

ICH 2019**International Conference on Humanities****CONSUMER AWARENESS AND ACCEPTANCE OF
AQUACULTURE PRACTICES AND PRODUCTS IN PENANG,
MALAYSIA**

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Abstract

High demand of seafood products combined with over-harvesting of wild catch aquatic products have elevated aquaculture as the alternative way to strike a balance between seafood product supply and demand. However, uncontrolled aquaculture activities are found to affect the environment negatively as well as the health of consumers. Better awareness and understanding can regulate aquaculture practices and bring about environmental health through consumers' pressure on the aquaculture production system. This study aimed to identify consumers' perception on aquaculture industry, to study consumers' awareness on sustainability of aquaculture practice and also to find ways to increase consumers' awareness and acceptance of sustainable aquaculture practice and its products. A mixed research method was used in this study combining quantitative questionnaire survey of respondents who bought aquaculture products at wet markets in Penang, and qualitative in-depth focus group discussions (FGDs) with a number of selected respondents. Research findings show that most of the respondents are aware that aquaculture might give lots of negative effects to human health and the environment but, they still chose to buy aquaculture products due to cheaper price than wild catch seafood products. Hence, from the findings, it is clear that even though people have awareness, they have little choice but to accept the quality of aquaculture products. However, the results also show that enhancing consumer awareness and understanding empowers consumers to put pressures on producers paving the way towards sustainable aquaculture and greater acceptance of aquaculture practices and products.

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Keywords: Consumer, awareness, sustainable, aquaculture, practice and product.



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1. Introduction

The aquaculture industry has increasingly evolved into one of the most important food industries for the supply of aquatic food as over-harvesting of wild aquatic food has continued to deplete supplies (Food and Agriculture Organization of the United Nations ([FAO] (2020), Fisheries and Aquaculture Department (2012). Aquaculture, commonly also known as aquafarming, is the farming of aquatic products such as fish, prawns/crustaceans, molluscs, algae, aquatic plants, and other aquatic organisms. Aquaculture involves the farming of freshwater, saltwater and/or brackish water edible aquatic organisms under artificial and controlled conditions in contrasted to natural fishing and harvesting of wild aquatic food. Aquaculture is seen as the saviour in a world of depleting fisheries caused by over-fishing, pollution and other reasons. The aquaculture industry is one of the fastest growing food-producing industries in the world, supplying more than one-third of the world's fish food. However, poor regulation of the aquaculture industry has caused serious problems. Hence, despite much benefits to society, the industry is saddled with safety concerns. Unregulated aquaculture practices, especially in developing countries, have caused serious environmental problems. It has been documented that aquaculture products have man-made toxic substances such as antibiotics, pesticides, and persistent organic pollutants that can severely affect consumers (Cole et al., 2009). The above pollutants found in farmed fish can pose health concerns to unsuspecting consumers, in particular in children, pregnant or nursing women, and old people.

In Malaysia, aquaculture began in the 1920's, and has developed gradually. Aquaculture practices employed are brackish water aquaculture, marine aquaculture and inland aquaculture. Aquaculture farmers culture a wide variety of species, including saltwater, brackish water and freshwater varieties that include prawns, fish, shellfish, finfish, cockles, abalones, oysters, crabs and others. Increasingly, aquaculture has become a very viable and important source of supply of aquatic food towards enhancing food security as well as improving local livelihoods and earning export revenues for the country. In the recent Malaysia plans, the aquaculture sector has evolved to become the most important area in the government's recent development policy. The Malaysian government aims to increase aquaculture production by many folds in the future. In the 1990s, total production from aquaculture was 52,302 tonnes, and this was increased to 114,114 tonnes in 1994, almost doubled. According the data shown by Fisheries and Agricultural of the United Nation (2020) in year 2013, the total aquaculture production in the country increased to 194,139 tonnes with a market value of USD 308 million. By 2017, the total aquaculture production was more than 200,000 tonnes. This was about 20 percent of the total value of the fisheries production in Malaysia (Fisheries and Agricultural of the United Nation, 2020). Of the total, more than 70 percent is brackish water aquaculture in terms of value and quantity (FAO, 2020). However, difficulties in land acquisition, rising production costs, lack of skilled labour and threat of diseases are obstacles which impede the development of aquaculture (FAO, 2020). More importantly, the lack of strict regulations in aquaculture has led to negative effects of the industry on environment and society.

