

jorge.velasquez02@cu.ucsg.edu.ec

Correspondence:

## Development of agricultural and aquaculture activities in the economically active population: Puna Island case.

### Desarrollo de actividades agrícolas y acuícolas en la población económicamente activa: Caso Isla Puna

#### Jorge Velásquez-Rivera

Master's Degree, Universidad Católica de Santiago de Guayaquil, Faculty of Technical Education for Development, Agricultural and Livestock Careers, Guayaquil, Ecuador. jorge.velasquez02@cu.ucsg.edu.ec, <https://orcid.org/0000-0002-3500-8403>

#### John Franco-Rodriguez

Master, Universidad Católica de Santiago de Guayaquil, School of Technical Education for Development, Agricultural and Livestock Careers, Guayaquil, Ecuador. john.franco@cu.ucsg.edu.ec, <https://orcid.org/0000-0002-6285-8200>

#### Jesus Meléndez-Rangel

Master's Degree, Universidad Católica de Santiago de Guayaquil, Faculty of Technical Education for Development, Agricultural and Livestock Careers, Guayaquil, Ecuador. jesus.melendez@cu.ucsg.edu.ec, <http://orcid.org/0000-0001-8936-5513>

#### Bella Crespo-Moncada

Master's Degree, Universidad Católica de Santiago de Guayaquil, Faculty of Technical Education for Development, Agricultural and Livestock Careers, Guayaquil, Ecuador. bella.crespo@cu.ucsg.edu.ec, <https://orcid.org/0000-0001-8964-8150>

#### Emma Moreno-Veloz,

Master's Degree, Universidad Católica de Santiago de Guayaquil, Faculty of Technical Education for Development, Agricultural and Livestock Careers, Guayaquil, Ecuador. emma.moreno@cu.ucsg.edu.ec, <https://orcid.org/0000-0001-7152-8898>

#### José Molina-Villamar

Universidad Técnica de Manabí, C.P. 130103, Portoviejo, Ecuador. E-mail (VMY) [biologia\\_molina@hotmail.com](mailto:biologia_molina@hotmail.com), <https://orcid.org/0000-0003-2893-326X>

#### Abstract

Ecuador is a country with a mega diversity of natural resources; however, agricultural production is managed by a large group of people who carry out their activities under unfavorable conditions, due to different aspects related to the geographical area, climate, production mechanisms and marketing opportunities, which in many cases do not result in adequate benefits. The skills and abilities developed in the field are an important strength for resource management, and training processes to reinforce them are a priority. The objective of this research was to analyze the agricultural and aquaculture activities of the economically active population of Puná Island. The methodology was based on a non-experimental design, of the field type, with a descriptive and longitudinal level, and a mixed methodological perspective. A survey was carried out to gather aspects related to the agricultural and aquaculture production of this population. The results show that the economic work force in these areas is based on the population over 35 years of age, with little economic income from marketing, especially to intermediaries.

**Keywords:** agricultural activities, aquaculture, commercialization, Puná Island

## Resumen

El Ecuador es un país mega diverso en recursos naturales, no obstante, la producción agropecuaria es manejada por un importante grupo de personas que sobrellevan sus actividades en condiciones desfavorables, debido a diferentes aspectos que tienen relación con la zona geográfica, clima, mecanismos de producción y oportunidades de comercialización que en muchos de los casos no resultan con un beneficio adecuado. Las habilidades y destrezas desarrolladas en el campo son una fortaleza importante para el manejo de los recursos, y resulta prioritario procesos de capacitación para el refuerzo de los mismos. El objetivo de la presente investigación fue analizar las actividades agrícolas y acuícolas de la población económicamente activa de la Isla Puná. La metodología se basó en un diseño no experimental, del tipo de campo, con nivel descriptivo y longitudinal, la perspectiva metodológica mixta. Se ejecutó una encuesta que reúne aspectos relacionados con la producción agrícola y acuícolas de esta población. Los resultados evidencian que la fuerza económica de trabajo en estas áreas radica en la población que supera los 35 años de edad, poco ingreso económico producto de una comercialización especialmente a intermediarios.

**Palabras clave:** actividades agrícolas, acuícolas, comercialización, Isla Puná

## Introduction

The lack of global sustainability of economic growth and the disparity in its social distribution reflect the limitations of capitalist society and conventional visions of development SENPLADES. (2009) which causes underdevelopment marked by increasing poverty, the reduction of which becomes one of the global goals of the Sustainable Development Goals to 2030 (*Report of the Inter-Agency and Expert Group*. 2016, 32).

