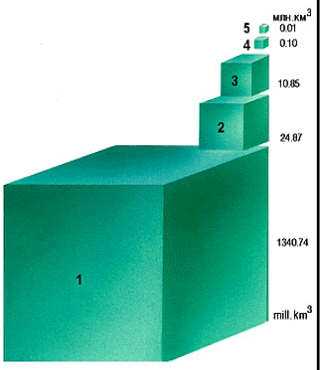
Zoogeography – Chpt 16 – part 17;

- Number of species - Marine (58% w/ 71% of water) v Freshwater (41%)
- Freshwater – Primary (33%) v Secondary (8.1%) v Diadromous (.6%);
- Lakes/rivers (< .009 % and .0001% total water supply respectively) - most freshwater in icecaps/ groundwater.
- Marine – 71% of world water; 33 or 32 phyla – 15 exclusive.

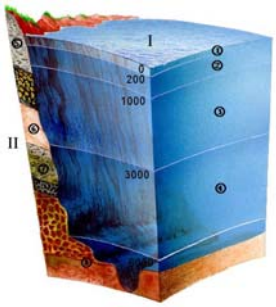
Water

- 1. The World Ocean
- 2. Glaciers and permanent snow cover
- 3. Ground water, permafrost
- 4. Lakes, rivers, bogs
- 5. Water in atmosphere



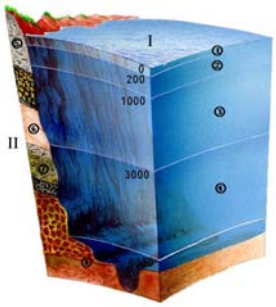
Zoogeography

- **I. Pelagic**
  1. Epipelagic
  2. Mesopelagic
  3. Bathypelagic
  4. Abyssopelagic
- **II. Benthic**
  5. Littoral, Sub-littoral
  6. Bathyal
  7. Abyssal
  8. Ultra-abyssal



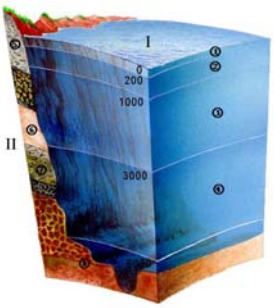
Zoogeography

- Major Marine Zoogeographic Regions - Four Main Ecological Divisions of Marine Fish
- Epipelagic - surface down to 200 m – 1.3% of species (325 spp);
- Continents and temperature – examples of tunas (most widespread – Little tunas associated with shore), halfbeaks (offshore – Hemiramphus – more widespread than inshore – Hyporhamphus) and needlefish (same with needlefish)



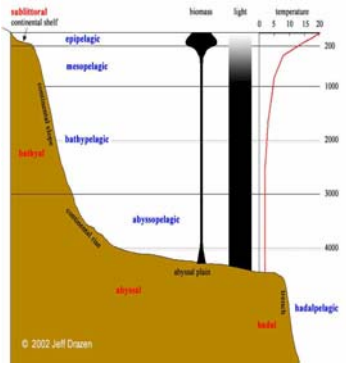
Zoogeography

- Major Marine Zoogeographic Regions - Four Main Ecological Divisions of Marine Fish
- Deep Pelagic - mesopelagic (200 m to 1000m) and bathypelagic (> 1000 m) – 5%;
- Sills (ridges that act as barriers) and temperature limit – temps vary in different deep zones



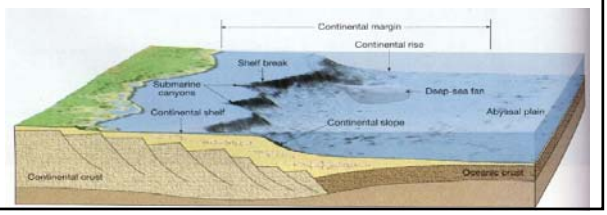
Zoogeography

- Major Marine Zoogeographic Regions - Four Main Ecological Divisions of Marine Fish
- 3) Deep Benthic – 6.4% or 1500 spp;

