4-H ADVANCED MARINE SCIENCE

MEMBER'S BOOK

This pilot Marine Science project was developed by Oregon State University's Marine Advisory Program and is being tested in Oregon, Washington, and California. The Marine Advisory Program is a part of the O.S.U. Extension Service and Sea Grants programs. Sea Grant is supported by the National Oceanic and Atmospheric Administration.

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ADVANCED 4-H MARINE SCIENCE

This project book contains a number of activities for a marine science club. A brief description of the activities are listed on the first three pages. The remainder of the book contains various materials for the club member. The activities should be completed at the club meetings as the leader will have materials and instructions necessary to complete many of the activities.

PROJECT ACTIVITIES

BEACH SAFETY

Keep records of accidents that occur on the beach, from newspaper, radio and TV news reports. Discuss the accidents, their causes, and measures that should have been taken to prevent them from happening.

LIFE IN THE OCEAN

Ocean Mammals

Give a report on the life history of one of the ocean mammals; seal, sea lion, whale, etc.

Phytoplankton

A leaflet entitled "Phytoplankton, Grass of the Sea", will be available from your leader. At one of your club meetings read the pamphlet and complete the discussion guide on page 7 of this booklet.

PHYSICAL OCEANOGRAPHY

Ocean Zones and Boundaries

Your leader will have a pamphlet entitled "Ocean Zones and Boundaries". Read and discuss the pamphlet at a 4-H meeting and complete the discussion guide on page 8 of this booklet.

Waves

Wave Tank

Construct a wave tank from instructions provided by your leader. Follow instructions to demonstrate beach erosion with your tank. Complete the discussion guide.

Tides

Read the material which explains the tidal cycle. Graph the tides for a three day period.

Ocean Currents

Read the material on drift bottles. Chart drift bottle releases from the data sheet.

Geology of the Coast

Read and discuss the pamphlet "Landslides of Oregon: North Coast", which your leader will provide, and complete the discussion guide.

Take a field trip to the Newport area to study the geology of that region.

Ocean Floor

Plot ocean sediments found off the Oregon coast. Read the material on ocean sediments and complete the discussion guide.

Contour the ocean depths off the Oregon coast.

NAVIGATION

Learn to use the compass and navigational terms by completing the discussion guide on page 28 of this booklet.

ROCKY BEACH FIELD TRIP

Take a field trip to the rocky beach at low tide to observe animal and plant life on the exposed rocks. Observe where and how each species lives. How do they get their food, protect themselves from enemies, keep from drying out or being washed away by the waves?

Fill in the Rocky Beach Field Trip Guide, pages 29-31.

Discuss your answers with your leader.

ENVIRONMENTAL PROBLEMS

Pollution

Discuss different kinds of pollution in the marine environment. Take a field trip to the beach or bay to list obvious pollution, or organize a litter drive to clean a problem area of the beach or bay.

SPORT FISHING

Learn how to tie and prepare fishing lures.

Invite a representative from a sporting goods store to give a talk about fishing equipment.

Discuss the life cycles of some of the sport fish, their feeding habits and habitat preference.

Discuss how to clean and care for fish after it is landed.

Prepare cluster eggs for bait at one of your meetings.

Take a fishing trip either to the coast or to an inland stream.

SEA FOOD

Home Processing of Sea Food

Prepare some sea food item by freezing, canning, or smoking. A pamphlet is available from your leader which has directions for freezing and canning sea foods.

Sea Food Industry

Learn about commercial fishing equipment and methods. Check with your State Fish Commission as they probably have literature on commercial fishing equipment.

Take a trip to a commercial boat dock to observe the equipment and various types of ships used for commercial fishing.

Take a tour through one of the sea food processing plants. Some processing plants will give guided tours if arranged in advance.

With your leader, check with those nearest you and arrange a club tour.

ACTIVITIES FOR THE BEACH

Rocky Intertidal Field Trip

Take a field trip to the rocky beach at low tide.

Beach Profile

On a sandy beach, determine the profile or amount of slope of the beach for both winter and summer. Instructions are given in "Field Guide to the Beaches", by John Hoyt.

Collect Algae

Collect samples of algae while on the beach field trip for pressing and cooking. Some of you may wish to try the bread and pickle recipes which are available from the leaders.

Marine Birds

Keep a checklist of marine birds and check off the individual birds as you sight them on your trip.

Sand Grain Size

Examine sand grain size at different locations on the beach, close to the water's edge, high on the beach and in the sand dunes bordering the beach. Explain why you find different sized sand grains at different locations on the beach.

Clamming

If your visit to the beach coincides with a good low tide, your group may wish to go clamming. Check for state bag limits and regulations before your trip. Information can be obtained from the Fish and Game Commission.

Fossil Collecting

Fossil clams and other fossils are often embedded in sandstone along the coast. Some of you may want to collect and make a display of marine fossils.

OCEAN MAMMALS

Give a report on the life history and interesting information about one of the ocean mammals: seal, sea lion, sea otter, porpoise, whale, etc. to your club or some other group. Learn as much as you can about the mammal you select.

PHYTOPLANKTON

Read and discuss the leaflet "Phytoplankton, Grass of the Sea" at a club meeting. Your leader will have a copy. Then complete the phytoplankton discussion guide.

Phytoplankton Discussion Guide

1. What is upwelling?

2. How does upwelling affect phytoplankton?

3. Explain the cause of the foggy weather experienced on the Oregon coast during the summer.

4. Which are the most numerous types of phytoplankton?

5. What does the word bioluminescent mean?

6. How is phytoplankton collected?

7. What is the importance of phytoplankton to the food chain in the sea?

8. How can we increase our yield of food from the sea?

9. How do DDT and oil affect phytoplankton and algae?

10. Name one species of phytoplankton which is responsible for red tides.

OCEAN ZONES AND BOUNDARIES

These questions are to be answered during or following your club's discussion of this topic.

Ocean Zones and Boundaries Discussion Guide

1. What are some of the problems encountered when making laws about the ocean?

2. What are the three traditional zones of the ocean in terms of ownership and use?

3. Why is the ocean becoming more important to us?

4. What are internal waters?

5. What is the territorial sea? How wide is the U.S. territorial sea?

6. Why does the U.S. claim a narrow territorial sea, while some other nations claim much wider areas?

7. What are the high seas?

8. What did the exclusive fishing zone act of 1966 establish?

9. Does each state have the exclusive right to sell the right to extract resources off its off-shore areas?

10. What kind of treaty agreement exists between the U.S., Canada, and Japan in regard to fishing for salmon?

WAVES

Wave Tank

A wave tank can be constructed from the instructions which will be provided by your leader. Complete the following experiment and discussion guide.

Directions

1. Make a beach in one end of the wave tank by pouring one pint of sand into one end of the tank.

2. Generate large (winter waves) in the tank for five minutes by moving the paddle back and forth in a horizontal movement.

3. At the conclusion of the five minute period, trace the outline of the beach on the glass side of the tank with a wax pencil.

4. Generate summer waves for five minutes by moving the paddle gently up and down.

5. While generating both types of waves, observe the movement of the sand.

6. At the conclusion of the summer period, compare the outline of the beach with the outline you drew at the end of the winter wave period.

Questions

1. Which direction was the net movement of sand during the period of large waves?

2. Which direction was the net movement of sand during the summer period?

3. How will this affect the beaches of Oregon during the winter and summer? Predict how the beaches will look.

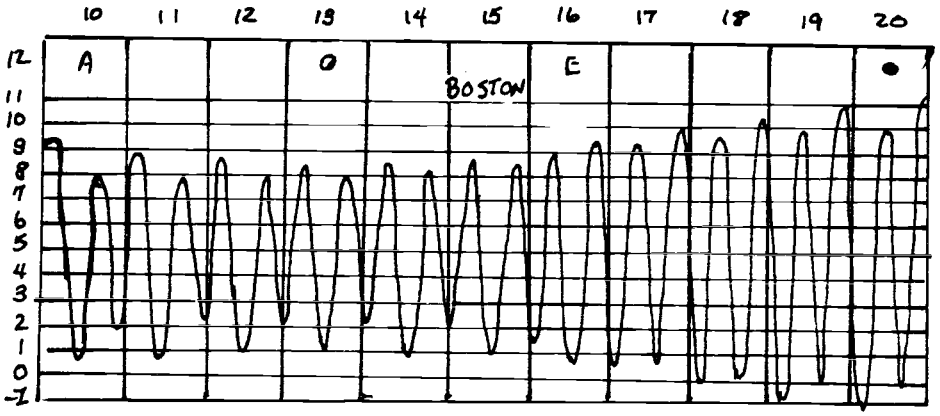
TIDES

The Types of Tides and Tide Curves

Nearly everyone has heard about the daily rise and fall of the tide and that the tides are caused by gravitational forces of the sun and moon. Information about the tides has always been of great importance to navigation, especially in guiding ships in and out of harbors and operating in shoal waters near shore and around islands. In time of war, a knowledge of the tides of a particular area is essential before an amphibious operation can be planned where boats, men and materials have to be landed along some distant shore. Tidal information is also used in designing plants for generating electricity with tidal energy.

