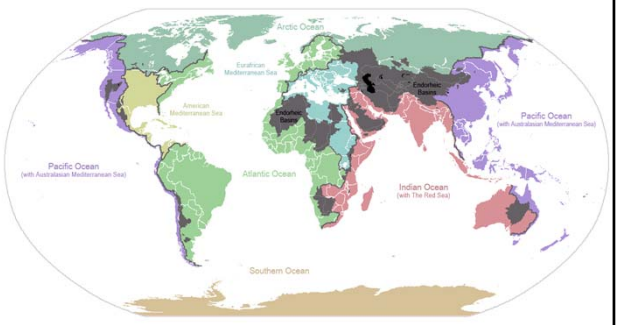
TROPICAL FRESHWATER ECOSYSTEMS



Global watersheds

Kricher Chapter 12

Amazon Basin

Guyana Shield

Brazilian Shield

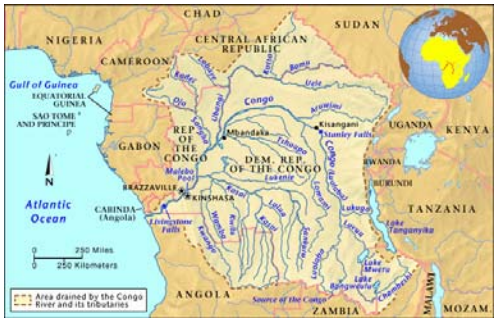
Amazon catchment area: 6.5 million km2

Amazon River
2nd longest: 6,437 km long
largest volume: Discharge 175,000 m^3/s
1/5th of planet's freshwater
Highest freshwater spp. diversity
1300 spp. of fish (60% endemic)

The Amazon River - "Ribereños"

Congo basin

- 2nd largest watershed, 2nd highest discharge: 41,000 m^3/s
- world's deepest river (220 m, 720 ft)
- ~700 fish spp., 80% endemic



The Congo River

Mekong Basin

- Discharge 16,000 m^3/s
- 800+ spp. of fish
- Highest diversity of large fish
- High endemism: waterfalls, rapids
- Dams, flood control, pollution, fishing threaten biodiversity

The Mekong River

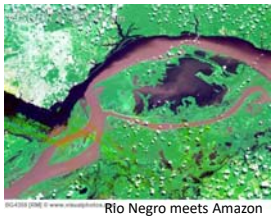
Tropical "**Whitewater**" Rivers
Physical & Chemical Properties

- Amazon is largest one!
- warm water (upper 5-13°C, lower 28°C)
- very turbid (0.1-0.5 m secchi disk)
  - drain mountains
  - soft clay substrate
- little light penetration
- **allochthonous** nutrient sources
- low oxygen, near neutral pH
- **annual floods**

deliver nutrients (0.8-0.9 billion tons/yr from Andes)
flood forest, expand aquatic habitat

Blackwater Rivers

- drain sandy soils (Guyana shield)
- very slow moving
- low in sediment (and nutrients)
- lots of tannins; tea-colored water
- acid pH (4.5-5.1)
- low diversity



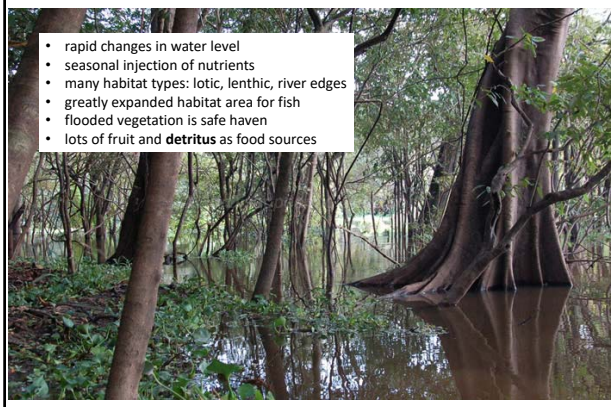
Rio Negro meets Amazon

piraña

Clearwater Rivers

- small forest interior streams
- often ephemeral
- shady (little **autochthonous** production)
- high pH range (4.5-7.8)
- low diversity, but ecologically important

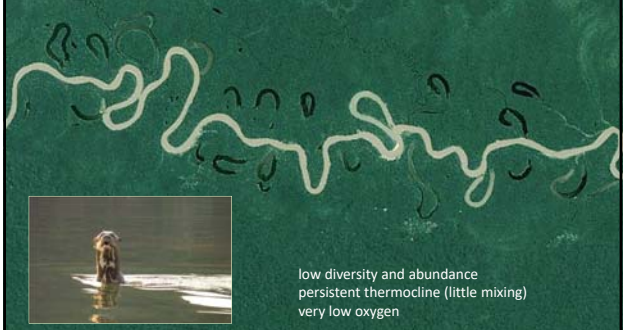
The Flooded Forest = Riverine or Gallery Forest



- rapid changes in water level
- seasonal injection of nutrients
- many habitat types: lotic, lenthic, river edges
- greatly expanded habitat area for fish
- flooded vegetation is safe haven
- lots of fruit and **detritus** as food sources

Kricher pg 451 "Amazon flood cycle"

Oxbow lakes & tropical lagoons



low diversity and abundance
persistent thermocline (little mixing)
very low oxygen

Phytotelmata

Adaptations of Amazon Fish

Amazon: 2,400 – 3,200 fish spp.

