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Design of a field trip introduction to tidepools using videotape

Laura I. Shaw
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DESIGN OF A FIELD TRIP INTRODUCTION TO TIDEPOOLS USING
VIDEOTAPE

A Thesis
Presented to
The Faculty of the Department of Biological Sciences
San Jose State University

In Partial Fulfillment
of the Requirements for the Degree
Masters of Arts
in Natural Science

Laura I. Shaw
May, 1993

APPROVED FOR THE NATURAL SCIENCE
PROGRAM IN THE DEPARTMENT OF BIOLOGICAL
SCIENCE

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ABSTRACT

DESIGN OF A FIELD TRIP INTRODUCTION TO TIDEPOOLS USING
VIDEOTAPE

by Laura I. Shaw

This thesis describes the research that went into designing a script and storyboard for a video to prepare elementary and junior high students to go on a field trip to the tidepools. Two goals are to align the script with a thematic integration of all science disciplines and to use an "ecosystem approach" to the discussion of the intertidal zone. The process of developing the script and a description of production procedures is illustrated.

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INTRODUCTION

At low tide we are privileged to view one of the most densely populated ecosystems in the world. The incredibly diverse wildlife of the intertidal region is readily accessible to the 45 percent of this country's population who live on the coast (Silverberg 1990, 9). School field trips to intertidal areas have long been popular. Proper preparation for a tidepool field trip can make the difference in whether students learn something about the complex interactions within the community or merely a few names of animals. As an outdoor educator and elementary science specialist leading tidepool field trips, I was constantly looking for better ways of preparing students for this experience and finding that very few materials were available to me. In the interest of time, most teachers look toward film or video for pre-trip preparation. Thus the idea of a video specifically designed to prepare students for tidepool field trips was born.

NEEDS AND CONCERNS

Ecosystem Approach

Distinctly lacking in most intertidal curricula and resources is an ecosystem approach to the intertidal zone. In a paper presented at the 1988 Symposium for Science Learning in the Informal Setting, Frank B. Golley explains how Sir Arthur George Tansley, who coined the term ecosystem, felt about this concept.

His ecosystem involved both the inorganic, made up of soil, rock, and water, and the organic, made up of organisms. This dynamic system involved constant exchange between the organic and the inorganic and between organic and organic so that an equilibrium of structure and function occurred. (Golley 1992, 3)

Most videos, films, curricula and books about the intertidal ecosystem lack a discussion of its abiotic elements. To understand the life forms of an ecosystem, it is important to understand their habitat. Since a field trip to an intertidal area is such an ideal experience for seeing an ecosystem in action, it is best to concentrate on adaptations for survival rather than extensive information about life cycles. A more in-depth study of life cycles would be a good research project for students as a follow up activity.

Alignment With Science Framework for California Public Schools

A thematic approach to science education is outlined in the Science Framework for California Public Schools (1990) and in Science for All Americans, a report issued by Project 2061 of the American Association for the Advancement of Science (1989). Thematic teaching in science includes all science disciplines (biology, earth science, physical science), and shows how they connect to help understand the world in a holistic manner. It is hoped that a more integrated approach to science instruction will reduce the fragmentation of science that occurs when instruction focuses on isolated facts and concepts.

Recent critics of science education have been dismayed by the lack of progress in students' understanding of the major concepts and issues of science. They cite the historical (and current) fragmentation of the major disciplines of science and complain that trivia seem to be the stock-in-trade of science lessons. Paul Hurd, Professor Emeritus at Stanford University, has observed that science is often taught "as a foreign language" in which isolated terms and apparently meaningless facts are arrayed for students' reading and regurgitation. Instead, themes should connect the realms of science; they should be stressed as students learn science; and they should also provide a framework to guide teachers in developing instructional tools. (Science Framework for California Public Schools 1990, 28)

The Science Framework for California Public Schools (1990) has helped to guide the creation of this video script and storyboard by its listing of important content strands. "What are ecosystems? How do organisms interact in ecosystems? How does energy flow within an ecosystem? How do ecosystems change? What are the responsibilities of humans toward ecosystems?" These questions as posed in the framework (136) have been most influential in formulating the content of this video script. This "ecosystem approach" helps to tie together natural history facts in a way that has not often been done in other media on the intertidal zone.

Human Impact in the Intertidal Ecosystem

In the United States, 75 percent of the population lives in states bordering the coastline and 45 percent live on the coast (Silverberg 1990, 9). Across the country millions of children every year visit tidepools on school field trips. If the public does not protect the heavily visited areas of our coastline, the resource will not be available to view.

James Fitzgerald Marine Reserve on the coast of San Mateo County, California is a heavily impacted intertidal ecosystem located near a major metropolitan area. Last year, 23,600 elementary and junior high aged students visited the reserve. In the "Monitoring and Management Plan for James Fitzgerald Marine Reserve," edited by Edna de Larios for the Parks and Recreation Commission in January 1993, it was found that yearly attendance at the reserve had increased from 70,000 individuals in 1969 to 111,000 in 1991. In addition, it was observed that 2,000 visitors were sometimes present in a single hour during a good low tide. The Monitoring and Management Plan

noted that more uncommon animals such as nudibranchs, sun stars, octopus, and eels are being sighted less frequently. It was noted that human trampling favors the monoculture of turban snails and mussels in some areas, decreasing species diversity. The algae in heavily trampled areas develops more of a "turf" growth form and is not as good a habitat for animals seeking shelter. The recommendations now are to restrict the numbers of school children who can use the reserve, and to develop a plan to limit the overall number of visitors (de Larios 1990).

For five years, I taught field biology on the San Mateo Coast for several outdoor schools. During this time I led tidepool field trips once or twice a week. Over this five year period I saw the diversity of species and numbers of animals grow smaller in the area that we used. I saw many other groups of students come with their teachers and blatantly disregard safety and the environmental impact of their visit. Mark Nolan, Director of Exploring New Horizons Outdoor School and former Director of Pigeon Point Environmental Program, has observed that in the area used for tidepooling by his program, the algae cover on the tops of intertidal rocks is becoming sparse.

A need for protection as well as interpretation of the intertidal area has been felt by the local state and county parks. The State Park Service on the San Mateo coast has begun a docent led tidepooling program at two popular intertidal areas to help educate the public on ways of decreasing human impact. Robert Breen, head ranger for James Fitzgerald Marine Reserve, has set up a training program for classroom teachers who wish to bring their students to the reserve. The program is small, however, and fewer than 10% of the teachers who bring their classes to the reserve attend. He has approached San Francisco State repeatedly to produce an interpretive film on the tidepools

that would discuss safety and impact as well as the natural history of the animals, but they have shown no interest in doing this type of film.

Safety

Each year several people are washed out to sea while exploring along the California coast. The intertidal zone can be an area of extreme danger because of high waves and slippery rocks. At James Fitzgerald Marine Reserve, people frequently sprain or break their ankles or fall and cut their hands and faces due to the difficulty of walking on slippery rocks (Breen 1993). School districts can ill afford to disregard any safety precautions that can be taken on a school activity. The proposed video will instruct about safety issues.

Preparation for Field Trips

Field trips to the intertidal area are still very popular even with dramatic cuts in field trip expenditures. Why precisely do teachers go on field trips, and how can they be used most effectively in teaching? In a paper entitled "Evaluating the Effectiveness of Field Experiences" John J. Koran, Jr. and S. Denis Baker, stated that:

Evaluating the outcomes of a field trip experience is clearly one of the most difficult of all tasks. First, objectives in the cognitive and affective domains need to be clearly specified. Then the question needs to be asked, "What will students be doing or saying to illustrate achievement of this objective?" (1989, 59)

After defining the objective of the trip, teachers need to provide advance instruction that relates to the field trip experience. "Films, slides, lectures, outlines and supplemental reading can all contribute to developing

necessary conceptual structure that students can use to incorporate and interpret field experiences" (Koran and Baker 1981, 59).

Video is especially suited to prepare students for a field trip because it is a visual introduction to a similar site and it encompasses a wide range of learners and learning styles.

