
Aquatics

“Water Planet”

~Approximately 71% of the Earth is covered by water.

~Oceans regulate the Earth’s climate, dilute and degrade wastes, and provide a major habitat for many of Earth’s creatures!

https://www.usgs.gov/special-topics/water-science-school/science/how-much-water-thereearth#:~:text=About%2071%20percent%20of%20the,in%20you%20and%20your%20dog.

Limited Freshwater

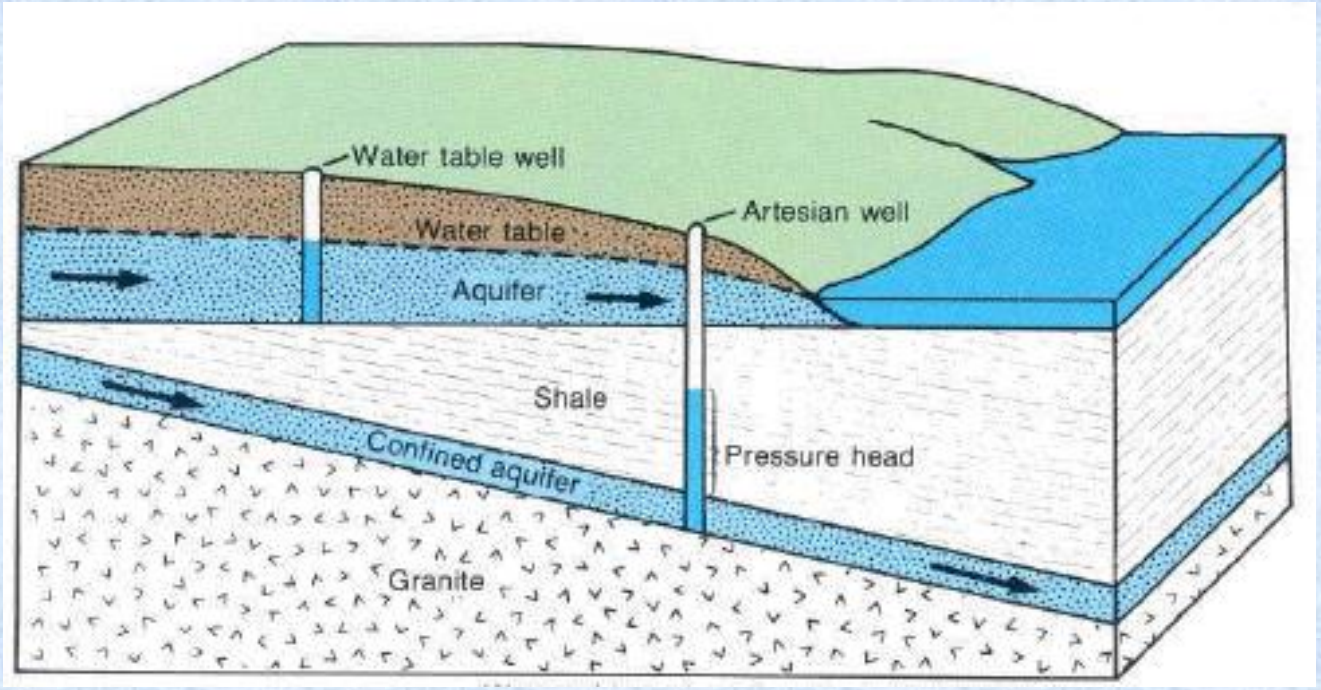
Approximately 3.5% of Earth's water is freshwater…….

>68% of that 3.5% is locked up in polar ice caps, leaving ~31% of all freshwater accessible.

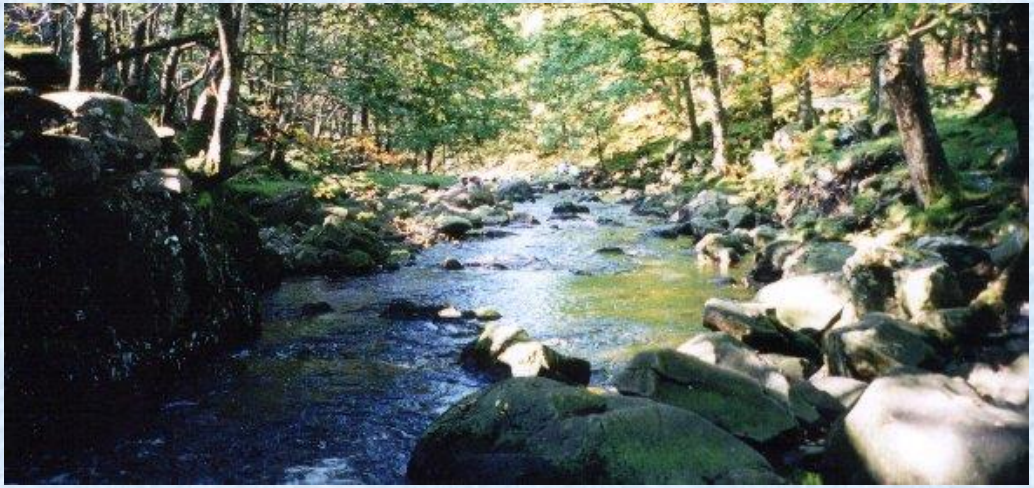
Rivers are the source of most of the fresh surface water people use, but they only constitute about 1/10,000th of one percent of total water.

Aquifers

About 30% of the world's total freshwater resources lies under the Earth's surface as groundwater. When water congregates below the surface it forms an **aquifer**.



Def: A land, gravel or rock formation capable of storing or conveying water below the surface of the land.



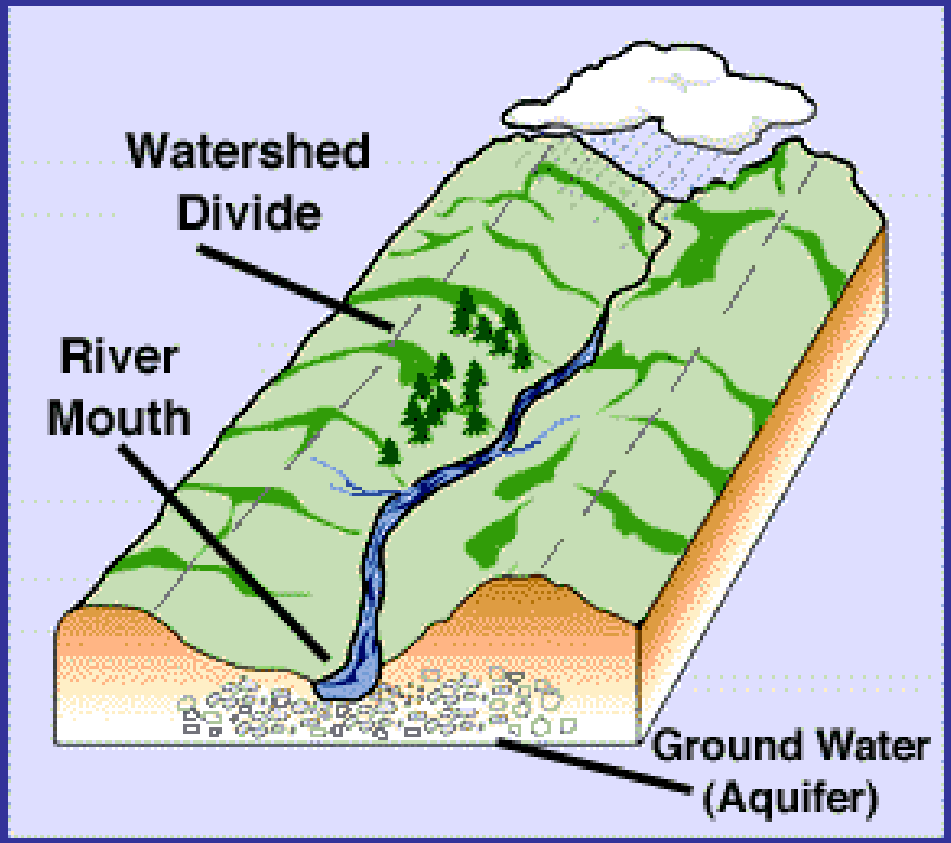
Water runs very slowly and seeps into rivers and lakes through their banks.

https://www.livescience.com/39625-aquifers.html

Rivers, lakes and wetlands receive water in other ways as well…….


CONDENSATION
PRECIPITATION
EVAPORATION
PERCOLATION
GROUNDWATER
HYDROLOGIC CYCLE

What is a “Watershed?