Ecuador is a country that has a special ecosystem, endowed with a great biological and cultural biodiversity, a situation favored by the rise of the Andes mountain range, its geographical location on the equatorial line and the influence of ocean currents on its coasts (Seger, 2020) However, there are populations that lack productive infrastructure since small-scale farmers are marginalized in this context and play functional roles within the current dynamics of agroindustrial companies, there are populations that lack productive infrastructure since small peasant producers are marginalized in this context and play functional roles within the current dynamics of agroindustrial companies Martinez (2017) and that despite the existence of first-hand raw materials, value added is not generated for multiple reasons, among them, the lack of preparation and/or training accompanied by few economic reactivation processes for being relegated from investment and development programs at the public and private level (Gudynas, 2016, p. 3).

One of these rural sectors is Puná Island, located in the Pacific Ocean off the southern coast of Ecuador, has a population of approximately 3344 inhabitants Merizalde et al. (2019) and is characterized by having a set of islands forming an archipelago, being in the main one the largest percentage of population that corresponds to two sectors fully identified as the parish head and the area of Cauchiche, which have different forms of income. The parish headwaters

called Puná vieja can be reached by boat from Guayaquil, traveling about an hour, where there is an itinerary of mobilization controlled by the Navy of Ecuador. Cauchiche or Puná nueva can be reached through Posorja, which is a shorter boat trip.

Since 2008, Ecuador has undergone a series of political, economic and social transformations due to the implementation of the new Constitution, which grants full rights (including social and economic rights) to all citizens, and also obliges the State to prioritize the payment of the social debt above any other obligation. One of the main problems in the country is the underdevelopment of certain populations, which have been forgotten by the governments in power, without the implementation of policies and decisions for change.

With this background, the objective of this research was to analyze the agricultural and aquaculture activities of the economically active population of Puná Island, with a view to strengthening their agroindustrial productive capacities. The methodology was based on a non-experimental design, of the field type, with a descriptive and longitudinal level, and a mixed methodological perspective. A survey was carried out to gather aspects related to the agricultural and aquaculture production of this population. The results show that the economic work force in these areas is based on the population over 35 years of age, little economic income due to marketing, especially to intermediaries, lack of knowledge of mechanisms to improve production and/or agro-industrial development, as well as the lack of productive infrastructure for the storage of agricultural and aquaculture products.

The rural parish of Puná stands out for having an interaction of the territorial and maritime system that generates importance within the historical and cultural context for the country. The existence of the pre-Hispanic period in this area, which played an important role during the Inca invasion and occupation, as well as during the Spanish conquest and colonization, added to the strategic importance that this sector had for Guayaquil, during the colonial and republican times, make the island an icon of Ecuadorian history.

In relation to its physical origin as such, several criteria are established, among them that, at the time of the Quaternary period, the island was part of the continent and then it was reduced by a rupture of the Puná Isthmus. Another criterion affirms that it is of submarine volcanic origin; the closest theory is the one that refers to the movement that has been produced for millions of years by the suspension of the tectonic plates that act in the Pacific area and by the action of the rivers that flow into the Gulf of Guayaquil.

In the eighties, the shrimp industry began its activities in Puná Island and currently occupies a large part of this sector, which has led to maintaining an economic dynamic for the city of Guayaquil and therefore for the country, but not for the parish, since approximately 80% of the population does not have basic services; therefore, there are limitations in the different areas of development causing low income which does not allow satisfying the basic needs of children, youth, adults and the elderly.

According to figures from the Central Bank of Ecuador, for the same period, the economic activities that showed the greatest growth were aquaculture and shrimp fishing with 16.7%. These data show an important dynamism in this field, which with an enterprising vision could change the social and economic panorama on the island, since the food processing industry, such as fish, seafood and others, offers an integral service in its processing operations, which adopts an efficient procedure with the help of a work program with friendly technologies for the prevention of the environment. Food and Agriculture Organization of the United Nations.

The new configuration of food distribution is associated with a greater role of trading companies in the markets of origin, especially for fresh consumer products, and has been conditioning, in recent years, the business behaviors of these entities, with important implications on their results in terms of growth, profitability or value creation. This fact is determining the emergence of strategic and business policy changes of marketing entities, especially those of an associative or cooperative nature (Martínez, 2017, p. 23) Value chains linked to urban markets and agribusiness offer new opportunities to add value and increase rural incomes Thiele et al., (2011). In a value chain, novelty must be considered, which is directly related to technology as it allows the development of new proposals; other important elements are increased yield, design quality and product accessibility to customers for purchase (Viquez et al., 2017).

