AP Environmental Systems Ch.8 Notes

**Aquatic Biodiversity**

**Core Case Study: Why Should We Care about Coral Reefs?**

* Biodiversity
* Coral reefs form in clear, warm coastal waters in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ areas
	+ Tiny animals (polyps) and algae have a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ relationship
	+ Polyps secrete \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ shells, which become coral reefs
* Provide important \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ services
* Vulnerable to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ocean temperatures leading to coral \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- \_\_\_\_\_\_\_\_\_\_ algae and thus the polyps
	+ Increasing ocean \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**8-1 What Is the General Nature of Aquatic Systems?**

* Saltwater and freshwater aquatic life zones cover almost \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the earth’s surface, with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ dominating the planet
* Key factors determining biodiversity in aquatic systems
	+ Temperature, dissolved \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ content, availability of \_\_\_\_\_\_\_\_\_\_, and access to \_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ necessary for photosynthesis

Most of the Earth Is Covered with Water

* Saltwater – \_\_\_\_\_ of the earth’s surface
* Global ocean divided into four areas
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Freshwater – \_\_\_\_\_ of the earth’s surface
* Aquatic life zones
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ life zones (marine life zones)
		- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ forests
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ life zones
		- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- Inland \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Aquatic Species Drift, Swim, Crawl, and Cling

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ – drifting
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- Primary producers for most aquatic food webs
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- Tiny photosynthetic bacteria
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- Secondary consumers
		- Single-celled to large invertebrates like jellyfish
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Strong swimmers – fish, turtles, whales
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Bottom dwellers – oysters, sea stars, clams, lobsters, crabs
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Mostly bacteria
* Key factors in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of organisms
	+ Temperature
	+ Dissolved oxygen content
	+ Availability of food
	+ Availability of light and nutrients needed for photosynthesis
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Degree of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in water
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ photosynthesis

**8-2 Why Are Marine Aquatic Systems Important?**

* Saltwater ecosystems
	+ Provide major ecosystem and economic services
	+ Are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ reservoirs of biodiversity

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Provide Vital Ecosystem and Economic Services

* Estimated \_\_\_\_\_ trillion per year in goods and services
* Three major life zones:
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ zone
		- Warm, nutrient rich, shallow; shore to edge of continental shelf; usually high NPP from ample sunlight and nutrients
	+ \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_
	+ Ocean \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Estuaries and Coastal Wetlands Are Highly \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Where rivers meet the sea
* Coastal \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Coastal land covered with water all or part of the year
* Seawater \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ with freshwater
* Very productive ecosystems with high \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ levels
* Examples:
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Shores Host Different Types of Organisms

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ zone
	+ Area of shore between \_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_ tides
	+ Rocky shore
	+ Sandy shore, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ beach
* Organism adaptations necessary to deal with daily \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ changes
* What is the importance of sand dunes in this type of ecosystem?

Coral Reefs Are Amazing Centers of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ equivalent of tropical rain forests
* Reefs are being destroyed and damaged \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Ocean \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Oceans absorb \_\_\_\_\_\_\_\_\_\_
	+ CO2 reacts with ocean water to form a weak acid that decreases levels of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ions (CO32-) needed to form coral

The Open Sea and the Ocean Floor Host a Variety of Species

* Three \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ zones of the open sea
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ zone
		- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- Nutrient levels \_\_\_\_\_\_\_\_\_\_
		- Dissolved oxygen levels \_\_\_\_\_\_\_\_\_\_\_
		- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ brings nutrients from below
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ zone
		- Dimly lit
		- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and smaller fishes
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ zone
		- Dark and cold
		- High levels of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ dissolved oxygen
		- Deposit feeders
		- Filter feeders
* NPP low in the open sea
	+ Except in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ areas

**8-3 How Have Human Activities Affected Marine Ecosystems?**

* Human activities
	+ Threaten aquatic \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Disrupt \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ services provided by saltwater systems

Human Activities Are Disrupting and Degrading Marine Systems

* Major threats to marine systems include:
	+ Coastal \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_; use of fishing trawlers
	+ Runoff of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ source pollution
	+ Point source \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ destruction
	+ Introduction of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ species
	+ Pollution of coastal \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Case Study: The Chesapeake Bay – an Estuary in Trouble**