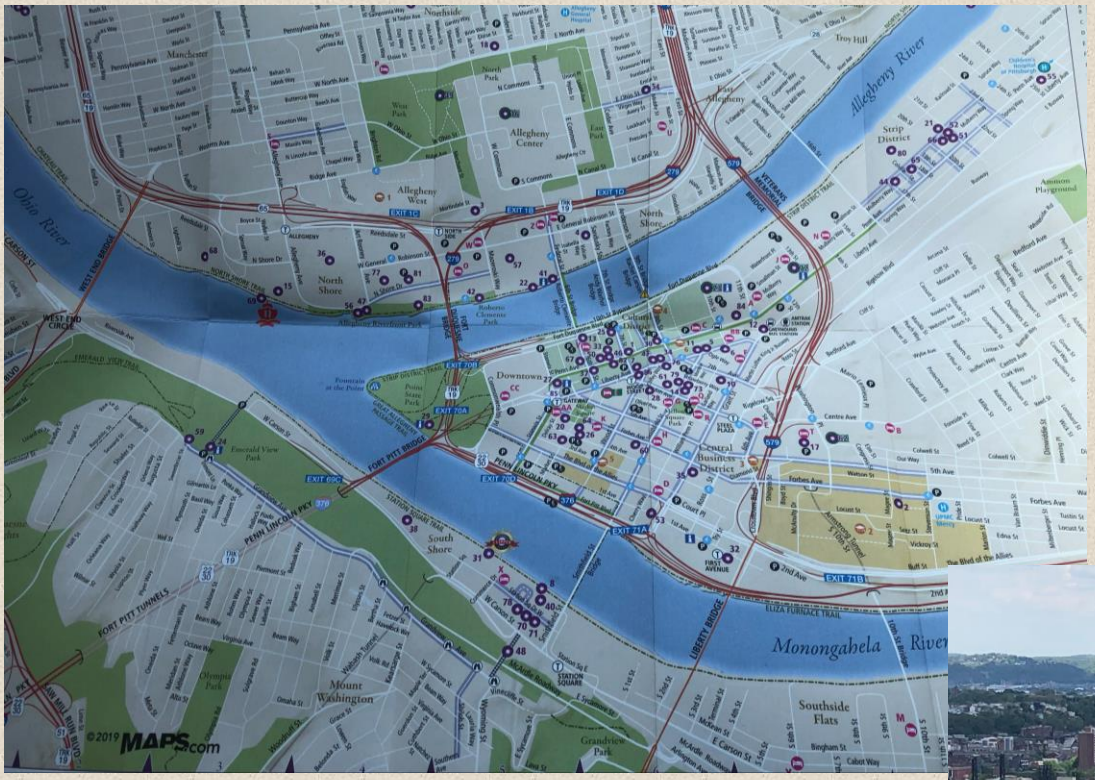
Definition:

An area of land that drains into a particular river or body of water usually divided by topography.

New York State has 17 watersheds. Chautauqua County is part of TWO watersheds…..

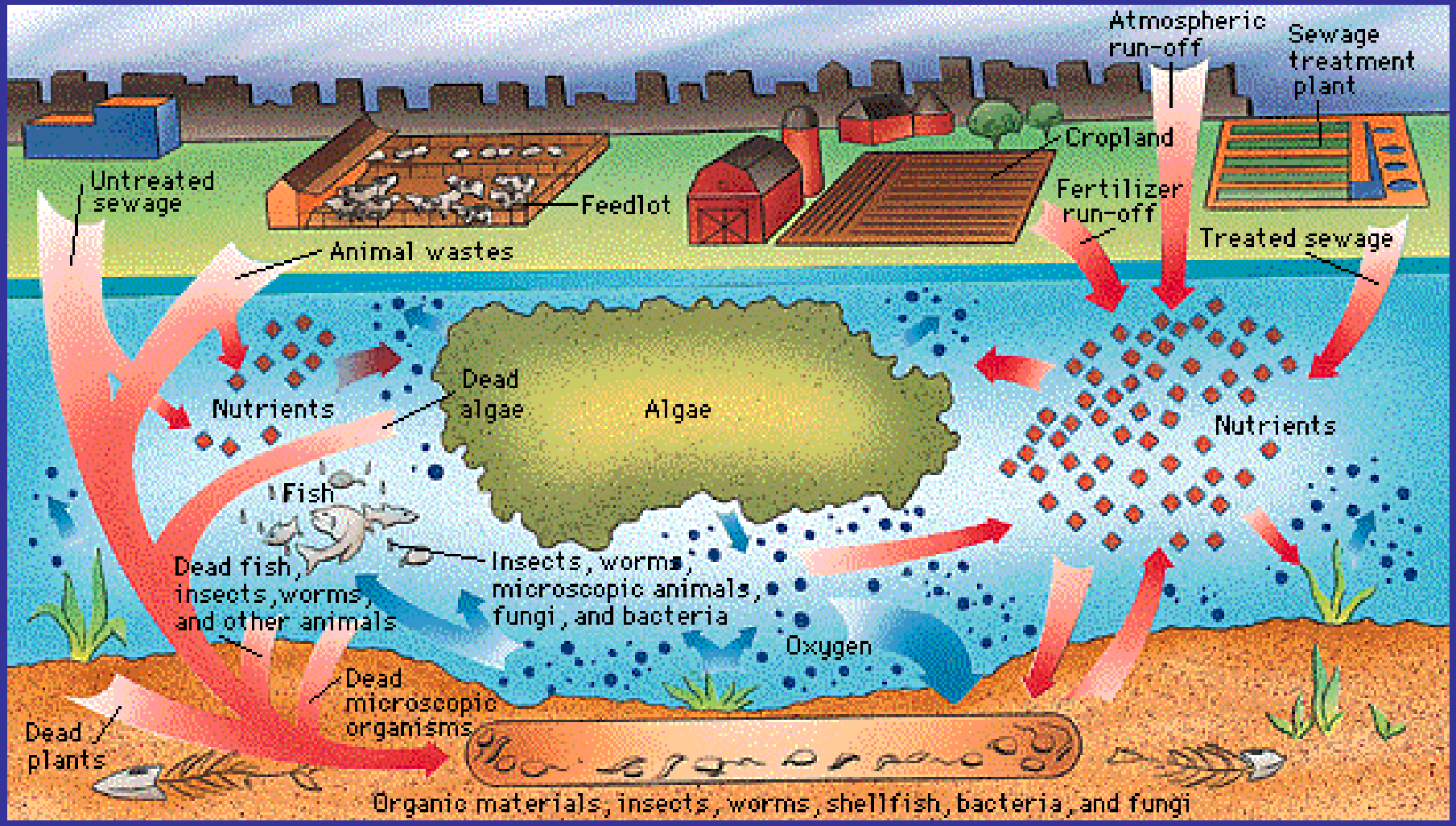
- Lake Erie to St. Lawrence to North Atlantic
- Mississippi to Gulf of Mexico

Chadakoin → Conewango → Allegheny → Ohio → Mississippi → Gulf of Mexico



Beginning at **Pittsburgh, Pennsylvania**, the Ohio is formed by the confluence of the Allegheny and Monongahela Rivers. It ends 981 miles later at Cairo, Illinois when it empties into the Mississippi.

Water Pollution



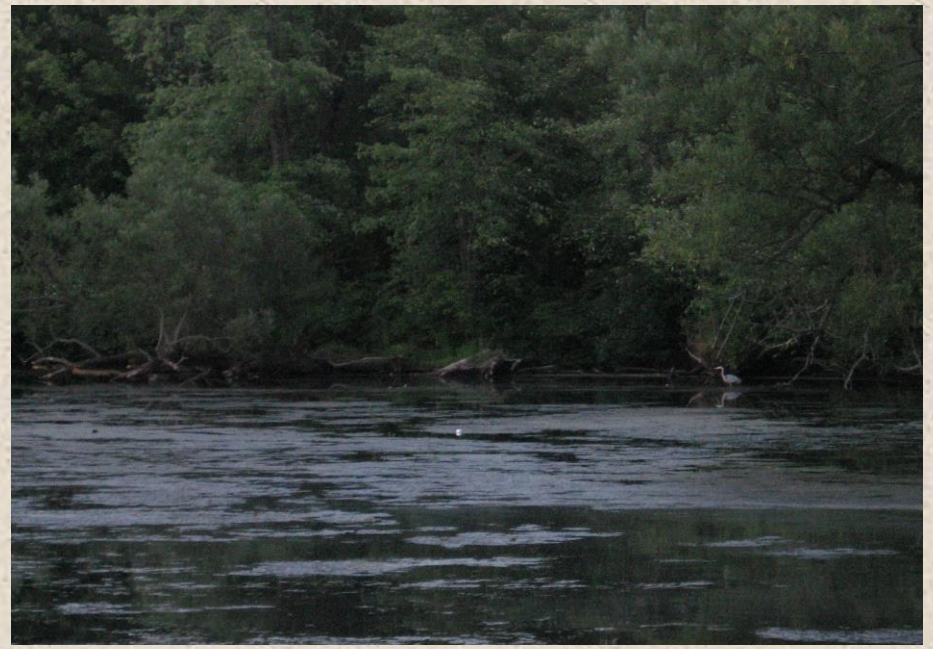
Point Source Pollution

Nonpoint Source Pollution

The Two Major Water Pollutants…

1) Sediments

2) Nutrients



Especially: soil, nitrogen, and phosphorus

Sediments

~Causes water turbidity.

