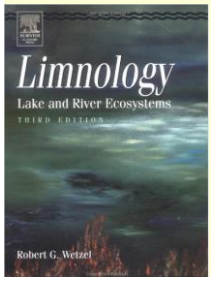
## Freshwater Ecology

## Lecture outline

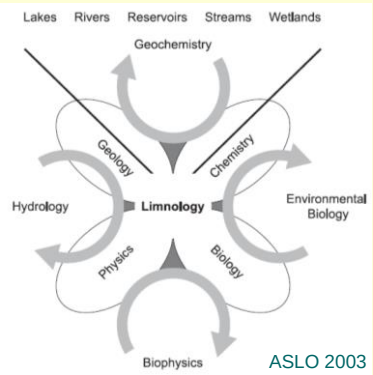
- **Definition**
- Why study?
- Water use
- Value of water

## What is freshwater ecology?

- ??
- Why isn't this class called ***Limnology***?




## Very interdisciplinary




ASLO 2003

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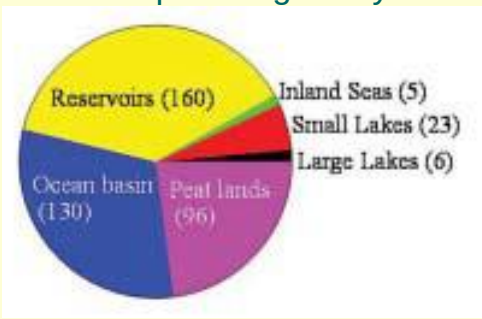
## Essential to life

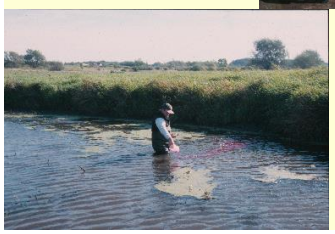
Psephenidae

## Important globally




Although inland waters are <2% of the Earth's surface, they store **three times as much OC** as the vastly larger oceans.
ASLO 2003

## It's there



## Fishing, hunting, and food

Thai recipe: 'steamed, also ground into a paste with chili and eaten with sticky rice'

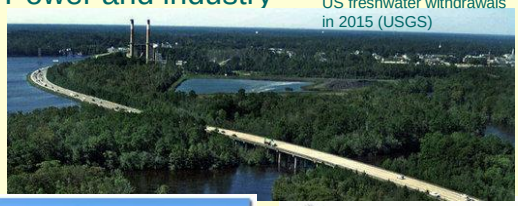
## Irrigation

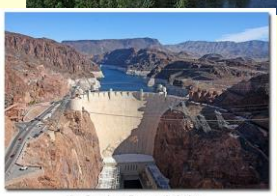
42% of all US freshwater withdrawals in 2015 (USGS)


https://water.usgs.gov/watuse/wuir.html

## Power and industry

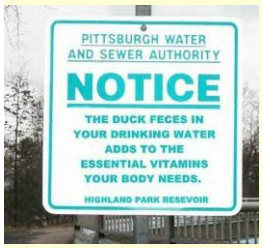
"Thermoelectric" = 34% of all US freshwater withdrawals in 2015 (USGS)



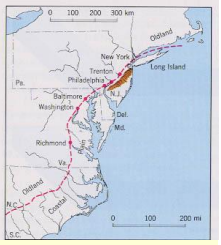


View from the walkway on the bridge

## Waste management and pollution




## Travel and transport




## Ahhhh…

## It's cool and fun

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- Value of water

## Consumptive vs. non-consumptive uses

- Examples?

## Distribution of water

**Table 1.1** Locations, Amounts, and Turnover Times of Water Compartments in the Global Hydrologic Cycle

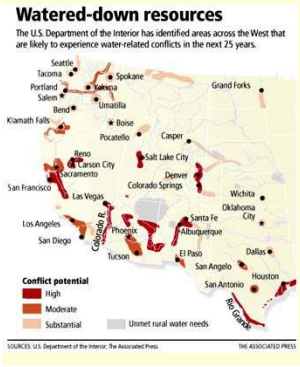
| Location | Amount (Thousands $km^3$) | Total % | % Inland Liquid Water | Approximate Residence Time |
|---|---|---|---|---|
| Freshwater lakes | 125 | 0.009 | 1.45 | 75 years |
| Saline lakes and inland seas | 104 | 0.008 | 1.20 | |
| Rivers (average volume) | 1 | 0.0001 | 0.01 | 5 months |
| Shallow and deep soil water | 67 | 0.005 | 0.77 | 100 years |
| Groundwater to 4000 m depth | 8,350 | 0.61 | 96.56 | 1,000 years |
| Icecaps and glaciers | 29,200 | 2.14 | — | 12,000 years |
| Atmosphere | 13 | 0.001 | — | 8.9 days |
| Oceans | 1,320,000 | 97.3 | — | 3,060 years |

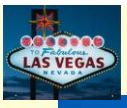
## Human use of freshwater depends on:

**Table 1.2** General Ranges of Water Use with Varied Socioeconomic Conditions on a per-Capita Basis; Rates per Country Are Estimates for the Year 2000

| Society | Range or Mean ($m^3 y^{-1}$ capita$^{-1}$) |
|---|---|
| Irrigated semi-arid industrial countries | 3,000–7,000 |
| Irrigated semi-arid developing countries | 800–4,000 |
| Temperate industrial countries | 170–1,200 |
| China | 431 |
| Jordan | 155 |
| Switzerland | 351 |
| Turkmenistan | 5,309 |
| Uganda | 9 |
| United States | 1,688 |

## Location matters




## Money matters

- Of the estimated 22,000 to 35,000 $km^3 y^{-1}$ of surface runoff, only about 9,000 $km^3 y^{-1}$ is geographically and temporally accessible
- Currently humans use 54% of the 9,000
- If all people on earth used water at the same rate as people in the U.S., all available water would be used
- What do you think will happen in the future?

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## What is the value of freshwater?

- Difficult to estimate; using Costanza et al. (1997):
  - Global values of wetlands: \$3.2 trillion $y^{-1}$
  - Global values of rivers and lakes: \$1.7 trillion $y^{-1}$
  - Why? Flood control, water supply, waste treatment
  - People are willing to pay for clean water, property near clean water and recreation
- Other values include irrigation (40% of world's crops), aquaculture, fisheries
- All natural resources in SC worth \$33 billion/yr (2016)
- Other values?