4-H ADVANCED MARINE SCIENCE

LEADER'S GUIDE

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.

4-H 3502L
1973

Extension Service
Oregon State University
Corvallis

CONTENTS

Contents in Beginning Leader's Guide

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ADVANCED 4-H MARINE SCIENCE

This Marine Science Project is written as a continuation of the beginning level. To complete this project, activities should be selected and completed by your club.

The project books contain information and are to be completed at the meetings. This leader's guide contains directions necessary to carry out the activities plus completed discussion guides and maps.

Many of the activities require pamphlets which are used to complete the project activities. These are obtained from the Oregon State University and should be purchased by your state 4-H office. The leader is responsible for making the pamphlets available to the club member. Other materials are listed as references which contain material pertinent to the activity, but are not necessary to complete it.

PROJECT ACTIVITIES

BEACH SAFETY

Keep newspaper clippings or record other reports of accidents which occur along the beach or ocean. Discuss the cause of accidents and how they could have been avoided.

LIFE IN THE OCEAN

Ocean Mammals

Each club member should give a report on the life history of one of the ocean mammals such as seal, sea lion, whale, etc. One meeting could be assigned for each report.

Reference: In the Wake of the Whale by John Barbour

Phytoplankton

Each club member or pair of members will need a copy of "Phytoplankton, Grass of the Sea". Read and fill out the discussion guide. A completed guide is on page 8.

References: Phytoplankton, Grass of the Sea - SG 9
A Guide to Marine Coastal Plankton by DeBoyd Smith

PHYSICAL OCEANOGRAPHY

Ocean Zones and Boundaries

Each club member will need a copy of the pamphlet "Ocean Zones and Boundaries". Read and follow the discussion guide. Each member has a discussion guide in his project book and a completed guide is on page 9.

Ocean Currents

The use of drift bottles to chart ocean currents is explained in the project books; also, the directions are given to chart drift bottle releases off Oregon. A completed map is on pages 10-11.

Waves

Wave Tank

Instructions for constructing a wave tank are given on page 12. A tank could be built as a club project. Directions for demonstrating beach erosion with the wave tank are in the project books.

Tides

Material in the project books explains the causes and actions of tides. A graph is included for charting the tides and a copy of the completed material is on page 14.

Geology of the Coast

Each member or members will need a copy of the booklet "Landslides of Oregon: North Coast". Read the booklet and complete the discussion guide. A completed guide is on page 15.

References: Visitors Guide to the Geology of the Coastal Area Near Beverly Beach State Park - Snavely and Macleod
Geology of Newport Area, Oregon - 1 & 2, Snavely, Macleod and Rau

Ocean Floor

Materials and instructions for plotting ocean sediments off the Oregon coast are presented in the project books. A completed map and discussion guide are found on pages 16 and 17.

Instructions for contouring ocean depths off the Oregon coast are presented in the project books. A completed map is on page 18.

NAVIGATION

Learn to use a compass and navigational terms. Complete the discussion guide. A completed guide is on page 19.

ROCKY BEACH FIELD TRIP

Before going to the coast, the Rocky Beach Field Guide sheets that are in the project books should be discussed so that the members understand what they will be looking for. They are to find the animals pictured and observe how they live. The guide sheets may be filled out later.

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.

References: The Frail Ocean by Wesley Marx
Crises in Oregon Estuaries - SG 4

SPORT FISHING

A. Have the members learn to tie and prepare several fishing lures. Perhaps some of the club members' fathers are avid sport fishermen and could teach them about different lures and baits.

B. Have a representative from a sporting goods store give a talk about fishing equipment.

C. At one of the meetings, discuss the life cycles of some of the sportfish, their feeding habits, habitat preference, etc.

Reference: Field Guide to Common Marine and Bay Fishes of Oregon, SB 607, Beardsley and Bond, Department of Fisheries and Wildlife

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

References: Fishing the Rocks, Surf and Bays, Oregon Game Commission
Sportsman's Map of Yaquina Bay, Fish Commission of Oregon

E. At one of the meetings, discuss how to clean and care for the fish after it is landed.

References: Care of Fish and Game in the Field
Preparing Cluster Egg Bait from Salmon and Steelhead Roe, FS 152

SEA FOOD

Home Processing of Sea Food

Each club member should prepare an item of sea food by freezing, canning or smoking. The following pamphlets contain instructions for food preparation:

References: Home Canning of Tuna and Salmon - FS 21
Home Freezing of Sea Foods - SG 7
Guide for Buying Oregon Fish and Shellfish - FS 170
A Smokehouse for the Sportsman and Hobbyist - EB 788

Sea Food Industry

A. Learn about commercial fishing equipment. It is doubtful that any commercial fisherman would be willing to take a club out on his boat.

