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ABSTRACT

This curriculum guide describes an activity-oriented marine study program, designed for use with middle school children (grade 5). The content focuses primarily upon the life sciences, with some emphasis on chemistry and geology. Following the development of a rationale for the inclusion of marine sciences in the school curriculum, a middle school/marine science educational philosophy is presented. The basis for the selection of marine science education topics is detailed. Lesson topics include: marine biology, fish adaptations, studies in unusual fish, commercial and soft-bone fish, marine geophysics, reptiles and mammals of the sea, waterfowl, conchology, algae, cephalapods, and crustaceans. Objectives are specified and concepts identified for each topic. Several individualized student learning packets are described. Sections on water pollution and chemical ocean studies conclude this guide. (BT)

TIVERTON MIDDLE SCHOOL

INNOVATIVE CURRICULUM DEVELOPMENT PROGRAM

MARINE ACTIVITY DYNAMICS-M.A.D.

INTRODUCTION

Rhode Island is called "The Ocean State." Mile after mile, one cannot argue the fact that our state is influenced by the nearby ocean. With this truth in mind, the idea of a marine curriculum dealing mostly in the area of life sciences was developed for our young Middle School children. To our knowledge, never before has a full scale fifth grade marine study program been attempted successfully in our state, or for that matter, in our country.

RATIONALE

Similar to true scientists, students learn by their past experiences at the local seashore. By examining marine animal and plant specimens with which they have come in contact, students begin their inquiries. What child or adult hasn't wondered about the sea life remains they have found walking along on a beach?

THE ARGUMENT

Who, in our Ocean State, hasn't thought about the awesome powers of the mighty waves, of the vast distances covered by water, and the dark depths within the mysterious sea?

Perhaps our planet bears the wrong name. After all, tremendous areas of water cover almost three-fourths of the so-called earth's surface. In our solar system, our planet is unique in its ownership of vast oceans. In fact, it has been estimated that if the entire land area were leveled and all the ice in the poles melted, the entire earth's surface would be covered by no less than a mile of water.

Furthermore, water forms part of the many chemical compounds found in living things, including seventy per cent of those in the human body. Also, all forms of life need water. Even plants and animals which live on land must ultimately rely on the ocean for their existence.

The sea is a vast world of never-ending beauty and tremendous complexity. Literally, it is the last frontier left to explore on the earth. Each year, nation upon nation faced with population explosion and mineral or other raw material shortages, look more and more to the sea for immediate answers.

However, basic knowledge of the sea and its effects has been largely neglected on the educational scene throughout the elementary grades in these United States. Imagine 70.8 per cent of the entire world's surface area is a neglected subject of study in the middle grades! Yes, this is a pilot program, but it is based upon past successful marine studies in Tiverton over the last six years. It is rich in experience, scope and awareness. Most of all, it relates to the children with a deep concern for the ocean's many assets and contributions.

WHY MARINE SCIENCE EDUCATION?

"Of all the things that I have ever seen, only the sea is like a human being; the sky is not, nor the earth. But the sea is always moving, always - something deep in itself is stirring it. It never rests, it is always wanting, wanting, wanting. It hurries on; and then it creeps back slowly, without having reached moaning. It is always asking a question, and it never gets the answer." 1

Is it possible to receive answers from the sea? Well, one thing is for certain, if people do not investigate its potential, or if we neglect our studies of it, the answer will never be found. Never before, in the field of education, has there been a more urgent need for answers to immediate and future questions. Yet, many complex, demanding questions relating to our marine environment still go unanswered.

To date, the conflict of dealing with the sea as a subject has been buried in our libraries; or marine education dealt with only those who gained immediate economic benefits at the adult level. These people were usually more persuasive than those educators who talked in terms of intangible and aesthetic values. Furthermore, because of the apparent rewards involved, past generations were willing to tolerate mass destruction of wildlife, forest, and topsoil, the depletion of

1 Excerpt from "The Spell of the Sea" by Olive Schreiner.

...l reserves, pollution of air and wasting of minerals, all in the name of progress. They probably do this because of ignorance, but in the name of progress. For the same reason, people are willing to overlook the reckless destruction of Rhode Island's natural resources, its sea coast with its access to the ocean.

