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ABSTRACT

This teacher's guide develops an interdisciplinary approach to marine science for elementary school children. The lessons are concerned with food chains, interdependencies, physical characteristics, comparative dissections, and student involvement in political issues dealing with water and air pollution. For each activity suggestions are provided regarding objectives, materials needed, procedure, evaluation, and follow-up. This work was prepared under an ESEA Title III contract. (BP)

# THE SEA

## An Interdisciplinary Approach to Marine Science for Elementary School Children



A publication of the Instructional Operations Division of the
Newport-Mesa Unified School District, 1601 Sixteenth Street, Newport Beach, California
Dr. William L. Cunningham, Superintendent
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THE SEA - An Interdisciplinary Approach to Marine Science for Elementary School Children has been written as a part of a larger endeavor, a Space Science Learning Program. The project has been undertaken with the assistance of the U. S. Office of Education under Title III of the Elementary and Secondary Education Act of 1965. This unit contributes to the attainment of the objectives of the larger project by presenting a specialized plan to enrich science and mathematics education at the elementary school level and to meet new curriculum needs of students.

Copies are available from the Newport-Mesa Unified School District, Space Science Learning Program, Mrs. Fay Harbison, Director, 1601 Sixteenth Street, Newport Beach, California 92660.

# INTRODUCTION

It is a tragedy when a shoreline community has to hire a "land locked" army engineer to come in and tell them why the sea is taking their beaches cway. It is a tragedy when a group of educated adults ask each other, "What's ecology?" or "Where did that tar on your feet come from?".

School students protest for lack of relevancy in their school curriculum while at the same time the school environment cries out for problem identification and possible solutions.

The unit "The Sea" is a classical approach to Marine Science with a few modern ecological correlations included. The lessons have to do with food chains, interdependencies, physical characteristics, comparative dissections and student involvement in political issues dealing with water and air pollution.

The on-shore mobile laboratory Marine Science Program may be utilized as an in-service program for teachers, a summer school institute for gifted students and as a space mobile program in 1970-71 for fifth and sixth grades. The mobile van may be used for field work at the Coast Guard Station, Newport Bay, the tidepools of Corond del Mar and in conjunction with the floating laboratory program for the Newport Bay.

If as teachers we cannot make our curriculum "come alive" and relate and involve the students with their environment, we certainly can expect more protests and demonstrations in the 70's. How can we expect someone to care about his neighbor if he doesn't care about his environment?

## GOALS

The goals of the 1970 on-shore mobile marine science laboratory were developed by consultation between the mobile instructor and county administrators of marine sciences, national administrators and teachers of marine sciences at the Marine Science Conference at Catalina Island, and locally with the science teachers of the Newport-Mesa Unified School District. As a result of these consultations, the following goals have been formulated:

1. Students shall show an increase in positive attitude toward the marine sciences on attitude scale test.

2. Students shall become actively involved in anti-pollution measures as indicated by their past-course activities.

3. Students shall become familiar with and perform assigned tasks using the oceanography tools of the Space Science Laboratory.

Objectives of more specific character are stated as a part of each demonstration and activity. These are included with appropriate section of the report.

## THE PROGRAM

Lesson:

1. The Physical & Biological Characteristics of the Sea
2. The Beach - A River of Sand
3. Newport Bay
4. The Sea - Currents, Waves, Tides
5. Salinity and Turbidity of Newport Bay and the Sea
6. The Cycle of Energy in the Sea
7. The Tools of the Marine Science Student
8. The Floating Platform (Field Experience)
9. A Comparative Direction (Post Field Experience Lesson)

# THE PHYSICAL AND BIOLOGICAL CHARACTERISTICS OF THE SEA

## I. Introduction

The sea is not a uniform body of water. It differs greatly in temperatures, salinity, and density. These factions and ocean currents influence the biological characteristics of the sea. Lesson one deals with an overview of the physical and biological characteristics of the sea.

