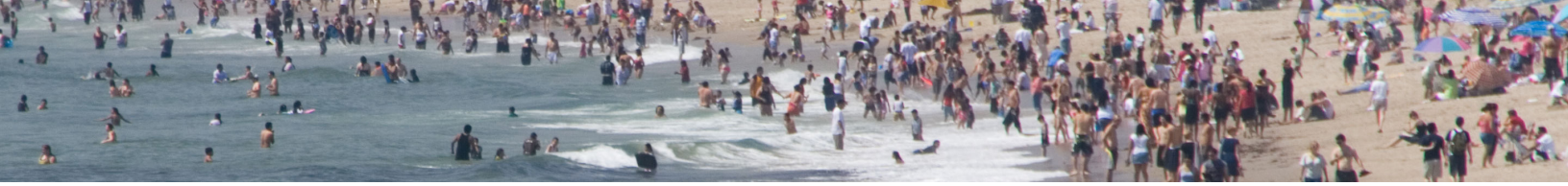
Unit Four: Human Impact on the Sea

Throughout this curriculum students have been learning about the structure and make-up of the ocean environment and its inhabitants. Now it is time to look at how we as humans affect the marine environment.

Through a variety of activities students will be introduced to the problems and effects of pollution, habitat destruction and the idea of limited resources. They will start out by observing what is in their own homes and how those items and everyday living actions can impact the marine environment. Learning about storm drains provides the student with an idea of how actions in the urban environment directly affect the marine ecosystem. Where we build houses, anchor ships, throw our trash and how much of the seas resources we consume all have an effect on the ocean environment.

Not only will they be involved with learning about our impacts, but more importantly, with exploring solutions to these problems. Direct individual action and community involvement are both ways to make a difference in our environment and students will get a chance to do just that as they proceed through this unit!



Lesson 1: A Shortage in the Sea

55 minutes

Concepts & Objectives

QUESTION

Are the things that we use from the ocean unlimited? Can we run out?

UNDERLYING CONCEPT

Resources are limited and we must take care in how we use them. Our actions now can affect the amount of the resource we have in the future.

SKILLS

- Brainstorming
- Analyzing
- Problem Solving

OBJECTIVES

Students will be able to:

- List ways that we use resources from the ocean environment
- Demonstrate the idea of a limited resource
- Conceptualize solutions to these problems

MATERIALS NEEDED

Various candies/crackers or items representing different marine resources. (Based on time and availability, any item can be used (paper clips, pencils, candy, crackers, etc.)There should be an uneven number of these “resources” for each group of 4 students, for example, 17, 9, 3, etc.; some number not evenly divisible by 4.

Suggestions:

- Fisheries - gummi fish or goldfish crackers
- Oil - black licorice
- Natural gas - blue “flame” gummies
- Pharmaceuticals - chocolate hearts (red wrapped)
- Minerals - gold chocolate coins
- Kelp/seaweed - green sour rings
- Corals, shells, pearls- white, orange, red or black candies

Vocabulary & Background

VOCABULARY

- Resource: a supply of something that we can draw from when necessary (usually it is something that we need, such as food/fish, or that we can make other things from, like kelp or oil or use for energy)
- Renewable: can grow or start over again (capable of being replaced by natural cycles or sound management practices, example: trees)
- Nonrenewable: resource cannot be replaced (there is no more once it is gone, example: oil takes millions of years to form and cannot be replaced in any realistic human time
- frame)
- Biosphere: living things together with their environment (surroundings)

BACKGROUND INFORMATION

Humans are part of the biosphere and rely on it for food (fish, marine life) and energy (mineral and oil/natural gas). Resources such as fish (or trees) are renewable, as long as too many are not taken/destroyed. They can continuously replenish themselves if not interfered with and inhibited from doing so. Other resources such as oil and minerals are non-renewable (at least in our lifetime). They are formed over millions of years and once depleted will take millions of years to replenish. We need to be aware of this in our patterns of consumption.

There are also human impacts not only from the consumption and depletion of the resource, but also from the exploration and production to market the resource. Pollution is one of the main effects of these activities.

Resources are limited and we need to take care in how we use them. If we take too many fish from the sea, or too much kelp to make ice cream, or too much oil for our cars, we will no longer have these resources. In addition, when we remove them from the environment it affects other species in the environment as well--for example: other organisms depend on the "scarce" fish for food and kelp has a whole community of organisms which depend on it. Coral is a good example of this problem. In many parts of the world coral (as well as decorative shells and pearls) is used for jewelry. Coral reefs are extremely fragile and are harmed by any impact: a diver chipping pieces off the reef and snorkelers and swimmers stepping on the reefs are two ways this can happen. There is also evidence that pollution and changes in climate (affecting ocean temperatures) are also harming coral. As a result coral reefs are beginning to die around the world. As they die not only are the organisms lost (coral reefs are alive---made up of millions of coral polyps, small soft-bodied animals that build calcium carbonate exoskeletons for protection) but the fish and other organisms that live on and around the coral reef die, too. Therefore in the case of coral reefs there are more reasons to protect them rather than to use or harm them.

Here is some further information about the uses of specific marine resources:

- Fish: food, fish meal (inexpensive protein for poultry, livestock), fish oil (margarine, cosmetics, paint, fertilizers, pet food)
- Oil: to use as fuel and to make plastics and other petroleum products
- Natural Gas: fuel for heat and for powering some cars and industries
- Pharmaceuticals (drugs from the sea): antibiotics and anti-inflammatory agents from corals and sponges, anesthetic and painkillers from poisons found in puffers and porcupine fish, heart attack prevention from oils found in fish
- Minerals: commercial value; can be from ocean mining (seabed sand and gravel, offshore coal mines, tin, iron, and even diamonds and gold. Also minerals, especially table salt, are taken from sea water (virtually every element on earth is in sea water)
- Kelp/seaweeds: ice cream, chemicals used in food processing, cosmetics, plastics. Corals, pearls, shells: used in jewelry.