When or where do we begin to make an effort to correct these wrongs? Can the answer be found through basic understandings, through developing interest, and through a good, valuable education? Of course, one really can't find true answers to these fundamental questions. However, it appears logical that one might begin to solve problems and find solutions through the development of a good, basic education in marine studies of our own coastal waters. Through the study of the nearby ocean, children could learn to "read" the ocean itself, and not just "read about" it in books. If one studies only books without experiencing the ocean, when one gets out-of-doors, one will not be able to really find the ocean, much less understand it. Our curriculum, M.A.D., is one of experience, one of doing, and one with things from the ocean!

RECOMMENDATIONS:

A BALANCED APPROACH

For most young Tiverton Middle School aged children learning about science, biology in particular, came to mean countless lectures and dissecting Formalin-soaked specimens. This approach is good to some extent, no one dare deny. However, if one may argue for those of us who work in the development of a new approach to an elementary marine science curriculum geared for children, we recommend learning through the "living approach" in conjunction with the old.

Children appear to learn best through direct observation of living organisms. If the organism is not living, then at least a simulated investigation with the organism's relationship in its community is by far superior to the pickled cadaver approach. In fact, young Middle School children can learn that all other living things are at least as interesting as some people and at times they can play an even more significant role in our world as a whole.

WHERE TO BEGIN MARINE EDUCATION

The Tiverton Middle School ought to incorporate in its life science studies a continuing and contributing program of ocean studies. This new development in curriculum should expand according to the students' educational endeavors, in order that they be better equipped and suited for their vital roles in a society becoming more dependent on the ocean for survival.

WHEN TO BEGIN MARINE EDUCATION

Grade five seems to be a time of curiosity, an age of inquiry. Furthermore, it is a time in the development of the child's experience when he or she finds sea shells, bones, feathers, and sea-washed rocks while at the beach. Exploring the seashore is one of their favorite summer pastimes. From any teaching standpoint, marine studies has the big advantage of being easily accessible. The fact remains, Tiverton is part of the so-called Ocean State!

MIDDLE SCHOOL MARINE SCIENCE EDUCATION PHILOSOPHY

As science discovers more of the secrets of the salt water world, the need for a deeper understanding of our sea is increased. Are we, as a people, ready to fall behind the times? Are we, as a society, willing to surge ahead blindly? Instead, shouldn't our Middle School be listed among the first in educationally investigating our surrounding seacoast? Let us base our philosophy on some of the known facts:

1) We believe that all current research in marine life studies since World War II holds much interest for young science students, as well as for adults in our present society.

2) We believe that all life on this planet exists because of the vast, all encompassing sea. Life itself is directly dependent upon the ocean for its air cycle, its water cycle, and at least ten percent of its food today. More and more areas of the sea are being investigated daily as a potential source of solving shortages in food, fuel, minerals, textiles, medicines, and other basic necessities.

3) We believe that all current indications in fostering sound survival programs are related to those with a basic educational understanding of the sea. This knowledge is a necessity for the continuation of humanity.

4) We believe that each year, an increasing world population demands more from the world's oceans. The marine world is not only used as a source of additional food and minerals, but it is also used as a site for dumping wastes, a source of energy, a place for recreation, and an avenue of international commerce.

With these judgments in mind, one must remember that the ocean is accessible to all nations. Therefore, all citizens of every nation must begin to attempt to understand, in terms of basic processes, the limitations and expectations of our exploitations of the common ocean for the good of all mankind.

THE BASIS FOR THE SELECTION OF MARINE SCIENCE EDUCATION TOPICS FOR THE TIVERTON MIDDLE SCHOOL

The selection of Marine Activity Dynamics is made on the basis of five broad criteria:

1) The relevance of the ocean's influence in regard to its use by all people, which is constantly changing in scope.

