

## Implementation Plan

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I have a great opportunity to teach an Advanced Marine Science elective at my school. It is an academic elective so I tend to get students who really want to learn about Marine Science and who are willing to do the work. They get to pick the elective so I receive those students who want it, which could be any group. Since it is an elective I am not required to teach any one particular subject, so I pretty much do what I want throughout the year. Much of my curriculum supports their other science class curriculum, and reviews information they have learned in the past, and introduces many concepts that they will be learning in the future.

Since my class is a year course, and it doesn't have to follow the standards for the eighth grade year, I am able to teach many concepts that have standards in different grades. In other words, I teach concepts that are covered by the standards in 7<sup>th</sup> to 12<sup>th</sup> grade. Of the 7<sup>th</sup> grade standards, we cover cells, genetics, evolution, earth and life history, structure and function in living things, and investigation and experimentation. Of the 8<sup>th</sup> grade standards, we cover structure of matter, reactions, chemistry of life systems, density and buoyancy, and investigation and experimentation. Of the 9-12<sup>th</sup> grade standards, we cover physics: motion and forces, and waves. In chemistry we cover gases and their properties, acids and bases, solutions, and chemical thermodynamics. In biology we cover cell biology, ecology, evolution, and physiology. In earth science we cover dynamic earth processes, energy in the earth system, and California geology.

I have divided the year into different units; Beach Fieldtrip Studies, Discovering the Sea Floor, Waves, Tides, Currents and Beaches, Chemical Oceanography, and Marine Biology. The overall plan is to have each unit last approximately eight weeks, but some units are shorter than others and some units take longer. The time it takes to complete the activities depends on the class. My rule of thumb is once the first person finishes, I give them one more period to complete the activity. I don't do this for everything, mostly the labs and larger projects.

In my class we have at least three fieldtrips. The first is a trip to Cabrillo Beach, where students do field research for the day. They do a wave study, they catch plankton,

they do a tide pool search where they have to find and identify different organisms, and they look at the plankton with field microscopes. I also take my students to Catalina Island Marine Institute (CIMI), at Toyon Bay. There we spend the weekend performing many marine science activities, and the students really get to experience marine science. At the end of the year we go to Sea World and they get to see an educational show on marine conservation, and they get to tour the park. This year my students are also participating in a program Occidental College offers called TOPS. My students have the opportunity to perform actual marine research on a marine research vessel. They get to go out and take data, and then use that data to answer their hypothesis and present their findings. They will be presenting in class, but some will also be picked to go to Occidental College to present their findings there as well.

I use all sorts of materials and equipment. I have been gathering stuff since I first started teaching. (That's what teacher's are good at.) The students use microscopes, plankton nets, manometers, I have a set of Marine Biology textbooks they use, and I recently acquired a salt-water aquarium. (It needs a lot of work before I'll be able to bring it to school though.) I have also ordered a touch tank that I will hopefully get, so students can touch live marine invertebrates in the classroom.

I evaluate the effectiveness of my program constantly. I look at their work, their test scores, their presentations to the class, to get an overall picture of how they're doing. I also cooperate with the other 7<sup>th</sup> and 8<sup>th</sup> grade teachers quite a bit. I try to add to or build on what they are teaching in their classes. Luckily, our science department is a very close, strong group of people, and it is easy for me to work with them. As a result, I will continue involving them in learning about Marine Science and helping them implement it into their programs. I have started already in the 7<sup>th</sup> grade department during our Professional Development time. The 7<sup>th</sup> grade department is going through our entire curriculum and revamping it, as we do this I am able to integrate activities from SSWIMS into our program. The 8<sup>th</sup> grade teachers are a little more difficult only since I am working on the 7<sup>th</sup> grade teachers still, but when we finish this project, I plan on joining the 8<sup>th</sup> grade teachers and doing the same with them.