Ecuador is at an opportune moment for the implementation of concrete strategies to promote a dynamic system of entrepreneurship through the joint work of the four key axes of the economy: academia, and the public, private and civic sectors Sandoval et al., (2020).

### **Materials and methods**

The present research comprises a non-experimental design, of the field type, with a descriptive and longitudinal level, mixed methodological perspective (Moreira, 2002, p. 34). For the study, the application of surveys directed to the economically active population of the agricultural and aquaculture sector was considered in order to establish information on the current situation of the producers. A survey was organized with three components: first, basic information on the producer's profile, business, products that generate the greatest income, marketing and destination. The second and third components refer to data related to the management of agricultural and aquaculture production, respectively. This consideration was taken into account because there are producers who carry out each activity independently and others who carry out both. Table 1 shows the number of questions established for each component.

Table 1. *Number of survey questions*

Component	Subcomponents	No. of questions
Producer	Producer profile	5
	Business profile	
	Products and revenues	
	Marketing and destination	
Agricultural management	Physical description of the property	5
	Soil and water aspects	
	Pest and pesticide management	
	Agro-industrial processing	
Aquaculture management	Species capture	

The survey approach used combinations of diatonic and open-ended questions, seeking to obtain as much information as possible. Table 2 shows the group of questions used in the first component (Producer).

Table 2. *Producer component questions*

Component	Sub component	Ask
Producer	Producer profile	What is your age?
		What is the level of education?
		What year did you start as a producer?
		Is the business inherited?
	Business profile	Do you work alone?
		Who in your family works with you?
		Do you work for third parties?
		What are the sources of financing for your business?
		What resources do you have?
Products and revenues	What are the most important products you produce?	
	What is the quantity and selling price of each of the products it produces or captures?	

	<p>Do you use any type of packaging for product delivery?</p> <p>Do you perform additional processes to the products and what are they?</p> <p>What are the reasons for not venturing into the production of handmade and/or processed products?</p> <p>Are you interested in venturing into the production of processed products?</p>
Marketing and destination	<p>What is the destination of your products?</p> <p>How do you distribute the products?</p> <p>What is the location of wholesale customers?</p> <p>What is the location of retail customers?</p> <p>What are the main obstacles to getting your products to the point of sale?</p>

Table 3 shows the questions for the second component (agricultural production management).

Table 3. *Agricultural production management component questions*

Component	Sub component	Ask
Agricultural production management	Physical description of the property	<p>What is the productive purpose of your land?</p> <p>How much land do you own?</p> <p>Do you have irrigation infrastructure?</p> <p>What is the experience in agricultural work?</p> <p>What are the tools you use in the field?</p>
	Soil and water aspects	<p>What is the soil type of your land?</p> <p>What is the topography of your land?</p> <p>What is the type of production management: organic or with chemical agents?</p> <p>Is your land contaminated?</p> <p>What are the main problems in agricultural production?</p> <p>Have you performed any laboratory analysis of your land?</p> <p>What are the farm's water sources?</p>

Pest and pesticide management	<p>What are the types of pests present in your crops?</p> <p>What type of treatment is applied for pests?</p> <p>Do you have specific equipment for pest treatment?</p> <p>What type of product is applied to prevent disease progression?</p> <p>What do you do with the containers of chemicals you no longer use?</p>
Agro-industrial production	<p>Do you know about raw material transformation processes? Do you pack your production on the farm?</p> <p>Is there collection and/or processing infrastructure for agricultural production?</p>

Table 4 presents the questions for the third component (aquaculture production management).

Table 4. *Aquaculture production management component questions*

Component	Sub component	Ask
Aquaculture production management		<p>Is there infrastructure for the collection, packaging and/or processing of captured species?</p> <p>What materials or equipment are used for the storage of fishery products?</p> <p>Do you perform any pre-treatment of the fish product prior to marketing?</p> <p>Do you recognize the species that are closed?</p>

The surveys were reviewed by a group of professors from the Agricultural, Agroindustry and Marketing careers of the Catholic University of Santiago de Guayaquil and then validated by the Vice Rectorate of Liaison. The sample size was calculated using the finite population formula (Alcahúd et al., 2011), (Barros-Bastidas & Gebera, 2020) used for populations of less than 100,000 inhabitants; 20% of the total economically active population (EAP) was taken as the basis for the calculation. The execution of the surveys was random, taking into account two main sectors: the parish capital and the Cauchiche area. The data used for this research were the following:

N = Total population: 1,444 producers (20 % of EAP)

$Z\alpha = 1.96$  squared (at 95 % confidence).

$p =$  expected proportion (in this case 50 % = 0.50).

$q = 1 - p$  (in this case  $1 - 0.50 = 0.50$ ).