2) The instructive value of the subject's scientific content to the student, which is also subject to change and expands as more emphasis is placed on a basic awareness of the marine environment.

3) The development of the total child's awareness in relation to the skills necessary for survival.

4) The involvement of the young student in the development of the basic processes such as formulating hypotheses, interpreting data, experimenting, observing, classifying, measuring, predicting, inferring, and controlling variables in sea aquaria.

5) Tiverton outreaches through a program suited for the New England coastal impact in areas of conservation. For example: The oil spills, off shore oil well drilling, nuclear energy, residue of industrial wastes, the two hundred mile fishing limits, territorial disputes, raw sewage, refinery operations, shipping and recreation. Without a basic understanding of these and other areas so urgent - what kind of future can there be for Tiverton?

MARINE ACTIVITY DYNAMICS

(M.A.D.)

LESSON GUIDE

a) Introduction of a brief historical prospective of marine studies.

b) Discussion, slides, transparancies of modern exploration and modern techniques of marine dynamics.

c) Summary of topical areas of interest covered.

d) A brief outline of intent, rationale for studying the ocean.

e) Film - "The Saltwater World" - National Geographic Series.

MARINE BIOLOGY

Every child is acquainted with some of the fish caught off Tiverton waters. Therefore, biology lessons ought to begin by introducing the basic model parts of the true fish - bony fish (class ostheithyes).

PROCESS

Familiarity with the basic organs and their functions.

1) Model investigation.

2) Dissection of native fish.

3) Concepts to be taught:

   a) slides

   b) specimens

   c) picture transparancies

4) Comparisons of the tapered bodies

   a) Streamlined shaped

   b) Non-streamlined

FISH ADAPTATIONS

1) Protective coloring (markings)

2) Countershading (dark and light sides)

3) Cryptic coloration (entire color changes)

CONCEPTS INVESTIGATED

TROPIC WEBS AND PYRAMIDS

1) Herbivores (Vegitarians)

2) Carnivores (Meat-eaters)

3) Omnivores (Eat both meat and plants)

4) Detritivores (Eats dead matter, carrion)

GROUP READINGS AND ORAL REPORTS.

A living fossil, the most famous and historic fish of ancient and modern times is investigated.

CONCEPT - The Coelacanth is a link between water animals and land animals.

1) Reserve Book - "Search For A Living Fossil" by Eleanor Clymer, written on a fifth grade level.

2) Transparancies

3) Slides of a rare species in New Haven

CONCEPT - The Coelacanth, African Lungfish, is an air-breathing fish with lungs, arms, legs and reptile-like scales.

INVESTIGATION of actual fossils and their formation, with discussion and written report.

STUDIES IN UNUSUAL FISH

(CHAENOIEPHALUS ACERATUS)

MAIN CONCEPT IN BRIEF:

1) Arctic Ice Fish, the most abundant fish in the world.

2) Adaptation of living in extremely cold climates with its invisible blood and modern use of medicine.

3) Investigations in finding new food sources and its fishing problems.

THE GIANT SUN FISH (MOLA MOLA)

OF RHODE ISLAND WATERS

CONCEPT METAMORPHOSIS

For instance, this fish lays somewhere around fifty million eggs, one year later, it reaches about one-eigth of an inch in size. Students compare rate of growth, physical factors, predators using a graph to plot its continual growth to eleven feet in length and weighing over a ton.

THE UNUSUAL EEL - ANGUILLA RASTRATA

CONCEPTS:

a) The migration of a "native fish" - Parent stream theory.

b) The fish cycle

IN BRIEF:

Children follow the growth and migration of a fish born off the coast of Bermuda, travels to Florida, drastically changes shape, migrates up the coast of the United States, and moves across many miles into landlocked waters - a fresh water inhabitat. In time, it moves back to the salt water world and makes another drastic change in metabolic rate.

SEA LAMPHREY - PETROMYZON MARINUS

Transparancies and slides.

