

**2023 Science Extension
Report**

Dugong or
Du-gone

Jack Binding

Table of Contents

Abstract.....	2
Acknowledgements.....	2
Literature review.....	2
Research Question	3
Hypothesis-	3
- Dugong Distribution is Influenced by Seagrass Species Composition.....	4
- Climate Change Affects Dugong Distribution and Habitat Availability	4
- Conservation Efforts Enhance Dugong Population Recovery	4
Discussion.....	9
Reproduction and life cycle	9
Threats and Conservation	9
Indigenous and local knowledge.....	9
Conclusion	10
Reference list	12
Appendices.....	14

Abstract- The aim of this report is to elucidate the complex effects of rising ocean temperatures, and to shed insightful light on the resulting effects on dugong populations, and the availability of vulnerable seagrass beds Along the Australian coast Most notably is the effects of climate change, which have combined to accelerate the decline in population estimates. Future strategies will be proposed, notably the latent potential to restrict the inevitable leakage to dugong removal from these water bodies Climate change remains a major threat to marine species if one of the ones they will keep. According to the Great Barrier Reef Marine Park Authority's study of the dugong's movements and distribution. There are currently about 85 000 dugongs living in Australia, but this is declining. With the help of research provided by Dr. D. R. Daniel Zeke of James Cook University (JCU) and research by Dr. Helena Marsh (JCU). These two have led extensive dugong research to understand dugong population movements and distribution across Australia. Through the careful preparation and synthesis of key data, an important revelation emerged, clearly revealing the initial causal factors that shaped the dugong population decline.

Acknowledgements

I would like to take time to acknowledge and pay our respects to the Aboriginal and Torres Strait Island People, the Traditional Custodians of the land on which we gather today. We honour their enduring connection to Country and recognize their unique and ongoing cultural and spiritual relationship with their ancestral lands and beings.

Literature review- Dugongs are aquatic herbivores that live in coastal waters of the Indo-Pacific region, but the majority of species are found in Australian coastal waters their role as bioengineers in seagrass ecosystems is critical to maintaining the health of marine ecosystems. Despite its ecological importance, dugong populations are facing declining problems due to various environmental factors. This study summarizes the existing literature and examines the key environmental factors contributing to dugong population decline and potential extinction risk One of the major contributors to dugong extinction is habitat loss and degradation. Current research and data on the degradation and loss of seagrass habitats important for dugong feeding and reproduction are lacking. Coastal development, pollution, sedimentation and habitat.

destruction due to human activities have led to substantial reductions in seagrass availability. This habitat loss not only curtails feeding opportunities but also disrupts the intricate balance within marine ecosystems, with cascading effects on the dugong population. The dugong

populations are losing their main source of food therefore attempting to migrate to different areas to find a flourishing source of seagrass. Climate Change and Habitat Shifts the impacts of climate change, including rising sea temperatures and sea level rise, have the potential to alter seagrass distribution and abundance. Such shifts disrupt dugong feeding patterns, causing malnutrition, and reduced reproductive success. Understanding the complex interactions between climate change and seagrass ecosystems is vital for devising adaptive conservation strategies. Attempts have been made by the Australian Marnie conservation Society. The inadequate conservation efforts The Insufficient efforts, fragmented policies, and inadequate enforcement undermine conservation initiatives. Engaging local communities, incorporating indigenous knowledge, and fostering international collaborations are imperative for enhancing conservation effectiveness. The challenges that dugongs face, as well as their declining populations, necessitate immediate attention and coordinated efforts on multiple fronts. Combating habitat loss, addressing boat collisions, mitigating bycatch, understanding climate change impacts, managing pollution risks, and strengthening conservation initiatives are critical for ensuring the survival of dugongs and preserving the ecological balance of their habitats. A comprehensive approach that incorporates scientific research, policy development, community involvement, and international cooperation is required to reverse the current trend and ensure the survival of these charismatic marine mammals.

