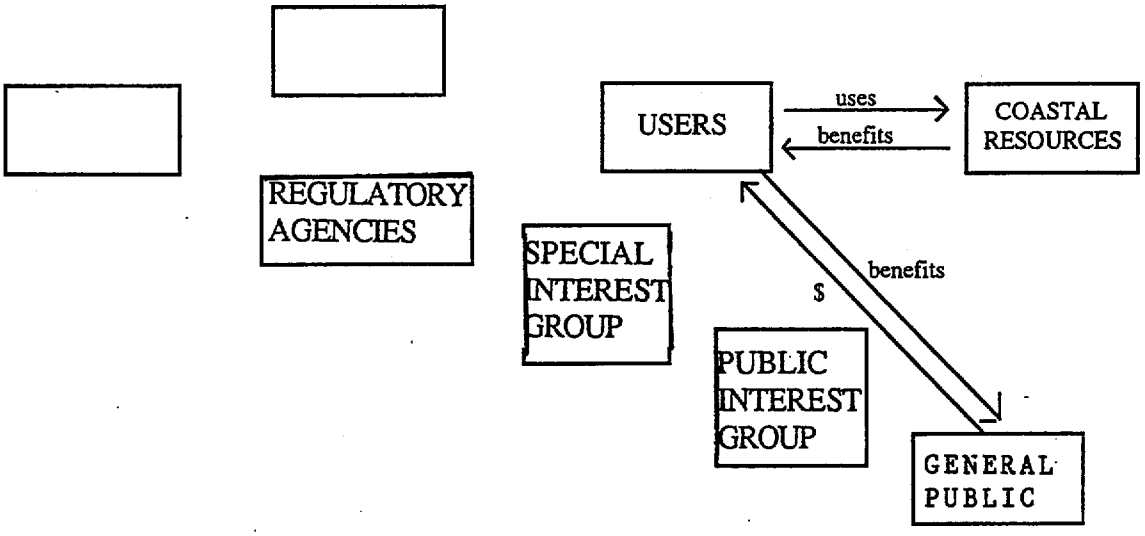
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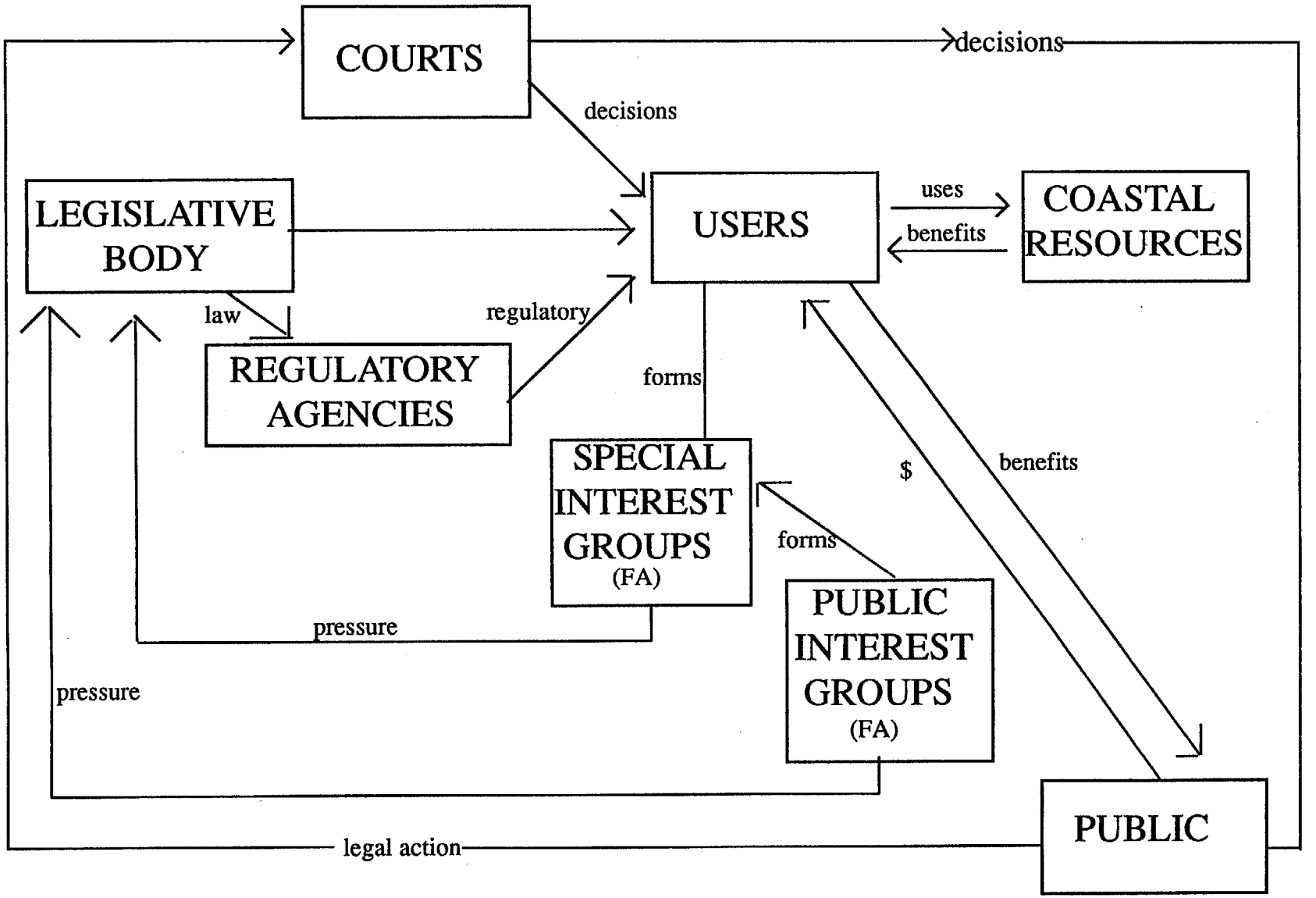
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LAMPREY VILLAGE INN PROPOSAL

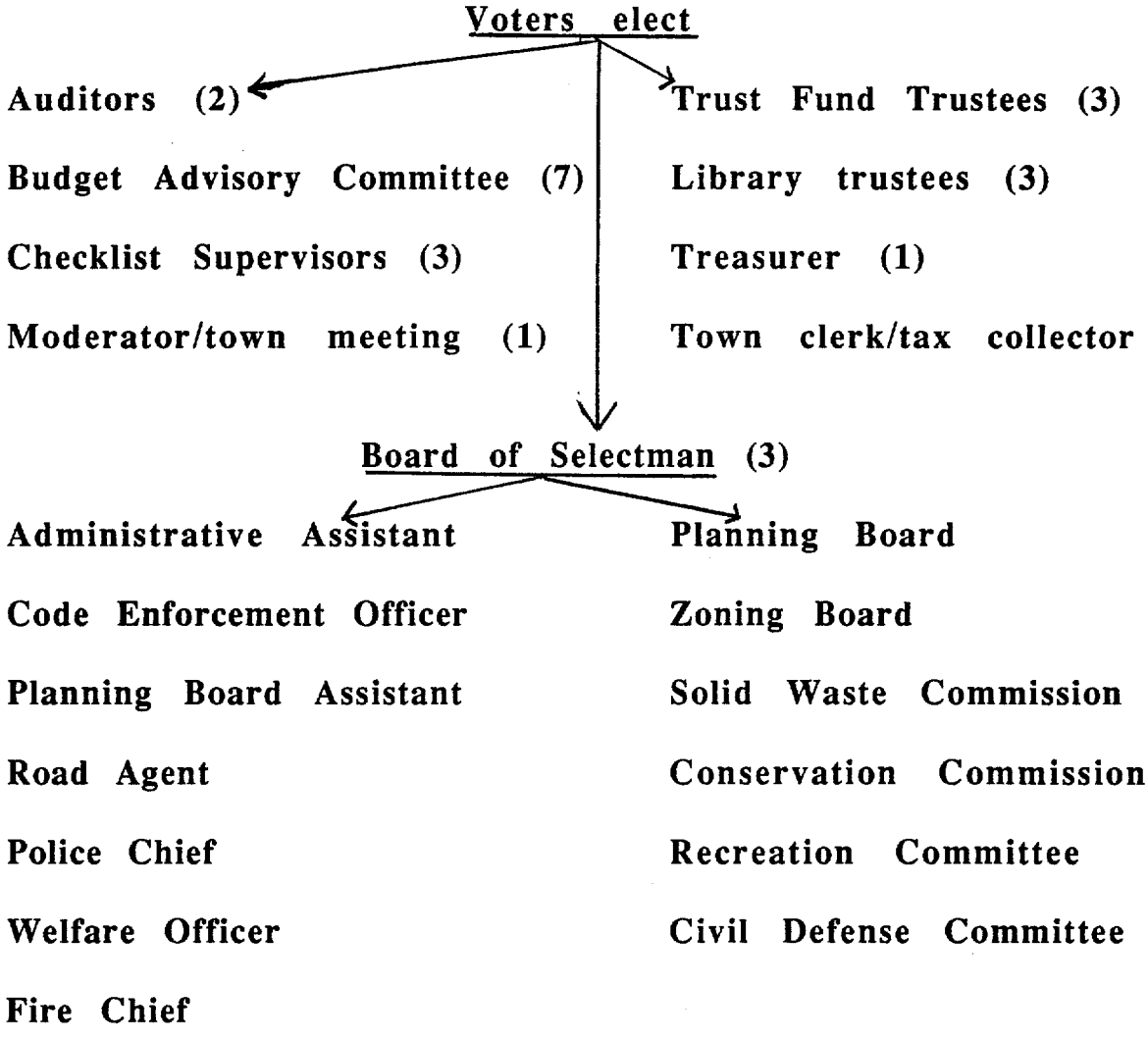
Your family has 10 acres, six of which are on the shoreline of a major river in the seacoast. You would like to set up a country inn there. You have done some market research and found that many people coming to the area have no place where they can stay comfortably for a short vacation, and you want to cater to that crowd. You would like to put a small dock in so that guests can use the canoes and motor boats you will have docked there.

Your property is near a wetlands area that acts as a recharge supply for an important aquifer (an underground pool that provides water for the town). Luckily, it is in a zone designated for commercial use, so you won't have to go to the Zoning Board of Adjustment in the town to ask for a variance. However, there appears to be some deer trails going through the inland part of your property. You have heard some say that the town plans to set aside this area and connect it with an adjoining part of the next town, so that the deer can pass freely back and forth on their trail. Many local fishermen come every year to fish from the shore on your property. Some canoeists like to launch their canoes there, also.

First, write up a preliminary plan which you present to the town's planning board. The plan should include where the inn will be located (you can draw a map if you like), how it is to be funded, what revenues it will bring to the town and what services the town will be required to supply.

Then list, in order, the steps you must take to present your project and have it approved. (Town governments vary in form. You may need to telephone your town offices to see how they handle projects such as this one.) Generally, the plan is presented to the planning board who involves the conservation commission, the solid waste committee, and the zoning board of adjustment if necessary. The abuttors (people living next to the project) and the general public are notified, and a public hearing on the project is announced. After input from these sources and consideration of the project as to whether it meets local, state and federal requirements, the planning board acts on the proposal. If the proposal is accepted, it is registered at the County Registry of Deeds by the town clerk.

EXAMPLE OF ONE FORM OF TOWN GOVERNMENT



Lesson 2: Who are the major user groups of coastal area resources?

Overview

Students will focus on specific user groups in the coastal area, learning more about their characteristics and concerns through an exercise that asks them to do research on an issue that is of particular interest to each group.

Materials

Reading: *People and the Sea* adapted from *What is Our Coastal Future*? published by the University of Maine as a part of the Northern New England Marine Education Project.

Slide Program: *Marine Careers* (with script)

Procedure

1. Read *People and the Sea* and ask students to list as many occupations as possible that are connected in some way with the marine environment.

2. Discuss these occupations, and broaden the list to include anyone who would be concerned with the coastal area. Arrange the list under the following categories:

- Conservation and Resource Protection
- Historic Preservation
- Residential, Commercial and Development
- Water-dependent Utilities and Industries
- Tourism and Recreation
- Fisheries and Aquaculture

3. Divide into six groups to represent the above six categories. The team should use the lists developed in exercise #2 to help them decide on a user group within the category.

Within each user group, there are individual occupations. **Each group member should take a role.** For example, with the Fisheries and Aquaculture group, there might be some of the following occupations:

- •captain and owner of a fishing trawler
- •part-time lobsterman
- •wholesale and retail seafood dealer
- •fishermen's co-operative president
- •aquaculturist specializing in depuration
- •aquaculturist who grows oysters in Great Bay
- •State Fish and Game Department employee

4. Students should use a variety of research techniques to develop a full picture of their role which will then be integrated into a 2-page description of their user group. Besides using written research materials, students must chose at least one other research method. They may choose from those listed below or originate their own methods.

- •visit sites
- •take photographs
- •tape an interview (with the person's permission)
- •watch an appropriate video tape, slide program, etc.
- •take a survey

5. To assemble the group user profile, students should incorporate what they have learned from research on their individual roles into a written report and an oral presentation.

6. Students should make large tags with the name of their role that they can hang around their neck for use in subsequent simulations and discussions. Encourage creativity in the design of the nametags. It will help students to be more aware of their role if they wear the name tags during class.

Lesson 3: What current issue concerns your user group?

Overview

Students will focus on a current coastal issue that concerns their user group. They will research the problem and come up with recommendations for its resolution.

Materials

Worksheet: *Resources, Case Studies and Sample Questions*

Video-tape: *Options for the Future,* University of New Hampshire, Sea Grant Extension Program.

Discussion Guide: *Coastal Issues: Options for the Future*

Maps: Coastal Maps of all types, including the grid-map they made during their field trips.

Other appropriate resources listed in the HELP section of this book.

Procedure

1. Ask the students to maintain the role they have chosen within their user group and follow the showing of the video-tape with a discussion in which they simulate their roles. Use the discussion guide provided to outline the following broad issues:

•the need for harbor management,

•bi-state cooperation managing shared resources,

•pollution and how to curtail its effects in an area where population pressures increase its incidence,

•the need to conserve natural resources while providing various types of access and use of them,

•pressure to replace water-dependent uses of the waterfront and shore with water-enhanced uses.

2. Ask the groups to study the appropriate case studies for their group in their reading *Case Studies, Sample Questions and Resources.* They should use research techniques they have found to be effective in the previous lesson to prepare a synopsis of the problem. The synopsis must include:

- an expanded description of the issue
- importance of the issue in the "big picture" of the state and region's coastal issues
- appropriate regulatory agencies and how they are involved in the issue
- at least three priorities that must be considered in devising options.
- options for solution (Remember to list advantages and disadvantages under the categories: economy, environment, political/social
- a prioritized list of solutions to the problem which includes short-term and long term considerations
- recognition that the user group's needs must be seen in terms of the needs of the whole community
- a decision on the issue chosen

3. After the research is complete, the students should decide upon a presentation format to enable each group to report on their particular issue. The presentation should be oral as well as written.

PEOPLE AND THE SEA

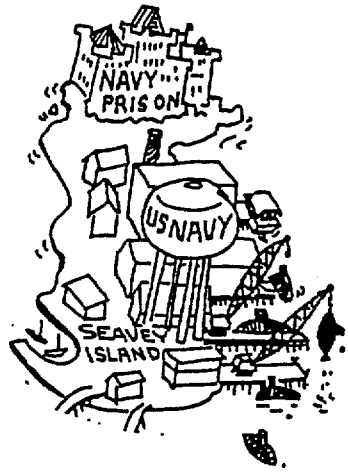
(Adapted from *What is our Coastal Future?* University of Maine, and *Ocean Opportunities, a Guide to What the Oceans Have to Offer.* University of New Hampshire.)

All our lives are touched by the oceans. Many of us live close to the sea. Indeed, by the year 2,000, 70% of the population of the world will live within 50 miles of some ocean, or large body of water. This coastal corridor with its dunes and beaches, marshes, and rocky shores is a fragile, yet significant part of our lives. Its beautiful vistas give us a sense of peace and wonder. Its shores are playgrounds for us. Also, many people make a living from this coastal area in Northern New England.

People from Europe came to fish in New England waters in the early 1600's. After spending a few productive summers fishing in places like the Isles of Shoals just off the New Hampshire coast, many of them came to live here permanently. Fishing is still an important occupation.

The oceans were always a source of food, but they also developed into highways for trade among nations of the world. The Port of New Hampshire was an important trade center during colonial times. Masts for the King of England's ships were hauled by teams of oxen down to the river banks and floated out to ships specially designed for carrying them across the Atlantic. Furniture and clothing was imported from Europe and after being unloaded from ships was carried inland on small boats or in wagons.

The Piscataqua River and the rivers which feed into the Great Bay Estuary have always been used as highways for transportation and commerce, first by native Americans and then by colonists. Even now, the Piscataqua has many industries and storage depots along the deeper New Hampshire side of the river. While overland shipping by air and land captured a great deal of the business of moving goods and people, in some enterprises ships still play a major role. Oil and gas are still carried mainly by ships. Also, the container ship industry has moved toward the "feeder operations" and smaller ships such as those that have utilized the Port of Portsmouth until recent months.



