Dugong Du'gone': Sea Grass Degradation a Threat to the "Cows of the Sea"
By: Adriano De Rose

Known informally as a sea cow, the dugong (*Dugong dugon*) is part of the Sirenia, an order of aquatic, herbivorous mammals that inhabit swamps, rivers, estuaries, marine wetlands, and coastal marine waters. They obtain the name sea cow as they are primarily found peacefully grazing on seagrass, akin to behaviour a cow would exhibit on land. Currently, the dugong, part of the family Dugongidae, is the only other extant family within Serenia asides from the Trichechidae, the manatees that they are often confused for (Berta et al., 2015). Dugongs differ from their manatee relatives in the shapes of their snouts, with a more agile upper lip for the consumption of sea grass, in their body size, as they are smaller than the manatee, and in tail shape, as dugongs have flukes whereas manatees have paddle-shaped tails (Denny, 2019). Dugongs are also the only plant-eating mammal that live out their lives in the sea and tidal reaches of rivers unlike the three species of manatee, who make use of bodies of freshwater (Marsh, 2018).

Dugongs typically encompass shallow, tropical waters. The range they are found at spans at least 48 countries and approximately 140,000 km of tropical coastline (Macdonald, n.d.). Not much is known about the distribution and range of dugongs as over most of its range, they are identified only from incidental sightings, accidental drownings and fishermen anecdotes (Marsh, 2018). Ultimately, dugongs are found (fragmented) in coastal waters of the Pacific and Indian Oceans, spanning from east Africa to the Red Sea and Australia (*Dugongs ~ MarineBio Conservation Society*, 2017). There is a reason however, that dugongs are found in tropical, shallow, coastal waters and this is because these conditions are often accompanied by the presence of seagrass in which dugongs are specialized to feed on (Heinsohn et al., 1977).

Seagrass, as previously mentioned, grows in soft or sandy bottoms of estuaries as well as along coastal regions of tropical, temperate, and subarctic marine waters. Dugongs depend on seagrass beds and have specialized behaviours that allow them to feed on various types of seagrasses. When feeding on smaller seagrass, dugongs may conduct an excavating behaviour, in that, they excavate the plants as they move forward, leaving feeding trails and clouds of sediment in their wake. When faced with larger seagrass, dugongs will feed not by excavation, but via cropping of the seagrass leaves (Marsh, 2018), where clusters of leaves are stripped from the stems of seagrass plants (Wirsing et al., 2007). One study even revealed that dugongs can seemingly switch between these two foraging tactics to avoid predation. They were found to reduce their use of excavation foraging when there were an abundance of predatory tiger sharks, due to it inhibiting vigilance and attracting predators (Wirsing et al., 2007). It is clear then that dugongs rely heavily on beds of seagrass to sustain them, to the point where they adaptively alter their behaviour to ensure they can still graze whilst looking out for predators. With this being established then, seagrass degradation, is one of the most impactful threats to dugongs, stripping them of a source of sustenance they require.

The World Wildlife Fund currently has dugongs categorized as vulnerable in status meaning that they are at high risk of extinction in the wild. They mention that the biggest threat contributing to this vulnerable status is seagrass habitat loss or degradation due to coastal development or industrial activities that cause water pollution (*Dugong | Species | WWF*, n.d.). There is a plethora of natural as well as human-mediated disturbances that result in the degradation of seagrass meadows and these, in turn, have a direct negative impact on dugongs. An article that reviews disturbances of seagrass lists the following disturbances. Natural

disturbances that impact seagrasses include geological events like coastal uplift, meteorological events like heavy rains and hurricanes as well as biological interactions like grazing, sediment bioturbation, and disease (Short & Wyllie-Echeverria, 1996). As for human-induced disturbances, these include reduced water clarity (due to sediment loading, resuspension, eutrophication), direct mechanical damage (e.g., dredging and filling, propeller scarring), as well as the releasing of toxic compounds into coastal waters (Short & Wyllie-Echeverria, 1996). While natural disturbances are important to note when studying seagrass loss, a study on seagrass degradation in Australian coastal waters notes that it is human-mediated activities that cause most seagrass loss (Walker & McComb, 1992). This is supported by another study that reports seagrass loss from human-induced disturbances is increasing at a greater rate than those of natural disturbances (Short & Wyllie-Echeverria, 1996).

