

ORIGINAL ARTICLE

Socioeconomic impact of COVID-19 on Peruvian amazon aquaculture: a survey to fish farmers of the San Martín region

Impacto socioeconómico del COVID-19 en la acuicultura amazónica peruana: una encuesta a los piscicultores de la región de San Martín

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Abstract

The pandemic produced by COVID-19, is affecting all sectors worldwide. Aquaculture and fishing are not the exception. The measures taken by governments in order to dissipate contagions prevent supporting the economy. Faced with this situation, governments and state entities are taking measures to cushion and strengthen companies. However, to make correct decisions regarding aid, it is necessary to diagnose the state of the productive sectors in order to carry out interventions and manage solutions to priority problems. The objective of the present study was to establish information on the aquaculture production units in the San Martín region, which enables the aquaculture sector to be managed efficiently, promoting efforts and public interventions in the region. The results show that more than 90% of the aquaculture producers in the San Martín region are affected, mainly by logistical difficulties in the delivery of supplies, which have stopped the operation of approximately 18% of fish production. During the COVID-19 dormancy period, aquaculturists implemented some biosecurity measures, mainly handwashing, but it is necessary to establish protocols for good aquaculture production practices to strengthen health aspects that prevent the spread of the disease.

Keywords: aquaculture, amazon, covid-19, Peru, socioeconomic

Resumen

La pandemia producida por COVID-19, está afectando a todos los sectores a nivel mundial. La acuicultura y la pesca no son la excepción. Las medidas tomadas por los gobiernos para disipar los contagios impiden apoyar la economía. Ante esta situación, gobiernos y entidades estatales están tomando medidas para amortiguar y fortalecer a las empresas. Sin embargo, para tomar decisiones acertadas en materia de ayudas, es necesario diagnosticar el estado de los sectores productivos para realizar intervenciones y gestionar soluciones a problemas prioritarios. El objetivo del presente estudio fue establecer información sobre las unidades de producción acuícola de la región San Martín, que permita gestionar de manera eficiente el sector acuícola, promoviendo esfuerzos e intervenciones públicas en la región. Los resultados muestran que más del 90% de los productores acuícolas de la región de San Martín se ven afectados, principalmente por dificultades logísticas en la entrega de insumos, que han paralizado la operación de aproximadamente el 18% de la producción pesquera. Durante el período de latencia del COVID-19, los acuicultores implementaron algunas medidas de bioseguridad, principalmente el lavado de manos, pero es necesario establecer protocolos de buenas prácticas de producción acuícola para fortalecer aspectos de salud que eviten la propagación de la enfermedad.

Palabras clave: acuicultura, amazonia, covid-19, Perú, socioeconómico

Introduction

COVID-19 is an infectious disease caused by a recently discovered coronavirus that has been spreading around different countries. The World Health Organization (WHO) has classified, on March 11, 2020, the COVID-19 outbreak as a pandemic, having spread in more than one hundred countries of the world simultaneously (WHO, 2020b).

Globally, the COVID-19 pandemic has generated a public health crisis and threatens the economy, due to measures taken to contain the infection rate and extensive restrictions on economic activities (Zhang et al., 2020). The economic impact of these measures is not precisely known, but the effects are expected to be in the medium and long term. The world economy may contract 3% in 2020, worse than during the 2008-2009 financial crisis (IMF, 2020).

In China, strict mitigation policies were adopted since January 2020 and the economic reopening was in March. The measures implemented in China showed economic losses in the first quarter of 2020, China's national GDP fell by 6.8% (NBS, 2020). In Hubei province, focus of the epidemic, GDP decreased 39.2% (Brodzicki, 2020). The restrictions also affected the agricultural and livestock sector, surveys indicate negative impacts on production chains. During this period, agricultural companies faced challenges in major logistic activities, especially in shortages of agricultural inputs, workforce, balanced feed and delivery problems (Martin, 2020). 60% of the companies surveyed mention lack of materials, this disrupts the livestock production sector that decreased 10% due to the combined effects of COVID-19 and African swine fever (Zhang et al., 2020).

The global collapse on the demand for hotels and restaurants has seen prices of agricultural products fall by 20% (Bhosale, 2020). Isolation and social distancing measures make it difficult to inspect and deliver products. This will have pronounced implications for perishable products such as animal protein and vegetables (Nicola et al., 2020). In addition to this, the demand for food has decreased, due to the uncertainty and the reduction of people's purchasing power, this decrease is initially slight, but it may worsen as the pandemic continues, since the loss of employment and reduction of income will increase (Siche, 2020). This low demand for food and restaurants, combined with labor, processing and storage capacity restrictions, has led to rule out mass production (Stephens et al., 2020).