There has been some discussion involving whether field trips are truly educational because of the wide variety of distracting stimuli. J. H. Falk and J. D. Balling's "The School Field Trip, Where You Go Makes All the Difference" (Science and Children 1980) related that 5th and 6th grade students were ready for all day field trips to novel settings, but that younger children did poorly with novel settings and learned best closer to home.

Another key to maximizing the field trip experience is to minimize the distractions. One way to achieve this is to give students an interactive task to perform. At the intertidal area this might be a simple key or guide to animals that they use while exploring. They might be asked to draw or take pictures of animals and plants they find. A very effective method to get students to look longer at a given micro-community is to have them sit very quietly by a particular pool and record all the activity and organisms that they see.

Although a number of values are attributed to field trips, their main objective is to provide learning through direct experience. The use of the community and its resources permits the expansion of the classroom to include the entire world of the pupil. The field trip is a laboratory which enables teachers to bridge the gap between the classroom and the world outside school. (Krepel and DuVall 1981, 9)

Few teachers would dispute that it is a noble idea to bridge the gap between school and the outside world. First hand experience of an ecosystem is a rare treat for students and highly motivating. When it is not possible to gain first hand experience, a video can be the next

best thing. As budgets are stretched further and tighter, arm chair field trips may unfortunately become the norm.

LITERATURE REVIEW

Videos

Though many of the films and videos screened seemed upon first glance to approach the intertidal area as an ecosystem, none gave substantial attention to the abiotic elements of the ecosystem. The most time in every film or video was used to discuss intertidal animals and relate facts about their natural history. "Animals That Live in the Surf" (Sigma Educational Films 1978) gave the most attention to physical habitat. The film mentions pounding waves, tides, grinding sand, burning sun, and drying air as all elements of the environment to which animals of the intertidal must adapt.

"The Monterey Bay Aquarium Video Collection" (Sea Studios 1988) mentions tides in conjunction with animal adaptations. The narration states that "Animals time their feeding activities to the tides"; then several animals feeding at high tide or low tide are shown. In the "Monterey Bay Aquarium Outreach School Assembly Programs Video" (Sea Studios 1988), the instruction starts out with a discussion of tides and wave shock. "Life Between Tides" (Britannica Films 1963) discusses how animals of the intertidal must live double lives in order to cope with their periodically wet or dry habitat. Wave force is the major theme calling attention to the important adaptations of animals clinging tightly to rocks or hiding from the waves. "The Boundless Seas" (Western Audio Visual Experiences 1978) presents a lot of information on waves and tides; however, its language is aimed above the elementary and middle school audience. All of the films contain themes of animal adaptations.

"Animals That Live in the Surf" and "Life Between Tides" focus more on animal adaptations than any other theme. Zonation is mentioned but not elaborated on in "Life at the Edge of the Sea" (State of California the Resource Agency 1976), "Life Between Tides," and "We Explore the Beach" (Coronet Films 1977).

Only three of the twelve films or videos viewed discussed human impact in the intertidal ecosystem. "Life at the Edge of the Sea" has the most to say about impact. Mentioned is the need to preserve the intertidal areas from the "ecologically unaware." The film's producers feel the survival of this fragile ecosystem is in peril when it depends on "the whim of man." The specific examples they give focus on heedless and widespread collecting.

Environmental impact is mentioned only in conjunction to oil spills in "We Explore the Beach." In "Tripping With Terwiliger: Bay Tidelands" (Terwiliger Nature Center Production 1973), the problem of turning over rocks and not replacing them, "as if someone took the roof of your house and tossed it away," is discussed. The video also demonstrates how to pick up a crab without injury to the crab or the person picking it up. Through visuals and music the film illustrates the problem of habitat destruction when houses are built near the shoreline. The effect of human trampling and mishandling of animals is not mentioned in any video or film previewed.

Two films actually demonstrate how to remove animals with a knife for observation. In "Animals That Live in the Surf" a chiton, a barnacle, and a limpet are all pried off a rock to show their adaptations for withstanding crashing waves. "Seashore Oddities" (Standard Oil Company 1974) shows rocks being turned over and not replaced and animals being pried off rocks. The film gives advice on how to collect animals. No cautions concerning impact

are given. In addition, "Seashore Oddities" opens with how the sea may be the answer to food and energy for the future. It shows oil drilling rigs and explains how compatible they are with the marine environment.

"Only We Explore the Beach" shows children in the tidepools. In this film, we see two children and a naturalist exploring the rocky intertidal zone. "Tripping with Terwiliger: Bay Tidelands" illustrates children exploring a mud flat intertidal area, and then the children are seen showing their parents what they found. None of the films reviewed are in a school or school field trip setting.

The biotic factors of the intertidal area are what all of the videos and films reviewed focus on. All of the films show animals in their natural habitats, except "Tell Me What You See; Sea Life That Doesn't Crawl" (WIVZ Wisconsin Instructional Television 1972) which uses mostly footage in a salt water aquarium. There is little discussion of intertidal plants in any of the videos. When algae are discussed, the focus is on adaptations to wave shock. Beyond being food, nothing is mentioned in any of these films about the role of algae in the intertidal ecosystem.

Most of the films depict seven to fifteen animals of the intertidal zone. Common names for animals are most frequently used. "Sea Shore Oddities" organizes its discussion of animals by taxonomy and illustrates far more species (Eight species of nudibranchs alone!) than any other film. Other films organize their discussion of animals around feeding and reproductive strategies or adaptations.

"The Monterey Bay Aquarium Video Collection" uses the medium of video to its fullest advantage. Close up shots of animals eating, moving, and mating are extraordinary. Included are sounds not available to most ears such

as the scraping of an abalone's radula on a rock while grazing. Through stop action photography the video graphically shows tidal changes and speeds up slow moving animals.

Film and video can easily appear dated because of the clothes or hair styles of the actors, the type of background music used, or the delivery of the narrator. The majority of the films seem dated, and indeed most are over 15 years old. All the background music used is classical music except for folk songs in "Bay Tidelands." A more modern video might use "new age," jazz, rock, or children's music. The narration on all but "Tripping With Terwiliger: Bay Tidelands," "Monterey Bay Aquarium Outreach School Assembly Programs," and "We Explore the Beach" is voice over and very academic sounding. Humor is not part of any of the narration except "Tripping with Terwiliger; Bay Tidelands." This is also the only video that includes touches of fantasy. Educational films need not be stiff and academic. Public television shows like "3-2-1 Contact" and "Reading Rainbow" have shown us the new trend of educational videos that are truly child centered, entertaining, and informative.

Table 1

Summary of Attributes of Existing Films and Videos

	Human Impact	Abiotic	Interesting to Children	Advantage of Media	Dated
Animals That Live in the Surf (F)	O	X	X	X	
Beach and Sea Animals (F)			O		yes
Communities of Living Things (V)					
We Explore the Beach (F)	X		O		yes
Life at the Edge of the Sea (F)	X		O	O	yes
Life Between Tides (F)		X	X	X	
Monterey Bay Aquarium Video Collection (V)		X	X	X	
Monterey Bay Aquarium Outreach School Assembly (V)		X	O	O	
Tell Me What You See: Sea Life that Doesn't Crawl (F)			O		yes
The Boundless Seas (V)		X	O	X	yes
Tidepool Life (F)				X	yes
Tripping With Terwiliger; Bay Tidelands (V)	X		X	X	yes
Seashore (F)			O	O	
Seashore Oddities (F)	O		O	X	yes

Legend

X	Good
O	Poor
Blank	Not Apparent
F	Film
V	Video

As illustrated in Table 1, Summary of Attributes of Existing Films and Videos, only 5 of the 14 videos and films discuss the abiotic community. None of the videos or films depicts the abiotic community in great detail. There is a need to illustrate this part of the ecosystem so that a discussion of animal and plant adaptations will make sense and students will be able to integrate animals' roles into the environment. Eight of the videos and films appeared dated. Only 3 of the 14 videos and films mention human impact or safety concerns while exploring in the intertidal area. Only two films depict children exploring the environment. Current trends in educational television show that children prefer to watch other children in real life situations rather than an expert narrator. Table 1 clearly shows that none of the videos or films have all the attributes necessary for a film or video to prepare students for tidepool field trips.

