

ORIGINAL

Analysis of the distribution and size of aquaculture in Peru: evaluation of species, areas and types of law

Análisis de la distribución y dimensión de la acuicultura en el Perú: evaluación de especies, áreas y tipos de derecho

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ABSTRACT

Aquaculture in Perú has experienced significant growth in recent decades, becoming a key activity in both the national and local economies. This study aims to analyze the distribution and scale of aquaculture activities in the country, evaluating the cultivated species, allocated areas, and the types of rights (AREL, AMYPE, and AMYGE) granted across various regions. A structured database was used to identify major geographic trends, predominant species, and differences in allocated areas based on the type of aquaculture development. The results show that the Peruvian Amazon concentrates the majority of aquaculture activity, particularly in native species such as Paiche (*Arapaima gigas*) and Boquichico (*Prochilodus nigricans*), while coastal regions specialize in high-value commercial species such as White Shrimp (*Litopenaeus vannamei*). Additionally, the analysis revealed that limited resource aquaculture (AREL) predominates in rural communities, while small and micro-enterprises (AMYPE) are playing an increasing role in the sector. This study concludes that strengthening public policies, promoting technological innovation, and providing training are essential for ensuring the sustainability and competitiveness of Peru's aquaculture sector.

Keywords: aquaculture; limited resources; small and micro-enterprises; aquaculture species; geographic distribution; Perú.

RESUMEN

La acuicultura en el Perú ha experimentado un crecimiento significativo en las últimas décadas, consolidándose como una actividad clave en la economía nacional y local. Este estudio tiene como objetivo analizar la distribución y dimensión de la actividad acuícola en el país, evaluando las especies cultivadas, las áreas asignadas y los tipos de derecho (AREL, AMYPE y AMYGE) otorgados en diferentes regiones. Se utilizó una base de datos estructurada para identificar las principales tendencias geográficas, así como las especies predominantes y las diferencias en las áreas asignadas según el tipo de desarrollo acuícola. Los resultados muestran que la Amazonía peruana concentra la mayor actividad acuícola, especialmente en especies autóctonas como el Paiche (*Arapaima gigas*) y el Boquichico (*Prochilodus nigricans*), mientras que las regiones costeras destacan por la producción de especies de alto valor comercial como el Langostino (*Litopenaeus vannamei*). Además, el análisis reveló que la acuicultura de recursos limitados (AREL) predomina en las comunidades rurales, mientras que las micro y pequeñas empresas (AMYPE) juegan un papel creciente en el sector. Este estudio concluye que el fortalecimiento de las políticas públicas, la innovación tecnológica y la capacitación son fundamentales para garantizar la sostenibilidad y competitividad del sector acuícola en el Perú.

Palabras clave: acuicultura; recursos limitados; micro y pequeña empresa; especies acuícolas; distribución geográfica; Perú.

INTRODUCTION

Aquaculture in Peru is a strategic economic activity in the aquaculture or fishing sector, with a significant impact on the local and national economy, playing a fundamental role in the food supply, job creation, and the economic development of regions with water potential (FAO, 2022). In recent decades, the growth of this activity has been driven both by domestic demand and by expansion into international markets, consolidating itself as a sustainable alternative to the overexploitation of traditional fishing resources (PRODUCE, 2020). According to Supreme Decree No. 015-2024-PRODUCE, aquaculture in the country is classified into three main productive categories: Aquaculture of Limited Resources (AREL), Aquaculture of Micro and Small Enterprises (AMYPE), and Aquaculture of Medium and Large Enterprises (AMYGE). Natural or legal persons mainly carry out AREL with an annual production of less than 10 gross tons. In comparison, AMYPE is aimed at smaller companies with annual production not exceeding 150 gross tons. In the case of bivalve mollusks of the Pectinidae family, annual production is up to 1,210 gross tons. Finally, AMYGE refers to companies with an annual production of more than 150 tons (PRODUCE, 2024). These categories reflect the diversity and structure of the aquaculture sector in Peru, allowing for more specific regulations adapted to the characteristics and capacities of the different actors in the industry.

At the local level, aquaculture has become an economic mainstay for rural communities, especially in the Amazon and the high Andean areas, where aquaculture of limited resources (AREL) and aquaculture of micro and small enterprises (AMYPE) have a predominant share (IMARPE, 2021). This type of production, generally on a small scale, allows producers to access stable economic income and improve their living conditions, reducing poverty and promoting food security (FAO, 2020; Guélac-Gómez et al., 2019).

