

Ecological Consequences of Marine Noise Pollution

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Abstract:

In this article, the author delves into assessing the grave consequences of marine noise pollution upon the innocent species in the marine environment right from the microscopic Zooplanktons to the largest mammal on the planet, the Whale.

1. Introduction

The ocean covers over 71% of the Earth's surface.¹ It is a home to over 10 million marine species of various kinds.² A major chunk of these marine species rely heavily upon sound to communicate with one another. In the deep oceans where even rays of the light are rare to be found. Communication through sound is crucial for them for purposes such as navigation, hunting, reproduction, etc.³ Marine species such as whales and dolphins have a highly advanced biological gift to use sound communication. Originally for all the marine species, the quiet environment makes it suitable for them to communicate accurately to others. However, because of interference due to anthropogenic factors, it becomes increasingly difficult for them to do the same. Not only this, but they regard it as a threat since the quantum of emission of noise is exorbitant and is dangerous for them. It leads to disruption of their behaviour as they heavily depend on sound for navigation. These harsh levels of noise are inducing stress responses in the species that are causing hearing-problems and even hearing-loss in certain species. Additionally the emissions of noise are rather more frequent which is causing continued disturbance to them over a longer duration, therefore aggravating the problem they are facing.⁴

The MNP is impacting the largest mammals on the planet The Whale to even the minutest, microorganisms which cannot be seen with a naked eye, the *Zooplankton*⁵. In 2005, a report stated that 37 whales had died because of the sound emitted from the use of Sonar by the US navy, which was a part of their deep-water

¹ Ocean, <https://education.nationalgeographic.org/resource/ocean> (last visited Apr 9, 2024).

² The Ocean Conference, https://sustainabledevelopment.un.org/content/documents/Ocean_Factsheet_Biodiversity.pdf.

³ Do Marine Mammals Experience Stress Related to Anthropogenic Noise? , INTERNATIONAL JOURNAL OF COMPARATIVE PSYCHOLOGY 274.

⁴WBI Studies Repository, https://www.wellbeingintlstudiesrepository.org/cgi/viewcontent.cgi?article=1008&context=acwp_ehlm. (last visited Apr 14, 2024).

⁵ See Zooplankton, small floating or weakly swimming organisms that drift with water currents and, with phytoplankton, make up the planktonic food supply upon which almost all oceanic organisms are ultimately dependent. Many animals, from single-celled Radiolaria to the eggs or larvae of herrings, crabs, and lobsters, are found among the zooplankton. Permanent plankton, or holoplankton, such as protozoa and copepods (an important food for larger animals), spend their lives as plankton. Temporary plankton, or meroplankton, such as young starfish, clams, worms, and other bottom-dwelling animals, live and feed as plankton until they leave to become adults in their proper habitats.

Zooplankton | Marine Microorganisms, Planktonic Organisms, Microscopic Animals | Britannica, <https://www.britannica.com/science/zooplankton> (last visited Apr 14, 2024).

training mission, at the North Carolina Coast. The critics stated that the area in which such activity was carried out had also impacted sea turtle species.⁶

There are a wide range of activities that are carried out in the sea that produce noise. In another incident, the use of air guns, utilised for underwater seismic surveys stated that as a consequence of the noise so produced, it led to killing of *Zooplanktons*, a microorganism that is so miniscule that cannot be seen with a naked eye.⁷

The effects of the noise created by anthropogenic activities created in the marine environment impacts variably depending upon the hearing range of the species. Largely, fishes can be classified to be as hearing specialists, meaning that they have a broad hearing range with lesser auditory thresholds. The others can be classified under hearing generalists, they have a narrow/limited hearing frequency range with lesser auditory thresholds.⁸

What is concerning is that the intensity and frequency of anthropogenic noise pollution is much greater than the natural acoustic stimuli. Therefore this type of noise pollution has been having grave and adverse consequences upon the species in the marine environment.⁹ Current studies have shown that anthropogenic noise has the potential to directly as well indirectly affect the many marine species in various forms. One such consequence is auditory masking. According to Oxford Reference, auditory masking means “The obscuring of one sound, sometimes called a test stimulus, by another, called a masking stimulus, causing the absolute threshold of the test stimulus to increase or its perceived loudness to decrease.”¹⁰ In other words, it would mean that the species are in such a condition that they are not in a condition to hear a certain frequency of noise, this is caused due to deafening of their auditory organs. Further, there have also been studies that reported a change in behaviour, both at individual level and social behaviour among the species. Therefore, noise pollution not only poses a threat at an individual level but also affects the composition level and eventually the health and functioning of the entire ecosystem.