Since resources can be limited we need to take good care of them and not take too much. We need to use them in a way that will allow them to continue to exist in the future.

Activity

INTRODUCTION

Ask for ideas of what a “resource” is and ask for examples (trees, minerals, oil, water, etc.) What do the words “renewable” and “non-renewable” mean? Place those definitions on the board. Using students’ resource examples, decide which are renewable (like trees) and which are nonrenewable (like minerals). Next make two columns on the board: “renewable” and “nonrenewable” and leave them blank, they will be filled in during the activity. Then divide the class into groups of 4.

ACTIVITY STEPS

1. Working in groups brainstorm things we use from the sea (ex: fish, kelp, krill, minerals, oil, pharmaceuticals) --and what we use these things for. List these on your Marine Resources Worksheet List (or a blank piece of notebook paper).

2. Make a list on the board of some of the student’s ideas and talk about what they are and how we get them. As you list the resources, ask the students if they are either “renewable” or nonrenewable,” and place in the appropriate column.

3. Pass out one set (of 4) “country cards” to each group, and a “resource” (candies/items). From the list on the board you will most likely have the resources listed in the “materials” section of this lesson plan, if not then make suggestions in order to end up with 6 or 7 different resources (depending on class size).

4. Each student in the group gets a “country” card. Read to class: “The card contains a description of some basic conditions of your imaginary country. (All groups should have the same set of 4 cards.) You will pretend that you are representing your country at a

5. world conference on how to handle the world’s marine resources. You have to make decisions about how to use /share that particular global resource (oil, fisheries, kelp, etc.) with the other countries in your group. As a group you will determine how to handle the shortage of resources (not enough to be divided up evenly). Consider your countries needs, the amount of resources available, if it is renewable or non renewable. List your ideas and the reasons for your decisions on your “Marine Resources Worksheet” (or a piece of paper). Come up with a group decision.”

6. Have a representative from each “Resource Conference” group describe how their group of countries decided to deal with dealing with their resource. (*Do we cut them up into smaller pieces so each country has a little less? Should some of the countries simply go without? Do we take turns for who goes without? Should none of the countries have use of the resource? Are there other ways to get more or similar resources?)*

DISCUSSION

- What kinds of problems can we have when we take resources from the sea? Shortages: from over consumption; overfishing. Impact on the ocean environment: pollution from harvesting methods for oil/minerals; altering habitat (for example, if we take too much kelp).
- As we use these resources up how can that affect other animals in the sea? (Examples: Who eats krill (small shrimp-like animals)? (Some whales) The Japanese harvest krill, what do you think might happen to the whales if too much of this resource is used? (Remind students of
- the food web) What about kelp? We use kelp to make ice cream. Who eats or lives in kelp? (fish, sea otters, sea urchins, etc. They would be affected if too much kelp was lost.)
- How does this work in the real world/how do we conserve our resources? (Suggestions: Fish: catch limits (#s and size), licensing, regulated ‘seasons’. Have regulated kelp cultivation.
- There is very little regulation of marine pharmaceuticals, we could do more in that area. Pollution issues can be addressed by reducing or stopping off -shore oil drilling and improving and enforcing laws about how it can be safely done if it is done at all.)
- What are possible solutions? (New alternative resources (ex: whale oil is no longer needed), new technologies, conservation and better management practices.)
- Should we not take any resources? (This would create other types of problems such as hunger, transportation and economic problems. Also, some cultures rely on certain resources. Without these resources that culture might not exist the in the same way.)

Extensions

This activity can vary widely depending on grade level and age groups.

Social Science: Instead of country cards, each student (or team of students) can pick a country and research it to determine its current population, economy, what are it's most important needs, what about future needs for marine resources?

Additional thought questions:

- Should people/countries pay for the right to take resources?
- Who should get the money?
- What should be done with the money?
- Do you think technology can solve all of these problems of shortages or must we use stronger measures of conservation; why?
- How can we use/divide the resources better among all groups of people and between people and marine life? (Use alternative things---students can come up with ideas for what those things might be----use less of each item.)
- Have a discussion of how we are part of the biosphere and depend on the sea.

COUNTRY

This country has a very large population.

This country does not have much industry or a high level of technology.

COUNTRY

This country has a small population.

This country has much industry and a high level of technology.

COUNTRY

This country has a small population.

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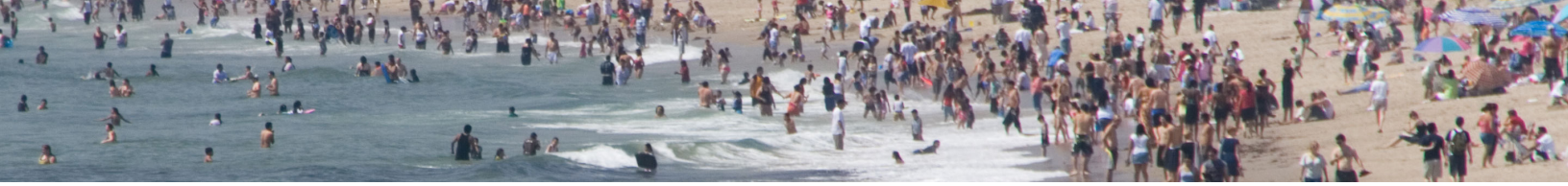


Lesson 2: Toxins in the Marine Environment

55 minutes

Concepts & Objectives

QUESTION

How do toxins enter the marine ecosystem, what are the effects of toxic pollutants on marine life, and how do toxins become concentrated in the food web?

UNDERLYING CONCEPT

Pollution comes from many sources, sewage outfalls and storm drain run-off are just a few. The effect of simple human actions, such as throwing motor oil down a drain, extends farther into the environment than the original action.