## II. Objectives

Student will be able to:

A. Select and name two physical characteristics of the oceans
B. Select and name two conditions governing distribution of ocean life
C. Compare and contrast benthic life with pelagic life
D. Compare and contrast tidepool life with estuary life

## III. Advance Preparation by Classroom Teacher (Additional information available from mobile instructor upon request)

A. The classroom teacher may ask the students to bring in current newspaper or magazine articles having to do with the sea and read and discuss them with the class.
B. The teacher may ask the class to watch "The Undersea World of Jacques Cousteau" which appears monthly on major T. V. networks.
C. The teacher may discuss the following vocabulary with the class:

plankton
salinity
tidepool
benthos
estuary
pelagic
nekton

## IV. Materials

A. Color slides of the world's oceans, bays and estuaries and the tools of the marine science student
B. 35mm carousel slide projector
C. Extension cord and cart
D. Screen
E. Plastic fish model
F. Plastic tidepool organism
G. Dictionary

V. Procedure

A. The mobile instructor lists the following vocabulary on the chalkboard:

| | | |
|---|---|---|
| sea | pelagic | beach |
| ocean | nekton | physical science |
| plankton | estuary | biological science |
| benthos | tidepool | salinity |
| temperature | | |

The instructor asks the students if they recognize any of these words and discusses their meanings. Several students are osked if they would like to look up the meaning of the unfamiliar words as we will be using them in the slide presentation.

B. The Slide Presentations:

1. Slides having to do with tidepool life
2. Slides having to do with pelagic life
3. Slides having to do with benthic life
4. Slides having to do with physical characteristics of the sea
5. Slides having to do with the tools of the marine science student

C. Mobile instructor idstributes plastic models of tidepool specimens and students list any two characteristics

1. Hord shell
2. Able to cling

D. Mobile instructor distributes other plastic models and asks the students to hypothesize as to their being tidepool, benthic or pelagic organisms and give evidence of their hypothesis. The mobile instructor never gives negative response (no) to any hypothesis but instead answers "maybe" in order to stimulate further research which may also act as a volunteer follow-up project.

VI. Evaluation

Sampling technique.

# THE BEACH - A RIVER OF SAND

## I. Introduction

The sand of our beaches is constantly shifting as is evidenced by the many "save our beaches" projects currently underway in Southern California. Lesson two involves the student in the problem of saving our beaches in that he actually builds a beach of clay and sand in a water table pan and studies the influence of waves upon the sand. He then places corrugated groins, rock groins along the beach (as we have done in Santa Monica and Newport Beach) and studies their effect. An excellent follow-up lesson would be a field trip to Newport Beach at 45th Street.

## II. Objectives

Student will be able to:

A. Build a beach using sand, clay, water, and water table pan
B. Label beach zones
C. Compare and contrast currents created by waves from differing directions
D. Place "groins" in beach to prevent erosion

## III. Advanced Preparation by Classroom Teacher

A. Show film "River of Sand"
B. Draw a cross section of the shore showing spray zone, inter-tidal zone, wash zone, crash zone
C. List vocabulary on chalkboard:

| | |
|---|---|
| swell | rip |
| chop | sand |
| erosion | groin |
| clay | wind direction |
| wave | wind velocity |
| jetty | |

## IV. Materials

A. 32 water table pans (Oceanography Unlimited)
B. 50 lb. clay
C. 50 lb. beach sand
D. 10 lb. small rocks
E. 90 pieces of corrugated aluminum
F. Red dye
G. 10" aluminum wave makers
H. 5" wave makers
I. 60 model homes

V. Procedure

A. Write the vocabulary on the chalkboard.
B. Show slides of Newport Beach erosion.
C. Distribute materials.
D. Show slides demonstrating how to put materials together.
E. Build "beach" in large instruction water table. Tell student you are going to produce a "southern swell" and ask them to predict what will happen.
F. Review vocabulory.
G. Ask them to build their own beaches and write down a prediction as to what type of current and erosion a certain wave pattern will produce.

VI. Evaluation

Sampling technique.