For aquaculture and fishing, these conditions are not the exception; the aquaculture sector has been negatively impacted as a consequence of the COVID-19 pandemic. Senten et al. (2020) surveyed a total of 652 members of the aquaculture sector in the U.S., revealing that 90% of respondents indicated being affected and some of the impacts were caused by the cancellation of orders and contracts with private companies and government entities, 80% and 9% respectively. Losses from sales can range between \$10,000 and \$15 million depending on production systems. Layoffs of personnel were seen in 33% of the companies and 26% report that they will have to reduce personnel in the coming months. Consumer demand for products of aquatic origin has decreased by 30% in most of the states in the interior and northeast of the U.S., although there are alternative ways to deliver seafood (takeaway) that have increased their participation in the chain (White et al., 2020).

The distribution of high impact aquaculture species such as tilapia has been modified, and tilapia produced in China is being shipped to the U.S., with a 50% drop in exports of the product to other countries in April 2020, especially developing countries. Curfews do not allow catches at night, reducing fishing and aquaculture activity for international and local businesses in different countries (Love et al., 2020). The

aquaculture and fisheries sector is forecast to decline 12% and global marketing channels are being affected (Mobsby et al., 2020). In South America the pandemic has also been affecting the sector of production of aquatic organisms, in Colombia, for example, sales during Easter decreased, reflecting the commercial prohibitions in supply centers and the restriction on buyers exiting their houses (El Tiempo, 2020). The impact will be evident in the future labor market for fish farming. In Brazil the pandemic interfered with the aquaculture work routine, however the Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), designed a protocol for work in the fish farming sector (de Lima et al., 2020). However, social distancing reduces the possibility of carrying out work normally and this affects the supply of products of aquatic origin, demand according to surveys has reduced 75%, specifically due to the prohibition of commercialization in fairs and supply markets (Amorim Reis-Filho & Quinto, 2020).

Although retail food companies such as supermarkets and grocery stores are considered essential and continue to operate, the measures taken to contain the COVID-19 outbreak have created an environment in which food may be more difficult to obtain. Specifically, different activities necessary to supply fish and fishery products from the producer to the final consumer are being indirectly affected by the pandemic, due to new sanitary measures; changes in consumer demand, market access or logistical problems related to transportation and border restrictions (FAO, 2020b). This, in turn, has a detrimental effect on the livelihoods of aquaculturists, as well as on the food security and nutrition of the populations, that rely heavily on fish for animal protein and essential micronutrients (Senten et al., 2020).

To counteract the adverse effects of the situation generated by COVID-19, it is necessary for each country to generate instant relief measures and implement them in medium and long-term, and in a manner tailored to each region, to balance the economy (Nicola et al., 2020). Given this, Europe has responded with 1.7 trillion Euros to dampen the negative impact on the economy (Garside, 2020). In the UK they announced £20 billion emergency credit guarantee packages for businesses (GOV.UK, 2020). The Bank of England has reduced interest rates to 0.1% (Bank of England, 2020). Different aids were announced in the U.S., among which are aids of \$14 billion for farmers (Nicola et al., 2020). Before making the definition of public policies to support the different sectors, the state and situation they are in must be clear, identifying the main threats and risks that producers and entrepreneurs present, in order to directly strengthen the weakest points and address specific problems that require resolution.

In this framework, the Peruvian Government, through the Ministry of Health, confirmed the first case of coronavirus dated March 6, 2020 and with Supreme Decree No. 008-2020-SA declared National Health Emergency for a period of ninety (90) calendar days, currently it was extended for 90 more days, and prevention and control

measures were established to prevent the spread of COVID-19. On March 15, 2020, a State of National Emergency was declared for a period of fifteen (15) calendar days, and mandatory social isolation (quarantine) was ordered, due to the serious circumstances that affect the lives in the Nation as a result of the outbreak of COVID-19. However, due to the situation of high contagion rates, social isolation was extended until July 31, 2020, mandatory for regions such as Arequipa, Ica, Junín, Huánuco, Madre de Dios, Ancash and San Martín.

This last region, San Martín, is located in the northeast of Peru and is characterized by its Amazonian territory, in which different economic activities are carried out, one of them being aquaculture. Here this activity has undergone notable growth compared to other regions of the Amazon in the last decade, with the breeding of introduced species such as *Oreochromis niloticus* (tilapia), *Macrobrachium rosenbergii* (Malaysian giant shrimp) and *Cyprinus carpio* (carpa), and native species such as *Colossoma macropomum* (gamitana), *Piaractus brachypomus* (paco) and *Arapaima gigas* (paiche) (PRODUCE, 2017; PRODUCE & GRSM, 2014).

