



Conservation of Marine Biodiversity from Plastic Pollution for the Health and Well-Being of Society: a *Maqasidic* Approach

Normawaty Mohammad-Noor^{*1}, Abdurezak Abdulahi Hashi²
Muhammad Mursyid Al-Amien Kayati³, Juliana Mohamed¹ & Shahbudin Saad¹

¹Department of Marine Science, Kulliyah of Science, International Islamic University Malaysia (IIUM).

²Department of Biotechnology, Kulliyah of Science, International Islamic University Malaysia (IIUM).

³Department of Fiqh and Usul al-Fiqh, Kulliyah of Islamic Revealed Knowledge and Human Sciences, International Islamic University Malaysia (IIUM).

Abstract

Conservation of marine biodiversity is crucial in sustaining a healthy marine environment for the benefit of all living things, especially human beings. Current mass production technologies have caused the oceans to be inundated by the mass dumping of wastes, particularly of plastics and its derivatives, which have in many ways poisoned and became toxic to the health of marine life and its biodiversity. The importance of conserving marine life has been mentioned many times in the Qur'an and is in line with the *Maqasid al-Shari'ah* principles i.e., 'protect the life and wealth', because without a clean environment, humans lose the essence of life. Therefore, this paper discusses the impact of technological advances, particularly on the production of plastics and its derivatives on marine biodiversity, and their implications on community health. In addition, the paper aims to identify ways to tackle such problems from the Islamic and marine sciences perspectives.

Keywords: Preservation, microplastic, marine biodiversity, pollution, *Maqasid al-Shari'ah*.

Abstrak

Pemeliharaan biodiversiti marin adalah penting dalam mengekalkan persekitaran marin yang sihat untuk manfaat semua hidupan, terutamanya manusia. Teknologi pengeluaran besar-besaran semasa telah menyebabkan marinan dibanjiri oleh lambakan besar-besaran bahan buangan, terutamanya plastik dan derivatifnya, yang menyebabkan keracunan dan menjadi toksik kepada kesihatan hidupan marin dan biodiversitinya. Kepentingan memelihara hidupan marin telah banyak disebut dalam al-Quran dan selaras dengan prinsip Maqasid Syariah iaitu, 'melindungi nyawa dan kekayaan', kerana tanpa persekitaran yang bersih, manusia kehilangan intipati kehidupan. Oleh itu, kertas kerja ini membincangkan kesan kemajuan teknologi, khususnya terhadap pengeluaran plastik dan derivatifnya terhadap biodiversiti marin, dan implikasinya terhadap kesihatan masyarakat. Di samping itu, kajian ini bertujuan untuk mengenal pasti cara untuk menangani masalah tersebut dari perspektif Islam dan sains marin.

Kata kunci: Pemeliharaan, Mikroplastik, Biodiversiti marin, Pencemaran, *Shari'ah*, al-*Maqasid*

Introduction

Biodiversity is defined as the number of species i.e., species richness and abundance in a given area or ecosystem. The ocean and seas cover approximately 70% of the Earth's surface. Thus, it is unquestionable that the marine environment contains an enormous

biodiversity exceeding those on land. A study that was conducted from 2000 to 2010 through the largest-ever worldwide collaboration that involved more than 80 countries had estimated that there are 1 million to 1.4 million marine species living on Earth (Costello et al., 2010). However, ongoing research on marine biodiversity since then has recorded even more newly discovered species.

In the marine environment, there are many ecosystems that are known to play an important role in maintaining the marine biodiversity, the environment and ultimately support human livelihood and well-being. These ecosystems include the

**Corresponding author*

Normawaty Mohammad-Noor

Department of Marine Science, Kulliyah of Science, International Islamic University Malaysia (IIUM).

Email: normahwaty@iium.edu.my

mangrove, reef, seagrass, estuary, and seaweed ecosystems. These ecosystems carry out crucial functions and must be protected because they provide water resources, nutrient storage and cycling, food and medicinal resources, absorb and breakdown pollution, maintain the climate and can be used for recreational purposes. In the natural state, the species richness and abundance in these ecosystems are high. To prevent the loss of marine biodiversity in these ecosystems, mainly from human activities, many islands and marine coastal areas around the world are gazetted as marine parks and marine reserves. By having these marine protected areas, appropriate management can be implemented through enforcement and environmental governance. Nevertheless, anthropogenic activities are increasing due to demands for a better life and a lack of awareness on the impact of such activities to marine life. This has led to an alarming decrease in the marine biodiversity. Significant threats to biodiversity include over-fishing, habitat loss and pollution, and each of these threats has been classified as a global threat (Costello et al., 2010). Different types of pollution have been identified, such as chemical, light, noise and marine debris that threaten the marine ecosystems (Howard, 2019). Marine debris includes any persistent manufactured or processed solid material that are intentionally or unintentionally discarded into the marine environment, e.g., plastics, glass, rubber and metals. Currently, plastic pollution and its derivatives such as microplastics are the biggest man-made pollution.