VII. Follow-up

A field trip to Newport Beach erosion area (35th Street - 59th Street). Motivated students may want to build a large model of Newport Bay and fill it as the tide comes in and drain it as the tide goes out and study the effect of current on sands.

# NEWPORT BAY

## I. Introduction

A study of the areas, depths, islands, currents, and life forms of Newport Bay. The mobile instructor shows several slides of Newport Bay and then distributes plastic specimens of life found in Newport Bay.

## II. Objectives

Student will be able to:

A. Identify six specimen of life found in Newport Bay.
B. Identify three primary areas of Newport Bay.
C. Read a nautical chart of Newport Bay.

## III. Advanced Preparation by Classroom Teacher

A. Study chart on page 115, Fishes of Upper Newport Bay and distinguish between areas.
B. Able to name six fish found in Newport Bay using above book.
C. List vocabulary on the chalkboard:

| | | |
|---|---|---|
| salinity | vertebrate | estuary |
| habitant | invertebrate | |

## IV. Materials

A. Thirty-five copies of Fishes of Upper Newport Bay - Gilbert Bane of U.C.I.
B. Newport Bay specimen (available from space mobile laboratory)
C. Slides of Newport Bay and projector and screen and cord.
D. Ten large nautical charts of Newport Bay.

## V. Procedure

A. Write vocabulary on the chalkboard.
B. Mobile instructor shows several slides of Newport Beach areas and live specimen taken in the field.
C. Plastic and preserved specimen are distributed and habitant discussed.
D. Nautical charts are distributed (one per three students).
E. Locate and identify upper Newport Bay, lower Newport Bay, Bayside Channel, lower speed zone, upper speed zone, bridge.
F. What is the greatest depth in Newport Bay?

## VI. Follow Up

A. Motivated students build a clay and sand model of Newport Bay and study influence of currents and tides.
B. Field trip to Coast Guard Station at Newport Bay and possible cruise on 85' cruiser.

Newport Bay (continued)

V. Evaluation

By observation.

# THE OCEAN CURRENTS, WAVES, TIDES

## I. Introduction

The student discovers the relationships between the oceans and the worlds weather, winds, types of waves and location of major currents and their effect on the biological organism of the sea. Tides are also considered.

## II. Objectives

Student will be able to:

A. Name two major ocean currents.
B. Locate two major ocean currents and give their direction.
C. Investigate the cause of ocean currents.
D. Demonstrate relationships between surface of the ocean and atmosphere such as $O_2$ and $H_2O$ exchange.
E. State the cause and nature of tidal waves.
F. State the cause of tides and discover the date of the highest tide annually in Newport Beach.

## III. Advanced Preparation by Classroom Teacher

A. Recite the names and location of the world's oceans.
B. Name and locate at least one ocean current.
C. Ask the class "if all the rivers run into the sea, why doesn't the ocean fill up?"
D. Locate the Gulf Stream.
E. What explorers sailed in, on, or across the Gulf Stream.

## IV. Materials

A. One set of encyclopedias
B. Number offprints from Scientific American
C. Thirty-five mimeos of world
D. One large wall, world map
E. Thirty-five tide charts for Newport Beach
F. Thirty-five tide charts for Los Angeles

## V. Procedure

A. Mobile instructor lists following vocabulary on chalkboard:

| | | |
|---|---|---|
| Pacific Ocean | Alaskan Current | $H_2O$ |
| Atlantic Ocean | Atmosphere | $O_2$ |
| Gulf Stream | Tide | $H_2$ |
| California Current | Earth | $CO_2$ |
| Davidson Current | Moon | |
| North Equatorial Current | Sun | |

The Ocean Currents, Waves, Tides (continued)

V. Procedure (continued)

B. Words are recited and discussed.
C. Motivated students look up in the encyclopedia:

Gulf Stream
California Current
Alaskan Current

These three currents and their directional flow is indicated on each student's world map.

