

## Lecture: Inland Waters

### Water Cycle--Hydrologic Cycle

- 71 % of the earth surface is covered in water
  - 97% is salt
  - 2% is in polar ice caps and glaciers
  - >1 % is fresh water in lakes, rivers & ground water

### Lakes

- Defined: low spot in the terrain that captures & holds water
- Study of inland waters = "limnology"
- California has most types of lakes
- Classification often based on geology of lake basin

### Lake Vegetation

- shallow water where light penetrates to bottom will have greatest diversity of plants (submerged, floating, & emergent types)
- Examples: rushes, sedges, cattails, pond lilies

### Lake Vegetation

- Open water dominated by phytoplankton

### Lake Invertebrates

- Many grazers feeding on phytoplankton (diatoms, algae)
- Bottom dwellers (crayfish)
- Zooplankton
  - Branchiopods ("gill-foot")--includes fairy shrimp & brine shrimp
  - Cladocera—includes water fleas (*Daphnia*)
  - Copepods ("oar-foot")

### Lake Succession

- As lakes age, they ultimately are destroyed
  - lake basins accumulate material & fill with sediment
  - lake becomes a meadow

## Types of Lakes

### Glacial Lakes

- low spots left by carving & scouring of glaciers that filled with water ("tarns")
- Form at rubble edge ("moraine") left behind by glacier

### Tectonic Lakes

- lie in basins formed by tectonic activity
- earthquake → movement of land → new lake basin
- Sometimes referred to as "sag-ponds" (depressions formed by subsidence)
- Lake Tahoe—largest, deepest CA lake
  - Sunken valley between Sierra Nevada & Carson Range
  - Subsequent damming by a lava flow at one end deepened the lake (1643 feet)
  - 72-mile shoreline

### Landslide Lakes

- impoundment of stream valleys by rock slides or mud flows
- May be triggered by earthquake
- Generally short-lived lakes, as the impounded river will overflow "land dam" causing erosion & restoring river

### Volcanic Lakes

- Lakes formed by volcanic processes
  - "caldera" lakes occur where volcanic crater collapses (e.g. Medicine Lake)
  - "closed-basin" lake occur in region of interior drainage (e.g. Mono Lake)
- Common in Modoc Plateau & Cascade Range

### Fluvial Lakes "oxbow lakes"

- Formed by depressions caused by flowing water
  - Rivers meander back & forth across a flood plain
  - meanders constantly change direction & old meanders separated from present flow may still have water plain
  - Common along large rivers of Central Valley

### Shoreline Lakes

- Lakes created by sand barriers
- Can change estuary into freshwater lake

### Reservoirs

- man-made bodies of water formed by damming rivers.
- primarily for storing water (irrigation, drinking, or industrial use), may also be used for flood control, recreation & hydroelectricity
- Most California rivers have been dammed & feed large aqueducts

### Rivers & Streams

- Watershed: area drained by rivers & streams
- 1<sup>st</sup> order streams:
  - beginning of river system (youngest)
  - Low water flow, so sediment transport is low
- 2<sup>nd</sup> order streams:
  - formed by junction of 1<sup>st</sup> order streams
  - More water → more flow → more erosion & sediment transport
- 3<sup>rd</sup> order streams:
  - Formed by junction of 2<sup>nd</sup> order streams
  - sediments moved down stream until water speed slows at pools, lake, meadow, valley, delta

### River Meanders

- At the lowest end of streams, gradient flattens and coriolis effect influences flow of water (N to right)
  - streams flow to right across a flood plain
  - When flow reaches uphill point, stream flows to left until drawn again to the right
- → meandering stream channel across a flood plain

### Tree Frogs

- Pacific Tree frog
  - Found in moist areas
  - Widespread habitats
- California Tree frog
  - Found along streams in drier basins
  - Often found on granite

### Garter Snake

- Found swimming in freshwater
- Feed on fish, salamanders, frogs/toads, small mammals, birds
- Discourage predators by defecation & release of musk → too disgusting to eat

### Freshwater Fish

#### Anadromous vs. Catamadrourous

- Anadromous
  - born in fresh water, spends most of its life in the sea and returns to fresh water to spawn
  - Lampreys, sturgeon, salmon, steelhead
- Catamadrourous
  - lives in fresh water and enters salt water to spawn
  - Striped mullet, eels

### Chinook Salmon

- May spend up to 8 years at sea
- Return to streams to spawn in large gravel beds with cold, flowing water
- Fry stay in streams up to 18 months

### Western Pond Turtle

- Characteristics:
  - up to 7.5 inches
  - Lives in streams & rivers, not often in ponds
  - Omnivore & scavenger
  - Predators are raccoons & coyotes
  - Reproduce by 7-11 years, laying ~11 eggs in sand/soil, live up to 40 years
- Threatened by habitat loss & competition with non-native turtles

### Beaver

- Ecosystem engineers
- "sacred center"
- beaver pruning stimulates willows, cottonwood & aspen to regrow bushier next spring
- Mate for life