From the Islamic perspective, the importance of environmental conservation for the benefit of all living things is strongly emphasized. There are many verses in the Qur'an that mentioned on environmental sustainability (e.g., Al-Rum: 41). Thus, Islam links the environmental awareness by connecting religion to other aspects of everyday life. Being a Muslim means that a person must understand and obey the explanations in the Quran, as humans are created as caliphs on the Earth. This principle is well known among the Muslim community, and it indicates the responsibility to sustain and guard the Earth and everything living in it. In addition, the management of the world must performed following the will of the Creator and the purpose of its creation.

Plastic pollution

Plastics are synthetic organic polymers which are produced from petroleum resources. Since their invention, they have been widely used for all kinds of purposes, including food packaging, medical and

technological applications (Frias & Nash, 2019). The manufacturing of plastics has increased rapidly since the 1940s and in 2019, the production reached 367 million tonnes (PlasticEurope, 2021). This revolutionary material has a multitude of uses as it has the properties of low density, low thermal and electric conductivity and resistance to corrosion, all of which unfortunately has also become the reasons for causing problems to the environment and finally to all living things (Frias & Nash, 2019). Due to these properties, the plastics are highly resistant to degradation and cause problems in their elimination from the environment (Sivan, 2011). The enormous number of plastics produced and used on land has spilled over to the marine environment. It is estimated that 10% of plastics produced will reach the marine environment and these plastics will accumulate and persist for a long period of time. Plastics waste can be classified into macroplastics and microplastics. Macroplastics are large plastic debris that can cause environmental impact through entanglement and ingestion by marine organisms such as by marine birds, mammals, fish and reptiles. In addition, macroplastics can act as transports for non-native marine species to new habitats, smothering the seabed and provide new ground. Stranded macroplastics on the beach can also cause problems to shipping, tourism, fishing and aquaculture resources (Sivan, 2011). It has been reported that macroplastics cause damage to marine biodiversity and this includes species that are red-listed by the International Union for Conservation of Nature (IUCN) (Gall & Thompson, 2015). Microplastics are the breakdown of macroplastics due to the action of ocean currents, solar radiation, abrasions and interactions with the natural environment (Frias & Nash, 2019) or are tiny plastic particles that are used in several industries such as in some cosmetic products. Due to their heterogenous properties, microplastics are difficult to be defined accurately. Therefore, by taking into consideration the size, origin, physical and chemical properties, Frias and Nash (2019) have defined microplastics as any synthetic solid particle or polymer matrix that characteristically are insoluble in water, derived from primary or secondary manufacturing and have different shapes and sizes (1 µm to 5 nm).

Microplastics and its impact on marine life and the human health

Microplastics have reportedly been detected in processed seafood products such as canned sardines and sprats, and the contamination is suggested to have happened through the processing of the fish, trophic

transfer or via prey-predator relationship (Karami et al., 2018). Microplastics were also found in zooplankton (Desforges et al., 2015), shellfish (Naji et al., 2018, Devriese et al., 2015) and fish (Ory et al., 2018; Tanaka & Takada, 2016). Due to their high surface area, microplastics can act as a vehicle for microbes and other organisms to invade new habitats and compete with the native species, thus leading to a loss of biodiversity. This would be of huge concern if the transported microorganisms are pathogenic, such as *Vibrio* spp. (de Tender et al., 2015; Keswani et al., 2016) that will increase the global disease risk to humans and animals.