The geographical variability of Peru, characterized by a diversity of climates and water resources, has influenced the distribution and development of aquaculture activity. The Amazon region, with its vast network of freshwater bodies, has encouraged the cultivation of native species such as the Paiche (*Arapaima gigas*), Boquichico (*Prochilodus nigricans*), Paco (*Piaractus brachyuros*) and Gamitana (*Colossoma macropomum*), which dominate production in departments such as Loreto, San Martín and Ucayali (PRODUCE, 2021; Quesquén-Fernández et al., 2022). On the other hand, coastal regions such as Piura, Ica and Tumbes concentrate species of high commercial value, among which the Fan Shell (*Argopecten purpuratus*) and the Prawn (*Litopenaeus vannamei*) stand out, whose production is mainly oriented towards export (Baltazar Guerrero et al., 2015), in the case of the Peruvian highlands, aquaculture activity is concentrated primarily in the production of Trout (*Oncorhynchus mykiss*) in regions such as Junín, Cajamarca and Huánuco, where the climatic conditions and access to water sources favor this crop (PRODUCE, 2021; Quesquén-Fernández et al., 2022). Although the areas assigned are smaller in comparison with the Amazon and the coasts, aquaculture in the highlands has shown sustained growth, highlighting the region's potential to produce cold-water species that supply the domestic market and, in some cases, small exports (Baltazar Guerrero et al., 2015).

However, the sector faces significant challenges related to infrastructure, technical training, and access to innovative technologies, especially in rural areas where small-scale producers predominate (Guélac-Gómez et al., 2019). Added to this is the need to strengthen public policies and regulatory frameworks that govern access to and use of aquaculture rights, ensuring the sector's sustainability and competitiveness (PRODUCE, 2021).

This study aims to analyze the distribution and dimension of aquaculture in Peru, focusing on evaluating the species cultivated, the areas assigned, and the types of rights (AREL, AMYPE, and AMYGE). It also identifies regional trends and the determining factors that condition the sector's development, emphasizing the role of micro and small enterprises and their contribution to the country's sustainable economic growth.

METHOD

This is a descriptive and exploratory study. The main objective was to analyze the distribution and dimension of aquaculture in Peru, specifically evaluating the species cultivated, the areas assigned, and the types of rights (AREL, AMYPE, and AMYGE) granted in different regions. The information used for the analysis comes from a structured database provided by the Ministry of Production (PRODUCE), which contains detailed records on aquaculture activities at the national level, categorized according to the type of right and the species cultivated.

The database used in this study includes information on aquaculture concessions and authorizations registered throughout the Peruvian territory. The data covers a range of aquaculture species, from native fish such as the Paiche (*Arapaima gigas*) to high-value commercial species such as the Prawn (*Litopenaeus vannamei*), the Scallop (*Argopecten purpuratus*) and the Trout (*Oncorhynchus mykiss*). The information is classified by geographical region, type of right (AREL, AMYPE, and AMYGE), and total area (hectares) authorized for each crop.

The information was extracted from official records provided by PRODUCE and other regulatory entities related to aquaculture in Peru. The data was organized in a table with the following key columns: Species, Department, Crop, Type of Right, Development, Number of Rights, and Area (hectares). The records were analyzed according

to the productive categories defined in Supreme Decree N° 015-2024-PRODUCE and segmented according to the type of aquaculture right (AREL, AMYPE, AMYGE). The analysis focused on identifying geographical trends and the distribution of aquaculture species at the national level. To this end, a descriptive approach was used to categorize the regions with the highest aquaculture activity and their predominant species. In addition, the areas assigned to each type of right were evaluated, identifying patterns according to the type of aquaculture development and the species cultivated.

Comparative analyses were carried out between the different categories of rights (AREL, AMYPE, AMYGE) to assess the relative participation of micro and small enterprises, large enterprises, and rural communities in the Peruvian aquaculture sector. The analysis of geographical variability was based on differences in the distribution of cultivation areas and the number of rights granted in each region, emphasizing the Amazonian and coastal regions.

Microsoft Excel and Power BI software were used to organize and filter information for data processing and analysis. Additionally, statistical analysis and data visualization tools such as R were used, which allowed the creation of graphs and thematic maps to illustrate the geographical distribution of aquaculture activities and the predominant species. It should be noted that the database used is limited to the official information available up to the cut-off date of the records, which could imply a lack of updated data in some regions or the omission of specific aquaculture projects not formally registered.