B. Take a tour through one of the sea food processing plants. Bumble Bee Seafood Company in Astoria, Oregon conducts tours through their plants, and others may be willing to conduct tours through their facilities.

Reference: Food Fish for the Future - FCO EB 1, Selden & Jones

ACTIVITIES FOR THE BEACH

Rocky Intertidal Field Trip

Take a field trip to the rocky beach at low tide. To conduct a meaningful field trip without collecting, have each club member fill out the Rocky Beach Field Trip Guide included in their project books after returning from the field trip. Emphasize to your club that they should not collect. Some beaches in Oregon are suffering from over-collecting and even collecting for educational purposes can ruin a beautiful beach.

Explanation of Rocky Beach Field Trip Guide terms

Wave Survival
: The club members are to observe the animal and indicate how it holds on to rocks or keeps from being washed away by waves.

Method of Protection from Drying
: During low tides some rocks are exposed and the animals are subject to drying. Does animal close shell, crawl under seaweed, or what?

Level
: Observe the particular animals and state if they occur high on the rocks or lower down close to the water. Different animals can withstand different amounts of exposure and as a result will be found at different heights on the rocks. Indicate if the animal occurs at a high, medium, or low level.

Niche
: This word refers to the specific habitat for the various animals. Examples of niches they might list are: crevices of rocks, under rocks, on the face of rocks facing the waves, surge channels, a flat rock shelf, in the holdfasts of algae.

Reference: Guidelines for Rocky Intertidal Field Trips
A set of 34 slides and accompanying description are available from the OSU Marine Science Center, Newport, Oregon, on a free loan basis (on intertidal life).

Beach Profile

Instruction for this project can be obtained from "Field Guide to the Beaches" by John Hoyt. A leader will probably find this to be a very helpful reference as it contains additional information; for example, it has a good discussion of rip currents.

Algae Collecting

Collect samples of algae while on the field trip, for pressing or for cooking. Directions for pressing and mounting are in the beginning Marine Science Leader's Guide. The plant press should be set up before going to the beach so the algae can be pressed upon arrival home as they do not keep very long. Recipes for algae bread and seaweed pickles are also in the beginning Marine Science Leader's Guide if members wish to experiment with seaweed cookery.

Reference: Guide to Common Seaweeds of British Columbia by R.F. Scagel

Marine Birds

Each club member should be required to know ten birds which they should record when sighted on the trip.

References: Field Guide to Western Birds by R.T. Peterson
Check List of the Birds of Oregon by Bertrand and Scott

Sand Grain Size

Construct a series of sieves which are of different size openings. Pass sand through the sieve at different locations on the beach. Determine the relative size of the sand grains close to the water's edge, high on the beach, and in the sand dune which borders the beach. If you do not wish to make the sieves, collect small samples of sand from the three locations and examine with a magnifying glass. Explain why the sand grains are smaller in the sand dune than at the edge of the beach.

Clamming

The 4-H club may wish to go clamming. Preparations for the trip should include learning the harvest regulations on the clam and learning the different kinds of clams.

References: Bay Clams of Oregon by L.D. Marriage, FCO EB-2
Razor Clams of Oregon, FCO EB-4

Fossil Collecting

Fossil clams and other fossil marine organisms are often abundant, embedded in the cliffs above the beaches. Some of the club members may want to make a collection of these and can use them as a display at the county fair.

Reference: Fossil Mollusks of the Oregon Coast by Ellen J. Moore

Answers to Phytoplankton Discussion Guide

1. What is upwelling?

A. Bottom water flows to the surface to replace surface water which has been displaced by northwest winds.

2. How does upwelling affect phytoplankton?

A. It brings nutrients to the surface which are vital to phytoplankton growth.

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

A. Warm moist air comes in contact with cold, upwelling water, and fog results.

4. Which are the most numerous types of phytoplankton?

A. Diatoms.

5. What does the word "bioluminescent" mean?

A. The ability of a living organism to produce light.

6. How is phytoplankton collected?

A. With fine mesh nets.

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

A. It forms the base of the food chain; converts light energy to chemical energy.

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

A. We could harvest directly the organisms on which fish feed.

9. How do D.D.T. and oil affect phytoplankton and algae?

A. D.D.T. has a negative effect on photosynthesis of algae. Oil reduces the light available for photosynthesis.

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

A. Gymnodinium breve. Cause of red tides in Oregon is Gonyaulax sp.

OCEAN ZONES AND BOUNDARIES

Answers to Ocean Zones and Boundaries Discussion Guide

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

A. Man has, in the past, limited his use to the surface of the water, but now the emphasis is extending to the sea floor. It is difficult to draw boundaries in the sea.