2. The following bullet points give a clear idea of how the MNP effects the species:

- (a) Hampers development/growth
- (b) Impact on Physiology
- (c) Behaviour Alteration
- (d) Beaching/Stranding
- (e) Impact on Reproduction
- (f) The problem of Masking

2.1 (a) Hampers development/growth:

The harsh levels of noise in the sea have the potential to affect not only the anatomy and morphology (morphology is the physical structure of the species). This happens as, at the beginning it starts with

⁶Michael Kaufman, Whale Stranding in N.C. Followed Navy Sonar Use, Wash. Post, Jan. 28, 2005.

⁷Noise pollution kills zooplankton, 546 NATURE 579 (2017), <https://www.nature.com/articles/d41586-017-00882-6> (last visited May 10, 2024).

⁸Chao Peng, Xinguo Zhao & Guangxu Liu, *Noise in the Sea and Its Impacts on Marine Organisms*, 12 IJERPH 12304 (2015), <http://www.mdpi.com/1660-4601/12/10/12304> (last visited Apr 9, 2024).

⁹Caitlin R. Kight & John P. Swaddle, *How and Why Environmental Noise Impacts Animals: An Integrative, Mechanistic Review: Environmental Noise and Animals*, 14 ECOLOGY LETTERS 1052 (2011), <https://onlinelibrary.wiley.com/doi/10.1111/j.1461-0248.2011.01664.x> (last visited Apr 9, 2024).

¹⁰Auditory masking, OXFORD REFERENCE, <https://www.oxfordreference.com/display/10.1093/oi/authority.20110803095433737> (last visited Apr 9, 2024).

damaging single cells which later develops to damaging organs.^[11] In a study conducted, it was observed that the noise can damage statocysts (“an organ of balance in some invertebrates, such as crustaceans, that consists of a sensory vesicle containing small granules”) in invertebrates, swim bladders in fish, and in marine mammals, auditory organs.¹¹ This damage caused to the fishes at organ-levels impacts their sensory skills that they are gifted by nature in perception and orientation control mechanism that helps them navigate from one place to another. If this is disturbed, they fail to follow their senses. The noise affects the species throughout their stage of development, also referred to as ontogenesis. While there are also natural challenges given the presence of environmental changes, the species can still cope up with it. Whereas in case of anthropogenically produced pollution, it is increasingly difficult for them to tolerate. As a consequence of this, anthropogenic noise results in malformations in the physical structure of the species. This also impacts their embryonic development, and largely increases the chances of larvae mortality (death of larvae of the species).¹² When the survival of the species or their ability to reproduce is diminished in the early stages of life, there is a risk of serious impact on the immunity of the population and resilience, leading to compromised structure and function of their ecosystem. In a study conducted of Scallop larvae who were subjected to mimicking a situation of noise production from seismic airguns, it was observed that there were significant development delays and that there were 46% malformations in their body.¹³

It is proven that the noise is greatly impacting the development process of the species amid the disturbance they have to go through given the anthropogenic noise. This in the long run is leading to changes in population dynamics in the species such that each species has some or the other deformity. At the same time, it is not the case that each and every species living in the marine environment is affected and impacted by the noise, there have been a study wherein crab species was not affected during its larvae stage, but in that same environment, the fishes’ larvae were severely impacted leading to mortality. However, it is seen that if not at one stage, the impact may be consequent in some other stage of the lifespan of the species.

2.2 (b) Physiology

The anthropogenic noise also causes physiological damage in the hearing systems of the species in the marine environment. In a study conducted, it was observed that Pink Snapper, a species of fish had suffered damage to the hair cells inside its hearing-sensory system. This injury had sustained even after 8 weeks, and the fish continued to be troubled all the while because of this.¹⁴

Additionally, in a study involving the impact of noise with low-frequency amounted to permanent and considerable changes in the hair cells of the statocysts (“an organ of balance in some invertebrates, such as crustaceans, that consists of a sensory vesicle containing small granules”)¹⁵ of the species namely European Squid, Common Cuttlefish, Common Octopus, and Southern Shortfin Squid.¹⁶

¹¹ Michel André et al., *Low-frequency Sounds Induce Acoustic Trauma in Cephalopods*, 9 FRONTIERS IN ECOL & ENVIRON 489 (2011), <https://esajournals.onlinelibrary.wiley.com/doi/10.1890/100124> (last visited Apr 9, 2024).