RESULTS

An analysis of the distribution and scale of aquaculture in Peru revealed that the Peruvian Amazon is the region with the highest concentration of aquaculture activities, especially in the regions of Loreto, San Martín, and Ucayali, which dominate in terms of the number of rights granted and authorized areas. In these areas, aquaculture focuses mainly on native species, such as the paiche (*Arapaima gigas*), boquichico (*Prochilodus nigricans*), gamitana (*Colossoma macropomum*) and paco (*Piaractus brachipomus*). These species are highly sought after on both the national and international markets. With its vast network of freshwater bodies, the Amazon continues to be a key location for aquaculture production.

On the other hand, the coastal regions of Piura, Ica, and Tumbes stand out for their production of high-value commercial species such as the Pacific white shrimp (*Litopenaeus vannamei*) and the fan mussel (*Argopecten purpuratus*). These species are mainly oriented towards export, playing an essential role in the country's fishing exports and strengthening the national economy, especially in international markets.

The Peruvian highlands present a different pattern in terms of aquaculture, with activities focused on species such as trout (*Oncorhynchus mykiss*), which is mainly cultivated in the regions of Junín, Cajamarca and Huánuco. In these areas, access to water resources and specific climatic conditions favor the production of trout, which is consumed both in the domestic market and in small exports. The areas allocated for trout in the highlands, although less extensive than in the Amazon or the coasts, show sustained growth in the number of rights, highlighting the potential of aquaculture in the Andes.

Figure 1

Number of Rights Granted by Region

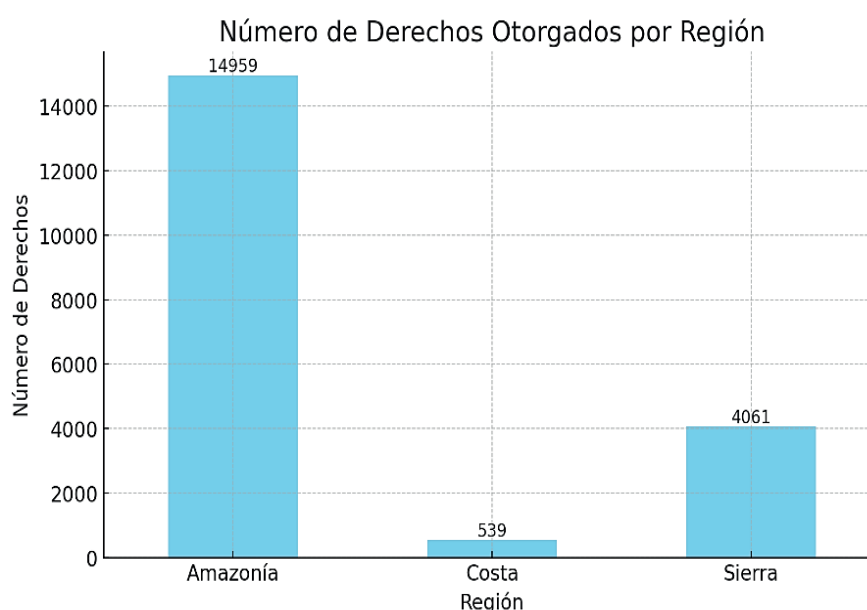
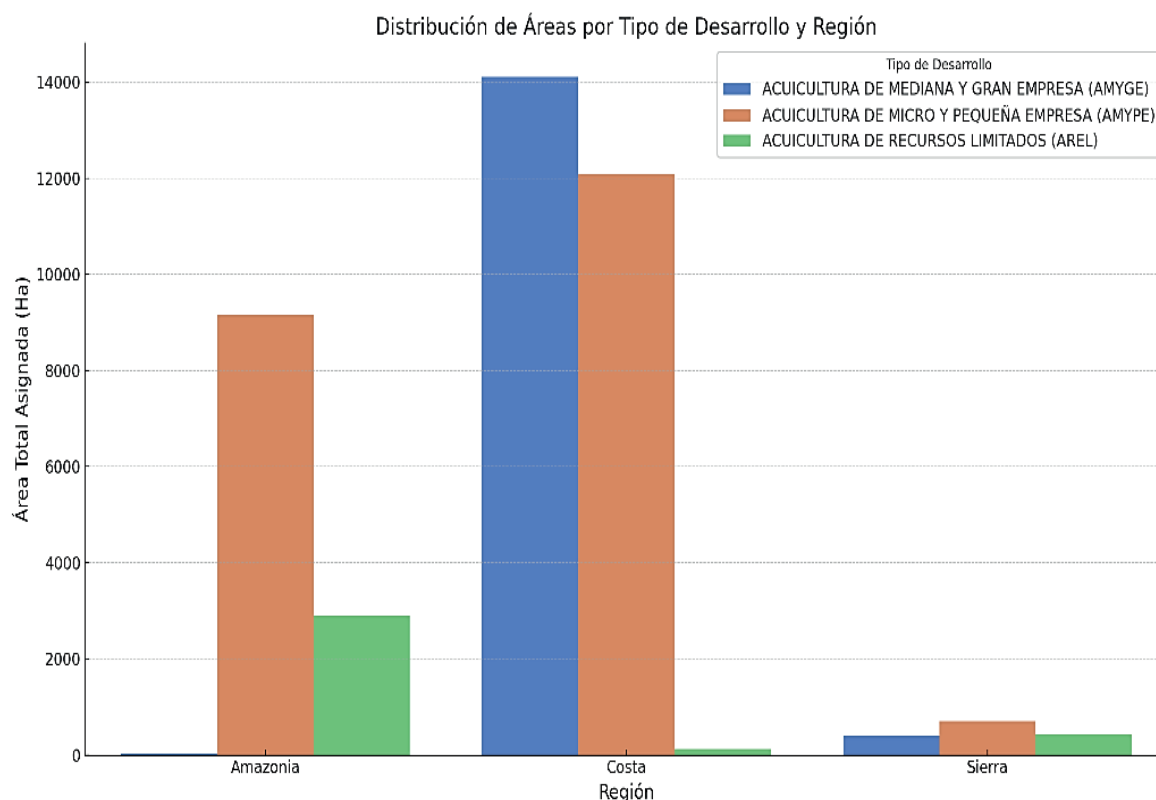