CONCEPTS:

a) Introduction of the primitive jawless fish.

b) People upset the ecological balance by creating the Welland Canal Seaway, infesting the Great Lakes with "vampires" of destruction costing billions of dollars to the economy.

c) Children investigate the methods of control of unwanted sea pests.

PIPE FISH OF TIVERTON

SEA HORSE - HIPPOCAMPUS

Transparancies, slides, aquarium specimens.

CONCEPT:

a) Not all fish have scales.

b) Some fish swim upright.

c) Some female creatures lay eggs, but it is the male that hatches the eggs in a pouch.

d) Some fish adapt to change by using their tails as limbs.

GRUNION - WEST COAST

CONCEPTS:

a) Not all fish are born in the water.

b) Children examine the moon and tide relationships to living creatures.

COMPARISON STUDIES

Transparancies, slides, films, specimens with discussion involvement.

1) Puffers of Tiverton

Concept: Protective defenses

2) Deep Sea Angler off our coast

Concept: Exceptional adaptations

3) Toadfish of Tiverton

Concept: Studies in fish communication at the University of Rhode Island.

4) Goosefish off our coast

Concept: Reverse predator (fish that eat birds)

5) Ocean Pout caught off our coast

Concept: Fish parasites

COMMERCIAL FISH

Movie, transparancies, specimens, slides, products.

A) Menhaden and Anchovies - Large schools of manhaden are caught in the Mount Hope Bay each year.

CONCEPTS:

1) Students will become acquainted with the most popular catch fish in the world.

2) Children will look into its economic value as a catch. For example, its use as animal foods for beef, soap, lipstick, bait, vitamins, paints, fertilizers and glue.

3) Children will review the Peru-Equador dispute and the problem of the two hundred mile fishing limit.

B) Swordfish - Xiphias gladius, Block Island

C) Marlin - Makaira ampla, Woods Hole

CONCEPTS:

1) Industrial waste (mercury) in the form of gases produce toxic poison.

2) Friction. By a well-streamlined shape, objects can out through water.

3) Applied concept of a streamlined shape to ships, automobiles, airplanes, rockets and submarines.

4) Stray fish migrate with climatic changes.

5) Children will explore the reasons fish leap out of water to rid themselves of unwanted pests.

6) Worm damage is examined.

SOFT BONE FISH - CARTILAGINOUS FISH

A complete lesson is given on sharks. Both good and bad features, along with myths, are investigated.

MAIN IDEAS:

1) Basic differences

2) Some types of fish have no real gills

3) Some fish have cartilage

4) Sharks are necessary for ocean life balance.

5) Fin comparison for safety identification

6) Safety techniques and the New England record

7) Vitamin use

Pupils look into the sharks off the coast of Rhode Island through research cards, transparancies, slides, one lecture, discussion, books, young specimens, jaws, and teeth fossils.

In brief, the following is a list of sharks from which each child will choose one shark and do an oral report with transparancies. In some cases, group reports will be given.

CONCEPTS:

1) Children need to express themselves.

2) Children need to learn to do research.

3) Children learn about how to inquire into differences.

SHARK RESEARCH OF R.I. WATERS:

1) Smooth dogfish - Mustilus canis

2) Sand shark - Carcharias taurus

3) Tiger shark - Galeaces cusier

4) Thresher shark - Alopias vulpinus

5) Blue shark - Prionace glauca

6) Maneater - Carcharodon carcharias

7) Hammerhead - Sphyrna zygaena

8) Basking shark - Cetorhimus maximus

9) Whale shark - California coastal areas

10) Spiny dogfish - R.I.

11) Lemon sharks and others

Children will also see specimens of the related fish, such as the remora and pilot fish.

RAYS

CONCEPTS:

1) Different shapes are important

2) Concealment of fish

3) Children become aware of certain dangers to people when adaptations of poison spines or electric organs are used in fish - main idea: body defenses.

