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ABSTRACT

This study guide is one of several supplementary materials for a 16-week newspaper course about oceans. Learning objectives are to help students understand the potential value of the sea, major sources of pollution, contribution of marine archaeology to knowledge of ancient civilizations, and the decline in fictional writing about the sea. Content and concepts span the fields of literature, history, law, and marine sciences. Discussion questions promote analysis of controversial issues such as United States government policies regarding offshore oil development. The study guide integrates the themes of newspaper articles and primary source readings from the accompanying materials. Presentation of learning objectives and discussion of key concepts enable students to pursue the course independently as well as in groups. Divisions in the study guide correspond with the six major units in the reader. Each unit in the guide contains a list of appropriate newspaper articles and selections from the reader, learning objectives, overviews of newspaper and reader materials, discussion of key concepts, factual questions, discussion questions, and a bibliography of related books or articles. (Author/AV)

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OCEANS

OUR CONTINUING FRONTIER

A Study Guide for Courses by Newspaper

Helen S. Hawkins

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INTRODUCTION

This *Study Guide* has been designed to assist both the student enrolled for credit in the Course by Newspaper titled "Oceans: Our Continuing Frontier" and the general reader of the newspaper articles and the supplemental anthology. It is our hope that this volume will facilitate and enrich your understanding of the many issues presented in the course.

We wish to acknowledge the assistance in the preparation of this *Study Guide* of Mary Hellman, who helped compile the list of organizations and sources of information, and of Jane L. Scheiber, who compiled the list of museums, formulated the learning objectives, and assisted with bibliographic annotations. We also wish to thank George Sharman of the Scripps Institution of Oceanography for critically reviewing sections of the manuscript.

We gratefully acknowledge the support of the National Endowment for the Humanities, which provided funding for this project. The views presented in this *Study Guide* are those of the author only, however, and do not necessarily reflect the views of the Endowment or of the University of California.

NOTES TO THE STUDENT

The materials for this Course by Newspaper consist of a series of sixteen weekly newspaper articles, which may be thought of as "lectures" by a distinguished faculty; a *Reader* or anthology of articles, stories, and poems that supplement the newspaper articles; and this *Study Guide*, which is intended to integrate the themes of the newspaper articles and the articles of the *Reader*. For those students who are pursuing this course largely through independent study, the *Study Guide* serves in some ways as a substitute for class discussions.

The course has been arranged into six major units with corresponding divisions in the *Reader* and *Study Guide*. A complete course outline appears on p. x.

Each unit of the *Study Guide* begins with a list of the newspaper articles and the appropriate supplementary selections in the *Reader*. This is followed by learning objectives for the unit and an overview of the newspaper and *Reader* materials for the unit. Key Concepts highlight some of the major ideas presented in the unit. Factual questions will enable you to test your own knowledge of the materials. The discussion questions are designed to test your ability to use the facts in a discussion, as well as to serve as a review and a stimulus to further thought about the topics. Finally, each unit contains a brief bibliography of additional books or articles, suggested by the authors of the newspaper articles, for those students wishing to investigate the topics in greater depth.

Although each student will discover for himself or herself how best to use the course materials, we would suggest the following approach:

1. Read the newspaper article each week; clip it and carefully save it for future study and review.
2. Glance over the Learning Objectives, Overview, and Key Concepts in the corresponding unit of the *Study Guide*. These will call attention to some of the more important points in the newspaper and *Reader* articles and will help to focus your reading.
3. Read the appropriate selections in the *Reader*.
4. Reread the Key Concepts and Overview more thoroughly this time.
5. Proceed to the factual questions, rereading the articles as necessary to answer them.
6. Consider the Discussion Questions. Suggested guidelines to answers are provided with each question, although there is, of course, no single "correct" answer.
7. Turn back to the learning objectives. Have you met these goals?
8. Check the annotated bibliographies for suggestions of further reading on topics of interest.

We have also included in this *Study Guide* for the interested reader a list of major maritime museums, a list of organizations that you can join that are concerned with ocean policy, and a list of some sources for additional information about our continuing frontier.

OCEANS: OUR CONTINUING FRONTIER

Academic Coordinator: H. William Menard
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OCEANS: OUR CONTINUING FRONTIER examines the whole range of human involvement with the sea. It shows through literature and painting how man's perception of the sea has changed and how, through exploration at sea, scientists have changed man's understanding of the history of the earth. The course also describes how society as a whole may be affected by marine pollution and by the extraction of food and minerals from the sea. The importance of international law, naval power and the merchant marine to the future use of the sea is stressed. Finally, the course considers how the sea, as a place of both work and recreation, affects the lives of individual men and women, afloat and ashore.

UNIT ONE: OUR CONTINUING FRONTIER

1. Oceans: Our Continuing Frontier
 H. William Menard

UNIT TWO: LITERATURE AND ART

2. Writers at Sea
 George P. Elliott, Professor of English, Syracuse University
3. Horrors of the Deep
 Eugenie Clark, Professor of Zoology, University of Maryland
4. American Imagery and Visions of the Sea
 John Wilmerding, Leon E. Williams Professor of Art, Dartmouth College

UNIT THREE: SCIENCE AND MYTH

5. Exploration of the Sea
 Edward Bullard, Professor of Geophysics, Institute of Geophysics and Planetary Physics, University of California, San Diego
6. A New World Picture
 Edward Bullard
7. Science and Ancient Sea Stories
 Willard Bascom, Director, Southern California Coastal Water Research Project

UNIT FOUR: MARINE RESOURCES

8. Mineral Resources of the Ocean.
Don E. Kash, Professor of Political Science and Director of the Science and Public Policy Program, University of Oklahoma
9. Can the Sea Feed the Land?
C. P. Idyll, Study Director of the National Ocean Policy Study, National Oceanographic and Atmospheric Administration
10. Pollution: Is the Sea Dying?
Bostwick H. Ketchum, Associate Director, Woods Hole Oceanographic Institution

UNIT FIVE: POLICY AND SEA POWER

11. Law of the Sea
William T. Burke, Professor of Law and of Marine Studies, University of Washington
12. The Sea: Defensive Barrier or Invasion Path?
Herman Kahn, Director, The Hudson Institute, Croton-on-Hudson, New York
13. The Sea: Connector or Barrier?
Herman Kahn

UNIT SIX: MEN AND WOMEN AT SEA

14. Ships and the Sailor
J. H. Parry, Gardiner Professor of Oceanic History and Affairs, Harvard University
15. Women and the Sea: Not All on Widows' Walks
Constantina Safilios-Rothschild, Professor of Sociology and Director of Family Research, Wayne State University
16. From Work to Sport
Heywood Hale Broun, journalist, television and radio personality

UNIT ONE

OUR CONTINUING FRONTIER



Frontispiece from *J. Beale's Natural History of the Sperm Whale*, 1839

NEWSPAPER ARTICLES

1. *Oceans: Our Continuing Frontier*
H. William Menard

READER SELECTIONS

- They Went to Sea*
Samuel Eliot Morison
- The Influence of Sea Power Upon History*
Alfred Thayer Mahan
- Menfish*
Jacques Cousteau
- The Perils and Potentials of a Watery Planet*
Jacques Cousteau

LEARNING OBJECTIVES

To understand

- the range of human involvement with the sea
- why the sea is regarded as a frontier
- America's intimate connection with the sea throughout its history
- the challenge of exploring the sea
- our changing perceptions of the sea
- the potential value of the sea
- the threat humans pose to the sea

Note: Most of these topics will be explored in greater depth in subsequent units, permitting the student to further develop his or her understanding of these issues.

OVERVIEW

This unit serves as a general introduction to the wide range of topics and issues the course will cover. More particularly, however, the unit focuses on the changing role the oceans frontier

has played in Americans' lives and suggests the new challenges it offers us today. The four *Reader* selections highlight some of the points H. William Menard makes in his newspaper article.

In his article, Menard sketches the historical importance of the sea to Americans, touching upon its significance as a highway for immigrants to the New World, an economic resource, a source of inspiration to artistic and literary activity, and an object of scientific inquiry. Further, where once Americans braved the dangers of the sea only to obtain a livelihood, today the sea offers recreational opportunities to an affluent people whose future prosperity may well depend on exploitation of its vast resources. As Menard emphasizes, the sea now constitutes the one remaining frontier that promises the opportunity for material benefit that the land frontier traditionally provided Americans.

As the *Reader* selection from Samuel Eliot Morison's *Maritime History of Massachusetts* indicates, the peculiar characteristics of that land frontier in New England contributed to Americans' success in building a maritime economy in the seventeenth century, an economy that flowered fully two centuries later in American dominance of the world whaling industry and "clipper ship" ocean commerce. Of course, as Morison relates, the riches of the fisheries in the area had first attracted Europeans to what would become New England. As new immigrants came to build new commonwealths in the wilderness, fish remained an important resource for their survival. But when New England's stony soil proved incapable of supporting the population, the land's abundance of timber and other material resources made possible the shipbuilding industry through which the ocean carrying trade in turn prospered.

Certainly other factors facilitated New England's maritime success. The availability of trained artisans to build the ships and willing men to crew them, the benefit of preferential British legislation, the market that the West Indies and southern planters provided for their cargoes and services all helped. But necessity spurred New Englanders to turn to the sea frontier, just as it spurs Americans today when the limits of the land frontier's opportunities have been reached.

Fishing remains important to New England, but,

as Menard points out, American shipping did not survive as a major industry, and the maintenance of a healthy merchant marine did not remain an important national priority. With the exception of wartime efforts, American capital and energy was directed instead toward exploiting the land frontier's resources. The development of one of those resources, petroleum, put an end to the American whaling industry, Menard notes, but as those supplies became inadequate to meet increasing demand, Americans turned again to the ocean to secure undersea oil, with consequences that other units will explore more fully.

With the official closing of the land frontier in the late nineteenth century (in 1890 the superintendent of the United States Census announced that the frontier of land available for settlement had essentially disappeared), some Americans turned again to the sea as an avenue to new frontiers. In the age of international imperialism, other nations were carving up the rest of the world for colonial exploitation. Men like Admiral Alfred Thayer Mahan argued that America's survival as a great nation, and, indeed, her survival as an independent nation, required our, too, becoming an imperial power through the reestablishment of a strong navy and merchant marine. Mahan was a persuasive and effective advocate for his own service, the United States Navy, which was poorly prepared and lacking in prestige, and his arguments struck a responsive chord with many Americans who now looked overseas for new frontiers to conquer.

In the *Reader* selection from *The Influence of Sea Power Upon History*, the book he published in 1890, Mahan emphasized the integral relationship between naval forces and merchant shipping and described the conditions necessary to becoming a great sea power. His American readers could readily recognize their own potential for fulfilling those conditions. Mahan's book contributed to American imperialist adventures that resulted from the Spanish-American War in 1898, but American merchant shipping generally remained weak, as

Menard notes, Mahan's arguments for a strong merchant marine as essential to national defense are relevant today. Unit Five explores that issue along with other sea-power policy questions.

The first *Reader* selection by Jacques Cousteau illustrates one of the ways in which Menard suggests that our views of the sea are changing. It describes a new experience of the sea that more and more Americans are coming to enjoy. The invention and development of the self-contained underwater breathing apparatus (SCUBA), in which Cousteau played a leading role, freed man to swim deep below the ocean surface to explore a whole new world. Through undersea photography, Cousteau and others have shared their experience of that new world with millions, dispelling misconceptions about its "horrors," and bringing television viewers a vicarious familiarity with its realities and delights. Although scuba diving has obvious practical applications and was, in fact, developed for military purposes, it is its recreational, pleasure aspect that has most directly affected ordinary people. The near euphoria of the first aqualung dive Cousteau describes is matched each time a newly trained and equipped scuba diver tastes the experience. The aqualung is thus a special milestone in the application of human ingenuity in penetrating the ocean frontier.

The second Cousteau selection, the final reading for this unit, concerns the more serious aspects of the new interaction of humans with the ocean world. This selection serves as a sampler of some of the policy issues with which later units of the course will deal. As Menard suggests, mankind has not yet exercised the kind of self-restraint that will be necessary if we are not irreversibly to poison the sea with pollution, to overexploit its living resources, or to disturb its delicate ecological balance. Although, as he points out, we can learn to farm, herd, and mine the sea to our benefit, the potential for human damage to it is equally enormous, given the record of human short-sightedness and self-

interest. Cousteau discusses some of the ways in which we have already negatively affected the ocean world and warns that drastic measures must be taken if the oceans are to be cured of this "cancer." He then describes several of the positive kinds of benefits the sea promises: weather control, sea farming and mining, new kinds of energy production, and other technological marvels. Cousteau argues that the oceans' riches belong to all mankind, including future generations, and that only a supranational governmental agency can assure the equitable utilization and preservation of this common resource.

KEY CONCEPTS

FRONTIER

The use of the frontier concept in the course title reflects its importance in American life and thought. The frontier is a territorial concept, used to denote both a limit—a boundary line between territories—and an area—either geographical or intellectual—at the fringes or cutting edge of human experience. It is in its sense of a little explored, used, or occupied geographical area that the frontier concept has most meaning for Americans.

Much of American history has consisted of the occupation and exploitation of successive land frontier areas, with general benefit to the pioneers involved. This fact gives to the term frontier a positive, hopeful connotation for most Americans, although it also carries a cultural memory of danger and lawlessness. History also shows, however, that Americans' transformation of the land frontier into a "civilized" area involved wasteful and destructive practices, the negative effects of which are only now being fully recognized.

Our unexploited land frontiers generated a national optimism that shaped the American character. One historian, Frederick Jackson Turner, theorized that American democracy itself was the result of the frontier experience. Today the oceans frontier seems to offer the promise of supporting the affluence that has, as others argue, been the real basis of American democracy.

For Americans the frontier is also a dynamic concept, implying continuing movement beyond the known and settled into the unknown and undeveloped, whether in the physical world or in the world of ideas. When we use the term in reference to areas of knowledge, such as the "frontiers of science," we assume that progress into those areas is as likely or even inevitable as was our historical progress into new geographic

areas. Recent discoveries in undersea geology have, indeed, extended those frontiers of the mind, providing an entirely new view of global geological processes.

In its other usage, the idea of a frontier as a boundary line was once much more apt in regard to the oceans than it is today. For millennia the ocean shore did mark a barrier line between two worlds—the land and the sea—beyond which human beings ventured only relatively recently in terms of the geological time scale. Until the late fifteenth century, the open oceans remained a barrier for Europeans, although the inland seas and coastal waters were well known and used. Technology and courage made it possible for man to transform that barrier into a frontier area of human penetration and use. For the immigrants to America who crossed that still formidable barrier at great risk, and for most of their descendants, the oceans offered little attraction as a frontier for exploitation while ample land frontiers still beckoned.

In centering on the frontier concept, this course focuses on the transformation of the ocean world from a barrier to a frontier area that promises great material and intellectual rewards. But the course also points out the dangers involved and the potential damage that could result if exploitation of the oceans frontier is as ruthless and lawless as was that of the American land frontier.

MARITIME ECONOMY

When the organized system through which the material needs of a people are met focuses primarily on the sea, that system is called a maritime economy. Many coastal regions in the United States have, at one time or another, and to varying degrees, depended on involvement

with the sea as a mainstay of economic activity. Although a maritime economy can consist simply of the domestic utilization of fish resources, it can also involve more complex elements, as Morison's description of seventeenth-century New England's economy indicates. There, the initial exploitation of fisheries by Europeans, which from the first involved shipping the catch to European markets, was soon supplemented by further ocean commerce. That commerce was in turn made more profitable by the development of another maritime industry, shipbuilding. Although fish remained an important food resource for New Englanders themselves, the other elements in the maritime economy of the region provided the wealth with which other needed commodities and services were obtained. That wealth, incidentally, also provided the capital that permitted the region's transition from a predominantly maritime to an industrial economy in the nineteenth century.

OCEAN HIGHWAYS

One aspect of the sea to which this unit refers is its use, in Alfred Thayer Mahan's words, as "a great highway." In many cases travel from one place to another can only be accomplished by crossing bodies of water. But, in addition, boat travel and hauling freight by ship has often been easier and cheaper than by land, although sometimes more dangerous. With the development of ship technology, from raft to rowed vessel to sail to steam and beyond, people have created ocean highways for the movement of men and goods. Such highways have been essential to many of the great migrations of human beings from one land mass to another, as in the case of the immigration to North America of all but the original settlers (the "Native Americans"), who came when the land bridge from Asia still existed. Ocean highways were the life line to the infant European colonies in North America and remain essential to the world trade on which the

American economy still depends.

In addition to the obvious commercial uses of ocean highways, they have also made possible military operations by one people against another that have often transformed the demographic and political character of different regions of the world.

SEA POWER

Sea power consists of the ability to use the seas for military, commercial, or other purposes. The military aspect of man's interaction with the sea involves offensive and defensive elements. As Mahan emphasized, the commercial utilization of ocean highways depends on a people's capacity to protect its shipping from attack, while the defense of the homeland from hostile invasion by sea also requires the specialized military forces that we call navies. In turn, aggression against other peoples, whether commercial or territorial, also often depends on using ocean highways. Throughout human history, peoples who have mastered the sea through technology and daring have imposed their will on others who failed to develop similar capabilities. Despite the development of new technologies such as airplanes and missiles, sea power remains essential to the self-interest of many nations, including the United States, in today's interdependent world.

OCEAN RESOURCES

The organic and mineral material resources of the ocean world include a vast variety of living creatures, plants, and substances that are or may become sources of supply for the filling of human needs. The main resource humans have traditionally obtained from the sea is food from a relatively small number of fish varieties at the higher levels of the food chain. Sea mammals also provided meat, fur, fat, or other usable materials. Few sea plants have yet been harvested for human use. Exploitation of the

oceans' mineral resources has also remained minimal, although salt obtained from sea water has long been a valuable product for mankind. Today, petroleum is becoming the most significant nonfood resource man obtains from the ocean world, although the mining of manganese nodules and other minerals promises to become increasingly important.

The energy-related resources of oceans extend, however, beyond the petroleum or other fuel resources they contain. The oceans also constitute a reservoir of potential power in the energy latent in the tides, waves, currents, temperature differentials, winds, and other ocean phenomena that can be harnessed for man's use. And, as Jacques Cousteau suggests, ocean weather itself may become a resource that man can control to shape the weather over land to more productive results.

AQUACULTURE

Aquaculture is a term sometimes used for the systematic cultivation of sea animals or plants. As H. William Menard points out, the usable harvest of plants and animals from the sea could be dramatically increased by the application of science and technology, much as land resources multiplied when agriculture replaced hunting and gathering. Already under way on a very small scale, aquaculture could become as revolutionary a development for the world of foods, fibers, pharmaceuticals, and other products as agriculture was in the past.

OCEAN POLLUTION

As Menard and Cousteau both warn, the discharge of poisonous materials into the sea, although to date only locally damaging, has recently raised serious questions regarding the oceans' capacity to absorb pollutants or to recover from such misuse. Sewage, chemicals, oil, nuclear wastes, and other noxious materials may

dangerously alter ocean ecology just as overfishing has virtually destroyed some important ocean food resources. The evidence and consequences of unrestrained ocean pollution will be examined more fully in Unit Four.

LAW OF THE SEA

A concept only touched on in this unit, the law of the sea involves the understandings recognized in international law that deal with matters related to the oceans. As we will see in Unit Five, until recently the concept of limited national control over the ocean has prevailed in international law, leaving all but narrow coastal margins ("territorial seas") open to the free use and exploitation by all nations. That concept is under challenge today as individual nations extend the areas over which they claim jurisdiction or exclusive exploitive rights. The United Nations is currently seeking to reach agreement on a new international law of the sea for the benefit of all mankind.

FACTUAL REVIEW QUESTIONS

1. During what periods has America built a strong merchant fleet?
2. What development destroyed the American whaling industry?
3. What is the purpose of Sea Grant Colleges?
4. How has involvement with the sea changed our attitudes toward it?
5. How do scientists now explain world geological processes?
6. What new developments threaten the oceans frontier?
7. What kind of economy did the founders of Massachusetts Bay expect to establish?
8. What factors fostered the shift to a maritime economy?
9. What were the key industries in the maritime economy of colonial Massachusetts and when were they established?
10. When were Mahan's books first published, and why did they prove important?
11. According to Mahan, what are the advantages of the sea as a trade route?
12. According to Mahan, what is the main purpose of a navy for peaceful nations?
13. How does Mahan account for the decline of the United States Navy?
14. What six "principal conditions" does Mahan list as affecting the sea power of nations?
15. What particular population characteristics does Mahan believe necessary to the development of sea power?
16. How did the American population of his day meet those characteristics?
17. How does "national character" influence sea power?
18. What role do forms of government, institutions, and rulers play in achieving sea power, according to Mahan?
19. What are the elements of the aqualung underwater breathing apparatus?
20. Why did Cousteau compare the new experience of swimming with an aqualung to flying?