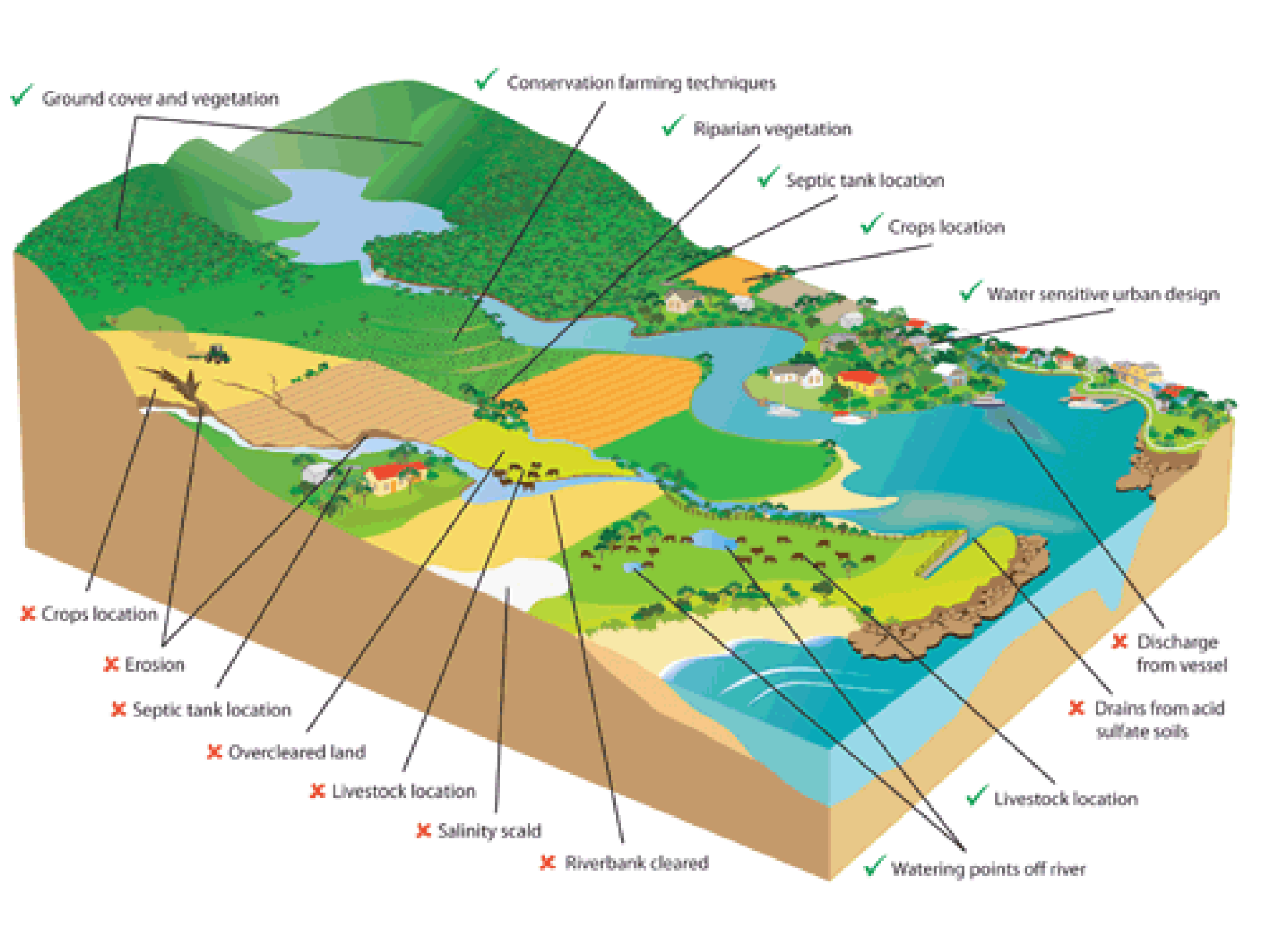
~Carry and store toxic materials, which may lead to bioaccumulation within the food chain.

Nutrients

HAB= Harmful Algal Bloom
(due to toxic cyanobacteria)

Ecological impacts?

- Poor erosion control
- Nutrient run-off (fertilizers, animal wastes, sediments, pollutants).
- Sedimentation, etc.


✓ Ground cover and vegetation
✓ Conservation farming techniques
✓ Riparian vegetation
✓ Septic tank location
✓ Crops location
✓ Water sensitive urban design
✗ Crops location
✗ Erosion
✗ Septic tank location
✗ Overcleared land
✗ Livestock location
✗ Salinity scald
✗ Riverbank cleared
✗ Discharge from vessel
✗ Drains from acid sulfate soils
✓ Livestock location
✓ Watering points off river

Water Testing

Drinking Water

- Alkalinity
- Color
- pH
- Taste & Odor
- Dissolved metals and salts
- Microorganisms (fecal coliforms like *E.coli*)
- Dissolved metals and metalloids (lead, mercury, arsenic, etc.)
- Dissolved organics:
  colored dissolved organic matter (CDOM); dissolved organic carbon (DOC)
- Radon
- Heavy metals
- Pharmaceuticals
- Hormone analogs

Environmental

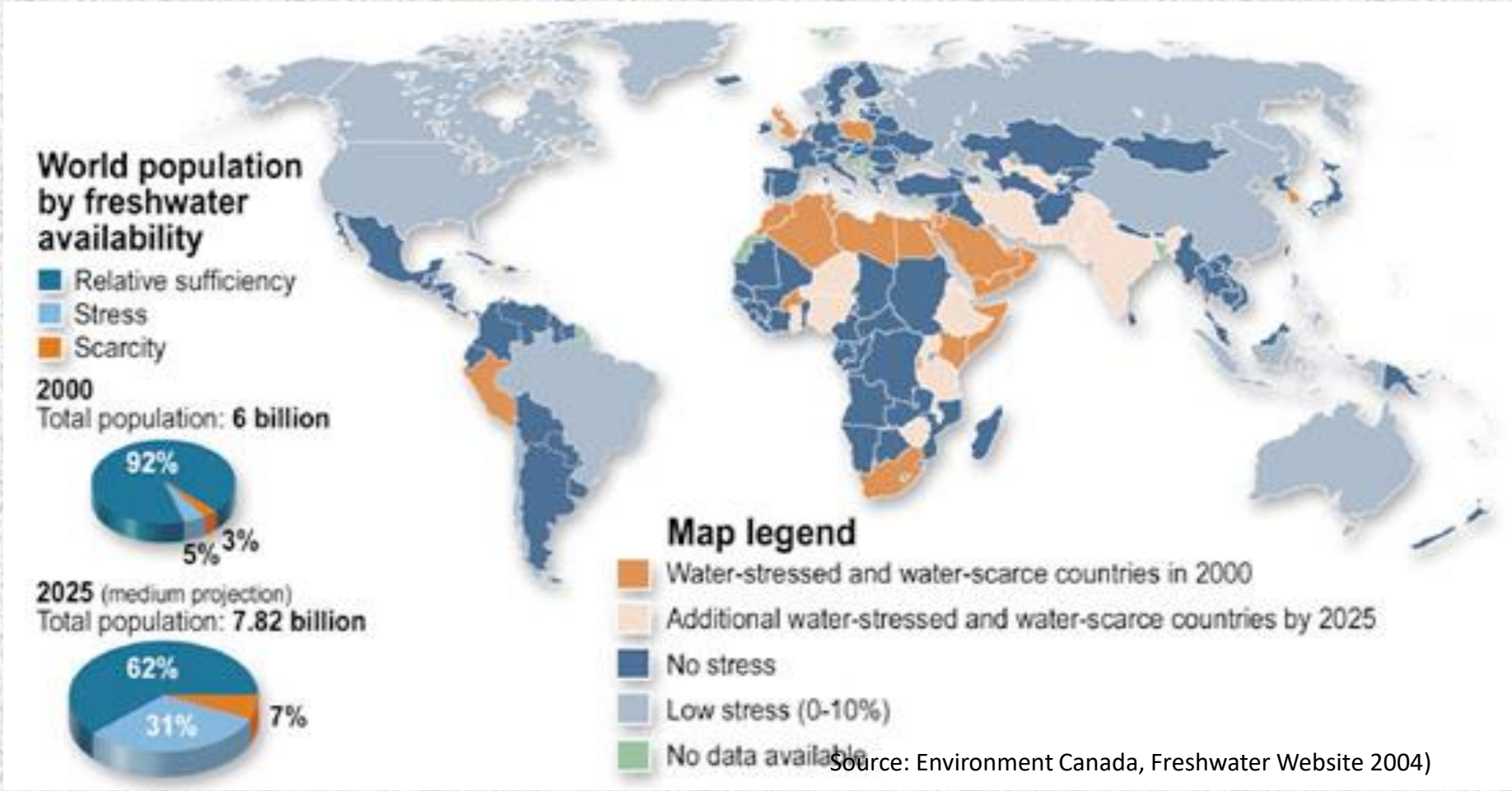
Chemical:

- Dissolved Oxygen (DO)
- Nitrate
- Organophosphates
- Chemical Oxygen Demand
- Biochemical Oxygen Demand (BOD)
- Pesticides

Physical:

~pH
~Temperature
~Total suspended solids (TSS)
~Turbidity

Biological: Coliforms, Macroinvertebrates

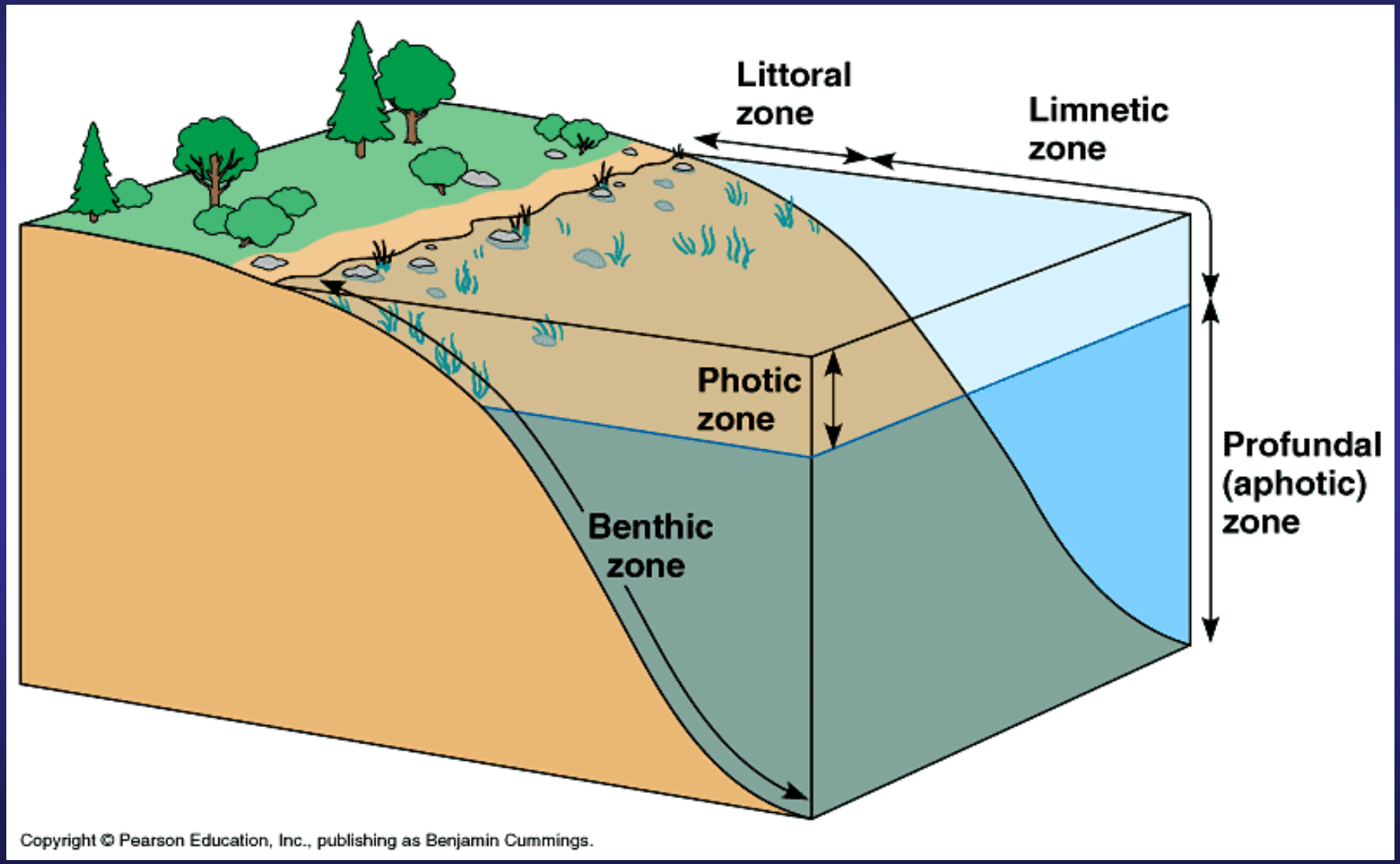


Source: Environment Canada, Freshwater Website 2004)

Global human population was 8,083,940,938 (~8.1 billion) as of 1:45 PM 1/8/2024 increasing by about 0.91 % per year! The rate of increase is now slowing slightly each year. https://www.worldometers.info/world-population/

According to the World Bank, as many as two billion people lack adequate sanitation facilities to protect them from water-borne disease, while a billion lack access to clean water altogether. According to the United Nations, which declared 2005-2015 the "Water for Life" decade, 95 percent of the world's cities still dump raw sewage into their water supplies. Thus it should come as no surprise to know that 80 percent of all the health maladies in developing countries can be traced back to unsanitary water.

