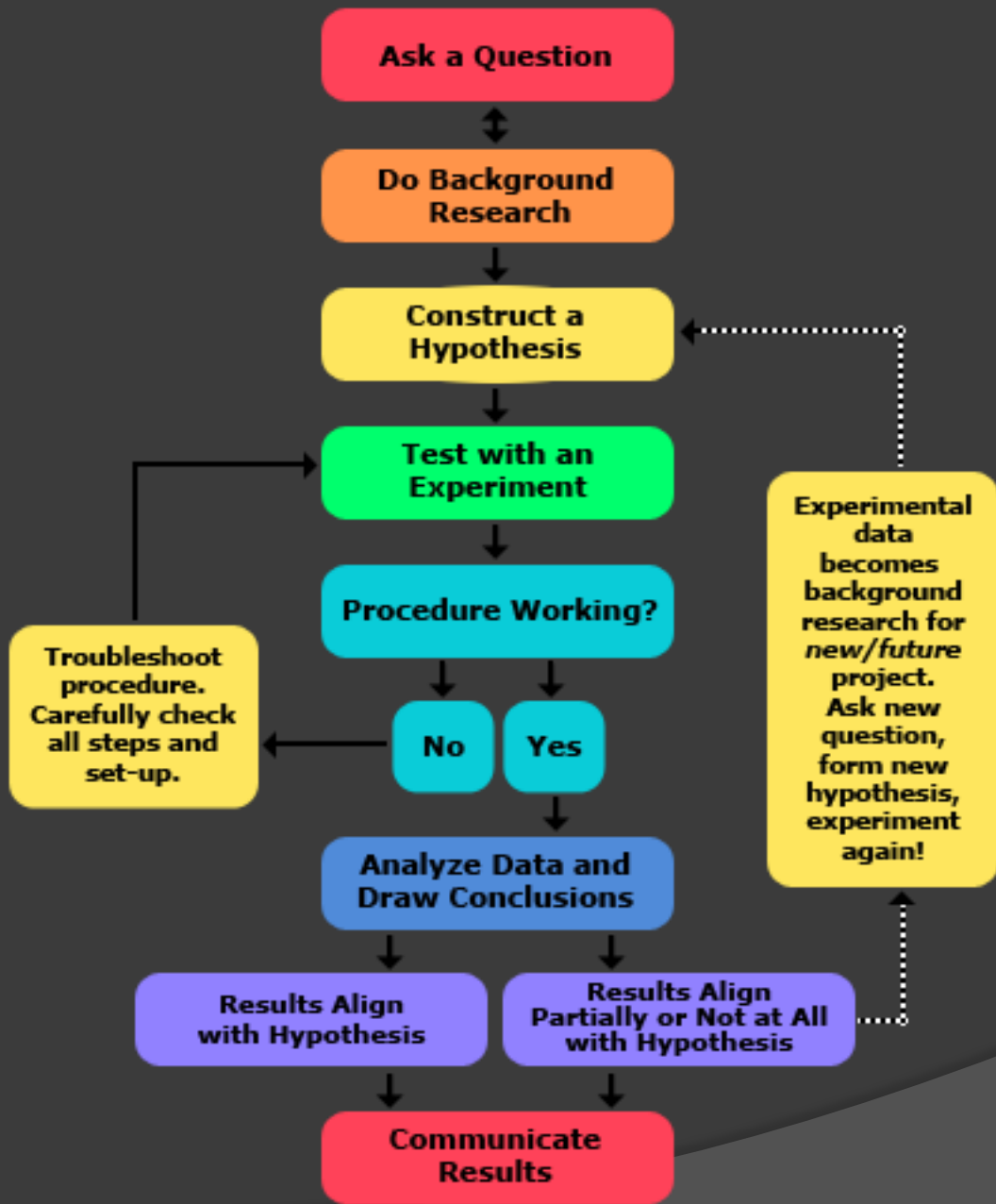


CHAPTER 2: TOOLS OF ENVIRONMENTAL SCIENCE



Types of Variables

Independent

The one thing you change.
Limit to only one in an experiment.

Example:
The liquid used to water each plant.

Independent Variable



Dependent

The change that happens because of the independent variable.

Example:
The height or health of the plant.

Dependent Variable



Controlled

Everything you want to remain constant and unchanging.

Example:
Type of plant used, pot size, amount of liquid, soil type, etc.

