

Understanding community perception on aquaculture: Lessons from Mauritius as an ocean state

POUVEN NIRSIMLOO^{1,✉}, SUSHMA MATTAN-MOORGAWA^{1,✉}, RANJEET BHAGOOLI^{1,2,✉}

¹Department of Biosciences and Ocean Sciences, Faculty of Science and Pole of Research Excellence, Sustainable Marine Biodiversity, University of Mauritius. Réduit 80837, Republic of Mauritius. Tel.: +230-52533192, ✉email: pouv520@gmail.com; ✉✉s.moorgawa@uom.ac.mu;

²Institute Oceanography and Environment (INOS), Universiti Malaysia Terengganu, Malaysia. ✉✉✉email: r.bhagooli@uom.ac.mu.

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Abstract. *Nirsimloo P, Mattan-Moorgawa S, Bhagooli R. 2019. Understanding community perception on aquaculture: lessons from Mauritius as an ocean state. Ocean Life 3: 47-53.* Aquaculture is considered as one of the fastest food production industry during the past decade and holds high importance in fulfilling the global seafood demand. Globally, limited studies have been conducted on the social acceptability of aquaculture. It thus remains a key challenge to understand the perceptions of people on this subject in order to manage fish farming in a sustainable way. A survey-based approach was developed in order to have an in-depth assessment of perceptions and attitudes of public on aquaculture and its implications on the Blue Economy in Mauritius. Respondents' perceptions were evaluated on five different aspects of aquaculture, namely, knowledge, socio-economics, environment, food security and implications for a Blue Economy. A total of 385 questionnaires was administered for the study from October 2016 to March 2017 and a response rate of 100% was recorded. Different statistical tests, like Spearman Correlation, Kruskal-Wallis and Chi-Square test, were used to compute data. Descriptive statistical methods revealed that 69.1% of respondents were in favor of expansion of the aquaculture industry in Mauritius. A poor but significant correlation ($r=-0.0169$, $p<0.05$) was found between favoring aquaculture expansion and perceived environmental concerns of aquaculture. A chi-square test confirmed a statistically significant association ($p<0.05$) between educational level of respondents and their knowledge on aquaculture. When aquaculture and Blue Economy in Mauritius were correlated, creation of employment opportunities, ensuring food security and boosting the economy of the country were factors chosen by most respondents to acknowledge the implications of aquaculture on the Blue Economy.

Keywords: Aquaculture, attitudes, blue economy, Mauritius, ocean state, perceptions

INTRODUCTION

Aquaculture is the rearing or farming of aquatic organisms, including fish, shellfish or aquatic plants, in fresh or saltwater (Verbeke et al. 2007). One of the fastest-growing food-producing sectors worldwide has been reported to be aquaculture (FAO 2016). At present, approximately 50 percent of world's fish that is used for food comes from aquaculture (FAO 2016). It has been predicted that in about a decade after year 2012, the production of fish through aquaculture will surpass that of capture fisheries (FAO 2012).

The Mauritian economy is dependent on various sectors and industries, mainly tourism, textile, and sugar. In the last decade, a diversification of sectors has been encouraged by the relevant authorities of Mauritius to ensure the country's long-term economic growth. These new emerging industries include Blue Economy as well as Communication and Technology. Studies done by the Ministry of Fisheries suggested that Mauritius has the potential to develop commercial aquaculture and predicted annual production of 29,000 tonnes of fishes. Promoting export and increasing fish production is the potential of aquaculture industry in Mauritius (Ministry of Agro-Industry and Fisheries & Board of Investment 2007). In most countries practicing fish farming all around the world, the aquaculture sector is still under study (Grigorakis

2009). At present, in Mauritius, aquaculture is not adequately developed to become one of the important pillars of the Mauritian economy. On a global scale, a limited number of studies have been conducted on the social acceptability of aquaculture. In order to manage fish farming in a sustainable way, understanding perceptions of people on this subject remains a key challenge (Bacher et al. 2014).

