Potential impacts of climate change on sustainable fishing resources for the Cocama indigenous people

Dr. Rick Bodmer, University of Kent

The Amazon basin is going through dramatic climate changes that will impact the largest rainforest on Earth. Each year the Amazon River goes through seasonal changes between the flooding period from December to June and the low water period between July to November. However, these normal seasonal changes are now becoming more intense, which is impacting the wildlife and local Cocama people. The Amazon River basin is home to the greatest richness of freshwater fish species in the world; as many as 8,000 species in total and at least 750 of these have been recorded in the Peruvian Amazon, with an estimated total of over 1,100 species in Peru.

Fish provide many local people with the largest proportion of protein in their diets as well as being the source of food for many other species within Amazonia. It is important that this rich diversity of freshwater fish is protected not only for its intrinsic value, but more importantly for its far-reaching value to humans and entire ecosystems. The sustainability of fish as a resource in the Peruvian Amazon is a concern as demand is increasing with development. The main threats to the fish communities of the Peruvian Amazon include the use of toxic plant substances in harvesting methods, large-scale fish extraction near the mouth of the rivers, and erosion and reduction in habitat through timber extraction. Studies suggest that overall biomass of catches is not increasing annually in the Peruvian Amazon as a whole, but harvests of some of the most popular commercial fishes are declining. This would suggest an overall unsustainable harvest of the most popular fish species and a compensating move by fishermen to other species.

Monitoring of the fish populations, especially species used by fishermen is important in developing appropriate fisheries management in and around the reserves. The importance of the seasonally flooded forests in the reproductive cycles and juvenile stages of commercially important species, make the Loreto region of the Peruvian Amazon a vital area for conservation and the development of effective management plans. Research on fish populations is being conducted to understand how the increasing climatic changes are impacting their ecology and populations. The research team is also working with the local Cocama communities to see how the changes are affecting the fishing that they depend on for their daily livelihood. The wildlife of the Yarapa River in the buffer zones of the Pacaya-Samiria National Reserve and the Tamshiyacu-Tahuayo Regional Community Reserve lives in an ecosystem that is driven by the large seasonal fluctuations occurring between high and low water seasons. The ecology of the aquatic and terrestrial wildlife revolves around these seasonal changes in water level.

The aquatic wildlife is affected by the large seasonal inundations. During the flooded periods the fish enter the water laden forests and feed on the abundance of vegetative and animal production, especially the abundance of fruits, invertebrates and other living organisms trapped in the annual floods. Indeed, many tree species fruit during this season and rely on the fish as their primary means of seed dispersal. During the flooded period many fish populations reproduce within the inundated forests. When the waters recede during the dry months, fish populations become condensed in the reduced lakes, rivers and channels with ever increasing competition and predation. During this period many fish populations migrate out of the smaller rivers and into the larger rivers.

The Cocama people who live in the flooded forests have adapted to the seasonal changes in both the use of the natural resources and their agriculture. During the high water season fishing is more difficult, since the

fish are dispersed throughout the inundated forests. In contrast, during the low water season the fish become easy prey being trapped in the reduced water bodies of the lakes, channels and rivers. The local indigenous people of the flooding forests alter their fishing accordingly, with a greater emphasis on fishing during the low water season.

The normal cycles in the Amazon forests are now being disrupted by the extreme flooding and drought events that are occurring. The flooded forests are particularly important at 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.

Results from this research show some important consequences of the extreme variations in water levels that have been occurring over the past several years. The fish were impacted by the extremely low water levels in the river system during 2010. In June, prior to the receding waters the fish had a greater abundance than average. However, as the waters receded the abundance of fish started to decline and in July fish numbers were below average. As the season progressed and the water levels sank below the long-term levels the fish abundance became obviously lower than average with a 63% decrease from normal years. Although the drought ended in late October 2010 and the fish numbers recovered, a second drought occurred in 2014, during which fish stocks were similarly affected. Sizeable fluctuations in fish stocks continued in 2015 when water levels reached record highs and the fish population grew considerably, while at the same time, ungulates and other terrestrial mammals (the other major food source for the Cocama Indians) plummeted to all-time lows.

Careful management of sustainable fishing quotas for the Cocama Indian population, in conjunction with sustainable hunting quotas are therefore paramount for both food security and the conservation of biodiversity in the reserve. Research will be conducted at the Lower Yarapa River in the buffer zones of the Pacaya-Samiria National Reserve and the Tamshiyacu-Tahuayo Regional Community Reserve on the species composition of catches, abundance estimated by CPUE, size and weight classes for demography, and habitat analyses of catches. These data will allow for a comparison of catches between river, lake and channel habitats to determine the current abundances and composition of the fish commonly used by local fishermen.

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 fish the Yarapa-Tahuayo rivers and connecting tributaries and oxbow lakes

During the census green gill nets of 3.5'' will be used in lakes and channels with weak currents and white gill nets in the river. Fishing points will be located on shores or banks where there is aquatic vegetation or shrubs, although meanders are the preferred areas. Individuals will be identified, measured and weighed. Catch per unit effort will be calculated by the number of individuals per species caught and the effort spent fishing at each zone.

Data will be collected at different survey locations within the reserve and at each survey site, fish surveys will be conducted in different river habitats (lake, channel, and river). Productivity of fish will be shown in terms of catch per unit effort, using the 'biomass captured per effort' method. The CPUE method is a robust indicator over time for the level of abundance, density and pressure fishing in a given zone. The length-frequency analysis helps to predict biological impacts of fisheries. A harvest focused on juveniles, for example, causes

greater impact than a harvest of adult fish not in their breeding period.

Statistical analyses will compare different fish species in term of abundance, size and weight classes (demography) and habitat use. These analyses will be compared within and between sites. In addition, data from previous years will allow for a longitudinal analysis between years to measure trends in the fish community. Results from the analyses will be used to improve current management plans for the fisheries.

Recommended Reading

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