The current context of the pandemic generated the need to provide honest information on the aquaculture production units in the San Martín region, which enables the aquaculture sector to be managed efficiently, promoting public interventions in the region. For this reason, the Instituto Tecnológico de la Producción (ITP), through the CITEacuícola Ahuashiyacu, the Regional Government of San Martín, represented by the Regional Directorate of Production (DIREPRO) of San Martín; and the support of the National Fund for Fisheries Development (FONDEPES), San Martín office, agreed to optimize human resources, collect information and adopt support measures for the sector.

Material and methods

The data of this study was collected through a survey applied in person and remotely. The questionnaire focused on information on the production and production unit, measures dictated by the national government for biosecurity in the face of the pandemic, credit situation and the perspective of the producer on support from the national and regional government.

The defined geographical scope was the total of the ten provinces of the San Martín Region, based on the estimated percentages of fish farms authorized by each province. The period of application of the survey, in which information was gathered, was between March 30 and April 5, 2020. The participation of producers, to provide information, was voluntary, without coercion or financial incentive.

The sample size was calculated with the formula to estimate a proportion in a population, through the WinEpi 2.0 program (Blas et al., 2013), with a confidence level of 99%, error of 10%, a close proportion 50% and based on a global population of 694 fish farmers registered by the DIREPRO database as of December 2019. The official sample was 244 surveys with complete answers. Table 1 shows the key characteristics of the sample.

Table 1*Sample description*

Characteristics	Percentage
Distribution by provinces	
Bellavista	6.56
El Dorado	3.28
Huallaga	4.51
Lamas	10.25
Mariscal Cáceres	9.02
Moyobamba	13.93
Picota	7.38
Rioja	13.11
San Martín	22.13
Tocache	9.84
Status of formalization at DIREPRO	
Formalized	54.10
Not formalized	45.90

Abbreviations: DIREPRO, Dirección Regional de la Producción. (N=244)

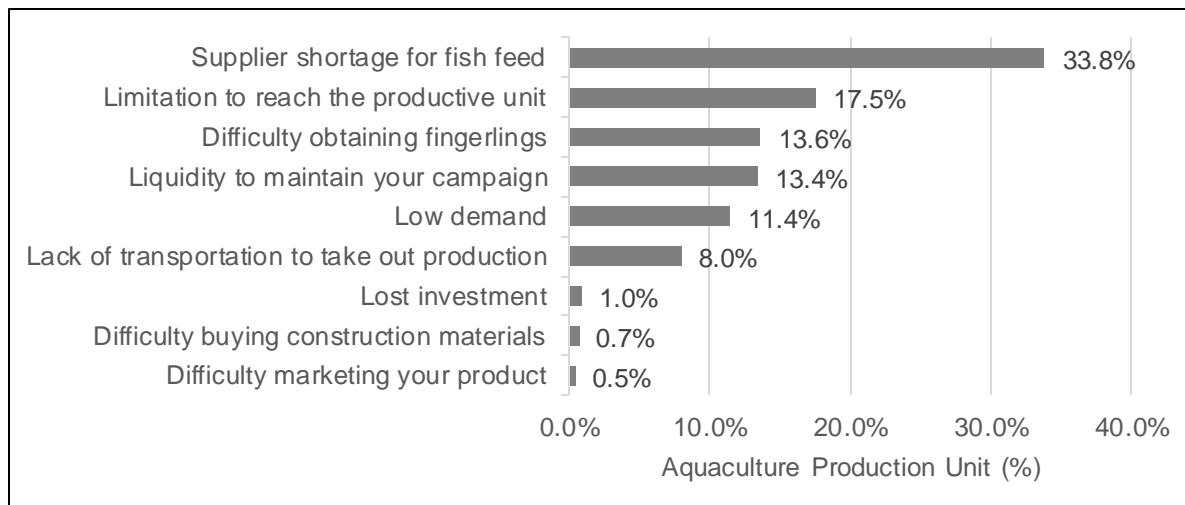
Results

Situation against the state of emergency

Of the total of 244 aquaculture production units surveyed in this study, 98% indicated that they are affected by the state of emergency. Among the main reasons why they are affected is the shortage of fingerlings and feed, as well as the limitation to reach their productive units (Figure 1).

Figure 1

Distribution of the limitations presented by the aquaculture production units of the San Martín region, during the state of emergency (n = 238)

