THE IMPORTANCE OF IMPLEMENTING GOOD AQUACULTURE PRACTICES BASED ON THE ANALYSIS OF QUR'ANIC VERSES

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ABSTRACT: *The objectives of the papers include presenting the current conditions of aquaculture practices, understanding the importance of good aquaculture practices, and most importantly reviewing the Quranic verses in accordance with the importance of conducting good aquaculture practices. Aquaculture itself is in charge of around 47 percent of the fish consumption in the world. Its value is estimated to be around 125 billion USD and it is responsible for 13% of the world's animal-source protein (eggs and dairy excluded). Around 24 million people rely on the sustainability of aquaculture to ensure they have a proper living. The Quranic verses state about environmental corruption, prohibition of wastefulness, and the importance of ensuring the environment is well protected. It is crucial that humans start to carefully monitor the environment as what happens to it is derived from their actions, as stated in Quránic verse 30:41: "Mischief has appeared on the land and sea because of (the meed) that the hands of men have earned." The paper also discusses the importance of productivity and quality as aspects of achieving success. The method used is library research which includes the observation from Islamic perspectives. This is in line with achieving the highest objectives of Shariah, which protect the farmers, the environment, the aquaculture, and the consumers. The output of the study may serve MyGAP and MS 1500:2009.*

Keywords: Aquaculture, Quranic verses, Pollution, Good Aquaculture Practices

I. INTRODUCTION

Aquaculture is an important industry in Malaysia that contributes to social and economic development while, Food safety and quality are critical issues of great concern in Malaysia and throughout the world. It is more critical for Muslims as their consumption must be halal (permissible in Islamic Law) and Tayyib (safe, hygienic, wholesome, clean, and good). By 2025, the world is expected to be inhabited by more than 8 billion people and the rise will likely happen to many cities in developing nations.

Urban population is estimated to reach four billion by 2025 and it is important to ensure that the demand for food supplies can be met in this condition. Apart from that, the income is also expected to be higher and this situation leads to the rise of the food demand [1]. The increase in food production is inevitable and during the process, it is imperative to ensure that sustainable and environmentally-friendly systems are applied [2]. The aquaculture itself is in charge of around 47 percent of the fish consumption in the world. Its value is estimated to be around 125 billion USD and it is responsible for 13% of the world's animal-source protein (eggs and dairy excluded). Around 24 million people rely on the sustainability of aquaculture to ensure they have a proper living [3]. However, many applied aquaculture production processes are responsible for wastewater containing total phosphorus, total nitrogen, as well as suspended solids. Many aquaculture systems are still conducted in conventional biological and chemical techniques. Therefore, it is crucial to come up with effective and efficient systems that allow the prevention of pollution [4]. Polluting the earth and its environment leads to catastrophic disasters like tsunamis and hurricanes. Humans are expected to bow in supplication to Allah and they have to conduct good behavior that ensures sustainability. The importance of creating a system that is pollution-free is in line with the Quranic verse below.

And cause no corruption upon the earth after its reformation. And invoke Him out of reverence and hope. Indeed, the mercy of Allah is near to the doers of good. (Surah Al-A'raf [7:56])

Aquaculture is defined as a farming-related activity or the production of water species in certain conditions that are under supervision. One of the most important factors that dictate the success of aquaculture production is the implementation of management practices. Good implementation of management practices leads to production sustainability. Production sustainability is important to ensure a high level of productivity and high quality of the resulting products [5]. Not only affecting productivity and quality, but good management practices can also be the reason for increased profitability [6]. Those companies that intend to improve the quality and reach higher customer satisfaction will likely end up being more successful than those without any intent to do so [7, 8]. The Quran also suggests the importance of quality management and the relevant verse is as follows:

"O my people! Worship Allah. Ye have no other god but Him. And give not short measure or weight: I see you in prosperity, but I fear for you the penalty of a day that will compass (you) all rounds. "And O my people! Give just measure and weight, nor withhold from the people the things that are their due: commit not evil in the land with intent to do mischief."(Al Qurán 11:84-85)

This paper offers an overview of Quranic verses that are relevant to the sustainability of the aquaculture system and the implementation of aquaculture good management practices. Islam encourages us to be responsible and environmentally friendly in every single aspect of our lives. Many aquaculture systems are still highly associated with pollution and it is important to develop methods to combat that. Apart from that, quality and productivity are also very crucial as the demand for food supplies has always continued to increase and aquaculture farming is an alternative source that can ensure the demand is met.

