Pollution in a Watershed

Background Info:

<table>
<tr><td colspan="2">Watershed</td><td>A watershed is the area of land where all of the water that is under it or drains off of it goes into the same place. John Wesley Powell, scientist geographer, put it best when he said that a watershed is:
"that area of land, a bounded hydrologic system, within which all living things are inextricably linked by their common water course and where, as humans settled, simple logic demanded that they become part of a community." - http://water.epa.gov/type/watersheds/whatis.cfm
- In the continental US, there are 2,110 watersheds.</td></tr>
<tr><td colspan="2">Water Cycle</td><td>There is no new water on Earth. The water cycle has been recycling the water on our planet for billions of years. The water evaporates from a liquid into water vapor in the air. It condenses into clouds, and then falls as rain, snow, sleet, or hail and is collected by streams, rivers, and lakes
- How we treat our water will effect a vital resource for MANY GENERATIONS</td></tr>
<tr><td rowspan="2">Sources/Types of Pollution</td><td>Point Source Pollution</td><td>Example: a factory dumping chemical waste.
Point source pollution is easier to correct
Wastewater emptied into bodies of water through pipes – can be dealt with directly</td></tr>
<tr><td>Non Point Source Pollution</td><td>Examples: They can result when rain from your lawn, driveway, city streets, construction sites, and parking lots runs off into creeks and streams. This runoff may contain: oil, fertilizers, pesticides, soil, and other substances harmful to water quality
Nonpoint source problems are more difficult to fix
Fixing nonpoint source problems usually requires a great deal of cooperation. Communities, farmers, homeowners, developers, and companies – all of us – must take better care of the land to reduce nonpoint source pollution.</td></tr>
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Activity –Food Web:

Goal: understand the watershed we live in and the effects of pollution.

- Intro: We are going to use a model of our watershed to demonstrate the effects and movement of pollution.
    - Discuss what a watershed is
        - Figure out which one we live in.
        - Use watershed 3D model and 3 sheets of Novato Creek, San Rafael Creek, and Russian River Watershed (reverse side has common species of each watershed)
- Plan a watershed:
    - Give each student a flag or sprinkles, or cocoa powder.
    - Plan the location and place flags using clay for:
        - Sewage treatment plant – black or yellow flag
        - Vehicle oil/exhaust - cocoa powder
        - Houses/lawns – light green
        - Animal waste – sprinkles
        - Ag run off – dark green flag
        - Power plant – red flag
        - Factory – pink
        - Gas station - Blue
        - Mine - Orange
        - Landfill – Purple
- Rain storm:
    - Spray the watershed with water
    - Watch the color run off the flags and build up in the creeks→rivers→ocean
- Take out figures:
    - Read a case study and discuss where they go
    - Select students to place the individual or family (armey men, and plastic animals)
    - Explain the cause of the illness and placement that makes the most sense.
- **Extension**:
    - Effect of pollution on a frog's lifecycle and why amphibians are considered an indicator species, (they live in/near water, breathe through there skin, and undergo metamorphosis).