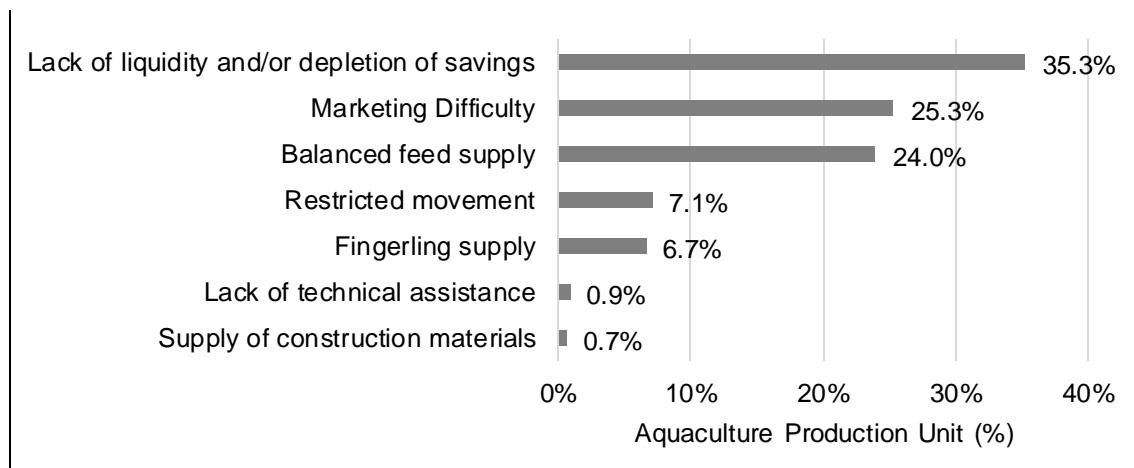


Situation facing the prolongation of the state of emergency

Of the total of 244 aquaculture production units surveyed in this study, 95.9% indicated that they were not prepared to face the prolongation of the emergency state. Among the main reasons why they are not prepared is the lack of liquidity and the exhaustion of their savings (Figure 2).

Figure 2

Distribution of the limitations presented by which the aquaculture production units of the San Martín region cannot afford the prolongation of the state of emergency (n = 234)

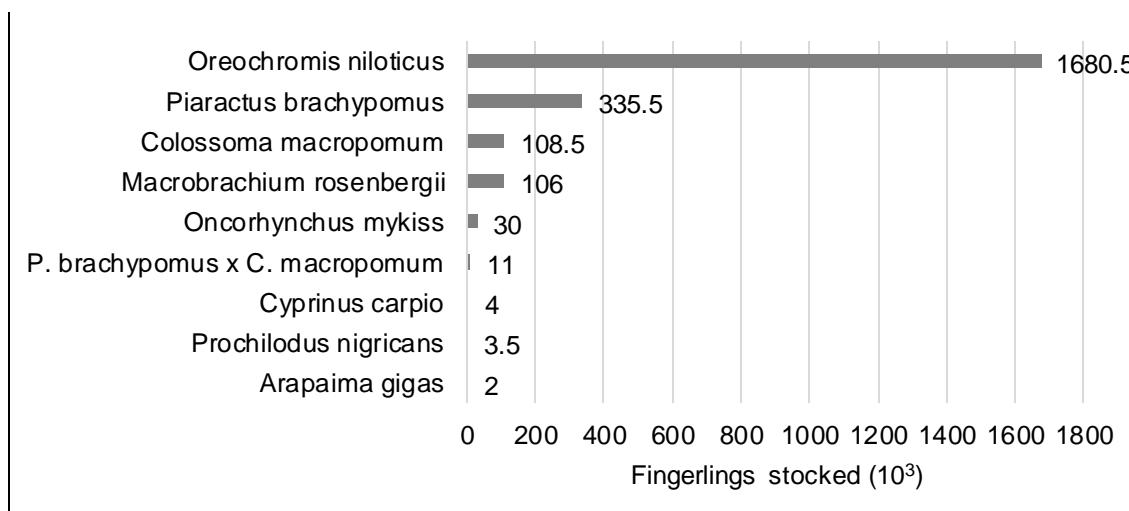


Production and marketing level in the state of emergency

Of the total of 244 units surveyed in this study, 82% indicated that they have production at different stages and 18% are not producing. At the level of stocked fingerlings, a greater number of thousands of grown *O. niloticus* was recorded (Figure 3). Making a correlation between the productive units that are affected by the state of emergency and if they are producing, it was observed that of the 238 productive units that are affected, 81.5% are producing. At the commercialization level, of the total of 244 aquaculture production units surveyed, 60.2% indicated that they are commercializing, where the most commercialized species corresponds to *O. niloticus*, followed by *P. brachypomus* and *C. macropomum*. Of the total number of aquaculture production units that are commercializing, 46.9% indicate that they have marketing difficulties, 40.1% do not and 12.9% do not indicate anything about it. Making a correlation between the productive units that are producing and commercializing, it was observed that of the 238 productive units that are producing only 73.5% are commercializing.