To study the tides, we must observe the time and amount of rise and fall of the tide each day over a long period. These observations are usually taken automatically in a tide station by an instrument that rises and falls with the tide and makes a recording. An example of such a recording is the typical tide curve shown below. After a number of recordings are collected for various places around the world, certain characteristics of the tide can be discovered and predictions made for the future on the basis of this knowledge.

Sample of an Automatic Recording Taken at a Tide Station



Tides are of three types:

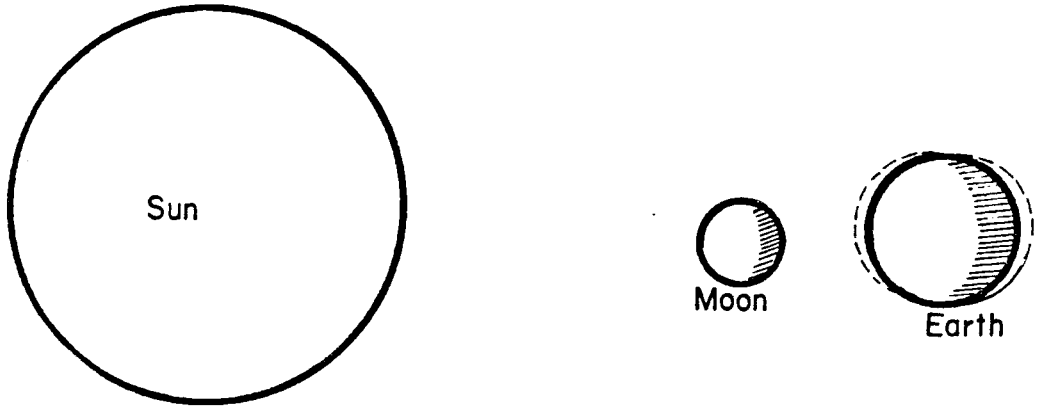
(1) SEMIDIURNAL tides have two highs and two lows each day with little or no difference between consecutive high or low water heights. Tides along the east coast of the United States are of the semidiurnal type.

(2) DIURNAL tides have only one high and one low each day. The tides along the Vietnam-China coast are diurnal.

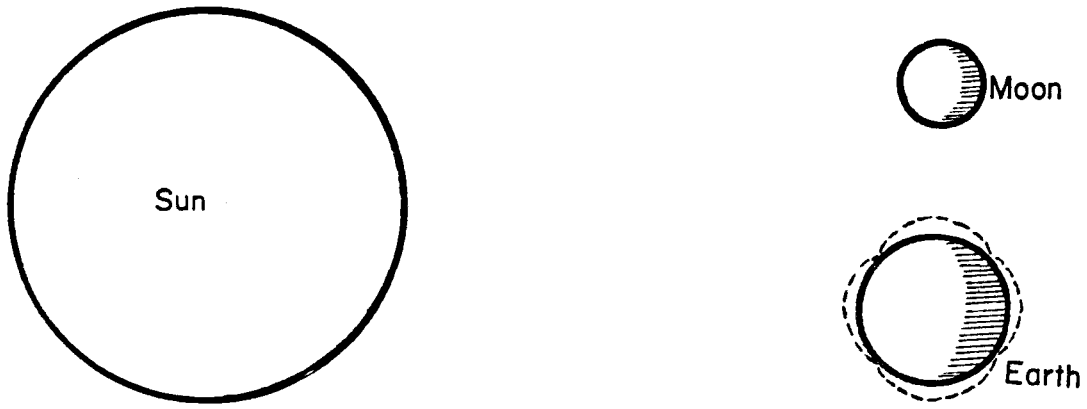
(3) MIXED tides have both diurnal and semidiurnal characteristics. They have two highs and two lows each day, but with considerable difference between heights of successive highs or lows. These differences are called DIURNAL (daily) INEQUALITIES. The tides along the Pacific coast of the United States are mixed.

Tides vary day to day and week to week. Every other week the tides are very low and very high. These are called SPRING TIDES. The following week the tides are not as high or low and are called NEAP TIDES.

When the moon and sun are in a straight line with the earth (new or full moon every two weeks), they pull together on the earth and cause the highest and lowest tides. SPRING TIDES occur when the water springs up (the term SPRING has nothing to do with the season of the year.



When the moon, sun and earth form a right angle (first and last quarters), the pulls oppose each other and the water is nipped or lowered; these are NEAP TIDES. The graph on page 10 shows a typical tide curve related to the phases of the moon for an 11 day period. The changes in the moon's position with respect to the sun and earth are called phases.



A graphical representation of the rise and fall of the tide can be shown by plotting a curve from predictions of times in hours and minutes, and heights in feet, for specific days. Predictions of tides occurring in the future are made mathematically from past tide observations and from knowledge of the motions of the earth, moon and sun in space.

Plotting a Tide Curve

Plot a tide curve from the tide predictions given here. The first day has been plotted on the graph below. Complete the tide curves for day 2, 3, and 4 by plotting the times and heights and connecting all points. Then answer the questions.

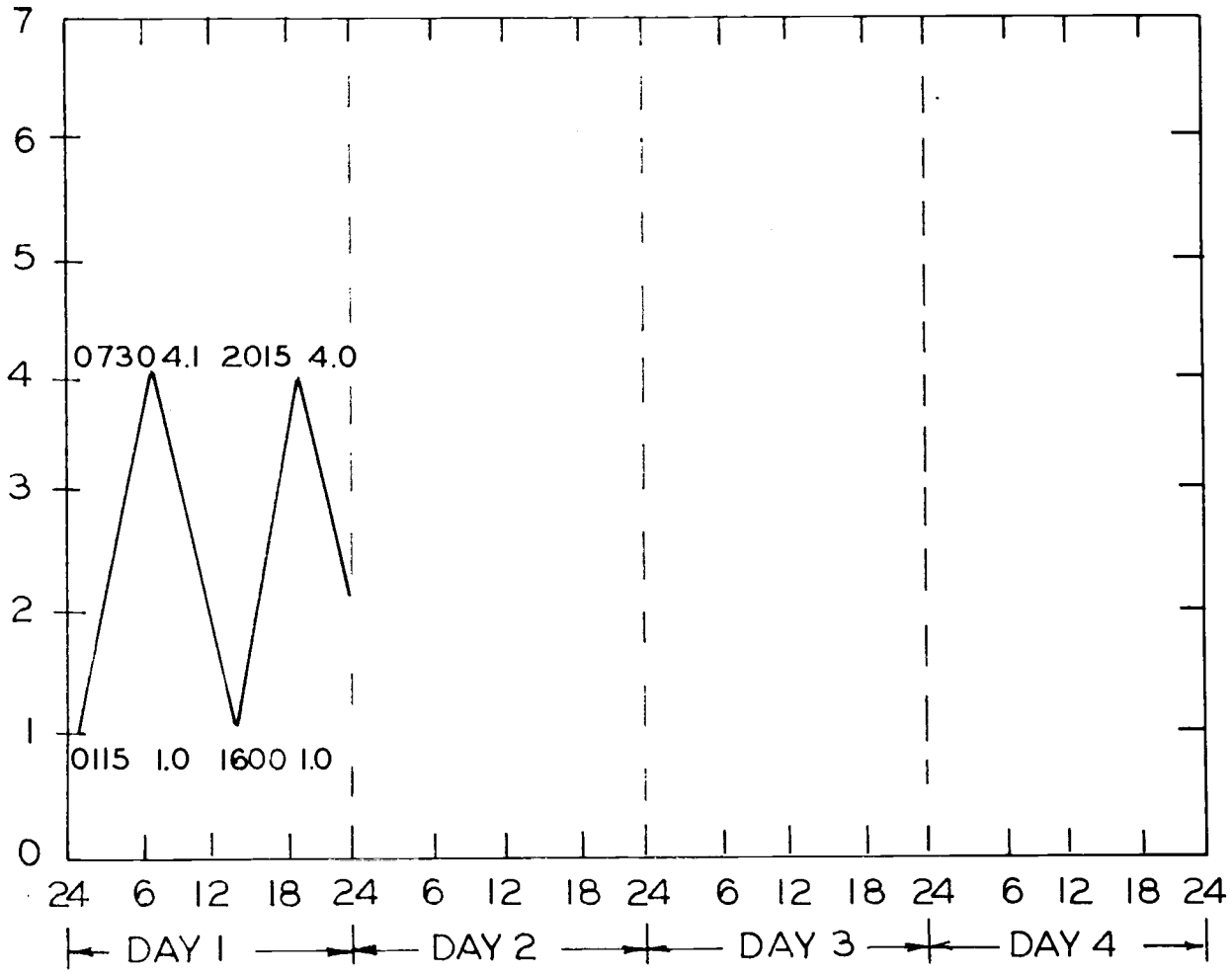
The days are divided into 24 hours (0 to 24), midnight to midnight.