Recently, Loh et al. (2020) writing on "The Crustacean Chronicles" reported that Malaysian aquacultured shrimps contain two antibiotics – nitrofurans and chloramphenicol, both of which can lead to serious health issues. It is believed that residues from these two antibiotics are carcinogenic. It was also reported that in 2020, many Malaysian shrimp exporters have been put on the United States Food and Drug Administration (USFDA) red list after samples of 18 shipments from 11 Malaysian exporters were detected

to contain chloramphenicol. Loh et al. (2020) also reported that between 2009 and 2018, a total of 28 Malaysian shrimp exporters were put on the red list by the USFDA when 56 shipment samples were found to be contaminated with nitrofurans. Out of the 28 exporters, 19 were from Penang. There is no doubt that the aquaculture industry produces a great deal of wastes and harmful by-products that are harmful to people and environment. However, the literature indicates that consumer awareness of contamination of aquaculture products is low despite the fact that consumers' association have been highlighting the issue for years (Consumer Association of Penang, 2020). To ensure that the aquaculture industry is environmentally-friendly and its products safe, consumer awareness must be increased. With greater awareness, consumers understand they have the rights to change environmentally-damaging aquaculture practices to environmentally-friendly practices as well as to improve product safety and quality. Lack of awareness and knowledge among consumers can hamper consumers in changing their purchasing behaviour on choosing the right seafood products. Past studies have shown that consumers in Penang have poor awareness of the production processes in general, the safety of the products and health problems related to the products as they usually choose a product based on pricing (Shafii, 2008).

Consumers are also one of the most important parties that can be instrumental in achieving sustainable aquaculture practices as they can either accept and buy or reject the aquaculture products. According to Yi (2019), consumers can be won over by applying certification systems that are related to sustainability. Sustainability-related certification systems are also closely linked to safety and environment. Hence, certification is a tool for transferring value, trust, and reward between producers and consumers (Belton et al., 2011). Although consumer awareness and acceptance of aquaculture practices and their products are essential for applying sustainable aquaculture, academic research on consumer awareness and perception toward sustainable aquaculture are limited. It is therefore necessary to study consumer awareness, perception and the variables/factors that affect consumer behaviour towards the aquaculture industry and its products.

This study is focussed on studying consumers' level of awareness and their perception of aquaculture practices among consumers in Penang. The pilot study of this research indicated that few consumers understood the aquaculture industry, their practices, the production system and its products. A good consumer needs to know as much as possible about aquaculture practices so that he/she can identify the product's quality and safety. This study focuses on consumer awareness regarding aquaculture practices and the safety of its products. Consumers' awareness leads to acceptance and support, and this is vital to improve aquaculture practices and the safety of the products. Consumption pattern or consumers' behaviour can affect natural resources use and the quality of aquaculture products. Consumer awareness on aquaculture products and practices depends on their knowledge, attitude, experience and health condition (Clay, 2004).