Controlled Variables



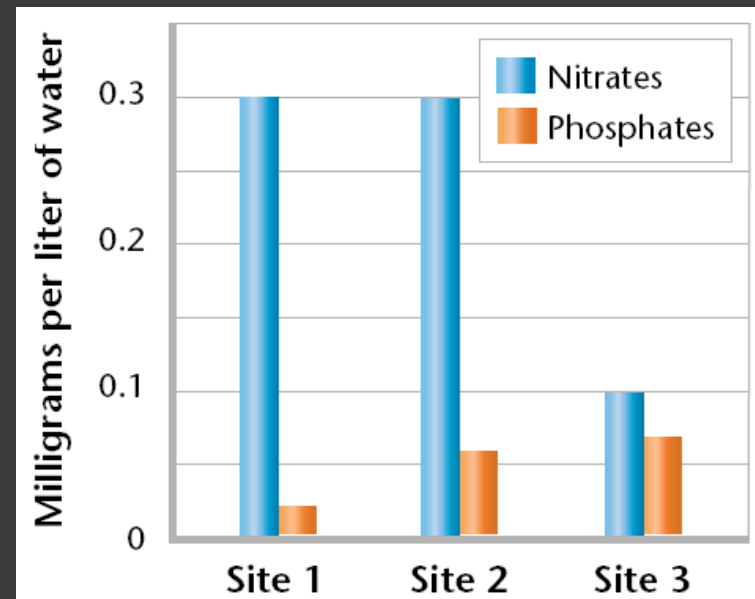
Experimenting

- ◎ **The experimental group-** the group being tested on
 - Only change ONE variable at a time.
- ◎ **The control group-** the group not being experimented on.
- ◎ **Why** do we need a control group?

Organizing and Analyzing Data

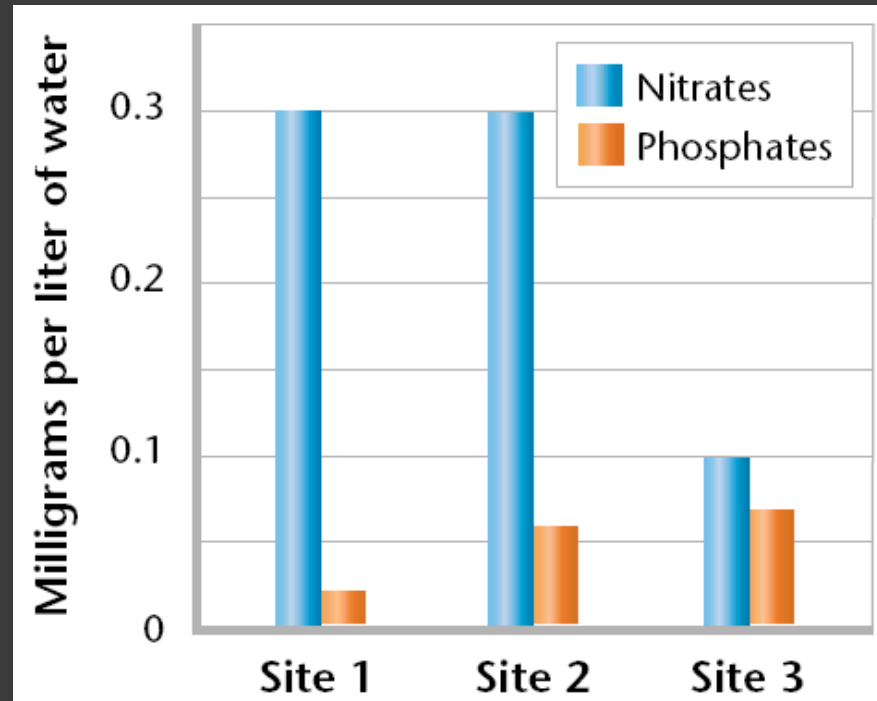
- Graphing the information makes the trends presented in tables easier to see.

Pollutant Concentrations		
Site	Nitrates	Phosphates
1	0.3	0.02
2	0.3	0.06
3	0.1	0.07



