Volume 4 - Issue 3– March,2024

SABUJEEMA

An International Multidisciplinary e-Magazine

Article ID: SIMM0368

Popular Article

"Guardians of the Sea: Leatherback Sea Turtles and the Battle Against Jellyfish Blooms"

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How to Cite this article

Lanjewar *et al.* 2024. Guardians of the Sea: Leatherback Sea Turtles and the Battle Against Jellyfish Blooms. *Sabujeema-An International Multidisciplinary e-Magazine* 4(3): 63-67

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ABSTRACT

Globally, jellyfish blooms are having an increasing negative effect on marine ecosystems due to changes in the environment and human activity. The disturbance of marine food webs, the depletion of fish populations, and the interruption of human activities like fishing and tourism are only a few of the serious ecological and social effects of these blooms. Because they are apex predators and eat a lot of jellyfish, leatherback sea turtles (Dermochelys coriacea) are essential in managing jellyfish populations. The problems caused by jellyfish blooms might be made worse by the decrease in leatherback sea turtle populations. For marine ecosystems to remain balanced, conservation initiatives targeted at safeguarding leatherback sea turtles are crucial. We may endeavour toward sustainable management solutions to save these essential marine species and preserve the health of marine ecosystems by realizing the interdependence of species within marine ecosystems and the significance of apex predators like leatherback sea turtles.

Keywords: Jellyfish, Blooms, Ecosystem, Leatherback Sea Turtle.

Introduction

In the last 20 years, jellyfish have started to overpopulate our waters. Millions of stinging jellyfish, each barely bigger than a peppercorn, are brushed aside by divers in New Zealand. One of the biggest nuclear reactors in the world was shut down in Sweden because a giant cluster of moon jellyfish clogged the plant's vital pipelines. And thousands of 200-kg Nomura's jellyfish, which have bells two meters in diameter, swarm fisherman in the Sea of Japan, breaking nets and gobbling up local seafood. These creatures devour fish eggs and larvae in droves, frequently sabotage attempts at marine farming, and outcompete mature fish by eating their own food. However, other kinds of sea turtles that possess the necessary resources for survival are also capable of surviving, unlike jellyfish. If current trends continue, it's possible that the ocean may eventually be completely covered in jellyfish. Is there anything, perhaps, that can govern these gelatinous creatures? Let us introduce the

modest marine turtle. Sea turtles are among the most ancient predators of jellyfish, while a variety of aquatic species also consume them. Furthermore, although all species of sea turtles that are now known to exist at some time in their lives feed on jellyfish, none eat as many as the leatherback. The biggest species of marine turtle is the leatherback. And over their roughly 50-year lifespans, they consume well over 1,000 metric tons of jellyfish almost entirely. Jellyfish, composed mostly of water with low caloric content, are a remarkable food source. Leatherback sea turtles, for instance, require around 400 kg of jellyfish daily to maintain a healthy weight, equivalent to a grand piano. Unlike other sea turtles that selectively consume protein-rich gonads, leatherbacks consume whole jellyfish, exploiting their vulnerable nature. Jellyfish possess cnidocytes, cells with nematocysts (poisonous harpoons) used to immobilize prey, but these have no effect on sea turtles due to their thick, keratin-coated skin. This protection extends to their esophagus, lined with keratinized spikes that impale captured prey. Jellyfish populations defend themselves through rapid reproduction, facilitated by both sexual and asexual means, leading to blooms that expand swiftly, especially in response to human-induced factors like farm runoff and climate change. Policy solutions are crucial but creating a market for jellyfish consumption could also help control their population growth.

The Role of Leatherback Sea Turtles

Because of their distinct physiological adaptations and specific eating habits, leatherback sea turtles (Dermochelys coriacea) are considered keystone species in marine ecosystems and are essential in managing jellyfish populations. When it comes to size, they are the biggest species of sea turtles, with adults growing up to 2 meters long and weighing more than 900 kg. They are able to endure the pressure of deep dives, delving over 1,000 meters in search of food, since they are characterized by the absence of a bony shell and the presence of a leathery skin covering a series of bony plates called osteoderms. Leatherback sea turtles are mostly carnivorous animals that consume jellyfish. They have developed adaptations to help them catch and eat their gelatinous meal. These include the peculiar pectinate structures of the oesophagus, which have spines pointing backward and aid in holding jellyfish in the throat while removing extra water. Additionally, their jaws are specially designed to rip through the gelatinous bodies of jellyfish thanks to their sharp, highly serrated edges. In example, during jellyfish blooms, leatherback sea turtles play a critical role in managing jellyfish populations. They contribute to controlling jellyfish abundance and halting unrestrained population expansion by eating enormous amounts of jellyfish. Unchecked jellyfish populations can negatively impact fish stocks and other marine animals, which is why this predation pressure is crucial for preserving the equilibrium of marine ecosystems. According to studies, certain leatherback sea turtles may eat up to their body weight in jellyfish per day. Leatherback sea turtles are known for their huge jellyfish diets. Predation pressure plays an important role in maintaining the balance of jellyfish populations and maintaining the general well-being and stability of marine environments.

Jellyfish Blooms and their Impact

In many maritime ecosystems throughout the world, jellyfish blooms—which are defined by sharp increases in the population

density of jellyfish—are becoming increasingly common and severe natural events. Human actions, including as overfishing, nutrient pollution, and climate change, are mostly to blame for this increase. Because jellyfish eat fish eggs and larvae and compete with fish for food, these blooms can have a significant negative influence on the environment, especially on fish stocks. They can also disturb marine food webs and change the dynamics of ecosystems. Additionally, jellyfish blooms can hinder fishing operations by blocking nets and other equipment, costing fishermen money. These blooms can damage equipment and clog intake pipes, which can interrupt aquaculture operations in addition to harming fisheries. In addition, swimmers and beachgoers are at risk from jellyfish stings, which forces beach closures and negatively affects tourism. Given the ecological and economical difficulties that jellyfish blooms provide, it is crucial to comprehend their origins and impacts in order to develop management plans that will maintain the sustainability and health of marine ecosystems.

