

Fisheries management of paiche "*Arapaima gigas*" in Cocha (lake) El Dorado of the Pacaya Samiria Reserve - Loreto, Peru.

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Abstract

Natural resources are the Nation's heritage. The State promotes with adequate legislation in accordance with the Constitution of Peru the sustainable use of natural resources, the conservation of biological diversity and protected areas, and the sustainable development of the Amazon. The General Law on Fisheries – Decree-Law N° 25977 is a framework legislation established to regulate fisheries activity and promote its sustainable development as a source of food, employment and income. It also aims to ensure the responsible use of aquatic living resources, thus optimizing economic benefits while safeguarding the environment and conserving biodiversity. The Regulation on Fisheries Management in the Peruvian Amazon (RFM) was introduced into this framework with the objectives of setting the foundation for the rational and sustainable use of aquatic living resources; developing the Amazon fisheries in accordance with the Code of Conduct for Responsible Fisheries; safeguarding the ecosystems and biodiversity; and ensuring a dynamic equilibrium between economic growth, encouragement of investment, and conservation of resources. The RFM of the Peruvian Amazon establishes Fisheries Management Programs that ensure a controlled exploitation of species or groups of species in a particular environment, under norms and regulations, monitored periodically and responding to socioeconomic needs. The latter refers to the protection of commercial or subsistence fishing of a fishing community and the conservation of one or several species that sustain these fisheries. In this context, the Management Plan for the *Arapaima gigas* of Cocha El Dorado in the Pacaya Samiria Reserve was approved. The Social Organization of Fishermen and Artisanal Processors Community Fishing Unit Yacu Tayta (CFU Yacu Tayta) extracts experimental quotas of paiche after monitoring, thus guaranteeing the sustainable use and profitability of the extraction of the resource. Through appropriate fishing gear, surveillance and control regarding minimum sizes, the organization contributes to the recovery of the species, and the plan improves the life quality and recognition of the community. Paiche fishing quotas in the Cocha El Dorado area are exclusively given to the CFU Yacu Tayta, with the aim to protect the recovery of the paiche population. Illegal fishermen are involved in paiche fishing, leading to various conflicts with the legal owners of the paiche fishing quotas. The CFU Yacu Tayta have formed control and surveillance committees to fight the presence of illegal fishermen.

1. INTRODUCTION

1.1 Description of the fishery

Paiche, pirarucu or arapaima (*Arapaima gigas*) is a species of osteoglossiform fish in the Arapaimidae family. It is the second-largest freshwater fish in the world. It grows larger than 3 meters (m) in length and weighs up to 250 kilograms (kg). This fish lives in low oxygen waters at certain times of the year; the oxygen absorbed through its gills is consequentially insufficient. The paiche must thus breathe oxygen from the air. In normal circumstances, the animal breathes surface air for a period of 15 minutes, but it can hold up to 40 minutes if it is in danger or is being pursued. Its swim bladder is highly developed, very large and vascularized, with a similar function to a human lung.



Figure 1. Paiche (*Arapaima gigas*).

Source: LEOA – UFMT/Campus Universitário de Rondonópolis.

Paiche (*Arapaima gigas*) is an important species for the Peruvian Amazonian population since it constitutes a source of food and of income through the marketing of its products. Consequently, the species has been subject to intense fishing operations, which have led to a reduced stock. Today, the species is threatened with extinction and is included in the Convention on International Trade of Endangered Species (CITES) Appendix II. In Peru, the presence of paiche is mostly confined to Protected Natural Areas, such as the Pacaya-Samiria National Reserve where it concentrates in Cocha El Dorado.

The fishing of this species is banned permanently in some areas of the Peruvian Amazon and is banned during the reproductive periods in other areas, with the fishing season taking place from March to September of each year. The Pacaya Samiria National Reserve (PSNR) is a protected area located in the Loreto Region of the Peruvian Amazon, with the Marañón River to the north and the Ucayali to the south, and covering an area of 2 080 000 hectares (ha) (20 800 km²) (Figure 2). It is the largest in Peru, and the fourth largest protected area in all of South America. It is also the largest protected area of the Amazon rainforest in South America. It was established as a RAMSAR site in 1986. According to the categories of protected areas of the International Union for Conservation of Nature (IUCN), PSNR is considered a "Protected area of managed resources".