Curricula

Most of the marine science curricula reviewed follow, in varying degrees, an ecosystem approach. Perhaps best at doing so is High Tide, Low Tide (Snively 1988). This curriculum is set up around reading selections supported by illustrations. Each selection of a plant or animal deals with how that animal behaves or appears at high tide and low tide. Two of the seventeen selections deal with the abiotic factors and the ecosystem viewed as a whole. Many of the suggested discussion questions address adaptations that the animal might have to its environment. Several of the ideas listed for role playing include showing the animals' adaptations at work. The drawbacks of this curriculum are that it is entirely reading based and does not include discovery activities other than role-playing.

The junior high curriculum of the Marine Ecology Research Project (Shenfil 1981) also briefly discusses animal adaptation, zonation, and animal behavior. Though some of the activities do mention abiotic factors none are focused around them. The curriculum in general does not treat the ecosystem as its theme.

Living in Water, a 4-6 grade curriculum by the National Aquarium in Boston (1987), includes many lessons on the abiotic factors in an aquatic ecosystem. These lessons cover the physical and chemical properties of water. The curriculum does not follow a habitats approach to studying the environment nor does it mention the intertidal zone.

Wet and Wild, a K-6 curriculum about the physical ocean (Murphy 1983), has a great deal of material relating to the physical properties of water. One lesson presents a good dramatization concerning tides but nothing else relates specifically to the intertidal ecosystem. Since the curriculum limits itself to the physical ocean it does not use an ecosystem approach.

Project Ocean (Dean, Halversen and Kaza et al. 1987) has a rocky shore habitat guide for K-1 students. All aspects of the ecosystem are mentioned though abiotic elements are not presented in a thorough manner. A great deal of teacher information is pulled from The Marine Biology Coloring Book (Niesen 1982). Several activities about the physical properties of water are compiled from Wet and Wild (Murphy 1983). There are some good dramatizations that show animal adaptations. Several interesting songs about the intertidal area are included.

Though this curriculum is designed for K-1 students the reading level of most material presented is at middle school level. Far too much complex

terminology is used. Even the level of background information for teachers is too detailed. Most of the curriculum is more suited for upper elementary students.

The Monterey Bay Aquarium's Marine Science Teacher Institute 1987, teacher training curriculum (Marine Science Project For SEA 1987) gives a great deal of information on ecosystems of the Monterey Bay. Though most of the material is in the form of background information to the teacher, it has been a guide in preparing the video script. It also contains a field guide that clearly outlines some of the adaptations of each animal, predator-prey relationships, and zonation restrictions.

Diving Into Oceans, a marine science curriculum from the National Wildlife Federation (1988-89) covers the abiotic elements of the intertidal zone well. It discusses zonation and animal adaptation with meaningful teacher background information. The most useful activity presented was the making of a three dimensional marine food web. This is an excellent activity for teachers to use at the end of a unit after students had done individual research on particular animals.

Human impact in the intertidal ecosystem was mentioned only in Project Ocean and High Tide, Low Tide. Project Ocean has several role-playing activities that illustrate human impact in the tidepools. Its list of tidepool field trip precautions concerning impact is almost identical to what is found in High Tide, Low Tide. This list was helpful in preparing the human impact segment of the video script, though the proposed video script and storyboard take a much more conservative approach to protecting habitat.

Children's Literature

There is a plethora of children's literature about the intertidal ecosystem from which to choose. A few books did follow an ecosystem approach in introducing the intertidal area. Tide Pools by Matthew F. Vessel and Herbert H. Wong (1971) is the most exemplary one. Beginning with a definition of ecology, the book goes on to describe the habitat of the tidepool. However, only tides and waves are mentioned as abiotic factors to which animals must adapt. Life in a Tidal Pool by Alvin and Virginia Silverstein (1990) gives a detailed description of the abiotic factors of the intertidal zone. It is very detailed and best suited for high school and college level students, but the information on temperature changes in tide pools and the flushing action of the waves was useful in preparing the video script. When the Tide Goes Far Out by Lorus and Margery Milne (1970) gives a very detailed description of tides, and the discovery by Newton that they were caused by the moon's gravity. Sea and Shore by Clarence Hylander (1950) also discusses the abiotic factors that affect intertidal inhabitants. He felt "Too many seashore explorers are content with merely learning the names of the plants and animals they find. These names should after all be only an introduction to learning their habits and life histories" (15).

Human impact and safety were also well covered in Tide Pools. The book discusses the safety concerns (wet and slippery rocks, incoming tides, and large waves) of exploring tidepools. It mentions returning animals to their exact habitats, not collecting animals, and not leaving trash. Particularly good is the discussion, "Will there always be tide pools?" Habitat destruction and pollution are clearly illustrated in ways that children can understand.

Come With Me to the Edge of the Sea (Stephens 1972) gives very clear directions about picking up rocks. "Don't turn over rocks in the tide pools. This will destroy the homes of countless creatures. Many animals lay eggs beneath rocks. If exposed to bright sunlight, these eggs may die or be quickly eaten by birds or crabs" (39).

On the other hand, two of the children's books reviewed encourage collecting. Sea and Shore and Tide Pools and Beaches (Clemons 1964) explained how to collect animals, including what tools to use and methods of preparation. Both of these books are dated in their attitude toward collecting. Tide Pools and Beaches does discuss litter and the importance of turning rocks back over to protect inhabitants.

The most important consideration for teachers when selecting children's literature for resource information is the readability and interest level of the text. The most complete description of ecology, habitat, and inhabitants is not going to be useful if written in language too difficult to understand. The Life of the Seashore, Sea and Shore, and Life in a Tidal Pool are too detailed and have text that is too technical even for upper elementary students. Tidepools is an excellent example of well written text for upper elementary students. Information is short, to the point, and avoids technical terms whenever possible.

PROPOSED VIDEOTAPE

Advantages of Videotape

Videotape best answers the problem of finding an accessible and appealing format for introduction of the intertidal area. Today's teachers use more videos in their classrooms than any other type of audio visual material. Indeed, 16 mm film is being phased out of county film libraries. The intertidal area should be shown visually, especially if students are expected to later identify inhabitants.

Video can show what the eye cannot see under normal conditions. We can get close to barnacles feeding without being underwater ourselves. Since much of the activity in the intertidal happens at high tide, video is an invaluable aid. Video is not dependent on real time. Using time lapse photography, movement that would take hours to observe, such as limpets grazing on algae, can be shown in seconds. Instruction does not have to be in sequence. A point can be illustrated with a flash back of a previous learning situation or to a scene from a completely different time and place.

Video is an effective educational medium because it involves both auditory and visual learning. For the limited English speaking student the visual material provides comprehensible inputs. At the elementary and middle school level there is often a very wide range of reading levels in a classroom. Curriculum that includes much reading can be very frustrating for students with reading difficulties. Video circumvents this problem because it is not dependent upon written language.

Because video can record in a naturalistic style, question and answer sessions can seem very real, and dialogue is not as likely to seem stilted as it often does in print. Video is the media of today's youth. It is their source of information and entertainment when left to their own devices.

When selecting videos to augment curriculum one must pay attention to many factors. "Media should contribute to specific instructional goals, be appropriate, authentic, organized, balanced, of satisfactory technical quality and cost effective compared to other possible substitutes" (Brown, Norberg, and Srygley 1972). Video should be timely. It has been my observation that nothing distracts students from the intended message faster than outdated hair styles, clothes, or dialogue of actors. Educational content will be lost as the student's attention is drawn to outdated hairstyles, clothing, and language.

Audience

The script and storyboard for the proposed video is created for upper elementary and middle school children. If a field trip is not possible, the proposed video could be used to introduce the intertidal area. It could be used by classroom teachers as well as outdoor school naturalists, state and county parks programs, scout programs, summer camps, and docents who do intertidal interpretation.

Steps in Creating the Script and Storyboard

A script for a video consists of all of the audio information to be presented, who presents it, and how it is presented (i.e., voice over narration). The storyboard consists of camera directions, directions to actors, and all visual

information necessary for planning the production. Often drawings of each scene are included to further illustrate what the scene should include.