Heights are measured from the zero reference line.

1. During what day is the tide diurnal?
2. During what day is the tide mixed?
3. During what days is the tide semidiurnal?
4. During what day is the range largest?
5. What is the smallest range and on what day?

TIDE PREDICTIONS

DAYS	TIME HOURS	TIME MINUTES	HEIGHT FEET
1	01	15	1.0
	07	30	4.1
	16	00	1.0
	20	15	4.0
2	02	00	1.0
	08	30	6.5
	14	15	2.0
	21	00	5.0
3	04	15	0.0
	16	00	7.0
4	04	30	1.0
	10	00	3.0
	16	00	1.0
	22	00	2.9



Construction of Drift Bottles

Drift bottles can be made from almost any empty glass bottle. The method described is used by the Oregon State University School of Oceanography.

Place data cards (see example on page 14) inside standard bottles. To insure minimum effect of wind drift, the bottles are partially filled with blasting sand so that they are nearly submerged when released. Use rubber stoppers plus plastic screw-on caps to seal the bottles.

There are many variations of the method described for making drift bottles. Any type of bottle can be used, but clear glass bottles are best (do not use plastic). Any kind of sand can be used, but it must be dry. Corks may be used instead of rubber stoppers, but they must be sealed with wax. The problem with using corks sealed with wax is that with time air bubbles in the wax will eventually break and the corks may be eaten by marine organisms causing the bottles to sink. Bottles should be pretested for buoyance before they are finally sealed. Bottles should be placed upside down, so the sand fills the bottle neck, in a bucket of salt water. Table salt may be added to fresh water for this purpose. Taste the salt and water solution to be sure the mixture is right. If a strong salty taste is present the solution is correct. If the bottles sink; take sand out, if they float too high; add sand. If the correct amount of sand is added to the bottles they should float just under the surface. Once the buoyancy test is completed, the bottles may be sealed with wax or parafin.

The data cards can be plain prepaid postal cards so that the finder can drop the card in a mailbox without buying a stamp.

When the drift bottles have been completed, they are ready for release in the ocean. We suggest that you contact local fishermen or your marine agent for information on how this can be done.

Recovery of Drift Bottles

Sandy beaches on the Oregon coast are numerous and people are extremely interested in beachcombing.

If you plan to have a drift bottle project, there are certain steps that need to be followed. Maintaining public interest is most important. A form letter (see example on page 14) should be sent to the person who returns a drift bottle card. The letter should explain the drift bottle project, state the goals you hope to attain, and should explain ocean current patterns off the west coast of the United States so that the finder will have some idea of why he found the drift bottle where he did.

The School of Oceanography at Oregon State University has had great success with their Drift Bottle Program because they follow these steps to keep the public informed. Page 14 shows a postcard used by O.S.U. in their drift bottles and a letter which explains the drift bottle study. The letter is mailed to those who find and return the cards.

Sample of a Self-addressed, Stamped Drift Bottle Data Card
(post card)

Card Number: 14

Finder's name _____

Address _____

Exact location drift bottle was found _____

_____

_____

Date and hour drift bottle was found _____

_____

_____

Sample of a Letter to be Used When Drift Bottle Data Card is Returned

"We thank you for returning Drift Card No. 14 which you found on Bullards Beach near the Coquille River jetty February 4, 1974. The bottle you found was released from a fishing boat about one mile west of Depoe Bay on November 10, 1973. It travelled 90 miles in less than 55 days at the rate of .068 knots. Our 4-H Marine Science Club releases drift bottles to learn about currents off the Oregon coast. The bottles are weighted with sand to submerge them enough to reduce the influence of the wind on their movement.

The California Current flows southward off the Oregon coast. The warm Davidson Current flows northward during winter months close to the Oregon shore. Also significant is a band of cold upwelled water along the Oregon coast during the summer. The upvelled water results from a combination of the rifts, rotation and local winds pushing surface waters off shore. Cold water rises to the surface from depths to 600 feet. Oregon's coastal weather would be warmer and drier during the summer if this band of upwelling was absent. The water and air temperatures would be lower during the winter if the Davidson Current did not flow north along the Oregon shore."

Sincerely,

Drift Bottle Release

To determine the speed and direction of surface ocean currents, drift bottles are released. Drift bottle data used was collected from a cruise of the R/V YAQUINA in November, 1970 from Newport, Oregon.

From the data below, plot the release and return positions for each drift bottle on the following page.

Since no visual observations can be made, it is impossible to know actual course each bottle takes. Make a straight line from point of release to point of return.

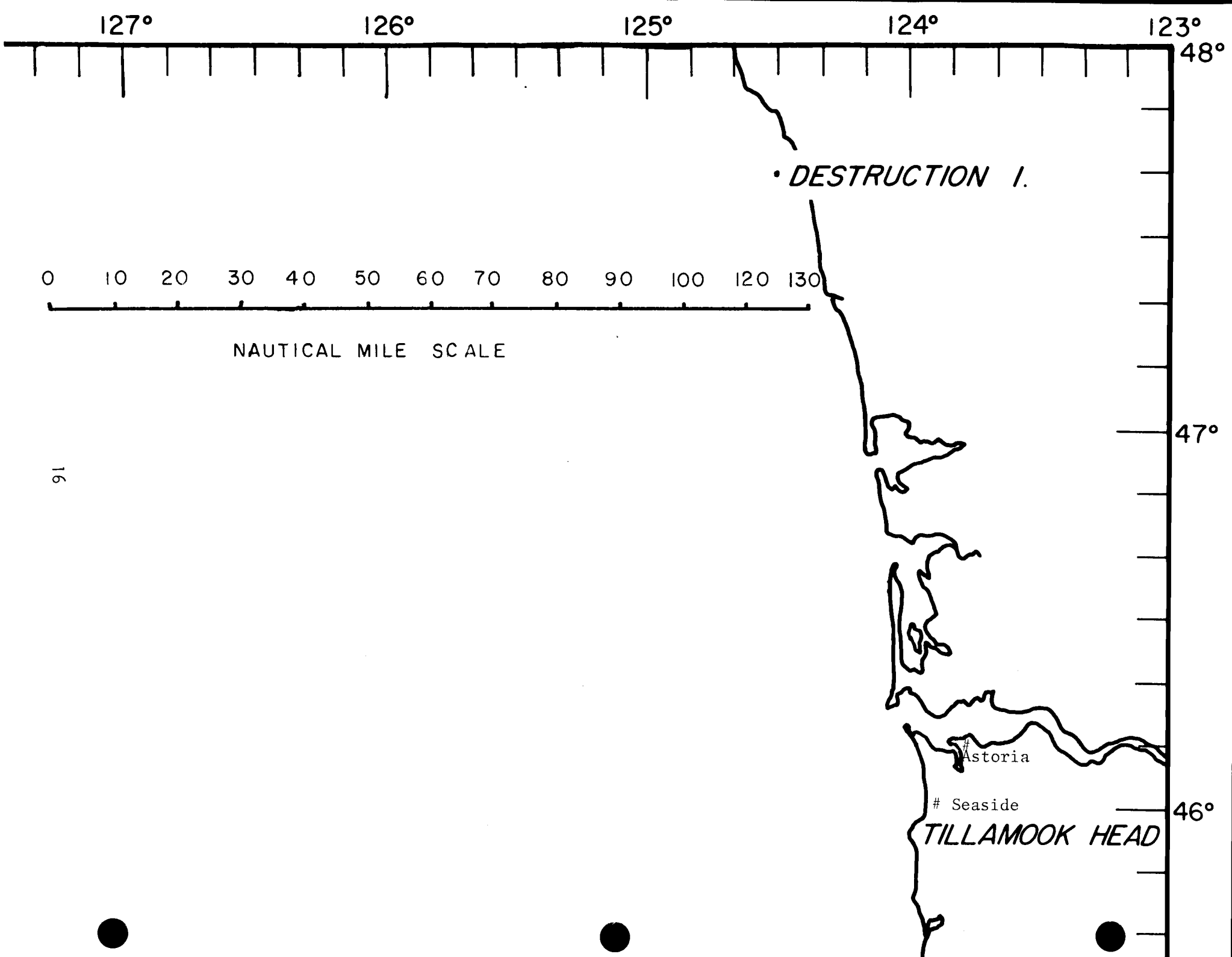
From the information you have plotted on your chart, determine the distance from release to return for each drift bottle. (Use the nautical mile scale.)