Main list of research projects along with sharks. Caught off Woods Hole and Newport, R.I. :

1) Sting Ray - Dasyatis centroura

2) Cow-nosed ray - Rhanoptera bonasus

3) Devil Ray - Manta biroctris (One such creature was caught off the coast of

Block Island measured more than eleven feet in width and weighed 1,689 pounds.)

4) Electric Ray - Comparison differences:

a) Big skate - Raja ocellata, Narragansett Bay

b) Common skate - "Monkeyfish" - Mt. Hope Bay

THE RHODE ISLAND (TIVERTON)

FISH PACKET DEVELOPMENT

This packet was created in 1974 at the Pocasset School with a prime emphasis on a low-keyed version of Rhode Island fish.

A) Terms are not often used, but examples are given of each preceeding concept

1) Classification of certain features that make living things unique.

2) Mapping skills - Children map out migratory routes taken by certain fish.

3) Physiology observations of fish in its movement, its eating habits, its breathing habits and the purpose of coloration.

4) Cryptic coloration

5) Countershading

6) Locomotion

7) Adaptations of fins as limbs, or protection

8) Protective schooling

9) Record sizes are investigated and why some fish are so large.

10) Children look into basic feeding habits of some fish with pollutants in mind.

11) Students investigate the idea of camouflage concealment

12) Weapons are needed

13) Evolution of fish through adaptations

14) Extinction possibilities

15) Overfishing problems

16) Symbiotic relationships when two different forms of fish live together for the mutual benefit of each other.

17) Mutualism relationships - when two different forms of fish live together for the benefit of each other individually.

18) Parasitism relationships - when one member of a partnership benefits to the detriment of the other.

19) Commesalism - when a relationship, in which a member benefits, and the other is not harmed.

20) Awareness of international competition and its problems, as well as its therapeutic value as a sport.

B) Some of the work skills used in this package of inquiry:

1) Reading

2) Writing in outlined form

3) Art sketching

4) Oral communication

5) Problem solving and deduction

6) Fact finding through questions

7) Listening development

8) Thinking independently and in a group (through discussion)

9) Mathematical computation

10) Estimating

11) Plotting and "enjoyment"

SPECIAL MARINE STUDENT SPECIMEN ACTIVITY PACKAGE

This package has been developed with the following concepts being applied for each student:

MAIN CONCEPTS:

1) The effects of ocean conditions as the distribution and abundance factors influencing marine organisms leading to food production.

2) The effects of the metabolic processes of these organisms on the total environment.

3) The influence of environmental factors which lead to the success or failure of populations to survive.

4) Marine ecology with its flow of energy through the food web.

5) The effects of pollutants on living organisms in the ocean.

6) The numerical taxonomy of marine living creatures, their biological make-up, their adaptations and their development.

7) The many uses of marine organisms to people.

TOPIC OF STUDY - "LOWER LIFE"

A) CORALS:

Slides, transparancies, ancient fossils, recent specimen formations and live Rhode Island colonies included in the aquaria.

CONCEPTS:

1) Children will explore the undersea world of corals as a building organism.

a) Skeletons of coral build barrier reefs

b) Darwin's Atolls

c) Fringing reef

2) Children will investigate the structure of coral colonies.

3) Pupils will classify and note differences between main families of coral specimens through the use of common names.

4) Scientists use discriptive names to identify animals

B) SPONGES - The Pore-bearers, simple animal life.

Slides, transparancies, a variety of specimens, including Rhode Island sponges, and a debate.

CONCEPT:

1) Some forms of life could be classified as animal or plant, or as both animal and plant.

2) Principles of interpretation

C) HYDRA (Jellyfish)

Slides, drawings, sketching and model building.

CONCEPTS:

1) Buoyancy

2) Colonial living

3) Specialization

MAIN IDEA:

Children are exposed to a variety of Rhode Island jellyfish. For example, the harmless comb jellies and the true hydra, the Portugese Man-Of-War. Students investigate how it reproduces itself. Time should be given to the safety procedures at the beach when one comes in contact with its stingers. The applied concept for community living in a society should be noted. Even symbiotic relationships of the Nomeus fish should be taught.