In planning this video script and storyboard I took a course on instructional videotape recording to familiarize myself with the planning and production technologies necessary for directing a video. I then went to the media centers of three county offices of education and to the Monterey Bay Aquarium's library to preview all the relevant films and videos that I could find. In addition to films and videos, I looked critically at children's educational television programming to see what was most current and successful in style and format.

Broad Outline of Topics for Script and Storyboard

I. Introduction to rocky coast

- A. One minute collage of quick shots of students exploring the tidepools and close ups of animals
- B. "Tidepool Boogie" by the Banana Slug String Band as background music

II. Explanation of tides

- A. Shots of coastline at high and low tide
- B. Closer shots of a tidepool at high and low tide
- C. Visual aide of tidal bulges and explanation of the moon's gravitational effect

III. Classroom discussion of adaptation in the intertidal zone

- A. Definition of adaptation
- B. Description of physical environment and adaptations
 - 1. Tides
 - 2. Waves
 - 3. Weather
 - 4. Temperature changes
 - 5. Salinity
 - 6. Defense
- C. How to read a tide table

IV. Safety - Discussion at the tidepools

- A. Boundaries
- B. Appropriate dress
- C. Walking on a slippery surface
- D. Watching the ocean
- E. Safe movement (walking not running)
- F. Buddy system

V. Human Impact

- A. Walking on bare rock
- B. Not lifting up rocks
- C. Handling animals
- D. Returning animals
- E. Collecting animals
- F. Pollution

VI. Intertidal Tour

- A. Spray zone
 - 1. Acorn barnacle
 - 2. Limpet
 - B. High tide zone
 - 1. Black turban snail
 - 2. Aggregating anemone
 - C. Mid tide zone
 - 1. Hermit crab
 - 2. Sea sacks (*Haloscion glandiforme*)
-

3. Sea star
 4. Cancer crab
 5. California mussel
 6. Coralline algae
 7. Blenny eel
 8. Sculpin
 9. Close look at one tidepool
- D. Low tide zone
1. Sea urchin
 2. Nudibranch

VII. Classroom review

- A. Review of adaptations to environment
- B. Review of human impact

VIII. Closing collage of tidepool animals with "Tidepool Boogie" as background music.

Classroom scenes will be used to start and end the video to tie in field trip preparation to post-trip activities. Since all but five of the fourteen films and videos reviewed left out any discussion of abiotic factors that affect tidepool inhabitants I felt this information should be up-front, as it sets the stage for the discussion of adaptations that follow. A simple explanation of the tides (one that excluded the effects of the sun's gravitational pull) is chosen because it is more age appropriate. If students can realize that the tide comes in and out twice a day and that the moon's gravity is the main cause of the tides

they will understand it fully enough to grasp how it affects the organisms that live in the intertidal community. The research concerning the abiotic factors in the tidepool environment is included in Appendix A because it is background information for teachers that is not easily found in existing curriculum materials.

The term *adaptation* is defined, since it may not be a familiar term. A student dressed up as a crab is interviewed by the students and teacher to illustrate adaptations. The interview is also used to report information about the crab's habitat. As preparation for their field trip, students look at a tide chart and learn to read it.

The next scene takes place on a cliff above the tidepools as students arrive. Here they meet the docent who will help to answer questions. The docent first discusses safety with the students. Since safety rules are so very important in this potentially dangerous environment, they are discussed at the beginning of the field trip.

Next a discussion of human impact takes place. Following a discussion with Robert Breen, head ranger at James Fitzgerald Marine Reserve, I reworked this section to include very conservative restraints on disturbing habitat. Many tidepool explorers are accustomed to rolling rocks over to observe animals that are under them. Robert Breen feels that this a destructive practice in the tidepools, even if rocks are replaced. Animals get crushed in the process of rolling rocks, their eggs get disturbed, and their shelter from predators destroyed. No animals are shown being collected in trays or buckets because this practice also causes substantial impact. Animals inevitably don't get returned to their proper tidepools or get injured in the process of being crowded into a viewing tray.

The twelve animals and two plants to be discussed are chosen on the basis of abundance in the tidepools and need for protection from human impact. Species chosen are found throughout a wide range of the Pacific Coast. For each plant or animal I tried to include how it is adapted to tidal variation. Animals are depicted in the order that they might typically be found as one walked further toward the ocean. Intertidal zonation is illustrated. The final determination on what animals to include is based on what is typical for a student to observe or find interesting.

The questions used are collected from naturalists at four local outdoor schools and from park rangers. Many of the questions were ones that I had heard over and over from students. I tried hard to stay away from excess technical terminology. When new terms are used, visual illustrations of the idea are included. When possible I reiterated human impact concerns.

Production

In creating the script and storyboard the first variable was, of course, the style of writing. Dialogue rather than a voice over narration was chosen. Dialogue is the trend in children's television programming and seems to have more "kid appeal." Children the ages of the intended audience were chosen to help students relate to the video as something that is about them. Dialogue in the tidepools presents technical problems with recording the voices without having them covered up by the ambient sound. Because there is a great deal of dialogue, the children who are chosen as the actors should have some acting experience and time to memorize their lines and rehearse scenes.

Filming this video will present special challenges. Many of the shots are extreme close ups and many shots have to be taken through water. The

shooting will require special close up lenses and filters to reduce the glare and distortion. Stock footage of some of these shots can be purchased so that the best quality video images are available. The scenes in the tidepools will need to be shot in at least two sessions because of the short amount of time that low tide occurs and due to the inevitable retakes that filming outdoors in a noisy environment requires.

Post production considerations mostly concern editing the type of acquisition mode selected, whether it be super VHS, or Super 8. Editing equipment can be rented, community television station's equipment can be used, or professional advisors and equipment at an edit studio can be utilized. Field testing of first cut footage will be done with several classrooms before the final edit is made.

DISCUSSION

There is much to be done in preparing curriculum materials on the intertidal ecosystem. Throughout all of the films, videos, curricula, and children's literature I reviewed, a thorough explanation of the abiotic factors at work in the intertidal ecosystem was lacking. Their habitat dramatically shapes the organisms of the rocky shore. Understanding their behavior, distribution, life histories, and energy flow between organisms must begin with an understanding of their habitat. The content strands of the science framework can help educators evaluate their materials so that they can tie together all the elements of an environment under investigation and provide thematic integration.

Through the literature search for this project I found that very little research has been done on science education in the intertidal area. How are we as educators to know what is most effective without evaluation from research? Evaluation of the existing curricula is needed. Are they effective? Classroom teachers who use these materials should be queried and their suggestions used to revise materials.

The message concerning human impact in the intertidal area needs to be made public. Not all intertidal areas are as heavily impacted as James Fitzgerald Marine Reserve. However, the results of the "Monitoring and Management Plan for James Fitzgerald Marine Reserve" (de Larios 1993) does give us a glimpse of what is to come as our population grows along with people's ever increasing interest in the sea. Now that the Monterey Bay is a National Marine Sanctuary, we have a moral imperative to preserve this area for future generations. Television, with its access to every living room, is an ideal medium for this message; let us hope that The Cousteau Society, the Oceanic Society, or The National Geographic Society will heed the call and provide specials on preserving our intertidal heritage. State, County, and National Parks also must work to educate the public. However, in these days of drastic budget cuts, docent run programs may be the only alternative we have beyond increasing interpretive signs. Hard decisions must be made concerning how much protection of the habitat (Can you turn over rocks if you replace them?) is necessary. How will protection of the resource be enforced?

CONCLUSION

The next step in this design of a field trip introduction using videotape will include obtaining letters of support so that fundraising can begin. James Fitzgerald Marine Reserve, Coyote Point Museum, San Mateo County Office of Education, Monterey Bay Aquarium, Lawrence Hall of Science, and local outdoor schools that use the intertidal area will be approached. I have been advised that a Packard Grant is a possibility because this video will be about marine life. A local film producer, Logan Payne, has expressed interest in working with me on this project. Her experience producing several award winning educational videos will be invaluable. Through team work with other members of the production crew I will gain more insight in using the medium of video to its best advantage. Field testing of the video footage will be very important to make sure that students find it enticing, that the message is clear, and that it meets the needs of classroom teachers.

MEDIA REVIEWED

VIDEOS AND FILMS

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Beach and Sea Animals. 1957. 11min. Encyclopedia Britannica Education Corporation. Britannica Films. 16mm.