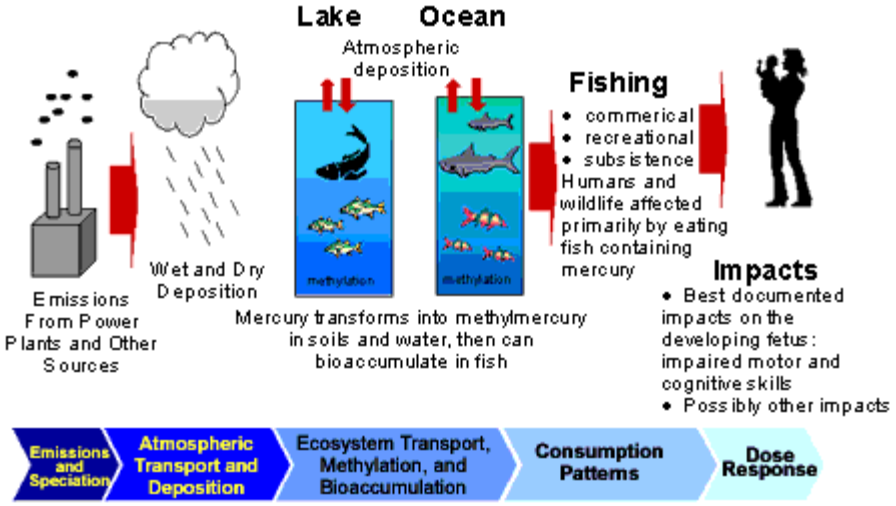
Case Study #1: The Castro Family

The Castro family are fishermen and women. They leave early every morning to catch fish to feed themselves and to sell at the market. Ms. Castro has a new baby but the baby's development is slowed and Ms Castro is concerned that there is something wrong. Mr Castro and Ms Castro are experiencing tremors; emotional changes (e.g., mood swings, irritability, nervousness, excessive shyness); insomnia; neuromuscular changes (such as weakness, muscle atrophy, twitching); headaches; disturbances in sensations; changes in nerve responses. And grandpa Casto died of respiratory failure.

Cause:

Mercury poisoning

How mercury enters the environment



Location:

Anywhere, especially if you eat lots of fish.

Case Study #2: Walter Walkins

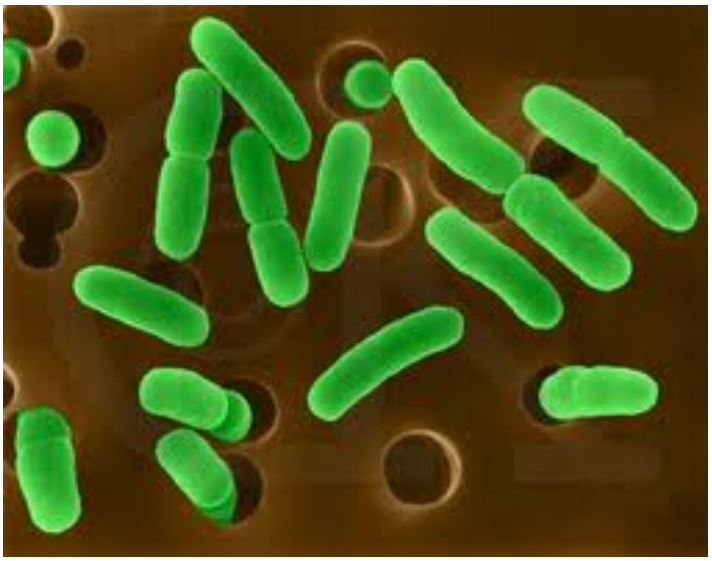
Walter is a naturalist. He enjoys camping and exploring nature. Recently during a long backpacking trip Walter ran out of water and had to drink water from a beautiful and clean looking spring. Now Walter is very ill, he is dehydrated due to suffering from nausea and scowers (loose stool).

Cause:

Fecal coliform infected Walter's digestive track when he drank contaminated water. Someone upstream of Walter's backpacking path has a septic system that is leaking human waste. Cholera is also caused by a bacteria from infected human's waste entering the water way and spreading to others.

Location:

Anywhere that human waste is getting into the water system.



Case Study #3: Mandy

Mandy is a sea-lion that had a really bad stomach ache. Mandy got so sick that she swam to shore and would not move. She was found by friendly people called the Marine Mammal Center, who used trained animal handlers to capture and safely move Mandy back to the MMC. The veterinarian at the MMC diagnosed Mandy and several other Sea Lions with Kidney damage/failure due to Leptospirosis.

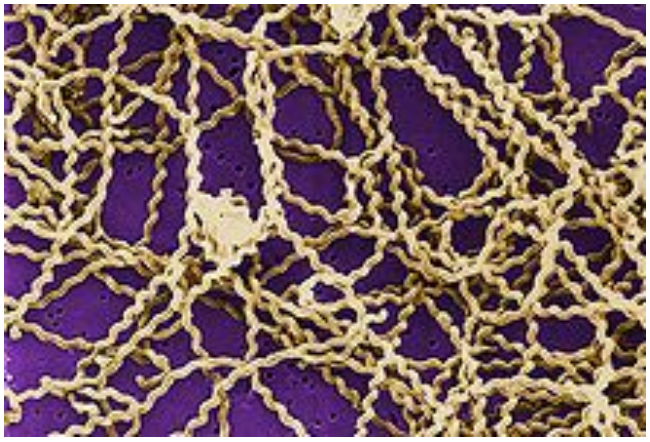
Cause:

Leptospirosis is caused by spiral shaped bacteria called Leptospira.