One of the biggest impacts humans have on seagrass beds is the human-mediated reduction of water clarity. This can occur for a number of reasons including sediment loading and eutrophication. Things like urbanization lead to industrial waste discharge which also negatively affects the clarity of water (Short & Wyllie-Echeverria, 1996). These deposits of sediment/nutrients end up contributing to a phenomenon known as shading in which suspended sediment effectively shades out the seagrass bed, inhibiting light from reaching it. This is important because without light, these meadows of seagrass undergo photosynthesis at reduced rates. Other human impacts on seagrass habitats involve direct mechanical damage. Practices like dredging end up removing plants in submerged habitats, boating activities end up reducing plant cover as propellers cut through seagrass and hulls of the boats drag through sea bottom, and docks shade the tide flat, prohibiting the necessary penetration of light (Short & Wyllie-Echeverria, 1996). The abovementioned factors all contribute to large-scale seagrass loss. Multiple reports and studies have emerged recently, confirming that seagrass habitats are degrading and being lost at alarming rates. One article reports seagrass loss as having increased almost tenfold over the last 40 years in both tropical and temperate regions (Orth, Carruthers, et al., 2006), and this steady loss of habitat has had significant negative impacts on dugongs.

Whether it is caused by natural or human-induced disturbances, seagrass habitat loss indirectly affects the wellbeing of dugong, seeing as how they are dependent on these seagrass beds for foraging. The World Wildlife Fund notes that if there is not enough sea grass to eat, then dugongs are not able to breed normally (*Dugong | Species | WWF*, n.d.). This inability to breed is just one negative effect of seagrass habitat loss on the dugong, forcing them into their vulnerable status. Another negative effect of seagrass habitat loss on dugongs is starvation, as with seagrass habitats declining globally, dugongs are in turn, losing their primary source of nutrition. A study conducted in Hervey Bay, Queensland, Australia discovered that seagrass loss was the driving factor behind a spike in mortality of dugongs in that specific area. Due to floods and a cyclone, more than 100 squared km's of seagrass was lost from Hervey Bay, resulting in the dugong population declining from 2206 to only 600 (AR & Marsh, 1995). The proportion of calves born in the population also declined approximately 22% (AR & Marsh, 1995), supporting the WWF's claim of seagrass loss affecting breeding in dugongs. The reason for this decline in dugong population was of course the loss of seagrass and the 99 recovered dugon carcasses allowed for the authors to conclude that death was a result of starvation (AR & Marsh, 1995). As the natural disasters displaced the dugongs, they were forced to feed sub optimally and this was reflected in their stomach contents which revealed algae, dead seagrass rhizomes and anoxic sediment(AR & Marsh, 1995). It has also been found that when dugongs are forced to relocate and become refugees after the loss of their seagrass habitat, they are actively excluded from areas of better-

quality seagrasses by the resident animals in the areas they arrive at (AR & Marsh, 1995). This becomes an issue then because they are not able to meet their metabolic needs after having made such a long trip, and they begin to deteriorate.

Preventing the degradation and promoting the conservation of seagrass habitats globally is therefore of utmost importance if dugongs are to be saved from endangerment and possible extinction. There have already been some documented solutions that have been aimed at tackling things like restoring water quality that had been altered by human activity. For example, there have been attempts in Australia to implement improved catchment management and this has seemed to slow rates of seagrass degradation and increase water quality (Walker & McComb, 1992). Also, developers in the state of Queensland are required, by law, to replace any area of seagrass they remove. It is important that policies like these be implemented globally so that humans are held accountable for the destruction of dugong habitats. This replacement of removed seagrass is occasionally successful as is noted by an article that looked at seagrass recovery in the Delmarva Coastal Bays, USA. Restoration efforts through 2004, resulted in approximately 46 ha of seagrass being seeded with 5-10% of seeds estimated to develop into viable seedlings (Orth, Luckenbach, et al., 2006). Dugongs are also legally protected in many areas and under many Acts, however this is only protection for dugongs against direct human impacts like intentional hunting. For example, they are considered a protected species under legislation like the Great Barrier Reef Marine Park Act of 1975. There does exist a Dugong & Seagrass conservation project, however. it only covers eight countries. The establishment of more of these conservation projects is paramount to ensuring not just dugongs, but dugongs AND their habitats are actively being maintained and protected. Through the spreading of knowledge, these conservation projects can aid in reducing the impact humans have on dugong habitats by becoming aware of the harm they are causing through recreational activities like boating. Majority of future conservation movements should involve just that, ensuring that even when not in protection areas, individuals are actively avoiding damaging seagrass and preventing pollutants/sediment from flowing into creeks and rivers. These things are only accomplished if people are educated on the interconnectedness of dugongs and seagrass with human activity.