Research Question- How might interactions between multiple stressors (e.g., habitat degradation, pollution, climate change) contribute to the observed decrease in dugong populations?

Areas to consider...

- How can traditional ecological knowledge from indigenous and local communities contribute to understanding the factors behind the decline in dugong populations?
- What are the historical trends in dugong population and habitat changes, and how do these trends relate to the recent decline?
- Do Anthropogenic activities affect the habitat and migration of dugong populations?

Hypothesis- There is not a singular hypothesis available for this type of research as there is not a single indicator of the main cause of the decrease as of currently.

- **Dugong Distribution is Influenced by Seagrass Species Composition-** This hypothesis suggests that dugong distribution is correlated with the availability of specific seagrass species. Researchers could investigate whether dugongs show preferences for certain seagrass species due to variations in nutritional content, habitat structure, or other factors.
- **Climate Change Affects Dugong Distribution and Habitat Availability.** This hypothesis proposes that climate change-induced factors such as sea level rise, ocean temperature changes, and altered weather patterns could impact seagrass habitats and consequently influence dugong distribution. Research might focus on how dugongs respond to shifts in their habitat due to climate-related changes.
- **Conservation Efforts Enhance Dugong Population Recovery.** This hypothesis suggests that well-implemented conservation measures, such as protected areas and community-based initiatives, will be able to contribute to the recovery of dugong populations. Research might involve assessing population trends in areas with active conservation efforts compared to unprotected regions. Through this they will be able to find the population density of areas and distribution patterns.

Methodology- The method described below provides a systematic approach to data collection for dugong research. Dugongs are marine mammals that live in shallow coastal waters in places like the east coast of Australia. Research is needed to understand the behaviour, ecology and conservation status of these animals. Objectives achieved through the study include understanding dugong population distribution, habitat preferences, feeding habits, reproduction, threats, and conservation efforts. Conduct a comprehensive review of existing literature and documents and web pages on dugong research are produced. Academic journals, conference proceedings, research papers, books, and popular online resources are valuable resources because they provide a wide variety of information on a variety of topics to help consolidate and evaluate presented data. This step helps identify gaps in knowledge and helps identify areas where there is more research. Through this, be able to identify primary and secondary sources for collecting data on your dugong. The primary sources are field surveys, interviews with experts, and firsthand observations, while secondary sources encompass published literature, reports, and databases. Collaborate with marine biologists could be extremely beneficial as well as, researchers, and local experts to collect firsthand data on dugong sightings, behaviour, and environmental factors. Techniques such as aerial surveys, boat-based observations, and underwater studies can provide valuable insights into

the Dugong species. Through talking to field professionals and their expertise can provide valuable insights, information on current research trends, and potential research directions an example of this is looking at the rejuvenation of seagrass. Some tools used for research could include cameras (both above and below water), GPS devices, hydrophones, drones, and specialized underwater survey equipment. Ensuring that these tools are well-maintained and calibrated for accurate data collection. Search and access online databases and repositories such as the state library website to access critical reports and peer reviewed topics related to marine research and dugong conservation. Institutions like marine research centres, universities, and conservation organizations often contain databases that can provide valuable information. We could then Process and analyse the gathered information using appropriate tools and methodologies. Statistical analysis, geographic information systems (GIS), and qualitative analysis techniques can help draw meaningful conclusions from the data. Then consider looking into the ethical pathways of research and animal welfare situations and environments. Through this reliability and validity of the information provided will be key for successful research of the species. Through these forms of research, the determination of the species will be significantly easier and will hopefully lead to an initiative being taken to reduce the effects of the environmental factors and potentially rejuvenate the dugong and seagrass populations.