In 2008, nearly 200 sea lion patients were admitted to the Marine Mammal Center with the condition, an increase over the previous year. When numbers are high, our scientists can take advantage to study the disease with the hope of finding out why outbreaks occur and how we can help those animals infected.

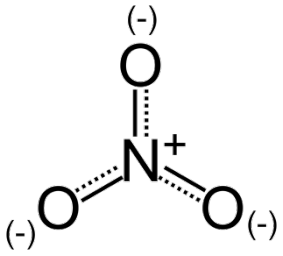
Location:

Ocean



Case Study #4: The Chee Children

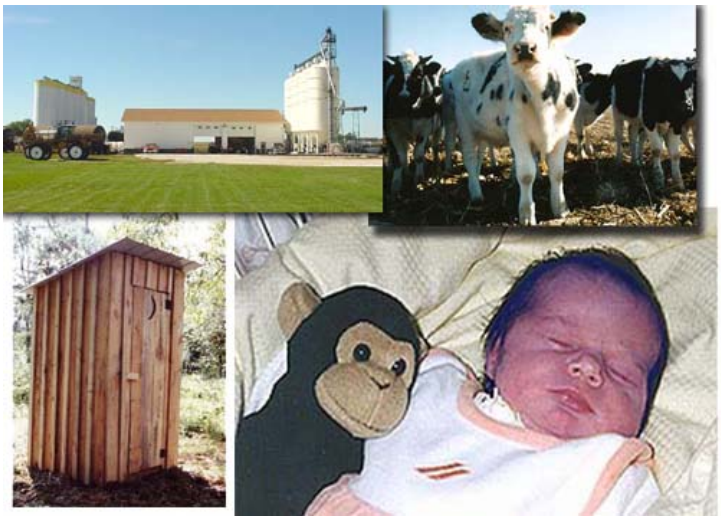
The Chee family moved to a beautiful home in the suburbs. The Chee children are 6year old twins. When the twins were 4 they began having rashes, and hair loss, and were later diagnosed with cancer. Interestingly 5 other families in there neighborhood have children that were diagnosed with the same cancer. Ms Chee has recently decided to expand her family and baby Chee was born and quickly turned the color blue!

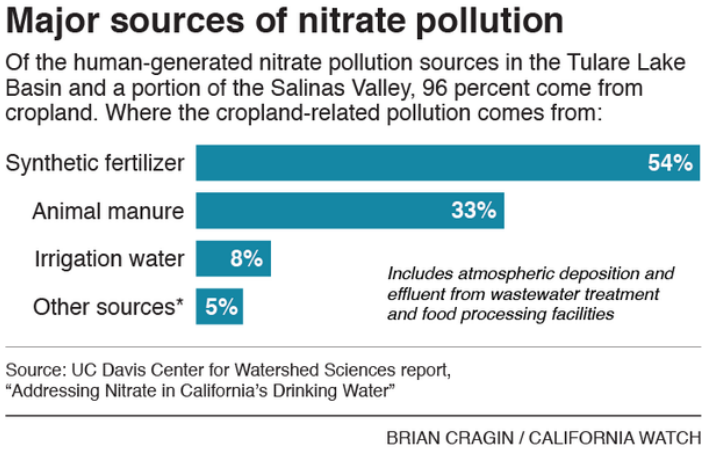


Cause:

Nitrates

Nitrate-contaminated water is a well-documented fact in many of California's farming communities. The agricultural industry, contributes many nitrates, including those from synthetic fertilizers, and animal manure. Plants take nitrates from the soil and industrial farms use synthetic fertilizers to replace it. Organic farms often plant legumes in-between crops that need nitrates because legumes (like beans and mustard) work with bacteria to put nitrates back in the soil.





Location:

Near farms and agricultural area.

Case Study #5: Abigail Smith

Abigail smith has had terrible allergies her whole life and she finally said enough is enough! She moved from her little farm to the big city to escape all the pollen and animal dander that was making her chronically uncomfortable her whole life. Upon moving into the big city her eyes began to burn worse then they ever had from allergies and she was often nauseous.

Cause:

Vehicle exhaust causes eye irritation, nausea and when released into the atmosphere it interacts with water and can lead to acid rain.

Location:

Where there are well traveled roads.