New Hampshire's coast, and particularly the deep Piscataqua River offers important sites for the location of heavy industry. Simplex Cable Company which makes cable for underwater communications, and the heavy steel plant, C.E. Avery Corporation are located there. The defense industry is well-represented by the Portsmouth Naval Shipyard which employs some 4,000 workers. Electric generating plants are in two locations on the New Hampshire side of the Piscataqua.

As more and more people move to the coast, the siting of energy sources is becoming very controversial. Yet coastal areas are ideal for several kinds of energy enterprises. New Hampshire Yankee's nuclear power station is located on the Hampton marsh about 2 miles from the open ocean. The nuclear power industry prefers to build on the coast where cold water for cooling the nuclear reactor can be easily obtained. Terminals for gas and oil products which are carried aboard ships need to be located near the shore. Alternative energy enterprises such as tidal power may be an important future source of energy. The ocean appears to be a good place to extract solar energy. Windmills might be mounted on real or man-made islands off the coast to generate electricity.

Many people come to the New Hampshire coast for recreation. Tourism is one of the leading industries in the state. Tourism generates $3 billion income for the state each year, and in the seacoast region 10% of the annual payroll is related to tourism. Nationwide, 150 million Americans spend time each year doing water-related recreation whether it is sport fishing, boating, swimming, beach-coming or sunbathing. The state government has a Department that deals with tourism.

Portsmouth is enjoying a burgeoning tourist trade, and many people like to come to the city by water. Coastal cruise ships sail into the Port every week during the summer and fall, docking at the Port. People debark to shop in the attractive shops that line the waterfront along Ceres and Bow Streets, or visit some of the historic buildings and parks. The Isles of Shoals Steamship Company plys the waters between Portsmouth and Star Island, offering a variety of excursions.

The New Hampshire coast is an attractive place to live. During the 1970's, populations of the coastal towns increased by 14%. In the

1980's, growth slowed down somewhat. New Hampshire's policy of no income or sales tax has attracted businesses to the area, providing jobs for people of the seacoast. While the influx of people and business may have a positive economic effect on the state, it also stresses the natural environment. Two of the area's largest existing industries, fishing and tourism, require unpolluted coastal waters, easy access to the coast, and in the case of tourism, natural uncluttered vistas.

Marine scientists, historians, archeologists and marine educators also use the coastal area. Jackson Estuarine Laboratory and the Coastal Marine and the Shoals Marine Laboratories provide opportunities for study of the coastal environment within a 20 mile radius of the University of New Hampshire. .Research on various marine and aquatic ecosystems and education programs for students are carried on there.

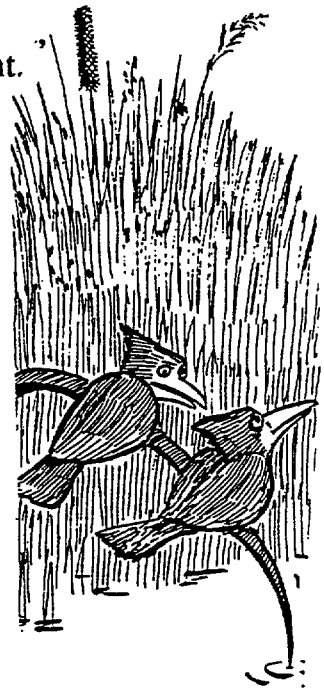
How to reconcile the population growth and its need to utilize the environment in a variety of ways with the need conserve natural resources is at the heart of issues facing the coast. We don't want to destroy the very things that attract people and businesses here in the first place.

RESOURCES, ISSUES AND SAMPLE QUESTIONS

Topic 1: Conservation, Research and Resource Protection

Suggested Resources (Addresses, phone numbers listed in HELP! section)

N.H. Department of Resources and Economic Development.
N.H. Department of Environmental Services,
N.H. Fish and Game Department, Marine Division,
U.S. D.A. Soil Conservation Service,
Director, Jackson Estuarine Laboratory, UNH
City and town conservation commissions
Society for the Protection of New Hampshire Forests,
Urban Forestry Center,
New Hampshire Coastal Program
Council on Resources and Development
Friends of Odiorne Point, Inc.
Town governments of Newington and Portsmouth



Issue Case Studies: Choose One to Investigate.

Case Study #1. Coastal Salt Marshes are slowly becoming freshwater marshes near Highways 1-A and 1. When Highway 1A was built, culverts that were too small to allow salt water to flow freely in and out with the tide were placed under the road. Now, not enough salt water gets into the marsh, and freshwater is inundating the marshes more and more. Freshwater plants are beginning to supplant the traditional salt water species. Even more of a problem are two "invader" plants: purple loosestrife and Phragmites. They can grow in fresh water and can tolerate water that is somewhat salty, as well. They crowd out plants like the salt marsh grasses that provide food for animals who depend upon the marshes. How can these problems be solved and by whom?

Questions to help with research:

1. How did the town of North Hampton approach the problem of their declining salt marshes?

2. What agencies control the development of highways and roads?

3. What are the roles of conservation commissions and planning boards in the protection of natural resources?

4. What role has the Audubon Society of New Hampshire played in the research and protection of endangered species? What remains to be done? Are there endangered species living in coastal marshes? What are they? Does the N.H. Department of Environmental Services have a list of endangered species?

5. In the N.H. Wetlands Board's Frank Richardson's opinion, what compromises might be made where development impacts wetlands? Has this been tried in the state? Where? With what success?

• •

Case Study #2: The secondary dunes along Highway 1A in Seabrook are the last ones on the New Hampshire shore. Some residential development has been allowed on portions, partly as a way to protect the rest of the dunes and the extensive marshes behind them. How is the town of Seabrook working with the state to save these valuable natural resources for habitat, vistas and as a barrier for the marshes?

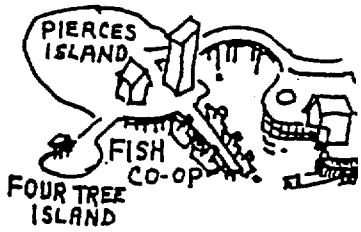
1. Who owns the dunes?

2. What agencies must grant permits before building is allowed on a dune?

3. Does New Hampshire have a problem with recreational vehicles (RV's) driving over the beaches and dunes? Why?

4. Are there endangered species living in the dunes? Read the Endangered Species Act (both state and federal) and determine what is done to protect endangered species.

5. What has the Seabrook Conservation Commssion done to preserve the dunes?



Topic 2: Fisheries and Aquaculture

Resources (See HELP! section for addresses, phone numbers)

Roland Barnaby, Extension Specialist, Rockingham County
National Marine Fisheries Service
John Nelson, New Hampshire Fish and Game Department
Frank Richardson, New Hampshire Wetlands Board
George Mavrikis, Manager, Portsmouth Fishermen's Co-op
Eric Sawtelle, Salmon Unlimited
Richard Langan, Manager, Jackson Estuarine Laboratory
Tom Howell, Spinney Creek Oyster Company
Anadromous Fish and Freshwater Research Laboratory, UNH
Department of Resources and Economic Development
George Frick, Department of Resource Economics, UNH
Bruce Lindsay, Department of Resource Economics, UNH

Issue Case Studies: Chose one to investigate.

Case Study #1. People are now eating more fish and seafood than ever before, but the numbers of fish in our rich coastal waters is declining rapidly. Haddock stocks have gone so low, that you can only fish for haddock at certain times of the year. Flounder and cod stocks are also getting low. The National Marine Fisheries Service who control commercial fishing say that the fishing effort must be reduced by 50% if we are to save our fish stocks. How can this be done?

Sample Questions to help you with your research:

1. What regulatory agencies are responsible for issuing fishing permits to commercial fishermen?

2. How does RSA (Revised Statutes Annotated) 483-A11-b protect fishing interests?

3. What is the "200-mile limit" and how has it affected New Hampshire fishing interests?

4. What species of finfish, shellfish, and crustaceans do New Hampshire fishermen catch the most of? What techniques are used

to catch various fish and shellfish? What can you find out about these animals' habitat, spawning times, average size and abundance. What are the federal and state regulations that govern their harvest?

5. Are most New Hampshire fishermen "daytrippers?" Are most full-time fishermen? Where are their favorite fishing places?

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Case Study #2. Since the seventies, aqua-culturists have tried raising lobsters and oysters in some portion of the Great Bay estuarine system. Now there are applications to try some innovative approaches to oyster culture. One aquaculturist wants to move oysters from one part of the estuary to another and allow them to grow in a better habitat. He also wants to harvest them on a regular basis. How can aquaculture be better regulated and supported in this state?

Sample questions to help with your research:

1. Is there currently any aquaculture being conducted in New Hampshire waters? Where and by whom?

2. What information and support does the state of New Hampshire give aquaculturists and how is the industry regulated?

3. What is the Inter-state Shellfish Commission and what are its powers? Does New Hampshire adhere to its regulations?

4. What is "red tide" and how does it affect the shellfish population? What happens to the price of shellfish in the markets when "red tide" warnings are posted?

5. Most of the shellfish beds in New Hampshire are closed. Why? Who closes them? When will they be open again?

Topic 3: Residential and Commercial Development

Suggested Resources (Addresses, phone numbers listed under HELP!! section).

Federal Aviation Administration (FAA)
N.H. Department of Transportation
N.H. Department of Resources and Economic Development
N.H. Water Supply and Pollution Control Board
N.H.Wetlands Board, Department of Environmental Services
N.H. Coastal Program
Walter Cheney, Developer
Newmarket Community Development Corporation
Army Corps of Engineers
U.S. Dept. of Agriculture, Soil Conservation Service, Durham
Local Boards of Selectmen in Newington and Portsmouth
Newmarket Conservation Commission
Pease Development Authority

Issue Case Studies: Choose one to investigate.

Case Study #1: Moody Point is a development on the shores of Great Bay which was developed with attention to both aesthetics and environmental quality. The developer, members of the Great Bay Estuarine Trust and the N.H. Office of State Planning created a plan that minimizes the impact of development on this fragile area. A stand of rotting pine trees was cut down and the resulting meadow was seeded with wildflowers. A pond was built to catch some of the soil that washed down the hill while the townhouses were being built. Residents can walk down a nature trail and see many different plants and animals.

The costs of building the development were high and the sale of townhouses has been very slow. The developer wants to change the permits granted for the project to allow him to build more single family dwellings than planned originally. He doesn't want to go through the entire permitting process again. Should the town allow him to take a short-cut?

Questions to help with your research:

1. How are questions of increased services for water, fire protection, electricity, transportation and parking handled for multiple family dwellings? Is it more costly to serve single family houses than multiple family dwellings?

2. Does residential development have an impact on the environment? Define **aesthetics, vistas, open space and access** and tell why each is important in considering a development.

3. Why is there usually erosion when a building is being built? What measures can be taken to control it?

4. How are wetlands protected? Was this an issue with the Moody Point development? What happened?

5. What regulatory agencies deal with planning and approval of residential and commercial developments?

****

Case Study #2: Pease Air Force Base is one of many bases across the country that is being closed. It is being transfered to N.H. State jurisdiction. A group consisting of seven members called the Pease Development Authority (PDA) has been appointed to administer the land. Nearby communities of Newington and Portsmouth have representatives on the PDA since they own 700 acres of the 4300 acre Base. Recently, the PDA proposed that the state accept a cost-free "public benefit transfer" of 2500 acres from the Federal Aviation Administration (FAA) for the purpose of developing an airport.

Some local residents are concerned about relinquishing control of the airport in return for this no-cost transfer. They are concerned about whether the airport will be mainly for cargo or for passengers, and about the noise from the airplanes. Others welcome the chance for more jobs that will result from businesses that are predicted to come into the area.

Part of the boundary of the new Great Bay National Estuarine Research Reserve is located within the Base along the shores of the Great Bay. An agreement between the Air Force and the Reserve was signed, allowing the shoreline to be included in the Reserve. That

agreement is no longer in force when the land is turned over to the State. The shoreline is part of the most pristine area in the Reserve. Migrating American eagles winter there, and several endangered species are found in the area. A Federal Wildlife Refuge which includes that part of the shoreline has been proposed for about 1100 acres of the Base. Also there are other ideas for its use: a state park, a marina, and housing.

In an already crowded coastal area, how can this unique resource best be used?

Questions to help with your research:

1. How will the transfer of Pease Air Force Base to the State of New Hampshire affect the natural resources of the Great Bay Estuary?

2. Does New Hampshire have a noise ordinance that airports must adhere to? Can communities, states and/or the federal government regulate noise?

3. Will development of the Base bring jobs to the seacoast? What kind of jobs?

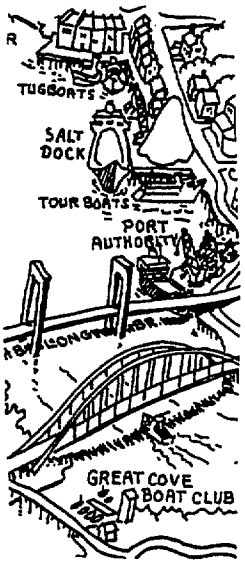
4. Would the proposed Federal Wildlife Refuge be compatible with a commercial airport? Can you find evidence to support your answer?

5. Would having a state park instead of a wildlife refuge be a good idea? Why or why not? Should public access be allowed to this part of the shore?

Topic 4: Water-dependent Industries and Utilities

Suggested Resources (Addresses, phone numbers in HELP! section)

Simplex Wire and Cable Company
Sprague Energy
National Gypsum Company
N.H. Yankee Corporation (Seabrook Power Station)
N.H. Public Utilities Commission
N.H. Coastal Program
N.H. Division of Air Resources
N.H. Water Supply and Pollution Control Board
Wetlands Board
State Port Authority, Ernest Connor, Director
U.S. Army Corps of Engineers
U.S. Coast Guard
Oil Spill Committee
Dr. Barbaros Cellikol, Civil Engineering Dept., UNH



Issue Case Studies: Choose one to investigate.

Case Study #1: In 1973 initial plans were made by the Olympic Oil Company to develop a refinery site on a large lake in southern New Hampshire. That lake turned out to be the Great Bay Estuary! The plan included a pipeline through Rye, N.H. and a supertanker port at the Isles of Shoals. Due to public outcry the refinery project was defeated on the grounds that "home rule" gave towns the ultimate power to determine what types of energy facility development could occur in their community.

Sample Questions to help with research:

1. What plans does N.H. have for dealing with oil spills? What are the environmental effects of oil spills?

2. What is the law that supports the decision in the Olympic Oil refinery case?

3. Which agencies have responsibility for regulating the siting of heavy industry along the coast? Are any heavy industries planned for the New Hampshire coast area? What are they and where are they proposed?

4. How did people organize to defeat the refinery proposal? What was SOS?

5. What forms of alternative energy are being utilized and/or developed in the Seacoast area?

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Case Study #2: The Port of New Hampshire, located near the mouth of the Piscataqua River has become a busy travel lane for oil tankers, cable ships, and cargo ships. Some ships stop at the commercial pier to load scrap metal from the tall piles that dwarf the Port offices. There are extensive plans to enlarge the whole port facility. The turning basin for ships opposite the commercial pier was recently dredged to make it larger and safer. More and more petroleum products are being moved upriver to storage depots. Oil spills happen fairly often in the river. What sort of research and planning is needed to effectively operate the Port?

Questions to help with your research:

1. What are three of the environmental and economic factors involved in expanding the Port of Portsmouth?

2. Do the scrap metal piles at the Port represent an important source of income for New Hampshire?

3. How many people have jobs connected with the Port?

4. What are the general operating procedures for ships coming into and out of Portsmouth? How does the tugboat service operate?

5. What sort of connections does the Port propose to have with the proposed commercial airport at Pease Airforce Base (now owned by N.H.)?

6. How are oil spills handled on the river? What research is being done to help protect the environment when a spill occurs?

Topic 5: Tourism and Recreation

Suggested Resources: (addresses, phone numbers in HELP! section)

Seacoast Council on Tourism
Coastal cities' Chambers of Commerce
Department of Leisure Management, UNH
N.H. Office of Vacation Travel
N.H. Department of Resources and Economic Development
N.H. Division of State Parks
N.H. Coastal Program
Seacoast Ranger, N.H. Division of Parks

Issue Case Studies: Choose one to investigate.

Case Study #1. Parking for the thousands of tourists who visit the New Hampshire beaches in summer is a big problem. Through 77% of New Hampshire's Atlantic shoreline is publicly owned, the realities of its limited shoreline and the high demand for ocean access have created obvious conflicts. In both Hampton and Seabrook, high density development and congested city designs have made parking a number one problem. Since there are few buses and no trains to provide other kinds of transportation in the coastal area, visitors must use their cars to get there. Both towns need to provide new solutions to the parking problem. What are some strategies being tried? How successful are they? Can you suggest more?