SKILLS

- Calculating
- Assessing
- Analysis
- Interpretation

OBJECTIVES

Students will be able to:

- Demonstrate the build up and concentration of toxins in an organism
- Interpret how that buildup can affect animals in an ecosystem

MATERIALS NEEDED

- Red or brightly colored candies such as sweet tarts, etc.
- Clear plastic bags
- Score sheets (optional) students create them

Vocabulary & Background

VOCABULARY

- toxin : poisonous
- pollution : contamination of air , soil or water by the discharge of harmful substances industrial wastes: waste products produced by factories and other industries that often contain harmful chemicals
- DDT (Dichloro Diphenyl Trichloroethane): a colorless insecticide, toxic to humans and animals when swallowed or absorbed through the skin
- bioaccumulation: toxins building up in each organism as they eat animals in the food web who have already eaten a toxin.

BACKGROUND INFORMATION

Pollution comes from many sources. It is more difficult to control when it is in water because water itself is a common solvent for many things and transfers pollutants throughout the ecosystem. Southern California has many problems with pollution in the marine environment.

There are many types of pollution, some of the worst are DDT and PCBs (polychlorinated biphenyls--used as insulation in the 1970's). Industrial wastes pollute wetlands, bays, estuaries, and the ocean itself.

Pollutants enter the marine ecosystem in a variety of ways. Until the 1960's some chemicals were allowed to be disposed of off-shore; we did not know then about their long term toxic effects. Today urban street runoff, farm fields and industrial sites contribute to the toxins in the ocean. Some, such as mercury, which is spewed out by coal burning power plants, fall from the air.

Another important way pollutants enter the marine ecosystem is through sewage plants (outfall sites). They impact the environment through the effects at the outflow site (where the final treatment is deposited into the ocean). Soft, muddy sediments are like sponges that slowly soak up all of the chemicals and toxins. Small animals that live in the sediment pick up tiny particles of it and are then eaten by larger animals. Poisons are then spread throughout the food web. Southern California's Hyperian Sewage Plant is unfortunately a very good example. DDT has been found in the sludge from the Hyperian outfall site. It was thought that by depositing the sludge far out in the bay that the ocean would dilute and cleanse the outfall, but this did not happen.

Benthic (bottom dwelling) animals that live in the soft muddy sediment take the toxins and chemicals into their system, by eating the particles or through taking in the water with the dissolved contaminants. For example, on Catalina Island mussels have been found to contain arsenic. Small fish eat small animals and crustaceans in the sediment. Bigger fish such as the

white croaker and California Halibut, eat these smaller fish as well as crustaceans who have already been contaminated. Essentially, fish that eat bottom-dwelling organisms become contaminated over time, as do the bigger fish who eat those fish.

Fish-eating birds and mammals also then become contaminated. Brown pelicans were nearly wiped out along the West Coast because they ate anchovies and other fish contaminated by DDT that flowed into waters off Palos Verdes from a pesticide plant. Scientist say that the DDT that destroyed the egg shells of the bald eagles and led to their extinction on Catalina Island, is related to the DDT in the San Pedro Channel. Years later after DDT had been outlawed, bald eagles were reintroduced to Catalina Island but once again they began to die out. It was discovered that the eagles were eating the seagulls' chicks and eggs who eat the fish which have levels of DDT in them. So although DDT was no longer being put into the San Pedro channel it was still present in the food causing the new group of eagles to have problems in hatching their young.

Dolphins in the San Pedro Channel have higher levels of toxins in them than dolphins found elsewhere. In general dolphins and seals off of Los Angeles County remain highly contaminated. They may grow tumors or lose their ability to fight off disease.

DDT (and other toxins that bioaccumluate) never leaves the system of an organism. Every time an animal is eaten by another animal the DDT or other toxin goes into the new animal and becomes even more concentrated, because the bigger the animal, the more contaminated food they will eat. It is important to note that people are not immune to this problem. People can get very sick from eating tainted fish or shellfish. These toxins can cause cancer or birth defects.

Activity

INTRODUCTION

- What are ways that poisons could get into the ocean and wetlands? (storm drain run off/ urban streets, farm lands, industry , air pollution, sewage plants)
- How do the poisons get into an animal? (gets into the food that it eats; direct instruction about sediments under the water absorbing chemicals)
- Who can tell me how the food web works? (brief review; be sure predator/prey isunderstood)
- Do you think that the poisons stay in the body of the animal or do you think that they leave? (stay there)
- What do you think happens to the poisons when the small animal is eaten by a bigger animal? (they go into that animal too)

Lets play a game to see how this works!

Before you start:

- Divide students into predator and prey groups.
- For example: In a group of 35 students have at least 5 levels within the food web.
- Example:
  - 12 zooplankton/crustaceans/ clams/worms, etc
  - 9 small fish
  - 7 medium/large fish
  - 5 birds (sea gulls)
  - 2 bald eagles

Explain:

- Animals can only "eat" the level below them. Students wear crepe paper ties---colored according to predator/prey level.
- Be very clear who can "eat" whom.

To Play:

Students wear a color tie according to their animal group and play a simple walking tag game. Everyone starts off with 2 candies each in their bags. Teacher explains that this is a "safe" amount of DDT or toxins in the animal's system.

ACTIVITY STEPS

1. Assign (or let students choose) their "roles" and wear the appropriate name tag name tag sheet included).

2. The lowest level: plankton, tiny shrimp, crustaceans, etc. have 2 candies in their bags and these students are the "prey". The next higher up predator group (example, "small fish") are "its predators". (NOTE trying not to use the word "taggers") . Playing walking tag game, predators must capture the crepe tie of the prey below their "trophic" level. When they "get" someone the predator "consumes" the prey's candies by adding those candies to the predator's bag. The prey then moves out of the group and sits down.

3. Tagging continues until all the prey is caught.

4. When the game is over the eagles have all of the candies.

Option:

Everyone except the sea gulls and eagles begin playing. Then the seagulls and eagles enter game as group gets smaller.