Humans are exposed more to microplastics because they are used daily and highly preferred due to their low price and versatility. There are several ways that humans can be contaminated with microplastics i.e., via cosmetics, clothing, medicine, dust and food. The uptake routes are mainly through ingestion, followed by inhalation and dermal contact (Prata et al., 2020; Campanale et al., 2020). After ingestion, microplastics can cause three potential hazards through the release of chemicals, physical particles of the microplastics and microbial pathogen induced by microplastics (Ma et al., 2020). Although the effect of microplastics in human health is not yet fully understood, it is foreseen that microplastics can cause many problems, such as inflammatory lesions, neurodegenerative diseases, immune disorders and cancers (Prata et al., 2020). The size of microplastics plays a crucial role in determining their effects on humans. Microplastics with a size smaller than 150 µm might be easier to be translocated from the gut to the lymphs and circulatory system in comparison to microplastics that are bigger than 150 µm (Barboza et al., 2018). Campanale et al., (2020) mentioned that microplastics smaller than 2.5 µm can enter the gastrointestinal tract through endocytosis by microfold cells once they have been ingested. This can cause inflammation due to their persistent nature, chemical composition and hydrophobicity. Furthermore, microplastics contain chemicals or can absorb chemicals during exposure to the environment and these chemicals may be toxic to animals and humans. Hazardous chemicals such as mercury, will be bioaccumulated and biomagnified through the food chain, before finally being ingested by humans or top predators. This raises concern of food security and food safety due to the loss of biodiversity and contamination of marine food sources (Barboza et al., 2018).

Policies to reduce marine plastics pollution

Intervention to reduce the use of plastic bags has started in many countries around the world, though

the degree of implementation and the capacity and magnitude of enforcement are varied. Among the strategies that have been implemented are bans on the sale of lightweight bags, charging consumers for lightweight bags and imposing taxes on stores that use the bags (Xanthos & Walker, 2017). Alpizar et al., (2020) have suggested that policies to reduce marine plastic pollution in developing countries need to be developed based on the impact pathway in order to understand the flow of plastics (production, consumption and disposal) and policy goals before identifying the role of specific policy instruments (such as taxes, subsidies, regulation and community preferences). Malaysia is one of the countries that implemented a plastic bag ban and the first attempt started in 2009. The high plastic usage has cause millions of tons of the plastics to reach the marine environment. To reduce plastic waste, many initiatives have been done by the Malaysian government, including the 'No Plastic Bag Day' campaign on every Saturday and Sunday. The campaign urges the public to reduce the use of plastic bags by not providing them, particularly in retail outlets, supermarkets and hypermarkets. A plastic bag charge (RM0.20) has also been introduced in most permanent business premises. This will encourage the public to bring their own reusable bags, thus decreasing the amount of single-use plastic bags.

Environmental Conservation with *Maqasid al-Shari'ah*

Environmental sustainability is always in synchronization with the objectives of the *Shariah* (Salamah, 2016), which are to protect the religion, the sustainability of human life, human intellect, human lineage and wealth. These five principles of *Maqasid al-Shari'ah* are also known as the five necessities (*al-daruriyat al-khams*), which are considered as basic human needs that are required to maintain the sustainability of human life (al-Qardawi, 2001). Therefore, environmental conservation is highly relevant to human needs. Its practice by humans to save the environment from collapsing, such as the loss of marine biodiversity due to pollution and human activities is in line with the *Maqasid Shari'ah* principles, specifically to protect the life and wealth, because without a healthy environment, humans lose the essence of life.

Thus, it can be said that preserving the environment includes five basic requirements (al-Kailani, 2014). Besides, the purpose of the *Maqasid al-Shari'ah* in general is to be beneficial to human life, and to minimize damage as far as possible. Al-Qardawi, a Muslim scholar, has proposed that the

Maqasid al-Shariah view on environmental preservation can be present in two ways i.e. curative (*ijabi*) and preventive (*salbi*). Curative is defined as keeping the current conditions, while preventive is defined as taking precautionary ways to avoid unnecessary damage. The *Maqasid al-Shari'ah* principles on environmental conservation as mentioned by al-Qardawi follow the five principles below (Muslimin et al., 2018):

First, protecting the environment is part of protecting the religion. This is because destruction performed to the environment causes the elimination of the sincere essence and devotion in religion thus impair human roles on the Earth (Salamah, 2016).

Second, protecting the environment is part of protecting life. Islam as the way of life pays attention to the rights of humans to live and has to maintain the soul and provide a healthy environment suitable for life. This is because health, safety, good life, maintenance of rights (al-Khayyat, 2004) reflects the protection of life. Thus, preserving the human life is a very fundamental part of Islamic teaching, as was mentioned in the Qur'an (Al- Maidah, 32).