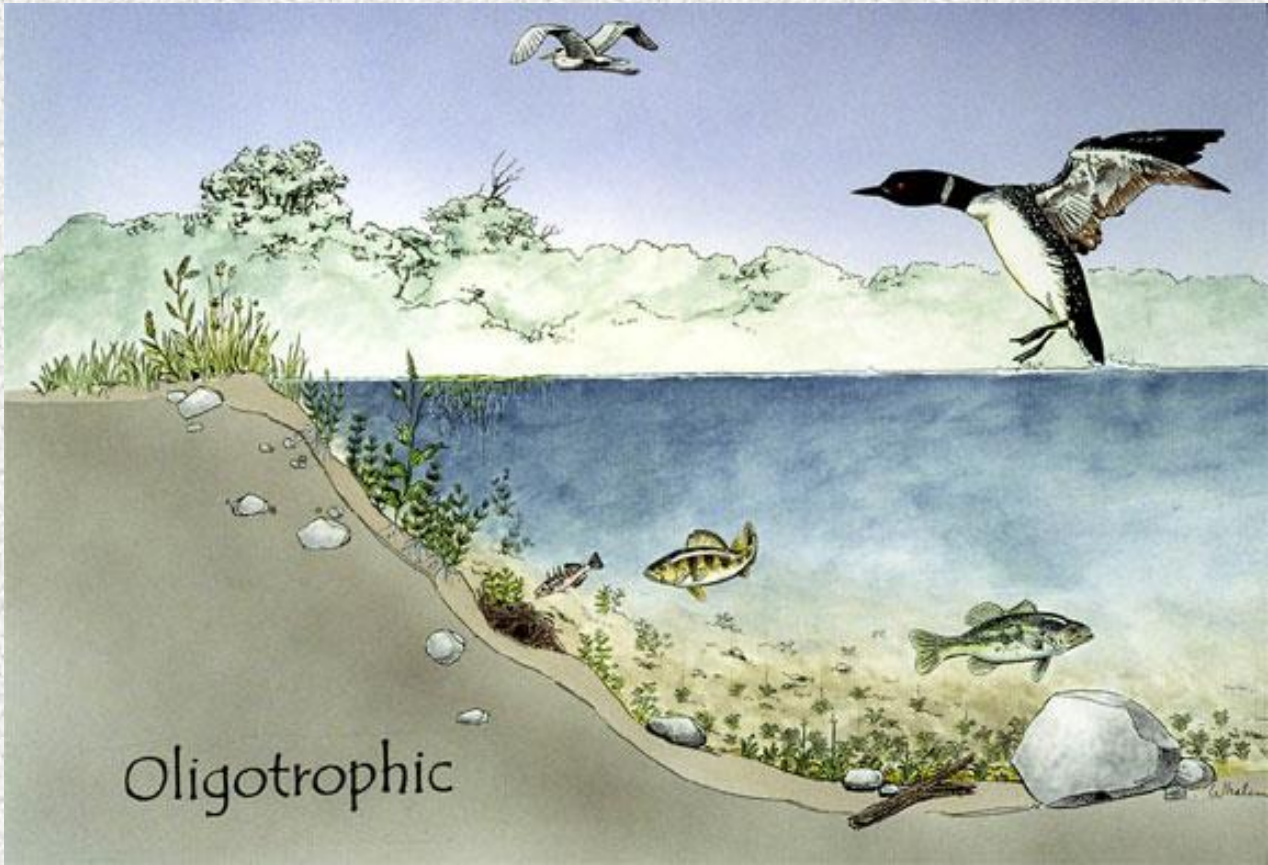
Lake Zonation



Lake Classification

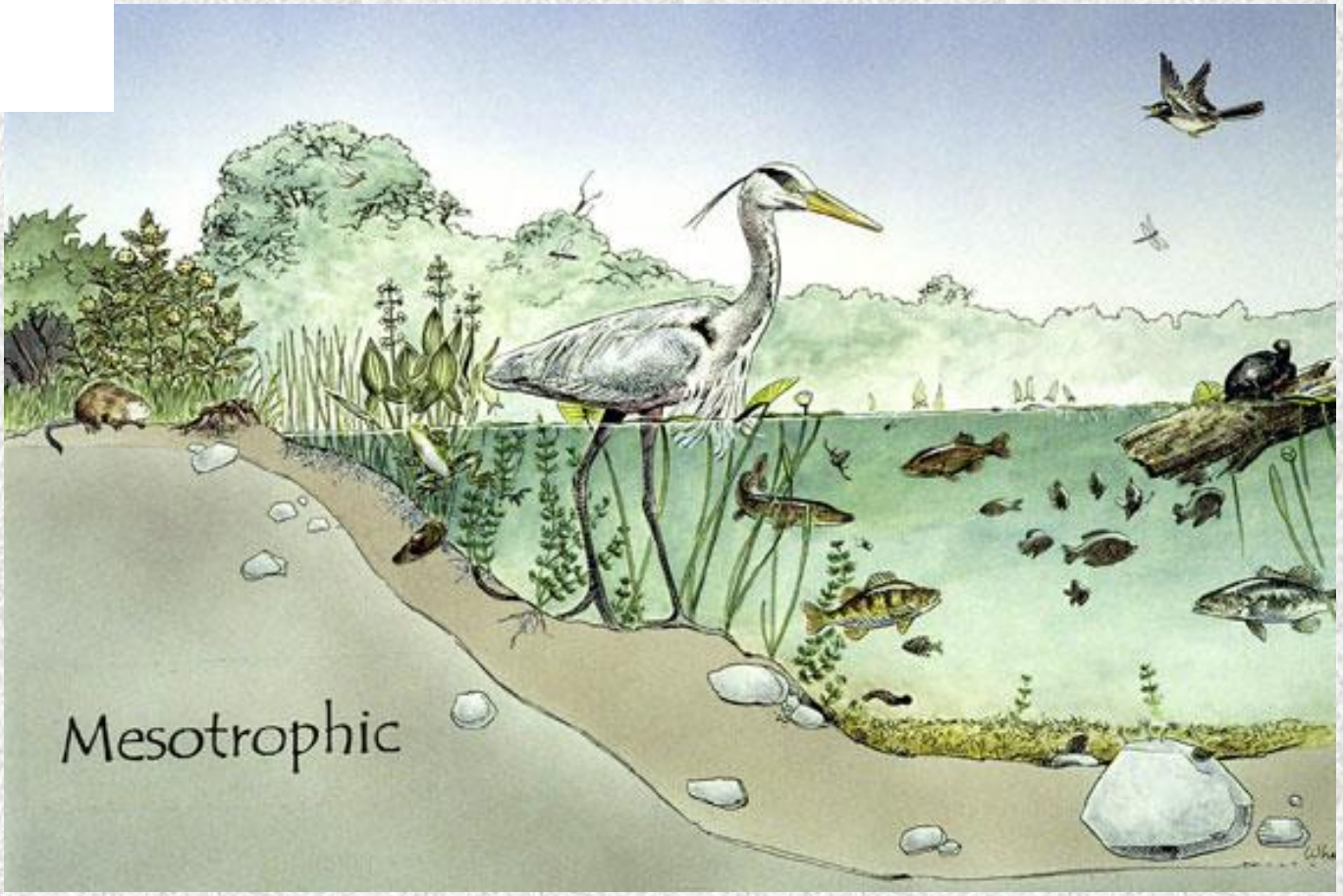
Oligotrophic

- Clear water, low productivity
- Very desirable fishery of large fish



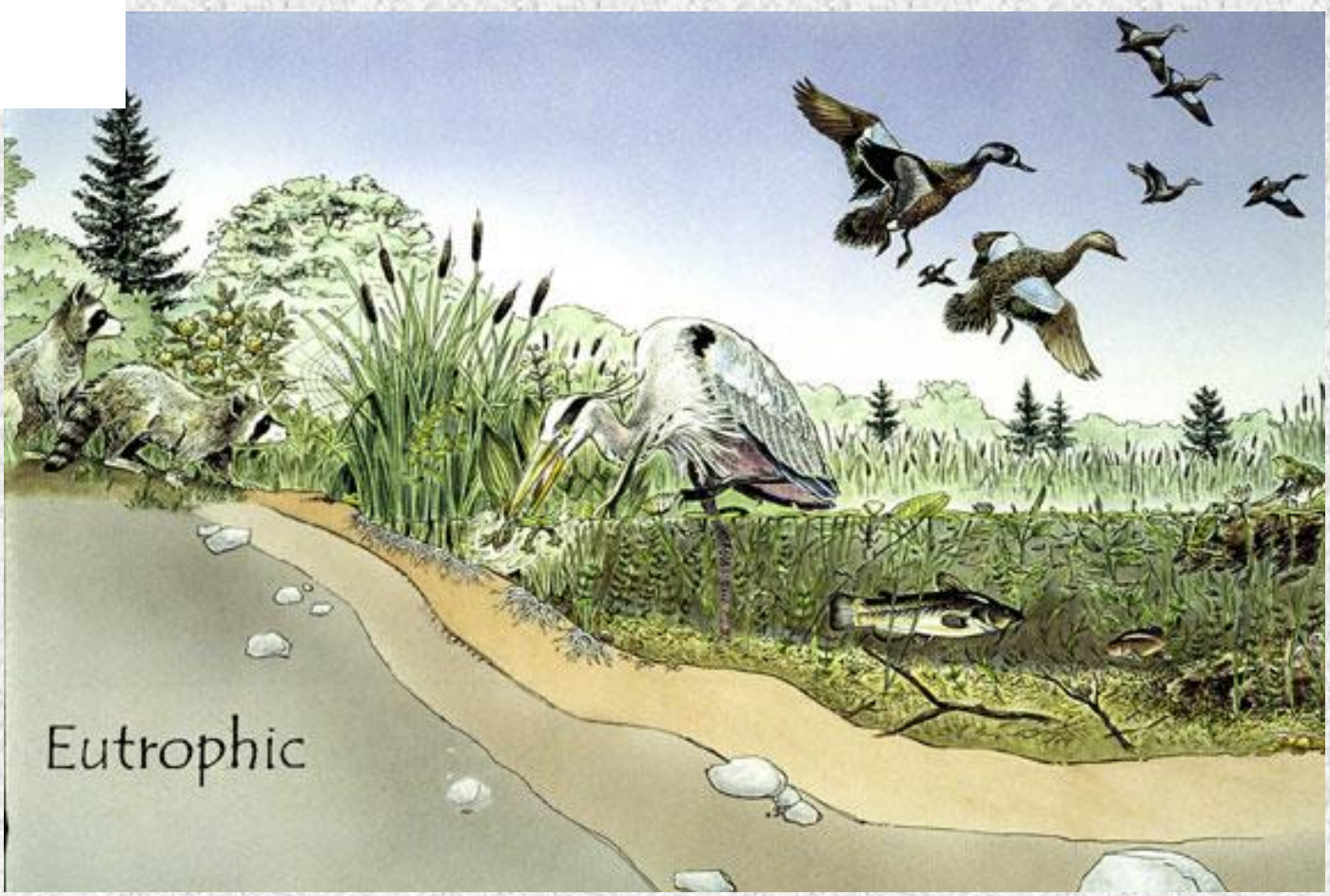
Mesotrophic

- Increased production
- Accumulated organic matter
- Occasional algal bloom
- Good fishery