2. Problem Statement

Every industry has a complex relationship with environment and society that is affected by the market, supply and demand and also the availability and sustainability of natural resources. Most products produced in the world use natural resources such as water, energy, soil and others that impact upon environment and people. The aquaculture industry and its products are no exception. In fact, aquaculture

farms use a lot of natural resources and cause degradation of environment, and poorly regulated aquaculture is shown to severely impact upon human health (Cole et al., 2009). This is because when pollution occurs it may influence the quality and quantity of the products, leading to negative effects on human health. To consume seafood, consumers need to understand what it means to prioritise sustainability over conflicting factors like price, the taste, quality and so on in the purchase situation. However, consumer awareness is vital to achieve sustainability goals when they buy or consume seafood or aquaculture products in wet market or eat in restaurant. When consumers are of low awareness, such as consumers in Penang, they just look at the price as the most important factor when purchasing aquaculture products. Based on this scenario, most consumers do not really care how aquaculture farms produce their products and distribute them to the market. Hence, they are not aware about the safety and quality of the aquaculture products, which may be contaminated and has the potential to harm their health. Eventually, poor awareness can lead to environmental degradation in terms of increasing CO₂ emissions, degradation of land and water quality, contamination of the environment, and negative effects on human health.

According to Nijdam et al. (2012), consumer's purchasing pattern of seafood can give rise to lots of negative effects to the natural resources quality and increase the vulnerability of the environment. However, if consumers purchase correctly, then it will bring positive effects to the environment. Consumers' decision making can have a big impact on industry and their production system. For example, when many people prioritise health and environment, they will prefer healthy food instead of tasty food, or junk food. Consequently, the food industry will change their strategy to produce healthy food that suits consumers' needs. This is because industry will fulfill the buyer's desire in the market so that they will earn more profit and sustain the product supply in the market (Mohan & Bhatta, 2002). Under the current scenario, however, consumers have low awareness on aquaculture, and they are unaware of their role in achieving sustainable aquaculture practices. Consumers believe that such a change must be the responsibility of the aquaculture industry or the government. Consequently, this makes the aquaculture industry solely focus on their quantity of production but not the quality, much less to safeguard or protect the environment. Unless Penang consumers change their buying strategy from one that is based on price to food safety, health food and food that is produced in an environmentally-friendly industry, it is unlikely that the aquaculture industry will focus on environmentally-friendly production systems, produce healthy aquaculture products free of contaminants, and become sustainable.

3. Research Questions

Several research questions are asked in this study as follows:

- What is the level of consumers' awareness and what is their perception on the aquaculture industry?
- What is the level of consumers' awareness on the sustainability of the aquaculture practices and their products?
- How can consumers' awareness on aquaculture be enhanced and what does it take for consumers to accept sustainable aquaculture practices and products?

4. Purpose of the Study

According to the research questions identified, this study is important because results of the study identify the level of consumer awareness and perception on aquaculture practices and its' products. Consumer perception can will identify the important factor/s influencing decision making among consumers when they buy seafood in wet market. Once the major factors of consumers' decision making are identified, they can give direction to the aquaculture industry to improve on their products and their practices. Indirectly, this study can propose some new inputs to the aquaculture industry to cater to the needs of the consumers based on their perception of aquaculture products. Next, this study can also understand consumers' awareness towards aquaculture practice and its' products. Based on this understanding, ways can be suggested on improving their awareness through labeling, public education, general knowledge, consumers' rights and so on. When consumers know their rights, they will take action to ensure aquaculture products are of good quality, free of contaminants and push the aquaculture industry to become more environmentally-friendly and sustainable. This study will also contribute some suggestions towards achieving sustainably managed aquaculture.

5. Research Methods

This study used a mixed method to do collect the data, process the data and analyze the data. The quantitative method used is through the distribution of questionnaires to 30 respondents in Penang state. A set of questionnaires was developed as the instrument for this study. There are a few sections in the questionnaire such as demography, consumers' perception and their awareness with regards to sustainable aquaculture practices and its products. This study collected 30 sets of questionnaires at various research locations. The researchers also selected 5 consumers to get detailed subjective data to supplement the quantitative data. These 5 respondents were grouped together for Focussed Group Discussion (FGD). The research was conducted in Penang, Malaysia and the major target of the study is to study about consumers' awareness towards sustainability aquaculture and its products. Thus, the study area was in Penang as the state has a large number of aquaculture farms. The data was analyzed by using SPSS. AS this is a preliminary study, the main statistical technique used was frequency analysis and descriptive analysis. Analyzed data are shown in the form of graphs, charts and tables.