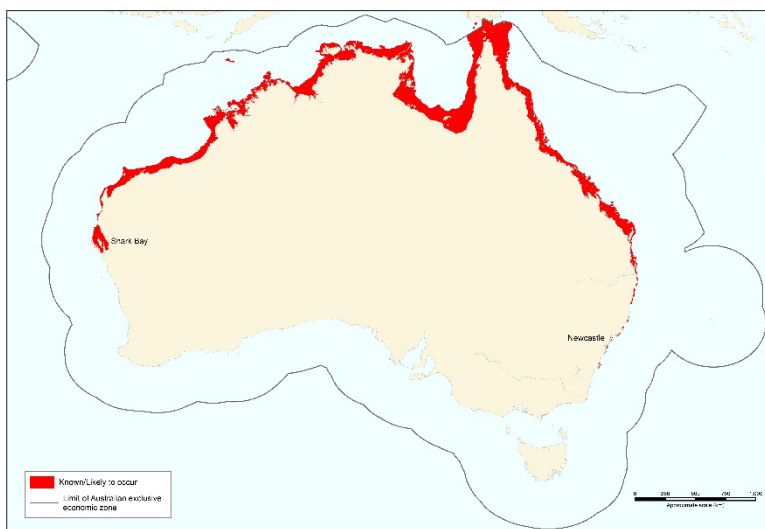
Results- Table 1

Survey Region	Area (km²)	Date of last survey	Population estimate \pmSE	Status of population suggested by surveys	Reference
Shark Bay	13 000	2007	9347 \pm 1204	Stable	Hodgson and colleagues (2008)
Exmouth	3180	1999 (July)	704 \pm 354	Stable	Hodgson and colleagues (2008)
Pilbara	N/A	2000 (April)	-	Unknown	Prince and colleagues (2001)
Gulf of Carpentaria	35 592	2007	9438 (\pm 1419)	Unknown	Sobtzick and colleagues (2015b)
Torres Strait	30 560	2013	15 727 \pm 2942	Stable	Sobtzick and colleagues (2014)
Northern GBR	25 440	2013	4517 (\pm 789)	Stable	Sobtzick and colleagues (2015b)
Southern GBR	26 892	2011	537 (\pm 223)	Declining	Sobtzick and colleagues (2015b)

Hervey Bay	4936	2011	1438 (\pm 438)	Stable	Sobtzick and colleagues (2015b)
Moreton Bay	1627	2013	759 (\pm 181)	Stable	Sobtzick and colleagues (2015b)

- Population estimates for dugongs in different regions of Australia. The Shark Bay, Exmouth and Torres Strait surveys used the Pollock and colleagues (2006) method. The other surveys used the Hagihara and colleagues (2014) method. Sobtzick and colleagues (2015b) explains the difference between the methods. (Marsh, 2005)

The table above covers the total dugong population along the Australian coast. An issue is chronic when attempting to obtain any data set or information that requires the classification of a population, or species. Thus, the validity of the population survey may not be entirely accurate. As shown in the data, most of the recordings are from 2015 using the Pollock 2006 method. Data on evasions per single attempt compiled by the Queensland Shark Control Program indicate that in dugong populations along Queensland's urban coasts (southern Great Barrier Reef and Hervey Moreton Bay) in the 1960s and 1980s decreased sharply in the decade and beginning (Marsh-ta: 2005) . Since the mid-1980s, aerial surveys have shown population stability, presumably due to extensive intervention by the Commonwealth and Queensland governments but during the severe weather events of 2010 After the -11 summer,