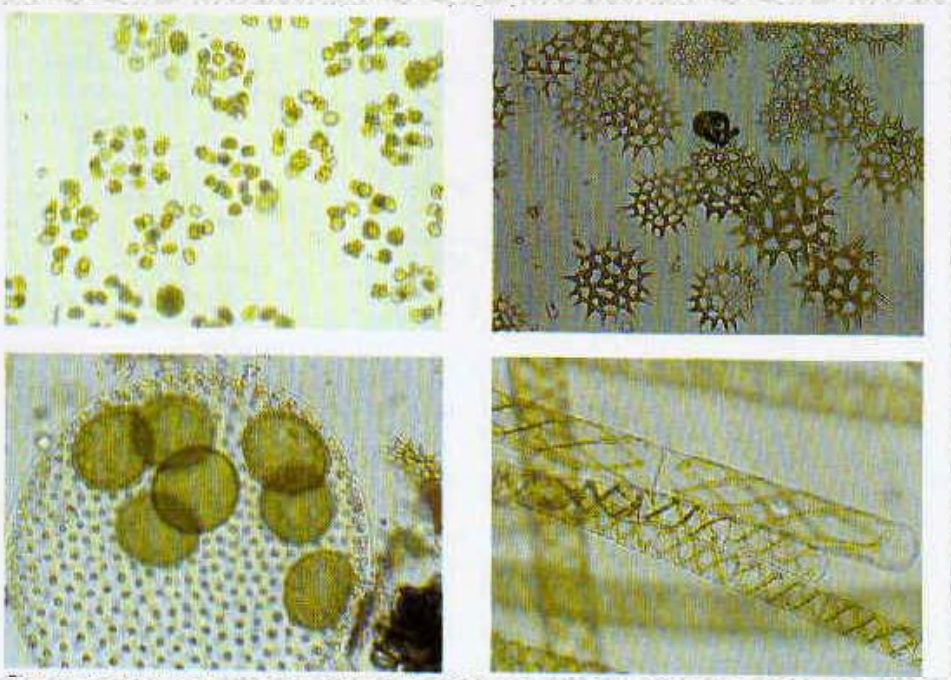


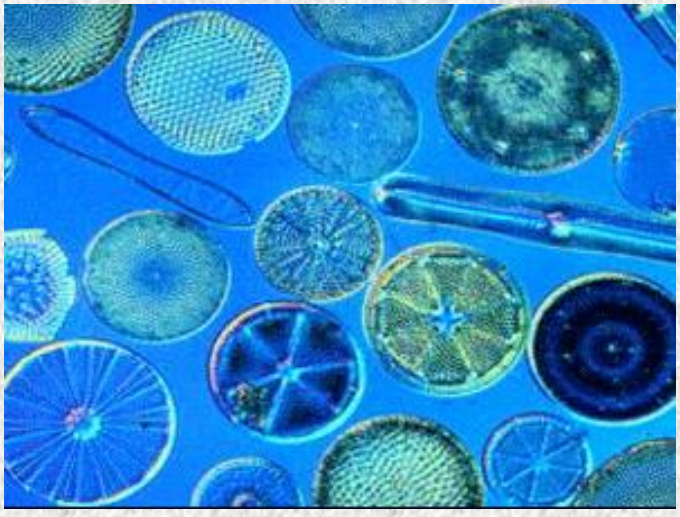
Eutrophic

- Very productive
- May experience oxygen depletion
- Rough fish common

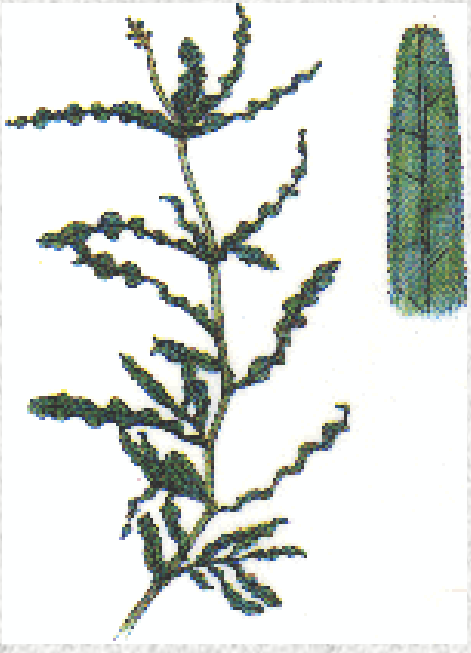


Phytoplankton and Zooplankton





Problematic Aquatic Plant Species

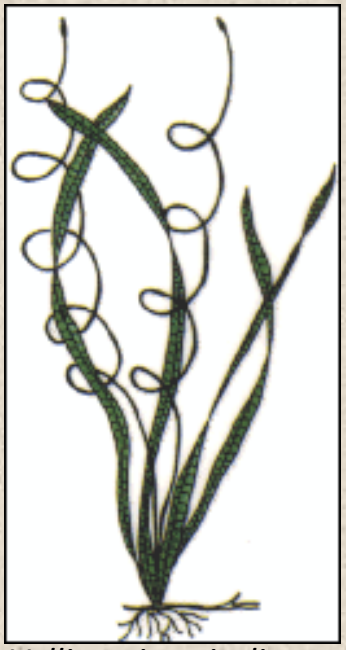


Potamogeton crispus (Curly-leaf pondweed)

Myriophyllum spicatum (Eurasian Watermifoil)

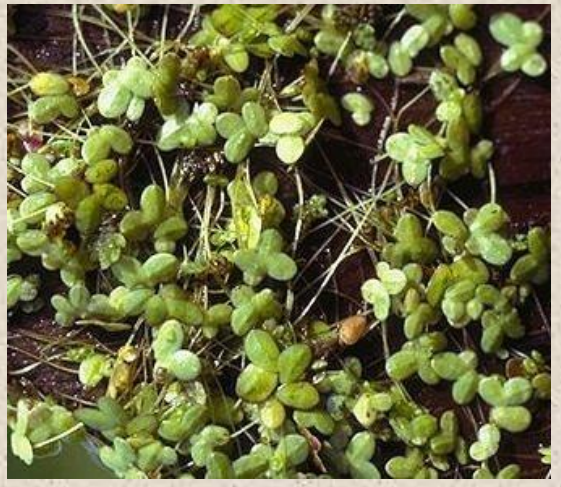
Trapa natans (European water chestnut)

Common Aquatic Plants……

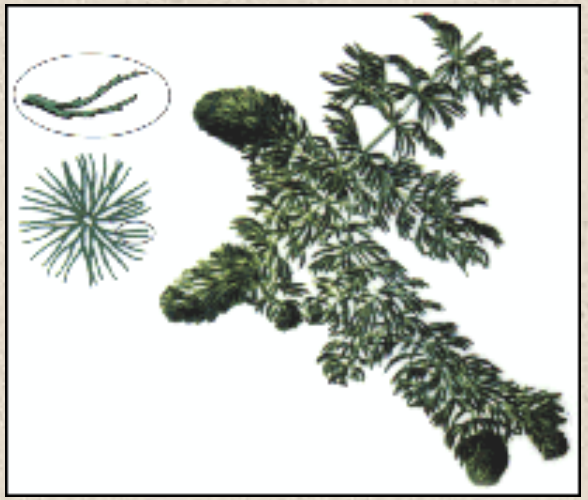


Vallisneria spiralis

Lemna minor



Spirodela polyrhiza



Cerotophyllum demersum

Elodea canadensis

Najas flexilis

Potamogeton amplifolius

Wetlands

Definition: an area that is saturated by surface or ground water through at least some portion of the growing season.

Characteristics:

1) Soil Indicators= **Hydric Soils**

--> decreased oxygen due to saturation for long periods of time (sulfur smell!)

2) Hydrology Indicators

--> evidence of standing water at certain periods during the growing season (drift lines, water marks on trees).

Ecological Roles: 1) Filtration

2) Storm Buffers

3) Habitat

*"Indicator Species"= **Hydrophytic Vegetation**

Examples…….