II. LITERATURE REVIEW

A. Environmental Issues Associated with Aquaculture Systems

Aquaculture production has continued to increase nowadays as the demand for food supplies is getting higher day by day. It is crucial to make sure that the same mistakes that occurred in the Green Revolution (agriculture) do not happen again [9]. Despite the high development in agriculture for human consumption, it is also important to note that this intensification was also responsible for coastal waterways and inland pollution, excessive use of water and energy, and excessive use of antibiotics and chemical products [10]. It is widely known that poorly managed aquaculture practices have caused a

lot of negative effects on their surroundings. The three types of impact include pollution, loss of amenity, and competition for land use [11]. The physical impact of the activity and the inducement of negative human reactions due to the physical impact of the activity are the two requirements as to why certain pollution cases must be urgently taken care of [12].

Some of the aquaculture practices have been accused of so many negative impacts on the environment and many studies regarding that were also conducted. Shrimp farming, especially for those requiring the construction of a pond, can have negative effects on the existence of marshes and mangroves. This can be intensified when there is no awareness regarding the importance of understanding the relationship between coastal fisheries and marshes and mangroves [13]. Apart from hurting wetlands and mangroves, aquaculture practices are also known to be the cause of harmed biodiversity due to escaped certain fish species. It is also the reason for harmful groundwater and surface water contamination through the release of wastes [14].

Some of the most commonly found pollutants in aquaculture systems include phosphorus and nitrogen. The nitrogenous waste components are mainly caused by the fish excretion that is associated with ion exchange and diffusion through feces, urine, and gills. The decomposition process and recycling of nitrogenous components are particularly imperative in aquaculture utilizing recirculation methods caused by the high toxicity level of nitrite and ammonia as well as the possibility of the environment hypertrophication by nitrate [15]. The success of aquaculture systems is dictated by the location chosen, waste removal methods, and water quality. As the aquaculture system is developed to the next level, it is important to manage nutrient pollution, river and water consumption, as well as the effects on the ecosystems of the locals [15, 16].

The food remains uneaten, and body parts, and dead fish are some of the organic wastes from agriculture systems. This is called nutrient pollution, and this triggers the growth of a particular species of phytoplankton called microscopic algae. The presence of this creature is the reason for harmful algal blooms and this is also the cause of intensified fouling [17]. The low-quality feed has also been long suspected as the cause of aquaculture pollution as well as its contaminated waters. The soluble organic content is a crucial aspect of the water quality in the environment [18]. There are so many ways that allow the feed to interact with many different aspects (osmotic pressure, chemical reaction, wave strike, temperature, and pH) and some of them include desquamation, swelling, resolving, breaking, and pulverization. The pollutants that are released in a direct manner can easily contaminate the neighboring water and the quality of the soil [19]. The emissions that are released can potentially reduce the dissolved oxygen, trigger eutrophication and hyper-notification, increase the sedimentation burden, as well as improve the existence of the benthic and planktonic creatures [20, 21]. Aquaculture systems are also highly associated with the release of toxins and heavy metals, especially for the production of shellfish [22].

Many of the farmers are struggling financially and they cannot afford the expensive formulated feeds. Due to this situation, they are often forced to utilize bad-quality agricultural waste and by-products as an alternative. The mentioned two are naturally unstable and moist. Apart from that, uneaten feeds and fecal contaminants can highly affect the water quality in the system. These are also usually discharged to canals and rivers and eventually, they become pollutants that affect the ecosystem. The uneaten fish and the pollutants can potentially become a medium that allows the growth of some aquatic weeds such as blue-green algae. The consumption of the blue-green algae will cause the fish muscle to taste quite muddy [23]. It can be concluded that the chemical and organic matter utilization and poorly managed nutritional values may eventually affect the livestock, the ecosystem, the environment, and the surrounding societies [24].

Similar to agriculture, chemicals are also heavily utilized in aquaculture systems. To prevent disease and control pests, chemicals like antibiotics, disinfectants, and pesticides are used. Other purposes of chemical use include increasing productivity, reproduction control, enhancing growth, processing, transportation, improving the quality of soil as well as treating water [25]. Even though the US government has regulated both drugs and chemicals, illegally registered products are commonly used due to economic reasons. In Thailand, an average of 13 types of chemicals, four types of pesticides and disinfectants, and three types of soil and water treatment products are used. Fluoroquinolones are one of the antibiotics that is commonly used by shrimp farmers in Thailand [26].