****

Case Study #2. White Island, of the Isles of Shoals, just 10 miles off the coast has recently come under the jurisdiction of the New Hampshire State Parks Division. The lighthouse is run electronically, and the buildings that once housed the Coast Guard crew who manned the lighthouse are empty. It is a nesting area for terns, an endangered species. Access is by boat or helicopter. What sort of management plan should be made for the island for use as a State Park?

Questions to help with research:

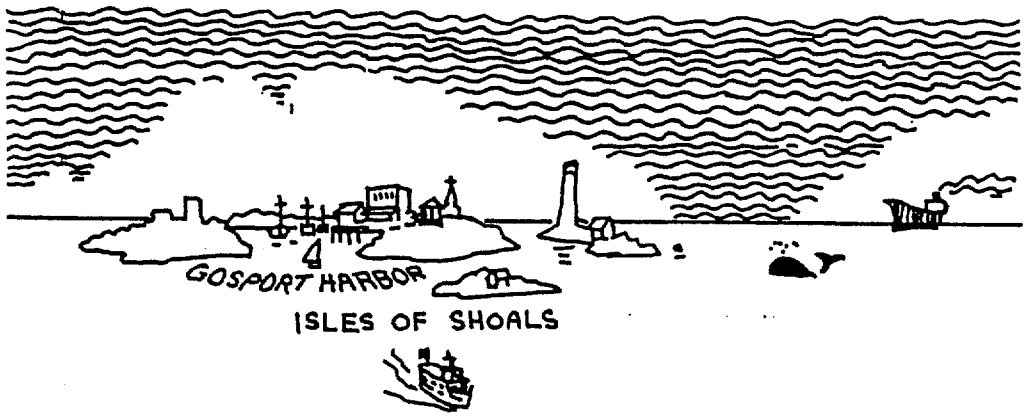
1. How is a management plan for State Park lands developed?

2. What role would the Audubon Society of New Hampshire potentially have in such a management plan?

3. What roles could a research scientist, historian, carpenter, and marine education specialist have in the development of White Island?

4. How can public access become a part of the plan?

5. How could the buildings on the island best be used and maintained?



Topic 6: Historic Preservation

Suggested Resources: (addresses, phone numbers in HELP!! section)

Society for the Preservation of New England Antiquities
State and Local Historical Societies
N.H. State Historic Preservation Office
N.H. Coastal Program
Strawbery Banke
Chambers of Commerce for cities and towns in the area
Albacore Museum
Portsmouth Shipyard Historical Society
Isles of Shoals Study Group
N.H. State archeologist

Issue Case Studies: Choose one to investigate.

Case Study #1 One of the first lumber mills in New Hampshire was located at Wadleigh Falls on the Lamprey River, one of the rivers of the Great Bay Estuarine System. Some of the timbers that supported water wheels and flumes are still visible. Later, mills that made leatherboard, processed plants into medicines, and planed lumber developed on the same site. Residents, interested in this historic site would like to protect it in some way.

Sample questions to help your research:

1. What is a "historic site?" What is the criteria for designation of historic sites. List ten in the coastal area. Who maintains and preserves them?

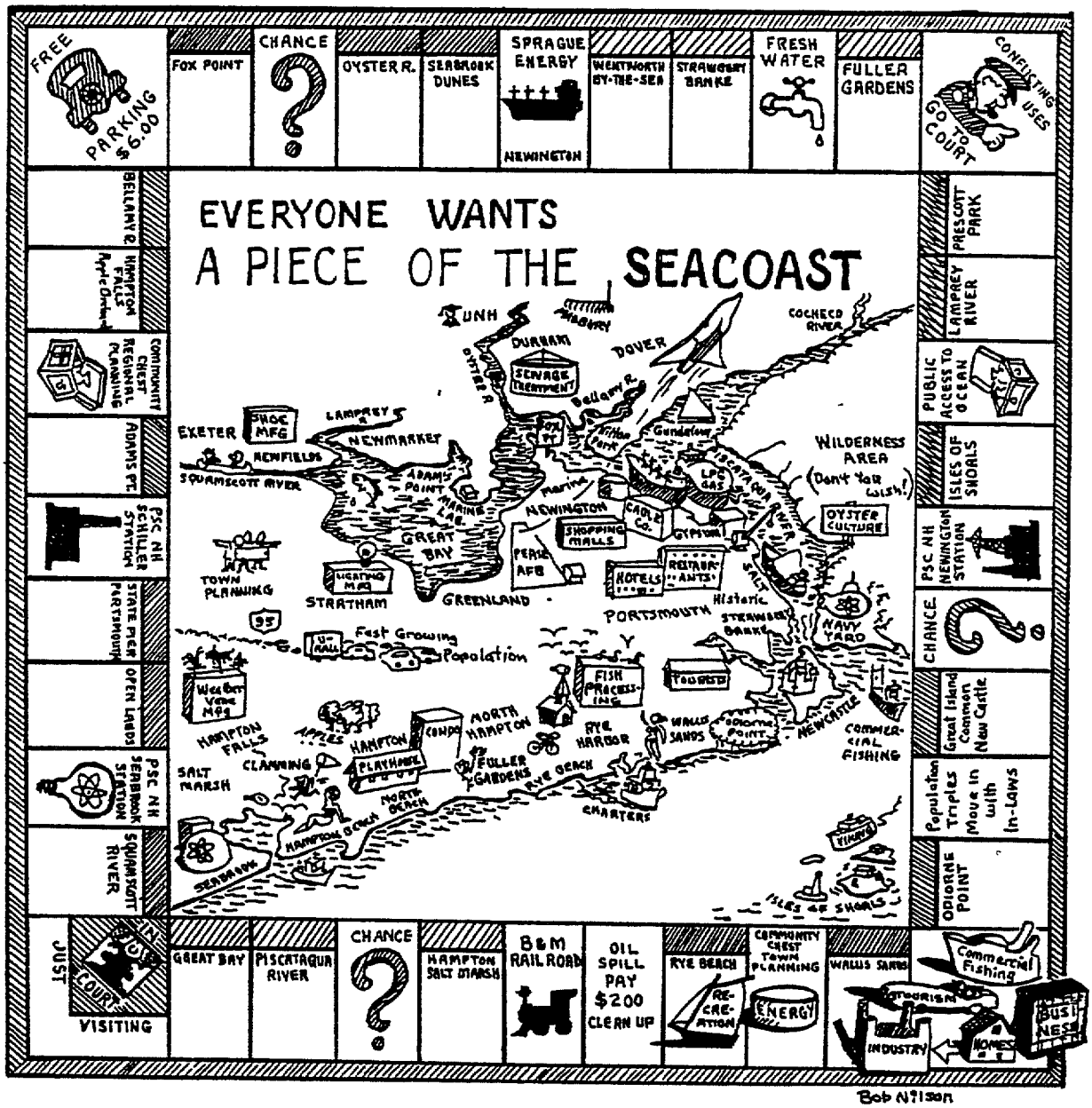
2. What part do state and local governments play in preservation of historic sites?

3. What part do historic sites play in the attraction of the coastal area for tourists and permanent residents?

4. How are decisions made between preservation, renovation, and use for other than the original purposes?

Take the plunge.

Everyone wants a piece of the coast. (Simulation Game)



Bob Nilson

IV. TAKE THE PLUNGE. EVERYONE WANTS A PIECE OF THE COAST.

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IV. TAKE THE PLUNGE.

Teachers' Guide

Concept

In any land or water use decision, individuals and communities must participate in a multi-step process where problems are identified, needs of the various groups that use the resource are considered, solutions are developed, compromises are made, and eventually consensus is reached. Making decisions is a complex process. Almost always there will be trade-offs and consequences, and often decisions have to be revised and mitigated in response to changing conditions.

Objectives

1. Students will gain an understanding of the ways in which uses of coastal land and water change with economic, social and political needs, and advances in technical knowledge.

2. Students will apply scientific and technical information gained through a field trip to Odiorne Point plus information they have accumulated in previous sections to the simulated issue and arrive at a decision.

Lesson 1: The rocky shore is a tough place to live.

Overview

In this lesson, students are introduced to the rocky intertidal, a natural resource that is common along the Atlantic shores of the northern Gulf of Maine. Students will have an orientation to the rocky shore, and then take a field trip to the beach at Odiorne State Park.

Materials

Slide program: *N.H.'s Rocky Shores* given by a UNH Marine Docent (free of charge for this project)

Video-tape: *The Intertidal Zone* (obtain from the New Hampshire Fish and Game Department, free of charge)

Reading: *Life in the Intertidal Zone*

Procedure

1. Introduce the topic by a discussion of different types of beaches that the students have visited: sandy, rocky, shingle, gravel, etc. Ask if they have ever gone tidepooling. Then show the video-tape or have the Docent there to give the program on the Rocky Shore.

2. Homework assignment: Read *Life in the Rocky Intertidal Zone* . On a 5 x 8 card, list the zones with a sketch of a plant and animal for each zone. Use plastic to cover the card after the information has been checked for accuracy. Then each student has a guide to take with them to the shore. (Also, take several field guides on the field trip).

3. Discuss the field trip and its purpose: to gather information about a specific natural resource and its environmental setting. Be sure the students wear rubber-soled shoes, dress in layers, and bring their lunch and a beverage. You will need to have emergency release forms for everyone on the trip including chaperones. Bring the forms on the day of the trip. (If possible arrange with the Odiorne staff to conduct your field trip for you, or purchase the packet *Alone on the Shore* from the Sea Grant Extension office.)

Lesson #2: Field trip to Odiorne State Park.

Overview

Students will investigate the rocky shore in terms of zonation and adaptation, and will discover interdependent relationships there. Following the rocky intertidal experience, they will inventory the rest of the park.

Materials

field guides for rocky shore, birds, flowers, trees and shrubs,
notebooks or inventory worksheets
pencils
optional: *Alone on the Shore* packet purchase from Sea Grant Extension office.

Procedure

1. **Suggestion**: Arrange with the staff at the Seacoast Science Center at Odiorne State Park for a guided tour of the rocky intertidal. Or, arrange your field trip yourself in consultation with staff members at your school. Be sure to have chaperones accompany you so that you can divide the class into groups of 4 to 5 students. Identify tasks that each student should accomplish in the field during their "tidepool tour." (You may want to consult with one of the Sea Grant Extension Educators or science staff at your school to plan this part of the trip.) Debrief afterward with a discussion that focuses on the concept of interdependence and how it is illustrated in that environment.

2. Devise a plan to inventory the park's other habitats. **Suggestion:** Divide the students into groups and assign each group one area: sandy beach, fresh-water pond and marsh, salt marsh, uplands, historic human habitats. Use the map to help you. Invite some people with expertise on those topics to accompany the groups. Each group should have an inventory sheet that includes major land-forms, fields, lawns, trails, streams, historic remains, roads, geologic features, and adjacent, visible lands that are outside the boundaries of Odiorne. Students may sketch or take photographs of the environment they are researching. Meet in about two hours and briefly discuss what people have found. Create an inventory of the park in preparation for the simulation exercise which follows.

Lesson 3: Odiorne of the future.

Overview

Students will divide into teams that contain members from each of the six groups in the previous section. Their task is to develop a multiple-use plan for the land now known as Odiorne Point State Park. Having done a survey of the park and paid close attention to the rocky shore intertidal area, they have some knowledge of the site upon which to base their plan. Encourage them to use techniques and knowledge gathered through previous projects in this book as well as additional research about the Park.

Materials

Reading: "Highlights of History," and other pertinant portions from the *Odiorne Point Natural Science and Historical Studies.*

Worksheet for User Groups

Procedure

1. Note: the following simulation activity was designed to culminate the experiences gained through the field trips, research and activities in preceding chapters. The challenge now is to address the situation from several perspectives. Individual values and perceptions will surface... yet the outcome will have to be a single plan derived from compromises of the separate groups.

Most of you have used simulation techniques in many different settings, so you know that:

a. students must be involved in decision-making processes that are like actual issues they will face in later life.

b. students need to build bridges beween science and social studies courses to see the interplay between scientific facts and human values.

c. students need to pursue studies that require them to process information, weigh alternatives, make choices and then live with the results of their actions.

2. Prepare the students for the task by asking them to imagine this scenario:

It is the year 2000. The state of New Hampshire and, indeed, the whole country has been depressed economically for 12 years. Oriodne Point State Park has become surplus property due to severe budget cutbacks in the state. The land was sold to a private developer. The developer has several options, but is not sure what should be done with the property. He/she knows that it should be put to the best possible use, both in terms of the quality of the environment and in its ability to contribute to the conomic health of the region. Formerly a conservation area, the land is now zoned for both residential and commercial development and multiple recreational use. Several different interest groups have begun to prepare proposals outlining specific plans for the property.

• Conservation research and resource protection groups would like to maintain the land for hiking, birdwatching, and low intensity use.

• Tourism and recreation groups are planning to try to augment the mooring and recreational boating capabilities of Little Harbor.

• Residential and commercial developers would like to build a recreational resort hotel on the site of the old Sagamore House, and call it by the same name. They want to have the option of including some condominiums and recreational facilities. The present Seacoast Science Center would remain, but it could be used as a place to hold big dances and receptions in the evening, and offered as a conference center for two days during each month.

• Fishermen and aquaculturists would like to establish a small aquaculture facility on the property... something with the potential for research and education as well as commercial gain.

• Water dependent industries and utilities are interested in investigating the feasibility of a windpowered generating station.

• Historical groups want to return the bunkers to the use for which they were intended, and invite the military back to use the Park as a training area for ground troops.

3. Group the students into the research teams from section IV. Each group should meet to review the park inventory, and to begin the basic formulation of its plan. One member of each team should be assigned as "chief planner". This person must meet with the other interest groups to make sure that his/her team understands the needs of the other use groups. Each group must develop a final plan that incorporates the needs of all six user groups. The developer is unwilling to conceed to any one group and insists on a concerted plan that is suitable for multiple use. (Modifications of concerns may have to be implemented on the planning process to minimize conflicts with the needs of other groups or to minize environmental degradation.)

4. Finally, the five plans will be presented for review by the developer and members of the Rye Planning Board, Conservation Commission and planners from the State. (You may designate certain students for these positions, or get actual people from these groups to look at the plans and give the students their opinions in a staged hearing on the plans.)

TAKING THE PLUNGE

Student Materials:

ODIORNE FIELD INVENTORY

Group Name_____

Your Name _____

Date_____ **Time**_____

First impressions: Pick a spot in your site and stand quietly for a few minutes, looking at the view, noticing birds, bushes and trees, etc., look for signs of animals, indications of human presence either recently or in the past, etc. Now, sit quietly and write down your impressions.

Select a specific environment on your site and investigate it thoroughly. Write down everything you can learn about it. Drawing or sketching is useful, also. Use field guides to help you.

Plants	Animals	Birds	Humans

Use the back of the page to note other observations.

WORK SHEET FOR EACH USER GROUP

Group name_____

Chief Planner_____

Group Members_____

_____

(This sheet is intended to help focus your thinking. Use it to organize your thoughts. Remember to use the results of your work on previous sections and the site survey of the park.)