## Beach Fieldtrip Studies Unit

### Activities:

1. Notebook Divider: Using a pre-made design, carbon paper, and thick paper, students create a notebook divider for this unit.
2. Tide pool Life: Students read about tide pool organisms in a field guide, and then list characteristics that would help them identify the organisms and two facts of interest to them. They also color the organisms the appropriate colors.
3. Life Between the Tides: Read article and then answer questions.
4. A Pacific Tide Pool: Match organisms with their names and color.
5. Tide pool Paste-up: Cut out animal halves, paste them together on construction paper, number them and write their names on answer list.
6. Tide pool Search: Read background information, color animals, cut them out and put them in the appropriate places in the tide pool.
7. Effects of Man of Tide pools: Read story. Think about what they are reading and try to decide how they would feel in a similar situation. Write a paragraph, describing what they think man's responsibility is toward living creatures.
8. Animals: Students figure out how scientists classify organisms. (For Sea, Grades 9-12)
9. Introduced Species—The Asian Clam in San Francisco Bay: Students learn about the dangers of introduced species. (For Sea, Grade 8)
10. The Grey Whale: Read information on Grey Whales, and then map out their migration route and the times they are in different places, and then answer questions.
11. The Sea Otter: Read article on Sea Otter's and then answer questions.
12. Filmstrips: "The Rocky Shore," "The Shell Builders," "Man and the Sea Past, Present, Future," "Grey Whale," "The Sea Otter," "Return to the Sea."
13. Puzzles: Find the Critter, Tide Pool Scramble
14. Observing Algae: Students observe live &/or pressed algae and use a dichotomous key to classify the algae. (For Sea: Unit 4—Ocean Waves and Life in the Surf Zone—Sandy Beaches and Kelp Forests)

15. Tidal Zonation Patterns: Read and color correspondingly. (Marine Biology Coloring Book)
16. Rocky Shores: Read and color correspondingly. (Marine Biology Coloring Book)
17. Tide Pool: Read and color correspondingly. (Marine Biology Coloring Book)
18. The Rocky Shore Field Notes: Give to Students to read and add to their notebook. Put together a field guide for their fieldtrip with previous work. (Sea Searchers Handbook)
19. Fieldtrip lessons: Do A-D the week before the fieldtrip, E-H are done during the fieldtrip.
  - A. Cabrillo Marine Museum Visitor Questions
  - B. Super Microscope Questions & Label the Parts
  - C. Understanding Waves
  - D. Sandy Beaches and Mudflats
  - E. Plankton Collection and Plankton Microscope Work
  - F. Wave Study Worksheet
  - G. Tide pool Worksheet
  - H. Write Me a Story
20. Unit Test

## Discovering the Sea Floor Unit

### Activities:

1. Notebook Divider
2. Mapping the Ocean Bottom: Read "The Sea" pages 55-73, and answer questions.
3. Sea-Perlatives: Read front, and answer questions on back.
4. Navigation: Read page 365, and do the activity "Make a floating magnetic compass," then read page 367, and do activity 2 "Use a nautical chart to determine position and plot a course." (The Fluid Earth—Unit 5: Transportation)
5. The Ocean Floor Notes: Give picture of ocean floor, go through and label the parts of the ocean floor with vocabulary given. Also, give the "Cross Section of Ocean Features" sheet out and let them take notes during lecture.
6. Plot a Profile of the Atlantic Ocean Floor: Create a cross sectional view of the Atlantic Ocean plotting points from a data table. Label the features seen, and then answer questions.
7. "The Restless Sea": Watch filmstrip and answer questions as they watch.
8. Mapping Project: Copy 10 definitions, then on Map A label Continents, Islands, Oceans, and then indicate locations of 50 features using appropriate symbols and labels. On Map B write the names for the features. Answer summary questions and complete ocean floor practice puzzle as a review.
9. "Introduction to Oceanography" filmstrip with questions
10. Locating Points on Globes: read pages 12-16, discuss how to locate points and do the activity on pages 16-21, where students make a globe with an orange. (The Fluid Earth: Unit 1—Earth and Ocean Basins)
11. Depth Sounding Lab: Students try measuring the depth of an ocean the same way ancient sea explorers did with cannonballs tied to the end of a rope and lowered down. Student's use cans filled with water to simulate the ocean, and they create a graph of what they think their ocean floor looks like and then dump the water to see if they were correct.
12. Exploring the Ocean Floor: Students use Riker Mounts to determine what a Fathometer would do. They use a probe and create a graph of what the ocean floor looks like. They compare their graph with the actual bottom of the riker mount.

13. Seafloor Features: read page 28, do activity on pg 29 "Interpreting contour maps of seafloor and coastal features" (The Fluid Earth: Unit 1—Earth and Ocean Basins)
14. Plate Tectonics Notes: Give students blank pages and they fill them in as I lecture on plate tectonics. (Use SSWIMS power point)
15. Plate Tectonics Filmstrip with Questions.
16. Reunite Pangaea: Lab showing how the plates fit together and create Pangaea. (For Sea: Grade 8)
17. Hydrothermal Vent Formation: Activity about how hydrothermal vents are formed and the places they are formed. (For Sea: Grade 8)
18. Plate Boundaries Lab: Lab on different types of plate boundaries, with an emphasis on the Mid-Atlantic Rift Zone.
19. Earthquakes Around Town and Around the World Lab: Students create a seismological Earth model and use their model to answer questions about where earthquakes are located.
20. Earth's Moving Plates: Read pages 62-68, and do the activity on page 67 "Interpret information about the earth's moving plates from the map in Fig. 8-2." (The Fluid Earth, Unit 1—Earth and Ocean Basins)
21. Mountains that Blow their Top Lab: Lab on different types of volcanoes. Students create model volcanoes and answer questions.
22. Dante's Peak Video with questions and cross word puzzle.
23. Discovering the Sea Floor Bingo Game Review.
24. Unit Test