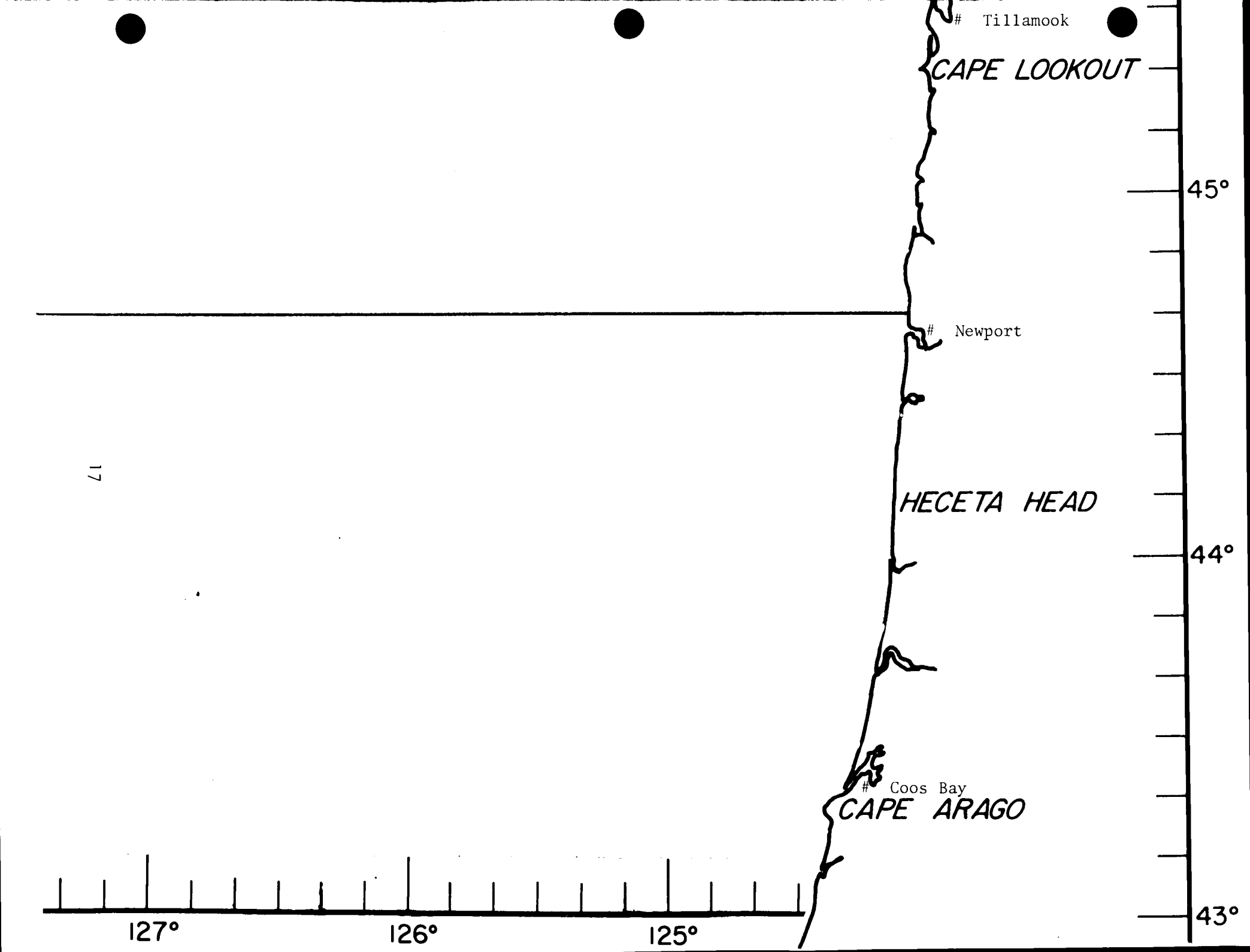
See if you can compute the speed of each drift bottle. (Convert days out to hours.)

DATA SHEET

Cruise Y7011B — November 19-21, 1970

Bottle #	Release Position		Return Position		Distance Traveled (N.M.)	Days Out	Velocity (Knots)	General Direction (Degrees)
	Lat. N.	Long. W.	Lat. N.	Long. W.				
1.	44-39.6	124-7.8	44-32.5	124-5.0	7.4	2	.126	165
2.	44-39.1	124-10.6	46-42.5	124-0.0	123.4	22	.234	000
3.	44-39.1	124-10.6	45-32.5	123-58.0	54.1	8	.282	010
4.	44-39.1	124-24.7	46-52.5	124-8.0	133.9	13	.429	050
5.	44-39.1	124-38.7	45-42.5	123-58.0	69.6	11	.264	025
6.	44-39.1	126-3.1	46-2.5	123-56.0	122.2	51	.100	045
7.	44-39.1	126-3.1	45-52.5	123-58.0	114.6	55	.087	050
8.	44-39.1	126-3.1	43-7.5	124-24.0	116.1	105	.046	145
9.	44-39.1	126-59.0	47-12.5	124-14.0	191.6	61	.131	035
10.	44-39.1	126-59.0	43-57.5	124-8.0	129.2	54	.100	110
11.	44-39.1	126-59.0	47-7.5	124-12.0	188.5	55	.143	040
12.	44-39.1	126-59.0	45-2.5	124-00.0	129.0	54	.100	080
13.	44-39.1	126-59.0	44-17.5	124-6.0	125.3	51	.102	100
14.	44-39.1	126-59.0	43-42.5	124-12.0	132.5	54	.102	115
15.	44-39.1	126-59.0	43-47.5	124-10.0	131.6	53	.103	115
16.	44-39.1	126-59.0	44-32.5	124-5.0	124.1	53	.098	095
17.	44-39.1	127-27.0	46-27.5	124-4.0	178.7	70	.106	050
18.	44-39.1	127-27.0	45.22.5	123-59.0	153.3	96	.067	075
19.	44-39.1	127-27.0	45-7.5	123-59.0	150.1	99	.063	080


127°
126°
125°
124°
123°
48°
47°
46°
DESTRUCTION I.
0 10 20 30 40 50 60 70 80 90 100 120 130
NAUTICAL MILE SCALE
16
Astoria
Seaside
TILLAMOOK HEAD


Tillamook
CAPE LOOKOUT
45°
Newport
HECETA HEAD
44°
Coos Bay
CAPE ARAGO
43°
127°
126°
125°

GEOLOGY OF THE COAST

Read the pamphlet "Landslides of Oregon: North Coast" which your leader will provide, and complete the discussion guide.