6. Findings

6.1. To identify consumers' perception on aquaculture industry

Table 01. Acceptance and the changing factor of aquaculture product consumption

Acceptancy of aquaculture product					
Accept aquaculture product			Reject aquaculture product		
Reason	Number of respondent	(%)	Reason	Number of respondent	(%)
Fresh	2	6.7	Not fresh	0	0
Tasty	4	13.3	Not healthy	4	13.3
Healthy food	0	0	Not tasty	0	0

Cheap	11	36.67	Smelly	2	6.67
Easy to get	3	1	Toxic contamination	1	3.33
Trendy	0	0	Affected the environment	0	0
			Against by religion	0	0
			Trendy	0	0
			Personal health problem	3	1
	20	66.67		10	33.33

According to table 01, research findings show that 20 respondents (66.67%) accepted aquaculture products with different reasons. Not surprisingly, of those who accepted, 11 out of 20 (55 %) stated that the reason was price. The next popular reason for accepting was that the food was tasty. None of the respondents mentioned health as the reason. In contrast, only 10 respondents (33.33%) rejected aquaculture products based on rational reason. According to the results, it can be seen that the majority of Penangites accept aquaculture products and feel they are safe for consumption. The findings indicate that most of the consumers (36.67%) choose aquaculture product as a source of protein in their daily meal because it is cheaper compared to wild catch seafood products. Other than that, tastiness of the food is also important for Penangites. Of the 5 detailed interviews, the FGD revealed that price was indeed a top factor influencing consumers' decision, followed by tastiness of food. It was mentioned in the FGD that Penang was a food paradise and Penangites view their food seriously. The FGD also revealed that none of the 5 respondents knew that aquaculture products can be contaminated by chemicals.

For the 10 respondents who rejected aquaculture products, the main reasons were that aquaculture products were not healthy or were not safe to be consumed, will negatively affect their health (e.g. such as allergy, product smelly and the product was easy to get disease due to contamination). These feedbacks make us understand the reasons why aquaculture product was still not accepted by a significant number of consumers who know unsustainable aquaculture product might bring a lot of negative impact to their health. This survey can identify consumers' perception on their decision making towards aquaculture product consumption and it was useful to identify major factors affecting consumers' choice of products. This understanding will help towards finding more effective ways to improve aquaculture practices and ensure safety of their products. For instance, although price has been identified as the major factor for consumer choice in buying aquaculture products, once consumers' awareness and understanding of aquaculture and product safety are enhanced, then price will become less important. Rational consumers will understand that their health and their environment are more important, and will change their choice to accept aquaculture products at higher costs if the products are safe. This willingness to pay is for a sustainable product from a sustainable aquaculture industry. Of the 5 detailed interviews, the FGD revealed that none of them rejected aquaculture products. However, when it was suggested to the group that aquaculture products can be contaminated by chemicals, the group quickly agree that they may reject such food in future. This confirmed that once people are aware and understood the problem, they will reject aquaculture products as they value their health.