Communities of Living Things: Program 7, Creeks and Oceans. 1974. 15 min. Barr Films. Videocassette.

We Explore the Beach. 1977. 12 min. Coronet Films. 16mm.

Life at the Edge of the Sea. 1976. 9 min. State of California the Resource Agency. 16mm.

Life Between Tides. 1963. 12 min. Encyclopedia Britannica Education Corporation. Britannica Films. 16mm.

Monterey Bay Aquarium Video Collection. 1988. 60 min. Sea Studios. Monterey, California. Videocassette.

Monterey Bay Aquariums Outreach School Assembly Programs: Habitats Program Grades 3-5. 1988. 45 min. Sea Studios. Monterey, California. Videocassette.

Tell Me What You See: Sea Life That Doesn't Crawl. 1972. 15min. WVIZ Wisconsin Instructional Television. 16mm.

The Boundless Seas. 1978. 100 min. Western Audio Visual Experiences. Jerry Fairbanks Productions. Videocassette.

Tide Pool Life. 1947. 12 min. Classroom Film Distributors. 16mm.

Tripping With Terwiliger: Bay Tidelands. 1973. 14min. Terwiliger Nature Center Production. Filmed by Sweet Home. Videocassette.

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Appendix A

Abiotic Factors in the Intertidal Ecosystem

The abiotic factors influencing intertidal ecosystems are enormous. "Probably no other part of the earth changes as much or as often as the intertidal zone. About every 12 1/2 hours the sea comes in and gives the shore a bath - sometimes a gentle cleansing and sometimes a hard scrubbing" (Stephens 1972, 9). Animals in the splash zone or high tide zone must be able to wait as long as twelve hours without water, and may wait as long as two weeks until the highest high tides of the month occur. The ability to hold in enough moisture to survive until the next high tide is a major limiting factor as to where intertidal animals are found. For most intertidal animals water is necessary for breathing as most have gills that must stay wet in order to take oxygen from the air or water. The water also transports the food supply of many animals, especially the plankton feeders.

Each zone has certain indicator plants and/or animals. Though water availability is the most common factor in zonation, predation and availability of food are also factors. For example, in the spray zone acorn barnacles are limited in their upper dispersal by their need for water but their lower limit is controlled by competition for food and space. The changing water level in the tidepools also brings mobility or lack of mobility to some animals.

The amount of wave action and the power of the waves are a constant force to which intertidal plants and animals must adapt. Under normal wind conditions 4 to 5 waves per minute break at the shore. Wave action can be gentle lapping in a protected bay or can produce a force of several tons per

square foot when the waves crash against an unprotected rocky point (Amos 1966).

Weather influences intertidal residents far more than other ocean animals. When uncovered by low tide they are directly exposed to extremes of heat and cold. Fresh water in the form of rain can greatly change the salinity of water in a tidepool. Too much fresh water and starfish anemones and crabs will bloat and die. Their bodies can only tolerate a certain range of salinity. The salt content in their body fluids is kept in homeostasis and adapted to the salt content of sea water. Other animals such as periwinkles can survive a greater fluctuation in salinity (Amos 1966).

Conversely, tidepools can become too salty due to the drying action of the sun and wind. When salinity is too high, animals may excrete too much water from their body fluids in an effort to regulate salt balance and they may shrivel and die (Amos 1966).

Sea coasts are often very windy places. Intertidal plants and animals must be able to adapt to the drying effects of the wind. Being exposed to air is not a natural state for sea creatures, and intertidal animals have all become adapted to ways of preserving water in their systems. Wind can also be a powerful force that can dislodge them from the rocks and toss them into the churning sea. Many of the same mechanisms that intertidal plants and animals use to hold on to the substrate through wave action help them when exposed to the wind.

Temperatures can be extreme for animals exposed by the tides. Fluctuations of 50 degrees F. are common for intertidal animals in the spray and high tide zones. Most marine creatures are adapted to the relatively

constant temperature of the sea. Tidepools that have little flushing and filling from the sea can heat up and cook their residents.

The rocky substrate's composition can limit the variety of habitats available to plants and animals. Are there free boulders to crawl under? Are all rocks polished smooth or do they have cracks and crevices for hiding in? Do the rocks break up easily, dislodging their residents? Do the rocks move easily with the waves, thereby crushing creatures near them? Does sand come in with the waves at certain times of the year and cover up tidepool residents?

Finally, the catastrophic changes brought on by storms are an abiotic factor that can change the entire balance and structure in a tidepool. Many animals are adapted to be pioneers in storm cleaned environments and recolonize the bare substrate. Dispersal through the water is a method that many intertidal organisms have which can help repopulate where storms have wrecked havoc.

Appendix B

Budget

Preproduction	
Research and Script	donated
Talent search	donated
Stock footage	\$500
Production	
Camera package (2 days)	\$1200
Camera operator (2 days)	\$1200
Audio recordist (2 days)	\$600
Additional audio equipment	\$100
Food and transportation	\$150
Post Production, Off-line	
Window dubs	\$350
Stock	\$125
6 days edit	\$1200
On-line	
Edit studio (24 hr.)	\$3600
Black encoded master	\$60
Audio Mix	
Mix	\$600
Audio master	\$100
Duplication master	\$85
Dubs (20 at \$5.90 with hard cases)	\$118
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Total	\$9488.00

Appendix C

VIDEO SCRIPT AND STORYBOARD

Legend

L.S. long shot

F.L.S. full length shot

M.S. mid shot

C.U. close up (head and shoulders)

B.C.U. full face

E.C.U. extreme close up

Stock footage Quality footage bought from another film company

VIDEO SCRIPT AND STORYBOARD

SCENE ONE - INTRODUCTION

(Establishing L.S. of ocean.)

(voice over narration)

The tide is like the earth breathing. Twice a day it goes out and comes in.

(M.S. of tidepools at low tide.)

When the tide is out animals living near the shore are exposed to the air and sun.

(Same shot of tidepools but at high tide.)

When the tide is in they are covered up with water.

(Same shot of tidepools but at low tide and twice as close.)

When the tide is out we can see one of the most densely populated environments in the world. The edge of the sea has plenty of sunlight and nutrients which support an amazing variety of life.

(C.U. of visual aide of earth with tidal bulges.)

How do tides work? The water on earth is constantly being pulled toward the moon because of the moon's gravity. On the side of the earth closest to the moon there is a tidal bulge and an opposing bulge on the side farthest from the moon. These sides of the earth would be experiencing high tide at this time.

SCENE TWO - CLASSROOM

(3/4 length shot of teacher at blackboard and the backs of some students.)

Teacher "Tomorrow on our field trip to the tidepools we'll see animal adaptations for a very unique environment. What do I mean when I use the word adaptation?"

(C.U. of student.)

Child "An adaptation is the way an animal or plant is made or behaves that helps it survive in its environment."

(M.S. of teacher and student dressed as a crab.)

Teacher "Well said. Today I just happen to have an animal here that is well adapted to the tidepool environment. Let me introduce Mr. Cancer Crab."

(Same shot.)

Teacher "Mr. Crab, can you describe your home to us?"

(C.U. of crab.)

Mr. Crab "Well, where I live on the rocky shore the tide comes in and out twice a day. Sometimes my home is covered with water and sometimes it is dry for several hours."

(C.U. of child.)

Child "How can you breathe?"

(C.U. of crab.)

Mr. Crab "I have gills to get oxygen from the water. As long as my gills stay wet I can get oxygen from the air too."

(C.U. of teacher.)

Teacher "Tell us more about your environment. What's the weather like?"

(C.U. of crab.)

Mr. Crab "When the tide is high and the ocean is covering me I don't notice the weather. But, when the tide is low the sun beats down on me, the wind dries me out, or storms bring rain and high waves."

(C.U. child.)

Child "What do you do in a really bad storm?"

(C.U. of crab.)

Mr. Crab "I hide. I like to find really tight cracks in the rocks where there's just enough room for me to squeeze in. If it rains too much and my tidepool becomes mostly fresh water-yuck-I can move to deeper water."

(C.U. of child.)

Child "What kind of protection from predators do you have?"