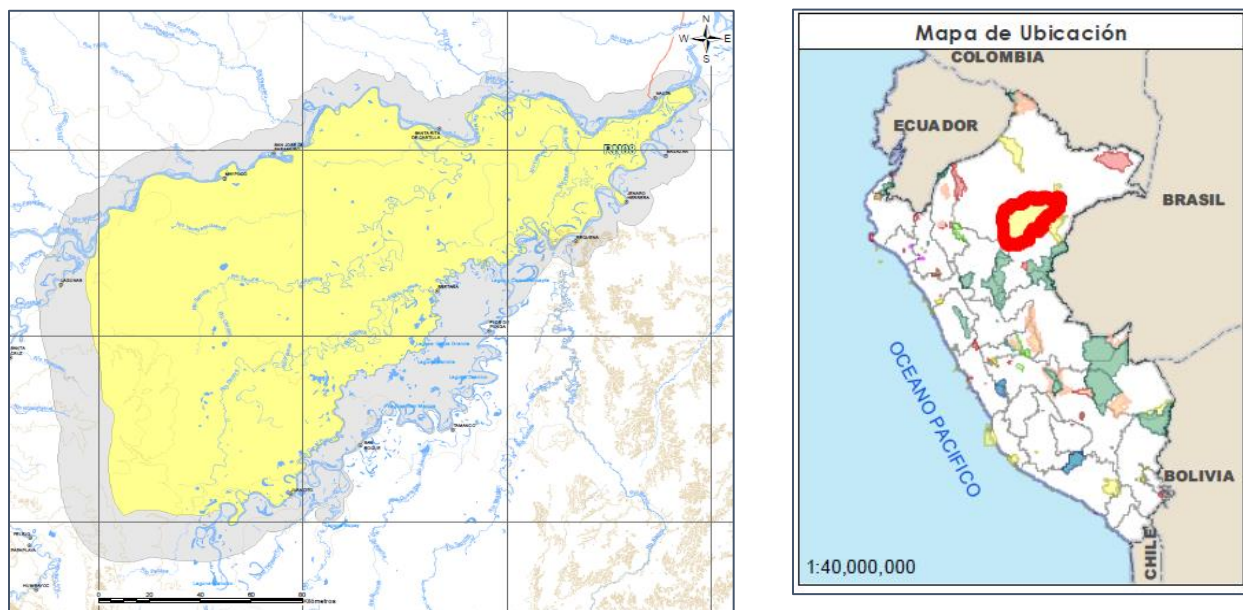


Figure 2. Map of the Pacaya Samiria National Reserve - Loreto, Peru.

Source: Ministerio del Ambiente (MINAM), 2018.

Cocha El Dorado is located to the northeast of the PSNR, in the upper section of the Yanayacu - Pucate basin. It has an estimated area of 462.91 ha and a perimeter of 30 217.09 m (Figure 3). It is located at 9 439 397 N and 574 672 E.

