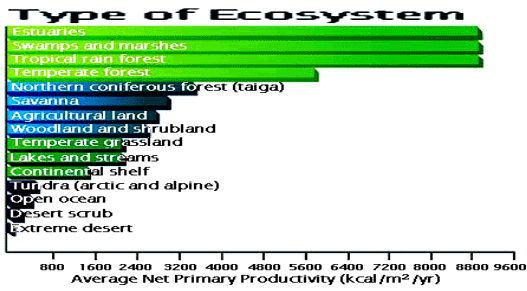


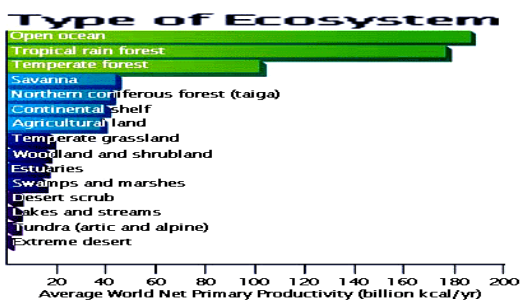
## Productivity per unit area (m<sup>2</sup>)



## Chapter 25 Conservation

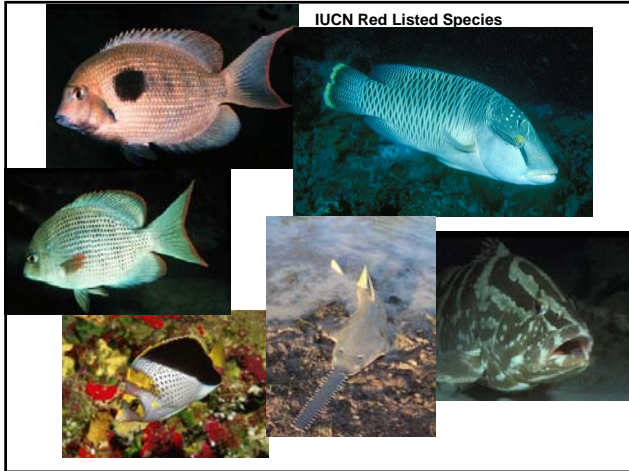
- Important concepts: Biodiversity and Fishery Stocks.
- Looked at lot of diversity in class – what is happening to it and why?
- Biodiversity – variety of live forms and processes

## Total Productivity (global)



## Chapter 25 Conservation

- Extinction in fishes – IUCN 596 Fish species listed as imperiled; 24 extinct but many more really
- Estimated NA - 40 taxa extinct, 365 need special protection
- 20% of ALL FISH expected to go extinct in next 25-50 years
- Extinction rates increasing dramatically last 50 years – 1000x average and 10-100 > mass extinctions
- Normal extinction rates of animals = 9%/million years (1 or 2 per year) – Humans have accelerated these greatly
- Of 9000 species freshwater about 1800 (20%) extinct or serious decline – marine not as threatened as freshwater



## Chapter 25 Conservation

- Estuaries and inland seas
  - resilient species but sites of major coastal cities, freshwater diverted, ballast water (introduced species) – BUT few estuary species are endangered in spite of highly altered ecosystems. High levels of toxicity in fish
- Inland Seas
  - Caspian and Black Seas – among most endangered ecosystems in world.

## Chapter 25 Conservation

- Status of marine and freshwater fish faunas
- Freshwater – vast majority of threatened and endangered fish live in freshwater - e.g. – freshwater as islands or as ribbons of water
- Pollution – point source, sediment, run-off etc.
- Water diversion – water taken for human use



## Chapter 25 Conservation

- Marine – Few endangered marine species but changing rapidly – technology and fishing
- Also – continental shelves – fish concentrated and human influences spreading
- Coral reefs – high diversity; fishing, dynamite, poison, coral mining, sediments and pollution etc
- By catch harvest
- Fishing down marine trophic food webs – in Science