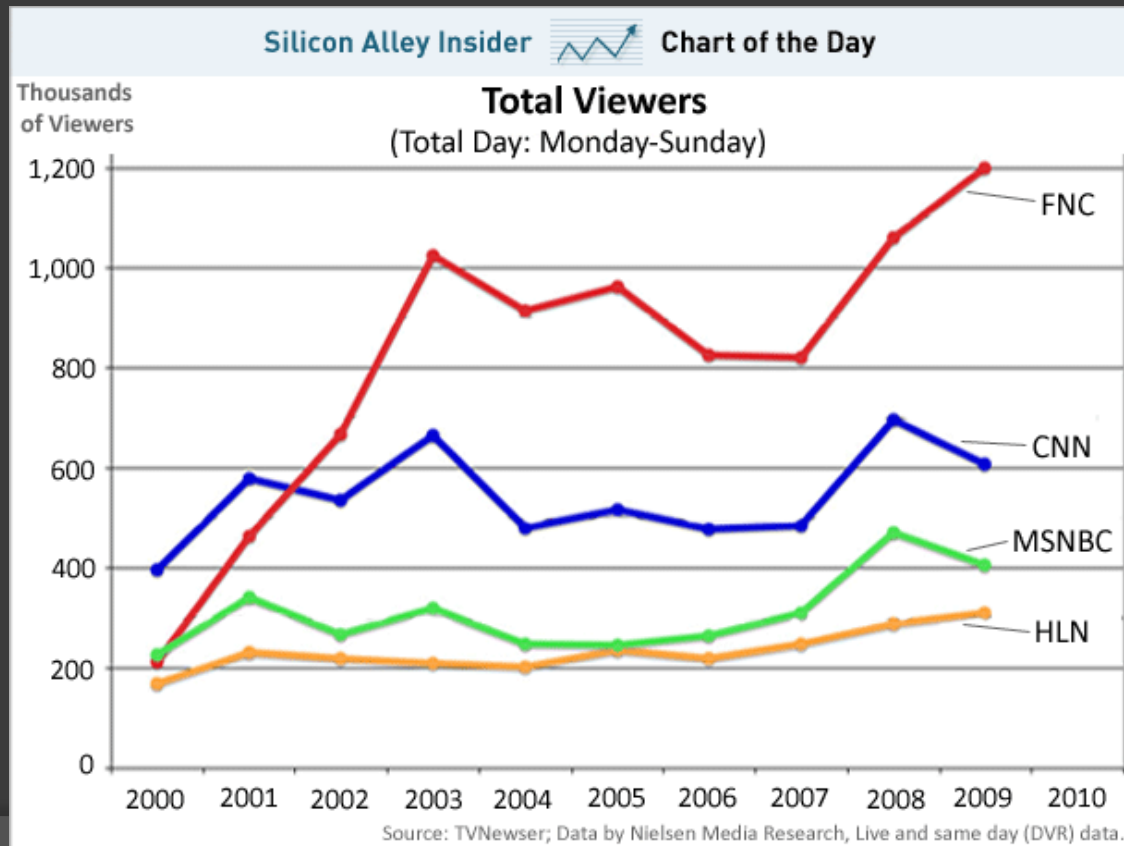
Organizing and Analyzing Data

- ◎ **Bar graphs (discrete)** are useful for comparing the data for several things in one graph.



Organizing and Analyzing Data

- ◎ **Line graphs (continuous)** are useful for comparing the data over time



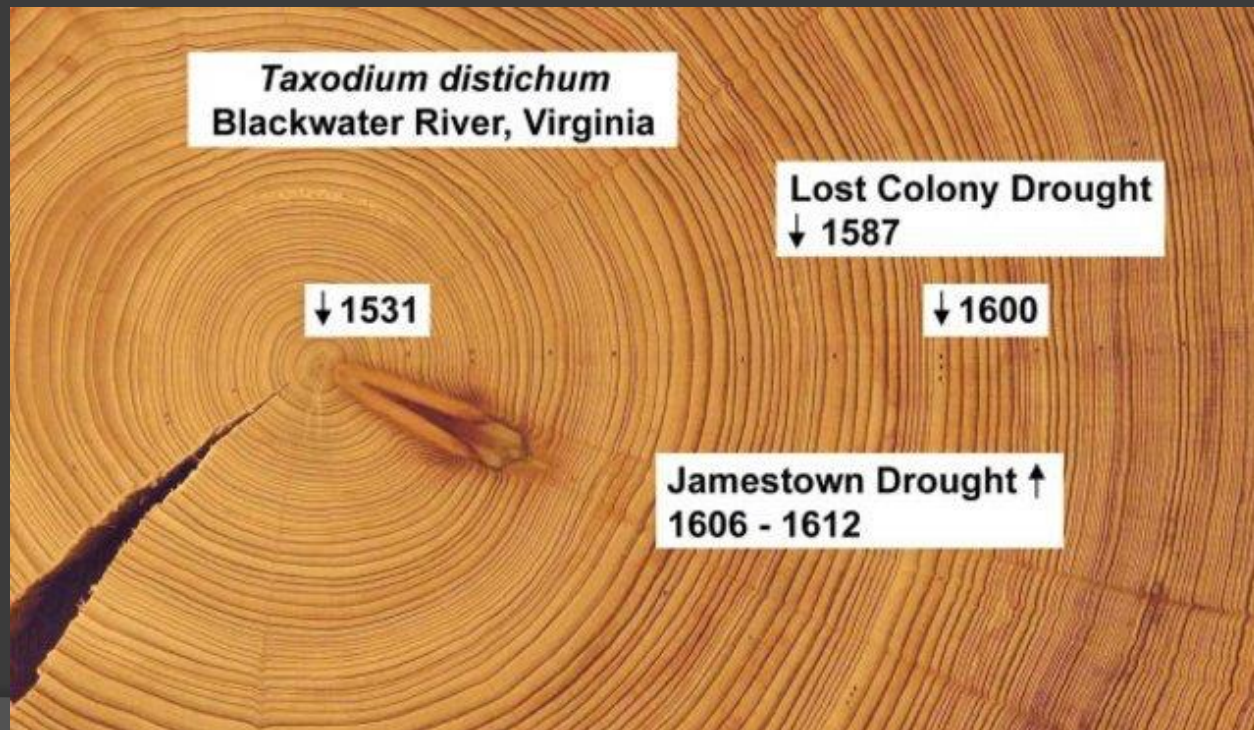
Repeating Experiments and Communicating Results