1. Objectives: What are we trying to do?

2. What are the needs of the other groups?

3. What are our priorities?

4. What major features of the property will be important to us?

5. What conflicts need to be addressed?

6. What do our plans entail?

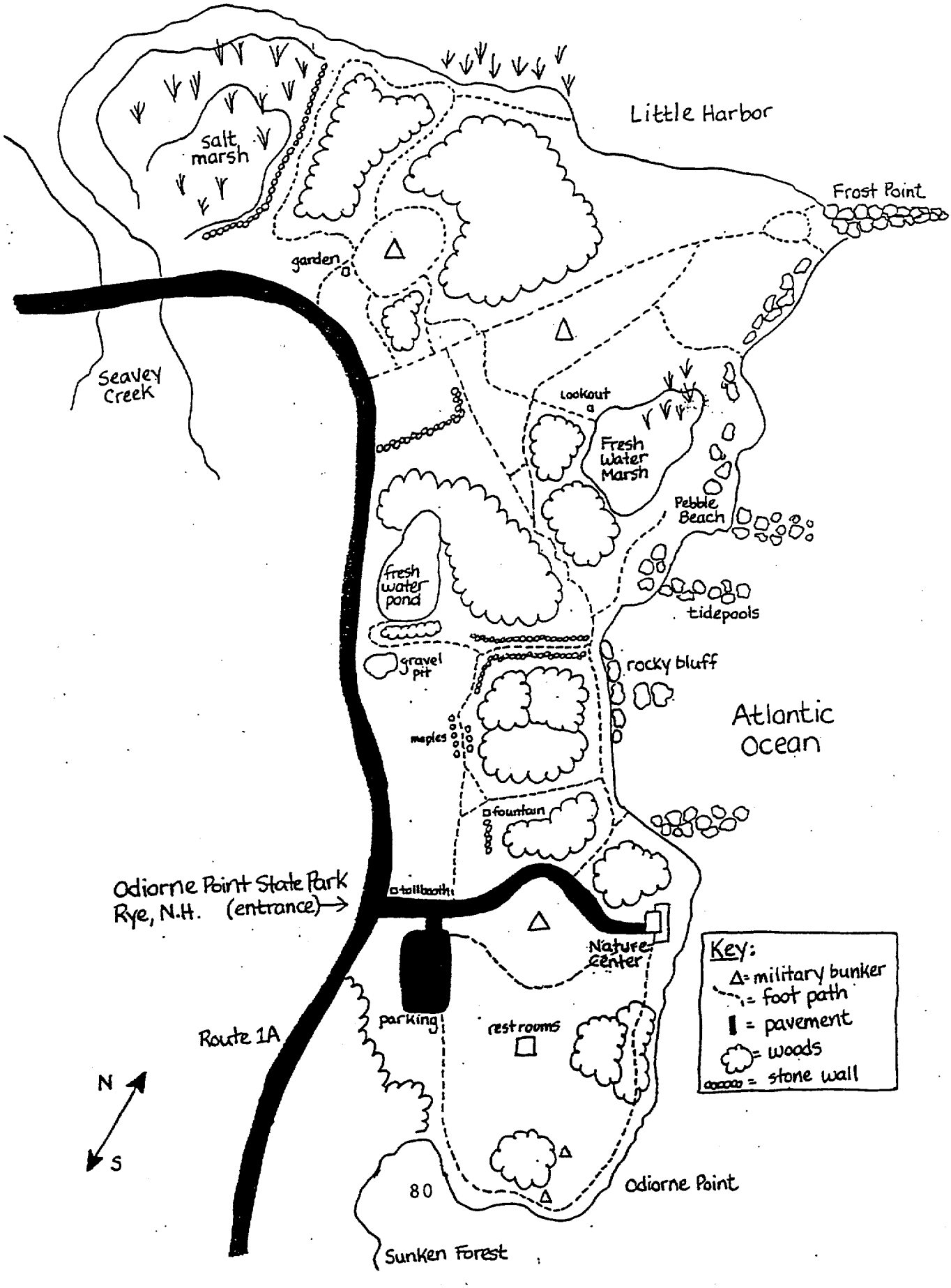
7. What permits, hearings, etc. might be required?

8. What are the pros and cons of our proposal?

9. What presentation format will we use to present the plan?

MAP OF ODIORNE STATE PARK

(From the *Through the Looking Glass Teachers' Guide*)



ODIORNE HISTORY

(from *Through the Looking Glass Teachers' Guide*)

SETTLEMENT YEARS

Odiorne Point saw its last days of true wilderness almost 400 years ago. Though Indians from various tribes of the Wabanaki Nation had used the area during their summer migrations, no permanent settlements were seen until the 1600's. In 1623, David Thompson and two other colonists sailed from England to what is thought to be Little Harbor in order to establish another center for trade and development in the New World. The efforts of Thompson, first settler of New Hampshire, paved the way for future settlers. He constructed a substantial headquarters building, known as a "great house" and established good relations with local Indians.

In 1630, Captain Walter Neale arrived at the mouth of the Piscataqua River with ambitious and enterprising plans for Little Harbor. More buildings were erected and shipping and fisheries formed a vital part of the settlement. The bustle of activity around the Piscataqua was rudely upset in 1633 by raids of Dixey Bull, the pirate. In 1633, Neale returned to England, leaving behind enough people settled in the area to ensure continuation of the colony.

FARMING YEARS

In 1660 John Odiorne purchased the homestead land that remained in the family until 1942. Two hundred and eighty years of Odiorne ownership has led to use of the family name for their section of town. Activity of the Odiorne farm included fishing, fish processing, gardening, operating a blacksmith shop and lumber mill and harvesting marsh hay for livestock feed. The Odiorne homestead farm closely bound with the area of the settlement, had been under three towns. Up to 1693, it was a part of Portsmouth. Next it came under New Castle for almost 100 years and it was finally transferred to Rye in 1791.

RESORT YEARS

The transition of Rye from a farming to a summer resort community was a gradual process. By the Civil War, agriculture had declined as a means of support. In 1868, George and James Pierce of Portsmouth bought property near Frost Point. They built and opened for business a country inn under the name "Sagamore House". Business flourished until June 12, 1871, when fire struck and completely destroyed the hotel. Soon after, several summer estates were established and for at least forty years the most noticeable aspects of the Point were its fashionable homes and formal gardens.

MILITARY YEARS

During World War II, all residents were evacuated and massive construction began. The Odiorne Point area was selected as a key position for protecting Portsmouth Harbor. Formal date of acquisition for most of the land was January 1942 and the installation was called Fort Dearborn. Concrete casements ("bunkers") and gun mounts were quickly constructed. As camouflage for the casements, enormous quantities of earth and trees were brought in to create the impression of natural hills. Advances in technology proceeded rapidly during World War II and the heavy fixed guns were obsolete almost as soon as they were ready for service. At the close of World War II, Fort Dearborn was no longer needed for military purposes and the government sold the area to the State of New Hampshire on the condition that it be developed into a state park. Purchase arrangements were completed in March 1961.

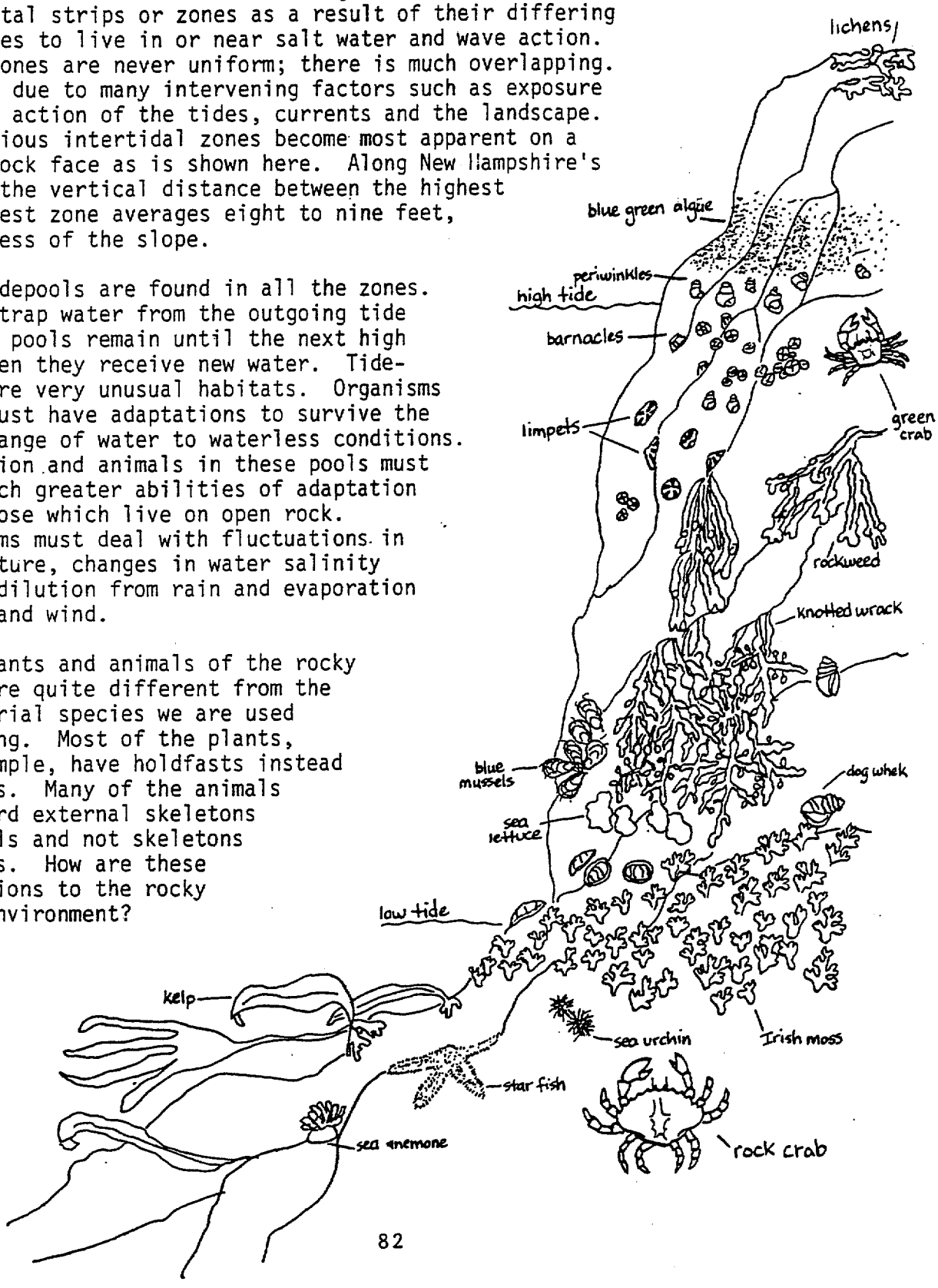
LIFE IN THE ROCKY INTERTIDAL ZONE

(from *Through the Looking Glass Teachers' Guide)*

The strip of land between the high tide and low tide marks is full of marine plants and animals that are all adapted to their harsh environment. These organisms usually appear in horizontal strips or zones as a result of their differing abilities to live in or near salt water and wave action. These zones are never uniform; there is much overlapping. This is due to many intervening factors such as exposure to sun, action of the tides, currents and the landscape. The various intertidal zones become most apparent on a steep rock face as is shown here. Along New Hampshire's coast, the vertical distance between the highest and lowest zone averages eight to nine feet, regardless of the slope.

Tidepools are found in all the zones. Basins trap water from the outgoing tide and the pools remain until the next high tide when they receive new water. Tidepools are very unusual habitats. Organisms there must have adaptations to survive the whole range of water to waterless conditions. Vegetation and animals in these pools must have much greater abilities of adaptation than those which live on open rock. Organisms must deal with fluctuations in temperature, changes in water salinity due to dilution from rain and evaporation by sun and wind.

Plants and animals of the rocky shore are quite different from the terrestrial species we are used to seeing. Most of the plants, for example, have holdfasts instead of roots. Many of the animals have hard external skeletons or shells and not skeletons or bones. How are these adaptations to the rocky shore environment?



Rocky Intertidal Zones

Zone 1: the black zone

This zone marks the high point of the sea's reach upon the land. Its only contact with ocean water is from spray which is splashed on it in a storm. A thin black crust on the rocks, which is actually a layer of microscopic blue-green algae, identifies this zone. When wet, the blue-green algae becomes slippery and gelatinous.

Zone 2: the periwinkle zone

This zone is submerged only twice a month by high spring tides. Periwinkles dominate the area and they seek cracks and crevices where the atmosphere isn't quite as harsh. They are equipped to withstand desication by secreting mucus which secures them to the rocks and locks out the air preventing dehydration.

Zone 3: the barnacle zone

Found below and intermingling with the periwinkle zone, this area is innundated by water twice a day. To contend with the tides and waves, barnacles live attached to rocks. They close up when exposed to air and open when the tide rises so they can filter for food. Mussels may also be present in this zone.

Zone 4: the rockweed zone

The middle intertidal area is the zone of two brown seaweeds: knotted wrack (Ascophyllum) and rockweed (Fucus). They are long seaweeds with conspicuous float bladders, found attached to rocks by a holdfast. They sway back and forth with the tides and provide a sheltered environment for many intertidal organisms.

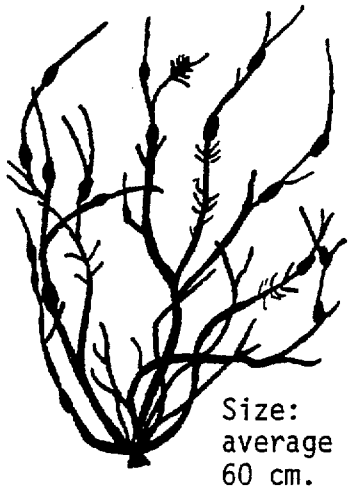
Zone 5: the Irish moss zone

Exposed only during very low tides, the Irish moss zone consists of organisms which can only stand short exposure to sun and wind. Short red tufts of Irish moss and smooth strands of dulse cover the rocks, harboring starfish and sea urchins, for example, below.

Zone 6: the kelp zone

This zone is always innundated with water and exposed only at the very lowest tides twice a year. It extends as far as light for photosynthesis can penetrate, which varies depending on the clarity of the water. Kelps dominate here and grow from the ocean floor. Other animals that live in this zone include: sponges, anemones, certain mollusks, echinoderms, arthropods and fish.

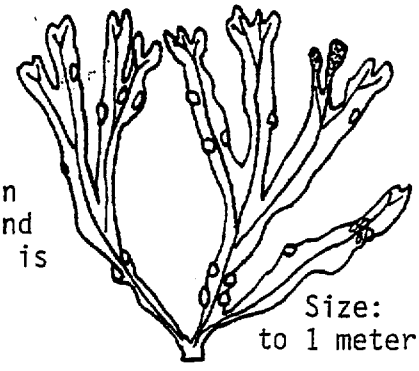
Plants



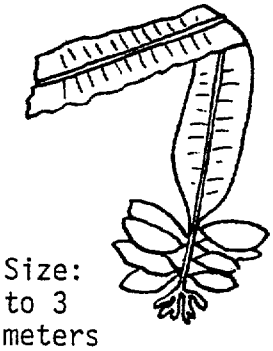
Size: average 60 cm.

KNOTTED WRACK (Ascophyllum nodosum)
Habitat: Sheltered areas in the mid-tidal or subtidal zone.
Characteristics: Knotted wrack is a perennial brown algae with a small holdfast that holds it firmly to rocks. The main blade has short branches with egg-shaped air filled bladders and no midrib. It is used in the packing of lobsters and bait worms.

ROCKWEED (Fucus vesiculosus)
Habitat: Exposed or sheltered areas in the intertidal zone.
Characteristics: This is an olive brown algae with a small holdfast, conspicuous midrib and air bladders within the upper blades. Rockweed is very slippery to step on and serves as a shelter for animals when the tide is out. It is collected and spread as fertilizer.



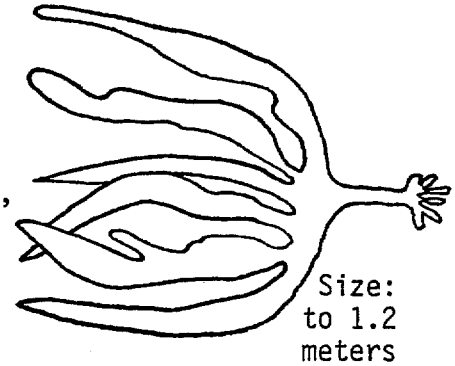
Size: to 1 meter



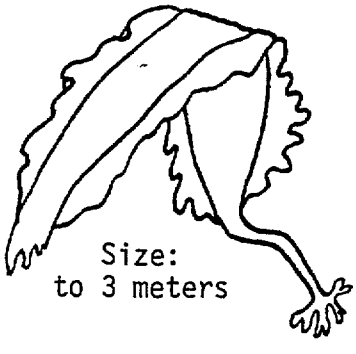
Size: to 3 meters

RIBBED KELP (Alaria esculenta)
Habitat: Exposed areas in the subtidal zone.
Characteristics: Ribbed kelp is a dark brown perennial algae with a large holdfast, an unbranched stipe and an obvious midrib. It is eaten in Ireland, Scotland, Iceland and Japan and is also a commercial source of potash. Ribbed kelp is often found unattached and washed up on the shore.

FINGERED KELP (Laminaria digitata)
Habitat: Semi-sheltered areas in the subtidal zone.
Characteristics: Fingered kelp is a perennial brown algae commonly found washed ashore at Odiorne. It has flat, narrow finger segments on the main blade. Algin, a stabilizer used in dairy products, is produced from it. Fingered kelp is high in certain vitamins and minerals.

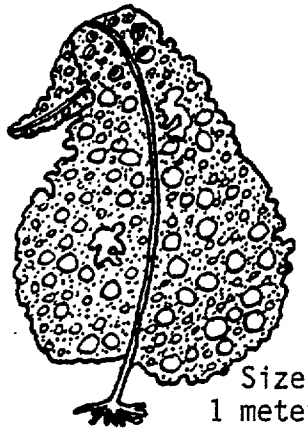


Size: to 1.2 meters



Size: to 3 meters

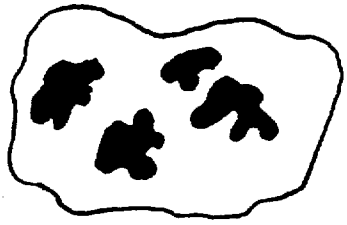
KELP (Laminaria saccharina)
Habitat: Semi-sheltered areas of the subtidal zone.
Characteristics: Kelp is a brown algae that has a rugged blade without a midrib. The blade is unbranched, tapered at the end and has many ruffles along the edges. The holdfast is unbranched and very tough.