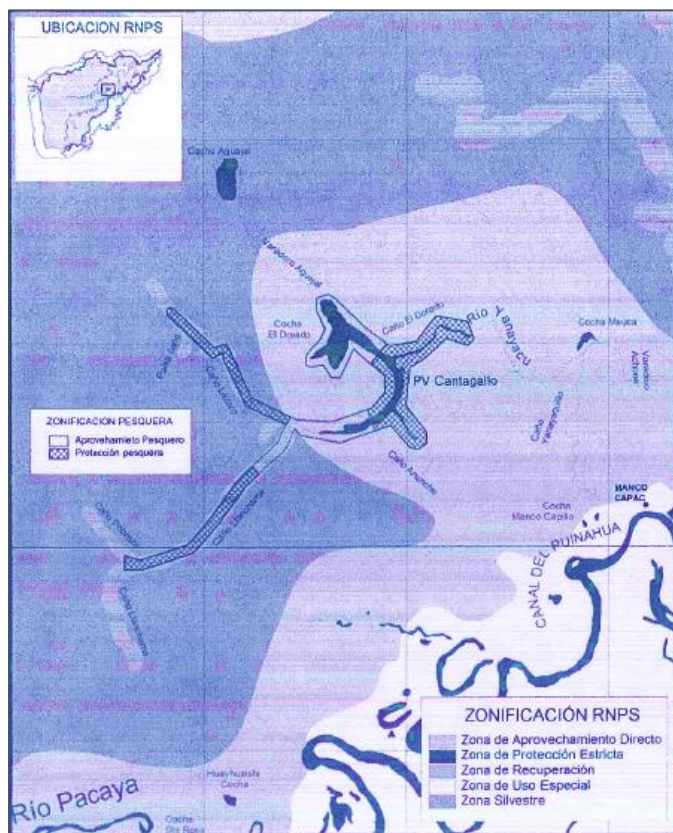


Figure 3. Map of El Dorado Cocha in the Pacaya Samiria National Reserve - Loreto, Peru.

Source: Programa de Manejo Pesquero (PROMAPE) Cocha El Dorado, 2015.

A small stock of merely ten paiche (*Arapaima gigas*) was found in Cocha El Dorado in 1994. This discovery led a group of artisanal fishermen from the Community of Manco Cápac to form the CFU Yacu Tayta to conserve hydrobiological resources for the sustainable use of paiche, with the support of a variety of public and private institutions.

Fishery management plans were established under the RFM of the Peruvian Amazon, among other directives, in order to recover overexploited resources and support their sustainable use –Paiche (*Arapaima gigas*) is the main species.

In this framework, with the Directorial Resolution N°747-2004-GRL / DIREPRO¹, the first Fisheries Management Program of the paiche resource "*Arapaima gigas*" of Cocha El Dorado was approved. This program gave the CFU Yacu Tayta the opportunity to establish experimental quotas for the resource, after monitoring, guaranteeing the sustainable use and profitability of the extraction of the resource. Thanks to appropriate fishing gear and the implementation of surveillance and control regarding minimum sizes, the area saw an improved recovery of the species, a better quality of life, and recognition of the community.

¹ [Dirección](#) Regional del Ministerio de Pesquería (DIREPRO)

Locals in Cocha El Dorado carried out a new census to study some of the new fishing management experiences. The results showed a significant increase in the paiche stock, which reached a population of 703 paiche specimens in 2014. In order to provide stability in the assignment of rights, in the context of the Supreme Decree N° 015-2009-PRODUCE, the RFM of the Peruvian Amazon was updated, with the aim to i) Establish the bases for the rational and sustainable use of hydrobiological resources and development of the Amazonian fishery, in accordance with the principles of the Code of Conduct for Responsible Fisheries; ii) Guarantee the dynamic balance between economic growth, promotion of investments and conservation of resources, including the protection of the environment and the biological diversity; iii) Facilitate the formalization of extractive and processing activities that affect the different fisheries of the Peruvian Amazon, promoting their development through PROMAPE, training, technology transfer and support to social organizations of fishermen and; iv) Contribute to the integral development of fishing as a source of food, employment and income.

Within the framework of PROMAPE of Cocha El Dorado, fishermen of the CFU Yacu Tayta were granted the right to manage and exploit the paiche resource. They established the use of gillnets, particularly gillnets of 12 “inches of mesh opening with thread N° 240 of 180 m of length and 18 m of height” to capture adult specimens with a minimum size of 1.60m. Additionally, they defined an experimental quota of annual catch of 15 percent (20 to 60 specimens per year), subject to the availability and abundance of the species. Fishing is conducted with canoes of 4 to 6 m in length, with 6.5 hp engines that allow the captured specimens to be transported to the Organization’s camp, in order to be processed.



Figure 4. Paiche capture.

Source: Diario el Comercio, 2018

<https://elcomercio.pe/somos/historias/fiesta-paiche-cuida-soberano-rios-amazonicos-fotos-noticia-551829>.



Figure 5. Paiche fishing boats.

Source: Diario el Comercio, 2018

<https://elcomercio.pe/somos/historias/fiesta-paiche-cuida-soberano-rios-amazonicos-fotos-noticia-551829>.

It is important to point out that illegal fishermen are operating in the Cocha El Dorado area and extracting the resource protected by the CFU Yacu Tayta. Within the framework of PROMAPE, the CFU Yacu Tayta have formed Vigilance Committees to protect the paiche resource from illegal fishermen.