- ◎ Scientists must publish their work so it can be repeated
- ◎ **If an experiment is able to be repeated, it is reliable**



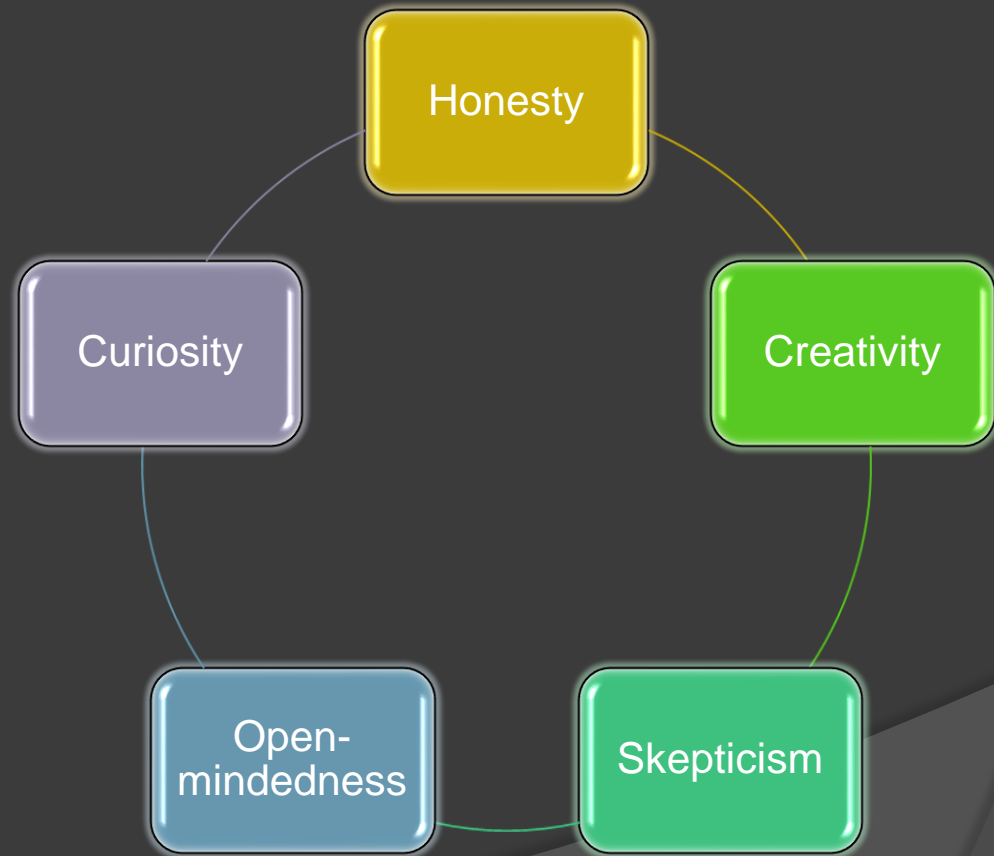
The Correlation Method

- ◎ **Correlation** is the linear dependence between two variables
- ◎ Correlation DOES NOT equal causation