Figure 3

Species cultivated in aquaculture production units in the San Martín region, according to thousands of fingerlings stocked, previously or during the state of emergency (n = 200)



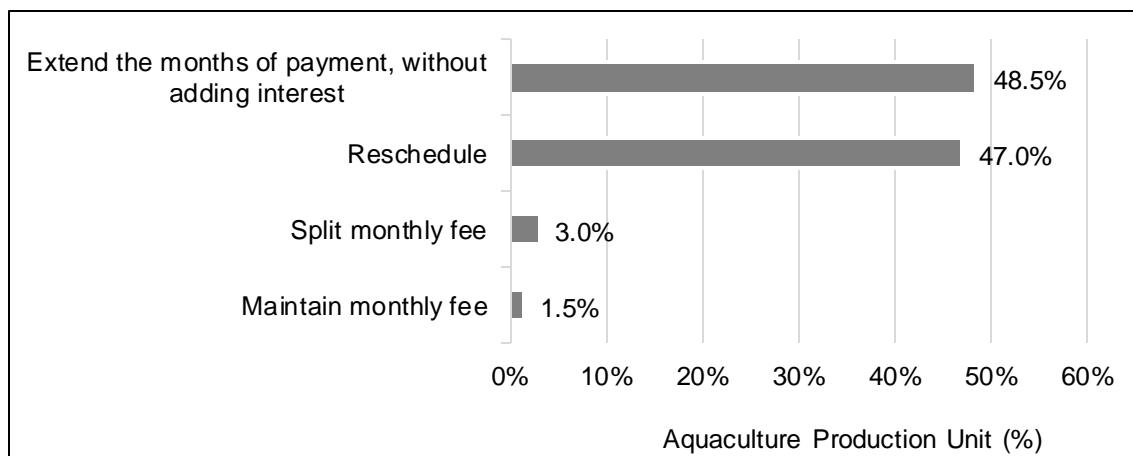
Availability and status of bank loans

Of the total of 244 aquaculture production units surveyed, only 27% indicated that they have bank loans to date. Of the total of 67 aquaculture production units that have bank credit, only 1.5% indicated that they can continue making their payments on time and the other 98.5% are requesting a reprogramming or an extension without interest of their payment (Figure 4). Making a correlation between the productive units that are affected

by the state of emergency and if they have bank credit, it was observed that of the 238 productive units that are affected only 27.3% have bank credit.

Figure 4

Distribution of aquaculture production units surveyed in the San Martín region in relation to actions that their financial institution should take regarding their bank credit (n = 67)

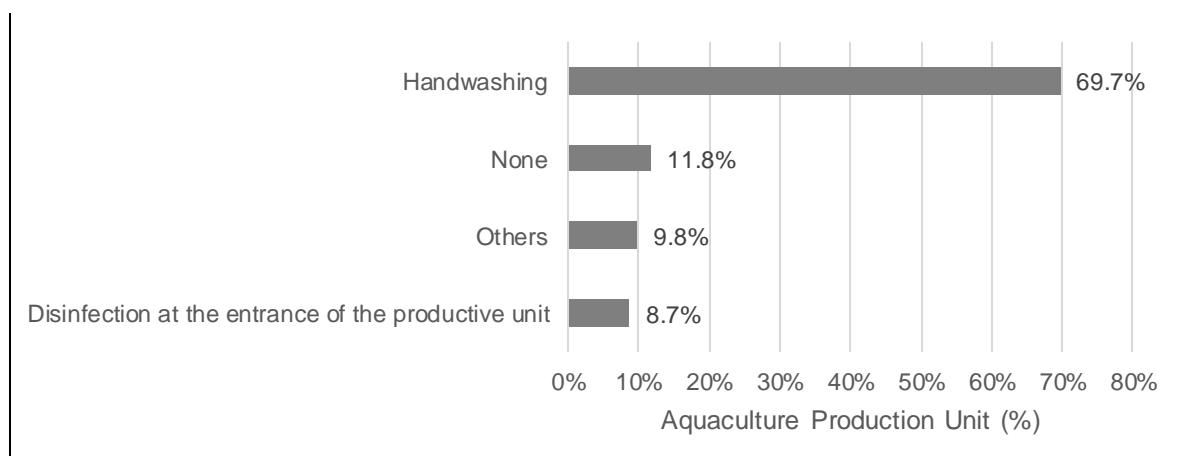


Biosecurity protocols against COVID-19

Of the total of 244 aquaculture production units surveyed, 88.2% apply at least one biosecurity measure at their production unit, the one with the highest percentage of application being handwashing (Figure 5).