The Blue Economy has crossed a milestone with the promulgation of the Marine Zones Act 2005, thus encouraging the implementation of research and production activities in the maritime zone of Mauritius (Francois 2016). The Mauritian economy is blessed with an Exclusive Economic Zone (EEZ) stretching over 2.3 million Km² and also co-manages about 400,000 Km² of its continental shelf with the Republic of Seychelles. This makes the Republic of Mauritius the 20th country in the world with the largest EEZ (Intercontinental Trust Ltd 2013). Some of the islands that form part of the Mauritian territory are Rodrigues, Agalega, Tromelin, St. Brandon and others (Jahangeer 2004). The inhabited islands are Mauritius, Rodrigues, and Agalega. Making the ocean an economic pillar in future years is one of the main objectives of the Mauritian authorities. At present, the economic and exploitation potential of the EEZ of Mauritius is largely untapped.

Sustainable aquaculture is of great importance because it offers prospects of commercial competitive profits as well as maintaining a stable level of income over the long term (Sadally et al. 2013). Sustainable aquaculture not only determines the environmental impacts at a specific site but also takes into consideration impacts of aquaculture offsite and combined impacts of human-environmental systems (Costa-Pierce and Page 2010).

At present aquaculture is not adequately developed to become one of the important pillars of the Mauritian economy. This study aimed to investigate the attitudes and perceptions of the Mauritian population on coastal aquaculture development in Mauritius and its implications for a Blue Economy. The specific objectives were to investigate the perceptions, attitudes, and knowledge of the Mauritian population on coastal aquaculture and also to determine the perceived impacts of aquaculture on the Blue Economy of Mauritius.

MATERIALS AND METHODS

Study site

Found just above the Tropic of Capricorn in the Western Indian Ocean (WIO), Mauritius forms part of the Mascarene Islands and is of volcanic origin. Mauritius has an area of 1865 km² and its coastline extends over 322 Km. According to Statistics Mauritius (2017), the actual total population of Mauritius stands at 1.26 million.

Survey method

A probability sampling method was used for this study. Random sampling was used for this research. This indicates that each member of the total population has an equal and known chance of being chosen. This method was mainly chosen since it ensures the validity of statistical conclusions. Questionnaires were used as a research instrument for collecting primary data from individuals since these are the best tools for collecting such information and views. This research tool is also considered as very useful as it provides data agreeable to quantification and saves cost and time (Friel and Wyse 2012).

Questionnaire design

A structured questionnaire was designed in order to target the Mauritian population. It was designed to balance complexity, in order to ensure depth of analysis, and also to balance simplicity, so as to ensure ease of completion for respondents. The questionnaire was designed to follow a self-administration system, where the respondents were required to fill in the survey questionnaire themselves. Some help was provided to respondents who had difficulties in answering questions and to those who needed clarifications. Structure of the questionnaire was designed in a simple way, with the latter prefaced with a brief note addressed to respondents as well as a short introduction of the topic and purpose of the survey. The questionnaire was divided into 6 sections, with a total of 37 questions.

The questionnaire comprised of both open-ended and closed-ended questions. Each section consisted of at least one open-ended question, where the respondent had to answer in his/her own words. Other questions were designed in closed-ended form, where they were either dichotomous- type or multiple choice- type questions, requiring the respondent to make selections from a predefined list of responses. The questionnaire consisted of 6 sections: knowledge assessment, socio-economic aspects, environmental aspects, food security, blue economy, and respondent profile. All sections except sections 3 and 5 consisted of Likert-type scale questions where respondent had to state their level of agreement with a series of statements. Likert scale, being a psychometric response scale designed to obtain the respondent's degree of agreement with a statement is measured using a five-point scale: (1) Strongly disagree; (2) disagree; (3) Neutral; (4) agree; and (5) strongly agree. Some questions like preferences of aquaculture products and employment opportunities from aquaculture, were measured using the 3-point scales ranging from 'Yes', 'No' and 'No idea'.