D. Three students look up tide in encyclopedia and report.
E. Tides are discussed and their relation with Earth - Moon - Sun.
F. Tide chart is discussed and the date of the highest and lowest tide noted on the world map sheet.
G. Position of Sun, Earth and Moon are demonstrated by students playing respective parts.
H. Three students look up atmosphere and report.
I. Reference is made to Scientific American off prints and read and discussed.

VI. Evaluation

Sampling technique.

# SALINITY AND TURBIDITY

## I. Introduction

Salinity or the amount of salt in a given amount of sea $H_2O$ is relatively constant throughout the world's oceans 350/00. However, where large amounts of fresh $H_2O$ enter the sea, brackish water is formed and the salt content may vary from 35/00 to 25/00. Because of these great differences in salinity in estuaries, the biological organisms are affected. This lesson has the student determine through titration the salinity of a sample of water taken from Newport Bay and a sample from the open ocean off Newport Beach.

## II. Objectives

Student will be able to:

A. Determine salinity of Newport Bay sample through titration
B. Determine salinity of ocean sample through titration
C. Determine difference between the two samples
D. Know function of secchi disc

## III. Advanced Preparation by Classroom Teacher

A. Read meanings of salinity and turbidity
B. Be able to name titration equipment - burette, beaker, indicator, table of chlorination

## IV. Materials

A. Titration set (available from Space Science Center)
B. One gallon sea water
C. One gallon bay water
D. Secchi disc
E. Work sheet V

## V. Procedure

A. Mobile instructor demonstrates how to set up titration materials.
B. High School student aids assist level six students to set up.
C. Mobile instructor demonstrates how to read burette and conversion table.
D. Samples are distributed (students shall not know which is bay water and which is ocean water). (One Salton Sea,45/00 sample is distributed).

## VI. Evaluation, Follow Up and Correlation

By observation

# THE CYCLE OF ENERGY IN THE SEA

## I. Introduction

The predator-prey relationship and its changes due to man's invasion of a biome have created both beneficial and tragic conditions on the continent of North America. The mountain lion, the predator upon deer, has been eliminated from most western states. As a result, the deer population has flourished to the point where it has caused erosion due to over grazing. Through regulated hunting, man has now become the control or predator. Will man assume the same role as he invades the sea? The shark, a primary predator of the sea, is a necessary part of the balance in the sea.

## II. Objectives

Student will be able to:

A. Trace the life cycle in the sea from microscopic plankton to the whale.
B. Explain and give examples of a predator-prey relationship and answer question, "Is a predator-prey relationship necessary to a marine environment?"
C. Trace energy cycle from Sun to man.

## III. Advanced Preparation by Teacher

A. Research known predator-prey relationships. (Encyclopedia)
B. Discuss energy and phytoplankton.

## IV. Materials

A. Slides
B. Two sets of encyclopedias
C. Large chart of an energy cycle
D. Large chart of eltonian pyramid
E. Vocabulary List:

| | |
|---|---|
| energy | food |
| prey | whale |
| phytoplankton | Sun |
| zooplankton | predator |

## V. Procedure

A. Mobile instructor shows slides
B. Mobile instructor introduces vocabulary (listed above)
C. Mobile instructor asks a few students to look up selected words.
D. Mobile instructor asks if any of the students can explain the role of the blue shark.
E. Students are asked to draw their own energy cycle starting with the Sun.
F. Mobile instructor asks, "If an area is polluted, what organisms die first?"

VI. Evaluation, Follow Up and Correlation

A. Write Fish and Game for free literature concerning predator-prey relationships in the sea and their place in food cycles.
B. Study predator-prey relationships as a part of Natural History phase of science.

# THE TOOLS OF THE MARINE SCIENCE STUDENT

## I. Introduction

This lesson is a preparation lesson for the field experience aboard the floating laboratory in Newport Bay. Tools are identified and their use demonstrated. Slides of their use at sea are also shown and a guest speaker from the Navy may be included. The class is divided into seven task teams and their tasks practiced.