Figure 5

Distribution of aquaculture production units in the San Martín region, according to Biosecurity measures established to prevent the spread of COVID-19 (N = 244)

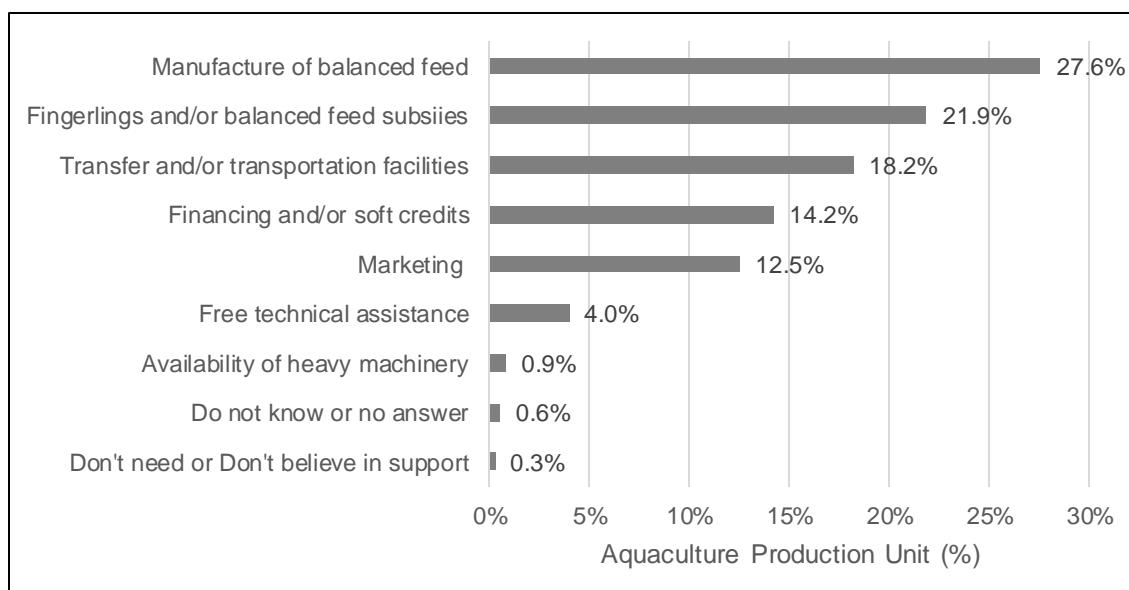


Perspective of the support they hope to receive from the government

Of the total of 244 aquaculture production units surveyed, in their opinion on the support that the central and regional government should provide to overcome this crisis and sustain their production, the main point is the supply of low-cost balanced feed and fingerlings to continue production (Figure 6).

Figure 6

Distribution of aquaculture production units in the San Martín region, according to their opinion regarding the support they should receive from the central and regional government during the state of emergency (N = 244)



Discussion

Although COVID-19 does not affect aquatic organisms, the full range of activities required for the delivery of aquaculture products, from production to the final consumer, is subject to the indirect impacts of the pandemic through new measures of biosecurity, changes in consumer demands, market access or logistical problems, related to traffic and transport restrictions (FAO, 2020a; Senten et al., 2020). Despite the fact that aquaculture has been considered an essential food production sector and operation of the production units has been allowed to continue, this has had a negative impact on the livelihoods of the fish farmers, as well as on food security and nutrition of populations that depend heavily on fish for animal protein and essential micronutrients (CFS, 2013; Senten et al., 2020).

In Peru, the state of national emergency has directly and indirectly affected aquaculture production units, in their production and marketing, but there is still no statistical data on a national level to determine the impact that the aquaculture sector has suffered on the socioeconomic level. However, with the information of the present study, carried out in special circumstances, the impact that COVID-19 has had on aquaculture is evident, at the level of the non-eastern Amazon region of San Martín, based on the conditions and perceptions of the fish farmers surveyed.

According to a study carried out by FAO in Asia, the impacts on aquaculture businesses by COVID-19 were immediate, the blockages subjected the value chain to serious interruptions in national and international transport for production supplies, raw materials for the processing, and finished products for domestic consumption and export (FAO, 2020c). The study found that 96% of the aquaculture production units surveyed indicated being affected by the state of emergency due to the COVID-19 pandemic, 6% more than the fish farmers surveyed in the U.S. affected by the pandemic (Senten et al., 2020) and 4% less than the artisanal fishermen surveyed in the Municipality of Salvador, Bahia, Brazil (Amorim Reis-Filho & Quinto, 2020). The shortage of fingerlings and balanced feed, and the limitation to reach their productive units are the most relevant causes, which are mainly due to the restrictions that were imposed on mobilization and transport. A recent study by Senten et al. (2020) on the impacts of COVID-19 on U.S. aquaculture showed similar results, where they reported that 90% of respondents were affected by the effects of COVID-19 and that they had experienced challenges in accessing a variety of production materials, goods or services that were essential for the operation of its productive units.

The current decrease in food demand (Stephens et al., 2020), is a reflection of the taken measures to avoid contagion, in Salvador, Bahia in Brazil the reduction in purchases of products of aquatic origin is 75%, reported due to the difficulty of consumers going to the supply centers and the restrictions on opening urban markets (Amorim Reis-Filho & Quinto, 2020); in the Philippines, the demand for local restaurants and hotels has dissipated fishing activities and therefore reduced prices, leading to factories ceasing to operate or to do so in less capacity (Ocampo, 2020).