Sample description and sample size

The survey was administered to random samples of the Mauritian population. It was ensured that all participants were above 18 years of age. A fair distribution between male and female respondents was also considered as important during data collection in order to ensure that accurate results are obtained. Based on a census carried out by Statistics Mauritius (2017) the total number of Mauritian population above the age of 18 years which was obtained was used to calculate the sample size. A total number of 385 questionnaires were administered in this survey. By considering a 95% confidence level and a 5% margin of error, the sample size was calculated using the Raosoft Sample Size Calculator (2017).

Study period and data collection

The survey was carried out for a period of three months, from October 2016 to March 2017. In each region where the survey was carried out, it was ensured that an approximately equal number of each gender was given the chance to participate. Each participant was approached in a professional way and before start of the interview, the respondents were told about the ethics of carrying out a survey, such as confidentiality of information that would be provided by them.

Statistical analyses

Before proceeding to any analysis, a normality test was carried out on data collected in order to know whether these were normal or not. The Shapiro-Wilk Test (IBM SPSS software 21.0) indicated that data collected was non-parametric. For a sample size of 384, the Shapiro-Wilk Test was most appropriate. A reliability test was also carried out to know whether the research instrument used had strong reliability or not. The Cronbach's alpha reliability test was carried out which, according to Laerd Statistics (2016), is most commonly used to determine internal reliability. A Cronbach's alpha reliability value of

0.901 was obtained, indicating that the research instrument used had strong reliability and the scale used showed a high level of internal consistency. Some of the statistical analyses carried out were Kruskal-Wallis test, Mann-Whitney U test, Chi-Square test, Spearman's correlations and others. IBM SPSS version 21.0 was used for statistical analyses and computing of data as well as the generation of charts, tables, graphs, and figures.

RESULTS AND DISCUSSION

Figure 1 represents the percentage of respondents who live in proximity to the coast. Majority of respondents (70.9 %) do not reside near the coast. This could cause a difference in knowledge about coastal aquaculture between respondents living near the coast and those living far.

Perceived development of aquaculture of Mauritius

Forty-one percent of respondents (Figure 2) rated the development of aquaculture in Mauritius as 'medium'. A lower percentage, 37.7 %, of respondents attributed the development of aquaculture in Mauritius as 'low'. Only an inferior population of 6 respondents (1.6%) perceived that there was a 'high' development of aquaculture in Mauritius.

Relationship between residence in proximity to coast and development of aquaculture in Mauritius

Statistical analysis carried out (Mann-Whitney U Test; p -value = 0.001) indicated that there was a statistically significant difference between development rate of aquaculture in Mauritius as perceived by respondents and their residence in proximity to coast. By comparing mean rank of respondents living in proximity to coast and those who did not live near coast, it was observed that the mean rank value of respondents residing near the coast (220.61) was higher than those who did not (181.67). This indicates that the respondents' perception on development of aquaculture is affected by the region in which they live.

Perceived environmental consequences of coastal aquaculture

Figure 3 shows how respondents perceive different consequences of coastal aquaculture. Overall, 42.8% of respondents agreed that coastal aquaculture had an impact on the environment and 15.9% perceived the contrary. Majority of respondents agreed that transfer of pathogens and diseases (46%), water pollution (45.5%) and eutrophication (52.2%) were potential consequences of aquaculture. It was also observed that 26.5% of respondents did not agree that coastal aquaculture could cause water pollution. A similar proportion of respondents (27.8%) stated that native species in the ocean could be affected by introduced aquacultured species acting as invasive species. Of those who agreed with this

environmental consequence of aquaculture, 19% explained that introduced aquacultured species could compete for food with native species. Moreover, 1.6% of them stated that introduced species could compete for space with native species while 2.6% of the respondents suggested that it could cause spreading of disease to the natural environment. Other explanations for this consequence include disruption of food chain (1.6%) and cross-breeding with native species (2.6%).

