



lecture resources  
*...bringing ecology to life*

# THE ECOLOGY OF FRESHWATERS

***A complete freshwater ecology course on CD-ROM.***

***PowerPoint presentations showing the variety of freshwater types, the species you are likely to find and the techniques you need to understand their ecology***

## LECTURE 5

### ANIMAL LIFE IN FRESHWATERS

#### Part II - Vertebrates

Photography, text & design by Pisces Conservation

**Vertebrate life** in lakes, ponds, rivers and streams is diverse.

It comprises:

Fish: Bony fish, some rays

Amphibians: Frogs, toads, newts, salamanders

Reptiles: Turtles, terrapins, snakes, crocodilians

Mammals: Rodents, beavers, otters, seals, manatees, dolphins

Birds: Ducks, rails, geese, swans

Some groups depend on water for reproduction while others use it for food or protection.



Fish are the dominant and most diverse vertebrate group and are a very important resource for man



Freshwater fish 1

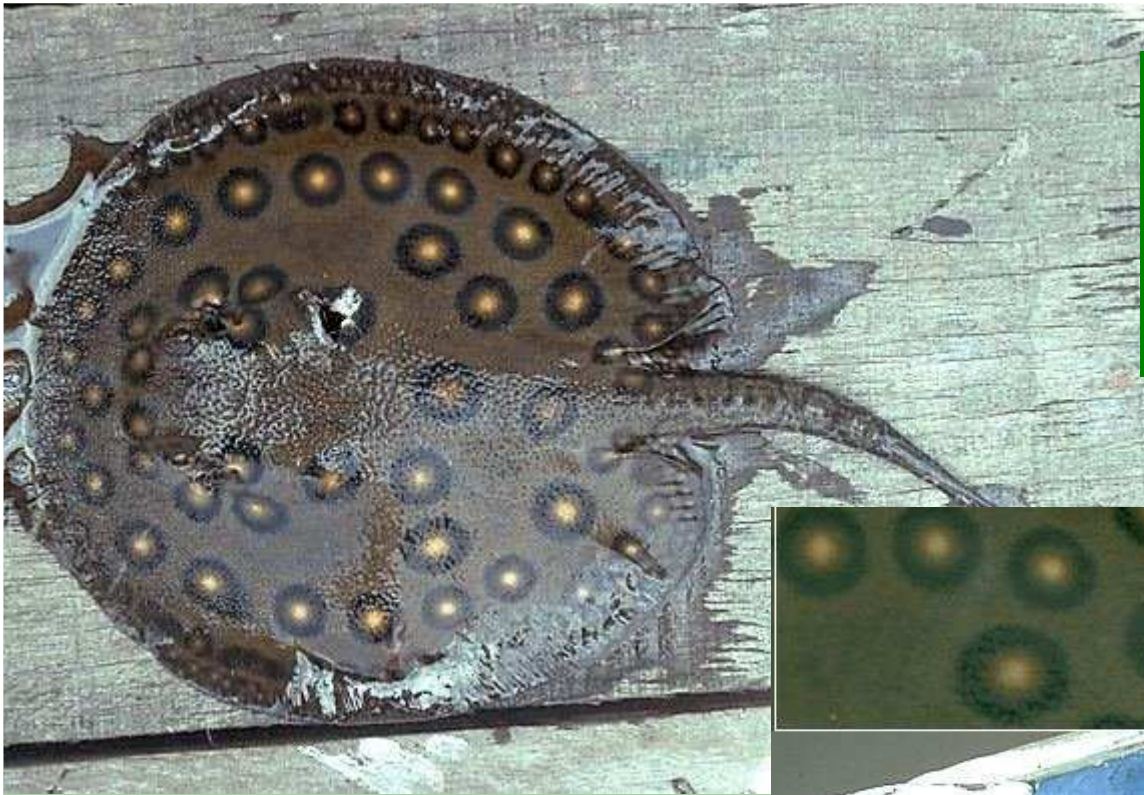
A day's fishing in the Amazon



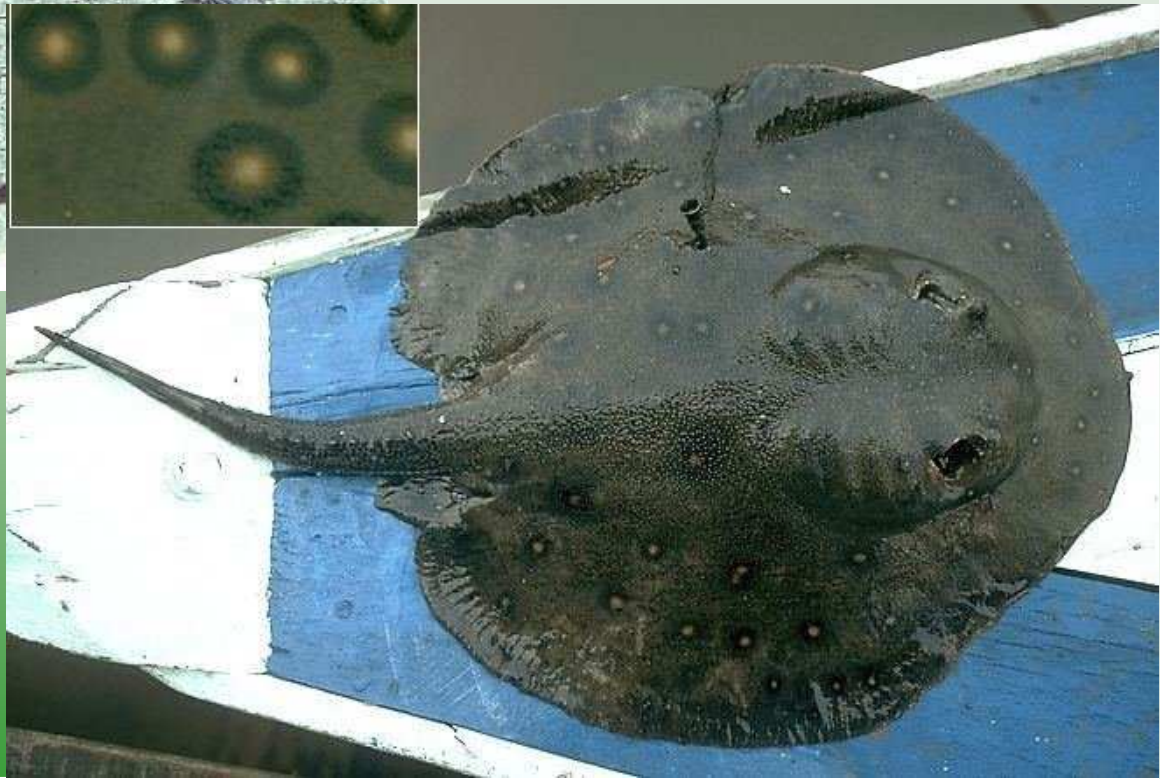
Ancestral to bony fish is the semi-parasitic lamprey – these often migrate to the sea; a feature commonly observed in freshwater fish.







Cartilaginous bottom feeders of the Amazon. There are not many elasmobranches in freshwater.



Although some sharks will enter freshwaters, some for many hundreds of kilometers, non are able to breed in freshwaters. However some rays are adapted to permanent freshwater life.



## Freshwater fish 3

*Potamotrygon motoro*

*P. Hystrix.*



Most fish are carnivorous, but some are herbivorous.

This Amazonian fish, the tambaqui, consumes seeds and nuts from trees as they fall into the rivers and flooded areas.

It has heavy molar-like teeth for crushing the seeds.



Freshwater fish 4

*Colossoma macropomum*



Some are very obviously predatory...



## Freshwater fish 5

*Raphiodon gibbus*

*Acestrorhynchus falcatus*



## Scavengers



Despite their fearsome reputation as predators Pirhana spp. are usually scavengers, feeding on carrion etc. However, given a chance they will attack living fish; here a catfish has lost part of its anal fin to an adventurous Pirhana.