Bangladesh, China, Indonesia, India, and Vietnam are some of the Asian nations that are known for their intensive aquaculture development. It has also been widely known that these countries are also responsible for regulating animal pollutants, human feces, and wastewater in the ponds [27]. Some of these methods are no longer popular to cater to the needs of farming more valuable items like shrimps as they are not able to grow in wastewater. The use of human feces may also greatly affect human health. Finfish farmed in wastewater-fed ponds may be the mediums of pathogens from human feces in their muscle tissue, digestive tracts, gills, and intraperitoneal fluid [28, 29]. Shellfish contaminated with animal waste and human excreta can be responsible for pathogenic bacteria and viruses in their digestive and muscle tissues [30].

B. Good Aquaculture Practices

All the examples of pollution reviewed earlier show that it is important to conduct such practices that allow sustainability. Aquaculture systems that involve unsustainable practices will likely be the reason for environmental degradation that can upset the natural balance of ecosystems. The impacts are even stronger in the surroundings that are near the area of aquaculture systems [11]. Thus, it is crucial to focus on the environmental effects as well as the solutions that prevent unfortunate occurrences. Such responsible aquaculture methods must be built to ensure good sustainability in production [31].

The implementation of good aquaculture practices is crucial as it is a medium that can prevent harming the environment and the surroundings. Certain precautionary actions must be taken as it is important to ensure the longevity of the system [32]. Environmental preservation and protection must be prioritized in the sustainable and responsible methods of aquafarming. Apart from that, good aquaculture practices are also highly associated with higher productivity and better product quality [11]. Not only

affecting productivity and quality, but good management practices can also be the reason for increased profitability [6].

Many studies regarding the improvement of aquaculture have been performed in the last decade [1, 33–38]. These studies were interested in reviewing the cases and some suggestions to improve the conditions were also made. One of the most important decision-making processes in aquaculture practices is the location selection that is relevant to the species developed [1, 39]. It is also important to apply the most suitable culture system [40, 41], find the best feed and feeding applications [35, 42, 43], implement a bioremediation system [44], apply proper waste management [45, 46], manage compliance certification [47] as well as perform more research studies to enhance the current systems [22]

The success of good aquaculture practices also relies heavily on the practices implemented by aquaculture farmers [48]. It is important that all the related activities are fully monitored, supervised, and reviewed to ensure that the best technical experience is achieved. Some relevant activities include food and diet, animal welfare, animal health, and animal nutrition. Malaysia has been one of the countries that take interest in doing so and some developments have also been made. Department of Fisheries launched a Code of Good Aquaculture Practices (GAqP) in 2005 [5]. As of now, the Code of Good Aquaculture Practices or Good Aquaculture Practices Scheme is called the Preliminary Farm Certification Program (PRP).

Good aquaculture practices are defined as the advancement and implementation of preventive measures to reach all the requirements regarding cultural techniques, environmental situations as well and the needs of a certain species. It is crucial that the aquaculture players take an interest in developing the system as it is a means to control the operation and to prevent the risk [40]. Potential diseases can also be avoided if aquaculture practices are well implemented [49]. Good knowledge about the system also prevents the players from heavily utilizing chemotherapeutic agents [50]. The Hazard Analysis Critical Control Point (HACCP) principles can be utilized as a medium that allows the risk management system to ensure that pathogens and diseases are not spread at aquaculture sites. The HACCP system is associated with preventive measures and a hazard analysis needs to be performed to get a better understanding of a potential hazard in the system. Upon doing that a Critical Limit, with a maximum and or minimum threshold, is set for each aspect of the method [51]. Once a violation is made, corrective measures must be conducted to ensure all the systems comply with all the requirements [52]. Both freshwater and marine aquaculture systems can benefit from HACCP principles to identify and control hazards that occur in the system or production development [51].

Biological, chemical, and physical preventive actions are taken to ensure that a better aquaculture system is reached. Biological activities are meant to handle infections and they include the responsible use of chemotherapeutic agents and the proper involvement of vaccines. Apart from that, the isolation of incoming seed stock is also important to prevent the distribution of dangerous pathogens [51]. Chemical activities are a means to treat the materials before entering the aquaculture sites. This is crucial as it is expected to hinder the growth of vectors or pathogens. Some of the chemical activities include performing chlorination or adding ozone to treat the water, and handling potential vectors such as clothing, footwear, and tools by exposing them to chlorine and iodine [49]. Physical activities are conducted to prevent contamination from the vectors to aquaculture facilities [34].