Discussion Guide to Landslides

1. What are some causes of landslides?

2. How are landslides classified?

3. Name four landslide types.

4. Which type of slide is associated with each coastal rock type?

5. What is the average yearly coastal retreat for Cape Meares? Newport?

6. What measures can be taken to prevent landslides?

Here's a Look at Offshore Oregon

The continental shelf is the shallow platform or terrace which surrounds the continent. It extends from the low line to a position offshore where the slope of the bottom increases markedly downward. The position at which the bottom slope changes is commonly called the shelf edge or the shelf break. Off Oregon, the continental shelf varies in width from approximately 9 to 40 miles, and the shelf edge lies in water 70 to 100 fathoms deep. It is a smooth surface interrupted in only a few places by small hills. The contour chart reveals that the shelf is extremely irregular in outline. It is narrowest off Cape Blanco and widest off the central coast in the vicinity of Florence. The average slope of the continental shelf varies from about ten feet per mile to about 55 feet per mile. In general, the slope of the shelf is steepest at the inner and outer edges and flattest in the central portions. Except for the hilly areas, the bottom is covered by sand, muddy sand, or mud. In the hilly areas, rock is commonly present.

The map of bottom sediments on page 23 is based on more than 800 samples collected from the continental shelf at three-mile intervals north of Coos Bay and at two-mile intervals south of Coos Bay. The boundary lines between sediment types should be considered approximate, as samples on either side of the boundary are two or three miles apart. It should also be kept in mind that bottom currents may shift the sediments from time to time.

The types of sediments indicated on the chart are based on the size of the sedimentary particles. The diameter of the particles making up the sediment was measured by passing the sediment through a sieve having standard size openings. The map on page 23 shows the type of sediment exposed at the bottom. Samples were collected by means of a clamshell type device which grabs approximately one-half pint of sample from the surface of the sediment. Rocky areas are indicated where rocks were collected and little or no sediment was recovered.

Bottom Sediments

The sediments outlined on the map on page 23 are sand, mud, and muddy sand. Sand is defined as consisting of particles which have diameters larger than 0.0625 millimeters (about 1/400th of an inch). Sediments which consist of more than 75% particles of this size are termed sand. Where less than 50% of the sediment by weight consists of sand-sized particles, the sediment is termed mud. For those sediments that are 50% to 75% sand, the term muddy sand is used. Most of the sand which occurs on the continental shelf off Oregon is similar to the sand on the beach. It is usually relatively fine in texture, although it feels gritty when rubbed between the fingers. The color varies from a light yellow to dark gray, but in general most of the sand is medium to light gray. Mud is slick or slimy to the touch, and ordinarily is a greenish or olive-gray color. The characteristics of muddy sand fall between those of sand and mud. Muddy sand feels slick, although the grittiness of the contained sand is apparent. The color varies from gray to olive-green.

Sand

Sand occurs in two major areas on the continental shelf: close to shore and at the shelf edge. The nearshore sand is usually gray. It extends from the shoreline out to a depth of about 50 fathoms off the northern and central coast. In the vicinity of the Umpqua River, sand is limited to shallower water, generally 30 fathoms or less, and forms a narrow belt along the coast at least as far south as the Rogue River. Sand which occurs as patches near the edge of the shelf is more variable in its characteristics than the nearshore sand. Shelf-edge sand may be somewhat coarser than the nearshore sand, and may vary in color from yellow or brown to dark green. In many areas, it contains appreciable amounts of broken shells.

Wherever sand occurs, it is likely that current activity on the bottom is regular and fairly strong (not as strong as in rocky areas, however). The bottom will generally be smooth and relatively hard. Where current or wave activity is persistent, it is not uncommon for ridges or ripples of sand to be produced.

The organisms common in the sandy inner shelf sediments include rapidly moving animals such as the commercially important Dungeness crab and English sole, slow creeping animals such as the Nassarius snail and stationary buried organisms such as clams. Sand dollars (flat sea urchins) are found close to the coast. These animals generally feed on minute plant material in the water or on other animals or sometimes on decayed plant and animal remains.

Muddy Sand

Gray to olive-gray muddy sand generally grades into the sandy areas. It occurs seaward of 50 fathoms in the northern portion of the shelf and seaward of about 30 fathoms in the southern portion. It is also common on the upper continental slope beyond the shelf edge. In areas where this sediment is present, the bottom is usually smooth but somewhat softer than the sandy bottom. There is less current activity at the bottom, but it is possible that in some places a rippled surface will have developed. It is not uncommon to find Rex and Petrale sole living on this type of sediment. Sea cucumbers, sea urchins, starfish, snails and other invertebrates are also commonly associated with these sediments.

Mud

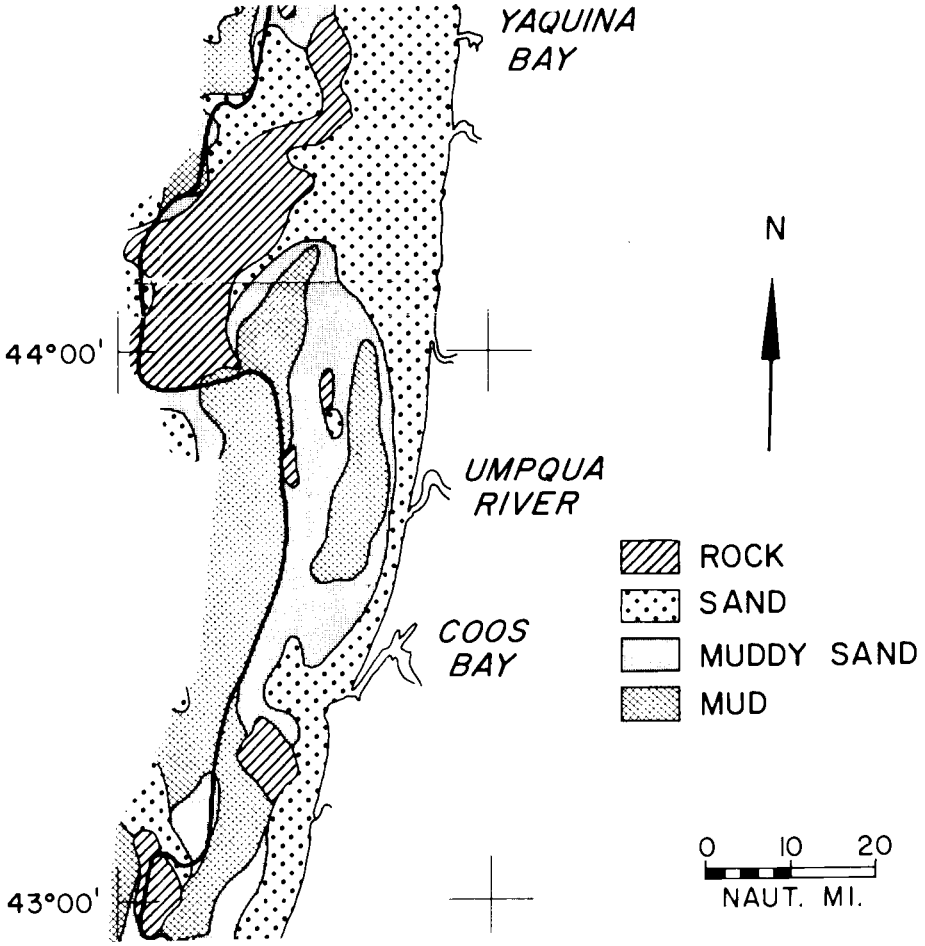
Muddy bottom is most common at or beyond the shelf edge. Mud is a finer grained sediment usually found in quiet water. It grades into muddy sand; the boundary between the two sediment types may be indistinguishable. Mud also occurs on the continental shelf southwest of the mouth of the Columbia River and off the Umpqua River. The muddy bottom is generally smooth and very soft. There is little or no current activity at the bottom, and burrowing organisms such as polychaete worms are very abundant. In addition, numerous sea urchins, sea cucumbers, starfish, and brittle stars are found on the sediment. Dover sole and pandalid shrimp are among the commercially important animals common to this type of bottom.