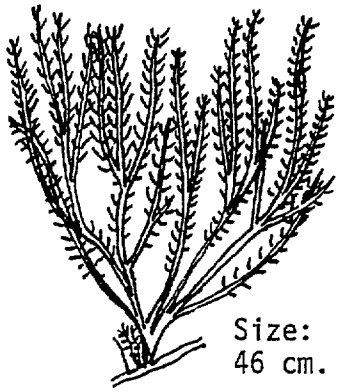
Size:
1 meter

SEA COLANDER (Agarum cribrosum)
Habitat: Subtidal zone; dwarfed forms can sometimes be found in the tidepools.
Characteristics: Sea Colander is a brown algae related to Kelp. Unlike Kelp, it has an obvious midrib and the blade is peppered with holes. Growth takes place at the base of the blade where the holes are smaller.

TAR SPOT ALGAE (Ralfsia verrucosa)
Habitat: Tidepools and lower intertidal rocks.
Characteristics: Tar Spot is a brown algae that forms a black crust on rocks and pebbles. Its texture varies from firm and tar-like to brittle and crumbly. The crust, which looks like a blob of tar, can be up to 3 mm. thick and several centimeters wide.



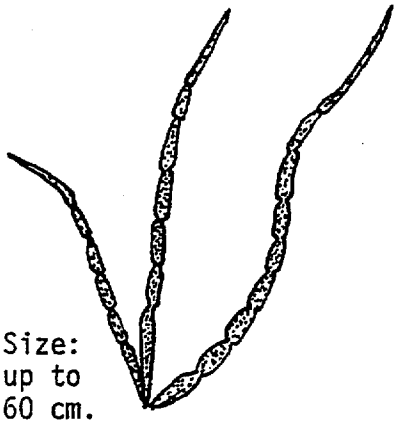
Tar Spot Algae growing on a rock.



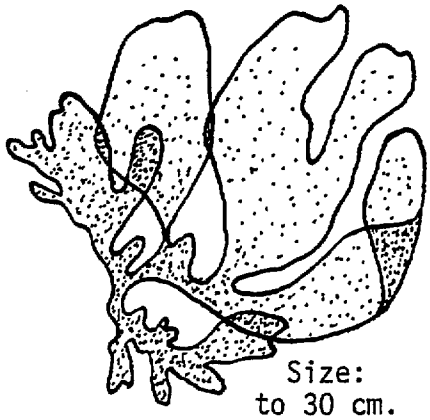
Size:
46 cm.

HORSE'S MANE (Desmarestia aculeata)
Habitat: Lower intertidal and subtidal
Characteristics: Horse's Mane is a brown algae commonly referred to as the acid plant, for its cell sap contains two acids with a pH of between 1 and 4. The branches of this bushy plant are often flattened. When exposed by low tides, the tips bleach white or yellowish.

SAUSAGE WEED (Scytosiphon lomentaria)
Habitat: Exposed areas in the intertidal zone and common in tidepools.
Characteristics: This is a brown, hollow, unbranched algae that is twisted in intervals and thus resembles chains of sausages. Usually found in clumps, Sausage Weed attaches to rocks with a small holdfast. It is an annual and is gone by mid-summer.

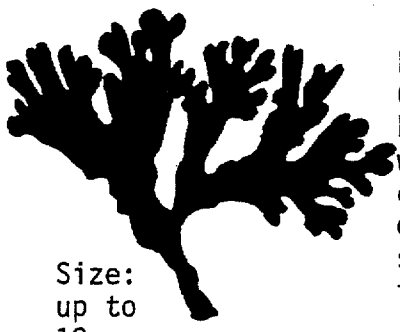


Size:
up to
60 cm.



Size:
to 30 cm.

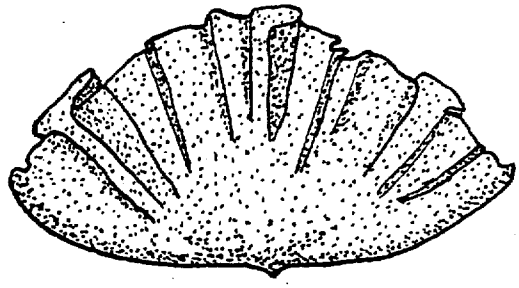
DULSE (Palmaria palmata)
Habitat: Mid-tidal to deep water.
Characteristics: Dulse is a tough, rubbery red algae that is nearly opaque when alive. In time of famine in Ireland, Dulse and potatoes formed a diet that saved the Irish population. It is also used as chewing tobacco, flour and medicine.



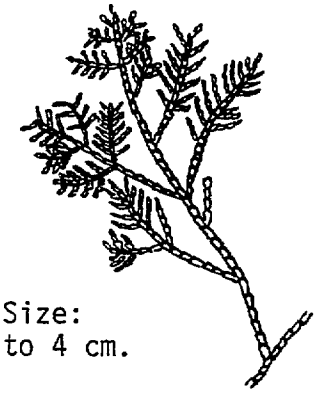
Size:
up to
18 cm.

IRISH MOSS (Chondrus crispus)
Habitat: Lower intertidal zone and below.
Characteristics: Irish moss is a deep red algae that is bleached to green then white by the sun. The blade is without a midrib and the holdfast is small. Irish moss dominates the zone between the rockweeds and kelps. 65% of the water-free material is gelatin and the algae is a source of carrageenin used as a stabilizer in many processed foods.

NORI or PURPLE LAVER (Porphyra umbilicalis)
Habitat: On rocks in intertidal zone.
Characteristics: This is a delicate red membranous algae (older algae may appear to be green) with a holdfast in the center of the blade. Often it is one cell thick. It serves as a food material in many areas of the world, especially in Japan.



Size: up to 30 cm.

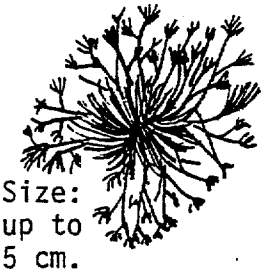


Size:
to 4 cm.

CORAL WEED (Corallina officinalis)
Habitat: Tidepools and lower intertidal zone.
Characteristics: Coral weed is a heavily calcified red algae. It precipitates calcium carbonate from the seawater and forms a "skeleton" of hard jointed segments. Alive it is red, pink or purple and flexible. Dead it is white and brittle. Coral weed is a perennial.

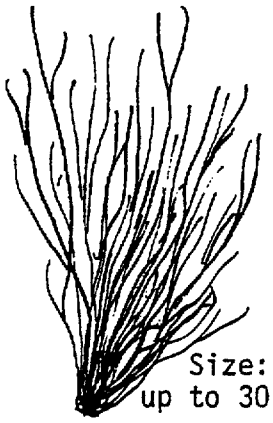
SEA OAK (Phycodrys rubens)
Habitat: Tidepools and lower intertidal zone.
Characteristics: Sea oak is a deep red algae commonly found as an epiphyte on coarse seaweeds such as Kelp. It is leafy and deeply lobed, with a midrib and a distinct branching system of veins.

Size:
15 cm.



Size:
up to
5 cm.

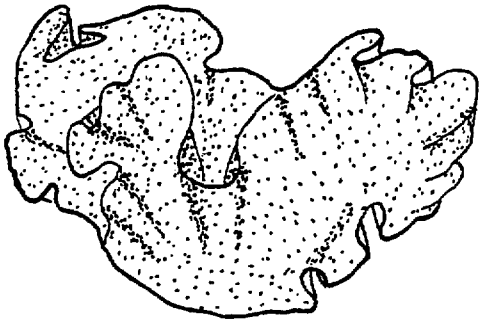
PINCUSHION WEED (Polysiphonia lanosa)
Habitat: Lower intertidal zone.
Characteristics: Polysiphonia is a bushy red algae whose construction looks like bundles of filamentous fibers or tubes bound together. One common species grows on other algae, often Knotted wrack. The main stem is very thin.



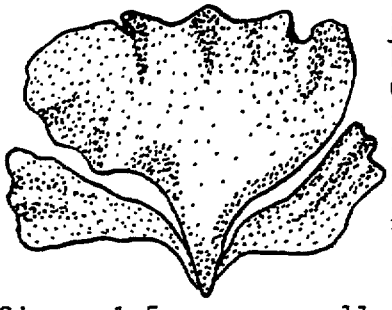
Size:
up to 30 cm.

SEA GRASS (Enteromorpha intestinalis)
Habitat: Intertidal zone and tidepools.
Characteristics: Sea grass is a long, thin, tubular green algae that arises from a small disc at the base where it is attached to a rock. It is .15 to 2.5 cm. wide. Sea grass has a very adaptable salinity tolerance and can be found in estuaries.

SEA LETTUCE (Ulva lactuca)
Habitat: Near and below the low tide mark.
Characteristics: Sea lettuce is a bright green algae made up of a double layer of cells in flat sheets. The holdfast is inconspicuous. Sea lettuce survives a considerable temperature range. It has the consistency of waxed paper.



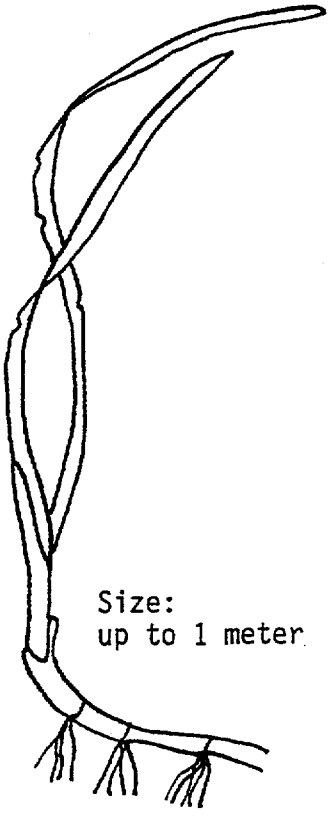
Size: up to 60 cm.



Size: 1.5 cm. or smaller

Prasiola stipata
Habitat: Spray zone and upper intertidal fringe.
Characteristics: Prasiola stipata is guanotrophic, that is, restricted to areas with lots of bird droppings (a gull rookery for example) due to its high nitrogen requirement. It is a dark green algae and can be scraped off rocks in ¼ inch flakes.

EELGRASS (Zostera marina)
Habitat: Sandy flats, estuaries and sheltered inlets. Submerged in 1 to 2 meters of waters.
Characteristics: Eelgrass is not an algae. It is one of the very few true flowering plants that lives in salty water. Eelgrass forms large beds of long grasslike blades whose roots mat together below the mud. It has a wide temperature range. At temperatures less than 10°C it is dormant. Between 10 and 15°C, eelgrass grows only vegetatively (by rootstocks) and above 15°C it flowers, blooming here in July and August. Eelgrass is a perennial, requiring several years to mature. A water borne virus or fungus destroyed most of the eelgrass on the Atlantic coast in 1931-32 and beds are just beginning to show signs of recovery. In addition to supporting and giving shelter to many marine organisms, eelgrass is the principle winter food of the Brant, a small sea goose.

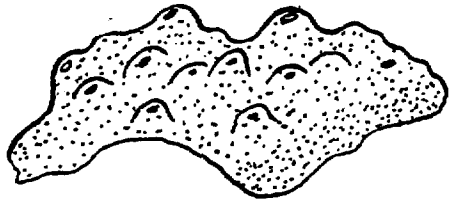


Size:
up to 1 meter

Animals

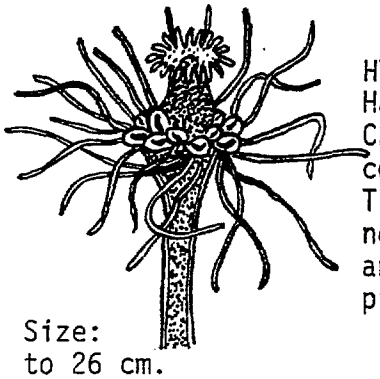
FINGER SPONGE (Haliclona oculata)
Habitat: Lower intertidal on under side of rocks.
Characteristics: A sponge is a collection of cells. Through cooperation and organization of these cells, a sponge takes water in, removes food and oxygen from it, and expels the water through large holes. The finger sponge is erect and branching, and grows in clumps. It is often found bleached and tossed up dead on the shore.

Size: up to 46 cm.



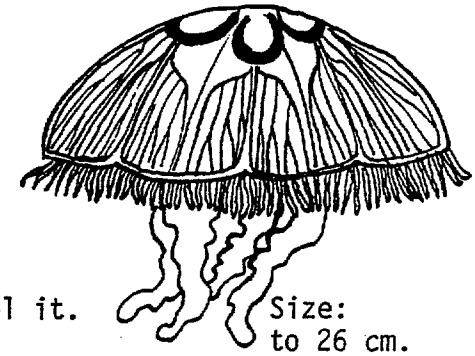
BREAD CRUMB SPONGE (Halichondria panicea)
Habitat: Lower intertidal and subtidal on underside of rocks.
Characteristics: Bread crumb sponge is a common encrusting sponge with an irregular form and volcano-like openings. It is squashy and spongy to the touch. The thinner the sponge the less likely it is to become loosened and torn off during a storm.

Size: several centimeters across



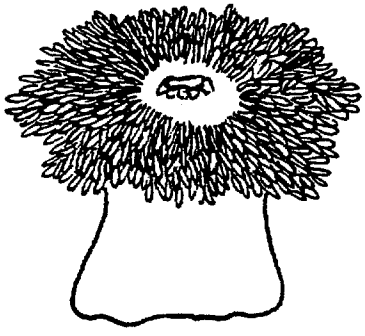
HYDROIDS (Tubularia sp.)
Habitat: Attached to rocks from lower to subtidal zone.
Characteristics: Hydroids are tiny animals that have a colonial attached stage and a free swimming medusa stage. The animals are stalked and have tentacles which contain nemotocysts (stinging cells). The tentacles capture food and draw it back into the mouth. Tubularia hydroids are pink.

Size: to 26 cm.



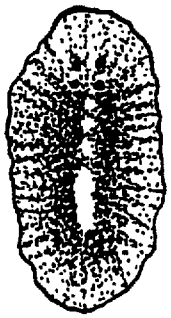
MOON JELLY (Aurelia aurita)
Habitat: Lives offshore, washes up as blob of jelly.
Characteristics: The moon jelly is the common white or translucent jellyfish that swims offshore here in July and August. The four gonads are horseshoe-shaped and visible from above. The moon jelly has nematocysts and can sting well enough to disable the small sea creatures it feeds on, but not so that a person can feel it.

Size: to 26 cm.



SEA ANEMONE (Metridium senile)
Habitat: Lower tidepools to ocean.
Characteristics: The sea anemone is an animal. Though due to its sessile nature and petal-like tentacles, it resembles a plant. The tentacles are armed with nematocysts (stinging cells) and are used to grab food. Usually, sea anemones are found in colonies of 20 to 100 individuals.

Size: to 10 cm.

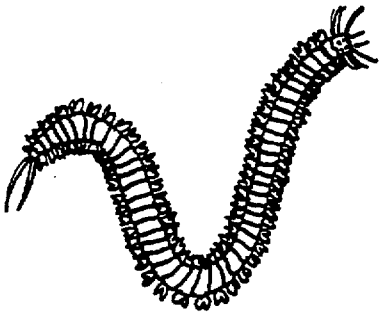


FLATWORM (Notoplana atomata)
Habitat: Under rocks from lower intertidal to subtidal.
Characteristics: Flatworms are soft, unsegmented flat animals with no appendages. They are common under rocks, gliding actively about. The four black dots on the top of the worm are its eye clusters. Its mouth is on the underside. Flatworms are carnivorous and eat live animals they come across. Flatworms are usually yellowish brown in color.

Size: 2.5 cm.

SCALEWORM (Lepidonotus squamata)
Habitat: Lower intertidal to subtidal.
Characteristics: The scaleworm is the most common segmented worm of the rocky shore. It is found under stones, in crevices, and between mussels. Twelve pairs of scales, overlapping like shingles, cover the animal. Bristles extend from either side and aid in movement. If disturbed, scaleworms will roll up like a pillbug.

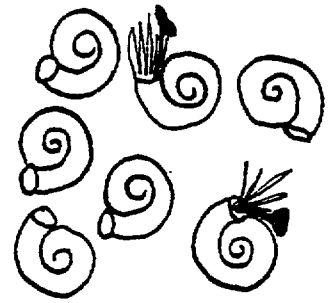
Size: to 5 cm.



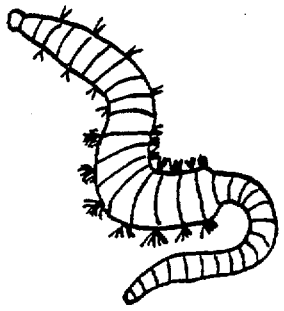
CLAM WORM (Nereis virens)
Habitat: Upper intertidal to subtidal down to 760 m. deep.
Characteristics: Clam worms are fairly attractive segmented worms. Their coloration is an elegant green, coppery brown and red. A pair of appendages and bunches of bristles extend from each segment. By day, the clam worm lives in sand, but at night it comes out to feed, using its good swimming ability and sickle-like jaws to prey on crustaceans and mollusks.