4) Students investigate industrial waste, nuclear heating of ocean waters in its helping to create new population growths of hydra.

D) SEA CUCUMBERS, SEA SQUIRTS, ANEMONES

CONCEPT:

Pupils witness the sea anemones in the classroom aquarium and learn about the contributions of pollution concentrations. This is a comparison study before and after.

ECHINODERMS - SPINY ANIMALS, FRIEND OR FOE?

Starfish, Sea Urchins, Sand Dollars

Biological dissections of the common Rhode Island starfish (Asterias rubens). This starfish is considered a plague at the present time.

Children will be exposed to a wide variety of test (hard remains) of classroom specimens. Students will also observe living animals in the sea aquaria. Data collected.

CONCEPTS:

1) Dehydration. Children will investigate the water vascular system.

2) Regeneration. Students will investigate the reproduction of starfish through the building of its rays in order to produce new life.

3) Interpretation of population explosions.

4) Students will look into the Kickimuit River population growth changes between June 4 and 16. Sample study.

5) Analysis of date for the eradication of starfish in Rhode Island waters. Children will look into transplanting of sea shell beds, dredging, mariculture, commercial fertilizers and modern research which seeks to discover a cosmetic or pharmaceutical ingredient in starfish.

HORSESHOE CRABS - LIMULUS POLYPHEMUS

OF RHODE ISLAND WATERS

Students will be able to handle live specimens, both male and female. Group dissection demonstrations at each lab table.

CONCEPTS:

1) Reproduction - Exception to rules

2) Life Cycle of a crab which isn't a crab

3) Survival - the living fossil

4) Exoskeleton - its structure, development, molting

5) Myth and fact

6) Usefulness in the sea and its impact on human blood clotting.

HIGHER CRUSTACEANS

LOBSTERS - HOMORUS AMERICANUS

Demonstration of lobster dissections, slides, transparancies, sketching, followed by the dissection of crayfish, sea aquarium, lobster pots.

CONCEPTS:

1) Students will be able to investigate the basic parts and adaptations of the organism and their functions.

2) Locomotion - children will explore jet propulsion.

3) Defense mechanisms of retreat, attack and camouflage

4) Students will look into the feeding habits of the so-called scavenger.

5) Students will investigate lobsters as a food source, especially the element ...ding importance to human growth.

6) Overfishing, scarcity and demand

7) Mariculture

8) Children will investigate the importance of crayfish in Rhode Island fresh water ponds.

9) Diversity - Students will compare differences of world populations of lobster distribution.

10) Special adaptation features such as the Tasmanian lobster, which lives most of its life out of water, will be featured.

11) For advanced students - Biological management.

CONCEPT:

Growth Rate Variable. Students will be given factual information data concerning Woods Hole and U.R.I. studies in raising lobsters.

Interpretation, analysis and deduction of temperature, molting, fishing regulations set by law and distribution.

CRUSTACEANS - CRABS

Hermit crabs, Alaskan King Crabs, swimming crabs, shore crabs, burrowing crabs, sand crabs, fiddlers, spider crabs, rock crabs. All are found in Rhode Island, except the giant Alaskan King crab.

CONCEPT:

Adaptations and niches.

COPEPODS - MICROSCOPIC LIFE

CONCEPT:

Children learn about the most abundant form of life on our planet. Investigation of live plankton specimens:

1) zooplankton investigation

2) phytoplankton investigation

3) comparison studies of water fleas, worms, fish louse, parasite barnacles.

BRINE SHRIMP, SEA MONKEYS

CONCEPTS:

1) Suspended animation - Cryptobiosis

Children will hatch brine shrimp (Artemia salina)

2) Children will investigate food chain scavengers, detrius eaters.

BARNACLES - FOULING ORGANISMS

CONCEPT:

Children take a hard look at the costly transportation problems resulting from fouling organisms.