Figure 2
Distribution of Areas by Type and Region



In terms of the types of rights, Limited Resource Aquaculture (AREL) continues to be predominant in the rural communities of the Amazon and the highlands. Micro and Small Enterprise Aquaculture (AMYPE), on the other hand, shows notable growth, especially in the Amazon regions and in the highlands, which reflects the role of small businesses as engines of local economic development.

DISCUSSION

The results show that aquaculture in Peru is unevenly distributed depending on the geographical and climatic characteristics of the different regions. The Peruvian Amazon is still the area with the most aquaculture activity due to abundant water resources and the demand for native species of high commercial value, such as the Paiche. This activity is strengthened by combining favorable local infrastructure and government support through policies promoting aquaculture.

On the other hand, the coastal regions, especially Piura, Ica, and Tumbes, focus on producing high-value species for export. Due to their proximity to ports and export infrastructure, these regions have a significant advantage in terms of access to international markets. Specialization in prawns and scallops is strategic for the national economy, standing out as key sectors for foreign trade.

The Peruvian highlands, although with more modest production in volume and extension of the areas assigned, show significant potential, especially in trout production. The regions of Junín, Cajamarca, and Huánuco have grown in terms of the areas dedicated to this crop due to water availability and the climatic conditions that favor its production. The presence of small aquaculture companies in these areas has a direct impact on the rural economy, improving the income of local communities and providing quality products for the domestic market.

Micro and Small Enterprise Aquaculture (AMYPE) has shown significant growth throughout the country, especially in the Amazon and the highlands, reflecting a trend towards a more diversified aquaculture sector that is more accessible to small producers. The growing participation of these actors highlights the fundamental role of small-scale aquaculture in reducing poverty and improving food security, especially in rural areas far from urban centers. Analysis of the types of rights shows that AREL is still the predominant modality in rural areas, which highlights the limited capacity of small producers to access larger areas of cultivation. However, AMYPE is gaining prominence, highlighting the importance of supporting the expansion of these companies through public policies that facilitate access to resources and technologies.