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

A. Internal waters, territorial seas, high seas.

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

A. Technology makes it possible to extract resources from the sea which were inaccessible to us before.

4. What are internal waters?

A. Watery areas within the boundaries of a nation.

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

A. A belt of ocean bordering a nation's coastline which is subject to the same scope of government control as the land. Three miles.

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

A. The U.S. is an air and sea power and wishes to discourage other nations from claiming wide territorial waters so we will have more space to maneuver.

7. What are the high seas?

A. Water beyond the territorial waters outside exclusive control of any nation.

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

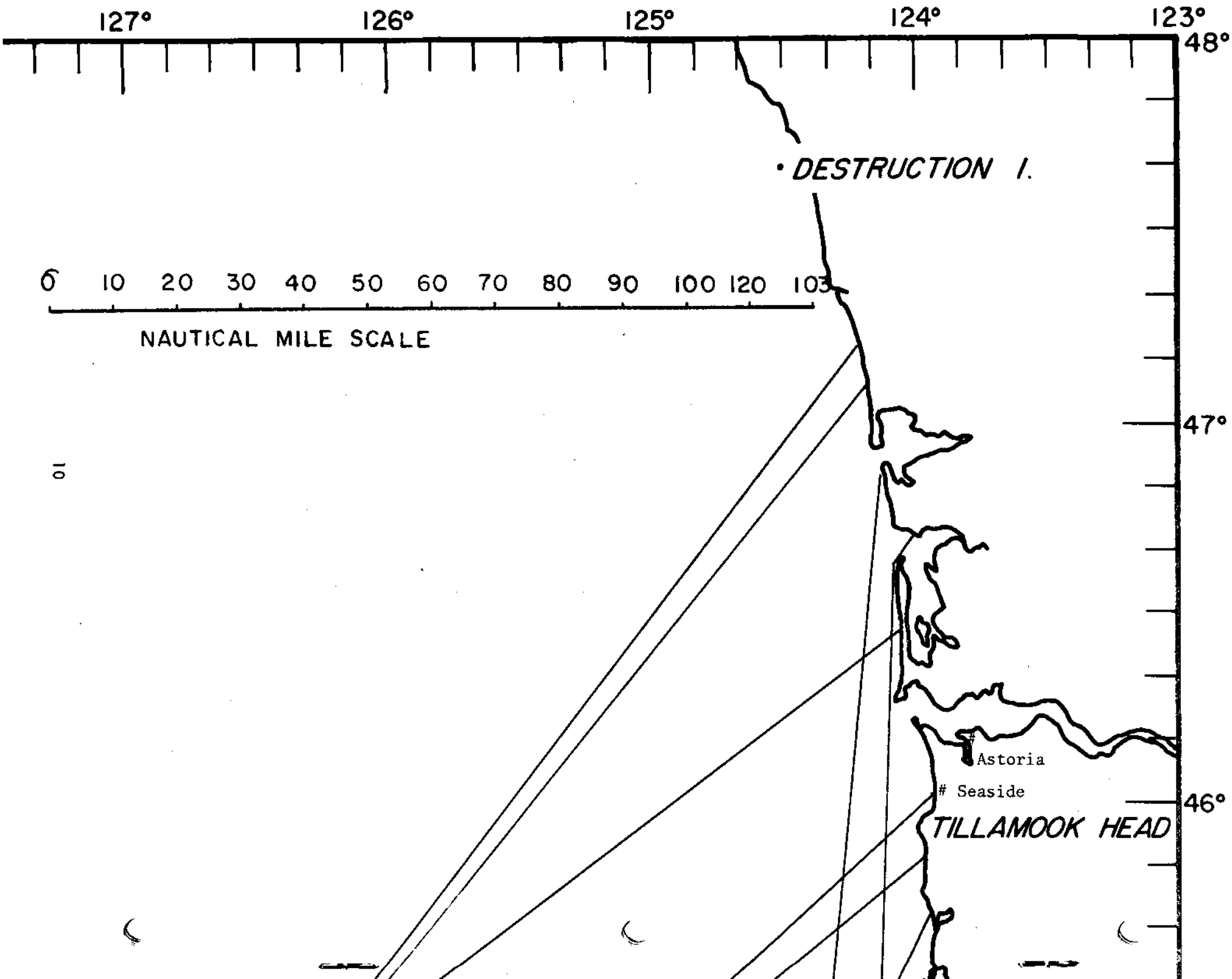
A. It established the exclusive fishing zone which gives the U.S. the exclusive right to the fishing resources out to 12 miles from shore.