## II. Objectives

Student will be able to:

A. Use bucket thermometer and record reading.
B. Use plankton net
C. Use secchi disc and record reading
D. Use van doren bottle and record reading
E. Preserve specimens
F. Identify specimens to order and record where captured.
G. Use Otter trawl and sing "drunken sailor"

## III. Advanced Preparation by Classroom Teacher

See movie "The Floating Laboratory"

## IV. Materials (Available from Space Science Laboratory) *See Oceanography Unlimited Catalog

A. Two bucket thermometers
B. Two plankton nets
C. Two secci discs
D. Two van doren bottles
E. Six plastic one-gallon jars
F. One gallon formalin
G. Thirty-five copies of Fishes of Upper Newport Bay - Banes
H. Thirty-five copies of The Stanley Key to the Fish Commonly Taken on Board th
I. Two long handled, needle nosed pliers — O. C. Schools Marine Scien
J. Two pair of gloves — Floating Laboratory - Valent

## V. Procedure

A. Mobile instructor demonstrates use of material
B. Slides are shown
C. Class is broken down into seven task groups
D. Class practices tasks (see task sheet)

## THE FLOATING PLATFORM (FIELD LESSON)

### I. Introduction

This lesson is a field experience aboard a vessel in Newport Bay. The lesson entitled "The Tools of the Marine Science Student" is a prerequisite.

### II. Objectives

Student will be able to:

A. Use oceanography tools
B. Key specimens to family
C. Make and record observations having to do with:

1. Vertebrates
2. Invertebrates
3. Equipment
4. Temperature of air and bay
5. Performed tasks

### III. Advanced Preparation for Classroom Teacher

Safety rules and lesson entitled "The Tools of the Marine Science Student".

### IV. Materials

A. See Oceanography Unlimited Catalog
B. Space Science Laboratory Catalog

### V. Procedure

See Marine Science Flating Laboratory Manual and the lesson entitled "The Tools of the Marine Science Student".

### VI. Evaluation, Follow Up and Correlation

Recorded information evaluated, compared, and contrasted in laboratory lesson.

## POST FIELD EXPERIENCE (A COMPARATIVE DISSECTING IN LABORATORY)

I. Introduction

Post floating platform experience could be keying of captured specimens, identification of invertebrates, determination of pollution from bay water sample, comparative salinites from samples taken at various location in bay, source studies of pollution, letters to congressmen concerning future development of Newport Bay.

II. Objectives

Student will be able to:

A. Identify bottom dwellers
B. Identify fish
C. Name and locate any four fins on fish
D. Compare and contrast fins of two specimens
E. Identify liver, heart, stomach, intestine, scales, gill, spines and lateral line.

III. Advanced Preparation by Classroom Teacher

A. Study chart of gross fish anatomy locating fins and internal organs.
B. Show slides of dissecting tools and internal organs (available from Space Science Laboratory.
C.

IV. Materials

A. Sixteen dissecting kits
B. Sixteen flatfish
C. Sixteen croakers
D. Chart of gross anatomy
E. Plastic model of fish

V. Procedure

Standard dissecting procedure

VI. Evaluation and Follow Up. Students may want to write letters to:

Mr. Walter Hickel
Fish and Game Department

Coast Guard

Science Clubs

Wesley Marx

U.C.I.

Congressmen

Union Oil Company

Gulf Oil Company

and other organizations having to do with the sea and its present and future use.

## RECOMMENDATIONS

The Teacher In-Service Program will consist of an overview of the Marine Science Program packet and four demonstration lessons from the Marine Science Program packet. Each demonstration will be activity oriented with an emphasis on learner achievement and the carrying out of behavorial objectives. The four lessons are:

1. The Physical and Biological Characteristics of the Sea (1)
2. The Beach - A River of Sand (2)
3. The Tools of the Marine Science Student (7)
4. The Floating Platform (Field Experience) (8)

The in-service lesson, The Beach-A River of Sand, will have three sixth-grade students assist in the demonstration and activities.