1. Changing Water Levels

- Migration
- Rapid development
- Move over land (catfish, lungfish)
- Estivation in mud

Adaptations of Amazon Fish

2. Turbidity / low light

- Non-visual communication
  - pressure, electroreception (lateral line)
  - chemosensory / olfactory (barbels)
  - sound & hearing (Weberian apparatus)
- Split eyes (e.g. Arowana)
- Influences color

Adaptations of Amazon Fish

3. Low primary production

- Detritivory, **frugivory**, predatory
- (allocthonous food sources)

4. Low oxygen

- Air-breathing (Labyrinth organ)

Flooded Forest
Arowana – allochthonous food sources

Adaptations of Amazon Fish to:

5. High predation risk

- Mouth-brooding (many Cichlids, paiche)
- Burrow nesting (catfish)

Amazon Fish Diversity (~2400 – 3200 spp)

Order Characiformes (piraña, tetras, etc)

- ~1150 neotropical spp., >10 families
- ~40% of Amazonian freshwater spp.
- laterally compressed bodies, soft ray fins
- upturned mouths
- soft fin rays
- Large teeth (predatory or frugivorous)

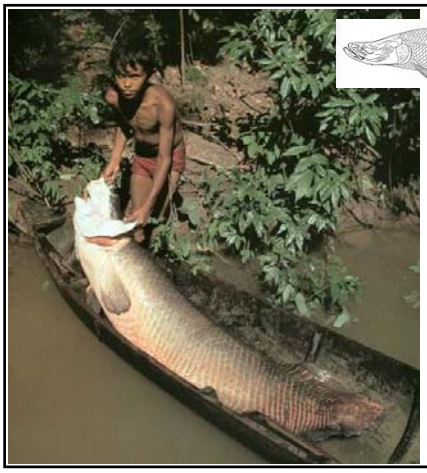
See Kricher pg 449-453

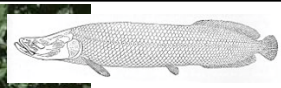
Order
Siluriformes
(catfish)

~34 families

39% of Amazonian freshwater fish
dorsoventrally depressed
spiny fin rays, most lack scales
small eyes, downturned mouth, **barbels**
scavengers, bottom-feeders, gill-feeders

The dreaded "Candiru"



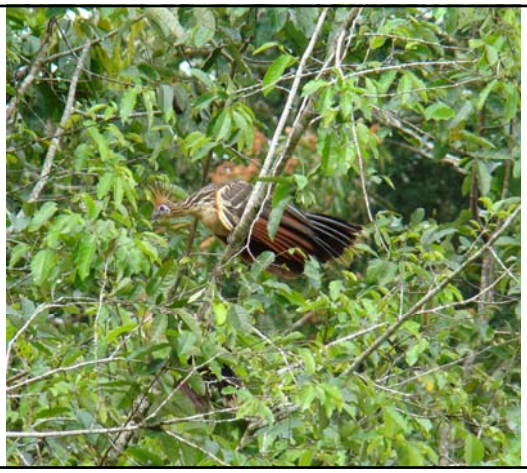


Order Osteoglossiformes
Arapaima gigas

"pirarucú"
"paiche"

- scales protect against piraña
- air-breather
- top predator in low O_2 lakes
- seasonal breeding
- mouth brooder
- endangered


OTHER DENIZENS OF RIVER



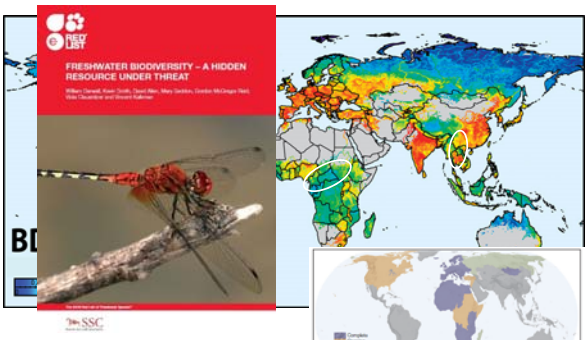
...AND THE FLOODED FOREST

Uakari (lower Amazon basin)

Capybara

Pygmy Marmoset

Global Freshwater Biodiversity Threat



But much is unknown...
State of progress of global fish assessment

Global Freshwater Biodiversity Threat

- habitat loss
- hunting
  - turtles and eggs
  - caiman skins
  - otter pelts
  - mammals
- Fishing

Global Freshwater Biodiversity Threat

- gold mining
- pollution
  - mercury
  - agrochemicals
  - petroleum

Global Freshwater Biodiversity Threat

- dams