Economic contribution and social implications of the fishing activity

Paiche catches are usually brought to the local market. The main product forms are whole fresh (Figure 6) and dried/salted (Figure 7). This is due to the scarce availability of processing and cold storage systems in the fishing areas. In addition, paiche is also produced via aquaculture and sold through exports or national markets.

There are some cases in which paiche is sold to intermediaries who distribute the products to other markets, in Iquitos or Lima. In other cases, the same fishermen vend their product to gourmet restaurants, which provides better economic benefits. However, the demand in this type of marketing is still low.



Figure 6. Fresh whole paiche.

Source: Diario el Comercio, 2018

<https://elcomercio.pe/somos/historias/fiesta-paiche-cuida-soberano-rios-amazonicos-fotos-noticia-551829>.



Figure 7. Dried/salted paiche.

Source: INFOPECA, 2009.

The residents of the reserve have reported that their income has increased since the implementation of this model. Thanks to a greater available stock and larger specimens, it has become easier to fish.

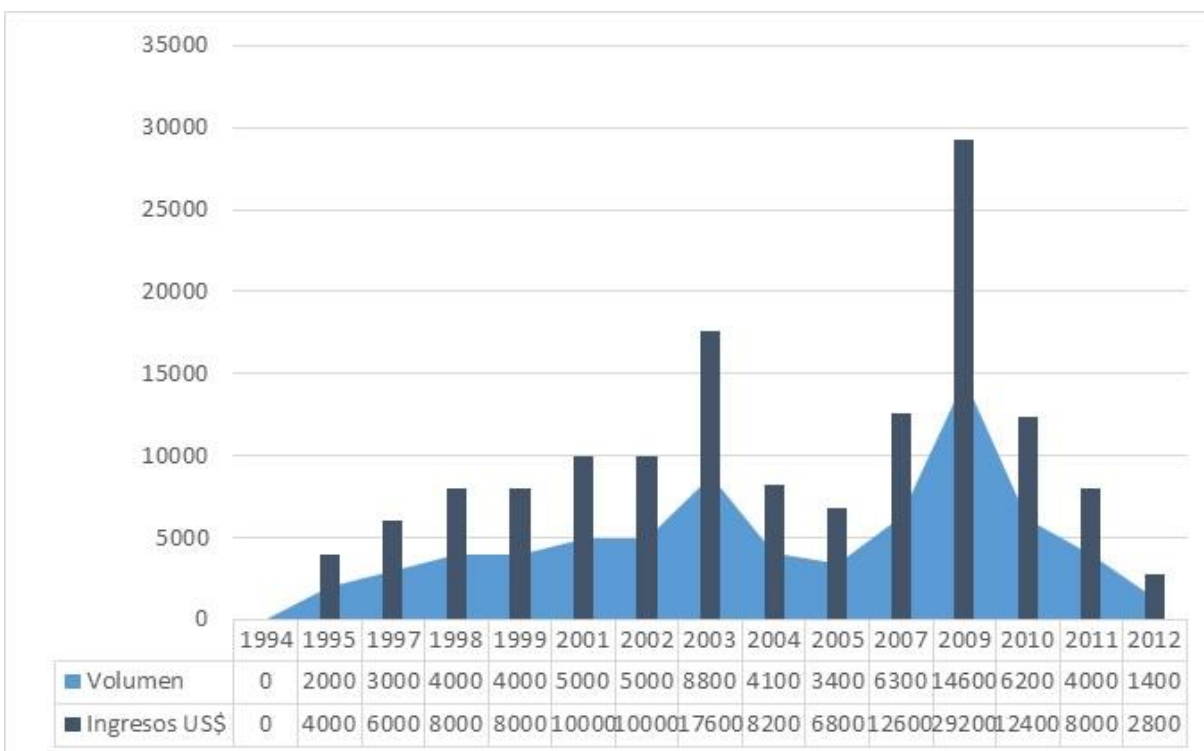


Figure 8. Income from the management of paiche in Cocha El Dorado.