Size: 20.5 cm. average

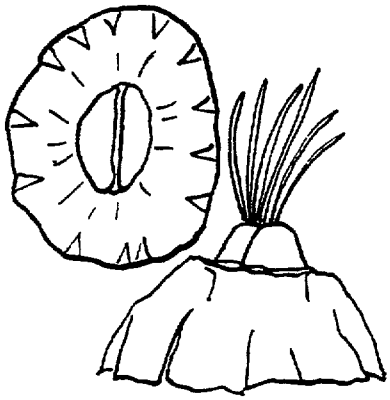
COILED WORM (Spirorbis borealis)
Habitat: Intertidal zone.
Characteristics: Coiled worms are tiny scalelike worms that live in coiled calcareous tubes which they attach to seaweed and sometimes to the shells of mollusks. At the opening of the tube, the worm has a wreath of tentacles, with one tentacle modified to form a plug or operculum. The tentacles serve as snares to trap food and gills for breathing.



Size: .32 cm. diameter coils

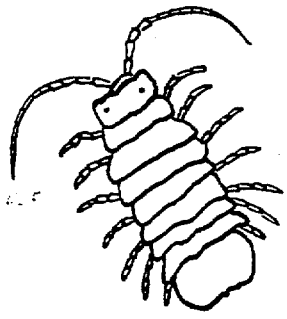


LUG WORM (Arenicola marina)
Habitat: Lower and middle beach.
Characteristics: The lug worm is the earthworm's counterpart along the beach. Living in U-shaped burrows under the sand, lugworms eat their way through the soil, absorbing the food present and expelling the sand in neat castings on the beach.



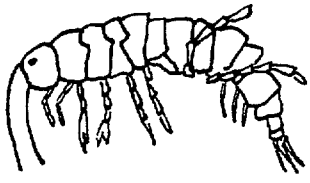
Size: to 2.5 cm.

COMMON ROCK BARNACLE (Balanus balanoides)
Habitat: Intertidally on rocks.
Characteristics: A barnacle is a little shrimp-like creature that is cemented upside down on its head inside a limestone house. When the tide comes in, the barnacle feeds by opening its trap door, extending its six pairs of legs and kicking minute bits of food into its mouth. Barnacles are attached to rocks by a very strong glue.



Size: .32 cm.

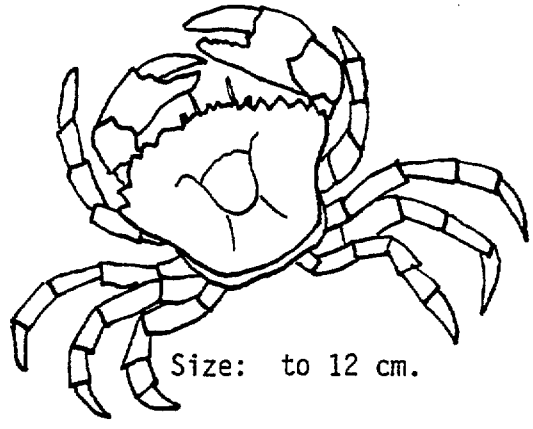
ISOPOD (Jaera marina)
Habitat: Upper intertidal.
Characteristics: Isopods are one type of crustacean arthropod, along with barnacles, crabs, beach hoppers and lobsters. This species is small and bug-like and can be found crawling on the underside of rocks in tidepools. Like most crustaceans, isopods are scavengers and are found wherever there is decaying matter.



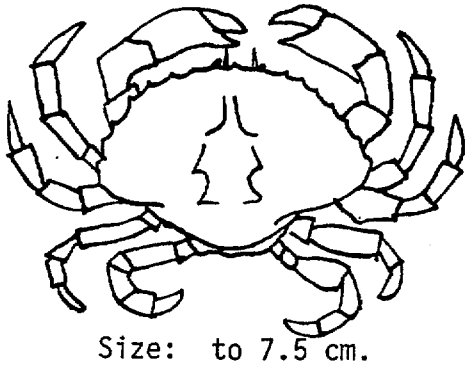
Size: to 2.5 cm.

BEACH HOPPER (Gammarus sp.)
Habitat: Intertidally in decaying seaweeds, tidepools and under rocks.
Characteristics: Beach hoppers (also known as beach fleas, sand fleas, sideswimmers) are the small crustaceans that jump from masses of seaweed when they are disturbed. They are laterally flattened with a small head, small eyes and a strongly arched back and can walk, swim and jump. Beach hoppers are harmless scavengers; eating bits of organic debris.

GREEN CRAB (Carcinus maenus)
Habitat: Intertidal to subtidal at shallow depths.
Characteristics: The green crab is numerous but not conspicuous in daylight. However, at night, they go everywhere, scavenging for decaying matter to eat. Green crabs are a dark blue-green color with a squarish shell. On either side of the eye stalks, 10 jagged points run the front of the shell.



Size: to 12 cm.



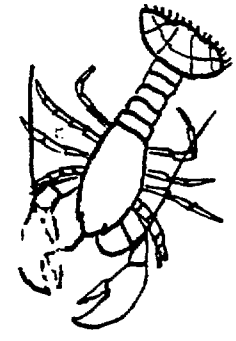
Size: to 7.5 cm.

ROCK CRAB (Cancer irroratus)
Habitat: Lower intertidal and subtidal.
Characteristics: Often found in banks of Irish moss and among Kelp holdfasts, the rock crab has an oval, reddish shell with toothed edges. Crabs will usually eat any kind of flesh they can get their claws into. Cast shells of this type of crab are found on the strand line of sand and rocks.

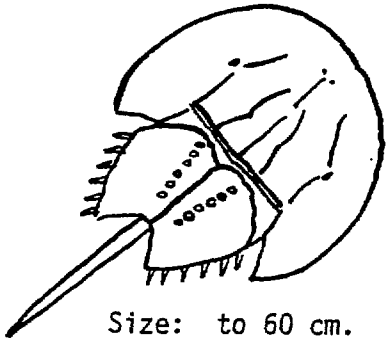
Size: to 1.5 cm.

HERMIT CRAB (Pagurus sp.)
Habitat: Intertidal to subtidal down to 45 meters.
Characteristics: The hermit crab is a close relative of the shrimp, lobster and true crab. It has five pairs of legs. Claws are present on the first pair, the second pair are used for walking, and the last two pairs are modified to help the crab stay in its borrowed shell. Hermit crabs never kill the original occupant of a shell when they need a new one. Often they inhabit empty periwinkle and dogwhelk shells.

LOBSTER (Homarus americanus)
Habitat: Lower intertidal and subtidal to edge of continental shelf.
Characteristics: Until the time of extensive harvesting, lobsters were the most common large crustacean on the rocky shore. Lobsters are lethargic, spending their days backed into a crevice well hidden by seaweed. At night they walk around the bottom scavenging for dead material. It is illegal to handle live lobsters without a license.



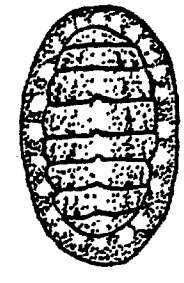
Size: to 1 meter



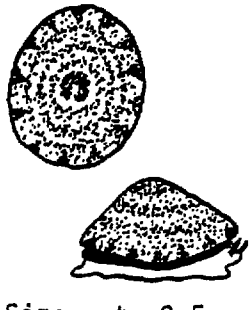
Size: to 60 cm.

HORSESHOE CRAB (Limulus polyphemus)
Habitat: Lower intertidal zone of estuaries.
Characteristics: The horseshoe crab looks menacing, but it is harmless. Its long tail is used to turn the animal over, not as a weapon. A member of the phylum Arthropoda, the horseshoe crab has jointed legs and an outer shell that is shed periodically as the body grows too big for it. Horseshoe crabs are not true crabs and are more closely related to spiders and scorpions. They feed on small clams and worms in the sand.

CHITON (Ischnochiton ruber)
Habitat: Intertidal zone.
Characteristics: The chiton is New England's most primitive living mollusk. A small oval animal with a firm fleshy foot below, the chiton is topped by 8 overlapping plates. Chitons find a nice rock and stick with it, wandering around only at night to feed. They eat algae scraped off rocks by their radula.

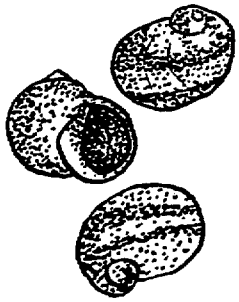


Size: to 2.5 cm.



Size: to 2.5 cm.

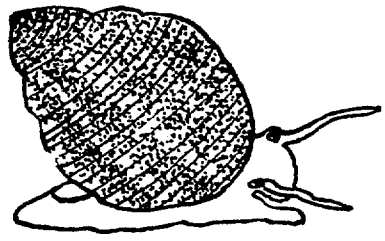
LIMPET (Acmaea testudinalis)
Habitat: Intertidal to subtidal at shallow depths.
Characteristics: The limpet is a snail with a simple flattened conical (Chinese hat-shaped) shell. It uses its large fleshy foot to adhere to rocks by day and moves around at night, scraping algae off rocks with its radula. Generally, it returns to the same spot to rest after eating.



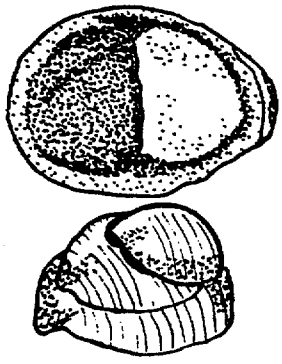
Size: to 1.5 cm.

ACORN SNAIL (Littorina obtusata)
Habitat: Mid-tidal zone, among rockweeds.
Characteristics: The acorn snail (also called the smooth periwinkle) is a small, round periwinkle with a brownish-yellow, smooth, shiny shell that may be banded. At low tide it is attached by mucus secretion to rocks and seaweed. A horny plate (operculum) at the end forms a very effective plug so the periwinkle will not dry out.

COMMON PERIWINKLE (Littorina littorea)
Habitat: Upper tidepools and intertidally all over rocks.
Characteristics: The shell of the common periwinkle is dark grey, low spired and stout. The shell opening is a slightly compressed O. Introduced to the U.S. from Europe, the periwinkle is abundant everywhere on the rocky shore. They scrape algae off rocks with their file-like radula. Common periwinkles are edible after boiling.



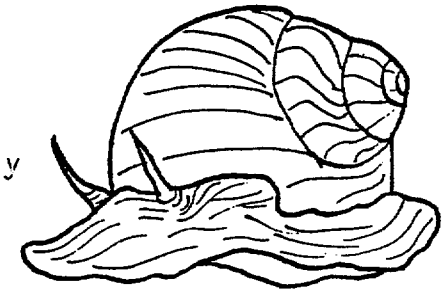
Size: to 2.5 cm.



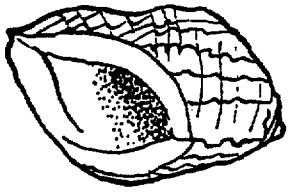
Size: up to 4 cm.

SLIPPER SHELL (Crepidula fornicata)
Habitat: Lower intertidal zones.
Characteristics: The slipper shell or boat shell is found occasionally in sheltered tidepools or attached to other mollusks. Their dusky white oval shell allows the slipper shell to attach themselves to each other. The underside of the shell is open and has a small shelf. They do not have to move to eat. Instead, they filter out food from the water.

MOON SNAIL (Lunatia heros)
Habitat: Sandy beaches
Characteristics: The moon snail is large, round and bluish-white. The animal itself is grayish and seems too big for its shell, but it can pull itself completely inside. The moon snail engulfs its food (often clams) with its foot and drills into it with its toothed tongue or radula. Empty moon snail shells are often found washed up on the rocks.



Size: to 10 cm.



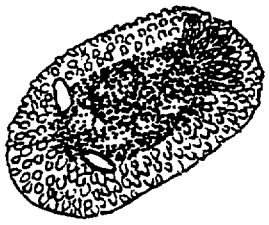
Size: to 4 cm.

DOGWHELK (Thais lapillus)
Habitat: Intertidal.
Characteristics: The dog whelk is a species of snail with a white pointed shell. The older the shell, the thicker it becomes and the color turns off-white. The radula of the dog whelk is used to bore through the shells of mollusks. The mollusk is then consumed.

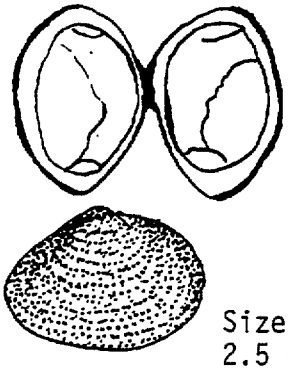
Size: 2.5 cm.

SEA SLUG (Coryphella verrucosa)
Habitat: Lower intertidal to subtidal.
Characteristics: Sea slugs (or nudibranchs) are shell-less snails. They have no true gill, but breath through projections on their backs. This sea slug has white-tipped projections, in strong contrast to their scarlet body below. Sea slugs are flesh eaters and are often found associated with the food they eat. Coryphella is often found on hydroids.

SEA LEMON (Onchidoris sp.)
Habitat: Lower intertidal zone.
Characteristics: The sea lemon is a nudibranch (sea slug) with a ring of gills near the back and one pair of tentacles. It has an oval shape, with a large foot underneath and a mouth containing a radula. Sea lemons feed on sponges and bryozoans.



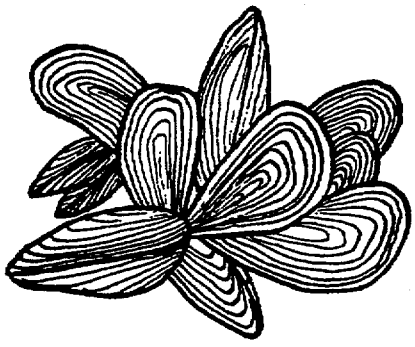
Size: to 2.5 cm.



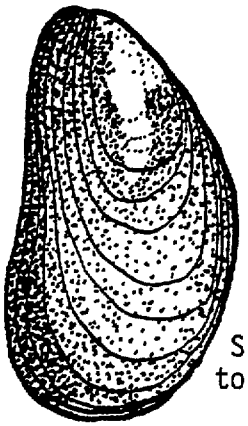
Size: 2.5 cm.

MACOMA CLAM (Macoma balthica)
Habitat: Intertidal, burrows in mud.
Characteristics: This bivalve has a small white or pinkish triangular shaped shell. Clams move by extending their flexible muscular foot out between the shells, gripping the mud and pulling their body and shell along. They extend their siphons to the surface of the sand to obtain the clean water necessary for food and respiration.

BLUE MUSSEL (Mytilus edulis)
Habitat: Intertidal to subtidal zones of estuaries and the open coast.
Characteristics: This is an edible bivalve animal that attaches itself firmly to rocks early in life. Byssal threads secreted by a gland near the foot are used for attachment, although it can be detached and move with its foot. Mussels are filter feeders, opening their shells underwater and straining out microscopic food.

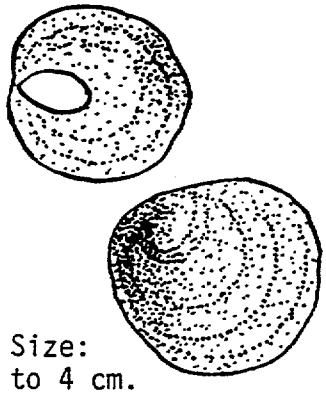


Size: up to 10 cm.



Size: to 15 cm.

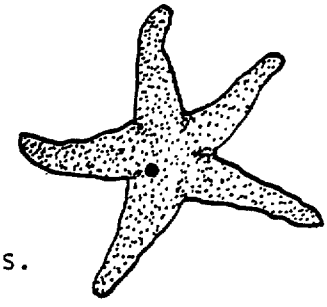
HORSE MUSSEL (Modiolus modiolus)
Habitat: Lower intertidal to subtidal.
Characteristics: The horse mussel is not edible and larger than the blue mussel. It is often cast ashore in the grip of laminarian seaweed holdfasts. Its heavy shell is dark brown and shaggy on the outside and has a pearly lining on the inside. Occasionally, pearls are present.



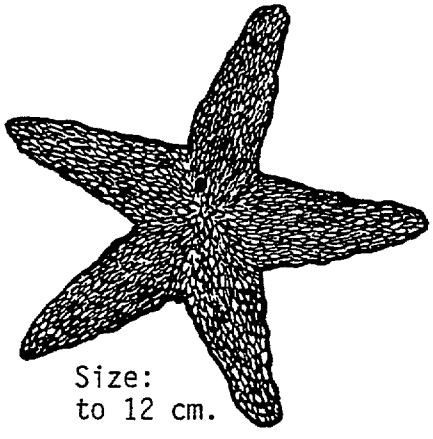
Size:
to 4 cm.

JINGLE SHELL (Anomia simplex)
Habitat: Lower intertidal and subtidal.
Characteristics: The jingle shell is a small bivalve with a thin translucent yellowish shell that has unequal valves (shells). The upper valve is larger and dome shaped. The lower valve is very thin, concave and has a round hold just below the hinge through which a large, calcified byssal thread attaches the jingle thread to a rock.