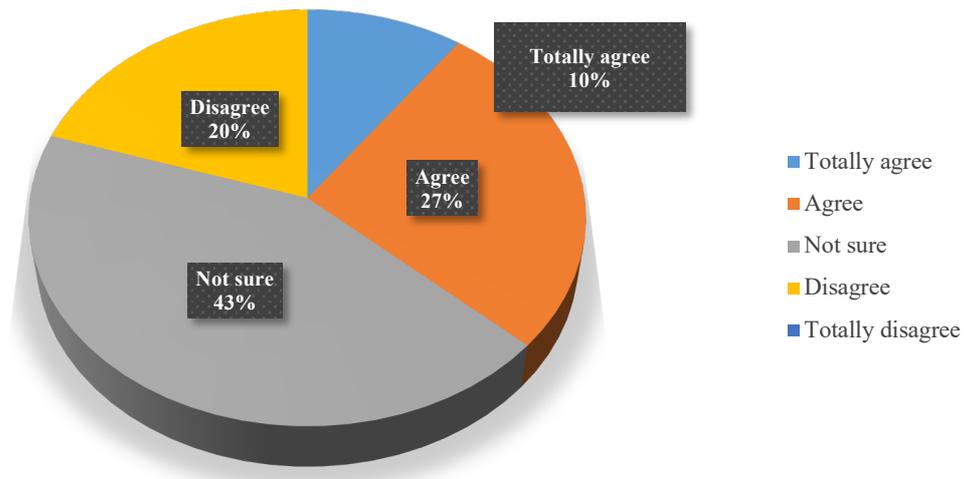


Figure 01. Aquaculture industry may contaminate environment

Figure 01 shows that most respondents/consumers are not sure whether the aquaculture industry contaminates the environment or not. Although aquaculture practices have huge potentials to contaminate our environment such as effluent discharge into receiving waters (rivers, ponds, lakes, seas etc), toxic pollution and soil degradation. Nevertheless, results of this study show that 43% respondents are not sure as to whether the aquaculture industry may contaminate environment. On the other hand, 20% of the respondents do not agree that aquaculture will pollute the environment. This group thinks that aquaculture is acceptable as it does not contaminate the environment. From these results, we find that the majority of the respondents are not aware that natural resources such as water and soil can be polluted by aquaculture practices if not regulated. Only 27% of respondents agreed with that aquaculture will negatively impact upon the environment, with 10% respondents totally agreeing with the same statement. Those who agree that aquaculture practices can cause environmental pollution are the well informed and educated ones with good awareness. They know the process of unsustainable aquaculture production system, the toxic chemicals they use, and the serious effects on the environment. As mentioned above, of the 5 detailed interviews, the FGD revealed that none of them rejected aquaculture products because they were not aware that it can be contaminated. Similarly, all the 5 were unsure whether the aquaculture industry contaminates the environment or not. However, as soon as it was made known to the group that aquaculture products can be contaminated by chemicals, the group quickly became aware of this issue and unanimously agreed that they will reject such food in future. This confirmed that once people are aware and understood the problem, they will reject aquaculture products as they value their health.

6.2. To study consumers' awareness on sustainability of aquaculture practice

a) Consumers' responsibility towards sustainably managed aquaculture

Consumer awareness on their responsibility can make aquaculture practices more sustainable. In this study, the results show that most of the consumers (36.7%) were not sure whether they have the responsibility to make sure aquaculture practices were sustainable or not. Another 30% of respondents disagree as they thought that they do not have responsibility on ensuring sustainable aquaculture practices.

These 66.7 % of respondents feel that the responsibility rests with the government or the aquaculture farmers/industry. In contrast, 20% of the respondents agree and 13.3% totally agree that they have the responsibility to make aquaculture practices more sustainable. These are the group of environmentally-responsible citizens. In general, most consumers do not think it is their responsibility to ensure the aquaculture industry is environmentally-friendly and sustainable. They are not aware that as responsible citizens and responsible consumers, it is part of their duty and responsibility to ensure aquaculture practices are environmentally-friendly and sustainable. There are also some respondents who indicated that they can do nothing or do little to influence the whole industry as they are merely consumers who buy cheap seafood. They do not realise that if consumers do not stand up and take action, then the industry will remain poorly regulated. Interestingly, from the FGD, it was found that there was unanimous agreement that consumers should bear some responsibilities towards the regulation of the aquaculture industry to ensure safe products. All 5 respondents were vocal in agreeing that consumers must be responsible although they also agree that government and the farmers should take the lead and be responsible. This confirmed that once people are aware and understood a problem, they will be more pro-active and take action.