*Serrasalmus* sp

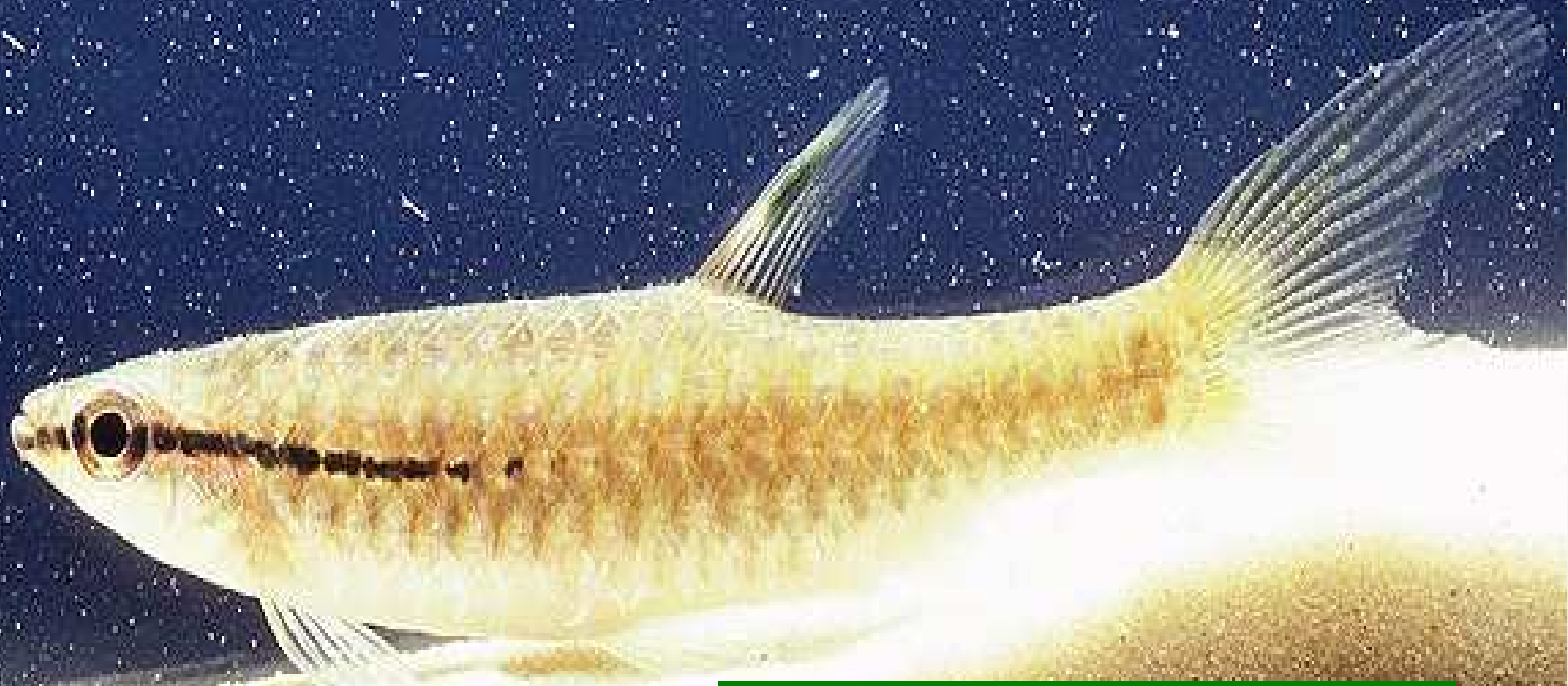
*Serrasalmus nattereri*, the red-bellied pirhana



Freshwater fish 6



Detritivorous fish



This species eats detritus and small invertebrates within leaf litter banks in small streams



The catfish are important bottom-feeding fish



The body shape of bottom feeders enables them to rest and feed on the river/lake bed with minimal energy expenditure. These catfish are commonly found in submerged leaf litter.



Freshwater fish 8

Banjo catfish  
Armoured catfish *Pterygoplichthys* sp.