21. What advantages did the aqualung have over helmet diving?
22. What relationship does the ocean have to the air we breathe?
23. Why does Cousteau say the ocean today is "sick"?
24. How could the oceans in the future contribute to "world weather control"?
25. How can electric power be produced from the sea?
26. What does Cousteau mean by undersea "acclimatization parks"?
27. Why does Cousteau believe responsibility for ocean deterioration lies with governments?
28. What measures must governments take to protect the oceans?
29. What does Cousteau mean by an "O.H.A."?
30. According to Cousteau, to whom must the riches of the sea belong?

ESSAY AND DISCUSSION QUESTIONS

1. Describe the factors that led to the development and decline of New England's maritime economy and evaluate its importance for the region and for the nation.

SUGGESTED GUIDELINES

1. Consult Morison's account for data on the early period.
 2. Note, too, Menard's references to the clipper ship fleet and the whaling industry.
 3. Drawing on your general knowledge of American history and Mahan's discussion of sea power, speculate as to the role New England's strong merchant marine might have played in securing and maintaining American independence and in preserving the Union during the Civil War.
- 2. If the purpose of Mahan's book was to encourage expansion of the United States Navy and Merchant Marine, how objective do you consider his discussion of the criteria necessary for sea power?**

SUGGESTED GUIDELINES

1. Review Mahan's comments on population characteristics, "national character," and governmental forms and institutions.

2. Does the discussion appear structured so as to encourage American readers to conclude that we could and should develop a strong navy and merchant marine?

3. Considering the evidence Menard and Cousteau offer, does man's present involvement with the oceans frontier promise more beneficial or harmful results?

SUGGESTED GUIDELINES

1. Note Menard's references to overfishing and ocean pollution, sea farming and undersea oil development, and his warning regarding a "lawless technological race" to exploit the ocean frontier.
2. Consider Cousteau's description of current damage to ocean ecology and his forecast of potential benefits, including weather control, food, drugs, mineral resources, energy, and living space.
3. Evaluate Cousteau's prescription for assuring a positive outcome through governmental action.
4. Should the resources of the ocean belong to all mankind, as Cousteau argues, or should they be exploited by individual nations on a first-come-first-served basis, as land resources have been appropriated in the past?

SUGGESTED GUIDELINES

1. Consider here both the moral question and the practical considerations involved.
2. If you agree with Cousteau, do you believe this objective can actually be achieved, given the reality of human self-interest and present national rivalries?

SUGGESTED READING, *Our Continuing Frontier*, H. William Menard

Note: Only books of the most general interest are included here. For more specialized works, the reader is referred to the other bibliographies in this STUDY GUIDE.

Borgese, Elisabeth Mann. *The Drama of the Oceans*. New York: Harry N. Abrams, 1976. A far-ranging and strikingly illustrated account, covering such subjects as marine archaeology, ocean architecture, the ecological crisis, sea-floor spreading and continental drift, and ocean warfare. The author, a founder of the International Ocean Institute, views the oceans as our last frontier, and she

devotes several chapters to the oceans as a vast natural resource that we have only begun to tap.

Carson, Rachel. *The Sea Around Us*. Rev. ed. New York: Oxford University Press, 1961. In this updated version of her classic work, which received the National Book Award for nonfiction in 1951, Rachel Carson reveals with

sensitivity and imagination the science and poetry of the sea—its origin, its changes through the ages, its tides and currents, its marine life, and its meaning for mankind.

Cousteau, Jacques-Ives. *The Ocean World of Jacques Cousteau*. New York: Harry N. Abrams, 1973-1975. In a series of beautifully illustrated volumes, the author introduces us to the many marvels of the ocean world. Separate books in the series include *Instinct and Intelligence*, *Mammals in the Sea*, *Man Reenters the Sea*, *Pharaohs of the Sea*, *Provinces of the Sea*, *The Sea Is Dangerous*, *A Sea of Legends*, *Challenge of the Sea*, *Guide to the Sea*, *Outer and Inner Space*, *Riches of the Sea*, *The Whitecaps*, *Quest for Food*, *Window in the Sea*, *Oasis in Space*, and *Invisible Messages*.

Freuchen, Peter. *Peter Freuchen's Book of the Seven Seas*. New York: Julian Messner, 1957. The late explorer and sailor offers a compendium of science and lore of the many facets of the sea, ranging from the origins of the ocean and its living creatures to famous sea voyages and battles.

Idyll, C. P. (ed.). *Exploring the Ocean World: A History of Oceanography*. New York: Thomas Y. Crowell, 1969. This compilation, profusely illustrated, traces the exploration of the ocean world from the ancient Egyptians through the 1960s. The developments in each of the branches of the composite science of oceanography—marine chemistry, biology, geology, and physics—are traced by a noted specialist in the field. There are also chapters on the applied sciences: fishery management, mineral and energy extraction, archaeology, and aquaculture.

Pell, Claiborne, with Harold Leland Goodwin. *Challenge of the Seven Seas*. New York: William Morrow, 1966. The senator from

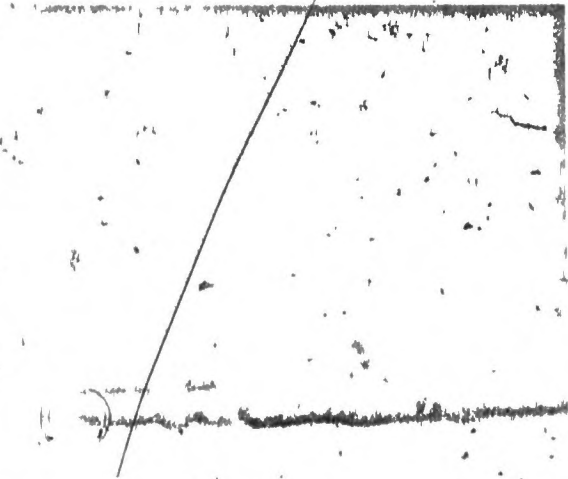
Rhode Island, a leading proponent in government for ocean development, designed this book to encourage Americans to "begin to think of the sea as a friendly and profitable environment in which to work" so that we can "begin the true exploitation of this greatest resource, the last of earth's own frontiers." Included are chapters on "the water planet," ocean resources, other uses of the oceans, ocean scientists, and the interrelationship of the seas to national security.

Also of particular interest are the following periodicals:

National Geographic, published by National Geographic Society, Washington, D.C.

Oceans, published by the Oceanic Society, San Francisco, California.

Sea Frontiers, published by the International Oceanographic Foundation, Miami, Florida.



UNIT TWO

LITERATURE AND ART

Courtesy of the Museum of Fine Arts, Boston. M and M. Karolik Collection



NEWSPAPER ARTICLES

2. *Writers at Sea*
George P. Elliott

3. *Horrors of the Deep*
Eugenie Clark

4. *American Imagery and Visions of the Sea*
John Wilmerding

READER SELECTIONS

- Sir Patrick Spens*
Psalm 107
Ariel's Song
William Shakespeare
Dover Beach
Matthew Arnold
Sea Fever
John Masefield
The Open Boat
Stephen Crane
Moby-Dick
Herman Melville

- The Poulps*
Jules Verne
Kraken
Frank W. Lane
Sharkproof!
Eugenie Clark
Shark Attack Against Man
H. David Baldrige

- Seascape and the American Imagination*
Roger B. Stein
The Art of the Seaman
Gerhard Timmermann and Helen L. Winslow
Visions of the Sea

LEARNING OBJECTIVES

To understand

- how human involvement with the sea has been reflected in literature and art through the ages
- our varying perceptions of the deep and of its creatures
- what the sea has meant to novelists and poets—as a setting, as a symbol or image, as a power, as a central character
- why great sea stories may be a thing of the past
- how marine painting has reflected our national experience

To become familiar with some of the best examples of sea literature and art

To develop an appreciation for poems and stories about the sea

To be able to compare “monsters of the deep” as perceived in history, literature, and motion pictures with the creatures known to modern marine biology

To be able to assess the threat that sea creatures pose to humans and the threat that humans pose to sea creatures

OVERVIEW

This unit explores some of the ways in which the literary and visual arts have reflected man's complex involvement with the sea. In song and story, myths, prayers, poems, and novels, science fiction and scientific reporting, primitive art, sophisticated painting and folk handicrafts, people have expressed a wide range of responses to the mysteries and realities of the ocean world.

George P. Elliott's newspaper article focuses on the great writers who have put the sea to literary use. Elliott argues that the sea's importance in literature stems from its strength as a natural symbol. Since the sea can be known intimately and yet remain foreign and potentially dangerous, the resulting tension can stimulate profound literary

creativity. For poets the sea has been a powerful, divine, or dominant presence, the scene of a spiritual adventure, and the inspiration to deep and lyrical thoughts and feelings. But Elliott singles out Homer, Melville, and Conrad as the greatest sea writers because the sea for them was “at once inexhaustibly marvelous and intensely real.”

The first group of *Reader* selections illustrates the range of literary response to the sea. The ballad “Sir Patrick Spens,” which continues the ancient oral tradition, expressed the experienced sailor's respect for the perils of the winter sea and the folly of the lords of the land who would underestimate its power. Psalm 107, the selection from the Bible's many references to the sea, poetically

assures believers that the sea and its storms are the work of one God, who will control them for seafarers who "cry unto the Lord in their trouble." In Shakespeare's *The Tempest*, written when the New World was attracting adventurers in increasing numbers, "Ariel's Song" describes the watery grave every ocean traveler feared.

Poems by Arnold, Masefield, Auden, and Booth each express different responses to sea sights, sounds, and memories. The melancholy tone of Arnold's "Dover Beach" contrasts to the joyful anticipation of Masefield's "Sea Fever," while Auden paints a more neutral word picture in "On This Island." Booth describes the record of past seaborne disasters that a severe ebb tide reveals, and Masefield, too, turns to the more sober side of sea life in "Dauber," in which the hero discovers himself in meeting the challenge of stormy seas.

The theme of ocean as adversary is developed in more detail in the prose selection by Stephen Crane. The struggle for survival creates a strong bond among the four shipwrecked men in "The Open Boat." They learn to know the sea in such a terrifyingly intense way that they become able to interpret the "sound of the great sea's voice."

The excerpts from Herman Melville's classic *Moby-Dick* serve as a transition between the first two groups of *Reader* selections. On the one hand, Captain Ahab's moving description of his lonely life at sea, and the physical and social self-deprivations it required, illustrates another facet of the human involvement with the oceans that earlier selections showed. But the suggestion in the opening passages of the menacing presence of great creatures in the "masculine" sea and the account of Ahab's confrontation with Moby Dick lead us into the next group of readings concerning "monsters of the deep." Whatever symbolic meaning Melville intended this tale to convey, it also reveals the realities of human encounters with sea creatures. It is not only a vivid example of the dangers involved when men seek to capture beasts of the sea for

their own purposes. It also illustrates how constant contact with them can dispel the mysteries that at first seem to surround such sea monsters.

Eugenie Clark's newspaper article takes a clear-eyed look at the creatures that were once considered "horrors of the deep" and suggests that man himself may be the real monster in the picture. She argues that we must now try to save the creatures we once feared and whose survival we now endanger. The *Reader* selections by Jules Verne and Frank Lane contrast the science fiction treatment of one "sea monster," the giant squid, to the scientific evidence of it. In "Sharkproof!" Clark shows how science may enable man to protect himself from the one sea animal that her newspaper article acknowledges is a real menace to him. David Baldrige analyzes the factors that enter into shark attacks on human beings.

The third group of *Reader* selections for this unit complements John Wilmerding's newspaper article on American artistic response to the sea. Wilmerding examines how changes in the subject matter and style of American marine painting and drawing reflect both the changing role of the sea in Americans' lives and the historical patterns of our national life itself. Roger Stein's article in the *Reader* considers the seascape as a mode of expressing our visual awareness of the sea, the coast, and the voyage. He also notes the tension involved in the artist's attempt to impose order on the "endless and intrinsically terrifying openness of the undifferentiated space of the sea." The selection on sailors' folkarts describes the ways in which ordinary men, for whom the sea was a way of life, expressed their responses to it in art. The works of art reproduced in this unit and elsewhere in the *Reader* further illustrate the range of human perceptions of the ocean world over a time span of almost 4,000 years.

KEY CONCEPTS

IMAGES OF THE SEA

The literature and art of the sea contain a wide variety of images that reflect individual artists' thoughts and feelings about the sea as well as experience of its factual reality. The sea and its creatures offer a world of beauty, riches, excitement, and delight as well as danger, death, and sorrow. The particular images through which men express their response to the sea depend on the psychological as well as the physical perspective from which they view it. The literature and art in this unit contain both bright and somber images, although the somber predominates perhaps because the question of life and death fascinates the creative imagination.

SEA SYMBOLISM

As one of the powerful natural forces of the universe, the sea symbolizes for man essential aspects of life itself. Because the sea is at the same time familiar and mysterious, friendly and dangerous, challenging and unconquerable, calm and turbulent, writers and artists have seen the sea as a symbol of the elemental conflicts between order and chaos, truth and error, good and evil, life and death. Man's struggle to survive in the alien ocean element represents the larger contest for survival of the human species. Individual contests with the sea as adversary demonstrate man's capacity to challenge nature and endure, while such contests illuminate human nature as well, revealing the depths and heights the human spirit can reach. Writers and artists thus express not only man's immediate experience of the sea but the larger truths it symbolizes for us.

THE SEA AS AN ALIEN ENVIRONMENT

Man is "out of his element" in the water. But

the sea is an alien environment for man not just because he will drown in it if he cannot keep afloat, or use artificial breathing apparatus, but because it is an unstable element in comparison to the land. Because of its fluid nature, it is constantly reshaped by wind and weather, making it an unpredictable and fickle environment. Storms can transform a placid sea into monstrous waves that can swamp and destroy ships. Man, of course, long ago harnessed ocean wind to propel ships, but too little wind becalms and too much threatens to destroy rigging and sails, if not the ship itself. The instability of the sea also endangers property and life on the shore. This dynamic aspect of the sea rouses elemental fears in man that are reflected in art and literature. Although man has used technology to make the ocean environment his own, it remains alien and dangerous to him.

THE SEA AS FRIEND AND FOE

A central element in writers' and artists' response to the sea is the tension between the rewards the sea offers and the price it can exact for them. The sea, then, is two-faced, wearing the image of a bounteous friend and of an implacable foe. Men who use the sea as a highway or a pleasure ground or who seek to capture its resources are constantly aware of the risks they are taking in doing so. The sea itself often, then, becomes an adversary, a hostile enemy against whom the seafarer may have to fight for his life. In literature, accounts like that in "Dauber" and "The Open Boat" show not only the strength of the sea as an antagonist but the relief or exhilaration that man can feel in surviving such a contest. "Sir Patrick Spens" is one example of how the contest is often lost.

"SEA MONSTERS": FACT AND FICTION

A "monster" generally means something out of the ordinary, abnormal in form or in size, and, often, dangerous to man. Many "monsters" lose their menace as man becomes more familiar with them or as technology increases his control over them. The "kraken" that frightened medieval seamen and later came to be considered mythical may well have menaced their ships. As Lane shows, nineteenth-century encounters with giant squid proved their existence and their power when provoked. For dramatic purposes, fiction writers like Jules Verne have exaggerated the facts about these real creatures much as medieval storytellers must have dramatized accounts of kraken.

Eugenie Clark's newspaper article considers other "monsters of the deep" as well as giant squid: the Loch Ness Monster, latimeria, octopus, the giant clam, the giant leptocephalus, giant rays, whales, and sharks. She concludes that only sharks really threaten man today. As science reveals the real facts about some of these "monsters" it becomes clear that man, with his complex technology, is much more of a threat to them than they to him.

SEA ART FORMS

Artists have expressed visions of the sea and of its creatures in every possible art form from ancient stone carvings and sculptures to modern photography. But this unit focuses particularly on marine painting and sailors' folkarts.

Representations of sea scenes, whether of the sea itself, the shore, or the voyage, are called *seascapes*. Abstract art expresses the essential elements of the scene rather than its visual detail. Seascapes reflect the perspectives and points of view of the individual artist who gives order and meaning to the formless and changing sea. They also reflect the shared cultural experiences of a people.

As Timmermann and Winslow show in their *Reader* article, sailors' folkarts, particularly those of whaling men on long voyages, included a wide variety of useful as well as decorative items like chests, boxes, household utensils, and adornments, many made from whalebone. Carved and decorated whalebone pieces called *scrimshaw* perhaps reveal the most detail of sailors' lives and their experiences of the sea. Ship models, too, demonstrate patience and dexterity as well as the artistic impulse.

FACTUAL REVIEW QUESTIONS

1. Why does Elliott say the sea is the strongest of natural symbols?
2. Whom does Elliott consider the greatest sea writers, and what special element characterizes their writing?
3. Why has fictional writing about the sea declined?
4. In which *Reader* selections is man pitted against the elemental force of the sea?
5. According to Psalm 107, who controls the sea?
6. In which *Reader* selections is the sound of the sea an important element?

7. What is the mood of Masfield's "Sea Fever"?
8. Where did Dauber's testing take place? What was his real profession?
9. Who were the four characters in "The Open Boat"? Did their experience divide or unite them?
10. In Booth's poem, what phenomenon revealed a "dried reservoir of disaster"?
11. What creatures represented the "murderous thinkings of the masculine sea" in Melville's *Moby-Dick*?
12. How does Captain Ahab describe his life at sea?
13. How does Ahab explain his obsession with Moby Dick?
14. What sea creatures were once considered "monsters of the deep"?
15. What sea creature is most dangerous to man today, and why?
16. What reports of giant squid did Verne's story reflect?
17. Where were giant squid actually encountered in the nineteenth century?
18. What evidence proves that one sea creature is definitely the enemy of the giant squid?
19. What fish promises to become a source of shark repellent for man?
20. What factors were correlated with shark attacks in Baldrige's statistical study?
21. What explanations are suggested for the low percentage of shark attacks on women?
22. When and why did American painters first turn to the full-scale seascape?
23. How and why did American marine painting after 1850 differ from earlier work? After 1900?
24. In which art works reproduced in the *Reader* is danger an element?
25. What paradox in the notion of seascape does Stein note?
26. What is scrimshaw, and what were the subjects of scrimshaw decoration?
27. What other handicrafts did seamen pursue?
28. What are some of the cultures other than American in which the sea was artistically represented?

ESSAY AND DISCUSSION QUESTIONS

1. Why does Elliott consider Melville one of the three greatest sea writers? In your opinion, does the Reader selection from *Moby-Dick* confirm his view?

SUGGESTED GUIDELINES

1. Review Elliott's criteria for great sea writing and his comments on Melville and restate them in your own words.
2. Analyze the *Reader* selection.
 - a. How is Melville's personal experience of the sea reflected in his writing?
 - b. How is his work different from that of the other writers represented in the *Reader* who also knew the sea well (Masefield, Booth, Crane)?
 - c. What evidence is there of a "passionate imagination bold, pure, and majestic"?
 - d. Consider the images Melville constructs, the symbolism he suggests, the intensity of his characterizations, his vivid descriptions of emotions as well as events, etc.

2. How do the sounds of the sea figure in the selections in the Reader?

SUGGESTED GUIDELINES

1. Consider Arnold's "Dover Beach," Masefield's "Sea Fever," and Auden's "On This Island." What emotions and images do sea sounds evoke for these poets?
2. How do these poets interpret, as Crane phrased it in "The Open Boat," "the great sea's voice"? What is Crane's interpretation?
3. Do these interpretations seem universal? Do your own memories of sea sounds—from actual experience, movies, or television—conjure up similar images for you?

3. Which "sea monsters" are dangerous to humans today? Which do humans endanger? Should we, as Clark argues, "save the sea monsters"?

SUGGESTED GUIDELINES

1. Review Clark's newspaper article and the *Reader* selections on giant squid and sharks. Do you agree with Clark's assessment that only sharks remain a danger to man?
2. According to Baldrige's study, how do most shark attacks occur?

3. How can technology reduce the danger?
 4. Under what conditions have giant squid and whales attacked man in the past?
 5. Why have some "sea monsters" become endangered species?
 6. If "sea monsters" are a food source for man, why should we "save" them?
4. Trace the changes in American life that our artists have reflected in their work. If this art reveals national events and moods as well as involvement with the ocean world, how would you expect American artists to deal with the sea today?

SUGGESTED GUIDELINES

1. Consult Wilmerding's newspaper article for the historical trends he believes American sea art has illustrated.
2. Survey the art reproduced in the *Reader* for evidence of these trends.
3. Review the topics for this course for suggestions as to current American involvement with the sea that might become the subject of art works.
4. Consider how the present national mood, as you view it, might shape an artist's approach.

SUGGESTED READING, *Writers at Sea*, George P. Elliott

Note: Most of these classic works have been reprinted in many editions. The editions listed here are, for the most part, still in print and readily available. Date of first publication is given in parentheses.

SHORT POEMS

Tennyson, Alfred (Lord). "Break, Break, Break" (1842). In *Poems of Tennyson*, edited by Christopher Ricks. New York: Norton, 1972.

Masefield, John. *Salt Water Ballads* (1902). Reprinted in John Masefield. *Poems*. New York: Macmillan, 1940.

Frost, Robert. "Neither Out Far Nor In Deep" (1934). Reprinted in *Poetry of Robert Frost*, edited by Edward C. Lathem. New York: Holt, Rinehart & Winston, 1969.