DISCUSSION

- Students discuss who has the most candies/DDT. Is it too much to live, or to have healthy baby eagles?

- What happens if there are no longer any healthy baby eagles being born? (the eagle population will die out)
- How did the animal get so much DDT? (by eating the other animals)

- Teacher explains the situation on Catalina Island.

Note to teachers: This is where background information should be presented.

Extensions

- Students brainstorm ways to keep the toxins out of the system. (laws, better testing procedures)
- Is there a way to help the eagles? (maybe monitoring and studying them, testing the sea gulls)

(LOWEST) LEVEL-1

ZOOPLANKTON

PREY for: small fish and medium fish

PREDATOR to no one

(LOWEST) LEVEL-1

CRUSTACEAN

PREY for: small fish and medium fish

PREDATOR to no one

(LOWEST) LEVEL-1

CLAMS

PREY for: small fish and medium fish

PREDATOR to no one

(LOWEST) LEVEL-1

WORMS

PREY for: small fish and medium fish

PREDATOR to no one

LEVEL-2

SMALL FISH

PREY for: small fish and medium fish

PREDATOR to: zooplankton, crustaceans, clams worms

LEVEL-3

MEDIUM & LARGE FISH

PREY for: sea gulls

PREDATOR to: small fish

LEVEL-4

SEA GULLS

PREY for: eagles

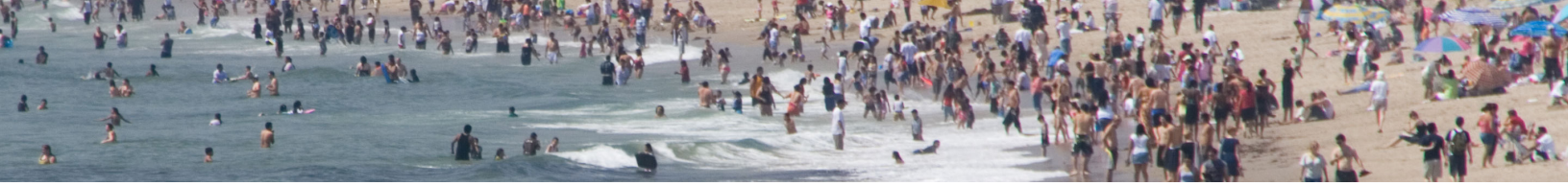
PREDATOR to: medium and large fish

(LOWEST) LEVEL-1

EAGLES

PREY for: no one

PREDATOR to: sea gulls



Lesson 3: Extinction is Forever

55 minutes

SEQUENCE: Students should have an understanding of the concept of toxins. For lesson that deals with this subject, please see the activity “Toxins in the Marine Environment.”

Concepts & Objectives

QUESTION

What are some of the reasons that animals become extinct and what are some of the results of extinction? How would it feel to be the last of your kind?

UNDERLYING CONCEPT

Human actions affect the ecosystem in many ways, some have permanent affects on other species. It is important to understand the finality of extinction, and our impact on other species.

SKILLS

- Interpertation
- Predicting

OBJECTIVES

Students will be able to:

- Postulate what it would be like to be the last animal of its kind
- Describe their interpretation of extinction

MATERIALS NEEDED

- writing paper, pens, pencils

Vocabulary & Background

VOCABULARY

- Extinction: When a certain type of animal or plant no longer exists.
- Exotic species: A species that is not native to the region; it has been introduced by humans.

BACKGROUND INFORMATION

Animals become extinct for several reasons: sometimes animals are hunted, killed, or pollution kills them, their home is destroyed or their food is taken away, and occasionally environmental changes take place so that they no longer can survive. When there are too few of animals of a species left, the species can no longer successfully reproduce itself, no more individuals are born and the species becomes extinct.

Brown Pelicans are a good example of an animal which almost became extinct. In the 1960's they were on the brink of extinction and no one understood why. A scientist at the Los Angeles County Natural History Museum, Ralph Schrieber, discovered that DDT was the source of the near extinction. The egg shells were breaking and no young brown pelicans were being born. This was one of the first discoveries of how DDT affected wildlife.

Even the largest species are not immune to these problems of extinction!

The Gray Whale which travels through the San Pedro Channel on its long migration from Alaska to Mexico, had previously become an endangered species. Historically it was killed in vast numbers for its blubber and meat. They were in danger of extinction and therefore became protected. Now their numbers are increasing and they have been moved off the endangered species list but are still protected against whaling.

Currently other fish that often end up on our dinner plate are being overfished and could possibly one day be threatened: tuna, shark, swordfish and halibut fall in this area. An important thing to remember about overfishing is that it is not just the number of the fish that are taken that affects a population, but also the age. If you take the younger fish then they cannot grow up to have baby fish and the population is decreased quite rapidly.

Catalina Island once was home to the California Sea Otter, but they were killed off for their fur pelts. Now only a sub-species exists at Monterey Bay and because their numbers are so limited they could be wiped out. Efforts to re-introduce sea otters to Southern California have met with objections from the fishing industry (due to competition for abalone). Also a reintroduction attempt at another Channel Island (San Nicholas Island) was a failure. The reintroduced sea otters all disappeared and it is unknown if they simply swam away or were killed by fisherman (who had threatened to shoot them).

It is important to note that with the sea otters gone it has changed the local ecosystem. Sea otters ate sea urchins and the sea urchins ate kelp. By upsetting the predator/prey balance it interferes with the web of sea otter/sea urchin/kelp forest. The sea urchin population increased due to the removal of sea otters and also lobster and sheephead which eat sea urchins are also being over fished. The lobster and sheephead fish ate also ate sea urchins. The increase in the sea urchin population (plus the effects of "El Nino" --which is a change in a major ocean current which affects upwelling and food sources) contributed to decrease in kelp.