Third, protecting the environment is part of protecting the human intellect. It is through the intellect that humans can act rationally and live a normal life. The faculty of intellect is what makes humans different from animals. Having this faculty makes the person responsible and accountable for their actions. This is the faculty that the revelation speaks of and gave guidance. Hence, to protect this faculty, Islam prohibits the consumption of all forms of intoxicants and alcohol.

Fourth, protecting the environment is part of protecting the human lineage. The natural wealth that we have today needs to be protected and passes to the next generation. Therefore, destroying the environment means violating the rights of future generations. Therefore, it is the duty of the current generations to protect the environment for future generations (Brown, 2017).

Fifth, protecting the environment is part of protecting the property. Environment is one of the most important assets that Allah created to support the continuity of life, hence it must be protected. Thus, humans need to protect and preserve the environment from damage in line with the principle of *Maqasid al-Shari'ah* which is to preserve natural resources, increase productivity, and guide the consumption and distribution of resources (al-Qardawi, 2001).

Therefore, it is clear that the Islamic understanding of the conservation of marine biodiversity is primarily derived from the five principles of *Maqasid al-*

Shari'ah. This includes the preservation of all forms of marine life and marine resources, avoiding wasteful consumption of marine resources and adopting a well-balanced approach to marine life.

Considering *Ma'alat* in Environmental Conservation

One of al-Shatibi's contributions in explaining *Maqasid al-Shari'ah* principles is to introduce the concept of *ma'alat* (consequences of actions) as an approach to applying *maslahah* (well-being) in human life. Since the principle of *ma'alat* engages with the collision between *maslahah* and *mafsadah* (harm), it need to be included under the discipline of *Maqasid al-Shariah* (Ishak, 2018). This means that the principle of *Maqasid al-Shari'ah* gives a clear guideline to differentiate between gaining *maslahah* and avoiding *mafsadah* in terms of priority. This idea is very significant and relevant to some situations in human life, when implementing Islamic rules might not achieve the seeking of *maslahah*, and maybe even be working against it. Thus, through the *Ma'alat* approach, al-Shatibi (2004) suggested to provide exceptions in some situations (Ishak, 2018). This approach has been used as a principle to ensure that the implementing of Islamic rules is in line with their original *maslahah*.

From the above introduction on the topic of *Ma'alat*, it is clear that considering the *Ma'alat* is a good approach in the application of *Maqasid al-Shari'ah* to environmental conservation. There are many types of ecosystems in the marine environment that play an important role in maintaining marine biodiversity, the environment and ultimately support human livelihood and well-being. Therefore, the marine ecosystems play a crucial function and need to be protected because they provide much benefits and *maslahah* to the human life. Among these benefits are that they serve as a source of water, nutrient storage and cycling, food and medicinal resources, absorb and breakdown pollutants, maintain the climate and can be used for recreational purposes, all of which are considered as *maslahah* for mankind. Thus, protecting the ecosystems and its functions is the best *wasilah* (means) of implementing the concept of *Ma'alat* by considering the consequences of our actions to apply the *Maqasid al-Shari'ah* in environmental conservation.

When discussing the topic of plastic pollution to the environment, it requires us to understand the issues through the perspective of *Ma'alat*. Plastics are widely used for many purposes to achieve the seeking of *maslahah* and benefits to human life, such as in food packaging to preserve food and medicine, and

also in technological applications (Frias & Nash, 2019). However, at the same time, the use of plastics also could lead to harm because as previously mentioned, this widely produced material is highly recalcitrant and persistent, which may harm the environment and all living things when it pollutes the environment. Thus, allowing the use of plastics, especially microplastics, results in being unable to achieve their *masalah* and benefits. Therefore, the principle of *Ma'alat* is applied to provide exceptions by banning the use of plastics, which normally would be allowed, since it would lead to *masfadah*.

Conclusion

Maintaining marine biodiversity is crucial for the life and health of humans. However, human activities have led to many problems that eventually led to the deterioration of the marine environment and marine life. Though originally a revolutionary and beneficial material, plastics have now become one of the biggest problems affecting the oceans. Microplastics derived from the plastics pollution can bioaccumulate and biomagnify in many marine organisms and eventually reach humans through the food web. Direct contamination of microplastics may cause potential hazards to human health if the management of plastic waste is not urgently tackled. Therefore, human must carry out our role as caliphs that have been entrusted by the Creator to manage the environment, including the marine environment for the benefit of the present and future generations of mankind. In addition, with the implementation of the five principles of *Maqasid al-Shari'ah*, the justification to conserve the marine environment in order to fulfill the basic human needs is strengthened.

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