Smith, Stevie. "Not Waving But Drowning" (1962). In Stevie Smith. *Selected Poems*. New York: New Directions, 1964.

Meredith, William. "The Open Sea." In *The Open Sea*. New York: Knopf, 1957.

Booth, Philip. "The Ship," "The Line," "The Stranding," "Refusing the Sea," "Voyages," "Offshore," "Seaweed," "The Man on the Wharf," and "Sea-Change." In *Margins: A Sequence of New and Selected Poems*. New York: Viking Press, 1970.

NARRATIVE POEMS

Coleridge, Samuel Taylor. *The Rime of the Ancient Mariner* (1798). New York: Dover, 1970.

Byron, George C. (Lord). *Don Juan; Canto II, Stanzas 11-112* (1821). Edited by L. Marchand, Boston: Houghton Mifflin, 1958.

Masefield, John. "Dauber" (1913). Reprinted in John Masefield. *Poems*. New York: Macmillan, 1940.

DRAMA

Syngé, John M. *Riders to the Sea* (1904). Reprinted in *The Complete Plays of John M. Syngé*. New York: Random House, 1960.

O'Neill, Eugene. *The Long Voyage Home* (1917), *The Moon of the Caribbees* (1919), *Bound East for Cardiff* (1916), *In the Zone* (1919), *The Rope* (1919), *Ile* (1918), *Where the Cross is Made* (1919). All reprinted in Eugene O'Neill. *Plays*. New York: Random House, 1967.

SHORT STORIES AND NOVELLAS

Melville, Herman. "Benito Cereno" (1855) and "Billy Budd" (completed 1891, published 1924). Reprinted in Herman Melville. *Piazza Tales*. New York: Doubleday, 1961.

Conrad, Joseph. "The Secret Sharer" (1912) and "Youth" (1902). Reprinted in Joseph Conrad. *Great Short Works*. Gloucester, Mass.: Peter Smith.

Hemingway, Ernest. *The Old Man and the Sea*. New York: Scribner, 1952.

Clark, Walter Van Tilburg. "Why Don't You Look Where You're Going." In *The Watchful Gods and Other Stories*. New York: Random House, 1950.

NOVELS

Melville, Herman. *Moby-Dick* (1851). New York: E. P. Dutton, 1950.

Conrad, Joseph. *Lord Jim* (1900), *The Nigger of the Narcissus* (1897), *Typhoon* (1903). All reprinted in *Great Short Works*. Gloucester, Mass.: Peter Smith.

———. *An Outcast of the Islands* (1896). Cleveland, Ohio: Collins World.

Hughes, Richard. *High Wind in Jamaica*, also entitled *The Innocent Voyage* (1929). New York: Harper & Row, 1972.

———. *In Hazard* (1938). Gloucester, Mass.: Peter Smith.

Nordhoff, Charles Bernard and James Norman Hall, *Men Against the Sea* (second of *The Bounty Trilogy*, 1934). Boston: Little Brown, 1946.

NOTES ON THE READING LIST*

Of the innumerable accounts of voyages, battles, and explorations, by far the most important is the many-volumed compilation made in 1598-1600, the heyday of British exploration, by Richard Hakluyt, *Principal Navigations, Voyages, and Discoveries*. Of all these, the most famous and perhaps the most elegantly written is Sir Walter Raleigh's "The Last Fight of the *Revenge* at Sea"; it may be found in almost any condensation of Hakluyt's *Voyages* or in a volume of Raleigh's selected writings. Raleigh was himself one of the great explorers and also a master of English prose at the time when it was most sumptuous, and the battle he describes, which took place in the vicinity of the Azores in 1591, was an episode in the shift of sea power from Spain to England. The account,

* Only literature in the English language, which contains a richer and more varied body of writing than any other, is considered here.

no longer than a short story, is eminently worth reading both for its own sake and as a high point in the prose epic of the founding of the British Empire.

Of other descriptions of actual voyages, the best known American example is Richard Henry Dana's *Two Years Before the Mast* (1840), a Harvard undergraduate's account of his experience as a seaman on a brig going from Boston to California by way of Cape Horn.

But literarily what matters most about experience of the sea is how it is transformed into material for the imagination to work with. Expository prose, whether repertorial or scientific, explains what the sea is, what is there, what happened; whereas poetry and fiction allow us to feel how someone is connected with the sea and to know what it comes to mean to him.

Eugene O'Neill used his seaman's experience in seven short plays; for many years they were staged as a sort of dramatic cycle under the title *S. S. Glencairn*; translated into another medium, they became an effective movie, *The Long Voyage Home*.

Any selection of short poems about the sea in the English language is bound to be arbitrary, for there are so many of them. From "The Seafarer" in Anglo-Saxon, the language out of which English evolved, to Philip Booth's 1976 collection of poems, *Available Light*, poets writing in the English language have used the sea in myriad ways, as they surely will continue to do forever. Swinburne's poetry is unimaginable without the sea winding through it.

The sea gives her shells to the shingle,
The earth gives her streams to the sea;
They are many, but my gift is single,
My verses, the first fruits of me.

There is a certain poignancy in the fact that the poet laureate of Britain at the time of the dissolution of her sea-built empire was John Masefield (laureate from 1930 to 1967), for he might justly have been called the poet laureate

of the sea as well. No English-speaking poet knew the sea better than he from personal experience or wrote about it more affectionately and intimately. His *Salt Water Ballads* celebrate this knowledge and are easily accessible.

As with poetry, the amount of sea fiction is so great that selection is bound to be to some extent arbitrary. Edgar Allen Poe's "A Manuscript Found in a Bottle" makes a good read, and so do some of Jack London's sea tales, most notably *The Sea Wolf*. Kipling wrote a few sea stories, and several of Somerset Maugham's colonial stories involve the sea. Two quite readable collections (both with inflated titles) have been made by William McFee: *World's Great Tales of the Sea* and *Great Sea Stories of Modern Times*.

Nordhoff and Hall's *The Bounty Trilogy*, especially the second novel, *Men Against the Sea*, was popular, and so, more recently, have been C. S. Forester's Captain Hornblower series. But since Conrad there have been only three sea stories of much literary consequence: Richard Hughes' *High Wind in Jamaica* (also entitled *The Innocent Voyage*) and *In Hazard*, both of them outrageously good tales, and Hemingway's *The Old Man and the Sea*, his last substantial short fiction.

Herman Melville's literary career and reputation underwent spectacular ups-and-downs. His first books were popular successes: *Typee* (1846), *Omoo, A Narrative of Adventures in the South Seas* (1847), and *White Jacket, or the World in a Man-of-War* (1850). But then he fell into such obscurity that his last and one of his best stories, *Billy Budd*, finished in the last year of his life, was left among his papers and not published for over thirty years. *Moby-Dick*, a small portion of which was reprinted in the *Reader*, was his pivotal book (1851). Little read and understood in Melville's time, it survived for decades more as a boy's adventure story than as an epic romance; but for the past generation or two it has been elevated to the highest rank of Ameri-

can literature. With its resurrection there have also risen to serious status two of his meta-physical yarns, both of which have also been made into powerful plays in recent years: *Billy Budd* (dramatized by Louis Coxe and Robert Chapman) and *Benito Cereno* (dramatized by Robert Lowell as the third of the trilogy *The Old Glory*). But *Moby-Dick*, of course, is the classic; of it, there would seem to be nothing left to say but "read it."

Joseph Conrad left his native Poland at seventeen and spent the first twenty years of his manhood at sea, most of them in the British merchant marine. He wrote, then, from a wealth of experience of sea and sailors equaled by no other writer of stature, and his prose style was worthy of his knowledge and of the tales he had to tell, despite the fact that he did not acquire the English language until he was past twenty. *Lord Jim*, *The Nigger of the Narcissus*, *Typhoon*, *Youth*, *An Outcast of the Islands*, *The Secret Sharer*—the roster of his sea tales is long and various, some of them masterpieces, all of them true to the life portrayed. That is, the principal characters of these stories are not ship passengers for whom the actions and relationships might almost as well have occurred in a hotel; nor are they two-dimensional stick figures; nor are they

bloodless symbols. Early in *Youth* he defines the world of his sea fiction better than anyone else could define it; let this sentence be a fit summation both of what he intended and of what sea stories at their best are based on: "Between the five of us there was the strong bond of the sea, and also the fellowship of the craft, which no amount of enthusiasm for yachting, cruising, and so on can give, since one is only the amusement of life and the other is life itself." Unfortunately, none of his stories are short enough to be included in the *Reader*, and they do not excerpt well; go read them for yourself entire, beginning with *Youth* and *The Secret Sharer*, those small marvels.

And what do unromantic writers think of all this? Doctor Johnson, the noted lexicographer, author and critic, was as unromantic an Englishman as ever was; listen to what Boswell reports him as having said in 1759, when "Romanticism" hardly existed and certainly was not yet a movement: "No man will be a sailor who has contrivance enough to get himself into a jail; for being in a ship is being in a jail, with the chance of being drowned. A man in a jail has more room, better food, and commonly better company." Caveat lector.*

*Let the reader beware!

SUGGESTED READING, *Horrors of the Deep*, Eugenie Clark

Benchley, Peter. *Jaws*. New York: Doubleday, 1974. The best-selling novel—and the basis of the motion picture sensation—about a great white shark that terrorizes a Long Island resort community.

Budker, Paul. *The Life of Sharks*. New York: Columbia University Press, 1971. English version by Peter J. Whitehead. First written in 1946, this book by a French marine biologist has been updated to include the results of re-

cent research. The broad-ranging discussion covers the anatomy of sharks, their utilization, and myths and legends concerning them.

Cousteau, Jacques-Yves. *The Undersea Discoveries of Jacques-Yves Cousteau*. New York: Doubleday. A multivolume series with beautiful, full-color plates. Of particular interest are the volumes, *The Shark: Splendid Savage of the Sea* and *Octopus and Squid: The Soft Intelligence*.

Clark, Eugenie. *The Lady and the Sharks*. New York: Harper & Row, 1969. An account of the author's twelve years as director of the Cape Haze (Florida) Marine Laboratory, which she started in 1955. The laboratory, which was established to study local marine life, became a leading center for research on sharks.

———. *Lady with a Spear*. New York: Harper & Brothers, 1953. The author relates her experiences as an ichthyologist and diver in waters ranging from the West Indies to Micronesia to the Red Sea.

Gilbert, Perry W. (ed.). *Sharks and Survival*. Boston: D.C. Heath, 1963. With the cooperation of members of the Shark Research Panel of the American Institute of Biological Sciences. Analyzes facts and factors in shark attacks and assesses the danger they pose to man.

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more: Johns Hopkins Press, 1967. A symposium sponsored by the American Institute of Biological Sciences, the Lerner Marine Laboratory of the American Museum of Natural History, and the Office of Naval Research.

Lane, Frank W. *Kingdom of the Octopus: The Life History of the Cephalopoda*. New York: Sheridan House, 1960. A well-researched book about the octopus, squid, and cuttlefish, written for a general audience.

Sweeney, James B. *A Pictorial History of Sea Monsters and Other Dangerous Marine Life*. New York: Crown Publishers, 1972. A profusely illustrated volume covering monsters of the past in fact and fiction as well as dangerous forms of sea-life that are alive today.

RECORD

Songs of the Humpback Whale. Recorded by Roger S. Payne. CRM Records, 1970.

SUGGESTED READING, *American Imagery and Visions of the Sea*, John Wilmerding

GENERAL REFERENCES ON MARINE PAINTING

Cordingly, David. *Marine Painting in England, 1700-1900*. London: Studio Vista, 1974. The book is divided into four major sections—the Dutch origins of British marine painting, the formation of an English style in the eighteenth century, the Romantic movement, and the Victorian period—each presenting a general discussion of the period as well as a discussion of the individual artists.

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Stein, Roger B. *Seascape and the American Imagination*. New York: Clarkson N. Potter in association with the Whitney Museum, 1975. American seascapes, from the colonial period to the early twentieth century, are viewed as an expression of the culture and national experience of the American people.

Wilmerding, John. *A History of American Marine Painting*. Boston: Peabody Museum of Salem and Little, Brown, 1968. A study of this genre from the earliest colonial portraits, with ships in the background, to the present.

EXHIBITION CATALOGS

American Paintings of Ports and Harbors. Jacksonville, Florida: Cumner Gallery of Art, 1969.

Baur, John I. H. *The Coast and the Sea: A Survey of American Marine Painting.* Brooklyn: Brooklyn Museum, 1948.

Brown, Jeffrey R. *Alfred Thompson Bricher, 1837-1900.* Indianapolis: Indianapolis Museum of Art, 1973.

Ferber, Linda S. *William Trost Richards: American Landscape and Marine Painter, 1833-1905.* Brooklyn: Brooklyn Museum, 1973.

Jacobowitz, Arlene. *James Hamilton, 1819-1878: American Marine Painter.* Brooklyn: Brooklyn Museum, 1966.

O'Gorman, James F. *Portrait of a Place: Some American Landscape Painters in Gloucester.* Gloucester, Mass.: 350th Anniversary Celebration, Inc., 1973.

Rivers and Seas: Changing Attitudes Toward Landscape, 1700-1962. Cambridge, Mass.: Busch-Reisinger Museum, 1962.

von Groschwitz, Gustave. *The Seashore: Paintings of the 19th and 20th Centuries.* Pittsburgh: Museum of Art, Carnegie Institute, 1965.

Wilmerding, John. *American Marine Painting.* Richmond: Virginia Museum of Fine Arts, 1976. See especially the introduction, "Sea and Shore in American Art."

———. *William Bradford, Artist of the Arctic.* New Bedford, Mass.: Whaling Museum of New Bedford, 1970.

STUDIES OF INDIVIDUAL ARTISTS

Beam, Philip C. *Winslow Homer at Prout's Neck.* Boston: Little, Brown, 1966.

Howat, John K. *John Frederick Kensett, 1816-1872.* New York: American Federation of Arts, 1968.

Gardner, Albert T. E. *Winslow Homer, American Artist: His World and His Work.* New York: Clarkson N. Potter, 1961.

Goodrich, Lloyd. *Albert Ryder.* New York: Braziller, 1959.

Huntington, David C. *The Landscapes of Frederic Edwin Church: Vision of an American Era.* New York: Braziller, 1966.

Richardson, E. P. *Washington Allston: A Study of the Romantic Artist in America.* New York: Apollo, 1967.

Wilmerding, John. *Fitz Hugh Lane.* New York: Praeger, 1971.

———. *Robert Salmon, Painter of Ship and Shore.* Boston: Boston Public Library and Peabody Museum of Salem, 1971.

———. *Winslow Homer.* New York: Praeger, 1972.

UNIT THREE

SCIENCE AND MYTH



Courtesy of J. Welles Henderson

NEWSPAPER ARTICLES

5. *Exploration of the Sea*

Edward Bullard

6. *A New World Picture*

Edward Bullard

7. *Science and Ancient Sea Stories*

Willard Bascom

READER SELECTIONS

The Voyage of the H.M.S. Challenger

The Challenger Her Challenge

Anatomy of an Expedition

H. William Menard

Seven Miles Down

Jacques Piccard and Robert S. Dietz

The Floor of the Sea

William Wertenbaker

Minerals and Plate Tectonics

Allen L. Hammond

The Search for Atlantis

J. V. Luce

Deep Water, Ancient Ships

Willard Bascom

Geology and the Flood

Paul C. Tychsen

LEARNING OBJECTIVES

To understand

- how scientists have studied the ocean, including the motivation and planning of oceanographic expeditions
- how science has changed our views of the oceans and of the world
- the excitement of scientific exploration and discovery
- the "scientific revolution" involved in the theory of plate tectonics
- the practical implications of the plate tectonic theory

- how marine archaeology can contribute to our knowledge of ancient civilizations
- how science can be used to test myths, confirming or exploding them

To become familiar with some of the more famous myths about the sea and the scientific explanations—or lack of them—for these myths

OVERVIEW

The newspaper articles for this unit deal with three aspects of scientific knowledge of the sea: the development of modern oceanography; the new conception of global geology that resulted from recent undersea research; and the historical and scientific evidence concerning ancient sea myths.

In his first newspaper article, Sir Edward Bullard traces the history of the new science of oceanography that began with the voyage of the British research vessel *Challenger* in the 1870s. In contrast to earlier ocean exploration, which was focused on discovering new lands, the *Challenger* Expedition sought to explore beneath the surface to learn the physical and biological secrets of the sea itself. But as Bullard points out, despite the useful data the voyage produced, little further deep-sea research took place during the next seventy years. Until World War II, ocean studies centered primarily on investigations into the marine biology of the shallower waters. War needs sparked the broadening of ocean science to cover all aspects of marine phenomena, and physicists, geologists, and chemists displaced biologists as the primary investigators. With a new infusion of intellectual energy and material resources, the technological innovations in undersea instrumentation, collecting devices, and diving apparatus transformed oceanography into one of the major areas of modern scientific inquiry.

Two *Reader* selections reveal the similarities and differences in the objectives, planning,

funding, and justification of the *Challenger* voyage and of the *Noba* Expedition almost a century later. The description in the *Reader* of the descent of the bathyscaph *Trieste* to the deepest known spot on the ocean floor, like Cousteau's description of "Menfish" in Unit One, illustrates the kind of intense personal excitement and satisfaction modern undersea exploration can involve.

In his second newspaper article, Bullard outlines the significant discoveries in undersea geology that led to a revolutionary revision in scientific thinking about how the earth is formed. These new views, in turn, opened up new vistas of obtaining mineral and petroleum riches from the sea:

William Wertenbaker details in the *Reader* the research developments that resulted in the new concepts of sea-floor spreading and plate tectonics; Allen Hammond explores the practical implications of the new theories in our "resource hungry" world.

The third subject of this unit is introduced by Willard Bascom's newspaper article titled "Science and Ancient Sea Stories." He describes how many of the tales about the sea from the ancient world that once seemed unbelievable now prove to have a scientific explanation. Archaeological and historical research give the accounts of Hercules and Jason and of the "lost continent" of Atlantis a new credibility and provide evidence of transoceanic travel by ancient peoples long before Columbus reached the New World. The *Reader*

selection by J. V. Luce about the Atlantis legend shows how modern science can transform an ancient "myth" into plausible fact. Paul Tychsen finds, however, that science can neither prove nor disprove another ancient account—the biblical story of Noah and the Flood. Geology shows that large areas of the earth were submerged in much earlier time periods and that a sudden and dramatic rise in the sea level occurred around 6,000 B.C., with consequent flooding of previously dry land areas including the world of the Bible. But neither of these findings fits Bishop Ussher's dating of the Flood or the details of the Noah story. The question of whether that story is myth or fact must, then, Tychsen suggests,

be left to theologians.

In the Reader selection from *Deep Water, Ancient Ships*, Bascom describes how another even newer science, marine archaeology, has revealed an important source of information about the ancient world: the artifacts that have been preserved for centuries in the waters covering sunken ships. Recently, modern technological devices—scuba, sonar, and submarines—have helped scientists to find and explore the deeper underwater archaeological sites that sponge divers have discovered. Like the other undersea sciences, marine archaeology promises even greater rewards in the future to explorers of the ocean frontier.

KEY CONCEPTS

OCEANOGRAPHY

Modern oceanography is the science that studies oceanic life and phenomena. It now includes a wide variety of subdisciplines, as geologists, chemists, physicists, biologists, and a host of other specialists investigate every possible aspect of the ocean world.

In the United States, oceanographic research is conducted and/or sponsored by the navy and other government agencies, private corporations, universities, and independent research institutions. Among the most prestigious centers are the Woods Hole Oceanographic Institution in Massachusetts, the Scripps Institution of Oceanography in California, and the Lamont-Doherty Geological Observatory in New York. These three centers have also regularly organized *oceanographic expeditions*, sending vessels to sea on research voyages in the tradition of the original *Challenger* enterprise. As Menard's account of the *Nová* project indicates, scientists from other oceanographic institutions often participate in such expeditions. As in other sciences, discoveries are rapidly shared within

the oceanographic community, facilitating the development of more accurate explanations of ocean phenomena.

PLATE TECTONICS AND CONTINENTAL DRIFT

In geology the term *tectonics* refers to the structure of the earth's crust. **Plate tectonics** is the comprehensive new theory that explains global geological processes in terms of the movement of the seven huge and the few smaller rigid *plates* that make up the earth's crust. An integral element of the theory is the concept of **sea-floor spreading**, a process through which new sea floor is continually being created as lava rises up through volcanic fissures along the **Mid-Ocean Ridge**, a world-girdling undersea mountain range. As the Mid-Ocean Ridge creates new crust, thrusting the plates out, old oceanic crust is pushed or drawn under (subducted) where the plates converge. The lateral motion of plates involves not only the ocean floor but the conti-

nents as well. The idea that the continents are moving is known as **continental drift**. Evidence of continental drift has led many earth scientists to believe that the continents were once joined in a single super continent, "Pangaea," which began to break up more than 200 million years ago.

Plate tectonics explains many previously puzzling geological phenomena and constitutes, as Bullard observes, a new world view of geological change. Though it oceanographers have made a major contribution to expanding the broader frontiers of science.