On land in Southern California other extinctions have almost occurred. One of these is

the El Segundo Blue Butterfly. Due to housing and industrial development, the type of plant that the Blue Butterfly lived on was almost completely destroyed. When plants, which are an animal's food source, are destroyed so is the animal that depends on them. This is happening on Catalina Island, as plants are destroyed due to overgrazing (by animals that were not originally on the island) the animals that rely on those plants become threatened. (NOTE: this is an example about Catalina can be an opportunity to discuss what is an "exotic species"---and why it is a problem)

Activity

INTRODUCTION

- How many of you remember our activity with DDT?
- What did DDT do? (It concentrated in the animals and made the animals higher up in the food web more toxic/full of DDT; in birds it made the eggshells thin and easy to break, then the chicks could not hatch.)
  If enough animals are killed or if the animals can't have babies, what do you think happens to the species? (The species cannot continue and eventually there are no more of that kind of animal left.) Teacher can use direct instruction to describe the Brown Pelican's near extinction due to DDT.
- Ask students to brainstorm about any animals (or anything) that they know of that has gone extinct (ex: dinosaurs)
- Why did these animals/plants etc. go extinct?

  [You can ask the following question of groups who can brainstorm amongst themselves to get answers.]: What kinds of human action cause another species to go extinct? (over hunting harvesting, not enough food, not enough land to live on, poisons/pollutants----[Teacher can refer to the above background]).

ACTIVITY

Story Writing:
Individually or in pairs have students write a story about what it feels like to be the last one "of your kind". Students can choose either an animal that they like or they can choose to create one.

They can also draw a picture of their animal if they want.

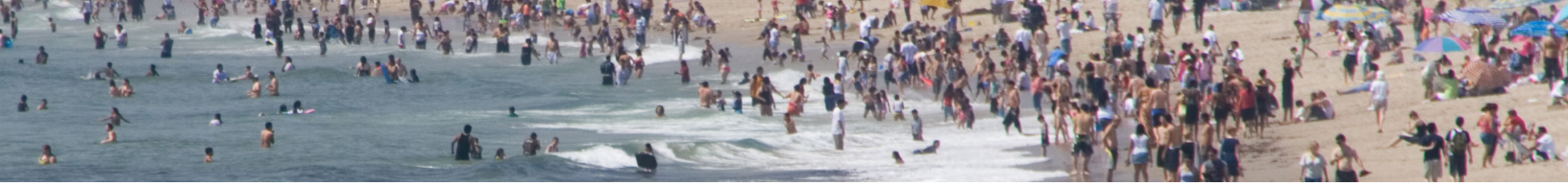
After 15-20 minutes of writing ask students to share their stories with the class.

BEYOND

- How would the world be different if your favorite animal was no longer around (was extinct) or your favorite kind of tree , bird, etc.
- Could an oil spill cause a local extinction? (Possibly if an animal was only located in that area such as a rare “endemic” {native} species that does not occur anywhere else).

Extensions

- Students can draw a picture of their animal.
- Students can do a small research project on a particular endangered or extinct species.
- Or create an informative poster about their animal.



Lesson 4: Eco Challenge

Two 55 minute class periods, two ten minute floow-ups a week apart

Concepts & Objectives

QUESTION

What do you have in your home that can harm the environment and what steps can we take to be minimize that impact?

UNDERLYING CONCEPT

Common items in our home can pollute the environment. How we live and what products we choose to use, and how we dispose of those products makes a difference in the harmful impact that we have on the environment.

SKILLS

- Analyzing
- Observing

OBJECTIVES

Students will be able to:

- List toxic and non-toxic products that they have in their home environment
- List alternative products that are not as harmful to the environment.
- Demonstrate how something as simple as a 6-pack ring can harm wildlife
- Determine personal actions they can take to improve the environment

MATERIALS NEEDED

- Eco Challenge Sheets
- Several six-pack rings
- A broom handle
- Two 12-foot pieces of rope
- Measuring tape

Vocabulary & Background

VOCABULARY

- urban: of or relating to a city
- toxic: poisonous
- "green": green in this sense means something, a product or a behavior that is not harmful to the environment

BACKGROUND INFORMATION

There are many common products that we use that get into the ecosystem and can cause harm. Products such as paint thinners, oil, and phosphate detergents may harm the environment by directly poisoning it. Plastic products are also harmful to our environment, they hurt and even kill marine and other wildlife. Our behavior which includes how much water we use, how much electricity, and how much gas we use also make a difference. For example, to produce the electricity to light your home requires burning barrels of oil. The resulting waste products pollute both our air and the water.

Activity, Day 1: What's Around the House?

INTRODUCTION

- Who knows what a toxin is? *Something that is poisonous*
- Do you think you have any toxins in your home? *yes/no*
- What do you use to clean the sink? To clean up a paint brush after you paint a wall?

ACTIVITY

1. Teacher passes out Eco-Challenge game cards. (Can be done in pairs).
2. Play Eco-Challenge.
3. Have each pair chooses 4 or 5 items and decide what they could use instead. After they have attempted to find alternative products pass out the "Household Alternatives" sheet and let them see how correct or close they were (or have them turn over the card if you are using the original printed game cards).

Next: Let's talk about how other types of waste products you have around your home can harm wildlife.

Has anyone ever seen one of these before? (Teacher holds up plastic six-pack ring)
Proceed with "Drastic Plastic" activity which is found directly after this activity description.
Please be sure to pass out one sheet to each student.

HOMEWORK

Have students make a list of:

- electric appliances they have in their home.
- other ways that they use electricity in their home.
- how often and in what ways do they use water?

Activity, Day 2: What's Around the House?

ACTIVITY

1. Students discuss and compare their homework lists.

2. Using their personal lists of their own home electricity and water use, students will writedown what environmentally friendly changes they will attempt to make in their home.