¹² Sophie L. Nedelec et al., *Anthropogenic Noise Playback Impairs Embryonic Development and Increases Mortality in a Marine Invertebrate*, 4 SCI REP 5891 (2014), <https://www.nature.com/articles/srep05891> (last visited Apr 9, 2024).

¹³ Aguilar de Soto, N.A., 2016. Peer-reviewed studies on the effects of anthropogenic noise on marine invertebrates: from scallop larvae to giant squid. *The Effects of Noise on Aquatic Life II*, pp.17-26.

¹⁴ McCauley, R.D., Fewtrell, J. and Popper, A.N., 2003. High intensity anthropogenic sound damages fish ears. *The Journal of the Acoustical Society of America*, 113(1), pp.638-642.

¹⁵ Statocyst, COLLINS DICTIONARY, <https://www.collinsdictionary.com/dictionary/english/statocyst>.

A study that calculated the levels of stress in the fishes, this was carried out by exposing the fishes to realistic noise produced by the ship, mimicking the real-world situation. The species of fish that were used for the purpose of this study were namely, European Perch, Common Carp, and Gudgeon. To calculate the level of stress in the physiology of the fishes, measurement of “cortisol” (also called as the stress hormone) level was done. The test was carried on for a duration of 30 minutes. The result showed a whopping 99% increase in the levels of cortisol in the European Perch, 81% increase in the Carp, and the highest increase of 120% in the Gudgeon.¹⁶

This study reflects that such increase in levels of cortisol can have negative repercussions in the fishes like the impact on growth, sexual maturity, reproduction, low immunity and decreased chances of survival.

2.3 (c) Behaviour Alteration:

The noise in the sea is capable of altering the behaviour of the species of the marine environment. A very prominently affected are the cetaceans, that is, the dolphins and whales have been observed to dramatically change their swimming direction when exposed to a ship approaching them on near to them. Such is done through a number of ways, such as increasing the speed at which they swim, increasing their diving angles, swimming below the water surface for an increased duration, and decreasing their distance between other animals.¹⁷ Similar has been the response of whales towards noise emitted from seismic surveys, wherein, their avoidance behaviour is seen.¹⁸ The avoidance behaviour from the approaching ships has also been observed in species of fishes such as Walleye Pollock or also called the Alaska pollock.¹⁹

2.4 (d) Beaching / Stranding

According to UIA (Union of International Associations), “Cetacean stranding, commonly known as beaching, is a phenomenon in which whales and dolphins strand themselves on land, usually on a beach.”²⁰ The noise pollution in the sea caused by ships disorients the dolphins making it even more difficult to communicate with one another of their mates.²¹ In another instance, in a study it was observed that the geophysical seismic surveys that had peak sound pressure levels at 175 dB had severely affected the population of the Giant Squids. As a result, it resulted in mass stranding of their population. In 2001, it was observed that five giant squid masses were found stranded in an area in Northern Spain. Two years later, four more giant squid mass stranded were found floating in the same area. Later it was understood that this happened due to geophysical surveys using air guns. Here, although there was no diagnosis of the obvious cause of their death, all of the squids had massive internal organs injury. This also included the injury to their statocysts while leaving them disoriented

¹⁶ Lidia Eva Wysocki et al., *Effects of Aquaculture Production Noise on Hearing, Growth, and Disease Resistance of Rainbow Trout *Oncorhynchus Mykiss**, 272 *AQUACULTURE* 687 (2007), <https://linkinghub.elsevier.com/retrieve/pii/S0044848607008113> (last visited Apr 11, 2024).

¹⁷ Nowacek, S.M., Wells, R.S. and Solow, A.R., 2001. Short-term effects of boat traffic on bottlenose dolphins, *Tursiops truncatus*, in Sarasota Bay, Florida. *Marine Mammal Science*, 17(4), pp.673-688.

¹⁸ Götz, T., Hastie, G., Hatch, L.T., Raustein, O., Southall, B.L., Tasker, M., Thomsen, F., Campbell, J. and Fredheim, B., 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. *OSPAR Biodiversity Series*, 441, pp.1-134.