UNIFORMITARIANISM

The doctrine of uniformity of geologic processes and results in all ages of the earth's history was first suggested by James Hutton in the late eighteenth century, developed and brought to general acceptance by Charles Lyell in the 1830s, and later given the name uniformitarianism by Thomas Huxley. This doctrine is generally considered to mark the beginning of modern geological science. As the subtitle to Lyell's *Principles of Geology* put it, the new approach involved "an attempt to explain the former changes of the earth's surface, by reference to causes now in operation." This position developed in opposition to the theory that all major geological features were the result of sudden catastrophic events, such as the biblical Flood. With the acceptance of uniformitarian doctrine, the study of the earth escaped the bounds religious dogma had imposed upon it, and geology emerged as a true science. As William Wertebaker observes, the doctrine remains a basic tenet of modern geology.

SEA MYTHS

This unit explores the explanations modern science has found for some of the ancient accounts of sea-related events that had come to be

considered "myths." In one sense, the word *myth* means a traditional story involving gods and heroes that often explains some natural phenomenon, but it also means an imaginary or fictitious person, thing, event, or story.

The stories about Hercules and Jason from classical Greek mythology feature both gods and heroes, but we are coming to see that they do in fact often describe real rather than fictitious phenomena. Willard Bascom's "translation" of some of the terms describing incidents in those stories suggests that our distance in time from the stories themselves or the events described is largely responsible for our considering them "imaginary." Similarly, if the modern suggestion that Minoan Crete was Atlantis is true, as scientific and historical evidence now indicates, we see that the legend of Atlantis became a myth because the factual basis for it was lost through distortion over time.

Science has also shown that the floods that figure in many ancient myths probably reflect actual experience of severe and sudden inundations of land areas. Although science can substantiate some of the phenomena described in ancient stories, it cannot, as Tychsen points out, settle questions that properly belong to the realm of theology.

FACTUAL REVIEW QUESTIONS

1. Why is the *Challenger* Expedition usually considered the beginning of modern oceanography?
2. What research focus dominated oceanography before World War II?
3. How did World War II affect oceanography?
4. According to Bullard, what technological developments transformed undersea exploration?
5. What roles did individual scientists, the Royal Society, and the Admiralty play in planning and executing the *Challenger* Expedition?
6. What was the objective of the 1967 *Nova* Expedition?
7. What different kinds of problems had to be solved during the planning phase of the *Nova* Expedition?
8. What spot on the ocean floor did the bathyscaphe *Trieste* reach in the dive described by Piccard and Dietz?
9. What sign of life did they observe there, and why was it significant?
10. Through what mechanisms is the *Trieste* enabled to descend and rise?
11. How do undersea rocks and mountains differ from those on land?
12. How does plate tectonics theory explain the character and evolution of the earth's crust?
13. What is meant by "uniformitarianism" and who formulated the theory?
14. Why was Maurice Ewing a key figure in ocean geology?
15. What objections were raised about the adequacy of the theory that the globe was shrinking as it cooled?
16. How did earthquake measurements contribute to plate tectonics theory?
17. Who first proposed the theory of continental drift, and what did it claim?
18. Why was the proof of the theory of ocean-floor spreading important to the acceptance of the plate tectonics hypothesis?

19. How did studies of magnetization help scientists to trace the history of the movement of the ocean floors?
20. What hypothesis did Vine and Matthews propose in 1963?
21. What was the "Eltanin-19 profile," and why was it significant?
22. What role does sea water play in the creation of economically valuable ore deposits?
23. What new models of ore formation did the theory of plate tectonics suggest? What four types of mineral deposits are involved?
24. How is plate tectonics theory being applied to exploration for minerals in the continental mountain ranges?
25. What are Bascom's explanations for the following: hundred-handed giant, the golden fleece, winged women, wandering rocks, the hydra?
26. What evidence is there of transoceanic travel in ancient times?
27. What were the sources of Plato's account of Atlantis?
28. On what grounds did K. T. Frost base his suggestion that "Atlantis" was Minoan Crete?
29. If Atlantis actually was Crete, how does Luce account for Plato's locating it in the Atlantic?
30. How does the island of Thera figure in the modern explanation of the Atlantis legend?
31. What role have sponge divers played in marine archaeology?
32. How have scuba, sonar, and submarines figured in marine archaeology?
33. In the wreck excavations Bascom describes, what kinds of artifacts were found and how old were they?

ESSAY AND DISCUSSION QUESTIONS

1. Compare and contrast the Challenger and Nova Expeditions. Is taxpayer support for such research justified?

SUGGESTED GUIDELINES

1. Consider objectives, scope, planning, and the arguments used to enlist government participation and support for the projects.
 - a. How do the activities of other nations figure in both projects?
 - b. What roles did private citizens, universities, and scientific organizations play?
 - c. How were government agencies involved?
 - d. How did the projects differ in objectives, techniques, ocean areas covered, and length of time at sea?
 - e. How were problems in organization, planning, and fund raising similar?
2. In your view, is this kind of research worthy of taxpayer support?
 - a. Note the results of the *Challenger* voyage and Wertenbaker's references to the role *Nova's* leader, H. William Menard, played in plate tectonics development.
 - b. Compare the scientific, economic, military, and prestige benefits to cost and alternative uses of tax monies.
 - c. If public funding is justified, were the cuts NSF forced in *Nova's* budget wise?

2. Explain plate tectonics. Why is it considered a revolutionary theory and what is its potential economic impact?

SUGGESTED GUIDELINES

1. Consult Bullard's second newspaper article and Wertenbaker's *Reader* article, and describe the plate tectonics theory and the "scenario" of world geological evolution it involves.
 - a. How does it differ from previous hypotheses?
 - b. Why is it more comprehensive, and what puzzling questions did it answer?
2. Review Hammond's article for data on its effects for mineral resource development. How might it affect oil exploration and economic activities in earthquake zones?

3. How convincing is the modern theory that Atlantis was actually Minoan Crete?

SUGGESTED GUIDELINES

1. Review Bascom's newspaper article for his account of the Atlantis question.
2. Consider Luce's *Reader* article.
 - a. If Atlantis was Crete, how does Luce account for Plato's locating it in the Atlantic?
 - b. Do you agree with Luce's assessment of the elements that make up the "hard core of the legend"?
 - c. What were the three important observations Frost made in 1909 in suggesting the Crete hypothesis?
 - d. Does the explanation of how the Egyptian name "Keftiu" could have become "Atlantis" for Solon ring true?
 - e. Why is Marinatos' 1939 article thought to have clinched the arguments in favor of the theory?
4. Describe how technological innovations have transformed the sea sciences in recent decades.

SUGGESTED GUIDELINES

1. Consult Bullard's first newspaper article for his listing of important innovations.
2. See also Wertenbaker's description of the seismic-reflection profiler, computer analysis of seismographic data, towed magnetometers, etc.
3. Then review the article on the *Trieste* by Piccard and Dietz.
4. Consider Bascom's description of the impact of technology for marine archaeology in his *Reader* article.
5. Finally, consult Menard's "Epilogue" in the *Reader* for further information.

SUGGESTED READING, *Exploration of the Sea*, Sir Edward Bullard

Horsfield, Brenda and Peter Bennet Stone. *The Great Ocean Business*. New York: Coward, McCann and Geohegan, 1972. Developments in oceanography are viewed against the political and economic considerations governing United States ocean policy. The authors focus on recent developments in marine geology, including evidence of sea-floor spreading and continental formation, but mineral and biological resources of the sea and research on waves, tides, and currents are also discussed.

Menard, Henry W. *Anatomy of an Expedition*. New York: McGraw-Hill, 1969. A first-hand account of a modern oceanographic expedition from its conception through its work at sea. The *Nova* Expedition was sent by the Scripps Institution of Oceanography to study

the geology of the sea floor in the southwestern Pacific.

The Ocean. San Francisco: W. H. Freeman, 1972. The September 1969 issue of *Scientific American*, devoted to the oceans, has been reprinted in this book format. Included are articles by Roger Revelle, R. W. Stewart, Warren Wooster, H. W. Menard, John D. Isaacs, Willard Bascom, Edward Wenk Jr., and others, covering a range of subjects from the origin of the oceans and the deep-ocean floor to marine resources.

Turekian, Karl K. *Oceans*. Englewood Cliffs, N.J.: Prentice Hall, 1968. A brief guide to the oceans, with emphasis on the geophysics and geochemistry of the marine environment.

SUGGESTED READING, *A New World Picture*, Sir Edward Bullard

Hallam, A. *A Revolution in the Earth Sciences: From Continental Drift to Plate Tectonics*. Oxford: Clarendon Press, 1973. A readable presentation of the historical background of Wegener's theory of continental drift as well as recent evidence of paleomagnetic studies of ocean-floor spreading.

Horsfield, Brenda and Peter Bennet Stone. *The Great Ocean Business*. New York: Coward, McCann and Geohegan, 1972. See entry listed in the bibliography for "Exploration of the Sea."

LePichon, Xavier, Jean Francheteau, and Jean Bonnin. *Plate Tectonics*. New York: Elsevier, 1973. An account of plate tectonics at a more advanced level than the other references in

this bibliography.

Sullivan, Walter. *Continents in Motion: The New Earth Debate*. New York: McGraw-Hill, 1974. In this excellent introduction to the subject of continental drift, the science editor of the *New York Times* describes the characters and clues that led to a new view of the earth with all the excitement of a mystery story. Included is a discussion of the potential practical applications of plate tectonics for earthquake control, locating oil and gas deposits, and harnessing geothermal energy.

Tarling, D. H. and M. P. *Continental Drift: A Study of the Earth's Moving Surface*. New York: Anchor Press/Doubleday, 1975. A discussion of the recent evidence that supports the

theory of continental drift and of its practical significance.

Vacquier, V. *Geomagnetism in Marine Geology*. New York: Elsevier, 1972. A rather more detailed treatment than most items in this bibliography of our present knowledge of the magnetic field of the oceans. The author, who developed some of the early instruments used in this work, made significant discoveries about the magnetic field in the northeastern Pacific.

Wilson, J. T. *Continents Adrift*. San Francisco: W. H. Freeman, 1972. This volume contains articles from *Scientific American*, most of which are available from the publisher separately as Scientific American Reprints. Some of the articles are also in *The Ocean*, listed in the bibliography for "Exploration of the Sea."

SUGGESTED READING, *Science and Ancient Sea Stories*, Willard Bascom

Bascom, Willard. *Deep Water, Ancient Ships*. New York: Doubleday, 1976. An account of marine archaeology in the Mediterranean. Included are descriptions of early salvage operations as well as of such sophisticated equipment as the Alcoa Seaprobe, a search and recovery ship designed to raise ancient wrecks from deep water.

Bass, George. *Archaeology Beneath the Sea*. New York: Walker & Co., 1975. A look at the methods, dangers, and rewards of marine archaeology. The author presents highlights from a number of underwater expeditions he directed in the eastern Mediterranean.

Casson, Lionel. *The Ancient Mariners: Seafarers and Seafighters of the Mediterranean in Ancient Times*. New York: Minerva Press, 1959. A highly informative and entertaining account of the maritime history of the western world from its origins to the seventh century A.D. Illustrative examples and anecdotes enliven the story of the growth of commerce and sea power as the ancient mariners progressed from timid coastal voyages to venturesome sailings across the open sea, eventually establishing a network that stretched from

Spain to Malay. The author, who personally visited the sites of ancient harbors on the Mediterranean, has drawn upon the findings of recent marine archaeology as well as on ancient accounts.

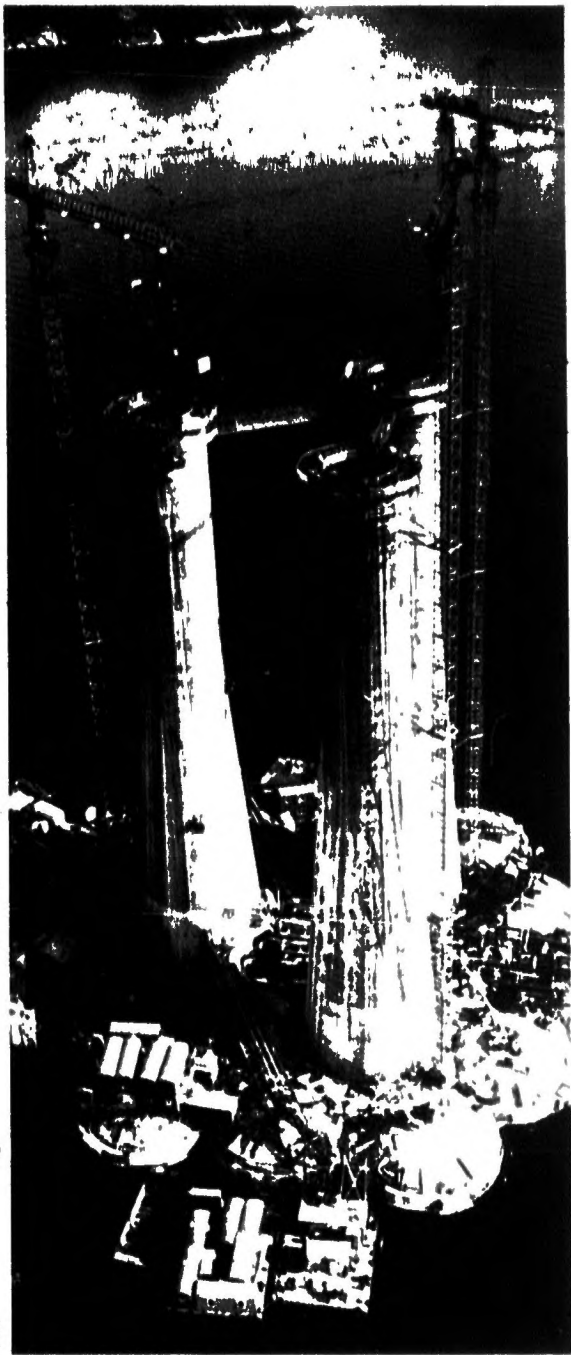
Gordon, Cyrus. *Before Columbus: Links Between the Old World and Ancient America*. New York: Crown Publishers, 1971. The author, who has written many books on the ancient civilizations of the Near East, examines a variety of evidence to support his conclusion that the Atlantic was crossed long before the Vikings and that "for thousands of years men have been in contact with other men at the ends of the earth, influencing each other's way of life, and producing thereby an intertwined network of developed regional cultures."

Luce, J. V. *The End of Atlantis*. London: Thames and Hudson, 1973. Comparing Plato's account of Atlantis with the evidence of recent archaeological finds in the Mediterranean, the author argues that Atlantis was part of the ancient Minoan empire.

Riley, Carroll, et al. (eds.). *Man Across the Sea: Problems of Pre-Columbian Contacts*. Austin: University of Texas Press, 1971. This volume contains twenty-one papers and three commentaries presented at a 1968 symposium of the Society for American Archaeology. Three main sections deal with theoretical and methodological aspects of the controversy over diffusion of peoples and cultures, with specific alleged contact across the Atlantic and the Pacific, and with the spread of certain key plants, such as maize and cotton.

Throckmorton, Peter. *Shipwrecks and Archaeology: The Unharvested Sea*. Boston: Little, Brown, 1969. A marine archaeologist describes what happens to ships and their contents after centuries under the sea and reports on his own investigations in this field study.

Wathenau, Alexander von. *Unexpected Faces in Ancient America, 1500 B.C. - A.D. 1500: The Historical Testimony of Pre-Columbian Artists*. New York: Crown Publishers, 1975. The author presents hundreds of photographs of pre-Columbian American art, depicting distinctive racial features, as evidence that the ancient population of the Americas included Asians, Semites, and Negroes.



UPI

UNIT FOUR

MARINE RESOURCES

NEWSPAPER ARTICLES

8. *Mineral Resources of the Ocean*

Don E. Kash

9. *Can the Sea Feed the Land?*

C. P. Idyll

10. *Pollution: Is the Sea Dying?*

Bostwick H. Ketchum

READER SELECTIONS

The Riches in Davy Jones's Locker

Taking Oil Off the Shelf

Robert Bendiner

The Outer Continental Shelf: Energy Needs vs. Environment

Luther J. Carter

Mining the Sea: Manganese Nodules

Allen L. Hammond

Deep-Ocean Mining

Frank L. LaQue

The Living Chain

Rachel L. Carson

Food from the Sea

C. P. Idyll and Hiroshi Kasahara

Farming the Seas: The Blue Revolution

Elisabeth Mann Borgese

The Very Deep Did Rot

Samuel Taylor Coleridge

How to Kill an Ocean

Thor Heyerdahl

Netting Oil

M. Blumer

A Realistic Look at Ocean Pollution

Bostwick Ketchum

Oceanic Oil Pollution

Roger Revelle, Edward Wenk,
Bostwick Ketchum, Edward R. Corino

LEARNING OBJECTIVES

To understand

- the nature and extent of the mineral and food resources of the ocean and the degree to which the ocean frontier can satisfy the world's growing need for these resources
- how we are using the ocean's resources and how we can maximize their potential value in the future
- the technological, legal, and political problems associated with exploiting the ocean's resources
- the major sources of ocean pollution, both inshore and in the deep sea
- the nature and extent of the threat that pollution poses to the ecology of the ocean
- possible solutions to the problem of pollution

OVERVIEW

This unit examines our prospects for obtaining increased mineral and food resources from the sea and considers how the question of ocean pollution affects those prospects.

Don E. Kash discusses the mineral resources of the ocean in his newspaper article. He points out that with domestic shortages and the political need to secure alternative sources, the current estimates of the quantity and quality of sea-floor oil, gas, and hard minerals make exploration for them very attractive. We have the technology to exploit these minerals, but experience with offshore resources suggests that political and environmental constraints might inhibit private risk taking in finding and developing deep-water mineral sources.

The *Reader* selection "The Riches in Davy Jones's Locker" discusses some of the international political issues involved and the United Nations' efforts to find a solution to them. (Unit Five will examine these matters more closely.) Robert Bendiner's article assesses the impact—

social, economic, and environmental—of offshore oil development. He concludes that although the danger of oil spills and damage to local ecology now appear minimal, related onshore activities create serious problems. He also outlines current government leasing policies and recommends reforms. Luther Carter gives details of proposed federal legislation regarding leasing on the outer continental shelf and analyzes its probable effects.

A deep-water mineral resource, manganese nodules, is the subject of Allen Hammond's article, which describes their character and location, methods of mining and processing them, and the environmental and political problems that might be involved in mining them. In analyzing the economic potential in mining "hard minerals," Frank LaQue comes to some sobering conclusions. He warns that they will not prove to be the bonanza that many hope and that their exploitation may widen rather than narrow the income gap between developed and developing

nations.

C. P. Idyll, too, warns against expecting too much from sea resources. In his newspaper article he answers the question "can the sea feed the land?" with a qualified no. He points out that the potential for increasing food yields from the sea is limited because most of the ocean's living resources are unsuitable food for humans. Nevertheless, significant gains can be made by turning to unfamiliar kinds of seafood. Aquaculture offers some promise, in his opinion, and better fisheries management can help as well. But international cooperation must improve, he argues, if the sea is to help close the world food supply gap.

Idyll's arguments are more fully developed and detailed in the *Reader* article he wrote with Hiroshi Kasahara. They recommend three essential steps if the ocean's food potential is to be realized: scientific conservation, increased search for little-used stocks, and development of new fishing techniques. The late Rachel Carson describes some of the different plants and animals that make up the ocean food chain and the zonal variations in the nature of the surface water that determine where each can thrive. Elisabeth Mann Borgese tells the history of innovations in fishing techniques and assesses their social and economic impact. Among other examples, she cites the whaling and Peruvian anchoveta industries in describing how technological change can aggravate rather than solve problems. But she also shows how technology could bring enormous benefits—a "Blue Revolution"—if it is applied to "aquaculture," cultivating rather than just gathering food from the sea.

The final major question this unit raises must also be given a yes-and-no answer. Bostwick Ketchum's newspaper article asks whether the oceans are dying. He concludes that they show symptoms of illness, but we can, if we will, cure the oceans' present "disease," just as we caused it. He reviews the evidence of inshore ocean pollution from sewage and industrial

wastes and of pollution of the high seas by chemical atmospheric fallout and petroleum, and he prescribes comprehensive recycling of wastes and adequate controls as treatment for the oceans' illness.

Reader selections dealing with this aspect of man's impact on the sea open with Coleridge's frightening poetic image of an ocean gone to rot. Thor Heyerdahl then contrasts the evidence he found of widespread pollution while on transatlantic raft voyages in 1969 and 1970 to the complete absence of such evidence in his first raft crossing of the Pacific some twenty years earlier. M. Blumer's report of oil-tar lumps in the Sargasso Sea in 1968 shows just how serious such pollution can become.

Oil is only one of the several kinds of pollutants Ketchum describes in detail in his testimony before a Senate committee, reprinted in the *Reader*. The effects of heavy metals, chlorinated hydrocarbons, and solid wastes, as well as petroleum pollutants, vary with the particular characteristics of each substance. He emphasizes that each must be evaluated as to quantity, toxicity, and persistence in the environment. The sources and consequences of ocean pollution from petroleum hydrocarbons are analyzed in detail by Roger Revelle and his collaborators in the final reading for this unit. Their recommendations for corrective action make clear again the necessity for international cooperation if we are not irrevocably to despoil the ocean frontier.

