Harvest and trade of pirarucu in the Brazilian Amazon

Introduction: Species, Use and Trade

The pirarucu (*Arapaima gigas*) is the largest scaled freshwater fish in the world, reaching to over 3m in length and to over 220kg in weight. It is found across the Amazon Basin. Pirarucu are highly vulnerable to overexploitation due to their large body size, late maturity, and low fecundity, coupled with dependence on extended parental care. The species has been listed in CITES Appendix II since 1975. It has not been assessed for inclusion in the IUCN Red List.

The species is highly valuable economically, and technological developments coupled with growing market demand have led to intensified exploitation of pirarucu in the Amazon Basin since the early 1960s. By the 1980s, widespread declines and local extinctions were apparent. Overexploitation was primarily due to large-scale commercial, relatively unselective fishing boats, which often traveled far afield to exploit unprotected lakes. All exploitation was banned in the state of Amazonas in 1996 in response to concerns over its decline. However, it proved impossible for government agencies with limited capacity to enforce these restrictions over the vast areas involved.

Over the last 20 years, Brazil has adopted a pioneering approach to pirarucu management based on supporting community rights to establish rules about access, to exclude other users from protected lakes, to monitor pirarucu populations, and to fish the species under government-approved quotas. This approach was based on the recognition that giving local people an incentive and a role in management could strengthen local monitoring and rule compliance and reduce overall conservation costs, while generating important local livelihood benefits. This approach was first adopted at the Mamirauá Biosphere Reserve on the Solimões River. The results have been dramatic – a "win-win" for both local livelihoods and for fish and wetlands conservation.

Community-based pirarucu management involves the communities residing in sustainable-use protected areas, on indigenous lands, and other areas subject to state-recognized fishing agreements. It is made possible through the development and scientific verification of community monitoring of pirarucu. Pirarucu have modified swimming bladders that allow them to breathe air in the oxygen-starved waters of the Amazon – to do this they must surface every 20 minutes. This surfacing allows them to be counted in floodplain lakes by highly experienced local and indigenous fishers with deep skills in perceiving subtle visual and auditory cues about surfacing pirarucu. In the dry season, floodplain lakes become discrete landscape features, enabling the population of specific lakes to be counted and quotas set. Fishermen work collaboratively and systematically to cover the lake area in a non-overlapping fashion over multiple observation periods.

Communities are involved not only in the monitoring, but in participatory development of local-level rules around resource access and their enforcement. Floating guardposts, managed by local communities, are set up at the entrance to lakes to monitor and restrict entry of fishing boats. With community participation, different lakes have been zoned for different uses: a) areas where pirarucu can be fished by local fishers for local subsistence/nutrition only; b) pirarucu breeding grounds, where

habitat is suitable for reproduction and no fishing takes place; and c) areas where pirarucu are fished for sale, both for the domestic (meat) and international (skin) markets. Pirarucu counts take place at the low-water season each year, with monitoring data forwarded to the national agency IBAMA (Brazilian Natural Resources Agency), which then authorizes a lake-specific quota of up to 30% of all adults (>1.5 m length).

The pirarucu management project began in 1999 with the goal of recovering the fish stock, in order to provide food security to the local residents. The project started with only one conservation unit authorized to work with fishing of pirarucu. Since them, the interest of other areas has grown and in 2018, 33 areas were issued with authorizations to catch pirarucu.

Pirarucu provides a variety of products, with the meat, the skin, the scales and the tongue all commercialized. Both meat and skin products from community-managed wild sources are exported to international markets, with the skin being the most important export (see Fig 1). The skin is used for exotic leather products, including shoes, bags and clothing, and exported mainly to the United States. The tanning is carried out by specialized tanneries within Brazil.

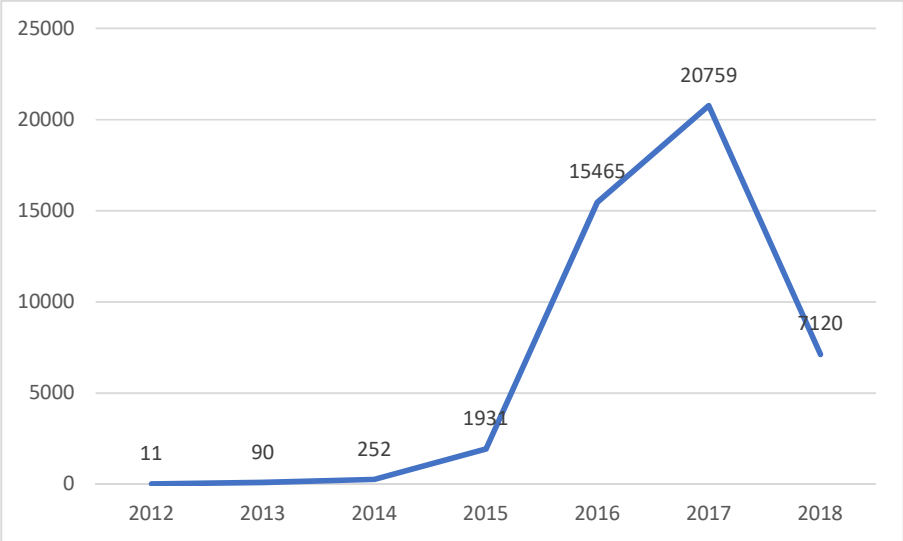

Fig 1. Export volumes of pirarucu leather bags and shoes 2012-2018. Source: IBAMA/2018 Brazilian Institute of Environment and Renewable Natural Resources.