Bottom-feeding fish in temperate waters



Freshwater fish 9

Bullhead *Cottus gobio*

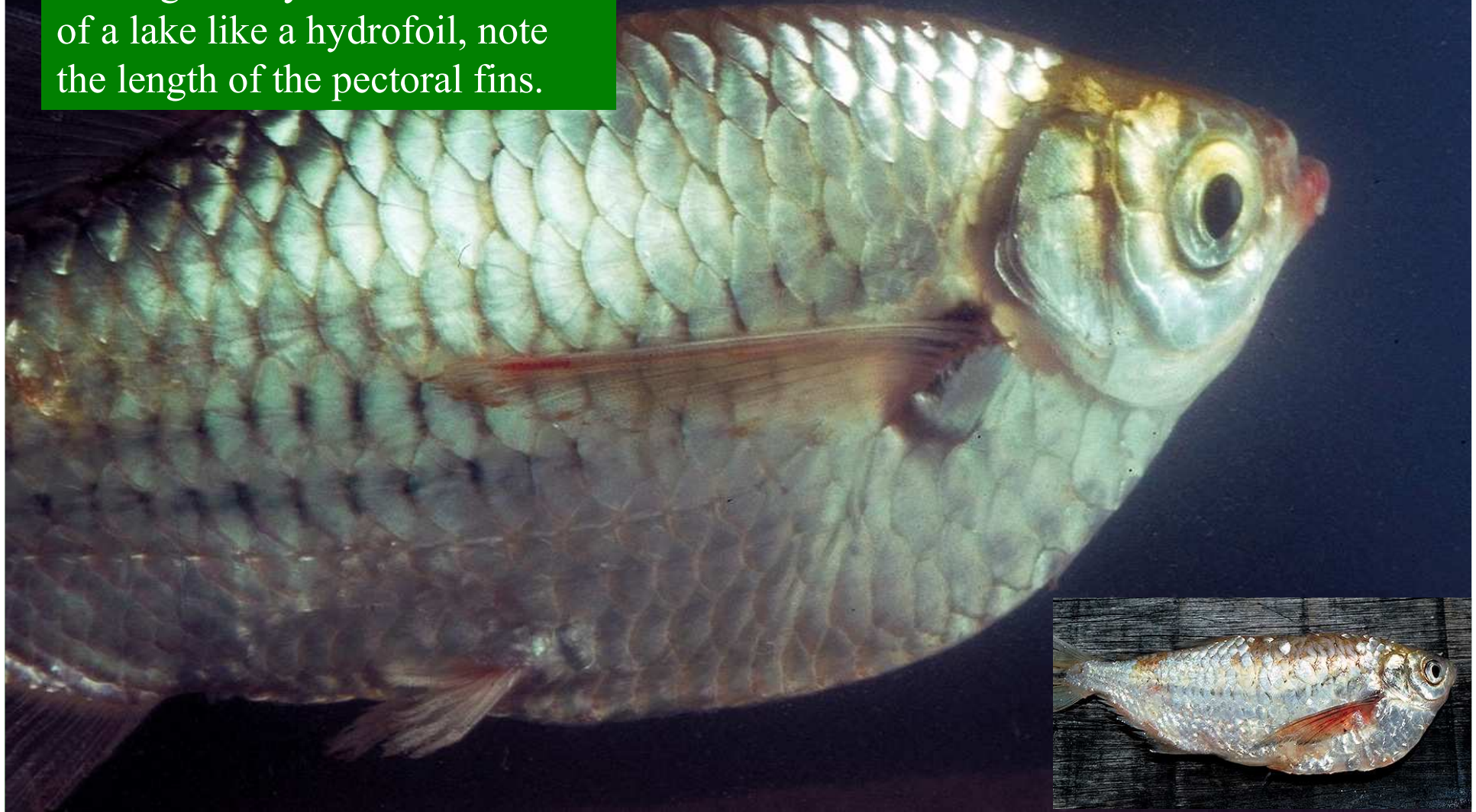
Gudgeon *Gobio gobio*

Stone loach, *Barbatula barbatula*



## Fish of open waters

*Triportheus* escapes predators by moving swiftly over the surface of a lake like a hydrofoil, note the length of the pectoral fins.





Fish have even evolved to live in temporary habitats



Freshwater fish 11

The lungfish, *Lepidosiren paradoxa*



## Amphibians



Amphibian eggs lack a waterproof external membrane and therefore require water to avoid desiccation. Amphibian skin is also permeable to water and therefore most amphibians are found near water most of the time.





## Amphibians



## Tadpoles

In spring huge numbers of tadpoles emerge from their egg clusters. They graze enthusiastically on algae and other plant material, developing into froglets or toadlets within a few weeks.

Predation is very high, however, and  $< 1\%$  of each cohort is destined for adulthood.





## Amphibians

Largely terrestrial but still completely dependent of water for breeding. Toad eggs are laid in strings whereas frog eggs are laid in clusters.





# Reptiles

Anacondas have the largest sexual dimorphism of any free-living vertebrate species.

Females are five times bigger than males.