Source: Author's elaboration based on information from the Instituto de Investigaciones de la Amazonía Peruana (IIPA) and PROMAPE 2015.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACH

2.1 Management of the fishery

The main authority managing the fishing activity is the Ministry of Production, which is the fisheries governing body at the national level. The most relevant aspects of fisheries management are presented in the RFM of the Peruvian Amazon, as well as the National Service of Natural Protected Areas (SERNANP), which is the governing entity of the Natural Protected Areas in the country that defines the management and resource use models as well as the areas of economic development. The DIREPRO of Loreto evaluates, approves and supervises the Fishing Management Programs proposed for the management of hydrobiological resources.

It should be noted that organized artisanal fishermen are the ones who suggest the Fisheries Management Program to the DIREPRO Loreto, with the support of scientific and technical entities such as NGOs and research centers. They define the type of hydrobiological resource to manage, the type of administration to be carried out, the objectives and results of the Program, the rights and obligations within the framework of the current regulations, the monitoring and follow-up, the use of the resource, the control and surveillance, as well as the evaluation mechanisms of the Program. This proposal is reviewed and evaluated by the DIREPRO who approves it through a Directorial Resolution. It should be noted that SERNANP also supervises the Management Program.

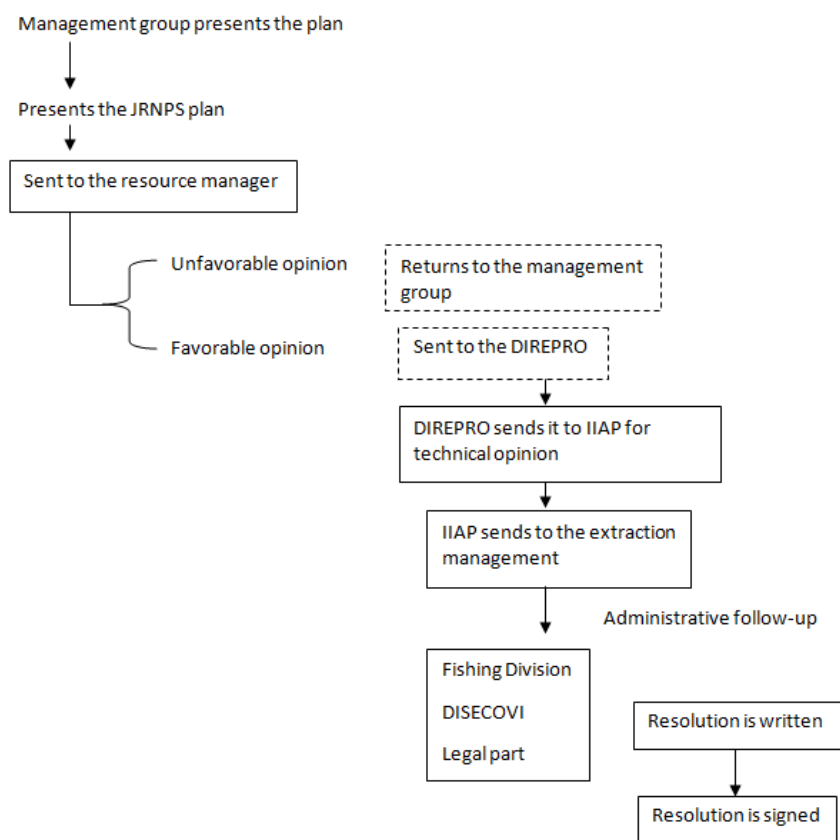


Figure 9. Flow chart for approval by PROMAPE.

Source: ProNaturaleza, 2009.

The management of administrative law is governed by a Fisheries Management Program approved by the Regional Government of Loreto through a Directorial Resolution, within the framework of the RFM of the Peruvian Amazon. The approval of the PROMAPE gives organized artisanal fishermen who presented the Program the right to manage the resource, carry out restocking actions, and define an extraction quota of 15 percent of the adult population (prior to stock assessment and measures of monitoring of stocks). They also have the right to carry out control and surveillance actions in order to ensure the respect of the fishing gear approved for the extraction of paiche, minimum sizes of capture and avoid the intervention of possible illegal fishermen that affect the sustainability of the resource. It should be noted that artisanal fishermen receive technical assistance from universities and research centers such as the IIPA.