$d =$  precision (5 %).

Simple random sampling. Two specific populations: Old Puná and New Puná.

Inclusion criteria: Agricultural and aquaculture producers.

Replacing these values in the above formula gives the following result:

$$n = \frac{N * Z_{\alpha}^2 * p * q}{d^2 * (N - 1) + Z_{\alpha}^2 * p * q}$$

$$n = \frac{1444 * (1.96)^2 (0.50)(0.50)}{(0.05)^2 * (1444 - 1) + (1.96)^2 (0.50)(0.50)} = 304 \text{ encuestas}$$

Once the surveys were completed, the results were tabulated using Excel 10.0 software (USA), generating Tables and Figures for the interpretation of the information.

## Result

Of the 304 producers surveyed, 65.13% (198) were in the fishing sector, 23.68% in the agricultural sector (106) and 11.18% (34) were engaged in both activities. Only 56.58% of the producers are affiliated with an association. Table 5 shows the age of the respondents.

Table 5. *Age of producers.*

AGE OF PRODUCERS (years)	NUMBER OF PRODUCERS	(%)
15 a 19		2.96
20 a 24		9.87
25 a 29		7.24
30 a 34		6.58
31 a 34	1	0.33
35 a 39	28	9.21
40 a 44		17.76
45 a 49		11.84
50 a 54		8.88
55 a 59		7.57
60 a 64		5.26
65 or more		12.5
TOTAL		100 %

67.76 % of the producers are 35 years of age or older. 32.24 % of the producers are in other age ranges. 86.18 % of the farmers have a basic education; while 10.53 % have no formal education, 1.32 % have attended literacy centers and only 1.97 % attend or attended university.

Regarding the business profile, in general, 50.99 % of the producers work independently and 49.01 % work for a third party. Of the total number of independent producers, 52.96% work with the family and 47.03% work alone. Of those surveyed, 50.33% stated that the business they currently own was inherited, while 49.67% indicated that it was not, and most of them indicated that they have been doing this type of activity for more than 20 years. Table 6 shows the percentages corresponding to the number of producers who work with family members.

Table 6. *Details of producers working with family members.*

<b>RELATIONSHIP</b>	<b>(%)</b>
<b>Son (a)</b>	29.95
<b>Another</b>	27.80
<b>Sibling</b>	21.93
<b>Spouse</b>	17.65
<b>Nephew (a)</b>	2.67
<b>TOTAL</b>	100 %

Of the independent producers who have help from a relative, 93.09 % indicate that their relatives do not receive any remuneration and only in 6.91 % of the cases do they receive remuneration. 79.68 % of the producers work with their children, siblings or other relatives; 17.65 % work with their spouse, and 2.67 % with their nephews and nieces.

Table 7 shows the type of financing received by the producer. 65.13% of the producers have their own sources of financing, the rest are financed through: informal sources, producer associations, banks, cooperatives, among others.

37.73 % of the farmers have only various work tools, 22.09 % have boats, 15.64 % have land without construction and 6.44 % have land with construction.

The income obtained in the commercialization processes of agricultural and aquaculture products, respectively, is reported in general terms. The first agricultural product is cherimoya, with an average production of 47 boxes per month and a selling price of \$8.90 per box. The monthly income of the people involved in this activity is around \$ 295.20. The second agricultural product is pitahaya; its average production is 500 units per month, with a selling price of \$ 0.35 per unit. The monthly income of the people involved in this activity is approximately \$ 200.00. The third agricultural product is watermelon; its average production is 70 units per month, with a selling price of \$ 1.35 per unit. The monthly income of the people

involved in this activity is \$ 155.00. Regarding aquaculture production, the most important product is fish, with an average production of 247 pounds per month, with a selling price of \$ 1.84 per pound. The monthly income of the people involved in this activity is approximately \$ 400.87.

The second product is crab, with an average production of 55 bundles per month, with a selling price of \$8 per bundle. The monthly income of the people involved in this activity is approximately \$ 399.72. The third product is shrimp; its average production is 208 pounds per month, with a selling price of \$ 2 per pound. The monthly income of the people involved in this activity is approximately \$ 370.21.

In fourth place is the conch, with an average production of 3,000 units per month, with a selling price of \$ 0.10 per unit. The monthly income of the people involved in this activity is \$ 319.44.