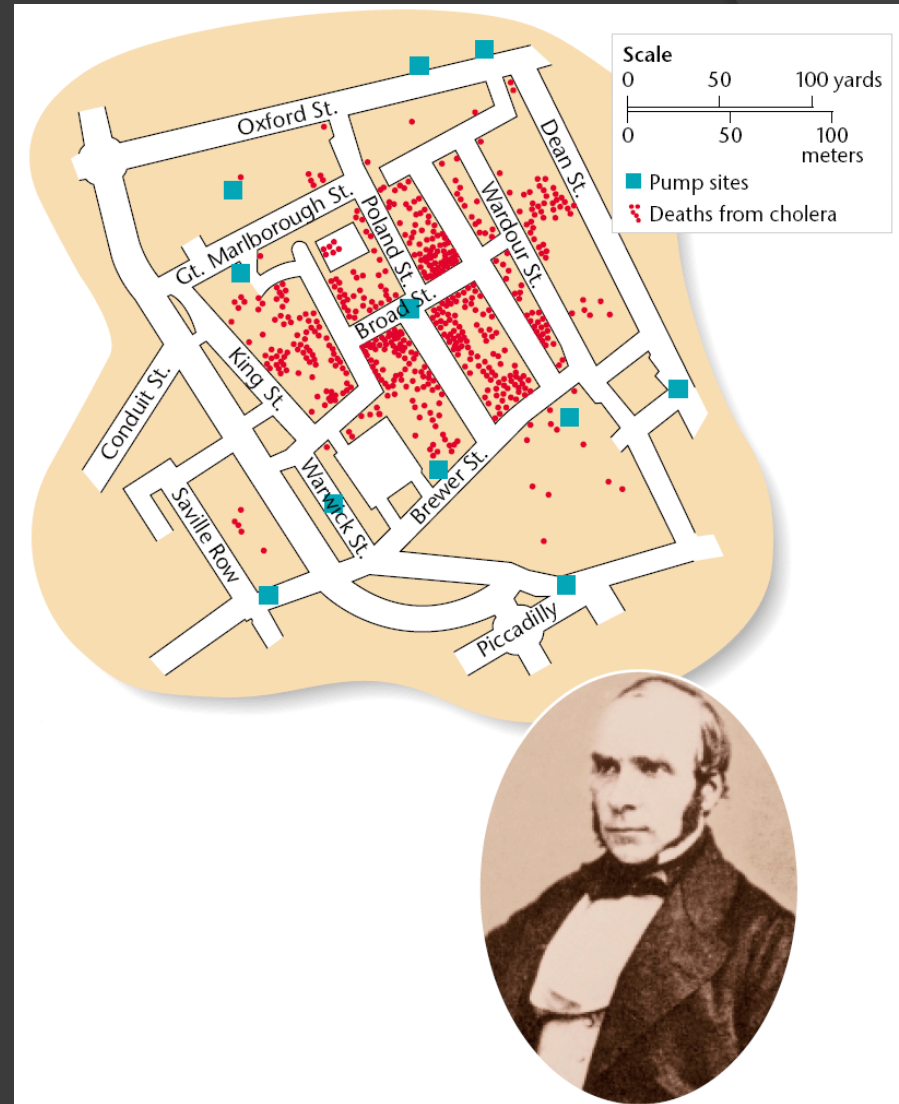
Scientific Habits of Mind

- Curiosity
- Skepticism
- Openness
- Honesty
- Creativity



Imagination and Creativity

- An example being when John Snow created a spot map which effectively pinpointed the source of a Cholera epidemic in 1854.