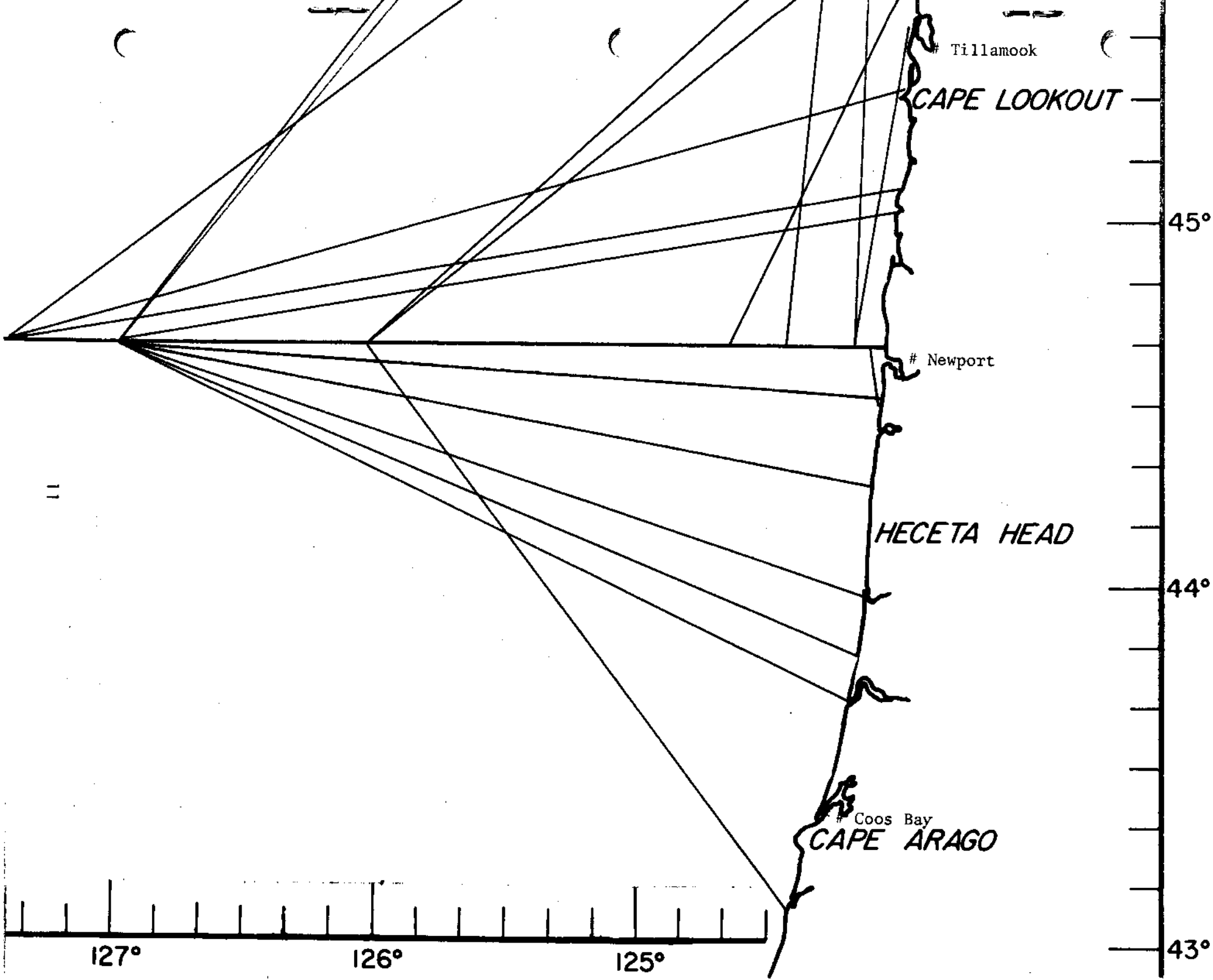
9. Does each state have the exclusive right to sell the right to extract resources off its off-shore areas?

A. Yes.

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

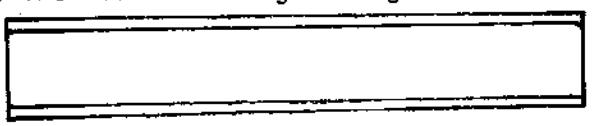
A. The American salmon spawned and developed in the U.S. can only be fished by U.S. fishermen.