Additional product information:

- a) The producers surveyed do not use any type of packaging for product delivery.
- b) 91.20 % of the producers stated that they do not carry out additional processes to the products, while 8.80 % indicated that they do. The main additional processes carried out by producers are:
  - 35 % salted and packaged.
  - 5.28 % washed.
  - 1.41% frozen.
  - 0.70 % other processes: sweets and natural juices.
- c) The reasons given for not venturing into the production of handmade and/or processed products are as follows:
  - 21.05 % of producers due to lack of knowledge of technical processes.
  - 14.55 % due to lack of equipment and work tools.
  - 13.70 % due to insufficient human resources.
  - 13.56 % due to lack of knowledge of commercial processes.
  - 12.43 % due to lack of knowledge of legal processes.
  - 11.44 % due to lack of credit lines.
  - 6.50 % due to lack of physical space.
  - 6.78 % for other reasons.
- d) 88.03 % of the producers said they were interested in entering into the production of processed products. The rest were indifferent.

The experience in agricultural work of the surveyed farmers is presented. It should be noted that the total number of farmers is 10650% of the farmers use a machete as their main work tool; 15% use only a rake; the rest of the farmers use one or more tools for their work and only 2.83% use agricultural machinery. 42.45% of the farmers said that the type of soil on their property was clayey; 16.04% were sandy; the rest were combinations of the different types and

6.60% could not define a soil type. 34.91 % of the producers indicate that the land where they work is mostly semi-flat; 28.30 % flat; 12.26 % undulated and 9.43 % sloping, which indicates the irregularity of the topography of the arable land. The 83.02 % of the agricultural producers assured to carry out an organic production, while, 15 % use chemical agents; the rest of the producers combine the organic with the chemical.

83.50 % of the farmers reported having clean soil, while 17.50 % have contaminated soil, caused by the presence of manure and chemical agents. Likewise, 23.58% of them indicated that the main problems of the soil are pests and low fertility; 10.38% identified low fertility as the main problem, followed by soil salinization and soil erosion (9.43% in each case). The other producers also mentioned the low presence of organic matter and soil compaction.

83.96% of the farmers have not performed any type of soil analysis; only 14.15% have diagnosed fertility and 1.89%, in addition to fertility, have analyzed soil microbiology; the analysis has been performed once a year. 44.34% of the farmers obtain water from wells; other farmers obtain water from two or more sources such as lagoons, by harvesting and piles, which depend on the rainy season. The lack of fresh water is one of the fundamental problems on the island. 8.49% do not define a source of water because they mention that it depends on availability. 91.51% reported that they always use this water source in the dry season, with rain being the main primary source.

72.64 % of the producers use environmentally friendly methodologies such as manual, cultural and biological practices, considered organic. 11.32 % do not use any management at all. The remaining group of producers, which amounts to approximately 15 %, use chemicals for pest elimination such as gramoxone, malathion, supermethrin and others. Approximately 83.02 % of the producers do not use chemical pest control agents; 6.60 % discard the containers; 5.66 % bury them and 4.72 % burn the containers.

About 86.79% of the agricultural producers do not know about raw material transformation processes, who stated that they do not pack their production on the farm and assured that there is no storage and/or processing infrastructure for agricultural production. The type of fishing gear used by the surveyed fishermen is shown. It should be noted that the total number of aquaculture producers is 198. 57.07% of the aquaculture producers use nets to catch the different species; 15.66% use fishing lines and hooks; 11.62% use hooks; 8.59% use manual extraction; and 7.07% use traps and pots.

A total of 97.47% of the surveyed producers involved in aquaculture activities stated that there is no infrastructure for the collection, packaging and/or processing of captured species and that 46.97% of them use ice chests for storage and approximately 28% use sacks and crates (especially shells and mangrove species) for this process, without prior treatment.

53.03 % of the aquaculture producers recognize the species that are banned because of their reproductive status, 31.82 % because of their size, 5.56 % because of both cases and 9.60 % do not know.

## Conclusions

67.76% of the producers are 35 years of age or older, 86.18% have a basic education, 65.13% of the respondents are engaged in fishing as their main activity and 56.58% of the producers say they are affiliated with an association. Most of them have been involved in this activity for more than 20 years. Fifty-one percent of the producers work independently; slightly more than half of these producers work with an average of two family members. Only 6.91% of the cases of family members-collaborators receive remuneration for their work, and 65.13% of the producers say that they work with their own financing and 10.86% recognize that they have access to informal sources of financing. According to the income they represent for the producers, the most important seafood product is fish and the main agricultural product is cherimoya. Of those surveyed, 91.20% do not carry out any additional processing of the products they market. The main destination of 83.88% of the respondents' products is Puná Island, and only 13.49% of the respondents market their products nationally. In general, there is no knowledge of the processing of raw materials, and there is no appropriate infrastructure for the collection, packaging and processing of agricultural and aquaculture products.

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