2.2 Brief history of former rights-based approaches used in the fishery

The allocation of rights for the use of the paiche in the Reserve areas is done based on the presentation and approval of a PROMAPE for the resource framed in the RFM of the Peruvian Amazon. The allocation of rights and fisheries management would not be possible without this instrument. The PROMAPE is approved for a period of five years and is subject to an assessment of compliance, which focuses on the recovery of stocks, the respect of bans, the respect of minimum sizes and use of fishing gear allowed, compliance in the use and management of the quotas granted, and the sustainability of the operation.

2.3 Rights-based approach: allocation and characteristics

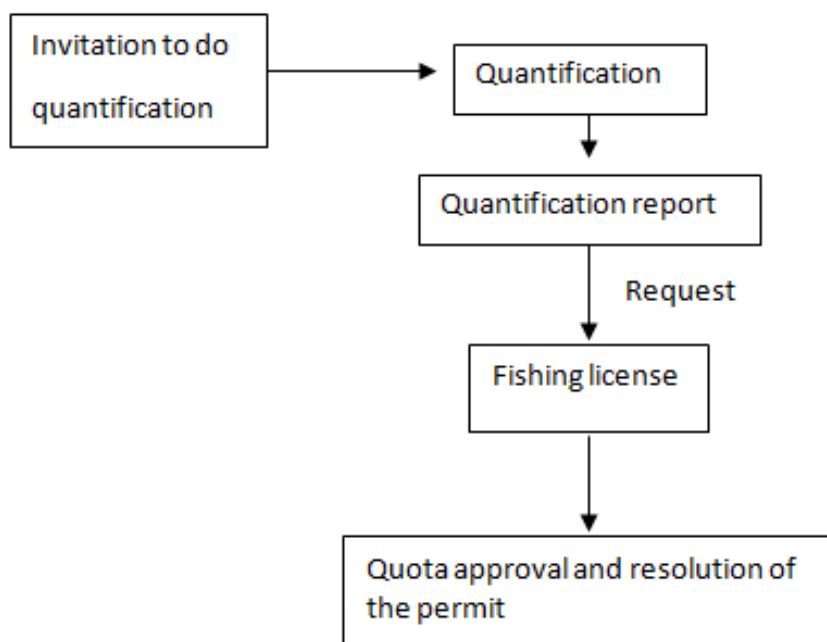


Figure 10. Flow chart to obtain the quota and fishing permit for PROMAPE.

Source: ProNaturaleza, 2009.

This type of program and the assigned quotas are not transferable, as the management and execution are entrusted to a formalized social organization in the area with the support of technical and research entities. The defined and approved quotas are also non-transferable as they are granted to the organization in the framework of PROMAPE. It has to be noted that there are several illegal fishermen in the area, and the legal holders of fishing rights try to defend their rights through control and surveillance.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

Paiche is a species in recovery contained in Appendix II of the CITES Convention and in the case of the management of the Cocha El Dorado. The management is focused on recovering the stock and promoting the sustainable use of adult specimens. Fishing rights are given to the CFU Yacu Tayta, since they are responsible for fisheries management within the El Dorado Cocha on the basis of an approved PROMAPE. These are granted with a legal device (Directorate Resolution) of the DIREPRO of the Regional Government of Loreto. Paiche stocks evaluation is carried out by the artisanal fishermen of the CFU Yacu Tayta with the collaboration of the IIPA and the supervision of the DIREPRO of the Regional Government. This stock evaluation is always carried out in the pre-capture period in order to determine the extraction quotas of adult specimens. These fish are caught based on the quotas approved for each season.

3.2 Economic viability of the fishery

The fishing effort capacity of the artisanal fishermen of the beneficiary Social Organization has improved according to the availability and abundance of adult specimens, but it varies between 2.3 and 11.2 (Figure 11).