The scholars also take a great interest in developing a better system for seaweed farming as it is highly associated with a sustainable coastal aquaculture system. The system is called Integrated Multitrophic Aquaculture (IMTA) seaweed farming and the production has been done in a huge scale [9, 53, 54]. The implemented system allows mutual advantages for the cultured organisms and it also affects the water quality of the system. Macroalgae benefit from inorganic nutrients to ensure their growth and therefore possible to reduce the seasonal nutrient depletion from aquaculture. Apart from that, macroalgae have also been used as a medium to treat the waste before being released into open waters [54].

C. Quranic Verses Related to Pollution Prevention

Allah has created a man to be ‘Khalifah’ or the caretaker of the earth. He has clearly stated in the Qurán: Behold your Lord said to the angels: *‘I will place a vicegerent on the earth.’* (Al Qurán 2:30)

“And it is He (God) who has made you successors Khalifa) upon the earth and has raised some of you above others in degrees [of rank] that He may try you through what He has given you. Indeed, your Lord is swift in penalty; but indeed, He is Forgiving and Merciful.” (Al Qur’an 6:165).

'Khalifah' or vicegerent is one who exercises the authority delegated to him by his principal and does so in the capacity of his deputy and agent. Hence, whatever authority he possesses is not inherently his own, but is derived from, and circumscribed by, the limits set by his principal. A vicegerent is not meant to do what he pleases but is obliged to carry out the will of his master.

As Allah began creating the earth for human beings, He ensured that the earth would be livable and sufficient for human life. Trees and plants were provided, rivers were given, and mountains were created. All of them are to ensure that humans can have proper life on this earth. As Muslims, it is important for us to keep the system in a good and orderly manner. The same goes with aquaculture practices, it is important that we come up with systems that do not upset the environment. Everything must be designed in a way that pollution is minimized. The Quranic verses related to the importance of environmental protection are as follows:

And cause no corruption upon the earth after its reformation. And invoke Him out of reverence and hope. Indeed, the mercy of Allah is near to the doers of good. (Al Qurán 7:56)

Khalifa is an Arabic word for an earthling, and it is an amazing word with many meanings like a caretaker of the earth, viceroy, guardian, and deputy. Despite the strength, it will bow down to Stewardship. Humans are destined to be the most brilliant creatures on earth. As humans, it is important to be responsible and to make use of the knowledge to our maximum capacity. In aquaculture practices, it is crucial that new discoveries and ideas are there to ensure the continuous development and sustainability of the system. The Quranic verses associated with the use of intelligence are as follows:

"Indeed, We (God) offered the Trust to the heavens and the earth and the mountains, and they declined to bear it and feared it; but man [undertook to] bear it. Indeed, he was unjust and ignorant. (Al Qur'an 33:72)

Allah dislikes all types of corruption, and environmental corruption is one of those. As humans, we are not supposed to conduct some behaviors associated with environmental corruption. It is important not to be greedy and take what we need only to ensure a good level of preservation. In the aquaculture industry, many systems are developed to ensure sustainability. Vandalism and poaching are not allowed as they may cause the depletion of the animal stock. If it is taken to the next level, this can put the world to hunger or malnutrition. The Quranic verses related to environmental corruption are as follows:

"And Allah loveth not those who do mischief" (Al Qurán, 5: 64)

"And do no mischief on the earth after it has been set in order: that will be best for you if ye have Faith" (Al Qurán 7: 85)

"Eat and drink: But waste not by excess, for Allah loveth not the wasters" (Al Qurán 7: 21).

"And do good as Allah has been good to you. And do not seek to cause corruption in the earth. Allah does not love the corrupters", (Al Qurán 28:77)

"Mischief has appeared on the land and sea because of (the meed) that the hands of men have earned." (Al Qurán 30: 41)

III. QURANIC VERSES RELATED TO ETHICAL AND GOOD AQUACULTURE PRACTICES

It is stated in the Qur'an, "*It is He who has made the sea subject, that you may eat thereof flesh that is fresh and tender, and that may extract there from ornament to wear; and you see the ships therein that plough the waves, that you may seek (thus) of the bounty of God and that you may be grateful*" (Al Qurán16:14). This verse indicates that God created sea so that humankind could find fresh food to eat and extract ornaments to wear therein. The Qu'ran also says about the ordains to preserve the environment: *"Then We made you heirs in the land after them, to see how you would behave"* (Al Qur'an 10:14). This verse explains that humankind may exploit and culture food (fish and other organisms) and ornaments without destroying marine ecosystems. Thus, humans should not disturb the balance in the sea created by God and they should be accountable if they destroy the marine ecosystems by any activities such as exploiting and culturing fish and other organisms. Therefore, the destruction of the marine environment is considered the immoral and unethical use of natural resources. Islam really cares about quality and wellbeing and good aquaculture practices are conducted to ensure that better quality is achieved. Better product quality is not only a medium that serves the needs of humans, but it is also something that can be related to the profitability of the company. The profitability earned will somehow lead to the longevity of the company and customers satisfaction. Good quality products dictate the success of the company.