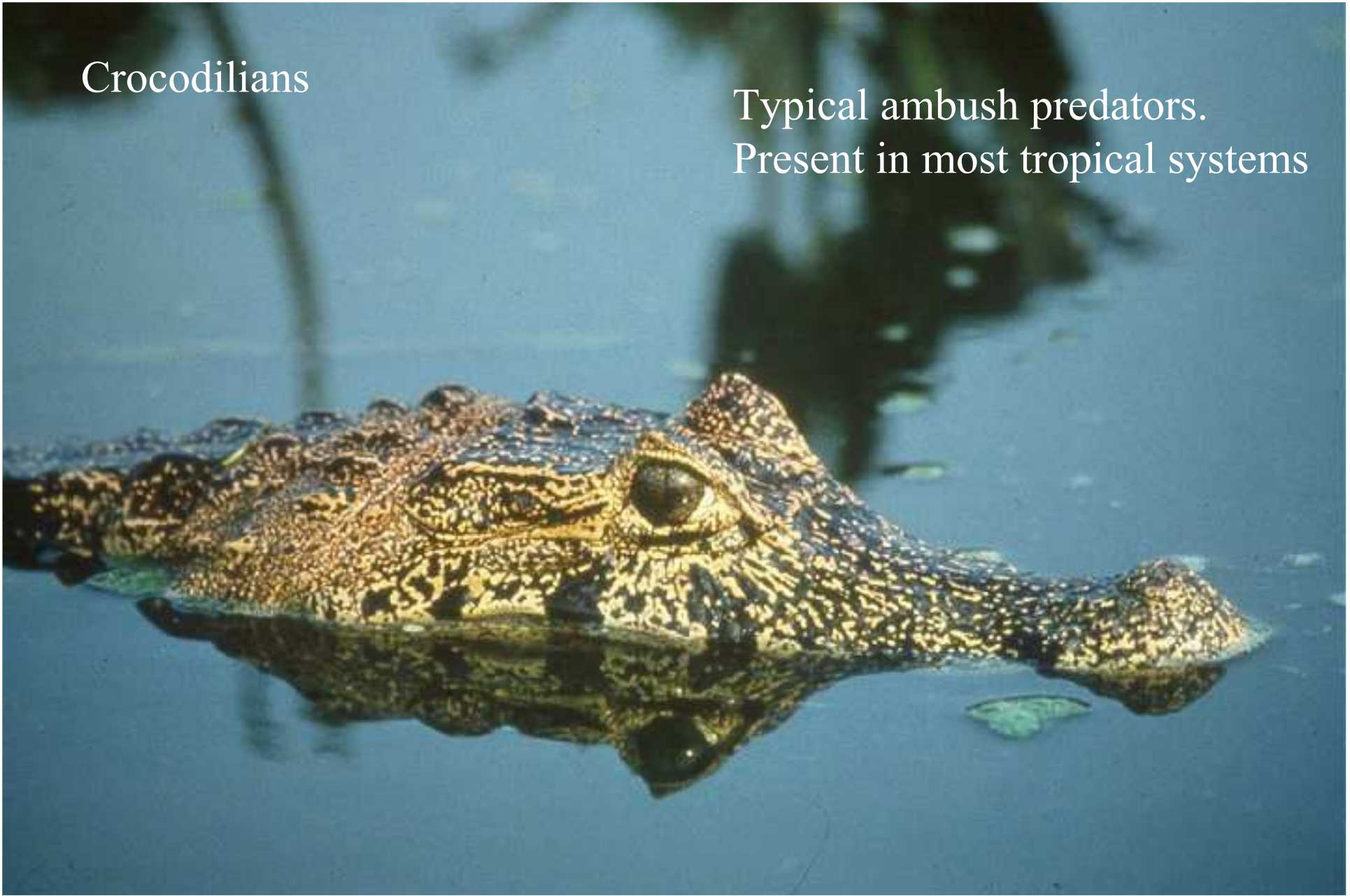
Although there are no truly aquatic reptiles (all species need to come ashore to breed), many spend most of their time in or near water. This anaconda was captured in the Mamiraua Reserve in the Amazon basin, it was about 6m long.