Also, the falls in price associated with the uncertainty about the duration of these trends have discouraged aquaculture production in many parts of the world (OECD, 2020). Due to the restricted movement and the lack of agricultural inputs for their production such as balanced feed or fingerlings many aquaculture production units have presented difficulties in their production, which has led some units to decide not to grow fingerlings this season or postpone their production until restrictions pass (FAO, 2020a, 2020d). This is reflected in the results of this study, where 18% of the aquaculture production units indicate that they do not have any production at this time, because they

have difficulty buying fingerlings, this is also a consecutive reflection of the pandemic, since fish farmers in various countries postpone their stocking, not only due to the lack of fingerlings, as observed in this study, but also due to different logistical factors expected in the future (White et al., 2020). The 82% of fish farmers who are producing to date, is due to the fact that they had already stock up to three months prior to the state of emergency and where *O. niloticus* is the species with the highest number of stocked fingerlings, comparing this with the numbers indicating that *O. niloticus* is the most produced species in the San Martín region and the fourth in Peru (PRODUCE, 2017; PRODUCE & GRSM, 2014). Similar situations are occurring in other countries, such as Indonesia, where hatcheries were unable to supply fingerlings to meat producers, because they were unable to obtain specific pathogen-free bloodstock from their sources abroad caused by the lack of flights, causing fish farmers to lose the productive campaign for lack of fingerlings to stock (PTI, 2020). In China, for example, the aquaculture industry works closely with small producers, supplying the fingerlings and then buying the animals to process and export them, during this time the purchases by the processors may decrease, which affects staggered stockings and the flow of the industry will be discontinued in the coming months (Can et al., 2020).

The various repercussions on aquaculture production and uncertainty about the future are variable, even more so at the commercial level. According to FAO (2020a), due to market disturbances, fish farmers are currently unable to sell their production and must keep large quantities of fish that must be fed for an indefinite period of time, which increases costs, expenses and risks. In the study by Senten et al. (2020), in the U.S., more than three-quarters of respondents (84%) reported lost sales and canceled contracts or orders during the first quarter of 2020; as well as its concern about the higher risk of losses due to the long-term possession of market-ready products and the probable effects of delayed sales on the product's marketing and price. In the study carried out, a similar pattern is shown at the marketing level, based on the aforementioned difficulties, where only 60.2% are marketing to date, and although it represents more than 50% of the aquaculture production units surveyed, it is indicated that of this percentage, 46.9% have difficulties to carry out the marketing normally. This is contrasted with the percentage information obtained between production units that are producing and marketing, where only 73.5% of these units are producing and marketing. This situation may be due to two realities; they produce fish for their own consumption or they produce to sell, but have their limitation due to the restriction of transit or transport.

Another point to take into account in the difficulty of commercialization, is the decrease in demand, because unemployment due to COVID-19 has affected income and consumption patterns, since people can find products such as canned fish at a lower price than fresh farmed fish (FAO, 2020c). In response to the challenges of declining marketing, many fish farmers are trying to establish new marketing channels, actively developing

direct sales channels to consumers through e-commerce or itinerant markets, but adaptation requires government resources, training and regulations (FAO, 2020a). Another factor that has decreased the demand for fresh or high-value fish is the closure of tourism and related businesses, such as hotels and restaurants (FAO, 2020c); this is reflected in a direct way in the San Martín region, which has tourist services with high demand in the Amazon, country restaurants being one of the main suppliers of high-value fish such as Arapaima gigas or others of lesser value such as *O. niloticus* of non-commercial sizes locally, that is 800 to 1000 grams (DIRCETUR, 2019). In some cases, fish farmers own the restaurants and their production is focused on supplying their own demand.

Fish farmers, access credit financing from financial institutions in order to increase their production and meet existing demand. Now, due to the economic impact that the measures adopted by COVID-19 have generated, the increase in prices of agricultural inputs and the reduced commercialization of aquaculture production, forces to reorganize expenses and offer production at low prices to recover investment expenses (FAO, 2020c, 2020b). This limits scheduling new campaigns or continuing existing ones, and makes it even more difficult for them to pay their bank loans. In the study carried out, 27% of aquaculture production units have bank loans, and 98.5% of these indicate that they cannot continue making their payments on time due to a lack of liquidity by the low commercialization they are facing, and request payment assistance, which is related with what was mentioned above, on the economic impact COVID-19 has had on the productive aquaculture units worldwide. From the study carried out, it was also highlighted that, of the units affected by the state of emergency, only 27.3% have bank credit and the other percentage of aquaculture units support campaign expenses through their own liquidity. FAO (2020c) in his report on the impact of COVID-19 on the aquaculture industry, mentions that financial assistance to the sector will be greatly reduced due to the scarcity of public resources and the liquidity problems that microfinance institutions will face, due to the fact that their investors are wary that borrowers can repay loans. Due to this, in different countries interest reduction measures have been taken for credits and reliefs of up to 14 billion dollars are projected for the agricultural sector (Nicola et al., 2020). On April 2, 2020, the European Commission adopted a set of ambitious proposals to mitigate the socio-economic impact of the coronavirus on the fisheries and aquaculture sectors. This initiative introduces additional measures and provides flexibility to the rules governing the expenses of the European Maritime and Fisheries Fund (EMFF) and co-financing of 75% by the European Union in aquaculture production (Scholaert, 2020).