The Islamic concept that discusses the importance of quality is as follows:

Humans have important yet interrelated roles in this world and they are the servants and vicegerents of Allah. Due diligence is important to ensure that the roles are perfectly done. It is important for humans to improve productivity. Good aquaculture practices are also highly associated with high productivity. Productivity is a sign of success and success in worldly life can bring success in the hereafter. To ensure productivity, it is also important that efficiency and effectiveness are achieved. Allah does not like waste and as humans, we are supposed to minimize the amount of waste. Some of the Quranic verses related to productivity include:

"For the wasteful are the brothers of Satan; and Satan is ungrateful to his Lord." (Al Qurán 17:27)

"And eat and drink, but waste not in extravagance, certainly He (Allah) likes not those who waste in extravagance." (Al Qurán 7:31)

"And He provides for him from (sources) he never could imagine. And if anyone puts his trust in Allah (SWT), sufficient is (Allah) for him, for Allah (SWT) will surely accomplish His purpose verily for all things has Allah (SWT) appointed a due proportion" (Al Qur'an 65:3).

Water is a very important aspect of human life and therefore, it is important to keep the water clean and sustainable. All creatures in this world highly depend on water and if the water is not properly managed, unfortunate things may occur at the end of the day. Good aquaculture practices ensure that the water bodies are not polluted, and it is important to keep the water bodies clean and consumable. Some of the Quranic verses regarding the importance of water for consumption are as follows:

"We made from water every living thing" (Al Qurán 21:30)

"Lawful to you is the pursuit of water-game and its use for food—for the benefit of yourselves" (Al Qurán 5: 96).

"Nor are the two bodies of flowing water alike, -the one palatable, sweet, and pleasant to drink. And the other, salt and bitter. Yet from each (kind of water) do ye eat flesh fresh and tender, and ye extract ornaments to wear" (Al Qurán 35:12).

Cleanliness is very important in Islam too. Humans are expected to handle cleanliness in every single aspect of their life. Cleanliness is the medium to reach a strong and healthy society. It is crucial that we build a Muslim society with those two mentioned characteristics. Cleanliness is also important in the aquaculture industry and therefore, the animals must be fed something clean. Human excreta and toxic waste are not supposed to be the diet of aquaculture animals. The Quranic verses regarding cleanliness are as follows:

"Surely God loves those who are most repenting and loves those who keep themselves pure and clean." (Al Qurán 2: 222)

"O' mankind! eat of what is in the earth lawful and good; and do not follow the footsteps of Satan. Surely he is a manifest foe for you." (Al Qurán 2:168)

IV. CONCLUSION

The paper has reviewed some Quranic verses and Islamic values that are highly associated with the implementation of good aquaculture practices. Some aquaculture practices are far from ideal as humans are naturally greedy and they only care about profitability. Based on the reviewed Quranic verses, it is crucial that humans start to carefully monitor the environment as what happens to it is derived from their actions.

Good aquaculture practices must be designed in a way that the balance in the environment is not upset. Quran also

suggests that it is important to design a system that allows everything to be conducted in an orderly manner. As a Khalifah, it is our responsibility to come up with an intellectual and ethical aquaculture system that is eco-friendly and not harmful to the surroundings.

Quality is one of the most important aspects of good aquaculture practices. Some Quranic verses regarding quality management, productivity, efficiency and effectiveness are also presented, if properly achieved, these are the signs of success. Efficiency and effectiveness are also highly associated with wastefulness, which is discouraged in Islam. By properly implementing good aquaculture practices, humans are expected to be more careful and ethical with the environment.

Water is also deemed very important in Islam and the aquaculture system applied dictates the quality of the water bodies. It is important to note that all creatures on earth are highly dependent on water quality. Therefore, good aquaculture practices are highly encouraged as we need to preserve the water and the animals as well as to maintain the cleanliness of the water source.

GAqP which is integrated with Islamic values according to Quránic verses can be implemented to serve MyGAP and MS 1500:2009.

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