Relationship between perceived consequences of aquaculture (water pollution) and favoring expansion of aquaculture industry in Mauritius

Spearman's Correlation test was carried out between water pollution as a perceived environmental consequence of aquaculture and respondents favoring expansion of aquaculture in Mauritius. A correlation coefficient ($r = -0.169$) indicated a poor negative correlation between these two variables. This implied that the more the respondents tend to say that aquaculture can cause water pollution, the more they disagree with the fact that they favor an expansion of the aquaculture industry or *vice versa*. Relationship between the two variables were significant (p -value = 0.001).

Access to the beach in proximity to an aquaculture farm

There was a superiority in number of respondents (29.6%) who rated their access to the beach as 'neutral' (Figure 4). 25.5% of respondents revealed that their access to the beach found near an aquaculture farm is likely to be 'difficult'. It should also be noted that 6.5% of respondents rated their access to the beach as 'very difficult', 11.2% of respondents found their access to the beach 'easy', and 13% of respondents found it 'very easy' in these specific circumstances.

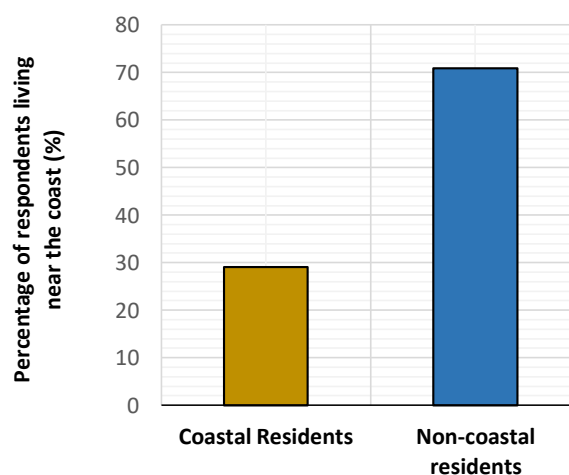


Figure 1. Percentage of respondents who live in proximity to coast

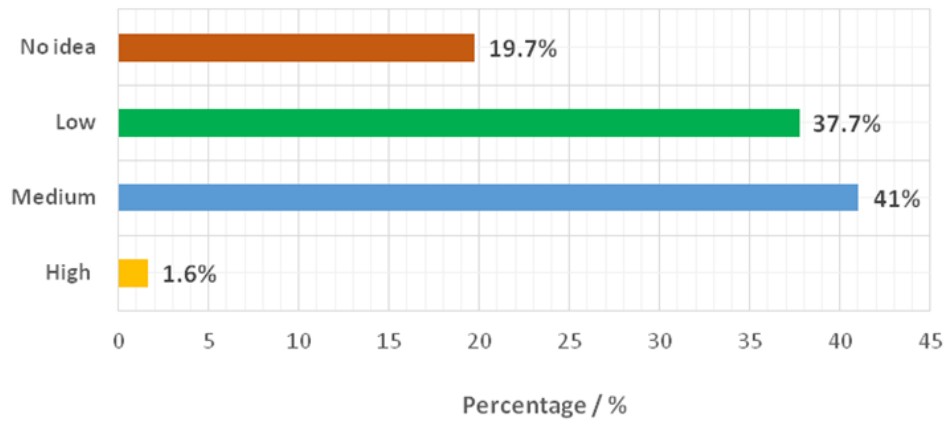


Figure 2. Development of aquaculture in Mauritius as rated by respondents (n=385)