(C. U. of crab brandishing his pinchers.)

Mr. Crab "Well, I have these great pinchers, but mostly I'm fast on my feet and hide in between rocks. Shore birds are my worst enemies. My hard shell keeps me from being an easy meal too."

(M.S. of teacher and crab.)

Teacher "Thank you Mr. Crab. Tomorrow we will see you again I hope."

(M.S. of teacher.)

Teacher "Lets look at this tide table so we will know when low tide will be. Can I have a volunteer to read it?"

(C.U. of tide table in child's hands.)

Child "On the left hand side are listed the daily high tides. On the right hand side are the low tides. The times in light type are A.M. and the dark type are P.M. tides. Tomorrow's lowest tide is at 3:11 P.M.. It is a negative 0.5."

(C.U. of teacher.)

Teacher "A negative low tide means that the low tide is below the mean or average low water mark. We should be able to see a lot of animals tomorrow."

SCENE THREE ON THE CLIFFS ABOVE
THE TIDEPOLS

(Establishing shot of docent and students. (3/4 view mid shot.)

Docent "Howdy, my name is Cathy. I'm a docent and I will help answer your questions as we explore the tidepools. Docents are trained volunteers who help the park system answer visitor's questions. You have come just at the right time to explore the tidepools. Low tide won't be for another half an hour so you have plenty of time to get to the farthest rocks before the tide starts to come in. Your teacher, parent volunteers, and I will be the boundaries to the west. You can't go past us. Where is the west?"

(Children pointing at ocean. M.S.)

Children "The ocean!"

(Group shot of docent and students. 3/4 view mid shot.)

Docent "Good, without a compass too! I notice we have some great tidepool fashions here."

(M.S. of child and pan to feet.)

Child "Yeah, I've got my oldest, grungiest tennies. They still have good tread on them so I won't slip. They can get wet and I don't care."

(M.S. and pan to legs.)

2nd Child "I've got long pants on so if I fall I won't scrape my legs on the rocks."

(M.S.)

3rd Child "I've got a good windbreaker for the wind."

(M.S.)

4th Child "I'm dressed in layers so no matter what the weather I'm prepared."

(C.U. of docent.)

Docent "Great, kids, you look ready to go. But before we head down to the rocks who can tell me what its like to walk on seaweed?"

(B.C.U.)

Child "Its slippery."

(C.U. of docent and zoom out to F.L.S. of docent bending down like a crab.)

Docent "Yes, so get down low and walk like a crab."

- (E.C.U. of hands.) Docent "Hold on to the rocks with your pinchers."
- (C.U. of docent.) Docent "Go slow. Only crabs can run in these tidepools. We've got some big waves so I want everyone to keep their eyes on the ocean. You should tidepool with at least one other person so you can help each other watch the waves. Never turn your back on the ocean."
- (Pan students descending F.L.S.) Group walks down cliffs.
- (C.U. of docent.) Docent "Wait, before we go exploring, we've talked about our safety, but what about the safety of the animals that live here?"
- (B.C.U. of child.) Child "Well, we can be careful where we walk."
- (C.U. of docent.) Docent "Yes, try to walk on bare rock if you can find it. Tidepools may be the most densely populated environment on earth. Its not easy to find bare rock."
- (B.C.U. of child.) Child "Lots of animals live under rocks. If we lift up rocks to look at them we can put the rocks back."
- (B.C.U. of docent.) Docent "Yes, but even lifting up rocks can crush animals or dislodge their eggs. In a place with as many visitors as here we ask that you look at the animals without moving their homes around."
- (B.C.U. of child.) Child "Doesn't it hurt the animals if we pick them up?"
- (Docent pulling at a limpet by a tidepool. F.L.S. of docent squatting down.) Docent "Some, like hermit crabs and turban snails are easy to pick up and not easily hurt. If you have to tug on an animal or pry it off the rocks then that animal will be injured by picking it up."

(Same shot.)

Docent "See, this one would be injured if I pulled it off."

(Zoom in to shot of docent's hands holding a hermit crab.)

Docent "Hold animals gently and hold them over the water in case you drop them."

(Zoom out to docent returning hermit crab.)

Docent "Be sure to return them to exactly the same tidepool they came from. If you put them in a different pool it might be a pool that doesn't get enough fresh sea water for them to live. These animals live in exactly the right environment for them to survive."

(B.C.U. of child.)

Child "Can I take a crab home for a pet? I have a salt water aquarium."

(B.C.U. of docent.)

Docent "No. If you collect animals from tidepools you must have a special permit. Most animals will die if taken away from their homes here. Fresh sea water, just the right temperature, and just the right food are required to keep these critters alive. This is their home and we can visit them here. They will always be here if we all take care of them."

(B.C.U. of child.)

Child "Are tidepools disappearing like the rainforests?"

(B.C.U. of docent.)

Docent "Some are. If people change the shoreline by building on it or if oil or chemical spills happen tidepool life can be destroyed."

(C.U. of trash.)

Docent "Also if visitors leave trash, that can be dangerous for tidepool animals too."

(Pan to shot of feet.)

Docent "This reserve can get as many as 2,000 visitors an hour on a good low tide. That's a lot of feet walking through your living room if you live here."

(3/4 view of docent and children.)

Docent "Let's go exploring now that we know how to have good tidepool manners."

SCENE FOUR - TIDEPOOL TOUR

ACORN BARNACLE

(Establishing shot (3/4 view) of docent and children looking at a rock. Zoom to close up of barnacles)

Docent "These are always some of the first critters you'll meet at the tidepools. These acorn barnacles live in the spray zone where only the sea spray and the highest tides hit them."

(Stock footage of E.C.U. of barnacles feeding.)

Docent "Did you know that these barnacles are glued to the rock by their heads? They spend their adult life upside. When they are covered with water they open up their shells, stick their legs out, and comb floating plankton out of the water for dinner."

(Stock footage of plankton.)

Child "What's plankton?"

(Same shot.)

Docent "Plankton are very small animals and plants - about the size of a pinhead. They float near the surface of the sea where there's lots of sunlight."

(B.C.U. of child.)

Child "What do barnacles do before they are adults?"

(3/4 shot of group.)

Docent "When barnacles are young they are free floating larva, part of the plankton soup; so are anemones, mussels and lots of other tidepool animals that will later spend their adult lives attached to a rock."

Limpets

(Close up of limpet with finger pointing to it.)

Child "Are these pointy things alive?"

(Same shot but zoom in closer.)

Docent "Yes, they are limpets. They are closed up tightly against the rocks right now because the tide is out and they don't want to lose any precious moisture from their bodies. They make a sticky mucous that seals their shell tightly to the rocks."

(C.U. of child.)

Child "Do they move?"

(Stock footage E.C.U. of limpets moving - time lapse.)

Docent "Yes. At night limpets slowly graze the rocks for algae. They prefer to be active at night when shorebirds aren't out to get them and the hot sun isn't going to dry them out. When day breaks they return to the same spot that they were on the rock. Its hard to see, but this limpet has scraped out a shallow indentation where only its shell fits."

(Close up of limpet.)

Child "How come they are pointy?"

(Pan to other limpets living in a crevice.)

Docent "Their shape helps deflect, or turn aside the force of the waves. They live in areas that are hit hard by waves. Often they will crowd into crevices where the waves don't hit as hard."

Black Turban Snail

(F.L.S. of docent and group walking to another tidepool and squatting down.)

Docent "Here is our first tidepool past the spray zone. See those black snails? They are signposts that say this is where the high tide reaches twice a day. This area is the high tide zone."

(Zoom in on one child picking up a turban snail and holding it so the operculum can be seen. E.C.U.)

Child "Okay, I have one. But it's going back in its shell and it looks like it's closing its door."

(Same shot.)

Child "Hey, it can crawl into its shell and close its door when someone wants to eat it."

(E.C.U. of turban snail.)

Docent "You're right. It can also close its door up tightly when the tide is out and seal moisture in its shell too."

(Shot of turban snails in a tidepool.)

Child "What do these things do in a tidepool?"

(E.C.U. of snail feeding - stock footage.)

Docent "Turban snails are algae eaters."

(M.S. of child picking up turban snail.)