b) Product's quality depends on aquaculture practice

The quality or safety of aquaculture products was very closely related to the farmer and farm practices. Better aquaculture practices may enhance the quality of products as it can reduce contamination on both products and environment. If sustainable aquaculture practice can be carried out perfectly, for sure many negative impacts can be eradicated. This will definitely improve the overall perception of aquaculture products among the consumers and the public. Based on the research findings of this study, it seems like most consumers were aware that the aquaculture practice can affect the quality of products. The questionnaire data showed that 40% of respondents agree there are connections between aquaculture practices and the product's quality. Another 26.7% totally agree that there is such a connection. However, 23.3% were not sure, 6.7% do not agree and 3.3% totally do not agree with the statement. Nevertheless, the results indicate a generally good perception on consumers' awareness regarding the potential of aquaculture practices in affecting product quality. From the FGD, there was unanimous agreement that better aquaculture practices will generate better quality products. The group agrees that there is a close connection between aquaculture practices and aquaculture products. This confirmed that the aquaculture industry can produce safe and quality products if safe practices are adhered to.

c) Environmental health will affect product's quality

When production is carried out in an ecologically open system, wastes are produced and discharged into the environment. These waste products may include antibiotics, hormones, uneaten feeds, chemical agents used to condition the sediments, pathogens and so on. Aquaculture is dependent on essential environmental services like land, water resources and soil. Therefore, when all these natural resources are polluted by the unsustainable aquaculture practices, it will cause a huge negative impact not only to these natural sources but also the products. Contaminated products when consumed can negatively impact upon human health. Furthermore, contaminated products may be returned/rejected by importing countries. This will not only cause losses to farmers but also to the exporting country of aquaculture products like Malaysia.

Research findings show 46.7% of respondents agree that environmental health will affect aquaculture product's quality. Another 26.7% consumers say that they totally agree that polluted environment may cause bad quality to the product. In short, majority of consumers were of the opinion that environmental health can affect the aquaculture product's quality. In contrast, only 6.7% consumers are not sure and 20% among them disagreed with the statement. The results show that enhancing consumers' awareness is vital to ensure sustainable aquaculture practice. From the FGD, it was found that the group generally agreed that the quality of the environment affects the quality of aquaculture products. A good environment with clean water, clean air, clean soil and uncontaminated feed will yield good quality aquaculture products.

d) Poor product's quality will affect human health

On public health perspective, unsustainable aquaculture products will lead to some negative impacts on social and economic aspects. Polluted aquaculture products may cause disease and affect human health. Hence, this study had interviewed the respondents to understand their awareness about the effect of poor product's quality to human health. Results showed that 36.7% totally agree and 56.7% agree that poor product's quality will give rise to negative consequences on human health such as food poisoning, vomiting and long-term poor health. Only 6.7% were not sure whether poor quality aquaculture products will affect human health or not. According to this survey, we can know that most of peoples are aware that the quality of aquaculture product will affect human health, especially those who have allergies. Of the 5 detailed interviews, the FGD revealed that there was agreement that polluted aquaculture products can cause disease and poor human health. This confirmed that once people are generally concerned about their health, and they will most likely not buy or consume aquaculture products in future as they value their health.

6.3. To find ways to enhance consumers' awareness and acceptance of sustainable aquaculture practice and its products

Based on the FGD with the 5 selected respondents, some ways to enhance consumers' awareness and acceptance of sustainable aquaculture practice and its products were found. As with any developing industry, the aquaculture industry is not without its problems. However, education, training, risk-based management or best management practice will reduce the possibility of negative impacts. A central planning approach such as an authority to develop a national sustainable aquaculture plan that is both environmentally safe and socially acceptable should be expedited in Malaysia in order to regulate and ensure the industry reaches its full potential of a sustainable aquaculture practice. Consumers are one of the parties that have to take an active role in discouraging poor/bad practices, and vice versa. Consumers have an important role to play as they are motivated by their desire to ensure access to safe and quality seafood products, health, safety and a healthy environment. As such, it is vital that consumers and producers work closely together with the government regulating the industry. For a start, all parties need to work together to enhance public awareness and understanding on the aquaculture industry and its products. This is to ensure that the industry moves in the right direction benefitting all parties.