KEY CONCEPTS

OWNERSHIP OF OCEAN RESOURCES

The prospects described in this unit for utilizing the ocean frontier to expand the world supply of food, minerals, and other resources involve the question of ownership. As Unit Five will discuss in detail, ownership of ocean resources has recently become a thorny issue in international politics. The United Nations is seeking agreement on a new law of the sea that will deal with this issue, but in the meantime many questions remain unresolved.

International law had traditionally recognized each coastal nation's right to control the waters off its shores to a distance of three miles, a zone called the nation's **territorial sea**. Vessels of other nations had only the right of peaceful transit within that zone, but all nations could use the **high seas**—the open waters beyond territorial limits—at will.

In recent decades, however, some coastal nations have unilaterally extended their claims to control of waters off their shores. Several, including Iceland, Peru, and recently the United States, have claimed proprietary fishing rights out to 200 miles. In some cases conflict with neighboring nations has resulted, such as the "Cod War" between Iceland and Great Britain. Some ten nations, again including the United States, have declared a 200-mile **economic resource zone** or **exclusive economic zone** in which mineral, gas, and oil resources are claimed as well. General agreement on extension of territorial seas to twelve miles is probable, but the extent of exclusive economic zones remains controversial.

In the United States, seabed resources within the three-mile limit belong to the coastal states, and those beyond it, on the **outer continental shelf** (OCS)—the part of the continent submerged in relatively shallow seas—are claimed

by the federal government, which leases them to private corporations.

The question of who owns deep-seabed resources such as manganese nodules remains unresolved. The United Nations has declared these resources "the common heritage of mankind," but no agreement has been reached on how their exploitation will be controlled. Technologically advanced nations who are already able and anxious to begin mining the deep seabed may unilaterally stake claims to rich areas if the United Nations cannot soon settle the matter.

LEASING PROCEDURES

Since most of the United States' offshore petroleum reserves are in federally owned areas, the government leases tracts to private companies for exploration and development. These leases are offered only after the Department of the Interior has carefully considered the environmental impact of proposed development. The private companies bid on the leases on the basis of the preliminary seismic and geophysical data they have gathered, but the exploratory drilling necessary to determine the extent of the oil reserves cannot take place until after the leases have been awarded.

These procedures have come under a variety of criticisms. Some argue that the government, reliant on the oil companies for much of its data, might unwittingly lease valuable tracts for a fraction of their worth. The Senate is considering legislation that would separate exploration for oil and gas, which would become a function of the federal government, from development and production. Some industry spokesmen argue that current procedures force them to assume unfair risks. The states are critical of leasing procedures because they have little voice but they must bear the onshore impact.

ONSHORE DEVELOPMENT IMPACT

Although threats to the environment from offshore-oil drilling have decreased as a result of new technology and regulations, there is growing concern about the social impact on shore communities. The influx of labor necessary to build and locate the oil rigs—sometimes amounting to thousands of persons—creates boomtown conditions that can irrevocably destroy the essential nature of small shore communities. The boom, which demands additional housing, stores, schools, roads, and other services, tends to be short-lived, and a ghost town can be left behind when it is over.

MANGANESE NODULES

One commercially attractive deep-ocean mineral resource is the deposits of manganese nodules that have already been found lying in beds at depths of from 9,000 to 18,000 feet on the floor of the open ocean. These nodules are lumps of manganese and iron oxides that contain significant amounts of copper, nickel, cobalt, or other minerals as well. Since the United States is dependent on other nations for some of these minerals, manganese nodule mining is of strategic as well as economic importance to Americans. As *Reader* articles for this unit detail, the technology for mining this resource—the *continuous line bucket (CLB)* and the *hydraulic* systems—has already been developed. Methods of processing the ore, using chemical separation, have also been developed. American, Japanese, and Western European companies are prepared to begin operations, but international political and legal controversies must be resolved, either by the United Nations or by these nations acting unilaterally, before manganese nodule mining can begin.

OCEAN FOOD RESOURCES

All living resources of the ocean are connected

in a **food chain** that leads from *plankton*, the tiny floating plant organism and the small animal organisms they sustain, to plankton-feeding fish such as herring, to fish-eating fish like tuna, to squid that prey on fish, to whales, which may eat plankton or much larger sea creatures. At each link in the chain, about 80 to 90 percent of the food value is lost to metabolism; for example, it takes approximately 1,000 pounds of animal plankton to sustain 100 pounds of herring, which could support only 10 pounds of tuna.

Since man cannot eat most ocean plants and plant-eating animals, our use of the ocean as a food source is presently limited to a relatively few species of animals at the higher levels of the ocean food chain. World food needs require an increased yield from other ocean sources as well as these traditionally utilized stocks. This unit examines several strategies to accomplish that: conservation measures to combat overfishing of commonly used species; exploitation of plant and animal plankton, particularly krill and red crab; further development of unconventional stocks like squid and lantern fish; improved fishing techniques; and aquaculture, the systematic cultivation of ocean food crops.

AQUACULTURE

Some analysts believe that aquaculture (or "mariculture"), cultivating ocean food crops rather than just gathering them, could dramatically increase food yields from the sea. Elisabeth Mann Borgese argues that just as the "domestication" of wild land plants and animals created the agricultural revolution, and recent scientific farming has brought about a new "Green Revolution," a "Blue Revolution" could be achieved by going beyond the "hunting and gathering" stage in our exploitation of ocean food resources.

The Chinese and other Asians long ago learned to operate managed fish ponds that took

advantage of the cycle of nature to increase yields. Oysters have been successfully cultivated for centuries, and a wide variety of fish, shellfish, and other sea animals are now being "farmed" scientifically with gratifying results. As Borgese notes, aquaculture could be pursued on a very large scale if ecological and political considerations are met. Then it would bring about a true food resource revolution.

OCEAN POLLUTION

As this unit details, pollution from a wide variety of sources already poisons wide areas of coastal waters and ultimately may threaten the deep oceans as well. Sewage, industrial wastes, and heavy metals are major *inshore pollutants*; radioactive materials, petroleum products, and artificial organic compounds are the major types of substances involved in *deep-sea pollution*. Effects vary with the quantity, toxicity, and persistence of the pollutant and the character of the receiving area.

Petroleum pollution is probably the most controversial at present since world oil production and consumption have increased markedly and new undersea sources are being developed. Most petroleum pollution now comes from normal tanker and ship operations rather than from dramatic accidental spills from tanker groundings and offshore oil production mishaps, although tanker accidents remain a significant pollution hazard as tanker size continues to increase. Perhaps most alarming for the long run is the huge amount of petroleum hydrocarbons that fall to the sea from the atmosphere.

Federal and state laws and international agreements attempt to minimize the danger and damage from pollution, but many feel that tighter regulation is needed and present laws must be strongly enforced.

FACTUAL REVIEW QUESTIONS

1. According to current estimates, what proportions of the world's oil and gas and hard minerals does the ocean floor contain?
2. What are the major constraints today on offshore oil development in the United States?
3. What are the "onshore" effects of ocean oil exploitation?
4. Why are coastal states unhappy with the present division of governmental power and responsibility regarding offshore oil in the United States?
5. What recommendations does Bendiner make regarding United States' offshore oil development policy?
6. What steps are now necessary in obtaining leasing rights to oil on the outer continental shelf?
7. How would proposed legislation affect the leasing process?
8. What other minerals do manganese nodules contain?
9. Where do the richest deposits of manganese nodules occur?
10. What two methods are proposed for mining manganese nodules?
11. What conclusions does LaQue reach regarding deep-ocean mining of "hard minerals"?
12. What are the major links in the ocean food chain?
13. How much of the present world food supply comes from the sea?
14. How much can we probably increase the present harvest of familiar seafoods?
15. What "unconventional" kinds of seafood could be used more widely?
16. What makes certain areas of the ocean rich in plant and animal life?
17. What measures do Idyll and Kasahara believe necessary if the ocean's food potential is to be realized?
18. What kinds of fishing techniques did ancient peoples use?
19. How have technological innovations led to overfishing of certain species?

20. What examples of aquaculture does Borgese give?
21. Where are ocean pollution problems most acute?
22. Which pollutants are of prime concern in deep offshore waters?
23. What were Heyerdahl's observations of pollution during his 1970 voyage?
24. What three characteristics of each pollutant must be understood in order to judge its impact or hazard?
25. Which heavy metals toxic to marine life are already reaching the environment in considerable quantities?
26. Why are chlorinated hydrocarbons dangerous pollutants?
27. What United Nations agency is concerned with ocean oil pollution and what actions has it taken?
28. What is the most common source of solid waste pollution?
29. What are the sources of petroleum hydrocarbons in the sea, and which source produces the greatest amount?
30. How are hydrocarbons removed from the oceans?
31. What kinds of consequences can hydrocarbon pollutants in the ocean produce?
32. What recommendations do Revelle and his collaborators make?

ESSAY AND DISCUSSION QUESTIONS

1. Describe present United States government policies regarding offshore oil development. In your opinion, should those policies be changed? If so, how and why?

SUGGESTED GUIDELINES

1. Consider first that offshore oil development is essentially a domestic issue, causing federal-state-local conflicts, rather than an international issue.
2. Note that most offshore petroleum is in federally owned areas and that coastal states believe they suffer the disadvantages of offshore development—visual and physical pollution, ecological disruption, "onshore" social disorganization when boomtowns come and go—while the federal

government enjoys the benefits. Are state demands for a share in the revenues and a role in managing development justified?

3. Review Bendiner and Carter for details of recent leasing policies resulting from "Project Independence."

a. Is independence from foreign energy suppliers more important than ecological considerations?

b. Why did federal policy change in the fall of 1975?

c. Are present leasing procedures economically inhibiting?

4. Would the proposed amendments to the OCS Lands Act that Carter describes be an improvement? Are Bendiner's recommendations sound?

2. How realistic are hopes of obtaining significant amounts of mineral resources from the sea in the near future?

SUGGESTED GUIDELINES

1. Note that manganese nodules are the one ocean mineral resource currently thought commercially promising.

2. Evaluate the technological side of deep-sea nodule mining.

a. From Hammond's description, does it appear that mining and processing techniques are sufficiently developed for operations to begin soon?

b. Must any problems in the two mining approaches still be overcome?

c. How extensive would initial ventures be likely to be?

d. Has sufficient investment capital been found?

e. When does LaQue estimate commercial-scale exploitations may begin?

3. Now turn to the political side of the question.

a. Note that since these resources are located in the open oceans, they involve international rather than domestic issues.

b. What are the elements in the international controversy over manganese nodule development?

c. How likely is it that they will soon be resolved?

d. Would unilateral action hasten development?

3. Describe the several proposals for increasing food yields and evaluate the prospects of each for closing the world food supply gap.

SUGGESTED GUIDELINES

1. Review Idyll's newspaper article and the *Reader* selection he wrote with Kasahara.
 - a. List the proposals they discuss. Which do they consider most promising?
 - b. What is their final judgment on how much of the world's food can be obtained from the sea?
2. Why is Borgese pessimistic about overcoming the "irrationality" that has caused overfishing and reduced per-boat yields?
3. Is she overly optimistic about aquaculture's prospects?
 - a. How much do you think ecological and political problems will inhibit large-scale sea farming?
 - b. How realistic do you consider Borgese's hope that we can turn from competition to cooperation to achieve a "Blue Revolution"?

4. Of the several kinds of ocean pollution, which seems to you most urgently in need of correction and which most readily correctable?

SUGGESTED GUIDELINES

1. Consult Ketchum's newspaper article and his Senate testimony and list the various kinds of pollutants and their effects, keeping in mind the three criteria he suggests.
2. Review the Revelle *Reader* article regarding petroleum hydrocarbons. Consider also Heyerdahl's and Blumer's evidence of oil pollution in the open ocean.
 - a. Which of the Revelle recommendations seems achievable?
 - b. Are those that require international cooperation less workable?
3. Consider Ketchum's general solution for all ocean pollution. Is it viable for domestic pollution problems? International?

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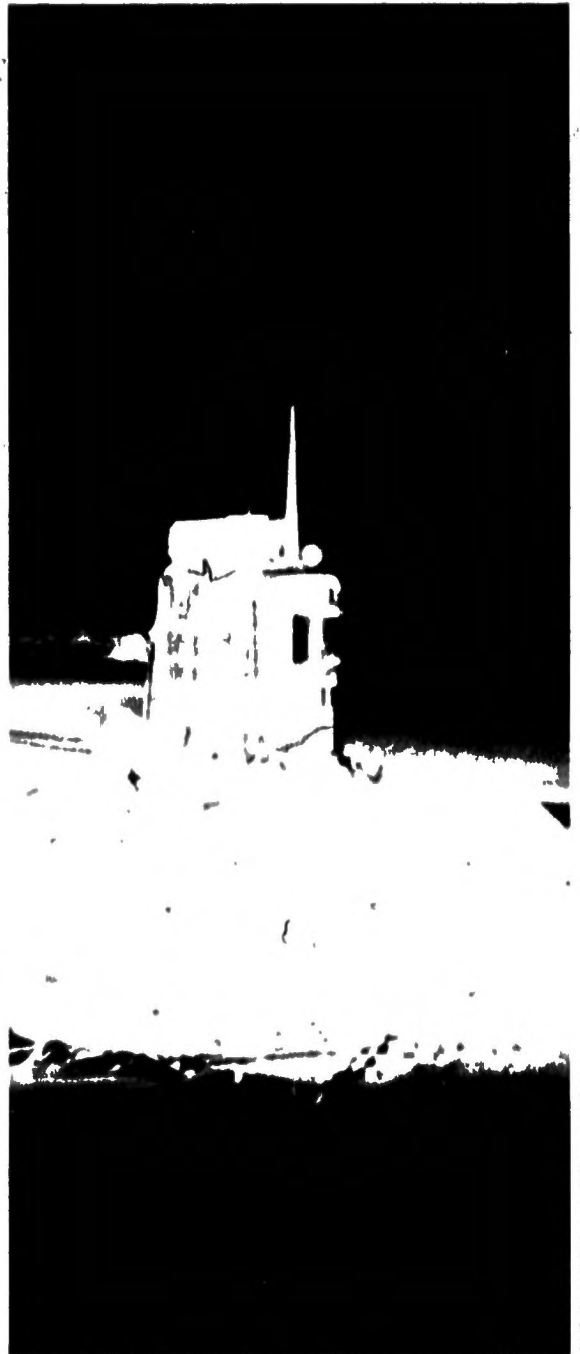
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UNIT FIVE

POLICY AND SEA POWER



NEWSPAPER ARTICLES

11. *Law of the Sea*
William T. Burke

12. *The Sea: Defensive Barrier or Invasion Path?*
Herman Kahn

13. *The Sea: Connector or Barrier?*
Herman Kahn

READER SELECTIONS

The Common Heritage of Mankind
United Nations General Assembly

Diplomats at Sea
Seyom Brown and Larry L. Fabian

The Law of the Sea and World Order
Henry A. Kissinger

Future Prospects for Law of the Sea
Arvid Pardo

Ocean Mining: Plans and Problems
Marne A. Dubs

Deep-sea Claim
Deepsea Ventures, Inc.

World Sea Power: U.S. vs. U.S.S.R.
J. William Middendorf II

Sea Power in the 1970s
George H. Quester

Supership
Noël Mostert

*Commerce and Transportation: Fulfilling Our
Commitment*

Marine Board of the National
Academy of Engineering

LEARNING OBJECTIVES

To understand

- the major issues involved in the law of the sea negotiations and the points of conflict between nations
- the official position of the United States on law of the sea and conflicting interests within the United States
- the impact of law of the sea issues on the exploitation of ocean food and mineral resources
- the traditional role of the United States Navy and how it has been affected by the development of new aircraft, nuclear power, missiles, and other technological developments
- the strength of United States sea power vis-à-vis that of the Soviet Union
- the importance of ocean-borne commerce in today's world
- recent trends in ocean commerce, including the growth of bulk shipping, VLCCs, container ships, flag of convenience registration
- the actual and potential impact of supertankers on seafaring and seamen, on ocean traffic and ports, and on the environment
- the problems facing the United States Merchant Marine and proposed solutions to those problems

OVERVIEW

Use of the ocean as a highway and exploitation of its physical resources have always been determined by the politics of power. In our era new conflicts between nations over the use of the sea for economic and strategic purposes have emerged. This unit examines three aspects of modern ocean politics—the international law of the sea, naval power, and maritime commerce—and suggests the important public policy decisions in these areas that face Americans today.

William T. Burke's newspaper article outlines the factors involved in recent United Nations

efforts to write a new international law of the sea. Increasing demands for resources, technological developments, resurgent nationalism, and new prospects of rich mineral resources from the deep seabed have all contributed to the erosion of traditionally accepted legal concepts governing the ocean. Since 1945, when President Truman declared American rights to seabed resources on the continental shelf zone off our shores, other coastal nations have extended their claims to control over ocean areas formerly open to all. The possibility that the oceans frontier

might become the scene of an unrestricted "resources rush" as nations grabbed off ocean territories for exploitation prompted United Nations action. After Arvid Pardo's 1967 speech to the General Assembly and the subsequent United Nations resolution declaring seabed resources the "common heritage of mankind," the United Nations convened a new Conference on the Law of the Sea in 1972. This conference has held several sessions and is still under way in 1976. However, the conflicts of interests between developing and developed nations have so far prevented agreement. Burke warns that if a new law of the sea is not established soon, unilateral actions will result in serious disputes and violence.

In the first *Reader* selection for this unit, the United Nations' 1970 resolution, the principles that underlie the Law of the Sea Conference negotiations are clearly stated. But as the article by Seyom Brown and Larry Fabian shows, particular national interests weigh more heavily than principles in the current debate over implementation of the resolution. The alignment of nations on such issues as how far national control should extend over offshore areas or how revenues of deep-sea mining should be shared depends on a wide variety of factors. The result is "multiple and overlapping coalitions." Brown and Fabian maintain that the oceans policy of the United States has been shaped too much by the demands of domestic special interest groups. We must, they argue, reach a new consensus on a policy that will serve world community needs as well as our own enlightened national interest.

Current United States policy objectives are detailed in Secretary of State Henry Kissinger's 1975 speech. He reaffirms American commitment to the concepts behind the "single negotiating text" for a draft treaty agreed to in 1974, but also defines the points on which American diplomats must insist.

The *Reader* selection by Arvid Pardo, who first called for a new law of the sea in 1967, offers

a pessimistic analysis of the kind of treaty that is likely to emerge from the present negotiations. His original concept called for international administration of the ocean space beyond reasonable national limits for the benefit of the world community as a whole, but particularly to help diminish the inequalities between poor and landlocked countries and more advantaged nations. He now believes that only the coastal states will benefit from the treaty, that "the commons of the high seas" will disappear, and that tensions and inequalities will grow while international cooperation in the oceans will diminish.

As was suggested in Unit Four articles, the legal uncertainty resulting from delay in international agreement has frustrated would-be developers of deep seabed manganese nodules. Marne A. Dubs' 1975 testimony before the U.S. Senate, reprinted in this unit, details the negative effect that uncertainty has had on the investment "climate," making it unfeasible for developers to obtain funds in order to proceed toward commercial operations, even though the technology to do so is available. He urges Congress to pass legislation protecting developers against loss resulting from a future international agreement or interference by other governments.

One corporation involved in manganese nodule work, Deepsea Ventures, took another approach to seeking legal security: In a letter to Secretary of State Kissinger, the company filed notice of "discovery and claim of exclusive mining rights," requesting government protection of those rights and of the company's investment.

Law is only as good as the power behind it, however. In the second newspaper article for this unit, Herman Kahn looks at modern naval power, emphasizing developments since 1945 when the nuclear and missile age began. He describes how modern technology has blurred distinctions between land and sea forces. Nevertheless, he argues, the navy will still have traditional roles to play in limited warfare and in protecting commerce.

Secretary of the Navy William Middendorf details those roles in arguing in favor of strengthening the United States Navy to meet growing Soviet naval power. George Quester suggests, however, that the threat of mutual nuclear annihilation has so transformed naval strategy that operations have become more symbolic than functional, with little likelihood of actual naval combat. He also analyzes the political power threat involved in recent Soviet expansion of its merchant marine, but concludes that although there is some danger that the West could become dependent on Soviet shipping, Soviet maritime investment should work in the long run to keep the seas peaceful.

Kahn's second newspaper article examines new developments in merchant shipping—super-tankers, container ships, hydrofoils, and the trend toward “flag of convenience” registration—

and assesses their implications. The National Academy of Engineering's Marine Board echoes the warnings Admiral Mahan voiced in the 1890s, recommending improved subsidies and better utilization of technology to rebuild a strong American merchant fleet. The relationship between two new shipping developments—“flag of convenience” ship operation and “Very Large Crude Carriers” (VLCCs)—is examined by Noël Mostert in the *Reader* selection from his book *Supership*. He attributes the high accident and pollution rate of VLCCs registered under flags of convenience to substandard operation by poorly qualified and overworked crews. He warns that the appalling menace these vessels present can only escalate unless an extraordinary international effort to control standards at sea is undertaken.

