

1 Aquatic Ecology

Chapter 7

2 Oceans are not equally divided by hemispheres

3 2 main types of aquatic ecosystems

- Marine: saltwater
- Freshwater

4 Advantages of aquatic ecosystems

- support more dense
- constant temp
- nourish dissolved nutrients
- water
- easy dispersment of organisms larvae and eggs
- less UV
- dilution of dispersion of pollutants

5 Disadvantages of aquatic ecosystems

- tolerate only a narrow range of temperatures
- Exposure to dissolved pollutants
- fluctuating population size for many species
- dispersion separates many aquatic offspring from parents

6 major types organisms

- 1-phytoplankton
- 2-zooplankton
- 3-nekton
- 4-benthos
- 5-decomposers

7 Key characteristics of aquatic organisms and systems

- less pronounced and fixed physical boundaries difficult to count or manage
- have more complex food chains more levels

8 Factors which limit life zones (surface, middle, bottom)

- temperature
- Dissolved oxygen (DO)
- light penetration

- availability of nutrients

9 Aquatic Environments: Types, Components, and Limiting Factors

- Marine
- Freshwater
- Plankton
- Nekton
- Benthos
- Euphotic zone
- Dissolved oxygen

10 Aquatic Ecosystems

11 Oceans

- 99.5% of habitable VOLUME
- contain 250,000 species
- ecological and economic services
- only 5% mapped or explored w level of detail of moon or mars

12 Ecological Services

- climate moderation
- CO₂ absorption
- nutrient cycling
- waste treatment and dilution
- reduced storm impact
- habitats and nursery areas
- genetic resources and biodiversity
- scientific information

13 Economic Services

- food
- animal and pet feed
- pharmaceuticals
- harbors and transport
- coastal habitats
- recreation
- employment
- offshore oil and natural gas
- minerals
- building materials

14 Concentration of dissolved gas

(parts per million by weight)

15 Factors which alter life in pelagic zones

- Light penetration reduced by algal growth

- DO
- CO₂ enters from atmosphere and through aerobic respiration
- CO₂ removed by producers and some by coral reefs
- CO₂ to carbonate ions calcium carbonate
- DO varies w number producers, consumers, and aerobic decomposers
- deep ocean circulation
- fish die at less than 5ppm

16 **Nutrient availability in pelagos**

- NPP varies throughout
- open ocean not swift no nutrients
- edges and upwelling

17 **Zonation in the ocean**

- 2 main bases of delineation
- Light penetration or depth
- Light penetration: euphotic, dysphotic, aphotic
- Depth: epipelagic, mesopelagic (700-1000m), bathypelagic(700-1000m to 2000 to 4000m), abyssalpelagic(Lower boundary at 6000 m), hadalpelagic

18 **Ocean zonation**

19 **Saltwater life zones**

- Coastal zones
- Pelagic zones
- Estuaries
- Coastal wetlands
- Mangroves
- Intertidal
- Barrier islands

20 **coastal zone**

- continental shelf
- 10 % of ocean area 90% of all marine species most commercial fisheries
- high PP (primary productivity) per unit area : sunlight and nutrients

21 **Estuaries (and wetlands)**

- Estuaries partially enclosed saltwater and freshwater mix
- temperature and salinity vary greatly in estuaries
- tides/seasonal variation/rain
- constant water movement stirs up nutrient rich silt
- high productive ecosystems -ecological and economic services

22 **Rocky and Sandy intertidal zones**

- stressful zone

- sweep away or crushed by waves
- immersed and exposed
- temp change
- rough but creates variety of ecological niches
- Biofiltration (sponges, oysters, fish, whales)
- filter feeders