Rock

Rock is most common along the coastline and in banks some distance offshore. Rock is also exposed in patches at the shelf edge. Rocky areas are generally higher than the rest of the shelf and are extremely rough and irregular. They are areas of strong current activity and are commonly inhabited by attached animals such as sponges, sea fans, sea anemones, corals, tube worms, and hydroids. Starfish and brittle stars are also present. Halibut is one fish generally living around rocky banks.

Subsurface sediments

Operations such as dredging may disturb the surface sediment enough to encounter different sediments beneath the surface. Recent studies have indicated that sand probably underlies mud and muddy sand in most areas. It is conceivable that dredging or coring operations near the boundaries of the mud and muddy-sand areas will penetrate the softer, finer grained sediments and will reach the sand a short distance beneath the surface. It is also possible that dredging or coring operations in the vicinity of the rocky areas will penetrate the thin sediment cover and encounter rocks beneath the surface of the sediment.



Map of Bottom Sediments

Sediment Plotting

Sediments on the floor of the ocean have scientific and economic importance. "Continental Shelf Sediments of Oregon" provides a general discussion of the sediments which occur off Oregon and of the fish and shellfish most commonly found associated with each type.

Plot the following 14 sediment stations on the partially completed map, page 23. Four types of sediments are indicated - rock, mud, sand and muddy sand. The position of each sample is located by referring to the longitude and latitude scales on the margins of the map. When you have finished plotting the sediments, compare your sheet with that provided in the Leader's Guide. Do the two look alike?

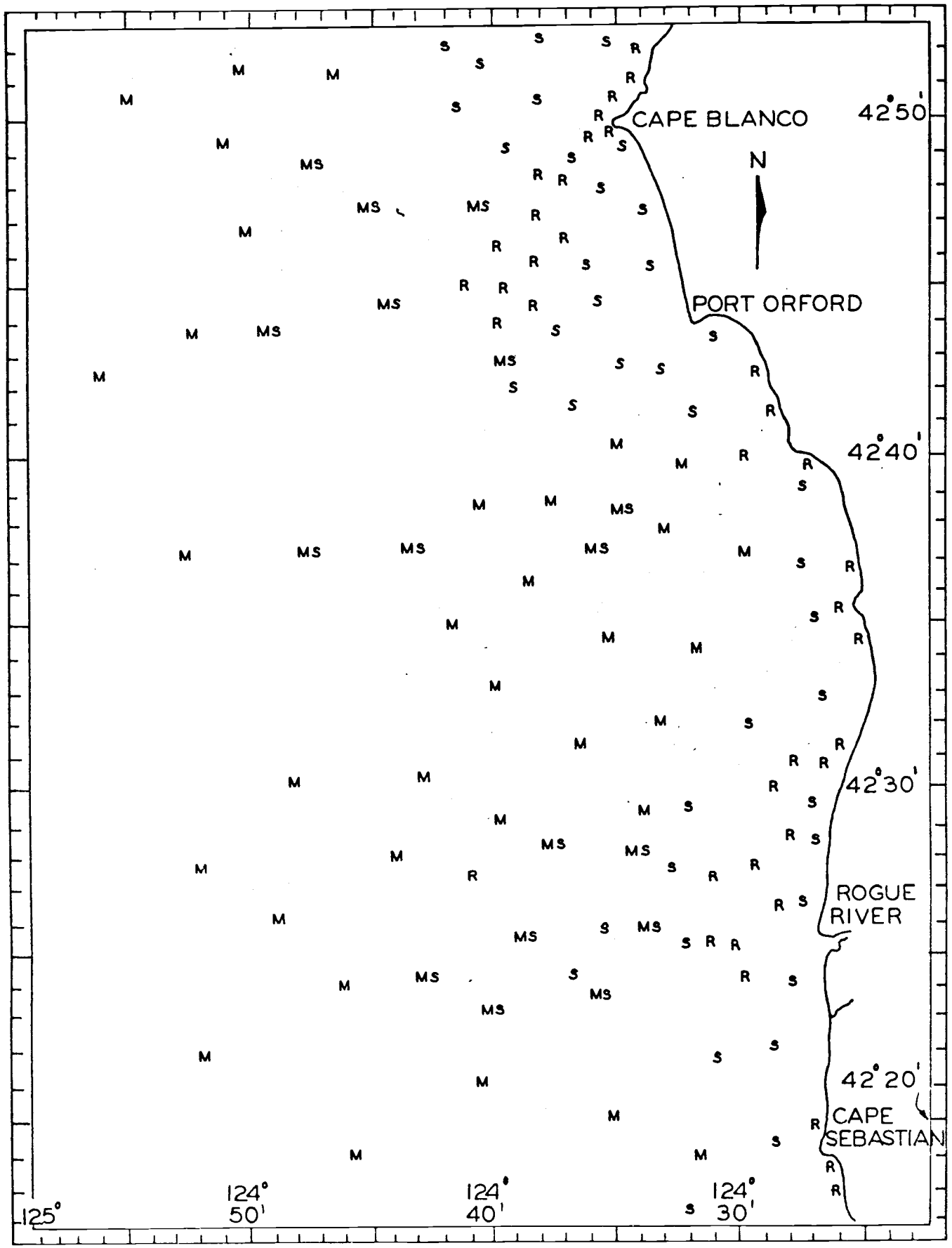
BOTTOM SEDIMENT DATA

LEGEND: R-Rock; S-Sand; M-Mud; MS-Muddy Sand

	Long.	Lat.	Sed. Type
1.	124-43W	42-51N	MS
2.	124-39W	42-48N	S
3.	124-41W	42-44N	R
4.	124-51.5W	42-40.5N	MS
5.	124-41W	42-40.5N	MS
6.	124-38.5W	42-39.7N	S
7.	124-29W	42-35N	M
8.	124-44W	42-33N	MS
9.	124-51W	42-32N	M
10.	124-41.5W	42-29.5N	R
11.	124-39.5W	42-26N	R
12.	124-42.5W	42-25.5N	R
13.	124-32W	42-23N	M
14.	124-30W	42-22.5N	R

The next step is to contour sediments of similar types, by drawing smooth lines around points that have the same kind of sediments. Again, compare your final version with the contoured map which is provided in the Leader's Guide. Do they look alike?

Now proceed to the questions. Answer them to your satisfaction then discuss them with your leader.


CAPE BLANCO
42°50'
N
PORT ORFORD
42°40'
42°30'
ROGUE
RIVER
42°20'
CAPE
SEBASTIAN
125°
124°
50'
124°
40'
124°
30'

Questions for Sediment Contouring Exercise

1. If you were a commercial fisherman using drag nets to collect bottomfish, what area(s) would you want to avoid while fishing?

2. Where would you be likely to find shrimp?

3. What are the approximate dimensions, north-to-south and east-to-west in nautical miles of the rocky area just off the mouth of the Rogue River? (1° of latitude = 60 nautical miles, 1' of latitude = 1 nautical mile)

4. Locate the position which is 6 nautical miles west of the mouth of the Rogue River and 24.5 nautical miles south of Cape Blanco (use latitude scale for distances, see #3).

   a. What is its latitude and longitude?

   b. How far from Port Orford is it?

5. What is the most common sediment type on the map? What type is least common?

6. If you and your family wanted to visit the portion of Oregon coast shown on this chart to look at tidepool animals, which areas would you choose?

Contour Depths

Bathymetric data or ocean soundings tell us something about the changes in depth and shape of the ocean bottom. Studying sounding notations on navigational charts, aids us in visualizing the outline or slope of bottom features.