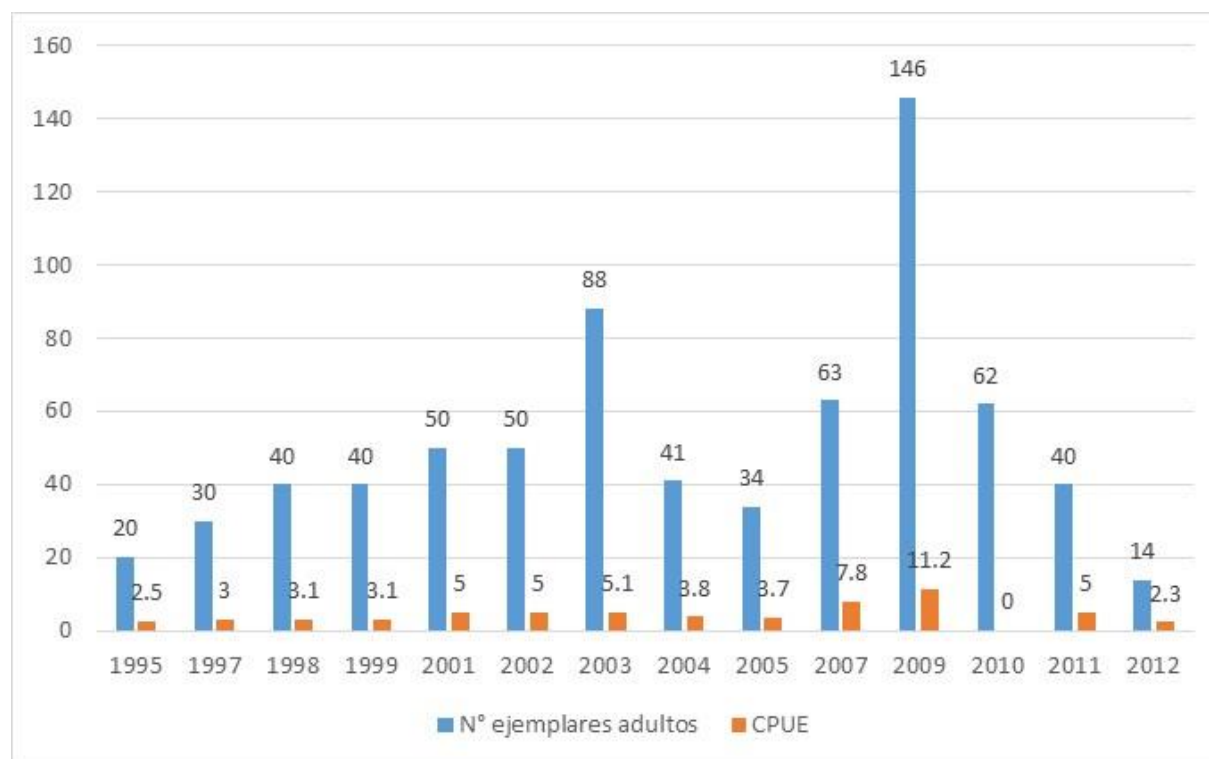


Figure 11. Capture per unit of effort of adult paiche specimens in Cocha El Dorado.

Source: Author's elaboration based on information from IIP and PROMAPE 2015.

These quotas are granted to the community that administers the PROMAPE, benefiting all the artisanal fishermen members (14) with direct employment and improved family income. The percentage of quotas has varied over time, between eight percent and 15 percent in the period 2004 – 2011, based on the abundance of adult specimens (Figure 12).