In Malaysia, programs like Malaysia Good Agricultural Practices (MyGAP) is a best management practice (BMP) that should be applied to all aquaculture farms. This program requires producers to abide with the country's legal requirements where the product is to be sold. The objective is clearly on health,

safety and food quality. According to Malaysia Department of Fisheries (DOF) (2020), MyGAP is a certification scheme drawn up by the Malaysian Department of Agriculture in 2002. According to Ministry of Agricultural and Agro-based Industry Malaysia (2014), the aims of MyGAP is to produce a comprehensive certification scheme for the agricultural, aquaculture, and livestock sector. This scheme is to increase the quality of agricultural products including aquaculture products produced by registered farms. Another objective of this scheme is to reduce the negative impacts on the environment. When the quality of production process and quality of aquaculture products are improved, exports to more country are expected. Last but not least, the objective of MyGAP is also to increase public acceptancy of aquaculture products. Therefore, this scheme or program is a good way to reach sustainable aquaculture practice and also to raise consumers' acceptancy along with safeguarding the environment.

From the FGD, it was also suggested that the authorities need to encourage farmers or aquaculture producers to use ecolabels to label their products. The function of the ecolabel practice is to increase consumers' confidence on aquaculture products since products that are labelled by ecolabel has already been checked or certified by a legalised third party such as a government department (e.g. Department of Fisheries). The practice of ecolabeling can increase consumers' confidence on aquaculture products. This is very important for consumers to avoid buying unlabelled contaminated products. Yi (2019), in the market-based approach, consumer support for sustainable aquaculture is really important. This is because the consumer support can be earned by using sustainability-related certification system such as ecolabel.

The FGD also mentioned that education is the key to success. With good understanding through education, consumers are willing to pay for sustainable aquaculture products, even if they are slightly more expensive. This is because a certified good quality product is healthy for the consumer. Farmers also invest to get better quality aquaculture products through the good practice or management in aquaculture industry. Many years ago, aquaculture practice in a sustainable manner was difficult due to too lack of technology support and high-costing. Recently, consumer that has high awareness on sustainability is changing this situation as increasing green consumer that demand good quality of goods and food in their daily life, thereby alleviating the cost problem. Therefore, educated consumers are willing to pay more to improve the aquaculture industry as this is a good way to increase product quality and conserve the environment.

7. Conclusion

There is no doubt that aquaculture is a very important industry supplying aquatic food to the masses. However, the industry in Malaysia is still poorly regulated and information on the industry and its products not readily available. Currently, globally and in Malaysia, aquaculture products are associated with some negative attributes such as foul smell, not tasty, not fresh and contaminated by chemical pollutants. Furthermore, the industry is also known to have negative effects on the environment. However, such negative effects are avoidable through better regulation, consumer pressure, marketing strategies and corporate social responsibility (CSR) on the part of the producers. This study had done a survey on consumers' perception and awareness on aquaculture practices and its products. Most of the consumers were found to be unaware of the implications that can occur due to unsustainable aquaculture practices and that those consequences may harm the product's safety, consumers' health and also the environment. This study provides some ideas for the improvement of consumers' awareness towards greater acceptance of