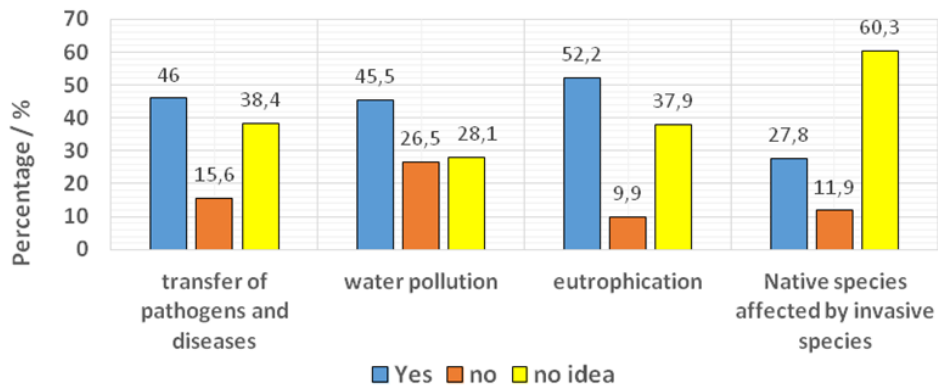


Figure 3. Perceived environmental impacts of coastal aquaculture

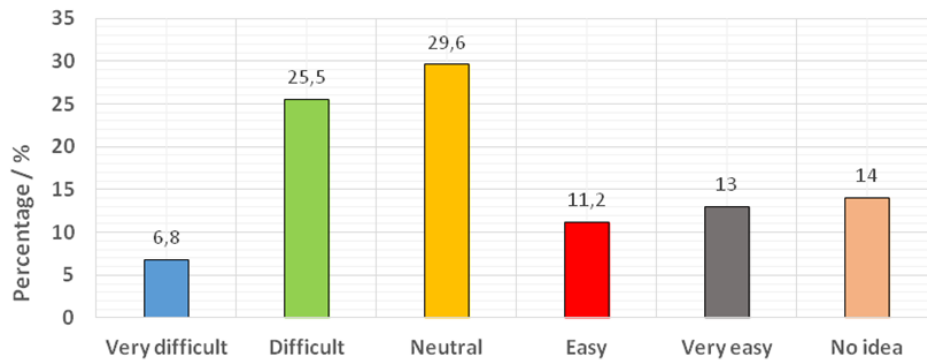


Figure 4. Perception level of respondents on their access to the beach found near an aquaculture farm

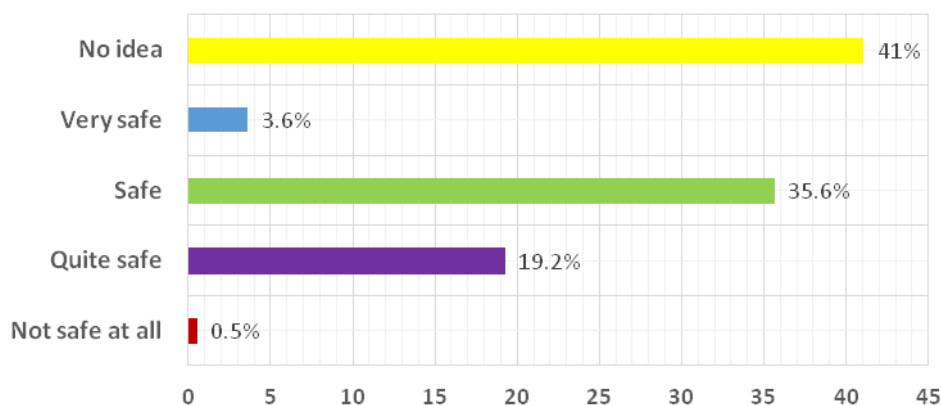


Figure 6. Perceived safety of consuming farmed products by respondents

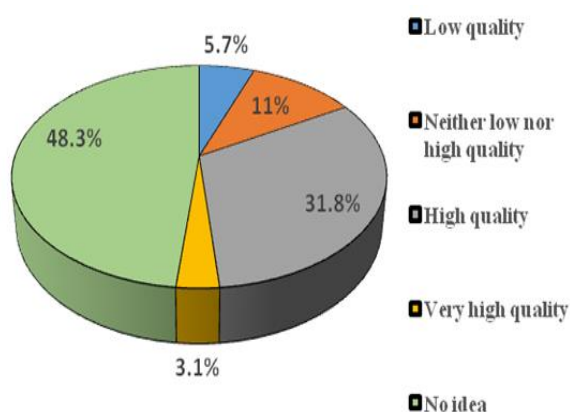


Figure 5. Quality of aquacultured products in Mauritius as perceived by respondents