¹⁹ De Robertis, A., Wilson, C.D., Williamson, N.J., Guttormsen, M.A. and Stienessen, S., 2010. Silent ships sometimes do encounter more fish. 1. Vessel comparisons during winter pollock surveys. *ICES Journal of Marine Science*, 67(5), pp.985-995.

²⁰ Whale beaching | The Encyclopedia of World Problems, <http://encyclopedia.uia.org/en/problem/whale-beaching> (last visited Apr 11, 2024).

²¹ Investigating the Causes and Consequences of Dolphin Strandings | GVI, <https://www.gvi.co.uk/blog/smb-investigating-the-causes-and-consequences-of-dolphin-strandings/> (last visited Apr 11, 2024).

2.5 (e) Reproduction / Sex

Underwater sounds serve an important role in maintaining cohesion and keep up with gamete²² release in certain species. In one study, it was reported that because of exposure to the noise of a passing boat, it was observed that it led to altering the social cohesion and as well as reduced nest-building in *Neolamprologus pulcher* (a species of fishes).²³

In another study, it was observed that the fish are avoiding areas containing noise from the ships, resulting in important feeding and breeding grounds in the sea to be less used.²⁴ Another study reported that the underwater noise emitted from a high-speed approaching boat reported that there was an interruption caused to spawning in the water in Common roach species.²⁵

In 2018, a study was conducted to analyse the courtship behaviour (“Courtship, in animals, behaviour that results in mating and eventual reproduction”)²⁶ in the marine species upon exposure to noise. The test consisted of exposing continuous low-frequency noise in the aquarium upon the two marine species (that were a part of the study)- the two-spotted goby and painted goby.

It was observed that upon addition of the noise, both the species exhibited less acoustic courtship. With painted gobies showing lesser courtship visually. While, the painted gobies (female) were observed to be less likely to spawn the gametes in the noisy environment.

Sound is a necessary element in exhibiting courtship, as it is through the song sung by the male species, the female species assess the quality of the male and also identify the correct species.

It was observed that in case of goby, although there was no impact on nest building, but when it comes to reproduction, the success rate was low.

This in turn, can change a population’s genetic make-up if female species prefer different traits in males in exposure to noise. Additionally, suppressing reproduction directly hampers the population.

2.6 (f) Masking:

The major concern of MNP is not the impulse anthropogenic noise in the sea, but rather the continuous and general increase in the level of noise that has resulted into an overall increase in the background noise in the sea. This leads to potential masking that is, simultaneous interference of the sounds produced by the marine species. There are studies that have proved that masking has disrupted breeding pattern in species

²² “Gamete, sex, or reproductive, cell containing only one set of dissimilar chromosomes, or half the genetic material necessary to form a complete organism (i.e., haploid). Gametes” Gamete | Definition, Formation, Examples, & Facts | Britannica, (2024), <https://www.britannica.com/science/gamete> (last visited Apr 12, 2024).

²³ Bruintjes, R. and Radford, A.N., 2013. Context-dependent impacts of anthropogenic noise on individual and social behaviour in a cooperatively breeding fish. *Animal Behaviour*, 85(6), pp.1343-1349.

²⁴ Engas, A. & Lokkeborg, S. (2002). Effects of seismic shooting and vessel-generated noise on fish behaviour and catch rates. *Bioacoustics*, 12, 131–135.

See also Popper, A.N. (2003). Effects of anthropogenic sounds on fishes. *Fisheries*, 28, 24–31. See also Marine transportation ranks as one of the main anthropogenic sources, after explosions and seismic testing (Slabbekoorn et al., 2010).

²⁵ Boussard, A., 1981, April. The reactions of roach (*Rutilus rutilus*) and rudd (*Scardinius erythrophthalmus*) to noises produced by high speed boating. In *Proceedings of 2nd British Freshwater Fisheries Conference* (pp. 188-200). University of Liverpool Liverpool.

²⁶ Courtship | Definition, Behavior, Animals, Examples, & Facts | Britannica, <https://www.britannica.com/topic/courtship> (last visited Apr 12, 2024).