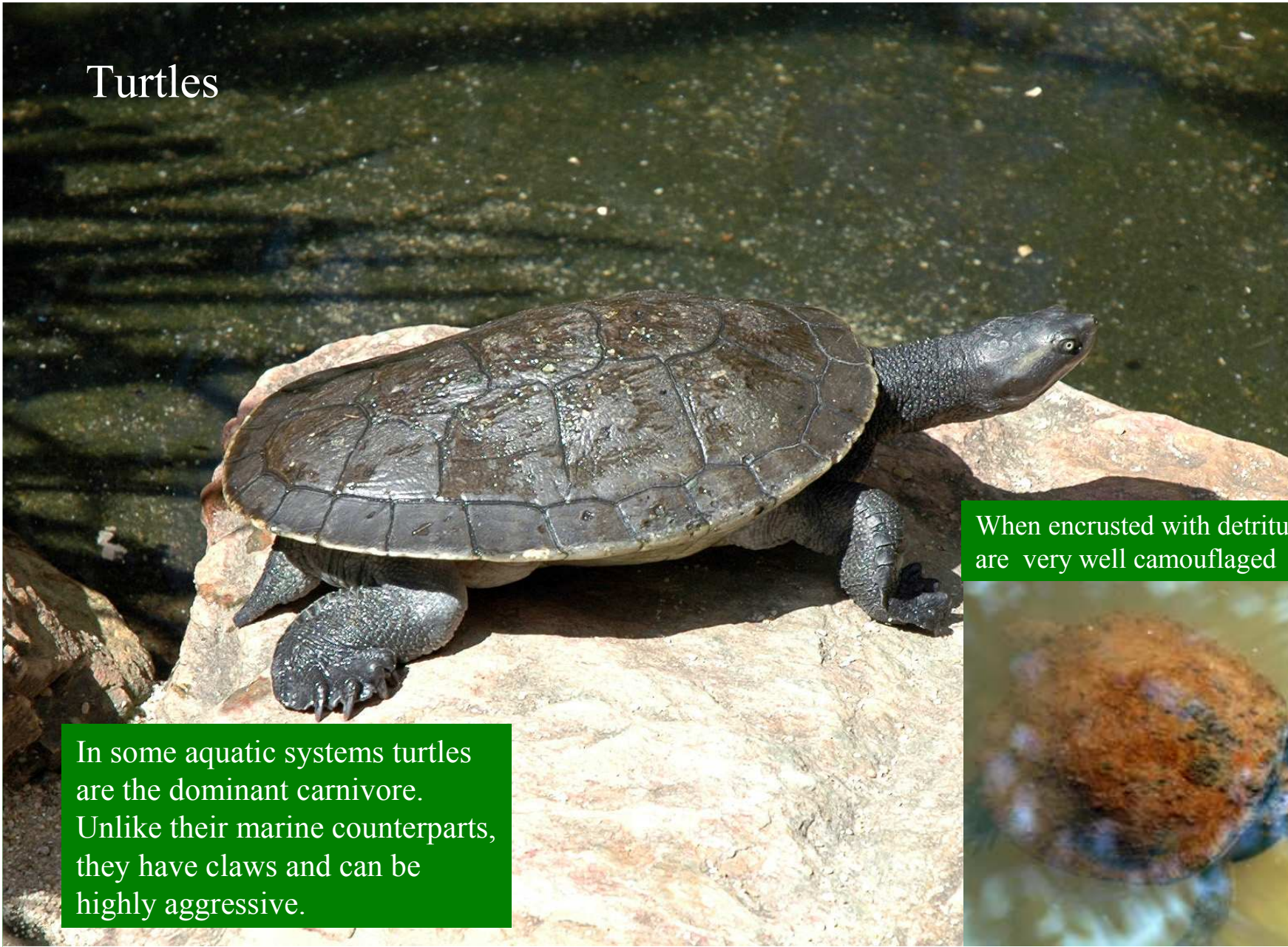
## Crocodylians

Typical ambush predators.  
Present in most tropical systems





# Turtles



When encrusted with detritus they are very well camouflaged

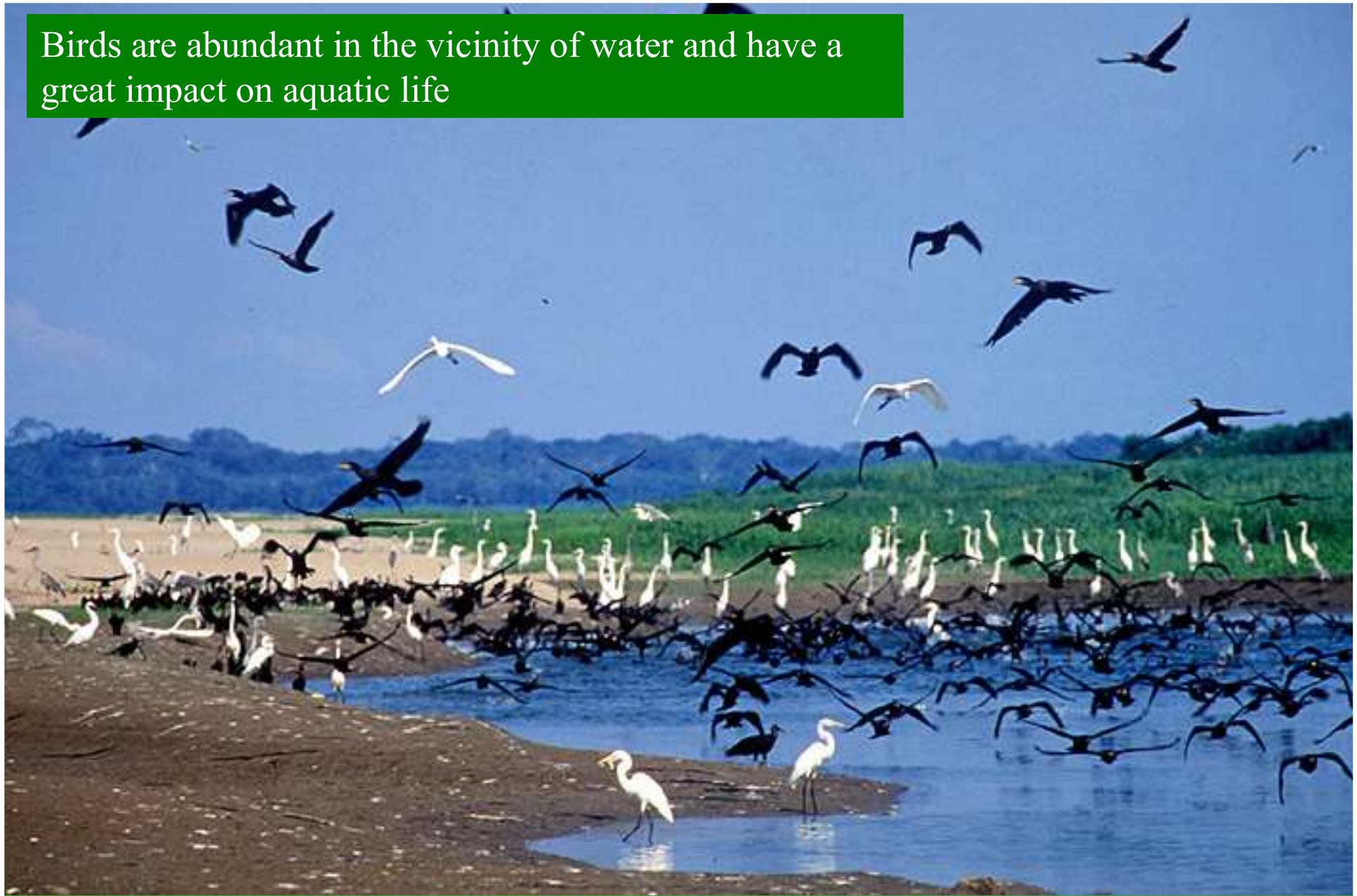


In some aquatic systems turtles are the dominant carnivore. Unlike their marine counterparts, they have claws and can be highly aggressive.





Birds are abundant in the vicinity of water and have a great impact on aquatic life



## Birds 1

## Predatory birds



Storks, egrets and heron will stand motionless for long periods of time then pick off any fish, frog or reptile that comes near



## Birds 2

Wood stork  
*Mycteria americana*

Snowy Egret  
*Egretta thula*



Piscivorous birds



Birds 3

Snake bird *Anhinga anhinga*

## Ambush predators



Kingfishers have polarizing filters in their eyes, so they can see fish through the surface reflection.

There is a great size variation in kingfisher species. These two birds are using the same branch, note the difference in size.