CEPHALAPODS - HIGHER MOLLUSKS

Octopus, nautilus, squids, cuttlefish.

As a very popular topic, children will observe specimens, slides, filmstrips or movies, T.V. specials.

CONCEPTS:

1) Myth versus truth. Children will investigate Victor Hugo's description of the octopus in the "Toilers of the Sea."

2) Defense mechanism. Students will be able to learn about evasive action and jet propulsion.

3) Food sources and the giant squid.

4) Adaptations and modifications of living organisms through evolution.

5) Animals learn by conditioning

6) Submarines - air pressure. Pupils will investigate the chambered nautilus compartments in the classroom. Children will also investigate the Carthagian bell.

7) Protective coloration through camouflage.

INVESTIGATION

A walk at the beach and seashore.

PROCESS:

Actual, recall, slides, movies, closed circuit T.V., transparancies, models.

MAIN SEASHORE PROFILES:

1) Rocky Seashore

2) Sandy Seashore

3) Salt marsh and brackish waters

4) Commercial developments - piers, bridges

OBSERVING ZONES:

1) Offshore

2) Shoaling waves

3) Intertidal flows

4) Tidal pools

5) Inshore

Collecting specimens, most children desire to bring in all kinds of souvenirs of the seashore visits. Of course, they will also have all kinds of questions.

ALGAE - "SEAWEED"

Investigation for main kinds, drying specimens, mounting, identifying.

Special emphasis should be given for the new-found uses in ice cream, milk shakes, candy, paints, ceramics, textile products, accoustic tiles, toothpaste, vitamins, etc.

CONCEPT:

Photosynthesis

CONCEPT:

The ocean as the basis for all life.

CONCEPT:

By using up landlocked resources, people need new sources for food and minerals.

CONCHOLOGY

Students learn the basic classification of mollusks (soft bodied animals). Sea aquarium, the seashore, slides, transparancies, and more than a thousand different kinds of sea shells.

SKILLS EMPHASIS:

Observation and classification.

MAIN CONCEPTS:

1) Basic value of mollusks as a food source.

2) Basic differences

a) Rhode Island shells

b) Worldwide shells

1) Temperate climates

2) Tropical climates

3) Respiration:

Students will investigate the basic biology of main group of univalves, bivalves, tusk shells, chitons.

4) Reproduction:

Children will compare the life cycles along our seashore and in the class aquarium.

5) Locomotion:

Methods of locomotion are explored and data is recorded.

6) Feeding:

Children will be able to look at special devices used in feeding.

7) Protection:

Adaptation of defensive mechanisms.

8) Aesthetic Value:

Children exposed to the beauty of the sea world through sea shells and the products made from shells. For example: pearls, mother of pearl shell, abalone jewelry, cameos, porcelain dishes, chicken feed, buttons, dye (murex), and collecting.

WATER FOWL OF RHODE ISLAND

Specimens, slides, books.

CONCEPT:

1) Children will be able to investigate the necessary adaptations of water fowl. Ornithology (bird study) is investigated in its relationship to the seashore. For example, beak types. Birds such as the local herring gull or blackbacked gull, are looked upon as scavengers.

2) Migration of birds into Rhode Island waters. Children will learn through observation of photographs, slides, and date migration patterns. For example, some ducks and geese populations winter here in Rhode Island.

3) Misuse of insecticides, DDT, and related poisons.

MAMMALS OF THE SEA

Whales, dolphins, killer whales, porpoises, and related mammals of the sea, including the Rhode Island harbor seal.

Slides, transparancies, specimen parts, reports and a debate.

CONCEPTS:

1) Logic:

Extinction versus food consumption. For example, students will compare

the value of saving the whales to dollars and cents.

Debate: Two teams attempt to change each other's viewpoint.

2) Comparison:

Size and measurement investigations.

3) Basic adaptation features are investigated.

4) Sonar (Echolation) radar. Children learn about a variety of life styles suited for a water environment.