3. Add to the list other changes they will make regarding recycling, chemical use, six-packrings, etc.

4. Teacher asks students to make as many changes as possible over the next two weeks.Students will discover what actual changes they can make in their own home environment.

FOLLOW-UP

At the end of the week and again at the end of the following week, have students repeat the list and see what changes and improvements they have actually made. What specific things did they do this week to improve how they impact the environment?

Possible examples:

- Reduced amount of garbage, because we are recycling more things.
- Change at least one thing to do with the chemicals around your house
- Cut the six-pack rings.
- Have turned off unused lights. How many times have you done this?
- Turn off the water while you brush your teeth
- Get their parents to take their own bags to the grocery store so they don't have to use more plastic bags.

Extensions

- Teacher passes out “Our Urban Environment” question sheet.
- Students research the answers, using the internet, by contacting the local city or county offices, asking experts, and/or doing library research. They may do this in groups or as individuals, over a series of days and present their information.

Our Urban Environment Question Sheet

1. What is the most important thing to know about chemicals in your house?
   - *That they can go into the environment and harm it, we must be careful how we dispose of them, we should use alternative products that do not harm the environment....*

2. What should we look for on the labels of products in the store to know if they are safe for the environment?
   - *What are the ingredients---are they harmful to the environment; consider the packaging lots of extra packaging adds to the landfill problems, we can buy products in bigger boxes to reduce waste....*

3. What are 3 ways that we can save electricity and energy?
   - *Turn off lights and appliances that are not being used, buy appliances that use less electricity, insulate your house, put insulation around doors and windows.....*

4. What are 3 things we can do to reduce our water use?
   - *Fix leaky faucets, water lawns and shrubs in the evening or early morning so you can water less often, install low-flow toilets--or put a plastic carton of water in the tank, take shorter showers---use the shower just to rinse on and rinse off, do not leave the hose running when you wash the car.....*

5. How much trash does a typical person produce each year (or month or day)?
   - *Students will get information directly off of the exhibit---9 pounds per day, 270 pounds per month, over 1.5 tons per year*

6. Why do we have smog in the city?
   Exhaust from cars, smoke and fumes from industry, ---all put chemicals in the air---as well as dust and particle matters, the geography of the Los Angeles Basin and the air layer above the basin (inversion layer) traps these chemicals in the air above the city. Sunlight hits the chemicals and causes more reactions that all combine to form smog.

Drastic Plastic

How would you like to spend you life with a choke collar around your neck? Discarded plastic six pack rings pose this threat to the ocean wildlife. The consequences of this type of entanglement can be quite serious and, in some cases, fatal. An animal that has gotten entangled in a six-pack ring or an abandoned fishing line has trouble catching food and avoiding predators. The material can cause chafing and even deep wounds. When amarine mammal is entangled in a net underwater, it may not be able to come to the surface to breathe, and consequently, it dies. Because these materials are made to be strong and durable, animals are usually unable to free themselves. Try this demonstration to learn how strong these materials really are.

MATERIALS NEEDED

- Several six-pack rings
- A broom handle
- Two 12 foot pieces of rope
- Measuring tape

STEPS

1. Using both hands, try to break a double or tripled six-pack ring. **Were you able to break it?_____**
2. String 4 six-pack rings onto the broom handle. Have two strong adults hold the broomhandle horizontally. Grab two rings with each hand and hang your feet off the ground.
   - **Did the rings break? _____ Did they stretch?_____**
   - **Do you think an entangled seabird or sea lion could break free? _____**
   - **Why or why not? _____**
   _____
3. Fold 3 six-pack rings in half lengthwise to make 6 three-packs. Tie a piece of rope to each end of the three-packs. Hold one end of the ropes and have a friend hold the other. Play tug-of-war.
   - **Did the rings break? _____**
   - If not, have another friend join each team and play again. Keep increasing the number of kids on each team until the rings break.
   - **How many kids did it take to break the rings? _____**

CONCLUSION

Now that you know how hard that it is to break the six-pack rings, be sure to cut each of the things before you put them in the trash.

ON YOUR OWN

Next time that you go to the supermarket, take a look at the soda cans on the shelves. Try to count all of the rings. Now imagine the number of animals that may be caught in these plastic rings.

Household Alternatives

TOXIC	"GREEN" Alternative
aerosol deodorant	pump or solid deodorant
aerosol hair spray	pump hair spray, setting gel
aerosol shave cream	brush and shaving soap, gel
air freshener	open windows, vinegar in dish, open box of baking soda, simmer cloves and cinnamon
bath cleaner	scrub with toilet brush, baking soda and liquid soap
bleach	white vinegar, baking soda, borax
carpet cleaner	cornmeal, club soda and towel, soap-based non-aerosol rug shampoo
chemical fertilizers	compost, peat moss, fish meal, manure
disinfectant cleaner	borax and water, alcohol and water
drain cleaner	boiling water, plunger, or "snake"
floor/furniture polish	1 tbsp. lemon juice in 1 pint mineral oil
insect poison	*ants* - red chili powder at point of entry *roaches* - boric acid powder in cracks *mosquitoes* - citronella candles *fleas* - flea comb, garlic and brewer's yeast, herbal baths *termites* - nitrogen gas technology
metal polish	*chrome* - cider vinegar or baking soda *copper* - lemon juice and salt, then rub *silver* - soak in 1 qt. warm water with 1 tsp. baking soda, 1 tsp. salt and sm. piece aluminum foil *brass* - ketchup or Worcestershire sauce, then rub
moth balls	cedar chips, lavender, newspaper
oil-based paint	water-based latex paint
oven cleaner	2 tbsp. liquid soap with 2 tbsp. borax and warm water
paint thinner	use water-based paint
rust remover	pumice stone, steel wool
rat poison	remove sources of food, plug openings with sheet metal or wire screens, use humane live traps
scouring powder	*grease* - borax on wet cloth, vinegar *stains* - steel wool, pumice stone *general* - baking soda
shoe polish	carnauba wax or beeswax
snail bait	salt, stale beer in shallow dish, overturn clay pots and collect snails
spot remover	club soda, lemon juice, salt
toilet bowl cleaner	toilet brush with baking soda and liquid soap
window cleaner	white vinegar and water, then wipe with newspaper