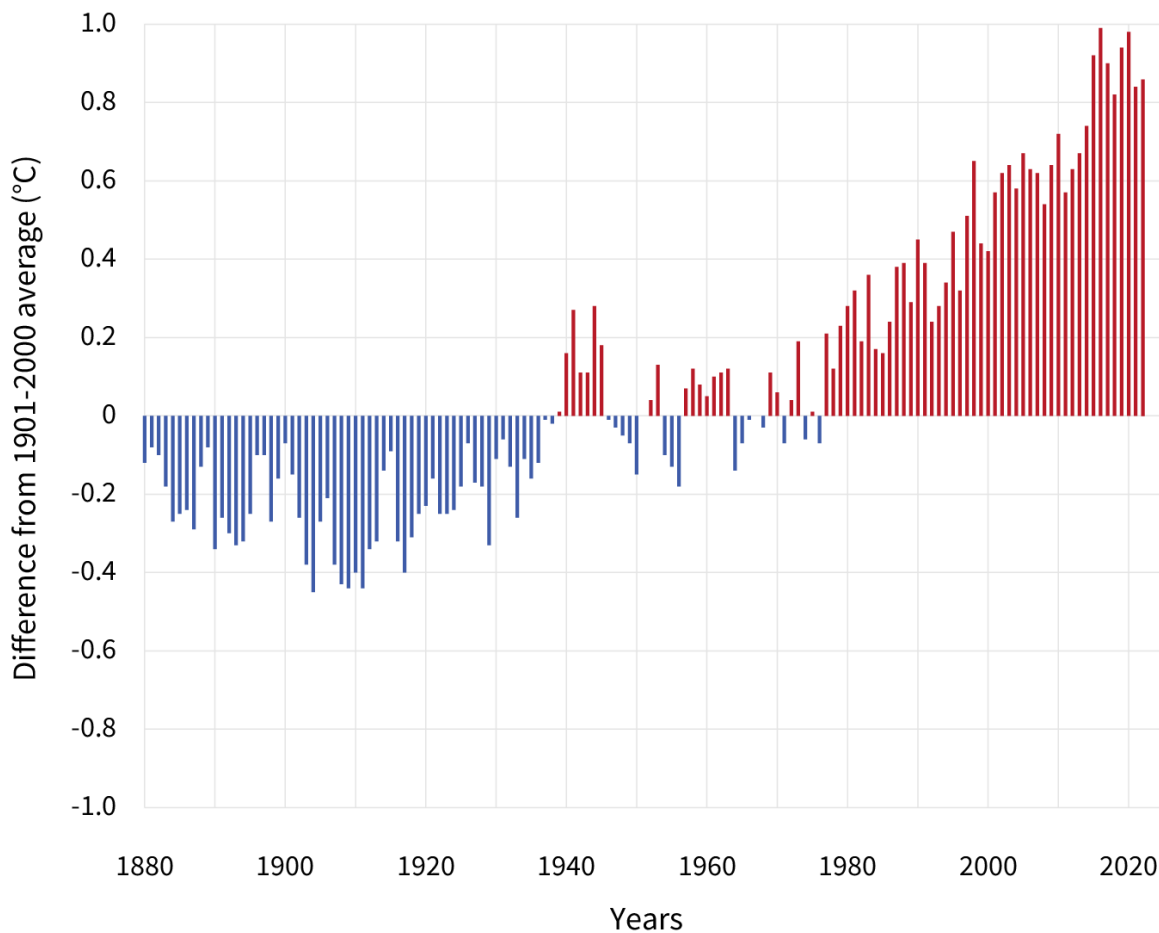
atmospheric survey estimates for 2011 were the lowest since the survey began in 1986 (Sobtzick et al. 2012, 2015b).

The table above displays a visual representation of the population density of dugongs along the Australian coastline. The validity of this measurement could potentially

be low due to no true indicator of population numbers or percentages being show. As displayed through the data the recording of the populations is not current therefore the accuracy of the measurement may not be precise. The data was collected by the Queensland shark control program. It found that the populations had decreased form the south of the great barrier reef to Hervey Morton Bay) there was a generous decline of the population from its measurements from 1960s to early 1980s and this trend has continued throughout the 2000s. (marsh-Ta, 2005)

Table 2- (Australian Government, 2018)

GLOBAL AVERAGE SURFACE TEMPERATURE



The diagram above displays the temperature fluctuation over time, previously the earth was decreasing in year average temperatures. Which is displayed in the blue. But over time society has introduced technological advancements and undergone industrial/ urbanisation which has led to the global average surface temperature to significantly increase over time. Looking at the trends of the data it's displayed that the temperature reaches an all-time high

during 2020 but as society has become more aware of the effects of climate change it has led to the average temperature dropping. This has been achieved through governmental acts, public awareness groups “WWF” and much more. Through this research, it reinforces the idea that climate change could potentially be one of the leading factors that are influencing the decline of the dugong populations on the coastline of Australia.