How Scientists use Statistics

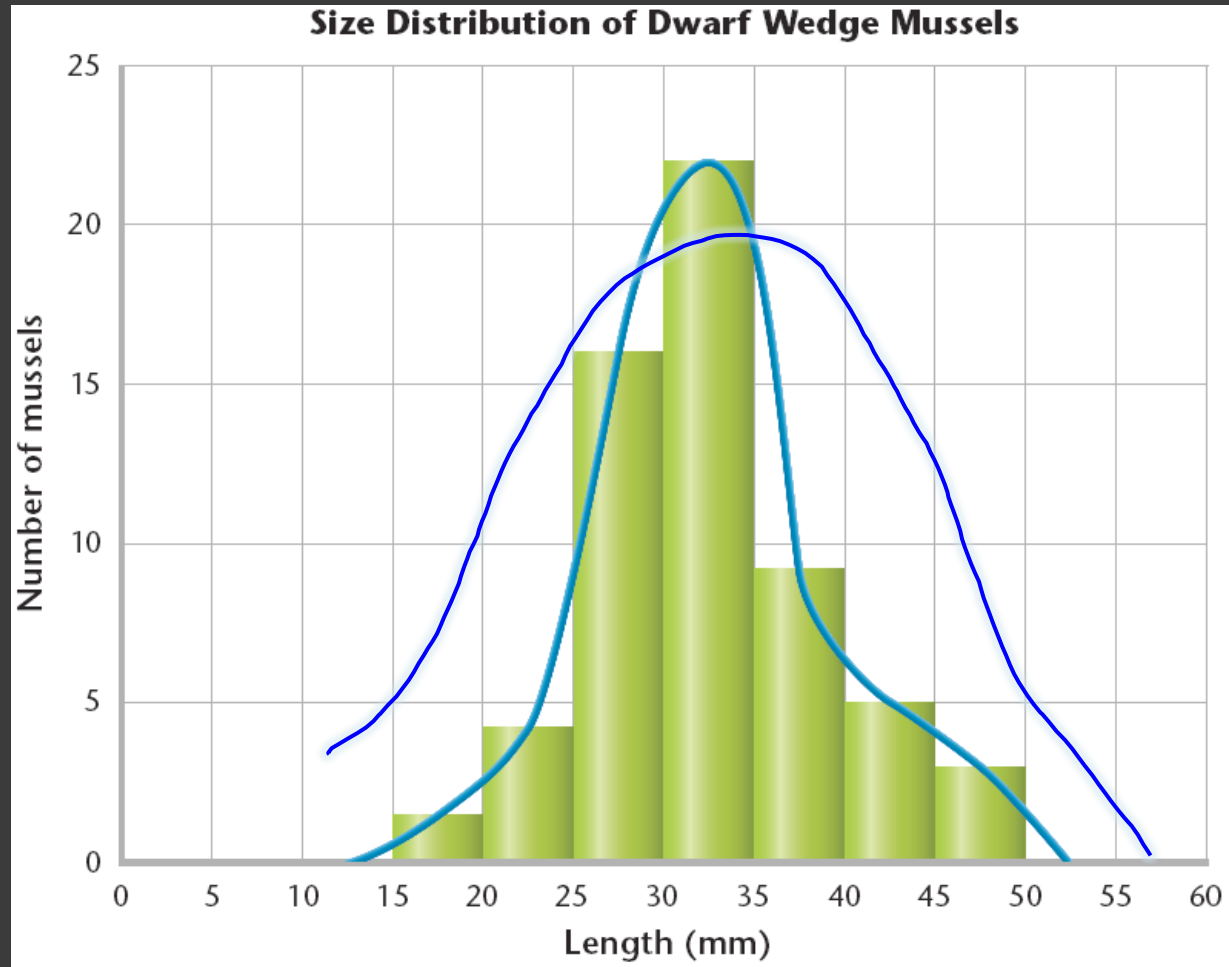
- ◎ **Statistics** is the collection and classification of data that are in the form of numbers
- ◎ Use to analyze and understand data



What is the Average?

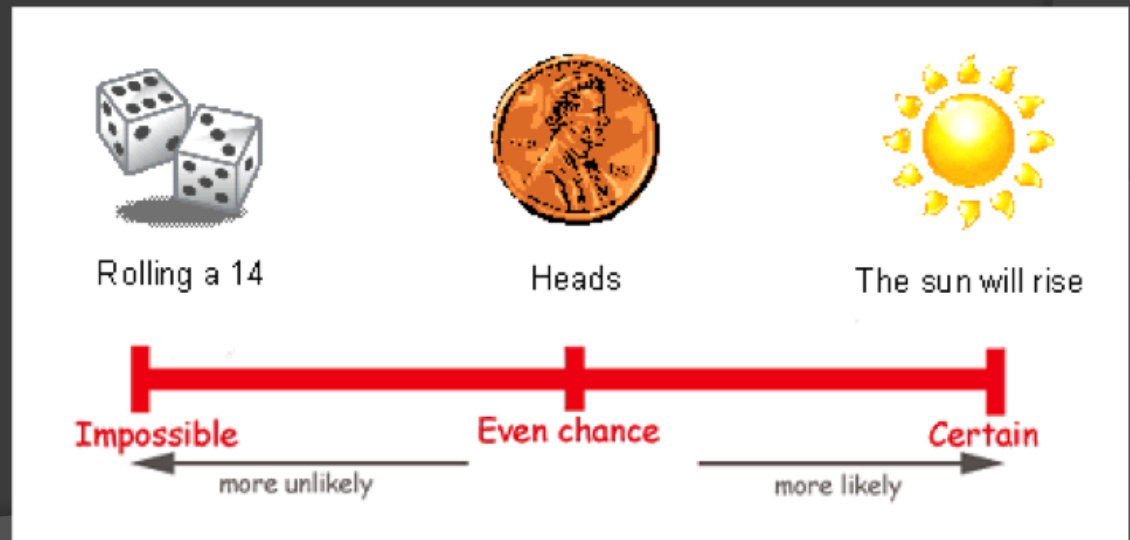
- ◎ **Mean** is the number obtained by adding up the data for a given characteristic and dividing this sum by the number of individuals
- ◎ Provides a single numerical measure for a population and allows for easy comparison