BLOOD STAR (Henrica sanguinolenta)
Habitat: Lower intertidal.
Characteristics: The blood star is an echinoderm with a red, fine granular surface and a light yellow underside with tubefeet in two rows. The madreporite or seive-plate on the upper surface at the intersection of two arms allows water to pass into its body. The blood star feeds on sponges.



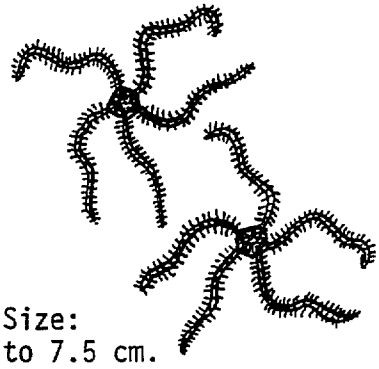
Size: 5 cm.



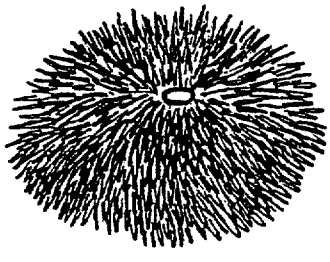
Size:
to 12 cm.

COMMON STARFISH (Asterias vulgaris)
Habitat: Intertidal to subtidal.
Characteristics: This starfish (preferred term "seastar") is an echinoderm with numerous small spines on the upper surface and rows of tubefeet below. Light sensitive eye spots are located at the end of each arm. Arms torn off are regenerated. Seastars pull open bivalves, evert their own stomachs into the bivalve shell and digest the animal.

DAISY BRITTLE STAR (Ophiopholis aculeata)
Habitat: Lower intertidal.
Characteristics: Brittle stars are secretive and commonly found in bread crumb sponge or in and among matted growth and holdfasts of seaweed along the sides of tidepools. Their movement is snake-like and their arms are fragile and easily broken off. Brittle stars eat minute detrital particles.

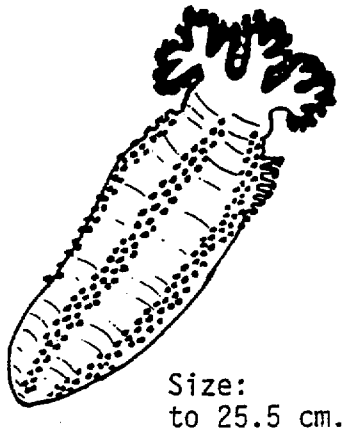


Size:
to 7.5 cm.



Size: up to 7.5 cm.

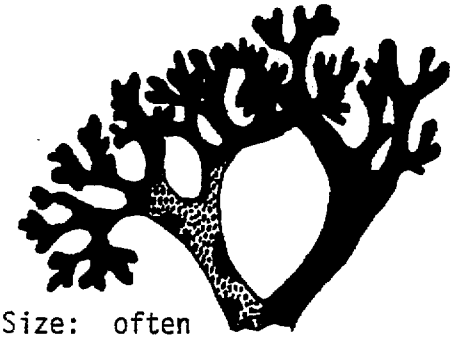
SEA URCHIN (Strongylocentrotus drobachiensis)
Habitat: Intertidal.
Characteristics: The sea urchin is an echinoderm with a hard spiny shell completely surrounding the soft parts. Tubefeet extend through openings in the shell plate. Mouth parts below are set in the center of the shell. Sea urchins are vegetarian browsers, scraping algae off rocks with their beaklike mouth.



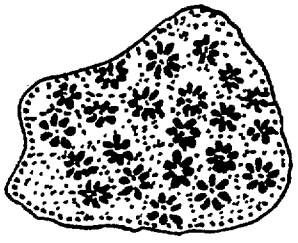
Size:
to 25.5 cm.

SEA CUCUMBER (Cucumaria frondosa)
Habitat: Lower intertidal and cold tidepools to subtidal.
Characteristics: The sea cucumber is a softbodied, elongated echinoderm. Thick-walled with a cylindrical body, it looks just like a cucumber. They use their tubefeet to attach to rocks and to move around. Usually, the crown of tentacles at the front end is withdrawn, but it protrudes for feeding. Sea cucumbers feed on microscopic plants collected from the surrounding water.

SEA LACE (Electra sp.)
Habitat: Intertidal.
Characteristics: Sea lace is a colony of minute animals called bryozoans that forms a crust on algae or shells. The colonies are made up of numerous calcereous cells and look like lace. To feed, each individual extends its tentacles through the opening in its tiny shell and grabs small organisms as they come within reach.



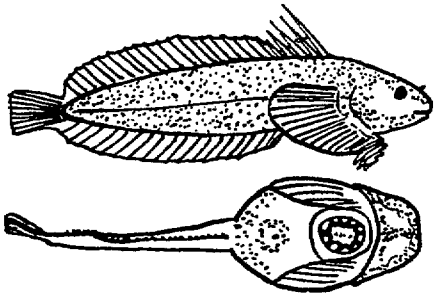
Size: often
1 to 2 cm. across



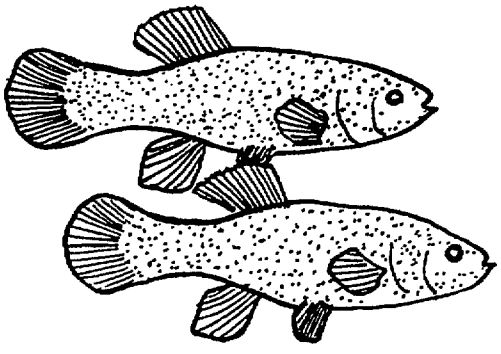
Size: to .32 cm.

STAR TUNICATE (Botryllus schlosseri)
Habitat: Lower intertidal to subtidal.
Characteristics: Star tunicates encrust on rocks and are dark greenish in a yellowish background. (Or sometimes yellowish on a dark background!) These are sessile colonial animals and are considered to be advanced invertebrates. The larval form of these creatures possesses characteristics, such as primitive backbone, that are similar to larval vertebrates. They are filter feeders.

SEA SNAIL (Neoliparis atlanticus)
Habitat: Low intertidal and subtidal.
Characteristics: Fish, unlike all the previous animals, are vertebrates. The sea snail is an unusual fish which looks very similar to the tadpole. It is an olive green color and its pelvic fins are modified to form a sucking disc on the bottom. The disc allows the fish to cling to rocks and even buoys.

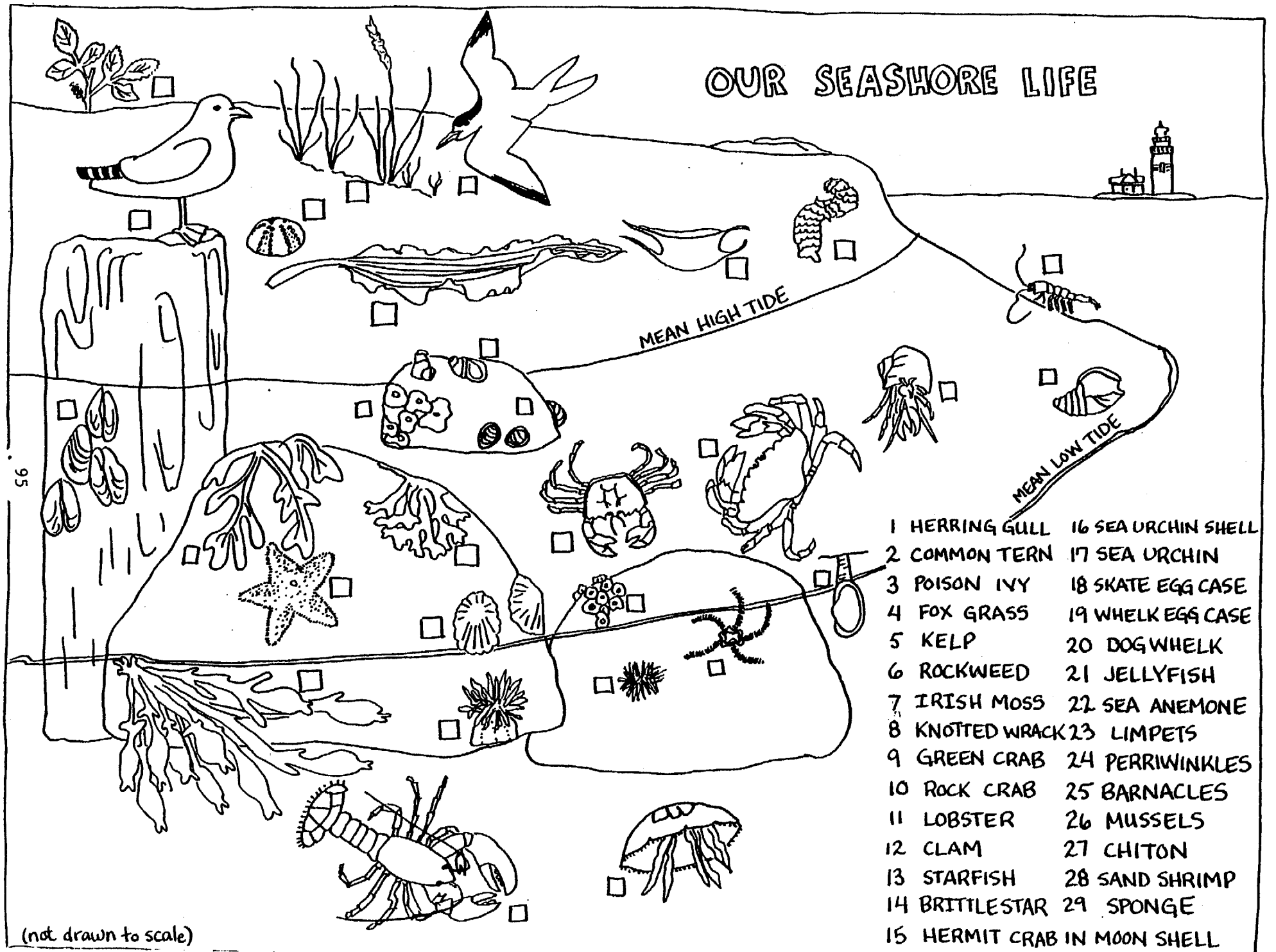


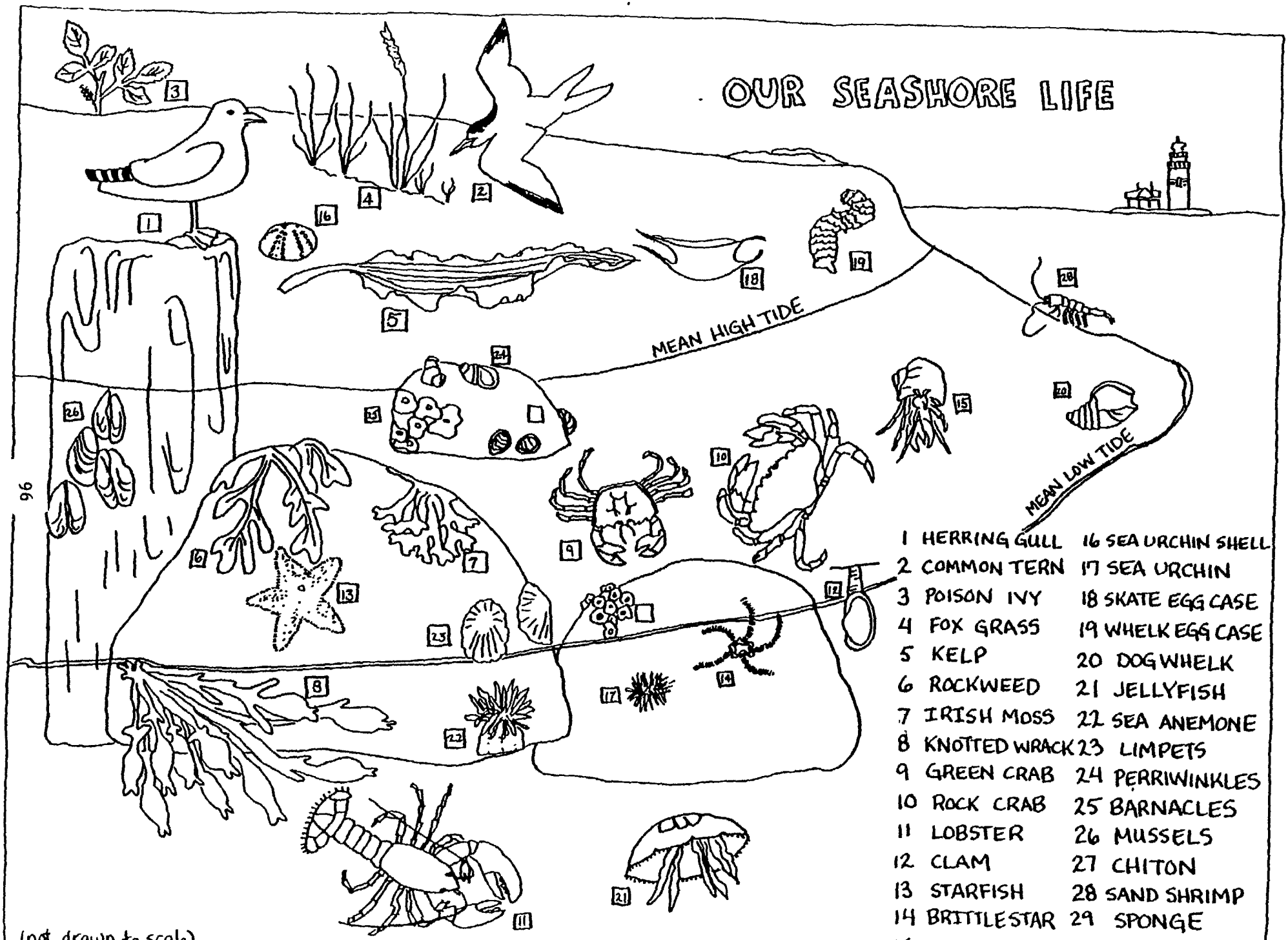
Size: average 7.5 cm.



Size: average 5 cm.

MUMMICHOG (Fundulus heteroclitus)
Habitat: Marshes, estuaries, intertidally.
Characteristics: Mummichogs, also known as killifish, are small, stout-bodied fish. They are resistant to a lack of oxygen and changes in temperature. If their tidepool dries up they work their way into the mud and wait for high tide. Mummichogs feed on plants, small marine invertebrates and mosquito larvae.


OUR SEASHORE LIFE
MEAN HIGH TIDE
MEAN LOW TIDE
1 HERRING GULL
2 COMMON TERN
3 POISON IVY
4 FOX GRASS
5 KELP
6 ROCKWEED
7 IRISH MOSS
8 KNOTTED WRACK
9 GREEN CRAB
10 ROCK CRAB
11 LOBSTER
12 CLAM
13 STARFISH
14 BRITTLESTAR
15 HERMIT CRAB IN MOON SHELL
16 SEA URCHIN SHELL
17 SEA URCHIN
18 SKATE EGG CASE
19 WHELK EGG CASE
20 DOG WHELK
21 JELLYFISH
22 SEA ANEMONE
23 LIMPETS
24 PERRIWINKLES
25 BARNACLES
26 MUSSELS
27 CHITON
28 SAND SHRIMP
29 SPONGE
(not drawn to scale)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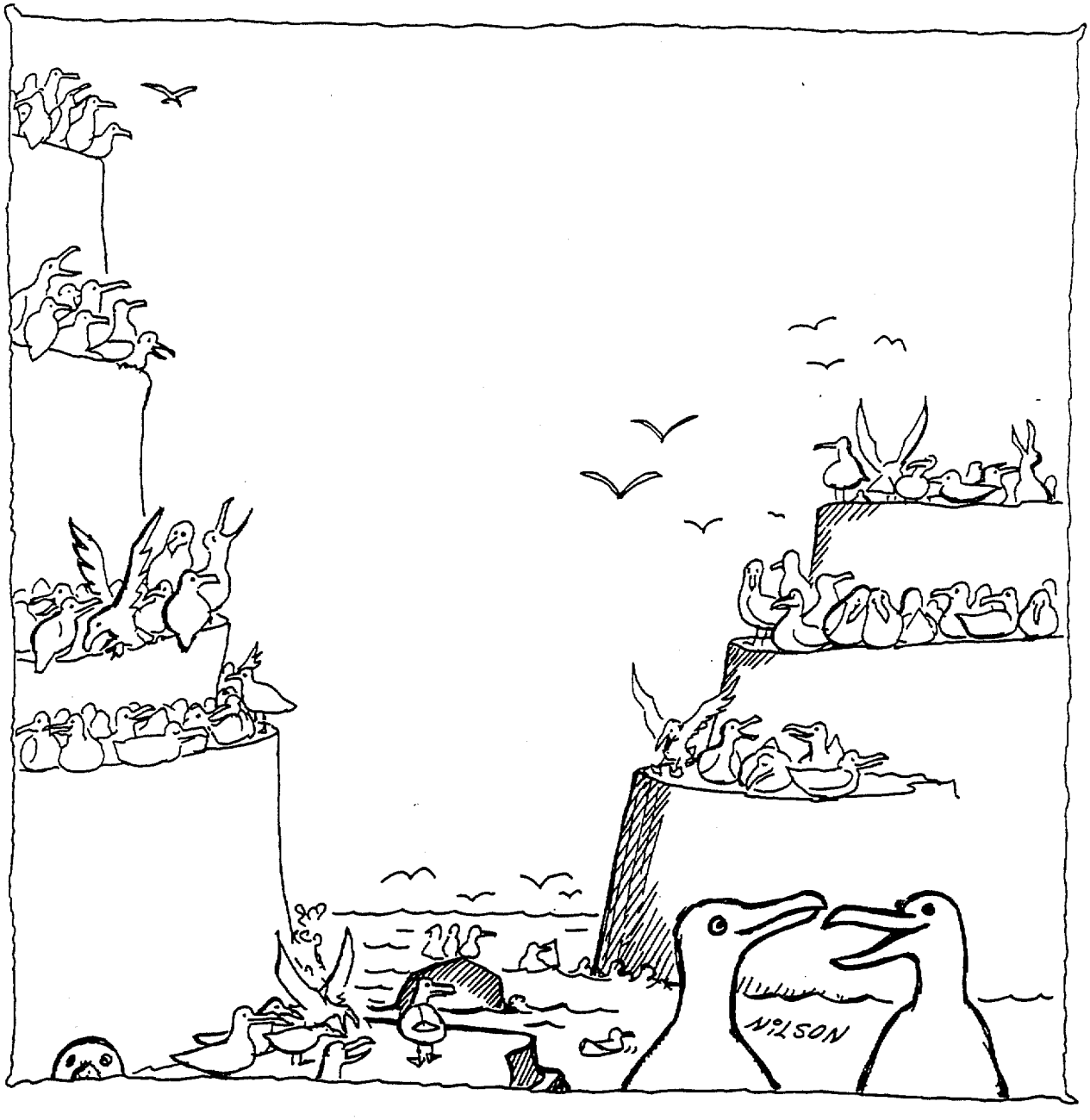
(not drawn to scale)

How did it go?