Discussion

Habitat and distribution: Dugongs are known for their preference for shallow coastal waters, seagrass beds, and mangrove ecosystems. Research on their habitat preferences and distribution helps identify critical areas for conservation and management. an example of this is the finding that the seagrass deteriorates after reaching above 40 degrees Celsius. through this research, feeding habits are understood as well as the feeding behaviour of dugongs is essential for assessing their impact on seagrass ecosystems. Research explores the types of seagrass species they consume, their foraging patterns, and the influence of habitat quality on their diet. Without their main food source, it will force the populations to migrate away from the coastal waters with no guarantee of a food source or habitat.

Reproduction and life cycle Dugongs have a slow reproductive rate, with relatively long gestation periods and infrequent calving. Research on their reproductive behaviour, mating rituals, and calf rearing provides insights into their population dynamics and potential vulnerabilities. Migration and movement patterns, studying dugong migration and movement patterns helps researchers comprehend their range, seasonal movements, and connectivity between different populations. This information is crucial for effective conservation planning.

Threats and Conservation Dugongs face numerous threats, including habitat loss, entanglement in fishing gear, boat strikes, and pollution. Research focuses on assessing the impacts of these threats and developing strategies to mitigate them. Conservation efforts involve collaborating with local communities, implementing protected areas, and raising awareness about dugong conservation. Technology methods, Advancements in technology have enabled researchers to employ innovative tools such as satellite tracking, underwater drones, and genetic analysis to gather more accurate and comprehensive data about dugongs and their behaviour. This data can then be shared across our country and others to raise awareness for the species and look for solutions of rejuvenation.

Indigenous and local knowledge Indigenous and local communities often have traditional knowledge about dugongs, which can provide valuable insights into their behaviour and

habitat use. Integrating this knowledge with scientific research can lead to a more holistic understanding of dugong ecology. Due to dugongs predominately being located in the eastern coastline of Australia they have been involved and identified as key parts of aboriginal culture. An example of this is the name given to dugongs. Although the creatures are all a part of the same family they received different names, the Kala Lagaw Ya is a western form of Torres strait island and refers to the creature as Dhangal. Whereas Meriam Mir this is eastern Torres strait origins and refers to a Dugong as Deger. **Ecological role** Dugongs are considered "ecosystem engineers"(Cordon, S, 2021, July 27) because their feeding activities maintain the health and productivity of seagrass beds. Research delves into the broader ecological implications of their presence and absence in these ecosystems. Seagrass plays a vital role within our society it filters more carbon than any tree yet is undervalued within our resource management of our country.

Public Engagement and Education Research findings on dugongs can be communicated to the public through various mediums, including documentaries, educational programs, and social media. Educating the public about the importance of dugongs in marine ecosystems can foster support for conservation efforts. As previously spoken about within the technological advancements. These advancements enable the opportunity for the spread of information and data to identify a solution to attempt at saving the dugongs as well as the seagrass populations. Governmental campaigns have previously been brought out to recognise the effects that pollution has on turtles (Don't be a tosser campaign) why can't this include other species like dugongs or talk about the effect that pollution has on the ecosystem as a whole? Dugong research encompasses a wide range of topics, from their behaviour and ecology to the threats they face, and the efforts being made to protect them. This research is essential for conserving these unique marine mammals and the ecosystems they inhabit. By combining scientific knowledge, traditional wisdom, and technological advancements, researchers can contribute to a better understanding of dugongs and drive effective conservation measures. therefore, there is a need for action if the rejuvenation of the dugong population is to occur.