See also: Courtship may be rather simple, involving a small number of chemical, visual, or auditory stimuli; or it may be a highly complex series of acts by two or more individuals, using several modes of communication. Many creatures resort to courtship feeding to attract a mate. Females of some insect species, such as the spongy moth (*Lymantria dispar*), may use odorous substances called pheromones to attract males from a distance. Male painted turtles (*Chrysemys* species) court by touch, and the courtship songs of frogs (*Rana* species) are heard on spring nights across much of the world.

that depend upon sound during mating and reproduction. There is a study that proves that low frequency noise emitted from the ships can dramatically reduce communication ranges for marine animals.²⁷ Furthermore, it was observed in whales that they are forced to adjust their frequency and loudness while communicating to their mates for compensating the effect of masking due to vessel noise.²⁸ It was found that even small vessels have a negative effect. In this study, a small vessel having a speed of 5 knots reduced the communication range of bottlenose dolphins within 50 metres around that area by 26%, and the number was 58% for short-finned pilot whales.²⁹

2.3 Certain important concepts for interpreting the studies relating to impact on MNP on the marine species:

1. Marine species cannot escape:

It should not be assumed that the species, upon impact of the noise will change their direction in order to leave the “noisy area” (such as a state where pile driving is being done or the like). One concerning factor is that marine species even if troubled by noise do not escape from the site of the noise. This is because of their “territorial nature”, that is, they reside at a fixed place where they have built a nest, which is utmost important for them to guard.³⁰ Additionally, fishes have a “fright response” (this is due to lower cortisol hormone) and they freeze in the place, and this response in the fishes was observed by those impacted by the noise.³¹ The Marine species respond to the noise by acting “immobile”, that is by staying stationary at a given place.

And a greater problem is when the species are unable to escape anywhere, this occurs because they are so disorientated to a level that their sensory system has given up and is dysfunctional.

2. Survival Rate:

Survival rate of the species in the laboratory environment is different than it is in reality, as the species in the lab are given adequate shelter, they are fed and there is no threat like it is in the wild. Even the species that have temporarily injured the hearing system will have a greater risk of predation, which reduces their survival rate.³² The species that become disoriented because of impact on their hearing system, become even more susceptible for predation. Additionally, they may also be more prone to noise-induced stress, which reduces their immune system.³³

²⁷ Payne, R. and Webb, D., 1971. Orientation by means of long range acoustic signaling in baleen whales. *Annals of the New York Academy of Sciences*, 188(1), pp.110-141. See Commercial shipping is the source of low frequency, (i.e., 5–500 Hz), background noise in the world’s oceans (Weilgart, 2007).

²⁸ McDonald, M.A., Hildebrand, J.A. and Wiggins, S.M., 2006. Increases in deep ocean ambient noise in the Northeast Pacific west of San Nicolas Island, California. *The Journal of the Acoustical Society of America*, 120(2), pp.711-718.

²⁹ Jensen, F.H., Bejder, L., Wahlberg, M., Soto, N.A., Johnson, M. and Madsen, P.T., 2009. Vessel noise effects on delphinid communication. *Marine Ecology Progress Series*, 395, pp.161-175.

³⁰ Arthur N. Popper, *Effects of Anthropogenic Sounds on Fishes*, 28 *Fisheries* 24 (2003), [http://doi.wiley.com/10.1577/1548-8446\(2003\)28\[24:EOASOF\]2.0.CO;2](http://doi.wiley.com/10.1577/1548-8446(2003)28[24:EOASOF]2.0.CO;2) (last visited Apr 11, 2024).

³¹ “Freeze or flee” reactions run in fish families, *ScienceDaily*, <https://www.sciencedaily.com/releases/2022/02/220215095503.htm> (last visited Apr 11, 2024).

³² Aguilar de Soto, N. 2016. Peer-reviewed studies on the effects of anthropogenic noise on marine invertebrates: from scallop larvae to giant squid. In: Popper, A.N., and Hawkins, T. (Eds.). *The Effects of Noise on Aquatic Life II. Advances in Experimental Medicine and Biology* 875: 17-26, New York: Springer Press.

³³ Aguilar de Soto, N.A. and Kight, C., 2016. Physiological effects of noise on aquatic animals. In *Stressors in the marine environment*. Oxford University Press.