## Waves, Currents, Tides and Beaches Unit

### Activities:

1. Notebook Divider
2. Major Ocean Currents: Students color and label a map of the world, and then label the currents, and the directions they are moving. They use their maps to answer questions about currents.
3. Wave and Current Notes: Students take notes on their own paper, as I lecture.
4. Nike Shoe Investigation: Students plot the location of points where Nike shoes were seen, and then answer questions about the currents responsible.  
(Oceanglobe: [http://www.msc.ucla.edu/oceanglobe/pdf/nike\\_invest.pdf](http://www.msc.ucla.edu/oceanglobe/pdf/nike_invest.pdf))
5. Wind Waves: Read page 88-93, and do activity 1 on page 93 "Simulate wind-wave formation, movement and effect on exposed coasts." (The Fluid Earth, Unit 2—Waves and Beaches.)
6. Wave-Coast Interactions: Read page 103-112. Do Activity 1 "Identify typical coastal features," on page 103 and then do Activity 2 "Observe patterns formed by waves interacting with coastal features" on page 106, and then do Activity 3 "Study the formation of currents and the effects of coastal features on them" on page 110. (The Fluid Earth, Unit 2: Waves and Beaches)
7. How do Oceans Affect Climate: Students plot temperatures of two cities (San Diego and Indio) during the year, they then use the graphs to determine how the ocean affects the climate.
8. Formation of Currents: Read page 171-172, Do Activity 1 on page 172 "Determine what conditions cause gravity currents to form in liquids," then read pages 173-175, and do activity 2 "Simulate convection currents formed between hot equatorial water masses and cold polar water masses." (The Fluid Earth, Unit 3—Physical Oceanography)
9. Wind and Surface Currents: Read pages 184-189, and then do activity 1 "Relate major ocean surface currents to wind circulation patterns and the rotational effect of the earth" and 2 "Simulate the interaction of bodies of water at different heights" on pages 190-194. (The Fluid Earth, Unit 3—Physical Oceanography)
10. El Nino: A current case study: Students learn about El Nino and its effects. (For Sea, Grade 8)
11. Tide Notes: Same as wave and current notes.

12. Tides: Read pages 113-130. Do Activity 1 "Plot a tide graph from a tide table", and then do Activity 2 "Graph the combined effect of tidal changes caused by the sun and the moon during a spring tide and during a neap tide." (The Fluid Earth, Unit 2—Waves and Beaches)
13. Physics of Sea Water Notes: Give worksheet, students take notes on the worksheet and solve problems on the back. Do a sample problem together first.
14. "The Liquid Sky" and "Sea of Motion" Filmstrips.
15. Manometer Lab: Students measure the water pressure of fresh and salt water using a manometer that they make. (The Fluid Earth, Unit 3: Physical Oceanography—page 195-202)
16. An oceanography review of waves, currents, tides and water pressure: Students use notes and answer questions.
17. Beach Sands Notes: Students are given worksheets that they fill in as I lecture.
18. Marine Sedimentation Lab: Students solve a mystery as they become familiar with the different types of sand from around the world. (Very similar to Activity 1 and 2 from the Fluid Earth, Unit 2—Waves and Beaches, page 140-153.)
19. Jeopardy Review
20. Unit Test

## Chemical Oceanography

### Activities:

1. Notebook Divider
2. Properties of Water and Other Liquids: Do Activity on page 155-157, "Observe water and describe its properties. Compare the properties of fresh water with the properties of salt water and alcohol." (The Fluid Earth, Unit 3—Physical Oceanography)
3. Current Notes: Students take notes from lecture, focus on density, salinity and temperature in lecture.
4. Density, Temperature, and Salinity: Read page 158, and do Activity 1 on page 159 "Test the effects of temperature and salinity on the floating and sinking of liquid samples in bags" (The Fluid Earth, Unit 3—Physical Oceanography)
5. Density Currents: Students create a density current of cold water as it sinks through a layer of warmer water.
6. Salt and Fresh Water: Students perform a similar experiment as above, but they discover what happens with salt versus fresh water.
7. Chemical Oceanography Notes: students take notes during lecture
8. Salinity Studies—Finding Salinity by weight: Students determine the salinity of a solution using an evaporation technique. (Similar to The Fluid Earth, Unit 4—Chemical Oceanography, pages 249-252)
9. Salinity Graphing: Students graph the salinity of Big Sur, CA, and then use the graphs to answer questions and do a Chemical Oceanography cross word puzzle.
10. Salinity Mapping: Students create a contour map of salinity at different stations along the coast of CA. They use their contour map to answer questions.
11. Water Analysis Lab: Students perform a variety of tests to determine that the ocean is filled with every element on Earth in varying amounts.
12. Chemical Oceanography Jeopardy game as Review.
13. Unit Test