Conclusion

In conclusion, the intricate relationship of climate change and various ecological issues has contributed to the distressing loss of the dugong species. The once-thriving marine mammal, symbolic of coastal ecosystems, now faces a precarious future due to the cumulative impacts of these factors.

Climate change, characterized by rising sea temperatures, changing ocean currents, and altered weather patterns, has disrupted the delicate balance that the dugongs relied upon. Seagrass beds, their primary food source and habitat have continued to deteriorate, As sea temperatures rise and ocean acidification takes hold seagrass ecosystems face stress which is leading to shifts in seagrass distribution, growth rates, and nutritional quality. These changes have a cascading effect on the dugongs, as they are compelled to traverse larger areas in search of adequate nourishment, often straying into territories with increased human activities and risks Human-induced disturbances amplify the challenges posed by climate change. Coastal development, pollution from various sources, and the clamour of boats disrupt the tranquil habitats dugongs depend on for feeding, mating, and raising their young. The cacophony masks their vital communication and navigation signals, potentially leading to disorientation and collisions. In addition, accidental entanglement in fishing gear and vessel strikes have taken a heavy toll, directly contributing to mortality rates. But this is only one of many ways that humans have contributed to the loss. Due to the increase of pollution, it caused for the ocean acidification levels to rise and cause for flora and fauna of marine life fail to flourish.

The loss of dugong species reverberates throughout the coastal ecosystems they inhabit. Beyond the poignant loss of a charismatic marine mammal, the repercussions extend to the very fabric of these ecosystems. Dugongs, as keystone herbivores, play an instrumental role in maintaining the health and balance of seagrass beds, which in turn are vital habitats for countless other marine species. As dugongs dwindle, these ecosystems face a potentially irreversible decline, impacting fisheries, carbon sequestration. Urgent and concerted efforts are imperative to reverse this trajectory of decline. Integrated strategies that address both climate change impacts and direct human-induced stressors are essential. This involves preserving critical seagrass habitats, implementing stringent conservation measures, and embracing sustainable practices to mitigate anthropogenic disturbances. Collaborative initiatives between local communities, governments, scientists, and conservation organisations are vital to ensure the survival of dugongs and the ecosystems they sustain.

Therefore, the research provided aligns with the population of dugongs deteriorating as time has continued and the temperature increases. Research has been conducted through universities such as James Cook, corporations like the marine conservation society and more. They have recognised the importance of the species to Australia's ecology and the aboriginal peoples.

