

COURSE OUTLINE

Marine Biology

Rutherford High School
Rutherford, New Jersey

I. BASIC PHILOSOPHY

Recognizing that a student's attitudes or feelings about marine biology are just as important in the long run as his or her acquisition of specific concepts, it is our goal to instill in our students the belief that marine biology is an exciting, relevant, human activity that can be enjoyable to study. To this end, the extensive use of laboratory experimentation, demonstrations and other hands-on activities are an integral part of the course.

II. METHODS EMPLOYED

- direct teacher instruction
- demonstrations
- laboratory experiments
- mini-activities (e.g. simulations) and laboratories
- computer-assisted instruction
- cooperative learning - problem solving
- filmstrips and videos
- library research
- problem and question & answer sessions
- homework

III. TEXT

An Introduction to the Biology of Marine Life

James L. Sumich

Wm. C. Brown Company, 1988.

IV. OBJECTIVES

1. GENERAL OBJECTIVES

- A. To introduce students to the marine environment and its indigenous organisms.
- B. To develop an understanding of man's effect on the marine environment.
- C. To develop an awareness of the career possibilities available to students in this area.

2. SPECIFIC OBJECTIVES

- A. To study the principles, concepts and facts through which the student can better understand and appreciate the nature of the sea and its inhabitants.

- marine
- B. To acquaint the student with the interrelationships of plants and animals and the environment within the sea.
 - C. To develop an understanding of man's effect on the balance of nature in the marine environment.
 - D. To explore the wise and effective use of the natural resources of the sea as a food source.
 - E. To investigate the non- nutritional exploitation of life.
 - F. To acquaint the student with the characteristics used to identify and classify marine plants and animals.
 - G. To acquaint the student with the adaptations of the marine organisms which aid in their survival.
 - H. To develop an awareness of the practical applications of the study of Marine Biology as it may affect the students in their career choices.

V. CONTENT AND SCOPE OF COURSE

I. Basic Oceanography

- A. Geography of the oceans
- B. Geomorphology of the oceans

II. Biozones

- A. Pelagic environment
 - 1. Neritic province
 - 2. Oceanic province
 - a. Epipelagic
 - b. Mesopelagic
 - c. Bathypelagic
 - d. Abyssopelagic
- B. Benthic environment
 - 1. Supralittoral
 - 2. Littoral
 - 3. Sublittoral
 - 4. Bathyal
 - 5. Abyssal
 - 6. Hadal

Methods: Lecture/Discussion

Filmstrip: *Study of Oceans*
Zones of Life in the Sea - Ecology

III. Balance of Nature

A. Ecological factors

1. Physical factors

- a. Light
- b. Temperature
- c. Salinity
- d. Pressure
- e. Substrate
- f. Currents
- g. Waves
- h. Tides
- i. Acoustics

2. Chemical factors

- a. pH
- b. Carbon dioxide
- c. Oxygen
- d. Nutrient elements

3. Biological factors

- a. Dispersal and migration
- b. Food and feeding habits of organisms
- c. Space

B. Food potential

C. Farming of marine life

- Methods:**
- Classroom instruction and laboratory techniques for analyzing water samples.
 - Setting up and maintaining a properly balanced aquarium.

Films: *Riches from the Sea*
A Tidal Flat and Ecosystem

Filmstrips: *Characteristics of Seawater*
Currents, Waves and Tides
Resources of the Ocean

IV. Plankton

- A. Introduction
- B. Criteria for classification of marine microscopic plants and animals.
- C. Phytoplankton
 - 1. Classification
 - a. Chrysophyta
 - b. Chlorophyta
 - c. Pyrrophyta
 - d. Phaeophyta
 - e. Rhodophyta
 - 2. Phytoplankton distribution
- D. Zooplankton
 - 1. Classification
 - a. Protozoa
 - b. Coelenterata
 - c. Platyhelminthes
 - d. Mollusca
 - e. Echinodermata
 - f. Arthropoda
 - g. Chordata
 - 2. Zooplankton distribution
- E. Planktonic Communities
- F. Collecting Plankton
 - 1. Nannoplankton
 - 2. Microplankton
 - 3. Macroplankton