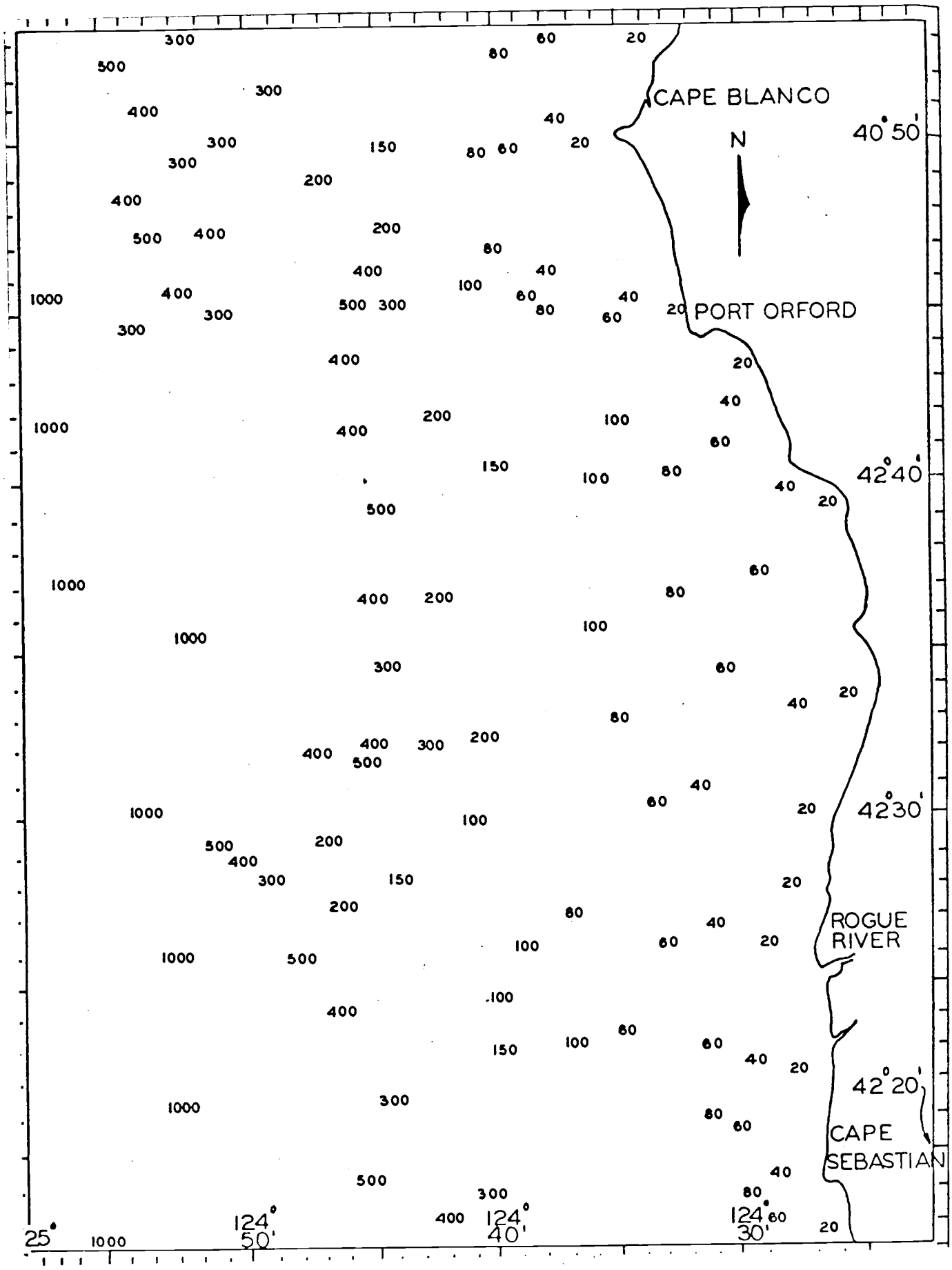
Bathymetry Contouring Procedure

1. All soundings are in meters. The suggested contour interval is every 20 meters from the coastline out to 150 meters, then every 100 meters out to 500 meters, and then the 1000 meter contour.

   (1 METER = 3.28 FEET, 1 FATHOM = 6 FEET)

2. Connect points having the same depth with a smooth flowing line (use map on page 25). Try to keep your lines free from wiggles or right-angle turns. Use a soft lead pencil.

   (As you draw the contour lines, various features of the ocean floor will become visible such as a trough, shelf, slope, or submarine canyon.)


CAPE BLANCO
N
40°50'
PORT ORFORD
42°40'
42°30'
ROGUE
RIVER
42°20'
CAPE
SEBASTIAN
25°
124°
50'
124°
40'
124°
30'

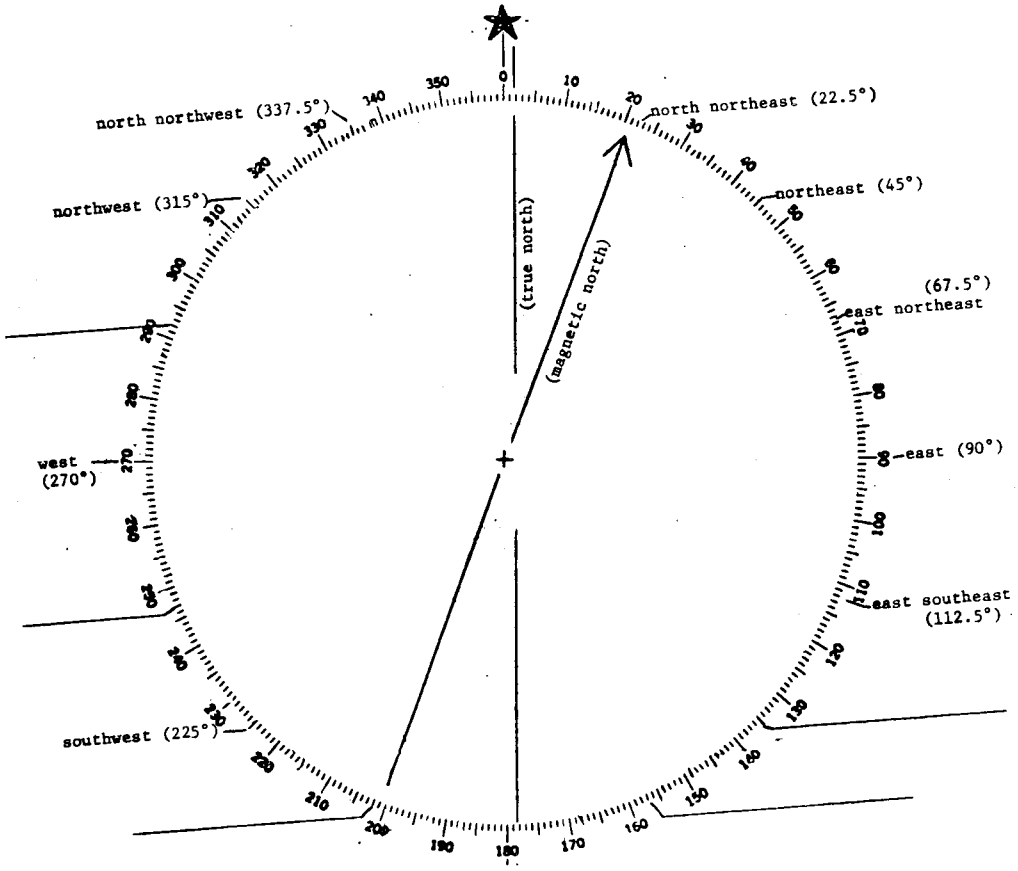
At sea, it is of utmost importance to distinguish between magnetic north and true north. For this reason, one finds a compass rose on all navigational marine charts. This rose shows clearly the equivalent magnetic and true north directions.

Almost all modern marine compasses are graduated from 0 degrees (north) clockwise through 360 degrees. There are 32 points in the compass; the four cardinal points being north (0°), east (90°), south (180°), and west (270°). The four intercardinal points are midway between the cardinal points and are northeast, southwest, southeast, and northwest. The eight points between the cardinal and intercardinal points are named for the nearest cardinal direction such as north northeast (lying between north and northeast, or at 22 1/2°), east northeast (67 1/2°), south southeast (157 1/2°), etc. The hard ones are the remaining 16 points prefixed by the nearest cardinal or intercardinal point by the nearest cardinal point in the direction of movement. Thus, the terms "north by east" (halfway between north and north northeast), and "northeast by east" (halfway between northeast and east northeast).

The recitation of the full compass circle known as boxing the compass, was quite an accomplishment by early mariners. It has now been largely replaced by use of degrees, except for the cardinal and intercardinal points, to indicate general directions such as "northeast" wind. A north wind is one which blows out of the north. An east wind blows out of the east, etc.