KEY CONCEPTS

INTERNATIONAL LAW AND THE SEAS

The concept of a body of rules and principles, that nations consider legally binding in their relations with other nations emerged in the late sixteenth century as a consequence of the creation of modern national states. As customs and rules developed in practice, theorists like the Dutchman Hugo Grotius formulated an intellectual framework for them and identified legal “doctrines” concerning specific problems in international relations. However, international law has force only because sovereign states find it to their advantage to recognize it, and war remains the final arbiter.

The international law of the seas was shaped primarily by the powerful maritime nations. In addition to agreement on such issues as piracy and the rights of neutrals, two central, inter-related concepts in oceans law developed: the

“territorial sea” and “freedom of the [high] seas.”

Territorial seas are the coastal waters over which a nation exercises full sovereignty, with the exception that vessels of other countries have the right of innocent passage. The remainder of the oceans is the **high seas**. There, all nations are free to use the oceans as they will.

The concept of territorial seas developed in the seventeenth century, but the distance from their shores over which coastal nations could claim control remained in dispute. Most nations accepted the three-mile limit, which was originally based on the presumed range of land-based cannon. Other coastal states claimed wider zones, and current international law agrees only that at least three miles of coastal seas must be recognized as territorial waters. Agreement on a twelve-mile limit now seems likely, but most nations consider any further extension of sovereignty over coastal waters too great an infringement.

ment of the freedom of the high seas. Claims to 200-mile exclusive economic resource zones, in which the coastal state has ownership and control of all ocean resources, will probably be recognized, but, again, other nations would retain the right of free passage.

The doctrine of freedom of the seas is relatively new in acceptance, although Grotius asserted it in 1609. Earlier, strong nations had claimed whatever seas they could control. In 1493 Spain and Portugal, the two great sea powers of the time, claimed sovereignty over the New World, and the Pope sanctioned its division, seas and all, between them. By the seventeenth century, however, the Netherlands, Great Britain, and France had become sufficiently powerful to break the Spanish and Portuguese monopoly and to command their recognition of freedom of the seas in the New World as well as the Old, but the concept did not become generally recognized in international law until the nineteenth century.

THE UNITED NATIONS AND THE LAW OF THE SEA

Beginning with the first Law of the Sea Conference in 1958, the United Nations has periodically addressed the question of international ocean law. The 1958 conference and another in 1962 failed to settle the territorial sea issue, but did establish other areas of agreement. In 1967, when deep seabed resources became technologically promising, Maltese Ambassador Arvid Pardo addressed the General Assembly, calling for a new ocean regime. The result was a 1970 resolution declaring that the oceans' resources, "beyond the limits of national jurisdiction, the precise limits of which are yet to be determined, were to be considered "the common heritage of mankind." An international regime was to be established to oversee the exploitation of these resources. The third Law of

the Sea Conference convened in 1973 to pursue these objectives and to settle other ocean law questions. Agreement on final treaty provisions however, has not yet been reached, and further conference sessions are scheduled.

MODERN SEA POWER

This unit explores the developments in this century that have radically altered nations' power to use the seas. Although many aspects of sea power as described by Admiral Mahan in Unit One remain unchanged, technological and political developments have enormously affected seaborne commerce and naval operations.

With the widespread use of submarines and the introduction of aircraft in World War I, two new dimensions were added to naval warfare. These capabilities and counter measures to them were fully developed and exploited in World War II, when naval power played a central role in the Allies' ultimate victory. But the advent of the nuclear and missile age in 1945 introduced new elements in naval strategy. Nuclear-powered ships and submarines and nuclear-armed vessels now perform different functions from the classic naval operations of Admiral Mahan's day, as articles in this unit show. New high-speed vessels promise to further alter naval tactics.

NUCLEAR STRATEGY AND THE NAVY

Since 1945 atomic weapons have transformed national defense strategy. After the Soviet Union broke the United States' nuclear monopoly in 1949, the concept of *mutual deterrence* evolved in which each superpower seeks to deny the other a *first strike capability*. If either one could be assured of destroying in a preemptive first strike the other's capacity to retaliate with sufficiently damaging nuclear attacks, the stra-

tegic stalemate that now deters both from launching an all-out nuclear war would be broken. Air fields and land-based nuclear missile launching sites are visible and vulnerable to a first strike attack as are naval surface vessels. At present it is missile-carrying submarines that constitute the one kind of launching site that cannot be located by an enemy. They, therefore, play the central role in nuclear deterrence strategy since they assure the necessary invulnerability to discourage a first strike attempt.

DEVELOPMENTS IN OCEAN COMMERCE

Technology has similarly transformed the other arm of sea power Mahan championed—merchant shipping—as well as affecting fishing methods and exploitation of undersea resources as Unit Four details. Despite developments in land and air transport, sea carriers remain the cheapest form of transportation for commercial purposes, as Kahn notes. *Very Large Crude Carriers* (VLCCs), or supertankers, and *container ships*, in which goods are prepackaged in large, sealed containers, have brought cost benefits in commodity shipping, and high-speed *hydrofoils* and vehicles riding on air cushions might well reclaim passenger and time-sensitive freight traffic lost to air transport. But equally important, the volume of world shipping has grown enormously, crowding sea lanes and adding to the hazards that increased size and flag of convenience operations involve.

FLAG OF CONVENIENCE

A significant development in seaborne commerce is the trend toward flag of convenience registration of cargo vessels. Ship owners in the highly industrialized countries escape high labor costs, taxes, and legal liabilities by operating their vessels under the flags of countries, particularly Liberia and Panama, that have minimal regulations regarding ship operation. Many

American ship owners, including a number of oil companies, take advantage of the economic and legal benefits flag of convenience registration affords, justifying their action on the grounds that it is really a case of "flags of necessity." They argue that requirements that American-flag ships must be American-built and 40 percent American-manned vastly increase costs, making foreign registration a necessity if they are to operate ships at all. Critics contend, however, that underregulated flag of convenience shipping results in accidents hazardous to the environment as well as to human life and that the United States can and must rebuild a strong merchant fleet under our own flag for national defense purposes.

FACTUAL REVIEW QUESTIONS

1. What was the 1945 Truman Proclamation regarding the seas?
2. What did Pardo's speech in 1967 emphasize, and what was its impact?
3. What was the 1970 United Nations resolution regarding the sea?
4. What would the resolution's proposed "international regime" do?
5. How do developed and developing nations differ on Law of the Sea (LOS) objectives?
6. What is an economic resource zone?
7. According to Brown and Fabian, what patterns of international politics does current ocean diplomacy reflect?
8. What domestic special interests have influenced United States ocean policy?
9. What three elements do Brown and Fabian recommend for an "enlightened American ocean policy"?
10. What are the three major and four minor LOS Conference issues, according to Kissinger?
11. Which nations does Pardo believe will benefit from an LOS treaty?
12. According to Dubs, what presently deters deep seabed manganese nodule mining?
13. What does the claim of Deepsea Ventures, Inc. ask the United States government to do?
14. According to Kahn, what major developments have changed the traditional role of the navy?
15. What is the "Pacific Basin Connector"?
16. What will be the tasks of the navy in the future?
17. What is the doctrine of "freedom of the seas"?
18. According to Middendorf, what four missions did the United States Navy fulfill during and after World War II?
19. What three new issues in which seapower is important does Middendorf believe the nation faces today?

20. What developments does Middendorf cite to support his contention that the Soviet Navy threatens to outclass the United States Navy?
21. According to Quester, how have nuclear weapons altered naval strategy since 1945?
22. What does Quester mean by a "trip-wire" role?
23. Why, according to Quester, is the number of ships in a fleet and their location still important?
24. How has the size of the Soviet merchant fleet changed since 1950?
25. What is a VLCC?
26. What is a container ship?
27. What is meant by a flag of convenience?
28. According to Kahn, what are the dominant features of modern commercial shipping?
29. What new kinds of vessels promise high-speed ocean transport?
30. What technological developments does the National Academy of Engineering's Marine Board describe?
31. What recommendations does the Marine Board make?
32. Why do "superships" registered in flag of convenience countries have such a bad accident record, according to Mostert?

ESSAY AND DISCUSSION QUESTIONS

1. Regarding the three major issues under debate at the Law of the Sea (LOS) Conference, do you support current American policy as outlined by Secretary of State Kissinger?

SUGGESTED GUIDELINES

1. Consult Burke, Brown and Fabian, and Kissinger regarding the three issues: the limits of territorial seas, the limits of offshore economic resource zones and the degree of control coastal states may exercise over them, and the role an "international regime" may play in the exploitation of deep-seabed resources.
2. Assess the objectives the United Nations resolution expressed. Are they desirable? Realistic? Review here the point of view Cousteau expressed in Unit One.

3. Consider the positions taken by developed and developing countries and coastal and land-locked nations, and assess the justice of their claims.

a. Consult here also the *Newsweek* article on "The Riches in Davy Jones's Locker" in Unit Four, Dubs, and the Deepsea Ventures claim.

b. Review the recommendations made by Brown and Fabian for an "enlightened" United States ocean policy and Pardo's predictions concerning probable treaty provisions.

4. Do the positions Kissinger outlines seem fair? Too narrowly self-serving? Overly generous?

a. If they are intended as "bargaining chips" to be traded for concessions, which if any points should remain unnegotiable?

b. If failure to reach agreement will result in undesirable unilateral action, is American policy contributing to that stalemate?

2. Is the United States Navy today sufficiently strong?

SUGGESTED GUIDELINES

1. Consult Kahn's first newspaper article regarding a modern navy's functions.

2. Review Middendorf's description of the missions the United States Navy has filled since World War II.

a. Why does he believe a strong navy is even more essential today?

b. How does he assess the comparative strengths of the Soviet and United States Navies?

3. Does Quester's analysis of the roles of navies in the nuclear age and of the current naval arms race with the Soviet Union argue against Middendorf's position? What might Admiral Mahan recommend?

3. Should government policies be changed so as to encourage a strong American merchant marine, and if so, how?

SUGGESTED GUIDELINES

1. Consider Mahan's arguments in Unit One.

2. Review the status of American merchant shipping today as described by the Marine Board of the National Academy of Engineering. Why must American shipping be subsidized?

3. Consider Kahn's and Mostert's explanations of why flag of convenience registration is economically attractive to American ship owners.

4. What arguments does the Marine Board give in favor of building a stronger American merchant marine?
5. Can we rely on flag of convenience ships and crews in wartime? (Consult Mostert here.)
6. Should the Soviet merchant fleet build-up affect United States policy toward our own merchant marine?
 - a. Consider Quester's analysis.
 - b. Why does the Marine Board consider the Soviet build-up an economic threat?
7. If the "Pacific Trading and Investment Area" Kahn describes will be increasingly important to us, should we let other nations carry out the merchant marine functions involved?
8. Now review the policy changes the Marine Board recommends.
 - a. Which seem attainable?
 - b. Can technology close the cost gap between cheap foreign labor and high American labor costs?
 - c. Will labor unions allow further mechanization?
 - d. How much should American taxpayers be willing to subsidize merchant shipping?

4. Considering the safety record of VLCCs operated under flags of convenience, what can be done to overcome this threat to human life and to the environment?

SUGGESTED GUIDELINES

1. Consult Kahn's second newspaper article.
2. Then review Mostert's description of the accidents these ships have been involved in.
3. Consult, too, the articles on oil pollution in Unit Four.
4. If some of these accidents involved American-owned ships, could the United States government do anything to prevent such irresponsible operation?
5. According to Kahn, what role do insurance companies play?
6. If the flag of convenience procedure reduces the ship owner's legal vulnerability, how have individual injured nations obtained payment for damages?
7. Why have these penalties failed to deter further carelessness?
8. If most of these accidents occur in territorial seas, is it the responsibility of individual nations to police these areas?

9. If international standards and rules should be set, what should they be, and how could they be enforced?

SUGGESTED READING, *Law of the Sea*, William T. Burke.

BOOKS

Christy, F. T., Jr. *Alternative Arrangements for Marine Fisheries: An Overview*. Washington, D.C.: Resources for the Future, 1973. The author argues that the freedom of fishing that has prevailed for centuries is leading to the waste of scarce resources and is no longer suitable to today's world. Asking "how fisheries can be managed so as to maximize the production of net benefits," he considers alternatives ranging from strong coastal state control to control by an international body.

Christy, F. T., Jr., et al. (eds.). *The Law of the Sea: Caracas and Beyond* (Proceedings of the Ninth Annual Conference of the Law of the Sea Institute, University of Rhode Island). Cambridge, Mass.: Ballinger Publishing Co., 1975.

An examination of the results of the Caracas session of the third United Nations Conference on Law of the Sea. Problems of seabed mining and impact of technological change on the future law of the sea are emphasized.

ARTICLES

"Law of the Sea: From Caracas to Geneva—A Time for Decision." *Columbia Journal of Transnational Law*, 14: 1-117 (1975).

Nye, J. S. "Ocean Rule Making from a World Politics Perspective." *Ocean Development and International Law Journal*, 3:29 (1975).

Osgood, R. "U.S. Security Interests in Ocean Law." *Ocean Development and International Law Journal*, 2:1 (1974).

SUGGESTED READING, *The Sea: Defensive Barrier or Invasion Path?* Herman Kahn

BOOKS

Earle, Edward Mead (ed.). *Makers of Modern Strategy: Military Thought from Machiavelli to Hitler*. Gordon A. Craig and Felix Gilbert, collaborators. Princeton, N.J.: Princeton University Press, 1941. A collection of articles by distinguished authors on some of the leading strategic thinkers from the sixteenth century to the beginning of World War II. Particularly recommended is the article "Mahan: Evangelist of Sea Power" by Margaret T. Sprout.

Quester, George H. (ed.). *Sea Power in the 1970s*. New York: Dunellen, 1972. A group of papers presented at the Conference on Problems of Naval Armaments, convened in April 1972 by the Cornell University Program on Peace Studies. Various aspects of the growing competition between the Soviet Union and the United States on the high seas are considered.

Potter, E. B. (ed.). *Sea Power: A Naval History*. Englewood Cliffs, N.J.: Prentice Hall, 1960. A group of twelve authors, all teachers of naval history at the United States Naval Academy, prepared this history of naval war-

fare from ancient times until the present. The emphasis is in American naval power and the role of sea power in the exercise of national power. Admiral Chester W. Nimitz was associate editor of the volume.

Richmond, Herbert. *Sea Power in the Modern World*. New York: Reynal and Hitchcock, 1934. Reprinted 1972 by Arno Press. An examination of Mahan's ideas in light of the developments in politics and technology of the first three decades of the twentieth century.

Walters, Robert E. *Sea Power and the Nuclear Fallacy: A Re-Evaluation of Global Policy*. New York: Holmes and Meier, 1975. (Original title, *The Nuclear Trap*). Taking a

geopolitical approach, the author argues that the United States is geographically and militarily superior to the Soviet Union and can therefore afford to decrease its reliance on nuclear power. He speculates on the role of submarines in the future and urges increased utilization of the sea and its resources.

ARTICLES

Stone, Norman L. "The Trend in Naval Power: A Crisis of Resolve." *United States Naval Institute Proceedings*, July 1975.

Oi, Atsushi. "Why Japan's Anti-Submarine Warfare Failed." *United States Naval Institute Proceedings*, June 1952.

SUGGESTED READING, *The Sea: Connector or Barrier?* Herman Kahn

BOOKS

Frankel, Ernst G. and Henry S. Marcus. *Ocean Transportation*. Cambridge, Mass.: MIT Press, 1973. An analysis of the development and status of ocean transportation, based on a research project of the Massachusetts Institute of Technology Sea Grant Program. Among the topics discussed are technology, the role of the government in financing shipping, maritime labor relations, and insurance. Also included are projections of shipbuilding capacity and supply and demand factors for the next decade.

ARTICLES

Alexander, L. M. "Extended Economic Zone and U. S. Ocean Interests." *Columbia Journal of World Business*, Spring 1975.

McDonald, David L. "Carrier Employment Since 1950." *United States Naval Institute Proceedings*, November 1964. pp. 26-33.

Saunders, George D. "Containers and Container Ships." *United States Naval Institute Proceedings*, April 1963, pp. 58-56.

Summerfield, Edward R. "Protection of Merchant Shipping." *United States Naval Institute Proceedings*, September 1964, pp. 40-47.



The Whaling Museum, New Bedford, Massachusetts

UNIT SIX

MEN AND WOMEN AT SEA

NEWSPAPER ARTICLES

14. *Ships and the Sailor*
J. H. Parry

READER SELECTIONS

- The Medieval Sailor*
Geoffrey Chaucer
- The Minor Horrors of the Sea*
Eugenio de Salazar
- Rotting Ships, Rotting Men*
J. H. Parry
- A Naval Officer's View of Naval Discipline*
Frederick Chamier
- A Sailor on Impressment*
- Daily Routine in a Sailing Warship*
Bill Truck
- Sea Language*
J. H. Parry
- Handing Sail in a Squall*
Richard Henry Dana
- A Clipper Captain's View on Steam*
John Masfield
- At Sea in Sail: The 1880s*
A Foremast Hand
- Haul Away, Joe*
- Life on a Trawler*
Jeremy Tunstall

15. *Women and the Sea: Not All
on Widows' Walks*
Constantina Safilios-Rothschild

Sea Nymphs of Japan

Luis Marden

Singlehandlers

Francis Chichester

Women as Passengers: A Voyage to India

Emma Roberts

Women on Warships: Navy Wives React

Linda Charlton

The Fisherman and His Wife

H. Russell Bernard

16. *From Work to Sport*
Heywood Hale Brown

A Royal Sport

Jack London

*The Quest for the America's Cup:
Lipton's Last Try*

Henry R. Illesley and Lincoln A. Werden

The Big One

Zane Grey

Solitude

Joshua Slocum

Across the Pacific by Raft

Thor Heyerdahl

Swimming the Hellespont

André Maurois

LEARNING OBJECTIVES

To understand

- what the life of the sailor has been like in the past in terms of work, social organization, living conditions, and health
- how the life of the modern sailor compares with that of the sailor of an earlier era
- how technology has changed the life of the sailor through the centuries
- the roles that women have traditionally occupied in seafaring communities
- the prospects for changes in the roles of women at sea
- why men and women have ventured on the sea for work and for sport
- the effect of the challenge of the sea on the human spirit

OVERVIEW

This unit turns from the larger focus of international issues to take a close look at the personal experience of men and women whose lives are tied to the sea, either as a livelihood or as a sporting challenge. The first newspaper article and group of *Reader* selections deals with shipboard life. Most of these materials involve only men since the sea has traditionally been a masculine preserve that few women have invaded in any role other than as ship's passengers. The second portion of the unit explores some of the different ways women have been associated with the ocean world. The final section concerns the sporting aspects of sea experience.

J. H. Parry's newspaper article examines ships and the life of the seafaring man from the time the first primitive rafts and boats were fashioned to the present. He shows how the sailor's lot has changed over the centuries with new technologies and techniques.

Reader selections for this section open with

Chaucer's fourteenth-century description of an English "shipman," a skilled and seasoned veteran of the trade that later helped to build the British Empire. Eugenio de Salazar's account of a voyage to the West Indies in the late sixteenth century details facets of shipboard life that changed little over the centuries: the seasickness, foul food and water, lack of privacy, discomforts, and boredom that passengers endured and the disciplined, hierarchical community the crewmen formed. In his first *Reader* selection, Parry elaborates on his earlier references to health problems at sea, describing the diseases that were the main cause of death, as well as misery, for sailors in the British navy. He tells how many of these health hazards, particularly the dreaded vitamin-deficiency disease, scurvy, were finally overcome.

Two other unpleasant aspects of early nineteenth-century British navy life—corporal punishment and impressment (forced enlistment)

—are defended by an officer, and a seaman agrees that without impressment there would probably be neither navy nor merchant marine. Another selection describes the daily routine on a British man-o'-war during the same period, explaining the mysteries of the "bells" system that regulated sailors' activities. Parry's second *Reader* article traces the sources of the British sailor's special jargon and shows its influence on English language and literature. The selection from Richard Henry Dana's *Two Years Before the Mast* illustrates "sailor's English" as he describes the teamwork involved in taking in sail in a storm.

When steam replaced sail, the challenge to the seaman lessened along with the dangers and discomforts of shipboard life. The contempt the sailing-ship captain in John Masefield's story expresses for steamships and their men reflects the pride "canvas" sailors took in successfully meeting that challenge. But with the pride often came "mostly grief," as a "foremast hand" relates in the selection from Alan Villiers' book. His account of ill treatment under a tyrannical captain and the ways the men retaliated shows a side of seamen's life that was not at all romantic, although he could still say that "the finest sight in the world is a full-rigged ship under sail." Chanteys like "Haul Away, Joe" helped the men to perform their tasks and to express some of their feelings about the sailor's life. The rigid hierarchy of roles aboard ship is one of the aspects of modern shipboard society that sociologist Jeremy Tunstall discusses in "Life on a Trawler." His analysis of the relationships among a particular kind of seafaring men and the effect of their way of life upon them shows how alienated some seamen can become from the larger society on land.