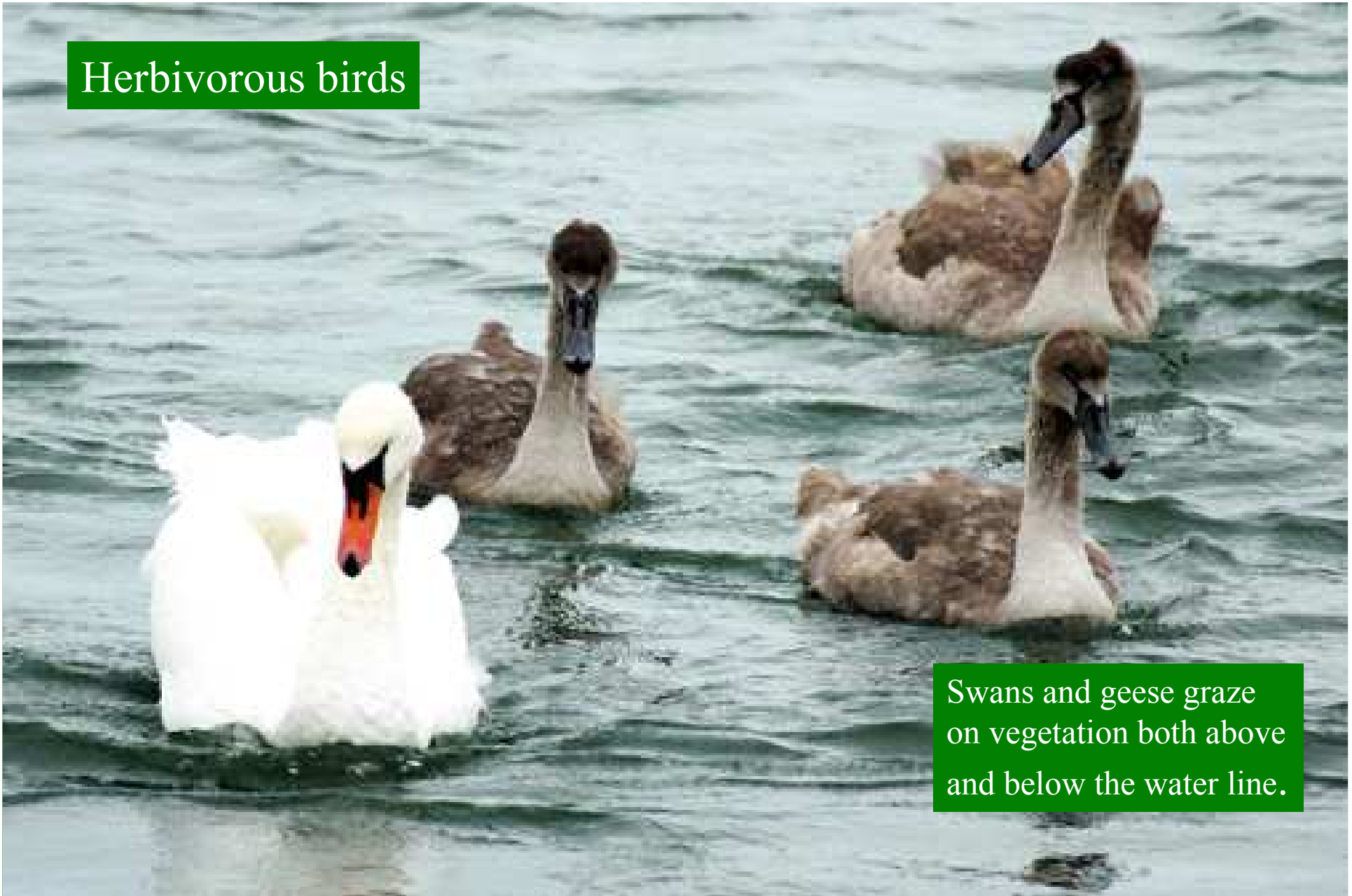




Predatory birds frequently coexist – a good example of niche differentiation



Herbivorous birds



Swans and geese graze on vegetation both above and below the water line.





## Omnivorous birds



### **Rails, coots and moorhens**

Some species feed mainly on plant material while others concentrate on invertebrates and frogs etc.

All species have very large feet, enabling them to walk on submerged or floating vegetation.





## Filter-feeding birds



Found in freshwaters as well as brackish to highly saline waters, flamingos filter animal and plant material from the water by disturbing the bottom with their feet and then pumping the resultant soup through sieve plates in their bills.





In recent years cormorants have increased greatly in abundance in freshwaters in Europe and N. America and are now viewed in some areas as a pest species, harming fish stocks.





The MAMMALS found in aquatic habitats have probably the greatest niche differentiation of any vertebrate group.

Some species are obligate aquatic e.g. dolphin, manatee

Some use water as a food source e.g. otter, platypus

Some use aquatic environments for protection e.g. beaver, tapir



Freshwater dolphin or Boto



Otter



Tapir





## Piscivorous mammals



River dolphins, or Botos, inhabit muddy waters and use echo-location to find fish and crustaceans on the river bed.



## Aquatic grazers

Upto 3m long and weighing upto 500kg, manatees and dugongs (Order *Sirenia*) have no natural predators.

Herbivores, eating sea-grasses and mangroves. They congregate in estuaries and coastal bays but migrate into warmer freshwaters in winter.





Semi-Aquatic herbivores



Skin dries rapidly so it spends most of its time in water.

Found in Ivory Coast, Liberia, Sierra Leone



Mammals 4

Pygmy hippopotamus *Hexaprotodon liberiensis*



## Aquatic carnivores



Otters will eat fish, crustaceans, birds, frogs and small mammals. They can close their ears and nostrils whilst diving.





## Semi-Aquatic herbivores



Frequents water regularly, to feed and bathe, although will happily exist on terrestrial vegetation.

Found in much of South America, from Columbia to Northern Argentina.





## Terrestrial herbivores using water



There is no rigid dividing line between aquatic and terrestrial mammals and some species will use water resources for cooling, drinking and bathing whilst living an otherwise land-based life.





Mammals can greatly modify and even create freshwater habitats



Mammals 8

Beaver lodges in a New York stream