23 Rocky intertidal zone

24 Estuary

25 Estuary by Madagascar

26 Sources of water in coastal zone

27 **Barrier beach**

28 Barrier Island Zonation

29 Coral Reef

30 Major threats to coral reefs

- Ocean warming
- Soil erosion
- Algae growth from fertilizer runoff
- Mangrove destruction
- Coral reef bleaching
- Rising sea levels
- Increased UV exposure from ozone depletion
- Using cyanide and dynamite to harvest coral reef fish
- Coral removal for building material, aquariums, and jewelry
- Damage from anchors, ships, and tourist divers

31 **Human Impact**

- degrade resources
- 40% of our pop on shores w/n 100Km
- 13 of 19 megacities on shores
- marshes/mangroves/seagrass lost
- wetlands gone
- trawlers
- coral reef destruct

32 Characteristics of freshwater streams and rivers

- Less than 1 ppt (book says 10 ppt!)
- Standing bodies of water: lentic
- Flowing bodies of water: lotic
- Flow from streams - rivers-oceans
- surface water - not sink or evaporate runoff when flows into streams
- **watershed** or drainage basin is area that delivers runoff sediment and dissolved substances to a stream

33 **Lentic bodies of water**

- Lakes and ponds (depth)
- Lakes have 4 zones; ponds usually only one
- Lakes are formed from depressions caused by glaciation, crustal displacement, or volcanic activity
- Sources of water include: springs, streams, rainfall, melting snow, and runoff

34 **Zones in lakes**

- Littoral zone: shore w emergent vegetation
- Limnetic zone: surface waters photic zone
- Profundal zone: deep, open water dysphotic or aphotic zone, low DO
- Benthic zone: bottom

35 **Zones of Temperate Lake**

36 **Oligotrophic lake**

37 **Eutrophic lake**

38 **Stratification and seasonal overturn**

39 **Zonation of freshwater streams**

- 3 aquatic zone in rivers
- source zone
- transition zone
- flood plain zone

40 **River Zones**

41 **Source Zone**

- head water or mountain highland streams rapids, riffles big DO
- photosynthesis less important source of O₂
- algae and mosses are attached to rocks cold water fish which have big BOD
- some adaptations to living under stones

42 **Transition Zone**

- headwater merge form wider, deeper streams slope is gentler fewer obstacles warmer water more producers (phytoplankton)

- fish both cool water and warm water lightly lower BOD

43 **Flood plain zone**

- streams wider deeper meanders oxbows
- less DO higher temperatures
- large population of producers algae cyanobacteria
- rooted aquatic plants
- erosion runoff muddy water silt
- carp catfish
- some in backwaters similar to lakes
- river may divide into channels like in our area
- delta formation
- nutrient inputs come from fallen leaves, animal feces, insects, and other forms of biomass washed into stream

44 **Tropical River**

45 **Wetlands**

- marshes
- swamps
- prairie pot holes depressions by glaciers
- flood plains
- bogs fens
- wet arctic tundra
- seasonal wetlands
- bottomland hardwood swamps

46 **Inland wetlands provide**

- water quality worth 2.6 billions
- flood control 7.7-31 billion / yr

47 **Impacts human**

- fragmented rivers and stream (dams)
- flood levees dikes
- 1-alters and destroy aquatic habitats
- 2-disconnects rivers from their flood plains
- 3 eliminate wetlands backwaters which are important for spawning
- in US 53% of inland wetlands estimated to have existed in lower 48 states in 1600's has been drained to grow crops or or destroyed to cover with concrete, asphalt, and buildings

48 **Prairie Pothole**

49 **Cypress swamp**

50 **Freshwater marsh**

51 **Sustainability in Aquatic Ecosystems**

- How sustainable are aquatic ecosystems
- each stream, river, and lake reflects the sum total of all that occurs in watershed
- nutrients, wastes, pollutants produced by human activities end up in the ocean
- many chemicals reaching aquatic systems come from the atmosphere

52 **Aquatic ecosystems renewed by**

- water purified by natural hydrologic cycle
- nutrients cycle in and out
- populations of biological organisms can be replenished, given opportunity and time

53 **These renewal processes work only if**

- not overloaded with pollutants and excessive nutrients and
- not over fished