Child "They are easy to pick up compared to the limpets. How come they don't get washed off the rocks all the time?"

(C.U. of turban snail in a hand.)

Docent "Well, turban snails do get washed off the rocks - but they can turn themselves over again easily. Also, their "foot" that they glide around on is good at holding on. They can hide from waves under rocks and in crevices too. Hiding where a seagull can't pick them off the rocks and eat them like popcorn is a good idea for these guys."

Aggregating Anemones

(C.U. of child pointing to an open anemone.)

Child "What's this thing. It looks like a flower!"

(Same close up.)

2nd Child "I dare you to touch it."

(Close up of anemone closing up on a finger.)

1st Child "Ooh it tried to get me! It closed up on my finger and felt like sticky tape!"

(M.S. of docent showing hands as she makes an anemone with them. Her fingers wave together then close into a ball.)

Docent "All right! You two have discovered a sea anemone's way of getting lunch. When they are underwater, they open up and wave their tentacles in the current waiting for shrimp, fish, plankton, or crabs to wander in. When they feel something they will close up quickly, stinging their prey with little poison darts."

(B.C.U. of child.)

Child "You mean I just got shot with poison darts?"

(E.C.U. stock footage of an anemone, time lapse of anemone feeding.)

Docent "Your skin is too tough for these anemones' darts. A fish, on the other hand, would be paralyzed by the poison and then stuffed down the anemones' mouth by its tentacles. Then when the anemone is done digesting its meal, burp!, it spits the bones back out."

(Shot of several closed up anemones with child's finger touching one.)

2nd child "How come this gooshy stuff over here spits out water when I touch it?"

(Zoom to C.U.)

2nd Child "Those gooshy things are anemones too!"

(Same shot but zoom out slightly to show group.)

3rd Child "But they don't look..... "

(C.U. with docent's finger pointing.)

Docent "They don't look the same because these anemones are closed up until the next high tide. The sand and shells help keep them from drying out. Also, you'll notice that there are hundreds of them living right next to each other. When the waves crash against them they have strength in numbers to help them withstand the pounding surf. When they are tightly packed together less of their surface is exposed to the air so they don't dry out. Anemones can live to be 80 years old! "

Hermit Crab

(F.L.S. of group of children and docent walking closer to the ocean, then bending down to see a tidepool.)

Docent "Let's go a little closer to the ocean. Now we are in the mid tide zone. The animals and plants that live here are covered with water most of the time."

(M.S. of children looking into tidepool.)

Child "Look how fast that snail went! He must have eaten sugar coated seaweed this morning!"

(3/4 shot of child as he squats down.)

2nd Child "I bet it's a hermit crab. They borrow empty snail shells to live in."

(C.U. of hermit crab in a hand.)

Child "Wow! It ducks back into its shell real fast when it's picked up."

(Same shot, show shadow of a hand passing over hermit crab as it ducks into shell.)

Docent "You can play jack in the box with it. If it senses movement or a shadow it will duck back in to get away from danger. See?"

(E.C.U. of hermit crabs in a tidepool eating - stock footage.)

Child "Well what do these things eat in the tidepools?"

(Same shot.)

Docent "They like anything - dead that is..... They are scavengers and eat dead animals, just like vultures eat dead animals on land."

Sea Sacks

(C.U. of child bending down and touching seaweed.)

Child "How come this stuff is so slimy?"

(Cut to shot of docent touching seaweed and zoom in.)

Docent "This 'stuff' is algae - these ones here are called sea sacks. It feels slimy because it is wet and has a special plant mucus to help keep it wet. Like all tidepool life, algae struggle with the drying effect of wind and sun when they are exposed."

(Same shot. Child's hand comes in and squeezes a sea sack blade.)

Child "Look, if I squeeze these things water squirts out!"

(Same shot but with docent's hand pointing.)

Docent "When sea sacks are out of the water they store water inside their hollow blades to keep them alive."

(M.S. of child pointing at the rocks.)

Child "There sure is a lot of this stuff."

(C.U. of docent.)

Docent "Yep, algae are some of the most widely distributed plants in the world. Algae provide oxygen for animals in the ocean to breathe. People use algae in toothpaste and ice cream to give them a smooth consistency."

Sea Star

(M.S. of docent surrounded by children.)

Docent "I've got a riddle for you. What has eyes on top of its arms, thousands of feet, pinchers on its back and spits its stomach out of its mouth every time it wants to eat?"

(B.C.U. of child.)

Child "A sea star?"

(C.U. of docent.)

Docent "Right, how did you know that?"

(E.C.U. of sea star feeding - stock footage.)

Child "I knew they took their stomach out for lunch because my uncle and I once found one eating a mussel. We watched it pull the mussel shell apart just a little bit, then stick its stomach in the mussel shell and digest it right in its own shell."

(Same shot.)

2nd Child "Ooh, imagine a giant sea star pulling apart the roof of your house, sticking its gooshy stomach in and dissolving your whole family for dinner!"

(M.S. of docent bending down to pick up a sea star.)

Docent "Sounds like the stuff horror films are made of! Here's one. Sometimes they lose some of their tube feet when you pull them off the rocks but sea stars can grow back parts of their bodies very easily."

(E.C.U. of underside of sea star showing moving tube feet - stock footage.)

Child "Look at all those feet moving! Are they all suction cups?"

(Time lapse of limpet "galloping".)

Docent "Yes, and if some of the feet get tired while pulling a mussel apart, they get to rest while other feet take over. These critters have staying power. You know, they are some of the most feared predators in the tidepools?" Why, if a limpet smells an ochre star coming, it will gallop away at four times its normal speed?"

(C.U. of child.)

Child "Yes, but sea stars are so slow moving!"

(B.C.U. of docent.)

Docent "Yes, slow but deadly. The barnacles, mussels, limpets, and snails they eat are not speedsters either. Want to do an experiment?"

(B.C.U. of child.)

Child "Sure!"

(M.S. of docent putting a sea star on the back of a student's arm.)

Docent " Turn this sea star over on the back of your arm and leave it for a couple of minutes. Okay, now take it off.

(Same shot but show child's hand coming up and pulling sea star off arm.)

Child "Yipees! It pulls!"

(E.C.U. of sea star in a hand.)

Docent "Yes, this sea star was trying to grind the hair on your arm off. See all these white bumps? They're pinchers. A sea star moves very slowly, so algae, sponges, or anemones might want to hitch a ride. Since it breathes through its skin it doesn't want anything hitching a free ride."

Cancer Crabs

(M.S. of child bending down pointing at a crab and zoom in on crab.)

Child "Look at that huge crab!"

(E.C.U. of crab.)

Docent "Yes, it's a cancer crab. They get big enough to eat for dinner."

(Pan to child's face.)

Child "Can I catch him?"

(C.U. of crab. zoom out to show docent's hands coming in to pick up the crab, then zoom further out to include docent's face in shot.)

Docent "I'd be very careful with such a big crab. If you want to pick up a big crab, imagine you are tickling it under its arms. Reach behind its big claws and pick it up on the sides of its shell like this. I always hold crabs close over the water so if it pinches me, I can put it back into the water and it will release its hold on me. I'm not going to throw or drop it on the rocks just because it was trying to protect itself from the biggest land monster it's ever seen."

(E.C.U. of crab.)

Child "How come crabs walk sideways?"

(Same shot.)

Docent "Because they can. They can walk forwards and backwards too. They need to be able to scurry in whatever direction a safe rock is if they see a gull coming their way! They have very flat bodies that can fit tightly in rock crevices to hide them from heavy surf or hungry beaks."

(C.U. of another crab being held by another student.)

Child "What is this underneath this crab's tail?"

(Same shot but show docent's hand pointing to the eggs.)

Docent "Those are the crab's eggs. She will carry her eggs with her for eight months until they hatch."

(B.C.U. of child.)

Child "If birds eat crabs, what do crabs eat?"

(E.C.U. of crab in tidepool - stock footage of crab feeding.)

Docent "Crabs are the garbage collectors of the tidepools. They will eat dead plants and animals or live ones. They aren't picky at all about what they eat."

California Mussel

(M.S. of docent squatting down next to some mussels.)