127°
126°
125°
124°
123°
48°
47°
46°
DESTRUCTION I.
0 10 20 30 40 50 60 70 80 90 100 120 103
NAUTICAL MILE SCALE
10
Astoria
Seaside
TILLAMOOK HEAD

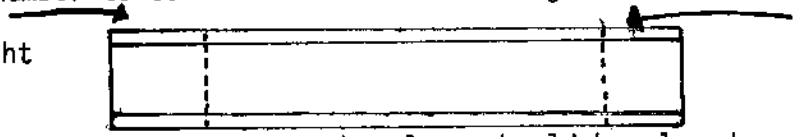

Tillamook
CAPE LOOKOUT
45°
Newport
HECETA HEAD
44°
Coos Bay
CAPE ARAGO
43°
127°
126°
125°

Construction of a Wave Tank

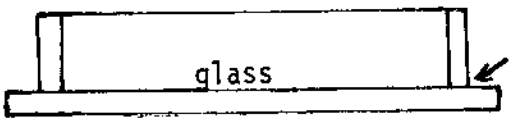
The wave tank can be constructed by using cedar lumber of 2x6 or 2x8 dimension. The length and height of the tank can be altered to suit your individual needs or to fit the size of glass available to you. The glass should be either crystal or plate. Single or double strength glass is not satisfactory. The cedar board should be cut with 2 grooves about 3/8 inch deep and 1 inch from the edge along the full length of the board.



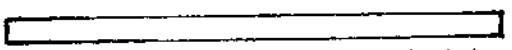
Once the grooves are cut, each end should be cut to the length desired for the height of the tank. This is done to provide the best fit for the grooves. Remember to consider the size of the glass when making these cuts.



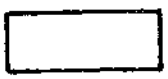
Once the ends have been cut, the glass should be placed on the base and centered. With the glass in the grooves, place the ends on the glass. There should be enough room left on the base to allow for the addition of the end brace. Mark the position of the end pieces then remove the ends and glass.



The positions of the ends should be cut into the base about 3/8 to 1/2 inch. This gives the tank better strength when it is filled.

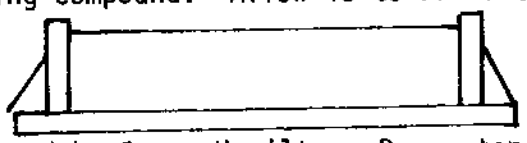


A piece of 2x4 should be cut to match the height of the end of the tank. The pieces of 2x4 are to be used for braces and should be cut in the fashion diagrammed below.



A good quality wood glue and wood screws should be used to secure the pieces in the following way.

Once this stage is completed, you should set both glass sides in place and check to make sure the remaining end fits before going any further. Once the fit is insured, remove the glass and place either a silicon or butyl rubber calking compound in the grooves. Replace the glass and the remaining end. Smooth out any excess calking compound. Allow 48 to 72 hrs. for the calking to cure.



This tank developed by Dewey Hamilton, Beaverton High School, Beaverton, Oregon.

Wave Tank

Large winter waves strip the sand from the beach and deposit it in offshore sandbars. Smaller summer waves wear away the built-up sandbars and replace the sand on the beaches; therefore, there is quite a difference in the appearance of the beaches season to season. Winter beaches are steep with much of their sand stripped away exposing rocky ledges and gravel beds. Summer beaches are gently sloping and well endowed with sand which covers the gravel beds.

Illustrate the action of winter waves and summer waves on the beach by making a beach by pouring a pint of sand into one end of the wave tank. Move the paddle back and forth in a horizontal movement to make large winter waves. Generate large winter waves for five minutes then trace the outline of the beach on the glass side of the tank with a wax pencil. Next, create summer waves for five minutes by moving the paddle up and down gently. Observe the movement of the sand. At the conclusion of the five minute period, observe the shape of the beach as compared to the outline you traced at the end of the winter wave period.