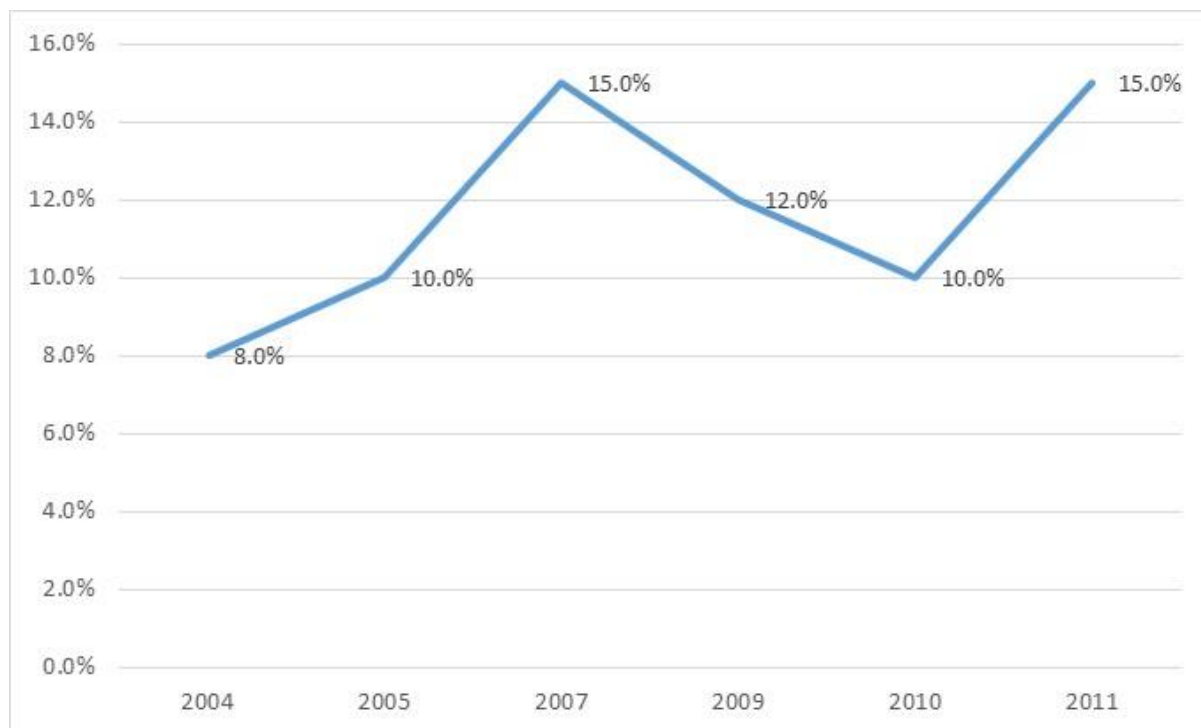


Figure 12. Evolution of the capture quota of adult specimens in Cocha El Dorado.

Source: Author's elaboration based on information from IIAP and PROMAPE 2015.

3.3 Social equality

Quotas improve the regulation of the extraction of paiche in the Pacaya Samiria National Reserve, contributing to sustainability and preventing illegal extraction. They also generate an economic benefit in the local community of Manco Cápac, thus contributing to its development.

In addition, according to a report presented by the IIAP in 2003, 150 inhabitants of the Manco Cápac community directly benefit from the economic income generated by the commercialization of the managed resource each year. This includes 18 fishermen from the CFU Yacu Tayta and 14 fishermen from the CFU Los Tibes, along with their respective families, which represents 35 percent of the total population. It is important to mention that the CFU Los Tibes also began working in the same sector as the Yanayacu-Dorado since 2000, thus becoming direct beneficiaries of the resources of the management area.

In addition, 429 people in the community (90 families) benefit indirectly from these resources because two percent of the income generated by the commercialization of fishery products is allocated to the community as a form of social service depending on their needs (health, education, electrification, management and others). The funds that the CFU Yacu Tayta give to the community are delivered to the Municipal Agency and managed by the Communal Assembly.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

In order to strengthen the sustainable management of the fishery, it is important to include the concept of aquaculture-based fisheries and restocking actions in the PROMAPE planning.

In addition, it is necessary to replicate this experience in other areas of the Amazon with communities and public and private organizations, in order to support management, conservation and exploitation of other fisheries in the global environment.

It is necessary that administrative procedures for the approval of catch quotas become less bureaucratic within the PROMAPE framework because this bureaucracy delays the use of resources during the fishing season.

4.2 Improving fishery sustainability in the future

The replication of the structure of the PROMAPE in other Amazon areas, within the RFM of the Peruvian Amazon, is considered vital. A broader legal framework within the General Fisheries Law of Peru and the National Fisheries and Aquaculture Policy is essential as well. This is an important tool that supports co-management and acknowledges the contribution of fisheries based aquaculture in the sustainability of fisheries.

4.3 Lessons learned

The experience of paiche fisheries and the quotas allocated to the CFU Yacu Tayta have shown that rigorous management and the allocation of fishing rights can readily reverse threats to the survival of a species. This is only possible if national laws, regional administrations, Non-Governmental Organizations and fishermen work together to implement sustainable fisheries. Clear rules and user rights are the basis for any fisheries management. The high prices of paiche products have attracted illegal fishing in the area. As a consequence, surveillance groups by legitimate fishermen were created to enforce the existing rights.

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