There is currently no evidence of food-related transmission of COVID-19, it is possible for a person to contract COVID-19 by touching a surface or object that has the virus and then touching their mouth, nose, or possibly eyes, but it does not appear to be the main route by which the virus spreads (WHO, 2020a). For this reason, as before

COVID-19, it is important to emphasize the need to implement rigorous hygiene practices to protect fishery and aquaculture products from contamination (FAO, 2020b). Specifically, on this subject in Peru, through URGENCY DECREE No. 026-2020, various exceptional and temporary measures were established to prevent the spread of COVID-19 in the national territory. In the present study it was observed that more than 80% of the surveyed productive units apply at least one biosecurity measure in their productive unit; the most practiced one being that of hand washing, which is one of the main measures to prevent the presence of COVID-19 and has been massively disseminated in the different media (WHO, 2020c). This measure is also recommended by EMBRAPA in aquaculture productions in Brazil, mainly when it comes into contact with a surface or person of unknown origin, and it is also recommended to reinforce the biosecurity measures of aquaculture property, which contribute to the safety of all members of aquaculture activity (de Lima et al., 2020).

It is still unclear whether the sector will experience a fast or slow recovery after the pandemic ends. When the survey was launched on March 30, there were still no announcements of public support programs for fish farmers and even less if the state of emergency was going to be extended. Respondents were asked if they were prepared to face the state of emergency and it was shown that 95.5% were not prepared to sustain their production campaign, which required acquiring balanced feed and actions for marketing; all this dependent on liquidity.

Currently, countries are focusing primarily on economic policies and tools that protect industry and employment, as well as working to ensure a rapid recovery in the fisheries and aquaculture sector, with limited attention to the long-term consequences (FAO, 2020b; OECD, 2020). Proper design and implementation of support measures are important to ensure that they reach those most in need, while making efficient use of scarce government resources (OECD, 2020). Respondents were asked about existing programs or measures that could help their productive units survive current challenges, they offered different perspectives on how the national and regional government should support them to overcome this crisis and maintain their production. The main point was to guarantee the supply of low-cost balanced feed and fry to continue their production, which is closely associated with the main limitations that aquaculture currently has worldwide (FAO, 2020a, 2020d; Senten et al., 2020). In this sense, government support policies in response to the COVID-19 pandemic must be adjusted in time, be specific, effective and consistent with long-term sustainability objectives (OECD, 2020).

Conclusions

Carried out in very particular circumstances, this study has attempted to investigate various aspects of the conditions and perceptions of fish farmers in production units in the face of the national state of emergency. The results clearly demonstrate that the COVID-19 pandemic has seriously affected aquaculture in the region. With 98% of the respondents informed that they are affected and have difficulties accessing the supply of primary agricultural inputs for their productions. Likewise, with only 60% of productive units selling and where almost 50% have experienced losses in their sales, due to restrictions on transportation, and requiring support in actions of promotion and articulation to markets. Likewise, respondents reported challenges with production and financing, where those with financial credits seek payment assistance, as well as new financial services that take into account the current situation. In relation to biosecurity measures, it is observed that aquaculture producers have been adapting correctly to these with more than 82.2% of the respondents applying them, but it is necessary to reinforce knowledge to comply with all the measures. In relation to the future scenario, more than 95% of the respondents mentioned that they were not prepared to face a prolongation of the state of emergency and are expecting the National Government and the Regional Government to mainly support the supply of primary agricultural inputs such as balanced feed and fingerlings, and articulation with markets. From this study it could be concluded that the described results represent some of the most urgent measures to implement; however, it is presumed that an increase in needs will be generated as the state of emergency is prolonged by COVID-19.

Limitations of the study

Given the nature of the current context due to the COVID-19 pandemic, the investigation was limited in getting to 100% of the fish farms, as well as in the completion of surveys by the producers, who do not manage at a 100% their own information about production campaigns. This led to the reduction of the initial sample, from 265 to 244 surveys, after invalid or incomplete responses were eliminated.

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Authorship contribution

EGG performed the data analysis. EGC, VSS and DCD wrote the article.

Conflict of interest

No potential conflict of interest was reported by the author(s).

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