Answers to Questions from Wave Tank Project

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

A. Away from the beach.

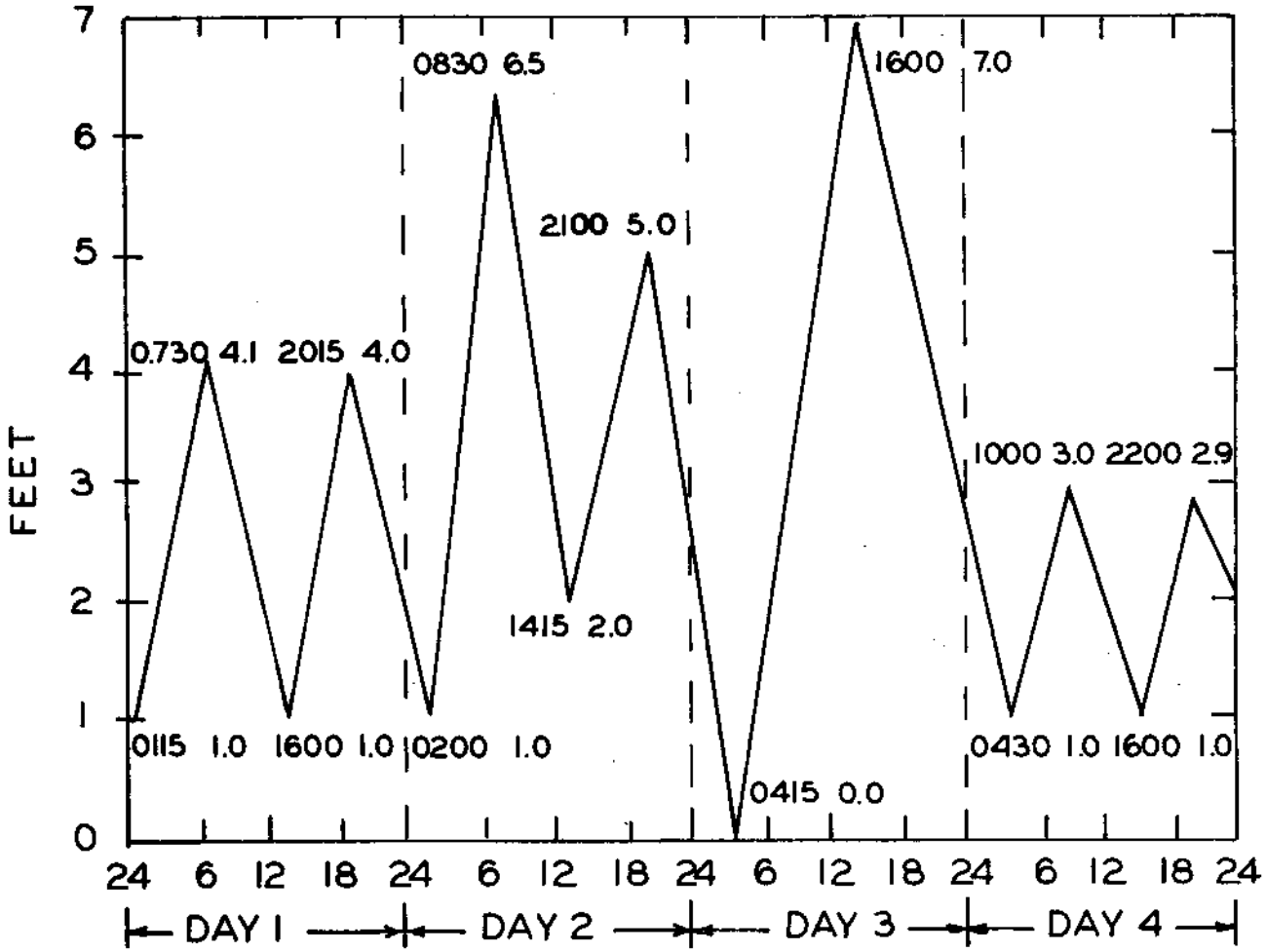
2. Which direction was the net movement of sand during the summer period?

A. Onto the beach.

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

A. Winter beach steep and stripped of sand.
Summer beaches sloping with abundant sand.

PLOTTING A TIDE CURVE
(SOLUTION)



Answers to Questions on Tides

1. The tide is diurnal on Day 3.
2. The tide is mixed on Day 2.
3. The tide is semidiurnal on Day 1 and Day 4.
4. The range is largest on Day 3.
5. The smallest range is 1.9 feet on Day 4.