The Interconnectedness of Marine Ecosystems

Marine ecosystems are intricately linked systems in which a variety of creatures interact with their surroundings and one another to build intricate nutrient cycles and food webs. Every species has a distinct function in preserving the ecosystem's health and equilibrium. One of the best examples of a species that is essential to marine ecosystems is the leatherback sea turtle (Dermochelys coriacea), which interacts with jellyfish populations. In aquatic environments, leatherback sea turtles are apex predators, which means they are at the top of the food chain. Because they are jellyfish predators, they aid in the management of jellyfish populations, which is crucial to preserving the ecosystem's equilibrium. Leatherback sea turtles' consumption of jellyfish indirectly affects the number of other species that jellyfish prey on, which in turn affects the entire food chain. The decrease in leatherback sea turtle numbers may have noteworthy consequences for marine ecosystems, specifically for jellyfish populations. If there were no leatherback sea turtles to regulate their population growth, jellyfish populations may expand uncontrolled. A few detrimental effects might result from this, such as the loss of fish populations as jellyfish eat fish eggs and larvae and compete with fish for food. Increased numbers of jellyfish may also change ecosystem dynamics and upset marine food webs, which would be detrimental to the ecosystem's general stability and health. Furthermore, other species that depend on jellyfish for sustenance may be negatively impacted by the fall in leatherback sea turtle populations. Since leatherback sea turtles, for instance, are known to eat a lot of jellyfish, their disappearance may cause the amount of jellyfish to rise, which may have an effect on species that feed on jellyfish. In summary, leatherback sea turtles are important to marine ecosystems because of their interactions with populations of jellyfish. Their disappearance would underscore the interdependence of species in these intricate systems and have far-reaching effects on marine ecosystems.

Conservation Efforts

Conservation efforts aimed at safeguarding leatherback sea turtles (Dermochelys coriacea) are crucial for maintaining the balance and well-being of marine ecosystems. These initiatives employ

various strategies to reduce risks to leatherback sea turtles and their habitats. Key conservation approaches include establishing marine reserves and protected areas where these turtles can nest and feed without disturbance, which are vital for their survival and population maintenance. Another critical effort involves the use of conservation-focused fishing gear to reduce bycatch, a major threat to leatherback sea turtles. By implementing strategies like turtle excluder devices (TEDs) in fishing nets, the number of turtle deaths caused by accidental entanglement can be significantly reduced. Public awareness campaigns are also part of conservation efforts, aiming to educate people about the importance of protecting leatherback sea turtles and to reduce human activities such as poaching and habitat destruction that pose threats to these turtles. Leatherback sea turtles play a crucial role in marine ecosystems as predators of jellyfish, helping to maintain the balance of marine food webs by controlling jellyfish populations. Conservation initiatives targeting leatherback sea turtles not only contribute to the preservation of marine biodiversity but also serve as indicators of the overall health of marine ecosystems. Thus, the conservation of leatherback sea turtles is essential for preserving the harmony and health of marine ecosystems. Preserving the natural predators of jellyfish, many of which are now under danger, is another strategy to keep populations from becoming out of control. Gill nets are frequently used in small-scale fisheries that are vital to communities in Peru and Mexico, but they also inadvertently catch and kill hundreds of sea turtles' year. Within the next 60 years, these behaviours may push leatherback extinction in the Eastern Pacific. Thankfully, some scientists have already created low-cost jellies that can be utilized to create jellyfish. Sea turtles, dolphins, and even seabirds have been shown to steer clear of fishing gear when green LED lights attached to gill nets are used, thanks to instruments designed to reduce these hazards. Small-scale fishermen should be able to maintain their livelihoods while reducing their negative effects on the fragile ocean protectors because to solutions like this.

Conclusion

In conclusion, by managing jellyfish populations, leatherback sea turtles (Dermochelys coriacea) are essential to marine ecosystems. By ingesting vast amounts of jellyfish, apex predators like them contribute to the equilibrium of marine food webs by avoiding jellyfish overpopulation and the ensuing disturbance of marine ecosystems. Additionally, the existence and quantity of leatherback sea turtles serve as indicators of the general health of marine ecosystems. Thus, maintaining the health and stability of marine ecosystems depends on safeguarding leatherback sea turtles. The protection of leatherback sea turtles is achieved through a variety of conservation initiatives, such as the creation of marine reserves and protected areas, the use of bycatch reduction strategies, and public awareness campaigns. To further safeguard leatherback sea turtles and preserve the equilibrium of the marine ecosystem, further study and conservation initiatives are yet required. This entails conducting continuous population monitoring of leatherback sea turtles, investigating the environmental needs and migratory patterns of these animals, and creating novel conservation tactics. Additionally, since these problems also affect leatherback sea turtles and their habitats, it is imperative to

address more general environmental challenges like plastic waste and climate change. Given the significance of leatherback sea turtles in regulating jellyfish populations and preserving the equilibrium of marine ecosystems, there is an unambiguous need for more investigation and conservation initiatives. Governments, non-governmental organizations, scientists, and the general public must work together to conserve leatherback sea turtles and maintain the viability of marine ecosystems for next generations.

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