Niche separation in the caiman species of the Peruvian Amazon

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Three species of caimans occur in the Loreto region of the Peruvian Amazon Basin, the black caiman (*Melanosuchus niger*), the common caiman (*Caiman crocodylus*) and the dwarf caiman (*Paleosuchus trigonatus*). Whilst the dwarf caiman is predominantly found in the narrow creeks and streams that course through the rainforest, both the black and the common caiman primarily inhabit larger bodies of water, such as rivers, streams and lakes.

The black caiman was intensively overhunted for its hide during the 1950s – 1970s, which was used in the fashion trade for products such as handbags, shoes and belts. Whilst protective legislation has severely reduced hunting pressures, illegal poaching across their range has led to inconsistent rates of recovery in black caiman populations. Current research has shown that the black and the common caiman compete for space and other resources, with the black caiman a better competitor. As shown by the Lotka-Volterra model of interspecific competition, as numbers of black caiman recover, common caiman decrease. This raises important conservation questions, since successful conservation of the black caiman will impact population levels of the common caiman.

Studies are being conducted in these river systems to monitor the recovery and conservation status of the caiman species, focussing on the black and the common caiman. This involves research on both the abundance and habitat use of the caimans, and studies on their feeding ecology and niche overlap. The population and habitat studies will research the outcomes of the competitive interactions, whilst studies on the feeding ecology and niche overlap look at the mechanisms underlying these competitive interactions.

As a result of seasonal variation in rainfall in the Andean headwaters, the rivers of the Amazon basin are subject to large fluctuations in water levels throughout the year that flood the surrounding forest. The ecology of both the aquatic and terrestrial wildlife revolves around these seasonal changes. The forests of the reserve flood as the waters rise between December and June, reducing the land available for terrestrial mammals but vastly increasing the aquatic habitat available to fish, which move into the forest to feed on the abundant vegetation and to breed. Although the diet of both the black and the common caiman change as they develop, fish are a dietary component of all age classes. This negatively impacts caimans since their prey is more sparsely distributed throughout the large expanses of the flooded forests. Between July and November the water recedes, condensing populations of fish into the reduced rivers, lakes and channels and driving some fish to migrate to the larger rivers. During this time the caimans have an abundance of prey.

In recent years these normal seasonal changes have become more intense. Both the wildlife and local people are affected by these extreme events, which are tentatively being attributed to climate change. The flooded forests are particularly important for understanding the impacts of climate change in the Amazon, since the aquatic and terrestrial interface between high and low water seasons makes this habitat sensitive to greater seasonal variations. In 2009 the water levels of the Amazon rivers reached unprecedented heights, flooding huge area of Amazonian forests, yet in 2010 the water levels were at a historic low, resulting in extreme dry conditions. In 2011, 2012 and 2015 the rivers again reached record highs, whilst in 2014 the water levels dropped to same low levels as 2010.

The caimans are resident species and do not display the same migratory behaviour as dolphins or fish when conditions in the river are unfavourable. The common caiman appears to have been impacted by the extreme low water levels, with a lower overall abundance in the river system during the drought of 2010 than in the previous six years. The black caiman appears to be less affected, showing similar abundances across years and no general declines correlated with extreme water levels. The research being conducted on caiman populations is therefore also being used to understand how the ever-increasing climatic changes are impacting their ecology and populations.

Methods

Data will be collected in the Loreto region of the Peruvian Amazon Basin, specifically at the Lower Yarapa River basin in the extensive forest and river system belonging to the indigenous Cocama Indians that connects two major protected areas: the Pacaya-Samiria National Reserve and the Tamshiyacu-Tahuayo Regional Community Reserve. Community-based conservation dominates the landscape of Loreto with large community-based reserves, community co-managed reserves and indigenous territories covering 98,800 km2. This study will survey caiman the Yarapa-Tahuayo rivers and connecting tributaries and oxbow lakes.

Censuses of caimans

To assess the population and ecology of each caiman species in the ecosystem it is necessary to gain an understanding of the population size and structure. Aquatic transects will be used to survey the caimans, travelling upstream or downstream on the main river and in nearby channels or lakes at different survey sites in the reserve (Figure 1). Caiman surveys and captures will be conducted from a small boat fitted with a 15-horsepower engine. Caimans will be located by their eye reflections using a 12-volt spotlight and approached to a distance where the engine will be silenced and the boat paddled closer. All caimans seen will be identified to the species level as best as possible and the size and age class recorded. A GPS will be used to determine the distance surveyed each night and the location of each caiman sighting. The macro habitat (e.g. river, lake) and micro habitat (e.g. open water, floating vegetation, sand bank) types at each caiman sighting will also be recorded.

This method of fixed-width sampling means the average abundance of each caiman species in the different macro habitats can be calculated as follows:

$$A = \frac{N}{L}$$

Where A = abundance
N = number of individuals
L = distance travelled along river

Caiman less than 2m in length will be captured using a noose made of a long pole with a loop of rope that can be pulled tight over the caiman's neck. Once on the boat, the limbs of the caiman will be tied with rope and tape used to secure the jaw shut. Total body length will be measured from the tip of the snout to the tip of the tail, torso length measured from the tip of the snout to the cloaca (the vent) and head length measured from the tip of the snout to the posterior edge of the orbital. The weight of the caiman will be recorded in kilograms using a spring balance. Ectoparasites such as leeches and nematodes found on each caiman captured will be recorded as an indicator of the health of the individual and also as a proxy of habitat preferences (based on the fact that the abundance of different parasites varies in relation to river and lake microhabitats).

Comparative statistical analyses will be conducted between species, size classes, and macro and micro habitat types. In addition, data available from previous years can be used to compare longer term changes,

both in the population demographics of the caiman species and changes in their resource use patterns over time.

Suggested reading

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