Evaluation



V. HOW DID IT GO? EVALUATION

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Course Evaluation 97

V: HOW DID IT GO?

COASTAL ISSUES: A WAVE OF CONCERN
Course Evaluation

Grade Level ___ Student or Teacher? (Circle one)

1. What part of this course did you use?

___ All
___ Which Way to the Beach: Introductory Concepts
___ How's the Water?: Make Decisions
___ Get Your Feet Wet: Research the Issues
___ Take the Plunge: Everyone Wants a Piece of the Coast!
___ Help!! Resources and References

If you didn't use it all, why? (This will help when we revise it.)

2. How long did it take to complete the part you used?

_____hours

3. Was this course:

___part of a biology course
___part of a social studies class
___other (please describe)

_____
_____
_____

4.

	No		Somewhat		Yes
Were the objectives clear?	1	2	3	4	5
Did the activities and lesson help you meet the objectives?	1	2	3	4	5
Did you learn skills you can use in your own community?	1	2	3	4	5
Would you recommend the course to someone else?	1	2	3	4	5

5. As a result of this course will you: (check as many as are appropriate)

___take an active part in solving community problems?

___try to get further training in decision making?

___have a greater appreciation of N.H.'s coastal resources?

___pay closer attention when the media is discussing a coastal issue?

___become involved in a coastal issue? Which one?

6. What would you add to the course?

7. What would you eliminate?

8. How would you change the curriculum, *Coastal Issues: A Wave of Concern?*

9 What part of the course did you learn the most from:

___readings ___case study work

___field trips ___user group profile exercise

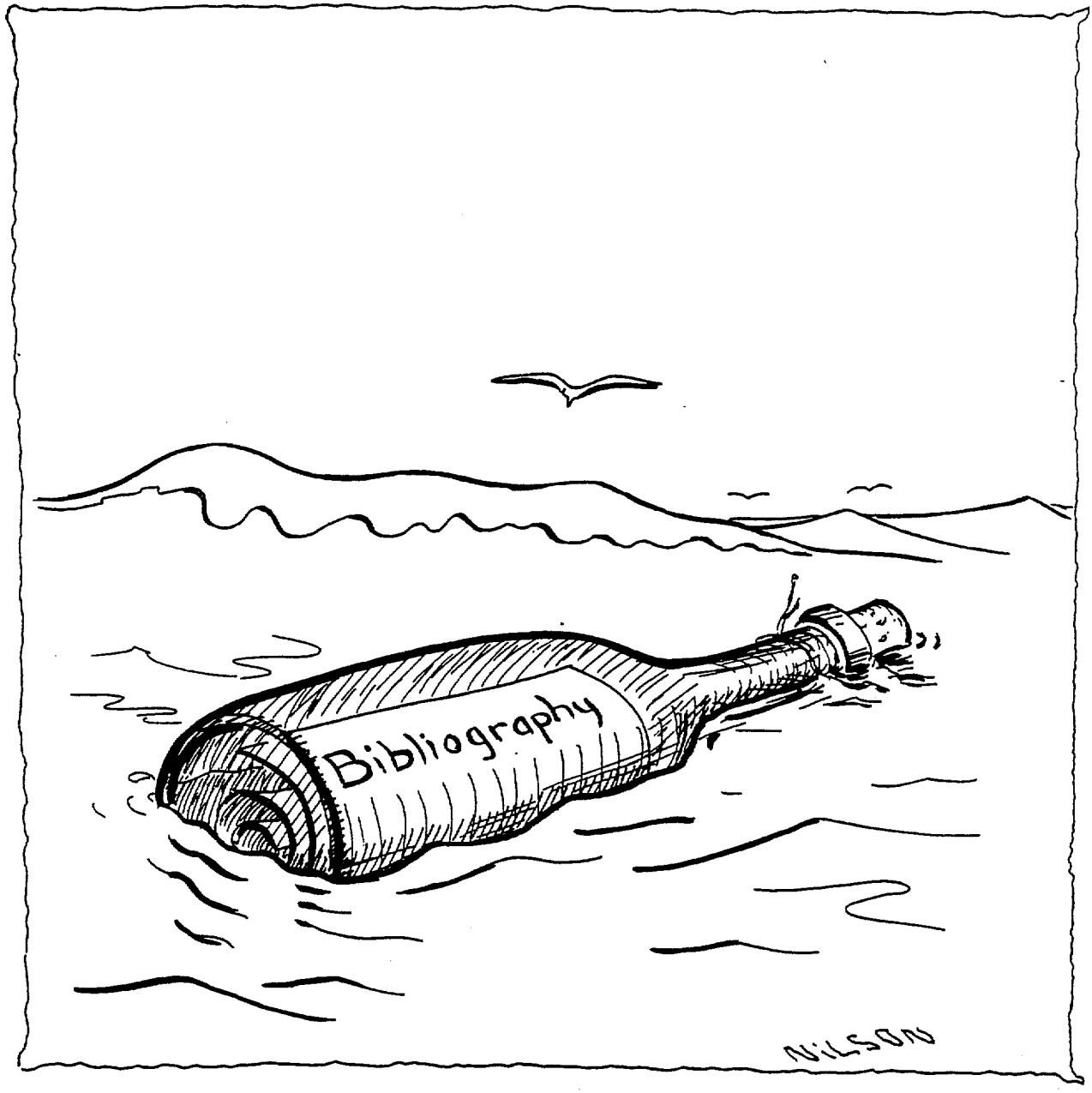
___Odiorne simulation ____other (explain)

10. Other Comments:

PLEASE MAIL THIS EVALUATION TO SHARON MEEKER, SEA GRANT EXTENSION, KINGMAN FARM/UNH, DURHAM, N.H. 03824

Help!!!

Resources and Appendices



VI. HELP!! RESOURCES AND REFERENCES

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VI: Help!! RESOURCES AND REFERENCES

Note: Most video-tapes, slide programs, and references listed below can be found in the Marine Education Resource Center (MERC) at the Sea Grant Offices, Kingman Farm, University of New Hampshire, unless otherwise indicated. Locations of resources to be found elsewhere are noted at the end of the particular entry.

Video-Tapes

The Intertidal Zone,. Incredible underwater photography brings you eye to eye with animals and plants that are adapted to living in this harsh zone between the tides. N.H. Fish and Game Department, 2 Hazen Drive, Concord, N.H. 03301.

Not Just Another Fish Story. Describes the fishing industry from seafloor to table in the Gulf of Maine. Maine Sea Grant Marine Advisory Program. (30 minutes).

Options for the Future: A Guide to Coastal Resource Management. Sea Grant Extension, UNH. (26 minutes).

Pointless Pollution: America's Water Crisis. Walter Cronkite narrates this examination of water contaminants believed to make up 80% of America's water pollution. N.H. Fish and Game Department, 2 Hazen Drive, Concord, N.H. 03302.

Return from the Sea... The story of resoration of Atlantic Salmon in New England. (27 minutes).

A Sea Beside the Sea. Excellent overview of the Gulf of Maine: its origins, development pressures and their results. (30 minutes).

A Sense of Place. Interviews and discussion with people from Maine responding to development pressures. Excellent. (25 minutes)

Slide Programs:

Note: Almost all the following slide programs are a part of the UNH Marine Docents' SEATREK program. Those with * have a tape or script and can be used independently. The others are presented by a Docent (volunteer). There is a small charge for the programs.

**Children of the Waters.* An overview of coastal resources and the issues surrounding them. (15-20 minutes).

Coastal Issues. A lecture that can be adapted to most audiences on current issues on the New Hampshire coast. (45-60 minutes).

**Getting a Bird's Eye View of the New Hampshire Coast..* Aerial photos, zeroing in on some points in the coastal area. (10 minutes).

**The Great Bay.* Slide-tape show with script and tape which advances the slides automatically. Short, general overview of the estuary. (12 minutes).

**The Great Bay Estuarine Research Reserve.* Complete presentation about the Research Reserve and some information on the estuary. (30 minutes).

**New Hampshire's Treasure: The Great Bay Estuary.* Describes the estuary in detail. (25 minutes).

Isles of Shoals. Natural and maritime history of the islands plus an insider's view of the Shoals Marine Laboratory on Appledore Island. (45-60 minutes).

Rocky Shores. Plants and animals of the intertidal zone. Concepts of zonation, adaptation, predation and interdependence. (45-60 minutes).

The Salt Marshes: Nurseries of the Sea. With script. Detailed description of the salt marshes in the estuary. (30 minutes).

Wings Across New Hampshire. Coastal birds and their habitats. New Hampshire Audubon Society. Call 603-224-9909 to reserve it. (45 minutes).

Books, References and Curricula

Adams, John P. *Drowned Valley* : The Piscataqua River Basin. University Press of New England, 1976. Excellent historical photos and newspaper articles on the seacoast.

Berrill, Michael and Deborah *Sierra Club Guide to the North Atlantic Coast, Cape Cod to Newfoundland.* Sierra Club Press, 1981. Describes the North Atlantic coastal environment for the lay person.

Brody, Michael and Meeker, Sharon. *The Floating Lab Teachers' Resource Manual.* UNH/Me. Sea Grant Marine Advisory, Rev. 1991. An oceanographic sampling program for grades 7-12.

Charting our Course: An Activity Guide for Grades 6 - 12 on Water Quality in the Gulf of Maine. Maine State Planning Office, Augusta, Maine, 1991.

Coastal Problems and Resource Management: Teachers Guide for a Secondary Social Studies Course. Curriculum Research and Development Group, University of Hawaii at Manoa, 1979.

Coulombe, Deborah A. *The Seaside Naturalist.*, Prentice-Hall, 1987.

Coulombe, Deborah A. and others.*Through the Looking Glass Teachers Guide,.* UNH/Me Sea Grant Marine Advisory Program. 1984.

Fishbanks, Ltd. A role-playing simulation game that teaches principles of sustainable management for natural resources. Institute for Policy and Social Science Research, UNH. Cost: $100.

Games on Issues of Sustainable Development. Interact, Learning Through Involvement, P. O. Box 997-591. Lakeside, California, 92040.

Meeker, B. Sharon. *The Great Bay Living Lab: A Resource Manual for Teachers and Students.* UNH/Me Sea Grant Marine Advisory Program. Revised, 1991.

New Hampshire Coastal Program and Final Environmental Impact Statement. N.H. Office of State Planning. July, 1988.

Yankee Lands: A Land Use Curriculum Project. Antioch/New Hampshire Graduate School. Keene, N.H. ,1984.

ADDRESSES AND PHONE NUMBERS

Anadromous Fish and Freshwater Research Laboratory
Spaulding Life Sciences
UNH
Durham, N.H. 03824

Albacore Museum
Market Street Extension
Portsmouth, N.H. 03801
436-3000

Audubon Society of N.H.
P. O. Box 528-B
Concord, N.H. 03301
224-9909

Civil Engineering Department
Kingsbury Hall
UNH
Durham, N.H. 03824

Conservation Law Foundation
3 Joy Street
Boston, M.A. 02108

Council on Resources and Development
N.H. Department of Resources and Economic Development (DRED)
Hazen Drive
Concord, N.H. 03301

Friends of Odiorne Point, Inc.
c/o Seacoast Science Center
Kingman Farm/UNH
Durham, N.H. 03824

Granite State Minerals Corp.
Newington, N.H.

Great Bay Estuarine Trust
P. O. Box 277
Durham, N.H. 03824

Great Bay National Estuarine Research Reserve
N.H. Fish and Game Building
37 Concord Road
Durham, N.H. 03824
868-1095

Isles of Shoals Study Group
174 Wednesday Hill Road
Durham, N.H. 03824

National Gypsum Company
Newington, N.H.

National Marine Fisheries Service
Gloucester, MA,
617-281-3600

N.H. Coastal Program Office
152 Court Street
Portsmouth, N.H. 03801
431-9366

N.H. Department of Air Resources
Concord, N.H. 03301

N.H. Department of Environmental Services
N.H. Wetlands Board
Water Resources Division
64 North Main St., P. O. Box 2008
Concord, N.H. 03301
271-2431

N.H. Department of Fish and Game
2 Hazen Drive
Concord, N.H. 03301
(271-3421 shellfishing closures) (271-2501 clamming permits)

N.H. Department of Fish and Game
37 Concord Road
Durham, N.H. 03824
868-1095

N. H. Department of Health and Human Services
Hazen Drive
Concord, N.H. 03301

N.H. Department of Resources and Economic Development
Division of Parks and Recreation
172 Pembroke Road
Concord, N.H. 03301
271-3483

N.H. State Port Authority
555 Market Street
Portsmouth, N.H. 03801
436-8500

N.H. Public Utilities Commission
8 Old Suncook Road
Concord, N.H. 03301
271-2431

N.H. Department of Transportation
Hazen Drive
Concord, N.H. 03301

Pease Development Authority (PDA)
Pease Air Force Base
Newington, N.H.
433-6088

Port of New Hampshire (See N.H. State Port Authority)

Portsmouth Fishermen's Co-op
P. O. Box 4159
Pierce Island
Portsmouth, N.H. 03801
436-8927

Portsmouth Historical Society
43 Middle Street
Portsmouth, N.H. 03801
436-8420

Resource Economics Department
James Hall
UNH
Durham, N.H. 03824

Rockingham County Extension Office
P. O. Box 200
Epping, N.H. 03042

Rockingham Regional Planning Commission
121 Water Street
Exeter, N.H. 03833
778-0885

Seabrook Power Station (New Hampshire Yankee)
P. O. Box 700
Seabrook, N.H. 03874
474-9521

Seacoast Anti-Pollution League
5 Market Street
Portsmouth, N.H. 03801
431-5089

Seacoast Council on Tourism
P. O. Box 830
Durham, N.H. 03824

Seacoast Science Center (formerly the Visitor Center at Odiorne Point)
c/o UNH Sea Grant
Kingman Farm/UNH
Durham, N.H. 03824
749-1565

Simplex Wire and Cable Company
Newington, N.H.

Society for the Protection of New England Antiquities
142 Pleasant Street
Portsmouth, N.H.

Spinney Creek Oyster Company
38 Newson Avenue
Kittery, N.H.
207-439-2719

Strafford Regional Planning Commission
County Courthouse
County Farm Road
Dover, N.H. 03820
742-2523

Strawbery Banke
454 Court Street
Portsmouth, N.H. 03801
433-1100

U.S. Army Corps of Engineers
New England Division
424 Trapelo Road
Waltham, M.A. 02254
800-343-4789

U.S. Coast Guard
Portsmouth Station
USGS
New Castle, N.H., 03854
436-4414

Urban Forestry Center
Elwyn Road
Portsmouth, N.H. 03801
431-6774

VOICE
Old Garrison Road
Dover, N.H. 03820
742-9434

Note: The University of New Hampshire's telephone number is 862-1234.