Docent "Here's one of the favorite foods of those sea stars we just saw. These are California mussels. They always live in areas of heavy surf where there is lots of oxygen in the water."

(M.S. of child trying to pull off a mussel.)

Child "I can't get them off the rocks!"

(C.U. of mussel bed.)

Docent "Don't even try to pick up these critters. They attach themselves to the rocks with strong threads made inside their bodies. Notice how close to each other they live? This helps them withstand the pounding of the waves and also helps them retain moisture."

(B.C.U. of child.)

Child "My aunt and I collect mussels to eat. But we can't collect them in the summer. How come?"

(E.C.U. of mussels feeding - stock footage.)

Docent "Mussels are filter feeders. When they are covered with water during high tide they open their shells a little bit and pump water in and out, straining the plankton from the water to eat. During the summer, some of the plankton that they eat contain a substance toxic to humans. From May through October they aren't safe to eat. If you do collect mussels, just take what you can use, and always walk with care around the mussels beds. Mussels are disappearing fast near populated areas of the California coast."

Coraline algae

(M.S. of child holding up a dead piece of coraline algae.)

Child "Hey, what kind of bones are these?"

(Zoom to close up of algae.)

Docent "Those aren't bones even though they look and feel like them. What you have there is coralline alga. It's an alga that secretes lime, a mineral found in bones, all over its body."

(B.C.U. of child.)

Child "What does it look like when it is alive?"

(C.U. of tidepool with docent pointing out coralline algae.)

Docent "Here is some. Isn't that a gorgeous shade of pink? Sometimes it is just a crust covering the rocks like this too."

Blenny eel

(C.U. of eel squirming in tidepool.)

Child "An eel! An eel! Is it electric?"

(Same shot but of hands trying to grab it.)

Child "Its slippery!"

(B.C.U. of docent.)

Docent "Well, you know the saying, slippery as an eel. Actually these are blenny fish, they just look like eels. In the low tide zone you will find them squirming away when you lift up seaweed."

(B.C.U. of child.)

Child "How come they are so slippery?"

(E.C.U. of blennies - stock footage.)

Docent "Blennies are long, thin and covered with a layer of slime. Being slippery means that when the tide is out they can still squirm around without much water to find seaweed and rocks to hide under. They need to hide from hungry shorebirds or hot sun that would dry them out."

(Same shot.)

Child "How come some are black and some are green?"

(Same shot.)

Docent "They can change color to match their surroundings, another adaptation to keep from being eaten."

Sculpins

(C. U. of tidepool showing sculpin and finger pointing to it.)

Child "Ooh look! There's a little fish! I didn't see it until it moved. Its exactly the same color as the sand!"

Docent "Yes, that little fish is a sculpin. They are color change artists because they can quickly change their colors to match the environment."

(Zoom in a little closer on fish.)

How does changing colors help them survive?"

(Stay with same shot.)

Child "Well if they blend it to the rocks and sand a bird or another fish couldn't see them and eat them. But why do they have such big heads and fins?"

(Stay with same shot.)

Docent "'The better to eat you with,' said the sculpin to the little snail. A big head means they can swallow large prey. Sculpins can walk along on their front fins looking for food or dart about quickly to hide from predators."

Close View of One Tidepool

(M.S. of docent bending down over tidepool and then zoom in.)

Docent "Let's stop and look closely at this tidepool. Are there more animals and plants here than in the splash zone?"

(C. U. of tidepool.)

Child "Lots more. There's tons of seaweed and I see lots of hermit crabs, turban snails, anemones, and.....look, here's a sculpin too!"

C.U. of tidepool with hand moving aside the seaweed. Zoom in on eel.)

Docent "Notice how this seaweed gives shade and protection for animals. Look! There's an eel hiding under it!"

(Same shot.)

2nd Child "That eel was the same color as the seaweed!"

(C.U. of sculpin.)	Child "Look, the sculpin blends in exactly with the sand at the bottom of the tidepool."
(C.U. of hermit crabs.)	2nd Child "Those hermit crabs are eating something. They're eating a dead crab!"
(Same shot.)	Docent "Who might eat the hermit crabs?"
(C.U. of sculpin.)	2nd child "Sculpins might eat the hermit crabs when they are little."
(Same shot.)	1st Child "I bet seagulls would eat the sculpin, if they could find it."
(C.U. of shrimp.)	3rd Child "Look! There's a little shrimp! The longer I look at this tidepool the more I see!"
<u>Purple Sea Urchin</u>	
(M.S. of docent and students walking farther out.)	Docent "Now we are in an area that only gets uncovered on the lowest of the low tides. This is the low tide zone."
(C. U. of sea urchin in tidepool.)	Child "I wouldn't want to step on this animal!"
(Same shot of sea urchin but zoom in closer, E.C.U.)	Docent "Yes, Cody, these purple sea urchins' spines are a great defense. Look closer. Do you see the seaweed caught in their spines? They can collect floating seaweed with their spines and then move it to their mouths on their underside with their tube feet. Urchins move slowly over the rocks grazing on large amounts of seaweed."
(C.U. of urchins in holes.)	Child "Look, these urchins are all living in little holes, I can't get them out!"
(Stay with same shot.)	2nd Child "I bet the waves can't wash them out easily either."

(Zoom out to include docent and child's face.)

Docent "Right, you can't get them out easily and neither can the waves wash them out. Urchins live in areas of pounding surf. With their spines they grind out a hole in the rock that just fits them. Its a good idea not to pick these critters up because they can lose tube feet and also if they don't get back down into their own hole the tide could wash them out right into the mouth of one of their predators like an otter, shark or ray. Sea stars, crabs, and people sometimes eat them too."

Nudibranch

(Cut to shot of tidepool with nudibranch - stock footage.)

Child "Wow, look at this little animal! It's bright pink and looks like someone's bedroom slipper!"

(Zoom in closer.)

Docent "All right! You've found one of my favorite animals of the tidepools. This is a nudibranch."

(Stay with same shot.)

Child "A nudi who?"

(Same shot but docent's hand points to cerata.)

Docent "A nudibranch is a sea snail without a shell. They are like a garden slug. They come in incredible colors. They get their name from their naked lungs. Nudi means naked and branch means lungs. See on the back of this one, these things sticking out. Those are its gills that it gets oxygen out of the water with."

(E.C.U. of sea lemon nudibranch.)

Child " Here's a nudibranch that is bright yellow."

(E.C.U. of phidiana.)

2nd Child "And here is one that looks like it has neon lights running through it."

(Same shot.)

Child "Their colors sure don't help them hide."

(Stay with same shot.)

Docent "Their bright colors advertise to predators that they are not good to eat. A lot of nudibranchs eat sea anemones. The sea anemones' stinging cells then become part of the nudibranch's body and can sting their predators."

(F.L.S. of child on rocks pointing at waves.)

Child "Waves coming! Waves coming!"

(M.S. of docent and group.)

Docent "It looks like the tide is starting to come in. Lets head back to the beach."

SCENE FIVE - CLASSROOM REVIEW

(Establishing shot of teacher at the board.)

Teacher "Remember all of the adaptations of tidepool animals? Who found an animal that was adapted to the tides coming in and out?"

(C.U. of shot of child.)

Child "I found a limpet that could clamp down tight on the rocks and keep water inside its shell until the next high tide."

(C.U. of child.)

2nd Child "I found a turban snail that could crawl into its shell and close its door when the tide is out."

(C.U. of teacher.)

Teacher "Who found something that was adapted to the force of the waves?"

(C.U. of child.)

3rd Child "The mussels we found that tied themselves to rocks with threads were good at not getting washed away by big waves."

(C.U. of child.)

4th Child "Sea stars can hold on tightly with their tube feet."

(B.C.U. of teacher.)

Teacher "What are some ways that we can reduce human impact in the tidepools?"

(B.C.U. of child.)

5th Child "When we tidepool we can be careful where we step and not pick up animals that cling tightly to the rocks."

(C.U. of child.)

6th Child "Yeah, and we shouldn't turn over rocks."

(B.C.U. of child.)

7th Child "I had fun can we go again?"

(1 minute of quick shots then roll credits.)

ENDING COLLAGE

("Tidepool Boogie" is playing in the background.)