The newspaper article by Constantina Safilios-Rothschild introduces the second subject of this unit, women's relationship to the sea. As she points out, women have generally been excluded entirely from sea-going occupations. Although in

some cultures, and sometimes in periods of crisis, women have lived or worked on boats, for most women their relationship to the sea has been indirect, through the activities of their family men. Despite recent breakthroughs for women, Safilios-Rothschild concludes that "the sea remains a masculine territory."

The ama divers of Japan that Luis Marden's *Reader* article describes are an exception to this generalization. They have made one ocean occupation "feminine territory" for hundreds of years. Here, a special physical characteristic of women—their thicker layer of body fat—made them clearly better suited than men to the job. That women can perform seamanship roles successfully and "master" the sea is shown in Ann Davison's account of her solo crossing of the Atlantic in a small sailboat. But most women who went to sea in the past went only as passengers. The advice Emma Roberts gave mid-nineteenth-century "ladies" who would travel by ship reflects the sex-related "sensibilities" Victorian culture encouraged in women. New attitudes toward women's proper roles are emerging, but not without opposition from men and women who feel threatened by change. Linda Charlton's *New York Times* report of navy wives' response to a ruling allowing women to serve on warships reveals not only their own jealousies and fears but also their conception of the nature of male society on board ship.

Navy wives are only one of the many groups of women whose lives are shaped by their husbands' lengthy absences at sea. H. Russell Bernard's sociological study of the sponge fishermen of Kalymnos, Greece, and their wives describes the difficult position these women fill in a society where the double standard of sexual morality is an important cultural element. Both envied and maligned by other women, the sponge fisher's wife must finely balance responsible independence and deference to her husband's authority in order to protect both his honor and their children's welfare. The resultant social and

psychological strains add to the anxieties inherent in the husband's dangerous occupation.

Heywood Hale Broun's newspaper article takes a light-hearted look at the "paths to pleasure" the ocean also offers us. He singles out channel swimming, "single-hander" sailing, and sport fishing. *Reader* selections illustrate other sporting challenges of the sea as well. Jack London describes his introduction to "surf riding," a Hawaiian "royal sport" that has become increasingly popular in the United States in recent decades. A sport that has largely been the province of "economic royalty," ocean yacht racing, is the focus of the *Reader* selection about the 1930 America's Cup races. The deep-sea sport-fishing that Zane Grey describes is another way man has pitted his skills against the sea for pleasure purposes, transforming what is ordi-

narily a form of work into "play."

As Broun suggests, it is sometimes difficult to understand why people undertake challenging sea adventures. *Reader* selections by solo-sailor Joshua Slocum and the *Kon-Tiki's* captain, Thor Heyerdahl, reveal their responses to the "vast blue sea" whose lonely reaches they invade. Whether motivated by personal or scientific interests, "sporting" encounters with the sea in which men, and women like Ann Davison, revert to more primitive technologies seem intended to prove self-mastery as well as mastery of the sea. As the final *Reader* selection describing Lord Byron's swim across the Hellespont shows, personal pride in proving physical capacity to perform in an alien environment enhances the pleasure human beings experience in entering the ocean frontier.

KEY CONCEPTS

SEAFARING TECHNOLOGY

As J. H. Parry's newspaper article outlines, technology has given man the tools and skills to take resources from the sea and to travel upon it. Improvements over time in vessel design and equipment, propulsive mechanisms, navigation methods, and fishing techniques altered seafaring life. A steady reduction in necessary manpower has been one of the primary effects of technological improvements at sea as it has been on land. As sail replaced human muscle, steel replaced wood, steam replaced sail, and modern automation further replaced human functions, the distances ships could travel and the risks involved as well as the numbers of crewmen needed have changed. When ships could venture farther and remain longer at sea, safety and health hazards emerged that later technological developments helped to alleviate. As other units have shown, in this century new technologies have opened the undersea

world to man as well as altering naval and commercial ocean activities and the lives of seafarers. But just as the technology that made long ocean voyages possible required increased social cooperation among crewmen, it would appear that social creativity must accompany technological innovation if man is to reap optimum benefits from his involvement with the ocean world.

HEALTH HAZARDS AT SEA

In addition to the dangers of accidental injury, being washed overboard, attacked by pirates, or shipwrecked, seafarers faced health hazards as well. Dampness, cold, inadequate food, and foul water predisposed both sailors and passengers to illness; and communicable diseases spread rapidly in any crowded, closed community, particularly if sanitation methods are primitive. As Parry notes, besides rheumatic complaints, shipboard life until recent times involved high risk of contracting typhus, dysentery, malaria,

and yellow fever. Until the nineteenth century, scurvy, caused by lack of vitamin C, was the sailor's scourge, causing-rotting gums, swollen joints, weakness, and, eventually, death. Through advances in medical knowledge, improvements in living and sanitation conditions, canning and refrigeration of foods, health hazards at sea are now little greater than on land, although distance from medical treatment facilities still involves greater risk for some seafarers.

SHIPBOARD SOCIAL ORGANIZATION

The isolation of shipboard life creates self-contained social communities that are, as Salazar observed, much like a town or city. Passengers excepted, these have largely been male societies, organized in a hierarchical structure based on the functions of different members. The necessity of close teamwork if the group was to survive encouraged the development of social cooperation that was enforced by strict discipline. Like people in other isolated societies, members of these communities have developed their own special cultural forms—language, recreations, and arts (as Unit Two detailed). Like other all-male societies, separation from the opposite sex involved strains that have attracted little analysis. 'Sailors' reputation for sexual promiscuity was not, of course, deserved by all seafaring men, but long absences from wives and families affected not only life at sea but also the lives of the women and children the men left at home, as Bernard's *Kalymnos* study shows.

Since the promise of gain could not always outweigh the dangers and discomforts of life at sea, particularly in the case of naval fighting-ships, until our own enlightened age *impressment* (forced enlistment), *shanghaiing* (kidnapping crewmen), and stringent *corporal punishment* of lazy or insubordinate crewmen were common. These practices created discontents that, combined with the impossibility of escape while at sea, often made a ship not unlike a floating

prison. Men serving under tyrannical officers often took the first opportunity to "jump ship," as one *Reader* account indicates, although the incidence of discontent should not be exaggerated. Nevertheless, the men who have created successful seagoing communities have learned how to live together cooperatively in close quarters for the mutual benefit of all.

SEXISM AT SEA

Sexism, like racism, is a set of attitudes and processes through which societal roles and opportunities are assigned on the basis of one group's physical differences from another, in this case on the basis of sex characteristics. In most societies the roles of men and women are sharply defined by sex, with the more powerful, prestigious, and profitable roles assigned to men. In addition to limiting women's participation in the society's decision-making processes, sex-role stereotyping has limited women's access to many occupations. In the case of seafaring, women have been almost entirely excluded. Recently a few women have cracked the barrier to "line" jobs at sea in merchant shipping, fishing, oceanography, and even now in the navy. But as *Reader* selections for this unit show, societal resistance to direct participation of women in seagoing activities is still strong, particularly in the Western democracies. Only time will tell whether recent advances in women's rights and responsibilities will prove to be permanent, or whether developments will bring about a reversal, as has happened often in the past. In that event sexism will assure that women's roles in ocean activities will remain indirect, through the involvement of their family men, or supportive, through onshore service occupations.

THE SEA AS SPORTING CHALLENGE

Although human beings have invaded the ocean frontier primarily out of necessity, many

have turned to the sea purely for the pleasure it affords. Beyond the simple delights of ocean swimming, people have developed sporting activities that reflect work activities associated with the sea as well as man's happy capacity to enjoy his world. The amateur angler, scuba diver, ocean naturalist, or boating enthusiast mimics for pleasure the "serious" work others are paid to perform. Other sea sports like surfing have no analogy to work and are purely pleasurable inventions. Most of the materials in this unit regarding sea "sport," however, reflect other facets of human nature—the competitive spirit and the desire to prove one's self in voluntary contests with the forces of nature. In the elaborate competitions we create involv-

ing sea activities, from "rough water" swimming races to the America's Cup to going after record sport-fishing catches, men and women measure themselves against each other as well as against nature. But the "single-hander" sailors who cross the oceans in small boats, the Thor Heyerdahls who test scientific theories as much for personal gratification as for science, the Byrons who swim channels primarily to prove they can—these adventurers risk their lives in pursuit of a kind of spiritual satisfaction that most pleasure seekers forego. But on whatever level people become involved with the sea for the mere joy of it, the ocean frontier offers immensely satisfying opportunities and rewards.

FACTUAL REVIEW QUESTIONS

1. How did the development of sail affect shipping?
2. How did long voyages affect sailors' lives?
3. What diseases were most common on ships?
4. When and how was scurvy finally prevented?
5. What were shipboard conditions like in the sixteenth century?
6. What was "impressment," and why was it necessary?
7. How does the bell system aboard ships operate?
8. How are the "dog watches" different from others?
9. What is meant by "warming the bell" and "tapping the admiral"?
10. What is a clipper ship?
11. According to the "foremast hand," which country's ships were better manned?
12. What is a "sea chantey"?

13. What is a trawler, and what are some of the features of trawler life?
14. In what countries do women serve in the merchant marine?
15. What are the "ama," and what equipment do they use?
16. How big was Ann Davison's boat?
17. Why did Emma Roberts advise "ladies" to choose upper cabins?
18. What was "Z-Gram Number 116," and how did navy wives react to it?
19. How long at a time are Kalymos sponge fishers away from home, and what problems does this create?
20. What does Bernard consider "the basic quality of male-female relationships" in sponge-fisher families?
21. What is *philotimo*?
22. Who first swam the English Channel? When?
23. What is a "single-hander"?
24. What is the America's Cup?
25. In his account in the *Reader*, what kind of fish did Zane Grey catch and where?
26. What did Joshua Slocum do to alleviate loneliness?
27. What was *Kon-Tiki*, and what was the purpose of Heyerdahl's voyage?
28. What is the Hellespont?

ESSAY AND DISCUSSION QUESTIONS

1. Trace the effects of technological development on life at sea.

SUGGESTED GUIDELINES

1. Review Parry's newspaper article.
2. Consult readings for other units as well as this one for examples of the developments he describes. Consider modifications in vessel design and materials, navigation techniques, the use of sail, steam, and other means of propulsion, and powered machinery.
3. How were voyage times and distances and crew sizes affected?
4. How did technology affect safety and health?
5. How have technological changes affected trading and other commercial activities such as the whaling and fishing industries?
6. Consider, too, new sea habitats—ocean oil-drilling installations, undersea craft, "superships," and high-speed vessels.
7. What changes has technology brought in navy life?

2. Considering both physical conditions and social factors, how does shipboard life today compare to that of the past?

SUGGESTED GUIDELINES

1. Observe that some physical and social factors will vary considerably depending on the function of the ship (e.g., fishing, commerce, navy), the roles of individuals (e.g., captain, cook, passenger), and the circumstances of a particular ship (e.g., poorly maintained or "shipshape," well officered or not), as well as over time.
2. Again, review other units, particularly Units Two and Five, as well as this one for relevant materials in considering such elements as quality of food, other physical comforts, privacy, health, risk of injury or death, and social opportunities and constraints.
 - a. Which of these were similarly experienced by every seafarer in a particular era? In every era?
 - b. Which of these have improved today?
 - c. Have any pleasurable aspects of sea life been lost in the process?
3. If you wish, focus on a particular kind of shipboard life (e.g., the navy, trawling, whaling) to detail certain contrasts.

3. Argue for or against the proposition that women should have equal opportunities for participation in ocean activities.

SUGGESTED GUIDELINES

1. Review Safilios-Rothschild's newspaper article and the *Reader* selections that supplement it.
 - a. Why have women been excluded from ocean pursuits in the past?
 - b. Which of the traditional reasons for women's exclusion are still given today?
 - c. In your view, which if any are valid?
2. If you consider women incapable of doing these kinds of work, do you think their incapacity is "ordained by nature" or culturally conditioned?
3. Do any of the examples Safilios-Rothschild gives of women's success at ocean activities argue in favor of their full participation?
4. Should the achievements of individual women like Ann Davison or groups like the ama be taken as exceptions that prove the traditional rule?
5. Would the arguments offered by the protesting American navy wives apply to other ocean work?
 - a. How significant is the danger of sexual involvement?
 - b. Would shipboard social life be disrupted, improved, or unaffected by women's presence?
 - c. What role do family considerations play in social attitudes toward women working at sea?
 - d. Would women threaten crewmen's efficiency?
6. Given today's technology, are physical size and strength differentials between the sexes important?
7. Should women be protectively excluded from all dangerous occupations?
8. Would you approve of qualified women serving in some lines of ocean work but not others—for example, in the merchant marine but not in naval ships?

4. Citing specific examples, describe the kinds of pleasures, aside from economic rewards, the ocean frontier affords human beings.

SUGGESTED GUIDELINES

1. Considering materials in earlier units as well, analyze the different accounts in the readings in terms of physical, intellectual, aesthetic, social, or spiritual satisfactions illustrated.
2. For example, review Cousteau's Unit One description of the physical sensations, intellectual

rewards, and aesthetic pleasures of scuba diving.

3. How does the art and literature in Unit Two both provide and illustrate certain kinds of satisfactions? Why is the poet of "Sea Fever" attracted to the ocean life?
4. Which readings illustrate the joys of discovery that scientific involvement with the sea can bring? Consider here fields like archaeology as well as marine geology, biology, and so forth.
5. Ask what kinds of social satisfactions seafaring men enjoy.
6. Review Broun's newspaper article and the last group of *Reader* selections for this unit. How does competition with others figure in ocean sports?
7. Regarding the spiritual satisfaction of proving one's self in the ocean environment, consider also selections in Unit Two, such as "Dauber" or "The Open Boat," and Ann Davison's account.

SUGGESTED READING, *Ships and the Sailor*, J. H. Parry

Dana, R. H., *Two Years Before the Mast*. New York, 1840, and many subsequent editions. One of the great classics of sea literature by an articulate and educated man who sailed as a foremast hand in a small sailing ship between New England and California.

Davis, R. *The Rise of the English Shipping Industry in the Seventeenth and Eighteenth Centuries*. London, 1963. The best brief study of the economics of shipping in that period, with valuable chapters on conditions of employment at sea.

Hardy, A. C. *The Book of the Ship: An Exhaustive Pictorial and Factual Survey of the World's Ships, Shipping and Shipbuilding*. New York, 1949. The best general survey of modern shipping.

Hornell, J. *Water Transport, Origins and Early Evolution*. Cambridge, 1946. The standard work on primitive water craft as they survive today.

Keevil, J. J., C. Lloyd, and J. L. S. Coulter. *Medicine and the Navy, 1200-1900*, 4 vols. London, 1956-1963. An exhaustive history of health and disease in the British Navy, but with much information about health at sea in general.

Landström, B. *The Ship*. London, 1961. A picture book, by a competent marine artist, of the development of ships from the earliest time to the present day.

Lloyd, C. *The British Seaman, 1200-1800, A Social Survey*. London, 1969.

Moster, Noël. *Supership*. New York, 1976. A carefully documented and disturbing account of the recent development of very large oil carriers.

Parkinson, C. N. *The Trade Winds*. London, 1968. A collection of essays on the shipping industry in the late eighteenth and early nineteenth centuries.

Parry, J. H. *The Discovery of the Sea*. New York, 1974. An illustrated account of the discovery that all seas are connected, and of the ships and seamanship employed in it.

Taylor, E. G. R. *The Haven-finding Art*. London, 1967. The best general survey of the development of navigation from Odysseus to Cook.

Villiers, A. *The Way of a Ship*. New York, 1953. The most comprehensive account of sailing ships, their working, and the life in them during the last fifty years of sail by an author with wide experience as seaman, master, and owner.

SUGGESTED READING, *Women and the Sea*, Constantina Safilios-Rothschild

BOOKS

Grönseth, Erik. *Reactions of Seamen's Wives to Frustrations Resulting from the Absence of Their Husbands*. Oslo: Institute of Sociology, 1969.

Weibust, Knut. *The Crew As a Social System*. Oslo: Batgransking, Norsk Sjøfartsmuseum, 1958.

ARTICLES

Andersen, Raoul, and Cato Wadel. "Land and Sea-Fishermen and Their Women." In Raoul Andersen and Cato Wadel (eds.): *North Atlantic Fishermen*. Newfoundland Social and Economic Papers no. 5, Institute of Social and Economic Research, Memorial University of Newfoundland, 1972 (Printed by the University of Toronto Press), pp. 141-147.

Anonymous. "New Bedford Fishermen's Wives Work to Save Jobs, Industry." *Maritime*, August 1970, pp. 27-30.

Collins, Ann. "The Social Efficiency of Conflict Aboard an Oceanographic Research Vessel." Addendum to Office of Naval Research (ONR) report BK-103-74 under contract #N00-014-73-A-0417-0001.

Comer, Nancy Axelrad. "Waterworks: Five Women in Oceanography." *Mademoiselle*, June 1974.

Firth, Rosemary. "The Position of Women." Chapter 2 in Rosemary Firth. *Housekeeping Among Malay Peasants*. 2nd Ed. New York: Humanities Press, 1966.

Isay, Richard A. "The Submariners' Wives Syndrome." *Psychiatric Quarterly*, 42 (1968), pp. 647-652.

Murdock, George P. and Caterina Provist. "Factors in the Division of Labor by Sex: A Cross-Cultural Analysis." *Ethnology*, April 1973, pp. 203-224.

Stiles, Geoffrey R. "Fisherman, Wives and Radios: Aspects of Communication in a Newfoundland Fishing Community." In Raoul Andersen and Cato Wadel (eds.). *North Atlantic Fishermen*. Newfoundland Social and Economic Research, Memorial University of Newfoundland, 1972 (Printed by the University of Toronto Press), pp. 34-60.

Williford, Miriam. "Lost Women: Ann Bonney and Mary Read—Move Over Errol Flynn." Ms., February 1974, pp. 24-26.

SUGGESTED READING, *From Work to Sport*, Heywood Hale Broun

Chichester, Francis. *The Gipsy Moth Circles the World*. New York: Coward, McCann and Geohagen, 1968. An account of Chichester's epic voyage, in which he sailed alone around the world in his fifty-three-foot yacht, *Gipsy Moth IV*.

Follet, Tom, Dick Newick, and Jim Morris. *Project Cheers: A New Concept in Boat Design*. London: Adlard Coles, 1969.

Jones, Theodore A. *Racing for the America's Cup, 1974: The View from the Candy Store*. New York: New York Times Book Co., 1974. A wealth of facts and figures about the race and racing conditions are combined with reporting about individuals from the principals concerned to the residents of Newport.

Robertson, Dougal. *Survive the Savage Sea*. New York: Praeger, 1973. The author gives a gripping, first-hand account of how he, his wife, three sons, and a young guest survived for thirty-eight days at sea after killer whales attacked and sank his schooner west of the Galapagos Islands.

Slocum, Joshua. *Sailing Alone Around the World*. Atlantic Highlands, N.J.: Humanities Press (Mariner's Library), 1948. A matter-of-fact account of the first solo voyage around the world at the end of the nineteenth century.

APPENDIX: MARITIME AND NAVAL MUSEUMS

There are dozens of museums across the country concerned with various aspects of the oceans. Museum with collections regarding maritime and naval history and affairs are listed below; aquariums and museums that feature marine life exhibits are listed on p. 86. Specialized collections or those of unusual interest have been noted.*

ARKANSAS

River Museum
111 E. 3rd
Little Rock, AR 72201

Collections: paintings illustrating history of the Arkansas River area; early racing shellboat; scale model of Arkansas River Navigation System; U. S. Coast Guard display.

CALIFORNIA

Allen Knight Maritime Museum
550 Calle Principal
P. O. Box 805
Monterey, CA 93940

Maritime Museum Association of San Diego
1306 N. Harbor Drive
San Diego, CA 92101

Museum of the Sea Aboard the Queen Mary
P.O. Box 20890
Long Beach, CA 90801

Collections: artifacts and papers relating to the ship's history.

Naval Training Center Historical Museum
Naval Training Center
San Diego, CA 92133

San Francisco Maritime Museum Association
Foot of Polk Street
San Francisco, CA 94109

Collections: 70,000 photographs and negatives of ships and shipping ports, largely West Coast; audio tapes of old-time seafaring men.

San Francisco Maritime State Historical Park
2905 Hyde Street
San Francisco, CA 94109

Collections: artifacts relating to California life and shipping of the period from 1890 to 1935.

CONNECTICUT

Marine Historical Association, Inc.,
Mystic Seaport
(A), Greenmanville Avenue
Mystic, CT 06355

Collections and displays: items demonstrating the nineteenth century skills and trades of the sea; exhibits of maritime treasures; tavern; counting house; sail and rigging lofts; apothecary shop; chapel; general store; clock shop; American art collections of the sea; marine; philately; chandlery; shipsmith shop. Old sailing vessels are tied up at the wharf.