- Methods:**
- Lecture/discussion instruction in the use of classification keys and identification guides using publishers' resource materials.
 - Laboratory procedures using the microscope for examination and identification of samples.

prepared

- Filmstrips:** *Marine Plankton*
Collecting and Preserving Plankton
Oceans - Planktonic, Nektonic and Benthic Realms
- Films:** *Plankton*
A New Look at Alga
Coelenterates

V. Nekton

- A. Introduction
- B. Primitive fish
 1. Cyclostomata
 - a. hagfish
 - b. lampreys
 2. Chondrichthyes
 - a. sharks
 - b. skates
 - c. rays
- C. Bony Fish or Osteichthyes
 1. Chondrostei - sturgeon
 2. Teleostei
 - a. Bottom dwellers
 - b. Pelagic fish
 - c. Abyssal types
- D. Other Nektonic Organisma
 1. Arthropoda
 2. Mollusca
 3. Reptilia
 4. Mammalia
- E. Distribution of the Nekton
- F. Collecting the Nekton

- Methods:**
- Lecture/discussion instruction in the use of classification keys and identification guides.
 - Laboratory examination and identification using previously preserved specimens.
 - Laboratory topics and procedures in identifying and classifying sharks.
 - Laboratory procedures in observing and identifying the swimming behavior of fish.
 - Laboratory dissection of the dogfish shark.

Film: *The Sharks*
The Right Whale - An Endangered Species

Videotapes: *The World of Jacques Cousteau*
Whales

Filmstrips: *The Pelagic Zone*

Oceans - Adaptations to the Oceanic Environment
Ocean - The Marine Environment
Life in the Open Seas

VI. Benthos

- A. Introduction
- B. Plant taxonomy
 - 1. Thallophyta, characteristics and habitat (algae)
 - a. Cyanophyta
 - b. Chlorophyta
 - c. Phaeophyta
 - d. Rhodophyta
 - 2. Embryophyta, marine angiosperms, characteristics and habitat
 - a. Tidal marsh flora
 - b. Beach flora
- C. Animal Taxonomy
 - 1. Sarcodina
 - 2. Porifera
 - 3. Coelenterata
 - 4. Annelida
 - 5. Bryozoa
 - 6. Brachiopoda
 - 7. Mollusca
 - 8. Arthropoda
 - 9. Echinodermata
- D. Benthic Communities
 - 1. Rocky intertidal community
 - 2. Abyssal community
- E. Collecting the Benthos

- Methods:**
- Lecture/discussion instruction in the use of classification keys and identification guides.
 - Laboratory examination and identification using previously preserved specimen.

- Filmstrips:** *Life on the Sea Floor and Shore*
Zones of Life in the Sea - The Tidal Zone
Zones of Life in the Sea - The Sub-Tidal Zone
Zones of Life in the Sea - Benthic Zone

Videotapes: *Planet Earth - The Living Ocean*
Innovation - Deep Sea

Nature Watch - A Coral Reef

Films: *Creatures of the Mangrove*
Echinoderms
Molluscs
Coral Reef

VII. Special Student Assignments and Projects

- A. Article Summary - choose an article on suggested topics, read and summarize.
- B. Presenting an assigned filmstrip to the class.
- C. Research report and oral report on assigned marine organisms.
- D. Research report on career opportunities
 1. Marine Biologist
 2. Botany with emphasis in marine field
 3. Zoology with emphasis in marine field
 4. Marine food science
 5. Marine environmental science
 6. Fisheries and management
 7. Marine microbiology
 8. Aquaculture

Methods: Suggested periodicals for article summary:
 National Geographic
 Sea Frontiers
 New Jersey Outdoors
 The Conservationist
 Natural History

For completion of research report:
 Periodicals (listed above)
 Publisher's resource materials
 Interviews with workers in the field

VI. GENERAL INSTRUCTION PROCEDURE

- A. Students should have a set of keys and guides selected by the instructor.
- B. Lecture-discussion will be used to present the characteristics of marine plants and animals that are useful in distinguishing them from one another and which may also affect their distribution in the marine environment.
- C. Field and laboratory studies will be used to obtain, observe and identify a variety of specimens from various local habitats.
- D. Filmstrips, films and slides will be used at convenient times during the semester.
- E. Field trips may include visits to the New York Aquarium, Sandy Hook Field Station, the Hackensack Meadowlands Salt Marshes, Newark Bay, etc.
- F. Selected periodicals will be provided for individualized reading and study.