Relationship between social appreciation of aquaculture as an activity and access to beach in proximity to an aquaculture farm

Spearman correlation was carried out in order to find a relationship between social appreciation of aquaculture as an activity and access to beach in proximity to an aquaculture farm. A correlation coefficient ($r = - 0.344$) revealed a moderately negative correlation between these two variables indicating that the more difficult the respondents would rate their access to the beach, the more they would agree that aquaculture is an activity of low social appreciation. Relationship between social appreciation of aquaculture as an activity and access to beach in proximity to an aquaculture farm were significant ($p = 0.000$).

Perceived fish quality from aquaculture farms in Mauritius

Majority of respondents (48.3%) had no idea the quality of aquacultured products in Mauritius (Figure 5). However,

31.8% of respondents suggested that farmed products in Mauritius are of high quality. Furthermore, few respondents (3.1%) reported that farmed products are of very high quality.

Perceived safeness of consuming farmed products

Above 35.6% of respondents find aquacultured products safe for consumption (Figure 6). 19.2% of respondents find farmed products quite safe for consumption, meaning there are some doubts and consumer resistance to these products. A further 3.6% of respondents find these products very safe to consume, and a smaller population of respondents (0.5%) think the contrary.

Relationship between quality of farmed products in Mauritius and safeness of these products for consumption

After a statistical analysis (Spearman’s Correlation) was conducted, it was found that a correlation coefficient ($r = +0.466$) existed between quality of farmed products and safeness of these products for consumption in Mauritius, indicating a relatively strong positive correlation implying that the more respondents find aquacultured products safe for consumption, the more they would be rating these products as high quality or vice versa. Moreover, this relationship was found to be significant ($p= 0.000$).

Discussion

Knowledge assessment on aquaculture

A high percentage of respondents (41%) rated the development of aquaculture in Mauritius as ‘medium’. This result is in conformity with a study carried out by Whitmarsh and Palmieri (2009) where they evaluated the social acceptability of aquaculture among the public of Scotland. It was found that the respondents’ perception on the development of aquaculture is affected by the region in which they live similar to the results obtained in Scotland (Whitmarsh and Palmieri 2009). This difference in perception among Mauritian respondents on development of aquaculture may be mainly due to level of exposure of respondents to aquaculture activities or information related to this specific topic in different regions of the country.

As for the expansion of aquaculture industry in Mauritius, 69.1% of respondents were in favor of expansion of the aquaculture industry. An in-depth study on this topic done in Scotland by Whitmarsh and Palmieri (2009) also found that the number of respondents in favor of aquaculture expansion greatly outnumbered those who were against. However, a study carried out in Baynes Sound of British Columbia by Murray and D'Anna (2015) does not support this outcome whereby most respondents did not agree to the expansion of shellfish aquaculture. Katranidis et al. (2003) obtained similar results where respondents from western Greece had a tendency to exhibit a negative perception and attitude towards aquaculture and its expansion. Some of the reasons for which aquaculture expansion is found undesirable and untenable include environmental, spatial and aesthetic impacts (Kite-Powell et al. 2013; Katranidis et al. 2003). Gibbs (2009) suggested the overloading of local 'carrying capacity' of shellfish aquaculture as one of the reasons that local people disagree with the expansion of the aquaculture industry.