Distribution



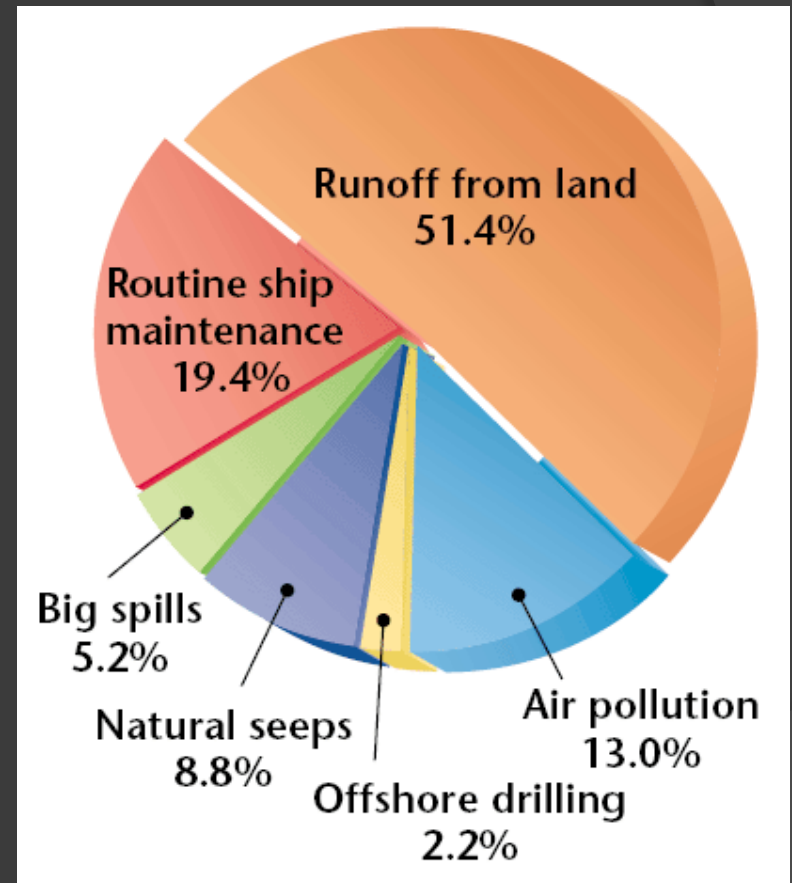
What is the Probability?

- ◎ **Probability** is the likelihood that a possible future event will occur in any given instance of the event
- ◎ Usually expressed as a number between 0 and 1 and written as a decimal rather than as a fraction
- ◎ Must have a large sample size



Thinking About Risk

- ◎ **Risk** is the probability of an unwanted outcome
- ◎ People often worry about big oil spills, but as the pie chart shows, there is a much greater risk of oil pollution from everyday sources