Figure 3
Distribution of the Most Produced Species by Region

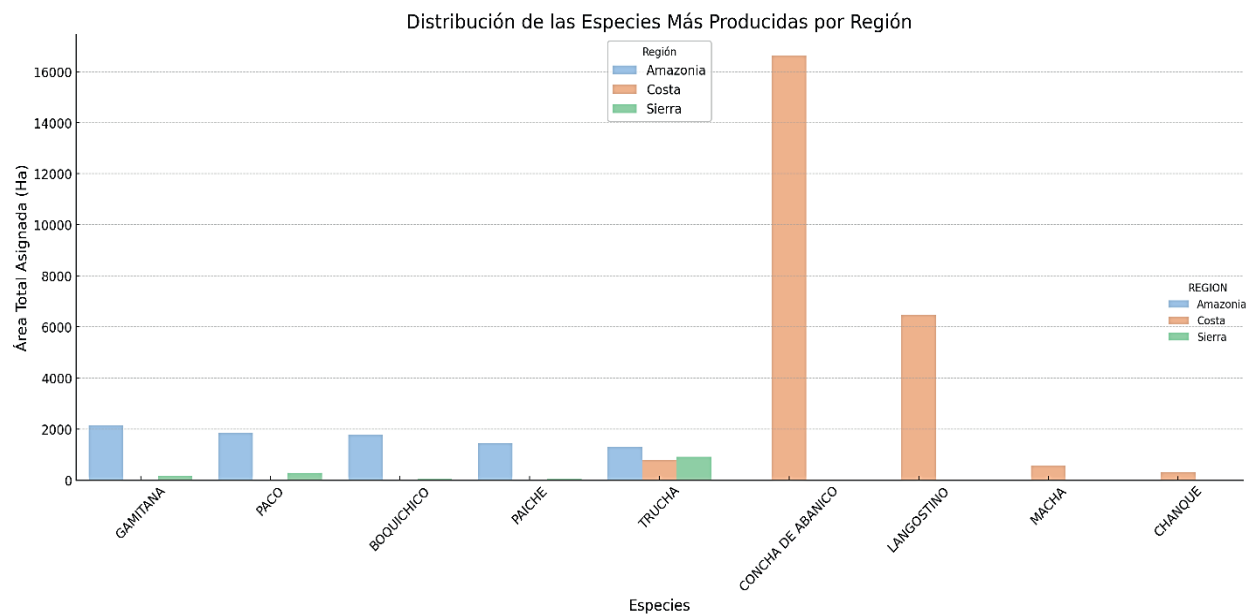
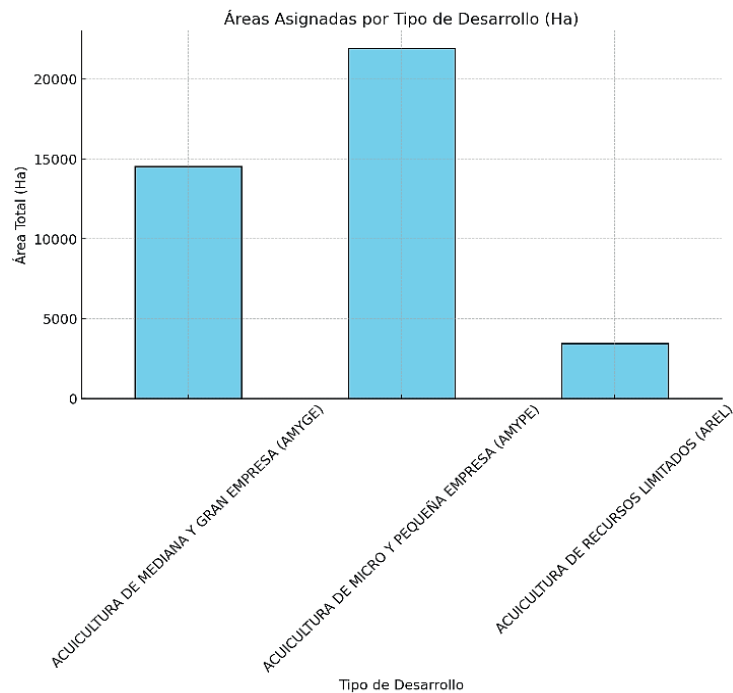


Figure 4
Areas Assigned by Type of Development (Ha)



CONCLUSIONS

Geographical concentration: Aquaculture in Peru is unevenly distributed, with a high concentration in the Amazon, followed by the coastal regions and the highland areas. Each region has its own characteristics and production approaches, reflecting the diversity of aquaculture activity in the country.

Predominant species: In the Amazon and the highlands, native species such as Paiche and Trout dominate production. Meanwhile, Concha de Abanico and Langostino dominate the coast, especially in export-oriented regions.

Types of rights and growth: Micro and Small Enterprise Aquaculture (MSEA) is showing notable growth, highlighting the importance of small companies in the country’s aquaculture economy. Concessions to medium and large companies are limited, concentrating on high-value species.

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CONFLICT OF INTEREST

None.

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