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ estuary in the U.S.
	+ Polluted since \_\_\_\_\_\_\_\_\_\_
* Large population increase
* Point and nonpoint sources raised \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Phosphate and nitrate levels too \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Excess \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from runoff and decreased vegetation
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, a keystone species, greatly reduced
* \_\_\_\_\_\_\_\_\_\_: Chesapeake Bay Program
	+ Integrated coastal management with local, state, and federal governments, as well as citizens’ groups
* \_\_\_\_\_\_\_\_\_\_ update:
	+ \_\_\_\_\_ years and \_\_\_\_\_ billion
* Program \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to meet goals

**8-4 Why Are Freshwater Ecosystems Important?**

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ecosystems
	+ Provide major ecosystem and economic services
	+ Are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ reservoirs of biodiversity

Water \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in Some Freshwater Systems and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in Others

* Standing (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_) bodies of freshwater
	+ Lakes
	+ Ponds
	+ Inland wetlands
* Flowing (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_) systems of freshwater
	+ Streams
	+ Rivers
* Lakes have four zones based on depth and distance from shore
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ zone
		- Near shore where rooted plants grow; high biodiversity
		- Turtles, frogs, crayfish, some fish
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ zone
		- Open, sunlight area away from shore; main photosynthetic zone
		- Some larger fish
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ zone
		- Deep water too dark for photosynthesis
		- Low oxygen levels
		- Some fish
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ zone
		- Decomposers
		- Detritus feeders
		- Some fish
		- Nourished primarily by dead matter

Some Lakes Have More Nutrients Than Others

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ lakes
	+ Low levels of nutrients and low NPP
	+ Very clear water
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ lakes
	+ High levels of nutrients and high NPP
	+ Murky water with high turbidity
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ eutrophication of lakes from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ input of nutrients

Freshwater Streams and Rivers Carry Large \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of Water

* Surface water
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Downward flow of water from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Three aquatic life zones
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ zone
		- Shallow, cold, clear, swiftly flowing
		- High dissolved oxygen
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ zone
		- Wider, deeper, warmer streams
		- More turbid
		- Less dissolved oxygen
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ zone
		- Wide, deep rivers
		- Broad, flat valleys

**Case Study: River Deltas and Coastal Wetlands**

* Coastal deltas, mangrove forests, and coastal wetlands provide natural \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ against storms
* Dams and levees reduce sediments in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of New Orleans
* Rising sea levels will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ coastal areas

Freshwater Inland Wetlands Are Vital Sponges

* Inland wetlands
	+ Lands located away from coasts that are covered with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ all or part of the time
* Include:
	+ Marshes, swamps, prairie potholes, floodplains, and arctic tundra
* Provide free ecosystem and economic services
	+ Filter and degrade \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ wastes
	+ Reduce \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and erosion
	+ Help to replenish streams and recharge groundwater \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Biodiversity
	+ Food and timber
	+ Recreation areas

**8-5 How Have Human Activities Affected Freshwater Ecosystems?**

* Human activities
	+ Threaten and disrupt ecosystem and economic services provided by freshwater lakes, rivers, and wetlands

Human Activities Are Disrupting and Degrading Freshwater Systems

* Dams and canals \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the flows of rivers
	+ \_\_\_\_\_\_ of the world’s largest rivers
* Flood-control \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ aquatic habitats and alters wetlands
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ pollute water
* Many wetlands have been \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for human purposes

Three Big Ideas

* Water dominates the planet
	+ Saltwater and freshwater aquatic life zones cover almost three-fourths of the earth’s surface
* The earth’s aquatic systems provide important ecosystem and economic services
* Human activities threaten biodiversity and disrupt ecological and economic services provided by aquatic systems

Tying It All Together: Coral Reefs and Sustainability

* Coral reefs:
	+ Thrive on solar energy
	+ Participate in nutrient cycling
	+ Sustain aquatic biodiversity
* In nature, everything is connected
* How can we can reduce harm to coral reefs?