References

AR, P., & Marsh, H. (1995). Response of dugongs to large-scale loss of seagrass from Hervey Bay, Queensland Australia. *Wildlife Research - WILDLIFE RES*, *22*. https://doi.org/10.1071/WR9950507

Berta, A., Sumich, J. L., & Kovacs, K. M. (2015). Chapter 5 - Sirenians and Other Marine Mammals: Evolution and Systematics. In A. Berta, J. L. Sumich, & K. M. Kovacs (Eds.), *Marine Mammals (Third Edition)* (pp. 103–129). Academic Press. https://doi.org/10.1016/B978-0-12-397002-2.00005-3

Denny, M. (2019, May 27). *How to Tell the Difference Between Manatees and Dugongs*. https://blog.padi.com/how-to-tell-the-difference-between-manatees-and-dugongs/

Dugong | Species | WWF. (n.d.). World Wildlife Fund. Retrieved March 22, 2022, from https://www.worldwildlife.org/species/dugong

Dugongs ~ MarineBio Conservation Society. (2017, May 18). https://www.marinebio.org/species/dugongs/dugong-dugon/

Heinsohn, G. E., Wake, J., Marsh, H., & Spain, A. V. (1977). The dugong (Dugong dugon (Müller)) in the seagrass system. *Aquaculture*, *12*(3), 235–248. https://doi.org/10.1016/0044-8486(77)90064-3

Macdonald, N. (n.d.). *Dugong dugon (dugong)*. Animal Diversity Web. Retrieved March 22, 2022, from https://animaldiversity.org/accounts/Dugong_dugon/

Marsh, H. (2018). Dugong: Dugong dugon. In B. Würsig, J. G. M. Thewissen, & K. M. Kovacs (Eds.), *Encyclopedia of Marine Mammals (Third Edition)* (pp. 274–277). Academic Press. https://doi.org/10.1016/B978-0-12-804327-1.00110-2

Orth, R. J., Carruthers, T. J. B., Dennison, W. C., Duarte, C. M., Fourqurean, J. W., Heck, K. L., Hughes, A. R., Kendrick, G. A., Kenworthy, W. J., Olyarnik, S., Short, F. T., Waycott, M., & Williams, S. L. (2006). A Global Crisis for Seagrass Ecosystems. *BioScience*, *56*(12), 987–996. https://doi.org/10.1641/0006-3568(2006)56[987:AGCFSE]2.0.CO;2

Orth, R. J., Luckenbach, M. L., Marion, S. R., Moore, K. A., & Wilcox, D. J. (2006). Seagrass recovery in the Delmarva Coastal Bays, USA. *Aquatic Botany*, *84*(1), 26–36. https://doi.org/10.1016/j.aquabot.2005.07.007

Short, F. T., & Wyllie-Echeverria, S. (1996). Natural and human-induced disturbance of seagrasses. *Environmental Conservation*, *23*(1), 17–27. https://doi.org/10.1017/S0376892900038212

Walker, D. I., & McComb, A. J. (1992). Seagrass degradation in Australian coastal waters. *Marine Pollution Bulletin*, *25*(5), 191–195. https://doi.org/10.1016/0025-326X(92)90224-T

Wirsing, A. J., Heithaus, M. R., & Dill, L. M. (2007). Can you dig it? Use of excavation, a risky foraging tactic, by dugongs is sensitive to predation danger. *Animal Behaviour*, *74*(4), 1085–1091. https://doi.org/10.1016/j.anbehav.2007.02.009