Common Spike Rush

Sweetflag

Pickerel Weed

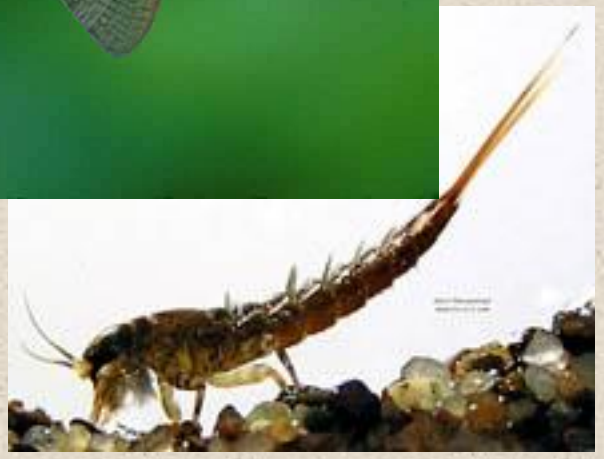
Arrowhead

Swamp Milkweed

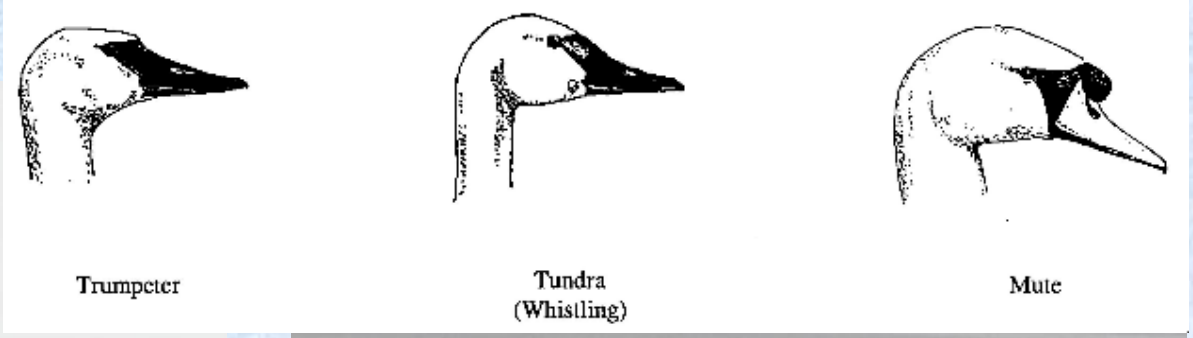
Blue Flag Iris

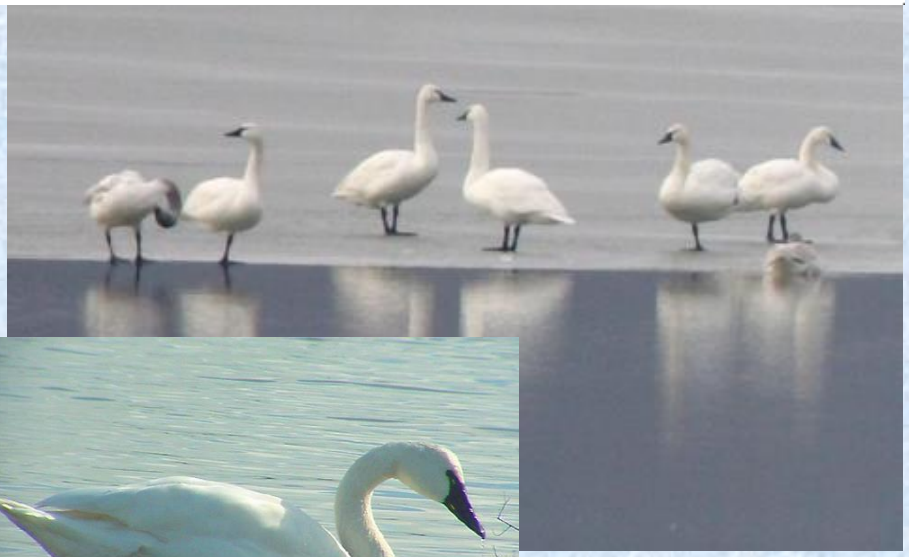

whirligig
saucer bug
water strider
china-mark moth
mosquito pupa
mosquito larvae
water scorpion
water boatman
diving beetle
mayfly larva
damselfly larva
alderfly larva
dragonfly larva
caddis fly larva

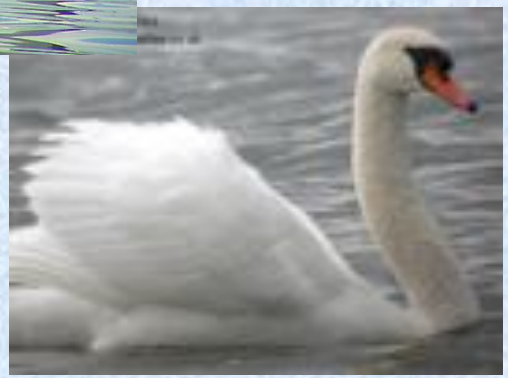
Invertebrates…



Common Water Birds…


Trumpeter
Tundra
(Whistling)
Mute





American Widgeon

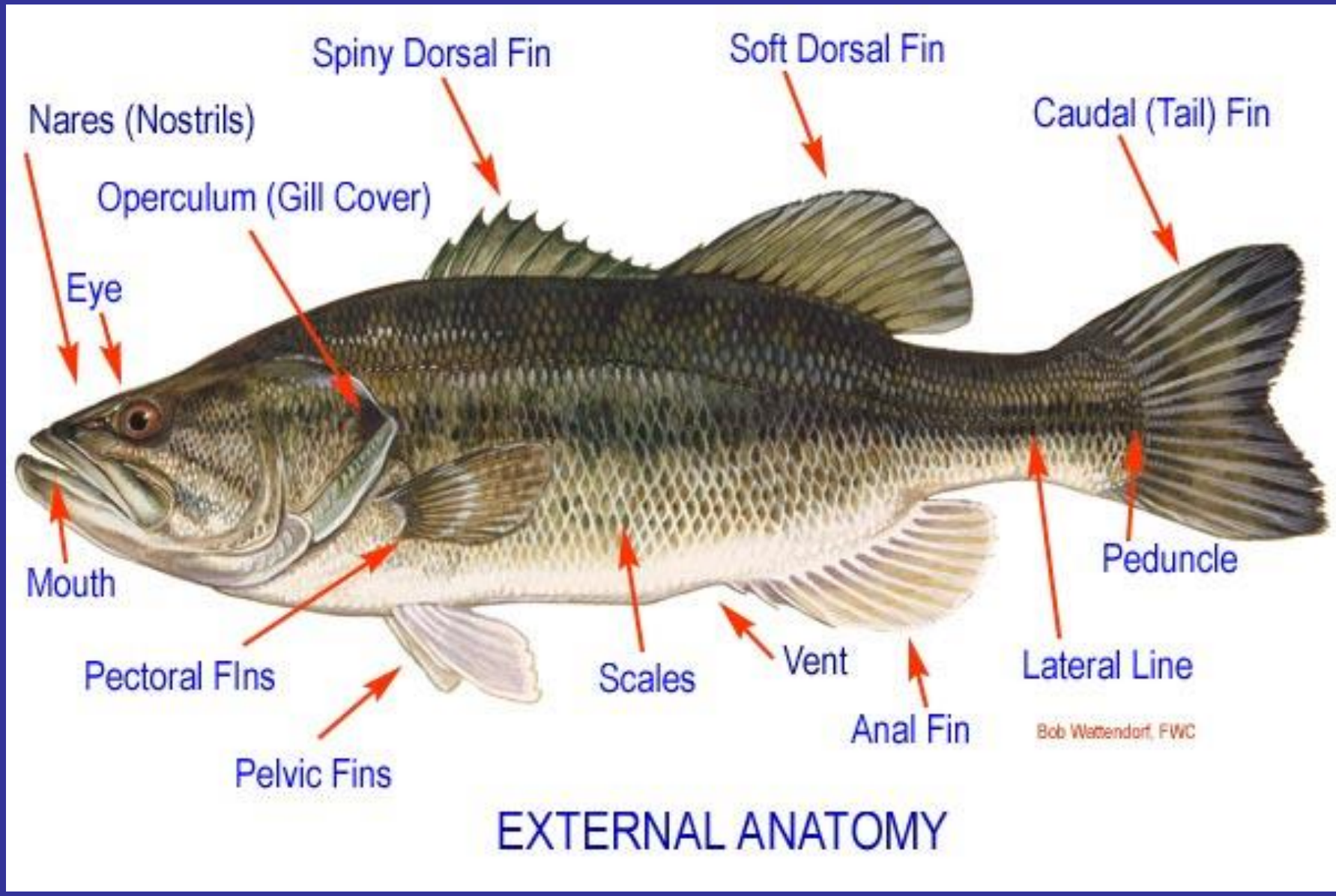
American Coot

Blue-winged Teal

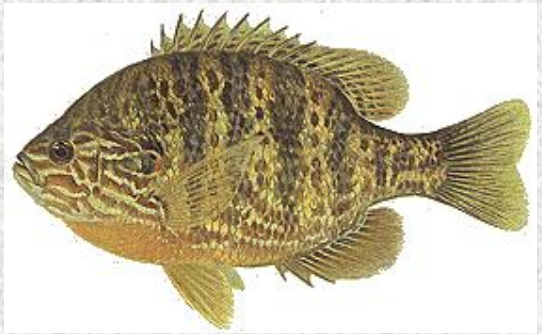
Wood Duck

Where do Great Blue Herons nest?