GEOLOGY OF THE COAST

Answers to Discussion Guide to Landslides

1. What are some causes of landslides?

A. Undercutting of the toe of a slope. Ground water decreases the strength of the soil.

2. How are landslides classified?

A. They are classified by the nature of the slip surface.

3. Name four landslide types.

A. 1. slump 2. slide 3. fall 4. shift

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

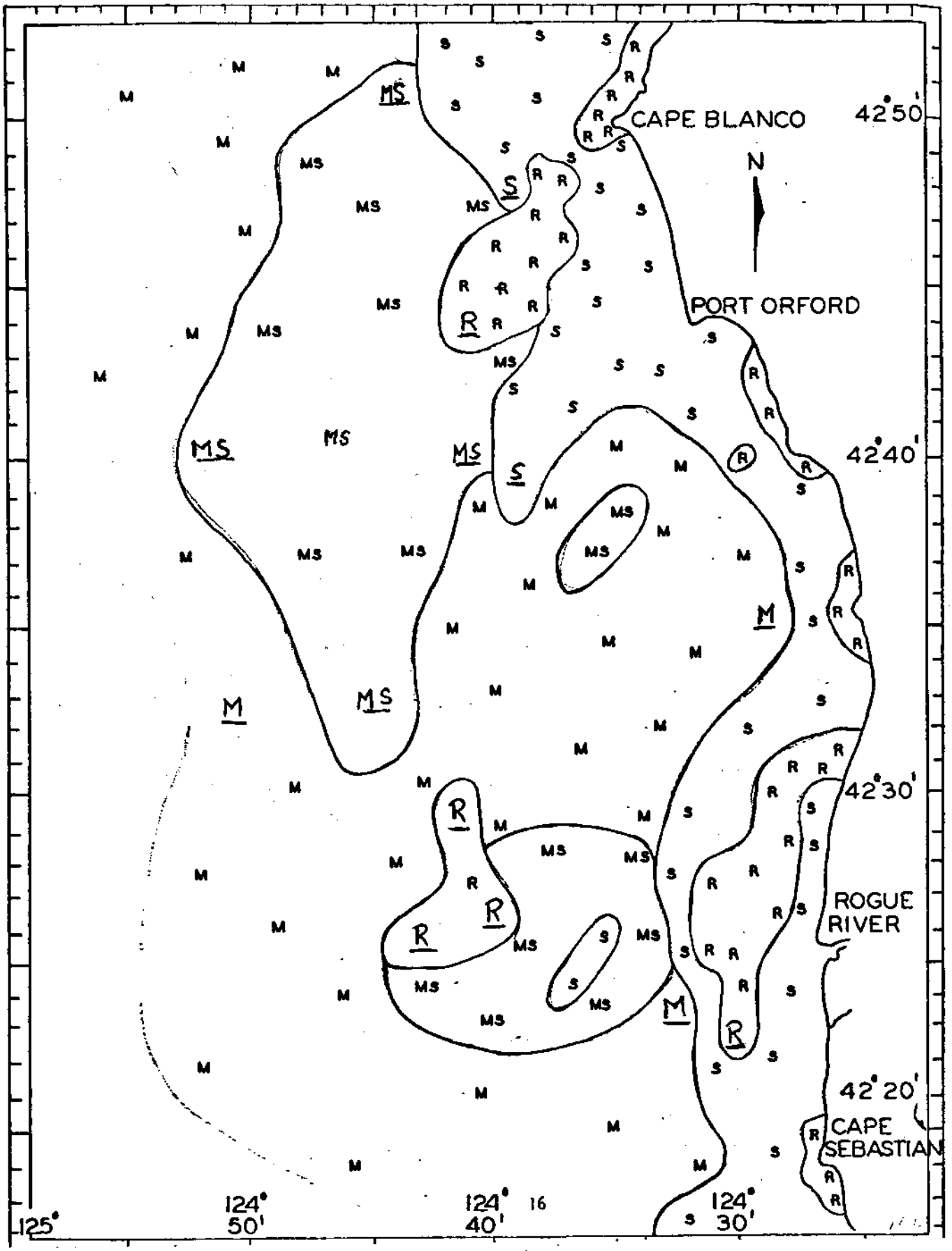
A. Fall - igneous rock. Fall, slump, slide, shift - sedimentary rock.

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

A. 30 feet per year for Cape Meares. 8 feet per year for Newport.

6. What measures are taken to prevent landslides?

A. Rip-rap, grass and shrub plantings, terracing and reduction of cliff angle.


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

Answers to Questions for Sediment Contouring Exercise

1. What areas would you avoid if using drag nets to collect bottom fish?

A. Rocky.

2. Where would you be likely to find shrimp?

A. Muddy bottom.

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?

A. 5 miles by 10 miles

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.

   a. What is its latitude and longitude?

A. Latitude 42-25. Longitude 124-31.5.

   b. How far from Port Orford is it?