Previous studies carried out in Scotland and Mediterranean suggest evidence that the social acceptability and expansion of the aquaculture industry were directly related to its perceived environmental impacts (Katranidis et al. 2003; Whitmarsh and Wattage 2006). A correlation analysis was carried out between perceived environmental consequences of aquaculture among Mauritian respondents and their views about favoring expansion of aquaculture industry in Mauritius. Poor negative correlation is indicative of some of the Mauritian respondents tending to think that aquaculture may cause negative environmental impacts and thus may be less in favor of expansion of aquaculture into a large-scale industry. One most obvious explanation is that most respondents would disagree with an expansion of such industry at the expense of environment, on which we depend a lot for our survival. Whitmarsh and Palmieri (2008) confirmed this result in a survey-based study in Scotland. They found that those respondents who attached the lowest priority towards the minimization of environmental damage from aquaculture were the ones who favored the expansion of salmon aquaculture in Scotland. Similarly, Freeman et al. (2012) reported a negative correlation between development and expansion of aquaculture and perceived environmental concerned among respondents in Germany and Israel.

Environmental aspects

A larger proportion of respondents (32.3%) rated their access to the beach in proximity of an aquaculture farm as difficult compared to those who said the contrary (24.2%). Furthermore, after a correlation was done between the social appreciation of aquaculture by Mauritian respondents and their access to the beach, it was found that these two variables were negatively correlated ($r = -0.344$), indicating that those who find the beach difficult to access tend to say that aquaculture is an activity of low social appreciation. The difficulty in accessing these coastal areas is mainly due to the fact that often this may end up in causing disagreements and conflicts with other users of the

beach and coastal zone (Hoagland et al. 2005; Halwart et al. 2007; Nimmo et al. 2011).

Food security

Verbeke et al. (2007) stated that consumers are always concerned about quality of farm products that they buy. Therefore to know the perception of Mauritian population on this subject, respondents were asked to describe the quality of aquacultured products in Mauritius. Surprisingly, 48.3% of the respondents had no idea of the quality of farmed products, but 34.9% perceived that these products are of good quality. Consumer survey studies carried out in Spain and other European countries suggest that quality of farmed species was considered to be of lower quality than their wild equivalents by the survey population (Kole 2003; Verbeke et al. 2007; Fernández-Polanco and Luna 2010). Bacher et al. (2014) argued that deficient information provided to consumers concerning the condition and quality of farmed products may be the result of this perception and distrust.

Nevertheless, the perceived safety of farmed products among Mauritian respondents was quite obvious, with more than 35.6% stating that the products are safe while 0.5% opposed to this fact and 41% had no idea. Verbeke et al. (2007) studied consumers' perceptions between farmed and wild products in Belgium and found that 22% of respondents perceived farmed fish was safer than wild ones. They explained this finding by arguing that farmed fish were healthier and safer for consumption since aquaculturists could easily control presence of diseases and pathogens throughout the aquaculture process. It was also debated that concepts of safety of farmed products rely on the consumers' perceptions about the harvest technology of farmed products (Young et al. 1999) which in turn depends on the quality and quantity of information that reaches the consumers from different sources (Fernández-Polanco and Luna 2012). In this study, it was found that the more the Mauritians tended to find the aquacultured products as better quality, the more they tend to find it safer for consumption.

Conclusions

Based on past studies carried out in various countries around the world, the public and stakeholder perceptions and attitudes play a vital role in governing the social acceptability of fish farming. This study was conducted in order to explore perceptions of Mauritian population on different aspects of the aquaculture industry in Mauritius. Implications of aquaculture on the Blue Economy have also been assessed in this study. More than half of the survey population had a good knowledge of Blue Economy. Further studies revealed that their high educational background may have been the reason for a good knowledge on this specific topic. However, most participants chose job creation, boosting the economy and ensuring food security, among others, as the factors linking aquaculture to Blue Economy of the country. The aquaculture industry in Mauritius has still a long way to go in terms of development in order to exploit fully its potential advantages and also to allow the Mauritian

consumers to make correct decisions based on scientific and unbiased information.

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