Traditional knowledge and skills are fundamental to this approach – it is in fact made possible by the union of communities' traditional knowledge in counting pirarucu individuals in the lakes, and the scientific research that has validated this counting method.

Women are involved in pirarucu management in terms of collecting and recording biological and biometric data, and handling fish for cleaning and cooling.

Livelihood Benefits

Key livelihood benefits for rural communities from involvement in management and trade of pirarucu are food security and income. These benefits are extremely important to the rural communities that harvest pirarucu, who typically have no or very minimal other opportunities to generate cash income. Food security has been improved through the widespread recovery of pirarucu stocks, and the opening up of avenues to legally harvest them. (Before establishment of community-based management, communities could not legally harvest pirarucu for food.) Trade in pirarucu products

generates critically needed income and provides the main means of the communities to meet their non-food needs, such as medicine and school expenses.

The harvest takes place only in a few months of the year. During the rest of the year, the community members involved are mainly extractivists (including non-timber forest products such as oil seeds and palm fruits), small-scale farmers (e.g. slash and burn cassava), and artisanal fishermen. Family income increases during the months when pirarucu are harvested. The extra amount earned varies according to the quota of each area and the number of people involved in the area. In 2017, it ranged from USD 700 to USD 1,350 per family (adjusting for purchasing power parity[1], this equates to Int$ 1,400 to Int$ 2,700). In 2017, 5010 fishermen, from 3,165 families, and 294 communities, were involved in the management of pirarucu. 11 conservation units, 3 indigenous lands and 11 fishing agreement areas were involved.

Campos-Silva and Peres (2016) estimated the commercial returns to the local communities, in 2015, for 26 lakes set aside for pirarucu management in a particular region of the Jurua River. These lakes are fully protected from fishing, apart from a limited, quota-based pirarucu harvest. The average total fishing revenue from each lake was USD 10,601 (assuming the Total Allowable Catch was fully harvested) with large lakes up to USD 52,093 per year. Locally, this translates into a mean household income of USD 1,046.6 for the average of 14.4 families using each lake. These revenues were increasing as time since the establishment of community-based management increased, reflecting increasing pirarucu populations. Population modeling suggests that on average, lakes would take 7.5 to 8 years to recover to a population of 1,000 animals, which would yield approx. USD 44,491 for the communities managing that lake. Importantly, in contrast to these pirarucu management areas, lakes managed for subsistence fisheries or under open-access conditions provided no commercial benefits to local communities.

This cash income enables private or community-level investments that would otherwise not be possible, such as house refurbishment or purchase of expensive equipment. Pirarucu sales also generate emergency funds, which can be used to meet urgent emergency needs of travel and medical care at urban centers in the case of serious illness or accidents. This emergency funding saves lives, and is not otherwise available from state health services. Further important benefits from community-based management, as reported by fishers themselves, are the strengthening of cultural values and growing “pride” in the community. In contrast to previous revenues from illegal pirarucu sales, which were distributed across the year, legal pirarucu harvest takes place only in the dry season and leads to a lump sum accruing. This enables greater community benefit from expenditures on, for example, community infrastructure. Community-based management has also strengthened traditional knowledge and its passing on to younger generations. Management has also brought dignity to the members of the community, since it allowed them to legally trade the fish with authorization from IBAMA. Community-based management led to more equitable distribution of benefits, as previously illegal catches were dominated by a few highly skilled fishers rather than shared across the community. All these benefits have strengthened community empowerment.

If pirarucu leather exports stopped, communities would return to the poverty level of the 1980s, when there was no legal pirarucu management and trade.

Livelihood benefits could be strengthened by increasing the returns earned by fishers - the average amount received by the fisherman in 2017 was a low price of USD 1.25 per kilo. More Federal and state support and subsidies are necessary to enable the scaling up of this approach more widely. Many communities are unable to meet the Brazilian government sanitary requirements for trade of fish, and lack the relevant processing equipment and infrastructure. Costs of establishing piraracu harvest (of boats, fuel, ice) can be high, and are prohibitive for some communities. Efforts have been

[1] The PPP figure for Brazil for 2017 of 2.01 was used (https://data.worldbank.org/indicator/PA.NUS.PPP?view=map).

made by supportive organisations to enable communities to increase returns by trading the skin directly with international consumers or with the tanneries that turn the skin into leather. For example, one of the largest tanneries in Brazil is now buying pirarucu skin directly from the ASPROC (Association of Rural Producers of Carauari) Fishermen's Association of the Carauari-Amazonas Community.