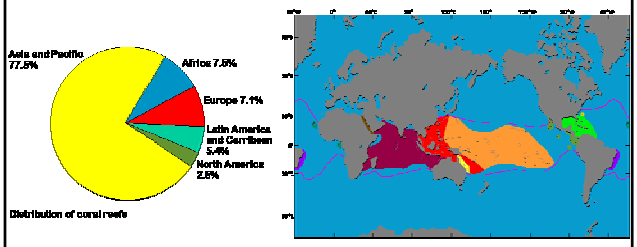


Zoogeography

- Major Marine Zoogeographic Regions - Four Main Ecological Divisions of Marine Fish
- 4) Littoral or Continental Shelf – Shore and shelf above 200 m – 11,250 spp. 45% (39.9% Shallow-warm; Shallow-cold 5.6%) - Temperature limits both fish and habitat – corals above 50m, > 18 degrees C.

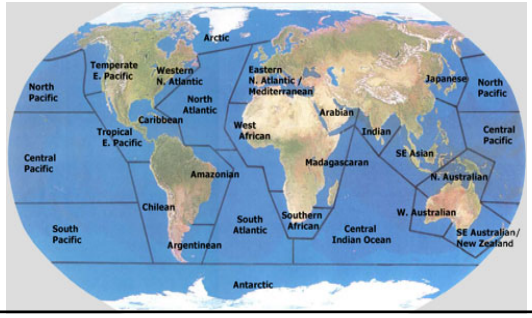


Coral Reef Distribution - above 50m, > 18 degrees C.



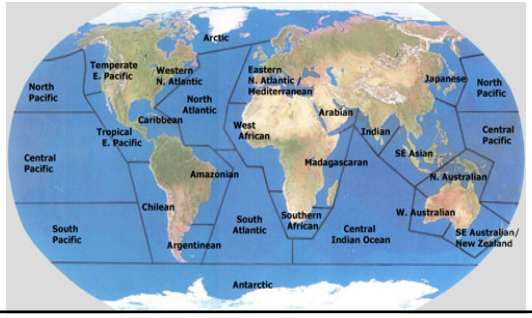
Inshore divided into four Major Inshore Marine Regions - separated by continents or vast marine regions

- 1) Indo-West Pacific Region – 3000+ species = 1/3; corals; bivalves etc



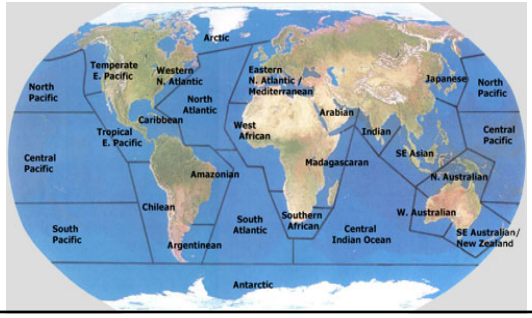
Inshore divided into four Major Inshore Marine Regions - separated by continents or vast marine regions

- 2) Western Atlantic – about 1200 spp – associated w/ West Indian coral reefs



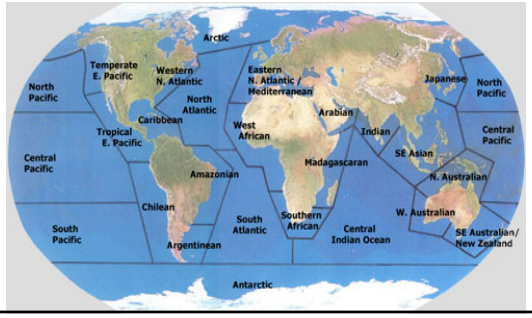
Inshore divided into four Major Inshore Marine Regions - separated by continents or vast marine regions

- 3) Eastern Pacific – recently separated from western Atlantic; - barrier = open ocean – The elevation of the Panama Ismathus about 3 million years ago – geminate species pairs



Inshore divided into four Major Inshore Marine Regions - separated by continents or vast marine regions

- 4) Eastern Atlantic Region – relatively depauperate 500+ inshore spp.