## Chapter 25 Conservation

- Characteristics of regions with most endangered fishes
- Highly developed countries
- Small isolated bodies of water
- High endemism
- Arid or Mediterranean climates
- Big rivers
- Big lakes
- SW United States – Colorado dammed and diverted – what is left has salts and pollutants (including exotic species)

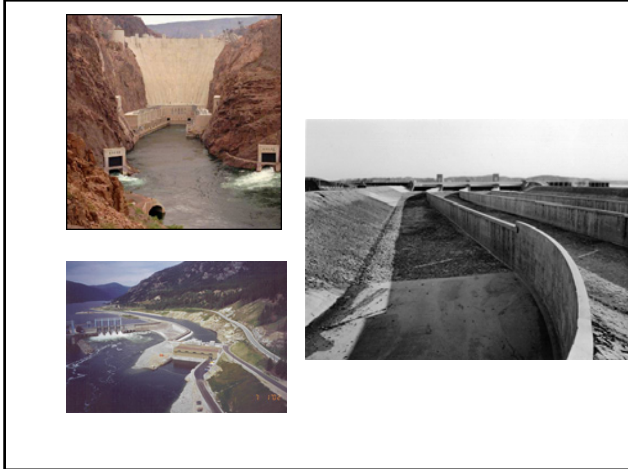


Photo: Fishermen squirting cyanide on reefs to capture reef fish



## Chapter 25 Conservation

- Causes:
- 1) Habitat Loss and Modification
  - Modification of bottom type – dredging, log removal, coral or gravel mining
  - Channelization and Dam building – flow, movement and sediment
  - Watershed perturbation – temperature, siltation
  - Competition for water



## Chapter 25 Conservation

- Causes:
- 2) Species Introductions
- Introduction – range extension based on human action; Transplant within country of origin; Exotic into new country
- Introduction of nonnative species – want to improve fishery BUT often opposite effect is true

## Chapter 25 Conservation

- Causes:
- 2) Species Introductions (consequences)
- Predators - Nile Perch, Peacock cichlid, Lamprey in Great Lakes
- Competition - Tilapia inhibit largemouth bass, Oreochromis niloticus in Lake Victoria
- Hybridization and introgression (hybrid offspring w/ parental genotypes) - Pupfish, Chubs and Tilapia
- Parasites and diseases (bacterial and virus = Furunculosis (trout bacteria) – Whirling disease (protozoan – immune in Europe; effects NA), ICH, Asian tapeworm
- Ballast water introductions – ruffe, round goby, zebra mussels



## Chapter 25 Conservation

- Causes:
- 4) Commercial Exploitation
- Overfishing – About 40% commercial marine fishes exploited at unsustainable levels. “Commercial extinction” and genotypic and phenotypic changes
  - Pacific sardine, Peruvian anchovetas, Giant totoaba, Tuna, sharks, swordfish, Orange roughy, etc.
  - Cod, Haddock, flounder off Georges Bank – closed w/ hopes of recovery
  - Caspian Sea – 3 spp sturgeon and species flock of shad

## Chapter 25 Conservation

- Causes:
- 3) Pollution - chemical, nutrient and sediment
  - Acid rain
  - Agricultural chemicals
  - Heavy metals
  - Indicators of Environmental Health – “Quality of fishing reflects the quality of living” American Sportfishing Association
  - Linkages between aquatic and terrestrial ecosystems

## Chapter 25 Conservation

- Causes:
- 4) Commercial Exploitation
- By-catch – reduce stocks (Red Snapper, Spanish mackerel, etc.)
  - 1:1 to 3:1 Fish shrimp – can be 130:1
  - New paper – Alaska lowest, shrimp worst 4:1
- Aquarium fishes - cyanide

## Chapter 25 Conservation

- Causes:
- 5) Global Climate Change - weather and temperature

## Chapter 25 Conservation

- Conservation Biology as a new approach in fish conservation
- 4) Values and fish conservation
- Economic values
- Ecosystem values
- Existence values
- Intergenerational values
- Non-economic values

## Chapter 25 Conservation

- What Can Be Done?
  - Level at which effort addressed
  - Biological Preserves
  - Restoration
  - Captive Breeding
  - Education