DISTRICT OF COLUMBIA

Truxtun-Decatur Naval Museum
1610 H. Street, N.W.
Washington, D.C. 20006

* Most of the information for this compilation has been drawn from the *Official Museum Directory*, published by the American Association of Museums. (Washington, D.C.: National Register Publishing Co., 1973.)

GEORGIA

Confederate Naval Museum
202 4th Street
Columbus, GA 31901

Collections: Confederate naval gunboats.

Fort Jackson Maritime Museum
P.O. Box 2132
Savannah, GA 31402

Georgia Historical Commission
116 Mitchell Street, S.W.
Atlanta, GA 30303

Collections: general museum includes marine items.

Ships of the Sea Museum
503 E. River Street
Savannah, GA 31401

Collections: ship models; ships in bottles; figure-heads; scrimshaw; re-creation of carpenter's shop and chandlery.

IOWA

Keokuk River Museum
Foot of Johnstone Street
Keokuk, IA 52632

Collections: marine and river transportation

MAINE

Bath Marine Museum
963 Washington Street
Bath, ME 04530

Collections related to Maine maritime history: paintings, models, tools, small boats; other sites in area include shipyard where wooden sailing vessels were made and an exhibit of sailors' life at sea.

Penobscot Marine Museum
Church Street
Searsport, ME 04974

Collections: paintings, prints, models, nautical memorabilia.

Sailor's Memorial Museum
Isleboro, ME 04848

MARYLAND

Chesapeake Bay Maritime Museum
P. O. Box 636
St. Michaels, MD 21663

Collections: aquarium; historic vessels afloat on waterfront; preservation project; maritime; waterfowling; historic artifacts of the Chesapeake Bay area.

Dragonfish, Maryland Naval Militia
Submarine
Pier 4, Pratt Street
Baltimore, MD 21202

Collections: battle flags; pictorial views and plans of submarines from 1779-1972; medals and captured weapons from enemy submarines and surface ships.

United States Frigate *Constellation*
Constellation Dock Pier, One Pratt Street
Pier 4, Pratt Street
Baltimore, MD 21202

Historic ship museum.

United States Naval Academy Museum
Annapolis, MD 21402

Collections: paintings; models; weapons; flags; numismatics; manuscripts and memorabilia of officers.

MASSACHUSETTS

Battleship *Massachusetts*
Battleship Cove
Fall River, MA 02721

Historic ship museum.

Cohasset Maritime Museum
Elm Street
Cohasset, MA 02025

Francis Russell Hart Nautical Museum
77 Massachusetts Avenue
Cambridge, MA 02139

Collections: rigged and half models of merchant ships; naval ships; yachts.

Kendall Whaling Museum
Everett Street
Sharon, MA 02067

Collections: marine and whaling folklore.

Nantucket Historical Association
Old Town Building
Box 1016
Union Street
Nantucket, MA 02554

Collections: general museum including marine materials.

Nantucket Whaling Museum
Broad Street
Mailing address: Box 1016, Fair Street
Nantucket, MA 02554

Collections: full size brick tryworks; rigged whale boat; scrimshaw; whale skeleton; South Seas room; cooper and blacksmith shops.

New Bedford Free Public Library
613 Pleasant Street
New Bedford, MA 02741

Collections: whaling prints and paintings; works by New Bedford artists.

New Bedford Whaling Museum
18 Johnny Cake Hill
New Bedford, MA 02740

Collections: gear and tools associated with whaling industry; model of whaling ship; ships carvings; scrimshaw.

Peabody Museum
161 Essex Street
Salem, MA 01970

Collections: artifacts from South Pacific; sailors' memorabilia including scrimshaw, models, navigational instruments; photographs, paintings. Museum originally established in 1824 by group of sea captains to house the "natural and artificial curiosities" they had gathered on their voyages around Cape Horn and the Cape of Good Hope.

Salem Maritime National Historic Site
Custom House
Derby Street
Salem, MA 01970

Collections: customs records; customs service weighing and measuring devices and equipment of 19th century.

USS *Constitution*
Boston Naval Shipyard
Boston, MA 02129

Collections: 44 gun frigate; exhibits of cannon; newspaper accounts of the War of 1812.

MICHIGAN

Dossin Great Lakes Museum
Belle Isle
Detroit, MI 48207

Collections: ship models, paintings, antique and modern nautical items, photographs, information on Great Lakes ships; restored interior from the former lake steamer *City of Detroit III*.

MISSISSIPPI

Steamer *Sprague*
City Waterfront
P. O. Box 848
Vicksburg, MS 39180

Collections: marine exhibits; steamboat; world's largest stern wheeler.

MINNESOTA

Steamer *Julius C. Wilke*
Levee Park
Winona, MN 55987

Collections: underwater archaeology; archives; steamboat graphics.

NEW YORK

East Hampton Town Marine Museum
Hither Lane
East Hampton, N. Y. 11937

Collections: materials relating to whaling.

Historical Society of Greater Port Jefferson
Box 586
Port Jefferson, N. Y. 11777

Collections: maps; half hulls; paintings; sail-maker's tools; shipbuilder's tools; looms.

Marine Museum of the City of New York
Fifth Avenue at 103rd Street
New York, NY 10029

New York State Maritime Museum
South and Fulton Streets
New York, N. Y. 10038

Collections: outdoor museum; transportation; commercial and cultural maritime history.

The South Street Seaport Museum
16 Fulton Street
New York, N. Y. 10038

Collections: marine art and memorabilia; archaeology; folklore; hull of square rigged ship *Waverfree*; iron schooner *Caviare*; original *Ambrose Light Ship*.

Suffolk County Whaling Museum of Sag Harbor,
Long Island
Main Street
P. O. Box 327-A
Sag Harbor, N. Y.

Suffolk Marine Museum
Montauk Highway
West Sayville, N. Y. 11796

NORTH CAROLINA

Alphonso Whaling Museum
Front Street
Beaufort, N. C. 28516

USS *North Carolina* Battleship Memorial
P. O. Box 417
Wilmington, N. C. 28401

Collections: World War II and U.S. Navy paintings; Kingfisher float plane.

OHIO

Campus Martius Museum
601 2nd Street
Marietta, OH 45750

Collections: marine archaeology; culture of Northwest Territory; river history; steamer, *W. P. Snyder, Jr.*

Great Lakes Historical Society Museum
480 Main Street
Vermilion, OH 44089

Collections: Great Lakes ship models; paintings; photographs; marine artifacts, relics; engines; yachting and racing artifacts.

OREGON

Columbia River Maritime Museum
16th and Exchange Streets
Astoria, OR 97103

Collections: ship models; navigation instruments; shipbuilding and rigging gear; small crafts; marine artifacts.

PENNSYLVANIA

Flagship *Niagara*
Foot of State Street
Erie, PA 16507

Collections: exhibitions pertaining to the Battle of Lake Erie.

Philadelphia Maritime Museum
321 Chestnut Street
Philadelphia, PA 19106

TEXAS

The Admiral Nimitz Center
304 E. Main Street
Fredericksburg, TX 78624

Collections: historic photographs, documents, and artifacts of World War II in the Pacific; items relating to the career of Admiral Nimitz.

Battleship *Texas*
3901 Westheimer
Houston, TX 77027

Historic ship museum.

VIRGINIA

The Mariners Museum
Museum Drive
Newport News, VA 23606

Collections: marine paintings; models; instruments; ceramics; glassware with nautical themes.

Portsmouth Naval Shipyard Museum, Inc.
2 High Street
P. O. Box 248
Portsmouth, VA 23705

Collections: history of the naval shipyard, Portsmouth area and the armed forces of the locality; the CSS *Virginia*, also known as the *Merrimac*.

WASHINGTON

Naval Shipyard Museum
Washington State Ferry Terminal Building
837 Fourth Street
Bremerton, WA 98310

Collections: articles and photos concerning Puget Sound Naval Shipyard.

WISCONSIN

Manitowac Maritime Museum
402 N. 8th Street
Manitowac, WI 54220

Collections: submarine artifacts; photos, documents; models of Great Lakes ships, artifacts; life boat; the historic submarine, USS *Cobia* (1944).

AQUARIUMS AND MARINE MUSEUMS

ARKANSAS

Arkansas Game and Fish Commission
Capitol Mall
Little Rock, AR 72201

Aquarium. Collections: Arkansas wildlife exhibits; zoology.

CALIFORNIA

Cabrillo Beach Marine Museum
Stephen White Drive
San Pedro, CA 90731

Collections: shore birds; marine fossils; sea shells; fish; whales; historical ship models; nautical instruments.

California Academy of Sciences
Golden Gate Park
San Francisco, CA 94118

Aquarium. Collections: ichthyology and natural history.

Marineland of the Pacific
Palos Verdes Drive South
Palos Verdes Peninsula, CA

Aquarium and sea life exhibits; aquatic shows.

Sea World
1720 South Shores Road
San Diego, CA

Oceanarium; aquatic shows.

T. Wayland Vaughan Aquarium-Museum
Scripps Institution of Oceanography
8602 La Jolla Shores Drive
La Jolla, CA 92037

DISTRICT OF COLUMBIA

National Fisheries Center and Aquarium
14th and Constitution Avenue
Washington, D.C. 20240

Aquarium and fishery museum.

FLORIDA

Beal-Maltbie Shell Museum
Box 31
Rollins College
Winter Park, FL 32789

Marine museum; collection of two million shells.

Marine Laboratory Marine Museum
10 Rickenbacker Causeway
Miami, FL 33149

Research collections of marine animals and plants.

Planet Ocean
3979 Rickenbacker Causeway
Virginia Key
Miami, FL 33149

Collections: an ocean science environment center with more than 100 exhibits in six theaters.

HAWAII

Sea Life Park
Makapuu Point
Waimanalo, HI 96795

Aquarium; natural history collections.

Waikiki Aquarium
2777 Kalakaua Avenue
Honolulu, HI 96815

Aquarium; living and dry exhibits.

ILLINOIS

John G. Shedd Aquarium
1200 S. Lake Shore Drive
Chicago, IL 60605

MAINE

U.S. National Marine Fisheries Service
McKown Point
West Boothbay Harbor, ME 04575

Aquarium; library of oceanography books.

MARYLAND

Calvert Marine Museum
Solomons, MD 20688

Collections: marine, naval.

MASSACHUSETTS

Aquarium of the National Marine
Fisheries Service
P. O. Box 6
Woods Hole, MA 02543

Aquarium; collections: fish, displays relating to marine environment; problems and methods of fishery research and management.

New England Aquarium Corporation
Central Wharf
Boston, MA 02110

Live aquatic displays; maritime history; oceanography; fishing industry information; natural history.

MONTANA

Banka's Shell Museum
403 S. Delaware Street
Conrad, MT 59425

Mollusca museum. Collections: marine; archaeology.

NEW YORK

Aquarium of Niagara Falls, USA
701 Whirlpool Street
Niagara Falls, NY 14301

New York Aquarium
Boardwalk and West 8th Street
Brooklyn, NY 11224

Aquarium. Collections relating to fish genetics.

NORTH CAROLINA

Hampton Marine Museum
120 Turner Street
Beaufort, NC 28516

Collections: mounted fish of area; seashells; aquariums; ship models.

OHIO

Cleveland Aquarium
601 E. 72nd Street
Cleveland, OH 44103

Collections: fresh and salt water living vertebrates and invertebrates; display of evolution of life in water.

Fairport Marine Museum
129 Second Street
Fairport Harbor, OH 44077

Fairport lighthouse and keeper's residence; navigation instruments; marine charts; models.

OREGON

Oregon State University Marine
Science Center
Marine Science Drive
Newport, OR 97365

Aquarium and marine collections.

Seaside Aquarium
200 N. Prom
Seaside, OR 97138

SOUTH DAKOTA

Gavins Point National Fish Hatchery Aquarium
Route 1
Yankton, SD 57078

Aquarium; aquatic displays of more than 140 native fishes.

TEXAS

Dallas Aquarium
621 E. Clarendon Drive
Dallas, TX 75203

ORGANIZATIONS TO JOIN

The following organizations, open to general membership, are concerned with various aspects of the oceans. Membership information for each can be obtained by writing to the organization's address listed below or by consulting its publication, generally found in local libraries.

AMERICAN CETACEAN SOCIETY

4725 Lincoln Blvd.
Marina del Rey, CA 90291
Publication: *Whalewatch*

The American Cetacean Society is a non-profit organization with a three-fold aim; conservation, education, and involvement with all matters plagic.

THE COUSTEAU SOCIETY

777 Third Avenue
New York, NY 10017
Publication: *Calypso Log*

Dedicated to "the protection and improvement of life," the society is particularly concerned with the conservation of our ocean resources and environment.

FRIENDS OF THE EARTH

529 Commercial
San Francisco, CA 94111
Publication: *Not Man Apart*

A world-wide environmental organization, with branches in 34 states.

INTERNATIONAL OCEANOGRAPHIC FOUNDATION

3979 Rickenbacker Causeway
Virginia Key
Miami, FLA 33149
Publication: *Sea Frontiers*

Dedicated to advancing science, research, and knowledge of the oceans. Planet Ocean is located at their Miami headquarters. (See p. 87.)

NATIONAL AUDUBON SOCIETY

950 Third Avenue
New York, NY 10022
Publication: *Audubon*

This organization is concerned with the conservation of wildlife—including sealife—and its habitat.

NATIONAL GEOGRAPHIC SOCIETY

P. O. Box 2895
Washington, D. C. 20013
Publication: *National Geographic*

National Geographic regularly carries articles in marine research, flora, and fauna.

NATIONAL WILDLIFE FEDERATION

1412 16th Street N.W.
Washington, D. C. 20036
Publication: *National Wildlife*

An organization for the protection of wildlife.

OCEANIC SOCIETY

111 Prospect Street
Stamford, CT 06902
OR
240 Fort Mason
San Francisco, CA 94123
Publication: *Oceans*

Founded to preserve and protect the life-nurturing resources of the oceans, the Oceanic Society is organizing membership chapters in several parts of the country.

SOURCES OF INFORMATION

The interested reader or student can obtain further information and/or publications about many aspects of the oceans from a wide variety of public and private agencies, some of which are listed below. In many cases, these materials are available upon request at little or no charge. Check your local public or university library for holdings of periodical and other publications. Organizations whose membership is open to the general public are listed separately on p. 89.

AGENCIES OF THE FEDERAL GOVERNMENT

INTERNATIONAL DECADE OF OCEAN EXPLORATION (IDOE)

National Science Foundation
Washington, D.C. 20550

The International Decade of Ocean Exploration is an international effort under the auspices of the United Nations toward effective utilization of the oceans and their resources. The National Science Foundation is handling the United States' contribution to the decade-long cooperative investigations. Booklets in four areas of research—environmental quality, environmental forecast-

SIERRA CLUB

530 Bush Street
San Francisco, CA 94108
Publication: *Sierra Club Bulletin*

Dedicated to "maintain the integrity of ecosystems," including that of the oceans.

ing, seabed assessment and living resources—are being prepared for the general public. For information, contact IDOE Washington headquarters.

MARITIME ADMINISTRATION

United States Department of Commerce
Washington, D.C. 20230

The Maritime Administration, a division of the United States Department of Commerce, is responsible for fostering the development and encouraging the maintenance of the United States Merchant Marine. Publications available free of charge from Washington headquarters include *The United States Merchant Marine: A Brief History*; *United States Merchant Fleet Pictures*; and *The United States Merchant Marine Academy*.

NATIONAL MARINE FISHERIES SERVICE (NMFS)

National Oceanic and Atmospheric Administration (NOAA)
United States Department of Commerce
Washington, D.C. 20235

This division of the National Oceanic and Atmospheric Administration was created in 1970 to protect and promote the wise and full utilization of marine fisheries resources. Publications are technical and include *Fisheries of the United States*, an annual compilation of data by NMFS about America's fishing industry (\$1) and a quarterly scientific journal, *Fishery Bulletin* (\$10.85 annually). They are available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402.

**NATIONAL OCEANIC
AND ATMOSPHERIC
ADMINISTRATION (NOAA)**

United States Department of Commerce
Rockville, MD 20852

NOAA's function is the coordination of the exploration, management and protection of the oceans and their resources. (The National Marine Fisheries Service is listed above). Information on their environmental projects is available from their Environmental Research Laboratories, Boulder, Colorado 80302. The Office of Coastal Zone Management, United States Department of Commerce, Room 350, 2001 Wisconsin Avenue, N.W., Washington, D.C. 20007, will provide information about its activities. A catalog of NOAA publications is available from its Maryland headquarters.

**UNITED STATES DEPARTMENT OF THE
INTERIOR**

Washington, D.C. 20242

As the nation's principal conservation agency, the Department of the Interior is active in the areas of water resources, wildlife resources and saline water conversion. (Geological Survey, a division of the Department of Interior, is listed below.) Available publications include *River*

of Life, Water: The Environmental Challenge (S/N 2400-0057 \$3.15.); *Sport Fishing, USA* (S/N 2410-00235 \$10.); and *Wrightsville Beach Test Facility* (S/N 2400-00479 \$0.30.). Send check or money order with your request to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

**UNITED STATES ENVIRONMENTAL
PROTECTION AGENCY (EPA)**

The EPA is involved in regulating and researching ocean pollution. Pamphlets summarizing legislation regarding ocean dumping and efforts to enforce that legislation are available from the Washington office.

**UNITED STATES GEOLOGICAL SURVEY
United States Department of the Interior
Reston, VA 22092**

This agency surveys the continental shelf and ocean floor to assess mineral resources and is responsible for the leasing of energy resources found there. Agency publications include *Leasing and Management of Energy Resources on the Outer Continental Shelf*, *Marine Geology: Research Beneath the Sea*, and *Why is the Ocean Salty?* They may be ordered from the United States Geological Survey, Branch of Distribution, 1200 South Eads Street, Arlington, VA 22202.

UNITED STATES SENATE
Senator Claiborne Pell, Chairman
Senate Subcommittee on Oceans and the
International Environment
Dirksen Senate Office Building
Washington, D.C. 20510

This subcommittee has conducted extensive hearings on Law of the Sea issues and on the development of deep seabed resources. Copies of the testimony are available from the subcommittee office.

PRIVATE AGENCIES AND
INTEREST GROUPS

AMERICAN INSTITUTE OF MERCHANT
SHIPPING (AIMS)

1625 K Street, N.W.
Washington, D.C. 20006

The AIMS, representing thirty-four shipping companies that operate more than two-thirds of the privately-owned ships registered under the United States flag, offers materials pertaining to the American shipping industry.

THE AMERICAN PETROLEUM
INSTITUTE (API)

2101 L Street, N.W.
Washington, D.C. 20037

The API, the trade association of the petroleum industry, offers a free catalog of their publications, which includes a booklet on offshore drilling and statistical summaries about the oil industry. Write to the Publications and Distribution Center at their Washington office.

LAW OF THE SEA INSTITUTE

University of Rhode Island
Kingston, R.I. 02881

Devoted to informed discussion of Law of the Sea issues, the Institute publishes proceedings of its annual conferences, workshop reports, occasional papers, and bibliographies. A catalog of publications is available.

MARINE TECHNOLOGY SOCIETY

1730 M Street, N.W.
Washington, D.C. 20036

The Marine Technology Society is a non-profit organization of professionals in marine-related fields. Their booklet, *The Oceans and You*, is a guide to oceanography as a career and is available from their Washington office for \$3. They also publish a bi-monthly professional journal.

THE NATIONAL ACADEMY OF
SCIENCES (NAS)

2101 Constitution Avenue
Washington, D.C. 20418

The National Academy of Sciences is an advisory group to the government. Three boards of its National Research Council are concerned with ocean studies: the Ocean Affairs Board, the Marine Transportation Research Board, and the Marine Board. A free catalog of NAS publications is available from the Printing and Publishing Office of the NAS upon request.

THE NAVY LEAGUE
818 18th Street, N.W.
Washington, D.C. 20006

With locations in 342 communities across the country, the Navy League is a civilian organization that promotes understanding of the importance of the seas to the nation's security and economy. They publish a magazine, *Sea Power*.

OCEAN EDUCATION PROJECT (OEP)
245 Second Street, N.E.
Washington, D.C. 20002

This non-profit organization is attempting to influence the development of an equitable Law of the Sea through public education and lobbying of delegates to the United Nations Conference on Law of the Sea. Their newsletter, *Soundings*, is available for \$5 annually, and a listing of their other publications is available at no charge.

RESOURCES FOR THE FUTURE, INC.
1755 Massachusetts Avenue, N.W.
Washington, D.C. 20036

Resources for the Future, Inc. is a private non-profit corporation for research and education in the development, conservation, and use of natural resources. A catalog of publications is available upon request.

SAVE OUR SEAS (S.O.S.)
245 Second Street
Washington, D.C. 20002

This citizens' group is working to mobilize public support for the United Nations Resolution on Law of the Sea. Their newsletter, *Sea Breezes* (a \$5 annual contribution is suggested) and background information are available from their Washington office.

SPORT FISHING INSTITUTE
609 Thirteenth Street, N.W., Suite 801
Washington, D.C. 20005

The Institute is concerned with research in fisheries ecology, water pollution, and fish conservation education. For information about the Institute and its publications, contact the Washington headquarters.