VII. REFERENCE TEXTS

1. Fleming, John N., *Marine Science Project Cards*, West Nyack, New York: Center for Applied Research in Education, Inc., 1978.
2. McConnaughey, Bayard H., *Introduction to Marine Biology*, St. Louis, Missouri: B. Mosby Co., 1978.
3. Sumich, James L., 1988. *An Introduction to the Biology of Marine Life*, William C. Brown Company Publishers, Dubuque, Iowa.
4. Wischnitzer, Saul, 1972. *Atlas and Dissection Guide for Comparative Anatomy*, W. H. Freeman and Company, San Francisco, California.

VIII. BIBLIOGRAPHY

1. Angel, Martin and Harris, Teqwyn, 1977. *Animals of the Oceans - The Ecology of Marine Life*, Two Continents Publishing Group, New York, N.Y.

2. Buchsbaum, Ralph and Milne, Lorus J., 1966. *The Lower Animals - Living Invertebrates of the World*, Doubleday and Company Inc., Garden City, New York.
3. Burgess, Robert F., 1981. *Secret Languages of the Sea*, Dodd, Mead and Company, New York, N.Y.
4. Daiber, Franklin C., 1982. *Animals of the Tidal Marsh*, Van Nostrand Reinhold Company, New York, N.Y.
5. Engel, Leonard et al., 1963. *The Sea, Time-Life Books*, New York, N.Y.
6. Mash, Kaye, 1975. *How Invertebrates Live*, Elsevier - Phaldon, New York, N.Y.
7. Miner, Roy Waldo, 1950. *Field Book of Seashore Life*, G. P. Putnam's Sons, New York, N.Y.
8. Ommanney, F. D. et al., 1969. *The Fishers*, Time-Life Books, New York, N.Y.
9. Van Cleave, Harley Jones, 1931. *Invertebrate Zoology*, McGraw-Hill Book Company, Inc., New York, N.Y.
10. Watson, Lyall, 1981. *Sea Guide to Whales of the World*, E. P. Dutton, New York, N.Y.

*Note: Basal text - used in conjunction with outside resources provided by the instructor as well as in class reference sources.

Minimum Proficiencies for Marine Biology

1. Students must become acquainted with the general characteristics of the marine biozones.
2. Students must be aware of the ecological factors - chemical, physical and biological - that affect the marine environment.

3. Students must be familiar with the Planktonic communities of the marine environment.
4. Students must be familiar with the Nektonic communities of the marine environment.
5. Students must become familiar with the Benthic communities of the marine environment.
6. Students must be acquainted with the interrelationships of the flora and fauna and the marine environment.
7. Students must develop an understanding of man's effect on the balance of nature in marine environments.
8. Students must become aware of the economic importances of the natural resources of the sea.
9. Students must be able to identify and classify marine organisms.
10. Students must demonstrate a knowledge of the equipment used in collecting local marine plants and animals.
11. Students must demonstrate proper techniques for dissection of the dogfish shark and a knowledge of structural identification.
12. Students must demonstrate an awareness to properly evaluate field trips and related experiences.
13. Students must complete one major research report.
14. Students must complete one research report on careers in marine biology.
15. Students must complete required summaries on major periodical articles when assigned.
16. Students are required to assemble and keep an up-to-date notebook.
17. Students must meet the standards for a passing grade as outlined in the policy on grading in the student/Parent Handbook.
18. Students must meet the requirements for school attendance as outlined in the Board of Education policy on attendance.