Aquatics
“Water Planet”

~Approximately 75% 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!

Limited Freshwater

Approximately 2.5% of Earth’s water is freshwater.......

~69% of that 2.5% is locked up in polar ice caps, leaving 31% of all freshwater accessible.

Therefore, only about .0077% of the total volume of the Earth’s water is accessible.

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.
Rivers, lakes and wetlands receive water in other ways as well.......
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.....
◆ St. Lawrence to Lake Erie to North Atlantic
◆ Mississippi to Gulf of Mexico

Mississippi River Basin

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

[Diagram showing sources and effects of water pollution, including untreated sewage, animal wastes, and treated sewage.]
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.
Drinking Water
• Alkalinity
• Color
• pH
• Taste & Odor
• Dissolved metals and salts
• Microorganisms (fecal coliforms like \textit{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
Global human population was 7.756464220 billion as of 9:15 PM 1/9/2020 increasing by about 81 million (1.05%) per year!  

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

- Littoral zone
- Limnetic zone
- Photic zone
- Benthic zone
- Profundal (aphotic) zone

Copyright © Pearson Education, Inc., publishing as Benjamin Cummings.
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
Common Aquatic Plants
Spirodela polyrhiza

Cerotophyllum demersum

Vallisneria spiralis

Lemna minor

Potamogeton amplifolius

Najas flexilis

Elodea canadensis

Cerotophyllum demersum
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
mosquito larvae
mosquito pupa
water boatman
diving beetle
damselfly larva
evenfly larva
caudis fly larva
water scorpion
chinamark moth
Invertebrates...
Common Water Birds...
American Widgeon

American Coot

Blue-winged Teal

Wood Duck
Where do Great Blue Herons nest?
Former: **Class Osteichthyes: Fish...**

*Note: Ray fin fish are now classified in Class Actinopterygii!*

![Diagram of fish anatomy](image)
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
Catfish Family
(Ictaluridae)

Channel Catfish

Minnow Family
(Cyprinidae)

Lake Chub Minnow

Black Bullhead

Carp (Carpio cyprinus)
Trout: Salmon Family (Salmonidae)

Brook Trout

Rainbow Trout

Brown Trout

[Images of different types of trout]
Other fish of interest......

Longnose Gar

Sea Lamprey (“Jawless”)
Don’t forget the mammals............

Muskrat

Raccoon

Beaver

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
   B. Types of Pollution
      1. Point Source
      2. Nonpoint Source
   C. Management and Legislation
      1. Laws
      2. Agencies

Updated S’20
Website

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