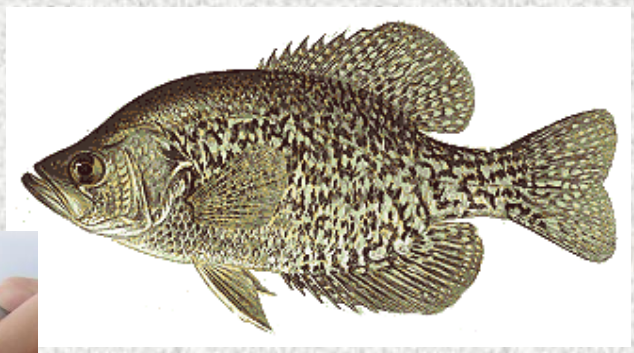
Class Actinopterygii: Ray fin fish…



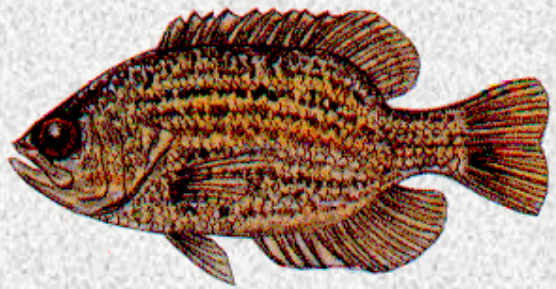
Sunfish Family (Centrarchidae)



Pumpkinseed Sunfish

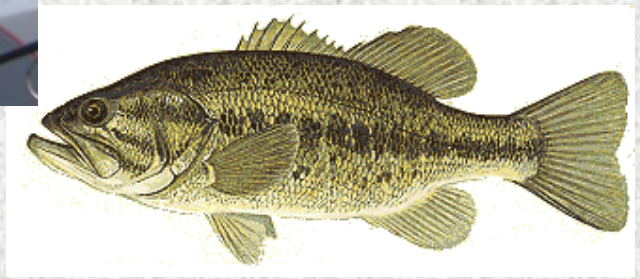


Black Crappie



Rock Bass

Smallmouth Bass



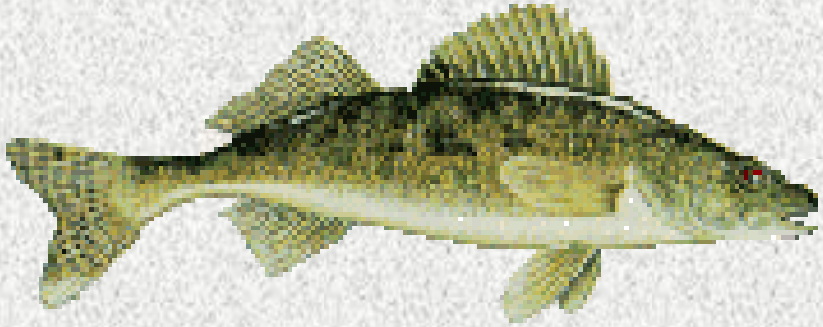
Largemouth Bass

Perch Family (Percidae)

Yellow Perch

White Perch

Walleye



Pike Family (Esocidae)

- Pike
- Pickerel
- Muskellunge

Northern Pike

Chain Pickerel

Muskellunge

Catfish Family

(Ictaluridae)

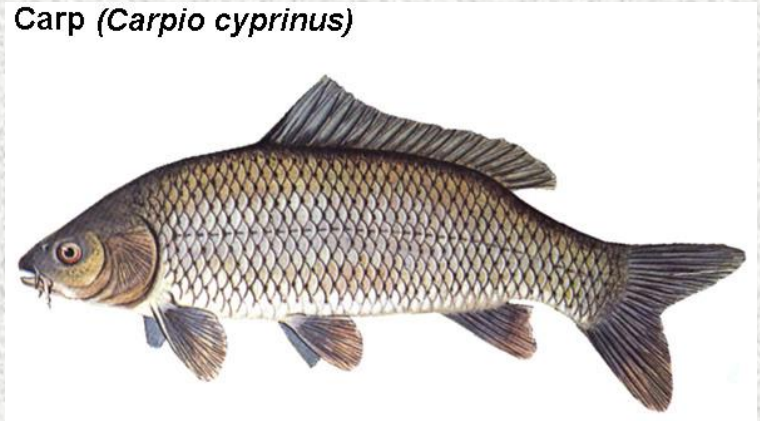
Channel Catfish

Black Bullhead

Minnow Family

(Cyprinidae)

Lake Chub Minnow



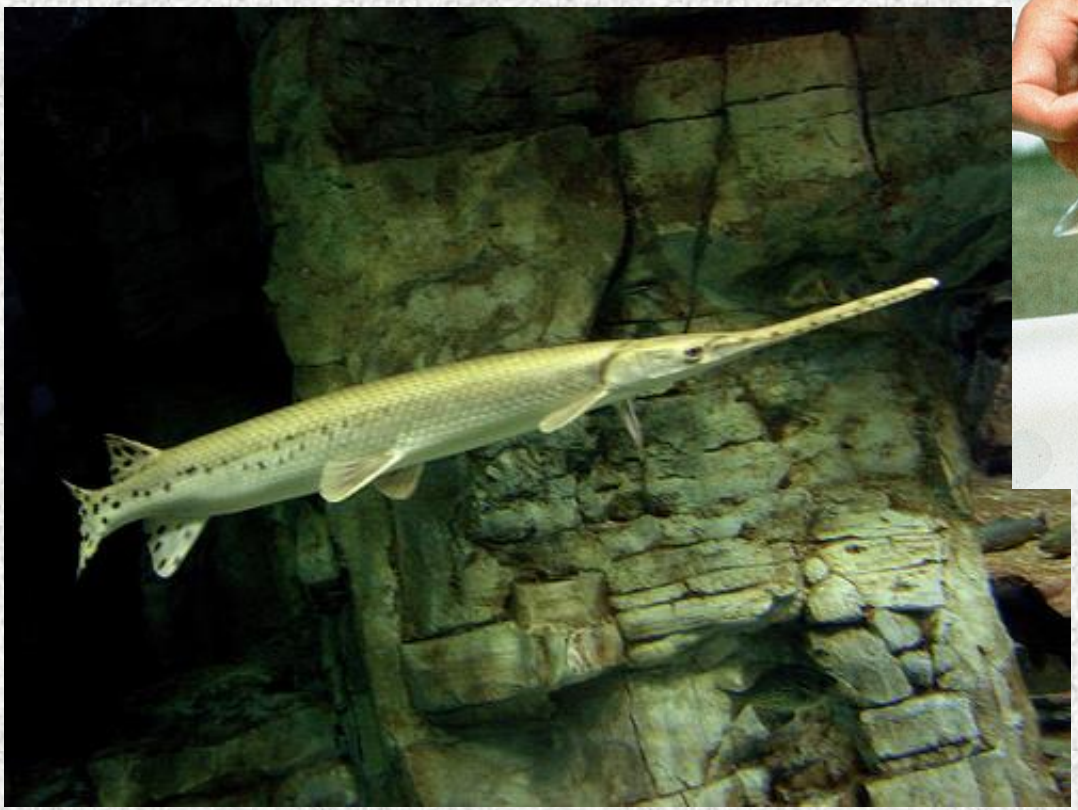
Trout: Salmon Family (Salmonidae)

Brook Trout

Rainbow Trout

Brown Trout

Other fish of interest…….



Longnose Gar

Sea Lamprey (”Jawless”)

Don’t forget the mammals…….

Muskrat

Beaver

Raccoon

River Otter

Study Outline

I. Abiotic Factors
- A. Water Cycle
- B. Watershed Features
  - 1. Stream Order
  - 2. Stream Health Factors
  - 3. Identify Boundaries
- C. Water Conditions
  - 1. Physical
  - 2. Chemical
  - 3. Biological

II. Biotic Factors
- A. Energy Flow
- B. Carrying Capacity
- C. Identify Aquatic Species (Plants, Fish, Amphibians, Micro- and Macro-invertebrates)
  - 1. Common
    - a. Basic Physiology
    - b. Lifecycles
    - c. Habitat
  - 2. Rare, Threatened, Endangered
  - 3. Invasive
  - 4. Water Quality indicators

III. Aquatic Environments
- A. Wetlands
  - 1. Definition
  - 2. Characteristics
  - 3. Functions/Importance/Values
- B. Riparian Zones
- C. Aquifers and Groundwater
- D. Ponds and Lakes
  - 1. Temperature Zones
  - 2. Vegetation

IV. Water Protection and Conservation
- A. Water Quality and Pollution
  - 1. Groundwater
  - 2. Surface Water
- B. Types of Pollution
  - 1. Point Source
  - 2. Nonpoint Source
  - 3. Thermal
  - 4. Control methods
- C. Management and Legislation
  - 1. Laws
  - 2. Agencies

Updated S'24

Website

http://www.nysenvirothon.org/nys-envirothon-aquatic-ecology-study-guide/