The "Eco-Challenge"

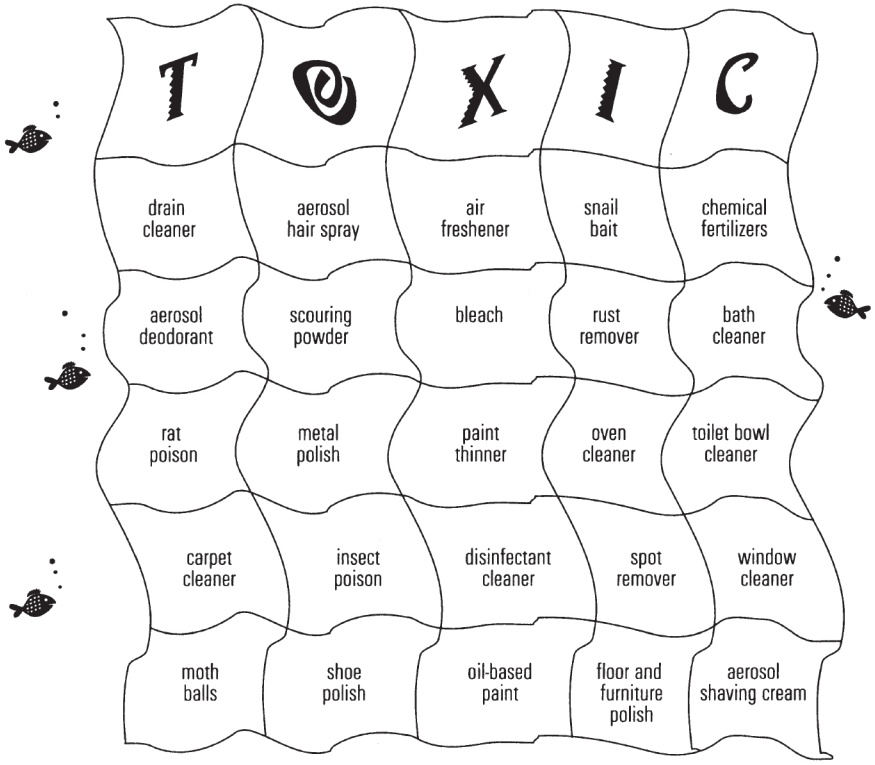
A Game That Makes Everyone A Winner!

Heal the Bay

Special thanks to the U.S. Environmental Protection Agency.

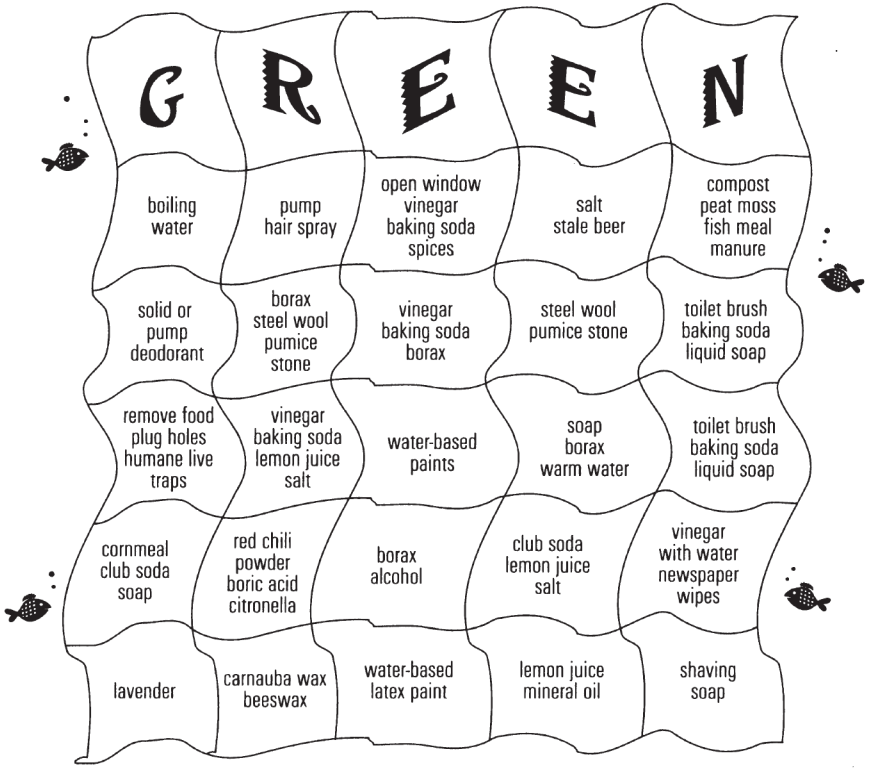
Play the "Eco-Challenge"

Draw an X on "toxic" stuff you have at home.



Number of X's ___ drawn

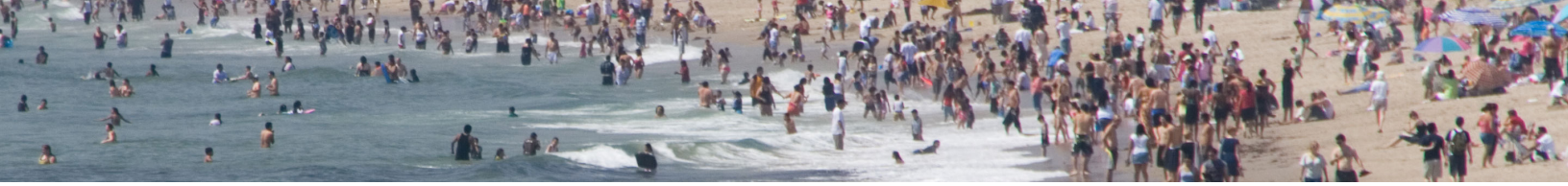
Draw an O around the "green" stuff you have at home.