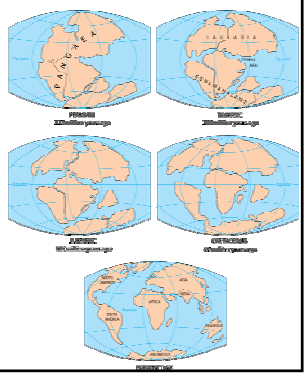


Zoogeography

- Vicariance Biogeography – Distributions and phylogeny = area cladogram;
- Vicariance event vs. Dispersal
- Barrier vs. Filter barrier
- **Three Kinds of Dispersal Leading to Range Expansion**
- Jump Dispersal
- Diffusion
- Secular Migration

Zoogeography

- Continental Drift – Continental drift 1915 (Alfred Wegener)
- Pangea (single landmass – 430 mya); About 180 mya split into Gondwana (SA, Africa, Australia, Antarctica, Madagascar and India) vs. Laurasia (Eurasia and North America)



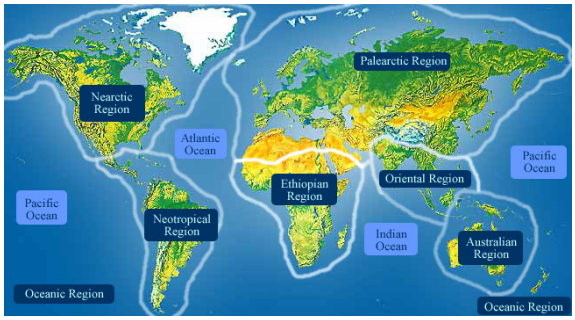
Zoogeography

- Mediterranean Sea – depauperate – 540+ species; Historical drying; Suez canal – one way transfers – open and empty niches for warm water species; widespread spp. penetrate.
- Arctic and Antarctic (274 spp surrounding – 174 immediate) Fishes – 5.6% - lots of cool adaptations

Freshwater Fishes

- Greater contribution to biodiversity - 41% diversity but .0093% of water; marine = 113,000 km2/sp available vs. freshwater 15 km2/sp available.
- Ecological versus Historical (phylogenetic & geologic) - Productivity (shallow productive) and Isolation (freq biogeographic events)
- Primary (strict) v Secondary (occasional marine)
- Freshwater fish vs. Peripheral (marine that are part time in fresh or some part of life history = diadromous)

Six Regions of Freshwater Fish (Alfred Russel Wallace 1876)



Six Regions of Freshwater Fish

- 1) Nearctic - N Amer - 14 fam; 950 spp.; Cyprinidae, Catostomidae, Ictaluridae, Percidae, Centrarchidae.
  - Three subregions: 1) Arctic-Atlantic 2) Pacific 3) Mexican transition

Six Regions of Freshwater Fish

- 2) Neotropical - S Amer - 32 fam; 2500 spp. no minnows/suckers – Characins; Catfish; Gymnotids; Cichlids - many marine invaders

Six Regions of Freshwater Fish

- 3) Palearctic - N Europe & Asia – 14 families;

Six Regions of Freshwater Fish

- 4) African – Diverse - 27 families primary; 47 overall - 2000 + spp.

Six Regions of Freshwater Fish

- 4) African – Diverse - 27 families primary; 47 overall - 2000 + spp.

Six Regions of Freshwater Fish

- 6) Austalian - 2 sp primary only; Ancient relicts – Osteoglossidae (Scleropages) and Ceratodontidae (Neoceratodus); 16 family marine origin.

Archaic

- Archaic – 6 groups – distributions = continental drift
- 1) Lungfish - 3 genera - Africa; SA and Australian
- 2) Bichirs – 11 spp. 2 genera in Africa – fossil = SA
- 3) Paddlefish – one Mississippi and China
- 4) Gars; 7 NA, CA, Cuba w/ fossils in India and Europe
- 5) Amiidae – one living – fossil on all except Australia
- 6) Osteoglossomorphs – (Primitive Teleost) – Primitive, widespread (no Australia)

Recent

- Recent – Five groups primary freshwater
- 1) Pickerels and relatives – NA – Europe and Asia; Northern Pike – greatest distribution of any north hemisphere fish
- 2) Darters and perches – NA; Europe, Asia
- 3) Sunfish – 12 E NA and 1 California (Archoplites)
- 4) Cichlids – Madagascar; India; SA and Africa
- 5) Ostariophysi
  - Cypriniformes – three large 2 small families
  - Carps and Minnows – missing SA and Australia
  - Suckers – NA except 1 China