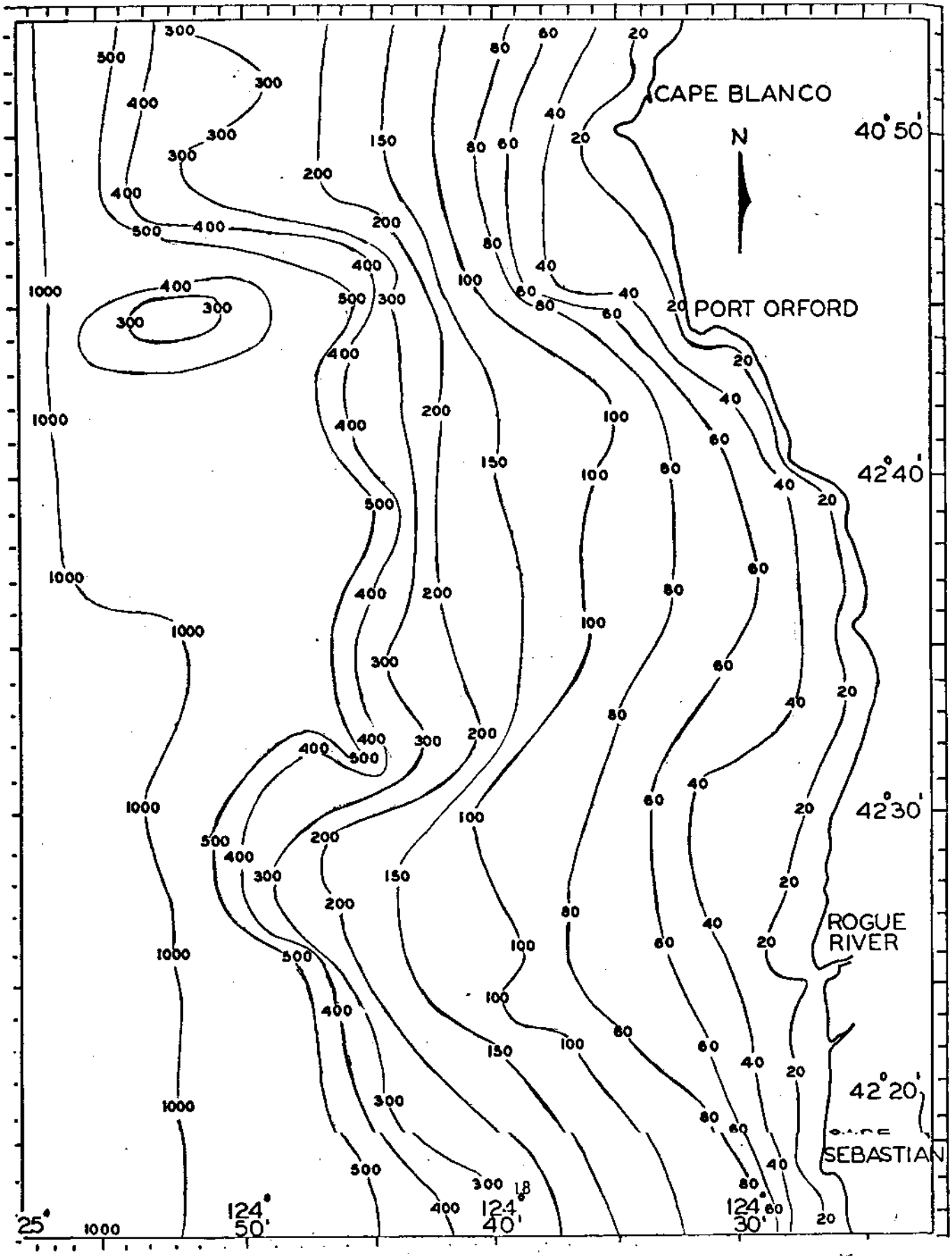
A. 20 nautical miles south of Port Orford.

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

A. Mud is the most common. Rocky is the 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?

A. Cape Blanco
Cape Sebastian
124-29 Long by 42-40 Lat
124-27 Long by 42-35 Lat
124-26 Long by 42-30 Lat


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

Answers to Discussion Guide on Navigation

1. Complete the points of the compass.

A. Southeast, south southeast, south southwest, west southwest, west northwest.

2. Name the cardinal points of the compass.

A. North, south, east, west.

3. How many degrees difference is there between magnetic north and true north?

A. Approximately 16.

4. If you are traveling 270 degrees, in what direction are you headed? 240°? 60°?

A. West. West southwest. East northeast.

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

A. Course: Intended direction of travel.
Heading: The direction the ship is actually traveling.

6. What is the left side of the ship called? The right side?

A. The left side: Port. The right side: Starboard.

7. If a light house were sighted to the right of the ship and towards the rear, what location would this be in nautical language?

A. Broad on the starboard quarter.