Conservation Impacts

Community-based management of pirarucu, based on sustainable harvest and trade, is an outstanding conservation success story. Widespread and rapid recoveries of pirarucu have taken place in areas with community management in place (see Fig 2). At Mamirauá, where this approach was pioneered, the pirarucu population increased nine-fold in eight years. Campos-Silva and Peres (2016), reviewing the Juruá River of western Amazonia, found populations increased in lakes managed under the community-based management regime, in contrast to "open-access" lake populations. Comparing the first and last years of management at each lake, population sizes increased by over 200% in the lakes that were protected by communities and subject only to harvest of pirarucu.

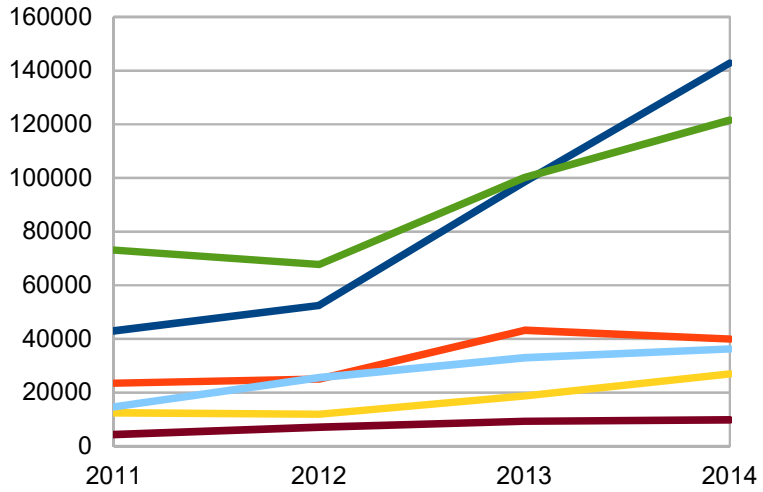

Fig 2. Pirarucu population size in six different community-managed areas of the Solimões River, 2011 to 2014.

The conservation benefits of community-based pirarucu management go well beyond the species itself. Conserving this top predator has knock-on impacts for the health of river ecosystems generally, and has led to increases in biodiversity, including other species of fish that are also used by local communities.

Further, the establishment of the community management programme has led to previously illegal fishers abandoning illegal practices and cooperating with the pirarucu management programme.

Livelihood benefits to indigenous and local communities from use and trade of pirarucu are important elements of this conservation success. The livelihood benefits mean that communities have strong incentives to participate in monitoring and support management and protection measures. Giving

communities a strong and recognized legal role in pirarucu use, management and trade has been key to gaining their support and active involvement in monitoring and enforcement.

Lessons for CITES Implementation: Challenges, Successes and Failures

A key lesson from this experience is that even where a species is seriously depleted by illegal harvest and trade, a community-based, participatory approach involving sustainable trade and local benefits can be much more effective than relying on bans and government enforcement capacity, particularly where government capacity to enforce regulations over vast areas is limited. Decentralization of natural resource management and involvement of highly motivated stakeholders are powerful tools for resource conservation and sustainable management. For pirarucu, local experimentation and leadership initially showed the way, and then the relevant government agency IBAMA has played a key role in supporting and enabling the extension of this approach over large areas.

Challenges remain, including barriers to reaching market hygiene standards for many remote communities, competition in the marketplace from illegally harvested and traded pirarucu, as well as potential competition from the emergence of commercial aquaculture for pirarucu.

Community socio-political organization has been an important element in enabling community-based pirarucu management. In a number of cases the existence of legally recognized sustainable-use protected areas has established a basis of community engagement in conserving and protecting natural resources, and thereby have created enabling conditions for development of community-based pirarucu management.

Sustainable use and wildlife trade can generate income and food security benefits, and underpin inclusion of traditional communities in decision-making processes. This leads to local buy-in and support for rules around fishing, enabling resource conservation and recovery.

Traditional knowledge of indigenous and local resource users can be vital in establishing sound management. In this case, Drawing on fishers' specialized skills, acquired through years of experience in fishing, was key to establishing a monitoring methodology to enable monitoring of the resource and establishment of sustainable quotas.

Key References

Campos-Silva JV & Peres CA (2016) Community-based management induces rapid recovery of a high-value tropical freshwater fishery. *Scientific Reports* 6: 34745.

Castello L, Viana J, Watkins P, Pinedo-Vasquez, M. & Luzadis V A (2009) Lessons from Integrating Fishers of Piraracu in Small-Scale Fisheries Management at the Mamirauá Reserve, Amazon. *Environmental Management* 43(2): 197-209.

Sinovas P, Price B, King E, Hinsley A and Pavitt A (2017). *Wildlife Trade in the Amazon Countries: Analysis of Trade in CITES Listed Species*. Technical report prepared for the Amazon Regional Program (BMZ/DGIS/GIZ). Cambridge, UK, UN Environment - World Conservation Monitoring Centre.

Case study prepared by Claudia Maria Correia de Mello and Sara Quizia Correa Mota, CITES Management Authority of Brazil, and Cristina Isis Buck Silva, Environmental Analyst, Brazil., based on published literature and government records. Edited by Rosie Cooney, IUCN CEESP/SSC Sustainable Use and Livelihoods Specialist Group.