2.4 Special emphasis on Cetaceans:

Cetacean is a family of the mammals of the marine environment that includes whales, dolphins and porpoises.³⁴ Among these, whales, especially blue whales, are very large species. A whale is among the largest animals on the planet Earth. In terms of weight, a blue whale weighs around 190,000 kg.³⁵ In spite of being such advanced creatures of the planet, the impact they face due to anthropogenic noise is tremendous. The stress response, which is a consequence of harsh noise is having lethal effects on them. This was explained by mass killing of beaked whales stranded with has emboli (A blockage of blood supply caused by air bubbles in a blood vessel or the heart.) upon their exposure to submarine-detection naval sonar.³⁶ Most researchers opine that a “fight or flight” stress response is responsible for the deaths of whales which is followed by harsh disturbances in the sea.³⁷ Recently, scientists had witnessed a type of mass stranding involving beaked whales. The shocking fact discovered here in this case was that the whales did not suffer from any disease or ailment and in a good body condition, but one common factor being the close link in space and time to a noise event.³⁸ Apart from noise, there was no other reason that explained the cause for the same.

2.5 Growing concern of anthropogenic noise:

With passing time, there is a growing consensus that multiple sources of anthropogenic noise pollution are acting in a concert, or even synergistically (“the combined power of working together that is greater than the power achieved by working separately”).³⁹ This is driving towards greater disturbance and abructing the changes in marine ecosystems.⁴⁰ In furtherance to this, there is also climate change that is highly likely to further make it worse the effects of anthropogenic noise. With increased temperature degree in the sea to increased carbon dioxide dissolved in the sea, increased acidity in the waters (low pH level), and decreasing salinity in the sea, this is turn fuels up the propagation of noise in the sea caused due to anthropogenic factors, due to the increase in the range of sound that can travel, especially for low-frequency noise.

2.6 Conclusion:

By analysing the tremendous problems and sufferings that the species in the marine environment have to go through because of anthropogenic noise pollution, it is understood that the innocent species are getting impacted in the short run and even more deeply impacted in the long run, including death because of the harsh noise. What is more concerning is the quantum of noise levels in the sea increasing with passing time, given the pace at which development in all spheres is taking place, especially due to increase in trade

³⁴ Cetacean | Life Span, Evolution, & Characteristics | Britannica, (2024), <https://www.britannica.com/animal/cetacean> (last visited Apr 13, 2024).

³⁵ How big is a blue whale? - Whale and Dolphin Conservation, WHALE & DOLPHIN CONSERVATION UK, <https://uk.whales.org/whales-dolphins/facts-about-blue-whales/> (last visited May 18, 2024).

³⁶ Jepson, P.D., Arbelo, M., Deaville, R., Patterson, I.A.P., Castro, P., Baker, J.R., Degollada, E., Ross, H.M., Herráez, P., Pocknell, A.M. and Rodriguez, F., 2003. Gas-bubble lesions in stranded cetaceans. *Nature*, 425(6958), pp.575-576. See also: Fernández, A., Edwards, J.F., Rodriguez, F., De Los Monteros, A.E., Herraez, P., Castro, P., Jaber, J.R., Martin, V. and Arbelo, M., 2005. “Gas and fat embolic syndrome” involving a mass stranding of beaked whales (family Ziphiidae) exposed to anthropogenic sonar signals. *Veterinary pathology*, 42(4), pp.446-457.

³⁷ Cox, T.M., Ragen, T.J., Read, A.J., Vos, E., Baird, R.W., Balcomb, K., Barlow, J., Caldwell, J., Cranford, T., Crum, L. and D'Amico, A., 2005. Understanding the impacts of anthropogenic sound on beaked whales. *J. Cetacean Res. Manage.*, 7(3), pp.177-187.

³⁸ Lucie Wade, Hal Whitehead & Linda Weilgart, *Conflict of Interest in Research on Anthropogenic Noise and Marine Mammals: Does Funding Bias Conclusions?*, 34 *MARINE POLICY* 320 (2010).

³⁹ Synergistically, (2024), <https://dictionary.cambridge.org/dictionary/english/synergistically> (last visited Apr 13, 2024).

through the sea, which ultimately contributes to more noise. It becomes increasingly important to have regulations in this sector in order to mitigate the pain and challenges that are putting a toll on the species in the marine environment, such that they are safeguarded and protected. At the same time, striking a good balance between anthropogenic activities and its impact on the marine environment is crucial, for which steps should be taken to minimise the impact the former may have on the marine species.