Thinking About Risk

Perceptions of Risk by Experts and Ordinary Citizens

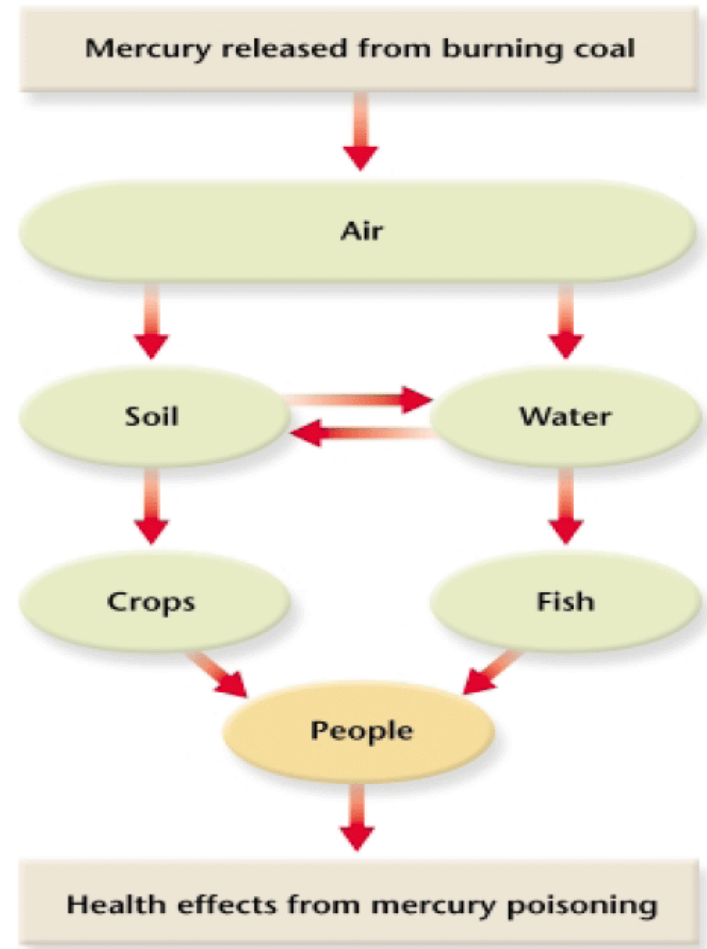
	High risk	Low risk
Experts	ozone depletion; global climate change	oil spills; radioactive materials; water pollution
Citizens	ozone depletion; radioactive waste; oil spills	global climate change; water pollution

Models

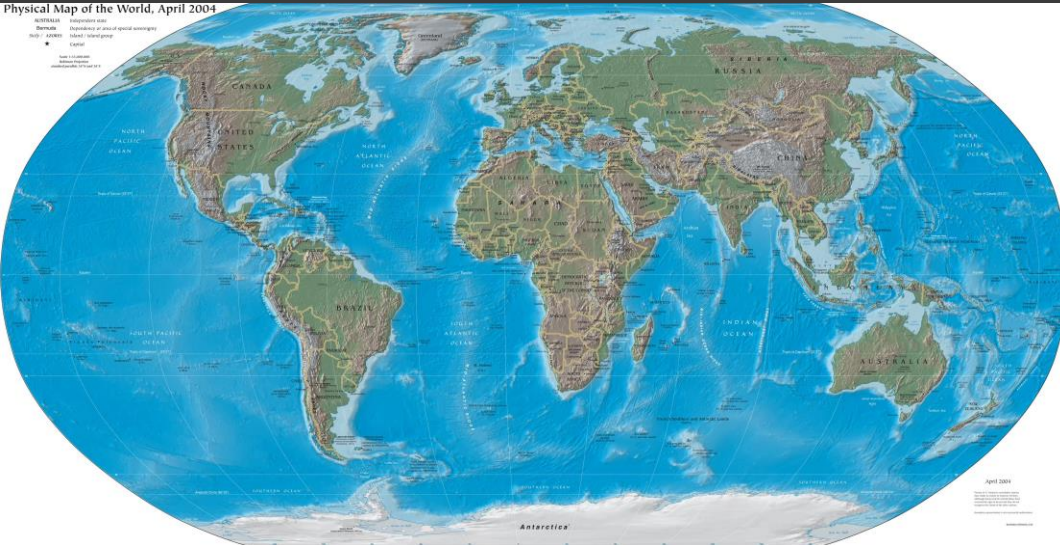
- ◎ **Models** are patterns, plans, representations, or descriptions designed to show the structure or workings of an object, system or concept
- ◎ Types: physical, graphical, conceptual, mathematical



Conceptual Model of Mercury Contamination



Physical Map of the World, April 2004



Values and the Environment

- ◎ **Values** are principles or standards that an individual considers to be important
- ◎ Values affect decision making.

Values That Affect Environmental Decision Making	
Value	Definition
Aesthetic	what is beautiful or pleasing
Economic	the gain or loss of money or jobs
Environmental	the protection of natural resources
Educational	the accumulation and sharing of knowledge
Ethical/moral	what is right or wrong
Health	the maintenance of human health
Recreational	human leisure activities
Scientific	understanding of the natural world
Social/cultural	the maintenance of human communities and their values and traditions

An Environmental Decision-Making Model

- © A **decision-making model** is a conceptual model that provides a systematic process for making decisions