5) Migration:

Children will be able to use map skills and plot routes taken by mammals.

SPECIAL FEATURES:

1) Whales in Rhode Island waters.

2) Children will learn from their teacher the first-hand knowledge. Methods of dissection techniques are used from the Woods Hole Institute.

CONCEPTS:

1) Conservation versus extinction

2)Products for humans versus nutrients necessary for the micro-scopic life within the ocean.

SPECIAL FEATURES:

1) Dolphins in the Sakonnet River

2) Training of dolphins. Marineland and New England Aquariums movie.

REPTILES OF THE SEA

TURTLES:

1) Leatherback - Newport

2) Hawkbill - Examination of specimen in the classroom

3) Green sea turtles. University of R.I. experimentation of navigation.

CONCEPTS:

1) Navigation

2) Structure

3) Incubation. Live incubation of turtles has taken place in the classroom.

MARINE IGUANAS:

Live iguanas are studied.

CONCEPT:

Reptile development

SEA SNAKES (Family Hydrophidae)

Children will learn about this creature's special adaptation to aquatic life style, such as their flattened tail, their nostril flap which closes to exclude water.

Medicinal uses for venom studied.

PHYSICAL SCIENCE - GEOLOGICAL MARINE STUDIES

Children will investigate the distribution of the land and ocean areas of the world.

1) Northern Hemisphere

2) Southern Hemisphere

CONCEPT:

Oceans. Students will become aware of the main feature of the world oceans.

SUBTOPICS OF INQUIRY:

1) Sea level

   a) Uplifting of large areas of ocean bottoms

   b) formations of glaciers

   c) sea floor - "Continental drift"

      1) fracture zones

      2) volcanic ridges

MARINE GEOPHYSICS

CONCEPT:

1) Ocean Depths - Students will learn about continental shelves, ocean basins, canyons, ocean rises, trenches, volcanic islands, island arcs, valleys, mountains, ridges, etc.

2) Coastal Oceans - Pupils will relate to the problems of mariculture, over-fishing, dredging, sounding in coastal waters.

SUGGESTIONS:

Reports, model building.

FOOD WEBS, FOOD CHAINS, TROPIC LEVELS

MAIN CONCEPT: "Survival"

Children will attempt to use their past experience in M.A.D. in a food chain simulation game designed by students of Pocasset School in 1974.

POLLUTION IN RHODE ISLAND WATERS

MAIN CONCEPT: "Control"

1) Students will investigate local problems. For example, R.I. waters are polluted to some degree.

2) Children will look into world problems. Smithsonian Institute's "State of the Earth Report."

a) Industrial wastes (synthetic, toxic)

b) The ocean as a dumping ground

c) Sewage - (organic) nitrogen cycle and plant nutrients

d) Oil Spills

1) offshore oil drilling

2) tankers

e) Ocean pollution through the burning of fossil fuels

f) Radioactive wastes

g) Sediments - dredging, sand movements, detergents

h) Disease causing agents

MAIN CONCEPT:

Citizens' application in future management of the world ecosystem.

THE OCEAN

MAIN CONCEPTS:

1) The ocean as the main source of the oxygen cycle (air).

2) The ocean as a climatic factor

3) The ocean as a food source

4) The necessity of life, the water cycle

CONCEPT: The tides.

GROUP DISCUSSION TOPICS:

1) The necessity for survival.

2) The need for international cooperation and laws concerning the oceans.

3) Applied knowledge put into practical use through investigation.

CHEMICAL OCEAN STUDIES

MAIN CONCEPTS:

1) Origin of life on this planet.

2) Protoplasm - life's building blocks

3) Basic composition of seawater

4) Salinity

5) Pressure

6) Temperature factors

7) A closed system

8) Currents and circulation

Advanced students will be able to do basic experiments, research studies in the above areas.

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C O N T R I B U T O R S

Charles Bennett

Gladys Bennett

Norman Champagne (Grades 5 and 6)

Ronald Durfee