Compass Rose

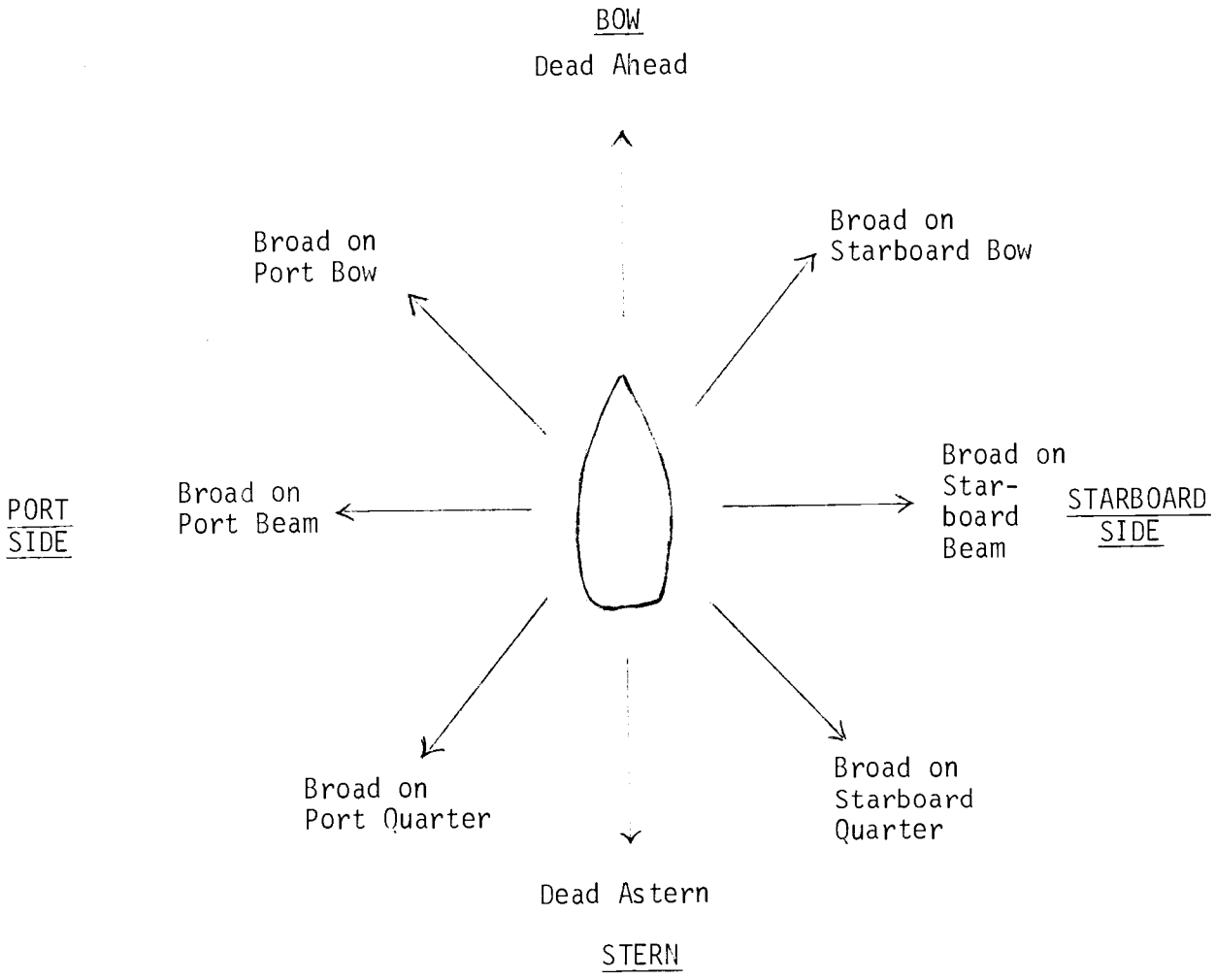
The outer circle is in degrees with zero at true north. The inner circles are in points and degrees with the arrow indicating magnetic north.



EXERCISE: Complete the points of the compass left blank.

A ship's course is the intended direction of travel from north (0°) through 360°. A Course of 180° is due south, and one of 135° is southeast.

A ship's heading is the direction the ship is actually traveling regardless of its prescribed course.



Discussion Guide on Navigation

1. Complete the points of the compass rose.

2. Name the cardinal points of the compass. _____

   _____ _____ _____

3. How many degrees difference is there between magnetic north and true north where you live? _____°

4. If you are traveling 270° what direction are you headed? _____

   240°? _____ 60°? _____

5. What is the difference between the course of the ship and its heading?

   _____

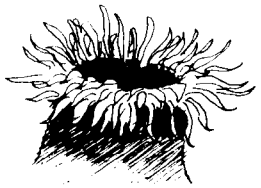
   _____

6. The left side of the ship is called _____

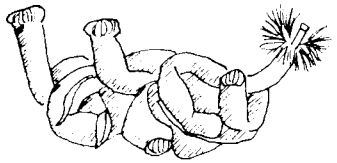
   The right side of the ship is called _____

7. If a lighthouse were sighted to the right rear of a ship, what would its location be in nautical terms? _____

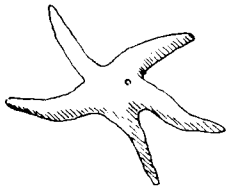
   _____



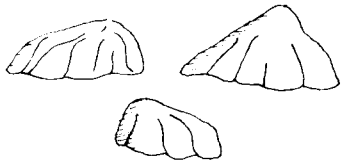
Anemone
Anthopleura spp.



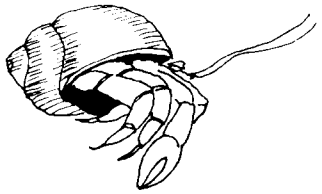
Tube worm
Serpula vermicularis



Common sea star
Pisaster ochraceous

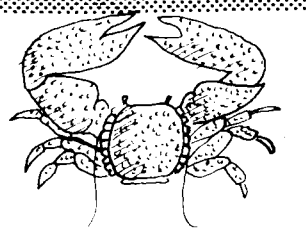


Limpets
Collisella spp.

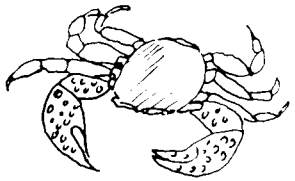


Hermit crab
Pagurus spp.

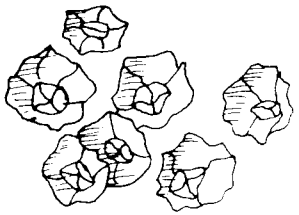
wave survival	protection from drying	level on rocks	niche	method of feeding



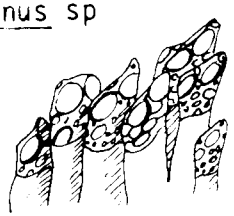
Porcelain crab
Petrolisthes cinctipes



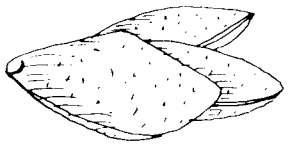
Purple shore crab
Hemigraphsus nudus



Acorn barnacle
Balanus sp



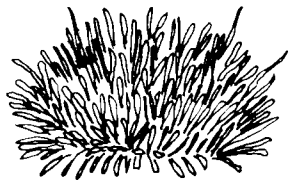
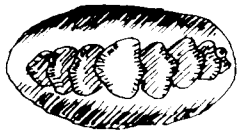
Leaf barnacle
Pollicipes polymerus



California mussel
Mytilus californianus

wave survival	protection from drying	level on rocks	niche	method of feeding

ROCKY BEACH FIELD TRIP GUIDE

	wave survival	protection from drying	level on rocks	niche	method of feeding
 Sea urchin *Stronglyocentrotus* sp.					
 Black chiton *Katharina tunicata*					

1. Turn over a rock and record what animals you find.

2. Why is it important that you return the rock to its original position?

3. What will this beach be like if everyone collects these animals to take home with them?

4. Why do you think these animals are found here but not on a sandy beach?