## Marine Biology

### Activities:

1. Notebook Divider
2. Nautiloid Model: Students create model of nautiloid
3. Fishwitch: puzzle
4. The Chain of Life: Read pages 103-113 in *The Sea* and answer questions.
5. Marine Biology—Microviewers: Students use microviewers to look at slides of marine organisms and answer questions.
6. Diatomaceous Earth Lab: Students look at diatomaceous earth to discover fossilized diatoms, and learn about diatoms in the process.
7. “The Survivors” and the “Invisible Multitude” Filmstrips.
8. Marine Plankton Microviewer Lab: Students use microviewers to look at plankton and answer questions.
9. Phytoplankton: Diversity and Structure: Read and color appropriately. (Marine Biology Coloring Book, number 19)
10. Plankton Lab: Students use microscopes to look at live plankton. They observe the plankton and draw what they see. Then they have to identify the plankton they’ve found and learn about it. (Similar to The Living Ocean’s Plankton activity on pages 390-400)
11. Classification, Nomenclature, and Keys: Students use a word classification key to identify several species of butterfly fish. (The Living Sea, Unit 1—Fish, pages 14-21)
12. Fish Prints: Activity 1 “Experiment with ways of making fish prints. Prepare a collection of prints of common fish species.” (The Living Earth, Unit 1—Fish, pages 4-7)
13. The External Anatomy of Fish: Activity 1 “Identify the common external anatomical structures of several fish. Compare the shapes, sizes, and locations of these structures.” (The Living Earth, Unit 1—Fish, pages 8-13)
14. Read a Fish: Students learn the functions of fish body parts, and how they help them survive in their habitat. (For Sea: Unit 4—Fish Features)

15. Fish: What's on the Outside: Students learn the external features of a fish, and how they can give clues to the fish's lifestyle. (For Sea: Unit 6—Issues of the Ocean Basins)
16. Invent-A-Fish: Students invent fish that could fit in different habitats.
17. Fish: Modeling the Inside: Students model the organs of the fish and compare the organs functions with human organ functions. (For Sea, Unit 6—Issues of the Ocean Basins)
18. Dissecting a Fish: Students examine a fish internally to identify organs of the different systems. (The Living Ocean, Unit 1: Fish, pages 88-95)
19. Sharks: Activity 1 “Compare sharks with bony fish,” activity 2 “Make a poster showing the habitats of sharks,” activity 3 “Analyze the meanings of the scientific names of some species of sharks,” activity 4 “Determine the latitude, season, and time of day of most shark attacks worldwide,” and activity 5 “Describe the type of activity and location of victims attacked by sharks.” (The Living Ocean, Unit 1: Fish, pages 110-126)
20. Classification and Comparison of Invertebrates: Activity 1 “Translate the Latin and Greek word parts that make up phylum names. Find a major identifying feature of each phylum,” and activity 2 “Compare the features of some common invertebrate phyla.” (The Living Ocean: Unit 2—Invertebrates, pages 137-145)
21. The Sting—Cnidarians: Students use classification key to discover information about cnidarians. (For Sea, Grades 9-12)
22. The Shelled Animals--Mollusca: Same as above
23. The Jointed Foot Animals—Arthropods: Same as above
24. The Spiny Skin Animals—Echinodermata: Same as above
25. Urchins: For Sea, Grades 9-12
26. “Starfish Threaten Pacific Reefs”—A three level guide: (For Sea, Grades 9-12)
27. Squid Dissection: Students observe the external and internal anatomy of a squid; we then clean and cook the mantle.
28. Build a Kelp Forest in your classroom: Students use the models of the kelp pieces and examples of organisms that live in a kelp forest to create a forest in the classroom. (SSWIMS Handout)

29. Pressing Seaweeds: Students “Make a collection of pressed seaweeds.” (The Living Ocean, Unit 3—Plants, pages 307-312)
30. Bioenergetics: Read pages 378-379, and do activity 1 “Develop food chains showing relationships between predators and prey.” Then read page 381, and do activity 2 “Develop a food web. Investigate the role of decomposers. Diagram the flow of energy and cycling of matter in the biosphere,” and activity 3 “Play the Trophic Level Game” on pages 385-389. (The Living Ocean, Unit 4—Ecology)
31. Jeopardy Game Review
32. Unit Test