aquaculture products and the ways to achieve sustainable aquaculture practice. A best management practice such as the MyGAP program for the public and aquaculture farmers can enhance information or awareness among consumers and farmers. This program or scheme provides a good guideline for aquaculture products buyers and producers. In addition, MyGAP can also ensure that the farmers practice sustainably managed aquaculture without using chemicals or hormones in aquaculture practice. Results from this approach may paint a better image of the industry via consumers' perception and acceptance of aquaculture products. The use of ecolabel certification can also increase consumers' awareness and their confidence on aquaculture products. More public campaigns on various aspects of sustainable aquaculture practices and products can enhance the industry's image and sustainability. Finally, education is an important factor for success. With good understanding through education, consumers are willing to pay more for sustainable aquaculture products. Farmers who invest to get better quality aquaculture products through good practice or management also reap benefits. Consumer participation in the aquaculture industry is vital as the green consumer movement demands green products. Moreover, educated consumers are willing to pay more to improve the aquaculture industry in order to increase product quality and conserve the environment.

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References

- Belton, B., Haque, M. M., Little, D. C., & Sinh, L. X. (2011). Certifying catfish in Vietnam and Bangladesh: Who will make the grade and will it matter? *Food Policy*, 36, 289 - 299. <https://doi.org/10.1016/j.foodpol.2010.11.027>
- Clay, J. W. (2004). *Borrowed from the Future: Challenges and Guidelines for Community-Based Natural Resources Management*. Ford Foundation.
- Cole, D. W., Cole, R., Gaydos, S. J., Grey, J., Hyland, G., Jacques, M. L., Powell-Dunford, N., Sawhney, C., & Au, W. W. (2009) Aquaculture: Environmental, toxicological, and health issues. *International Journal of Hygiene and Environmental Health*, 212(4), 369-377. <https://doi.org/10.1016/j.ijheh.2008.08.003>
- Consumer Association of Penang (2020). *Deficiency in Management of Malaysian Aquaculture Industry*. Retrieved 26 February, 2020, from <https://consumer.org.my/deficiency-in-management-of-malaysian-aquaculture-industry/>
- Fisheries and Agricultural of the United Nation (2020). The state of the world fisheries and aquaculture 2012. Retrieved 13 January, 2020, from <http://www.fao.org/fishery>
- Food and Agriculture Organization of the United Nation (2020). National Aquaculture Sector Overview: Malaysia. Retrieved 26 February, 2020, from http://www.fao.org/fishery/countrysector/naso_malaysia/en
- Loh, A., Shen, J., Hilmy, I. H. T., & Gopal, T. N. (2020, January 5). The Crustacean Chronicles. *The Star*. <https://www.thestar.com.my/news/nation/2020/01/04/the-crustacean-chronicles>
- Malaysia Department of Fisheries (2020). Retrieved 3 January, 2020, from <https://gosgstag.malaysia.gov.my/portal/content/26962>
- Ministry of Agricultural and Agro-based Industry Malaysia (2014). Retrieved 3 January, 2020, from <https://www.moa.gov.my/web/guest/mygap>
- Mohan, C. V., & Bhatta, R. (2002). Social and economic impacts of aquatic animal health problems on aquaculture in India (pp. 63-75). In J. R. Arthur, M. J. Philips, R. P. Subasinge, M. B. Reantaso, &

- I. H. MacRae (Eds.), *Primary aquatic animal health care in rural, smallscale, aquaculture development*. FAO Fish. Tech. Pap. No. 706.
- Nijdam, D., Rood, T., & Westhoek, H. (2012). The price of protein: Review of land use and carbon footprints from life cycle assessments of animal food products and their substitutes. *Food Policy*, 37(6), 760-770. <https://doi.org/10.1016/j.foodpol.2012.08.002>
- Shafii, N. I. B. M. (2008). Factors influencing compulsive buying behavior: a study of Penang shoppers. [Unpublished Master's Thesis]. Universiti Sains Malaysia, Penang.
- Yi, S. (2019). Determinants of Consumers' Purchasing Behavior for Certified Aquaculture Products in South Korea. *Sustainability*, 11(14), 3840. <https://doi.org/10.3390/su11143840>