Number of O's ___ drawn

Aim for no X's & lots of O's

Check the household alternative list to learn more about using "green" products.



Lesson 5: Down the Drain

Two 55 minute class periods

SEQUENCE: For a better understanding of concepts, students should first have done “Eco Challenge”

Concepts & Objectives

QUESTION
How do wastes from your neighborhood end up on the beach?

UNDERLYING CONCEPT

We are all part of the biosphere. The wastes that we produce directly enter the ocean ecosystem through the storm drain system or indirectly via the sewage system. We need to be aware and responsible for what goes down the drain.

SKILLS

- Deciphering
- Plotting
- Mapping

OBJECTIVES

Students will be able to:

- Mark storm drains to help raise awareness of the debris problem
- Conceptualize a system whereby pollutants enter the environment

MATERIALS NEEDED

- Paint
- Stencils
- Copy of map of the immediate area surrounding the school (preferably enlarged)
- Colored pens or markers
- Information door hangers
- 8 minute video “Make the Connection: An Educational Tour of Los Angeles” to order, please contact City of Los Angeles, Storm Water Management Division 231-847-6350

Vocabulary & Background

VOCABULARY

- Catch basins: red curb areas with openings under them for water to flow into
- Storm drains: system of catch basins and tunnels which are underneath the city and allow the water to flow off of the streets and into the drains and down into the ocean
- Source: where something comes from
- Non-point source pollution: pollution that enters the ocean from many sources (cars,farmlands, trash, etc.) and not from a single source such as a sewage outfall.

BACKGROUND INFORMATION

Many coastal cites have a drainage system built into their infrastructure to handle excess run-off from rain and storms.

Everything that enters a storm drain ultimately ends up at the beach. Trash, leaf litter, oil from cars, and many other types of debris flow through the storm drains.

One of the biggest problems occurs when it rains, especially the first rain of the season. All of the trash, oil, etc. that has built up on the roads and in the catch basins (red curbed areas with openings) where the storm drains are visible on the street) is “flushed” down the storm drains to the beach. Marine wildlife can become entangled in the debris, they can also harm themselves by eating it. In addition, oils and other pollutants literally pollute the ocean environment. This includes bacteria and viruses that cause health problems for humans.

We need to be aware that what goes down the drain comes out in the sea.

Activity, Day 1: Mapping the Storm Drains

PRIOR TO THE ACTIVITIES:

Two to three weeks prior to the activity, contact the agency in your area that is in charge of marking storm drains. In the Los Angeles area contact “Heal the Bay.” Contact your local city officials to find the agency in your area (they will handle all of the paperwork involved in being able to mark on the storm drains).

INTRODUCTION

- What happens to the animals at the beach and in the ocean when there is trash? *(issues of 6- pack rings, plastic that is eaten, pollution from chemicals)*

- How does trash get from the neighborhood to the ocean? (*through the underground storm drain system)*
- What is the hole under the sidewalk with the red paint on the curb called? *(catch basins)*
- What can we do to the catch basins to let people know that what goes into them ends up in the ocean? *(By putting special signs/marks on them).*

Let's take a walk around the school block and find the catch basins and storm drains so we can paint them and put signs on them.

ACTIVITY

1. Students and teacher (and assistants) walk around the block or two surrounding their school. Using either local street maps or student generated maps note where the storm drains are--- either write down the location such as: "in the middle of the 1100 block of Harvard Ave" and then mark it on the map when they return to the classroom---Or find the exact location and mark it on the street map guide while they are on the walk.

2. Write down and note which storm drains are unmarked and which need to be re-painted.

3. These maps will be used during the next day's activity.

Day 1 Extensions

- In Los Angles the water in storm drains could flow into the LA River or could flow to Biona Creek. Contact Heal the Bay or your local water resource agency to determine exactly which path is taken by your local storm drains.
- How is the impact different if it goes through the LA River or to the Biona Creek? (In Los Angeles, the LA River goes directly into the ocean, while the Biona Creek passes through a large wetland area and can have other impacts besides the direct beach environment. There are other animals and plants that live in the wetlands that are a little different from those that live just on the beach.)

Activity, Day 2: Down the Drain

ACTIVITY

1. This activity works best by dividing the class into groups of 2 or 3. You will need an assistant for the other group(s). If that is not realistic, one group can remain in the classroom/library doing internet research on the impact of trash and pollution on marine life.During this time, the other students stencil one or two of the storm drains.

2. Using the maps, take students out to the storm drains that are in easy walking distance of your school.

3. Note and record any trash seen around the catch basin.

4. Following the instructions on the stencil kit, stencil the storm drains.

5. Under Teacher's supervision (or an adult) students may hang the information provided by your local agency (or students can create information signs as part of their activity) signs on the door knobs of the nearby residents.

6. Graph any data or record in a science journal.

DISCUSSION

- How should people clean their sidewalks? *(sweep away from the catch basin and throw the waste into the trash)*
- What should people do with the oil from their cars when they change their own oil? *(take it to a recycling station or garage that is equipped to handle it for them)*
- What should people do about their dog's waste? (*put it in the trash or it will eventually washout into the ocean)*
- What can we do to be sure that people know about the storm drain problem? *(put up more signs, talk to our friends, families, and neighbors, place posters at local stores)*

Day 2 Extensions

- Students can make flyers to educate the neighborhood and pass out to neighbors and post at local stores.
- Students can keep track of the storm drains they marked and periodically check for debris build up--and keep them clean.
- Contact your local agency that maintains the sewers. Often someone will come to your school and discuss the difference between sewers and storm drains; possibly including opening a manhole cover on the street to illustrate the difference in routes between storm drains and sewers.