Reference list-

1. AMCS. (N.a). *Queensland Marine Parks* Australian Marine Conservation Society. <https://www.marineconservation.org.au/queensland-marine-parks/>
2. Australian Government, Department of Climate change, Energy, the Environment and Water . (2018, July 21). *Dugongs*. DCCEEW. http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=28
3. Cordon, S. (2021, July 27). *The endangered dugong: A shy 'ecosystem engineer'*. Landscape News. <https://news.globallandscapesforum.org/53734/the-endangered-dugong-a-shy-ecosystem-engineer/>
4. *Dugongs*. (2017). Australian Marine Conservation Society. <https://www.marineconservation.org.au/dugongs-in-australia/#:~:text=Australia%20is%20home%20to%20the,live%20in%20the%20Torres%20Strait>
5. Gallaher, A. (Ed.). (2023, January 10). *Dugong*. TSRA State of the Environment. <https://torresstraitsoe.org.au/sea/dugong/#:~:text=Dugongs%20are%20susceptible%20to%20climate,traditional%20take%2C%20and%20illegal%20fishing>
6. Jackson , Jeremy (Ed.). (2018, October 8). *Dugong Ecology report* . Marine Ecology within Australia
[.https://login.ezproxy.sl.nsw.gov.au/login?url=https://go.gale.com%2fps%2fretrieve.do%3ftabID%3dNews%26resultListType%3dRESULT_LIST%26searchResultsType%3dMultiTab%26hitCount%3d2%26searchType%3dAdvancedSearchForm%26currentPosition%3d2%26docId%3dGALE%257CA560203175%26docType%3dArticle%26sort%3dRelevance%26contentSegment%3dZEES-MOD1%26prodId%3dGRNR%26pageNum%3d1%26contentSet%3dGALE%257CA560203175%26searchId%3dR2%26userGroupName%3dslnsw_public%26inPS%3dtrue](https://login.ezproxy.sl.nsw.gov.au/login?url=https://go.gale.com%2fps%2fretrieve.do%3ftabID%3dNews%26resultListType%3dRESULT_LIST%26searchResultsType%3dMultiTab%26hitCount%3d2%26searchType%3dAdvancedSearchForm%26currentPosition%3d2%26docId%3dGALE%257CA560203175%26docType%3dArticle%26sort%3dRelevance%26contentSegment%3dZEES-MOD1%26prodId%3dGRNR%26pageNum%3d1%26contentSet%3dGALE%257CA560203175%26searchId%3dR2%26userGroupName%3dslnsw_public%26inPS%3dtrue)
7. Kenneth H. Pollock, Helene D. Marsh, Ivan R. Lawler, & Mathew W. Alldredge. (2006). *Estimating Animal Abundance in Heterogeneous Environments: an Application to Aerial Surveys for Dugongs*. Jstor. https://www.jstor.org/stable/2387364?searchText=dugong+population&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3Ddugong%2Bpopulation&ab_segments=0

[%2FSYC-6744_basic_search%2Ftest-2&refreqid=fastly-default%3Acbdf5e3258a88a441d129115209a3e86&seq=2#metadata_info_tab_contents](#)

8. Lemnuel V. Aragonés, Ivan R. Lawler, William J. Foley, Helene Marsh Oecologia. (October, 2006). *Dugong grazing and turtle cropping: Optimization in tropical seagrass systems* [Paper presentation]. James Cook, Townsville. https://www.jstor.org/stable/20446035?searchText=dugong+population+decrease&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3Ddugong%2Bpopulation%2Bdecrease&ab_segments=0%2Fbasic_search_gsv2%2Fcontrol&refreqid=fastly-default%3A7e08618ff8696ac7669f8b866d9fa9e9&seq=2.
9. Manitus (Ed.). (2017). *Transfer of the Australian population of Dugong dugon (dugong) on Appendix I of the Convention*. proposals for dugongs. <https://cites.org/sites/default/files/eng/cop/11/prop/26.pdf>
10. Matson, P. (Ed.). (2016, June 8). *Dugong dugong*. Species Facts Sheets. <https://marinemammalscience.org/facts/dugong-dugon/>
11. Queensland Government. (2020, March 8). *Torres Strait Islander World list*. Queensland Governemnt Open Data Portal. <https://www.data.qld.gov.au/dataset/siq-aboriginal-languages-word-lists/resource/9229d441-bdcc-40a9-8ad9-d287b2d679c4>
12. Seagrasses. (n.d.). AIMS. <https://www.aims.gov.au/docs/projectnet/seagrasses.html>
13. Tan, A. (2016). *What is Seagrass?* Seagrass Watch. <https://www.seagrasswatch.org/seagrass/>
14. *The Magic of Seagrass*. (2020). The Ocean Agency. <https://www.theoceanagency.org/toolkits/seagrass>
15. UniSC. (2022 September,15). *Dugongs and turtles are starving to death in Queensland seas – and La Niña’s floods are to blame*. Univeristy of the Sunshine Coast Australia. <https://www.usc.edu.au/about/unisc-news/news-archive/2022/september/dugongs-and-turtles-are-starving-to-death-in-queensland-seas-and-la-nina-s-floods-are-to-blame>
16. Unknown. (2017, August 12). Tropical research. Australian Tropical Marine Research. <https://www.aims.gov.au/>

17. Unknown. (2023, January 18). *Global Average Surface Temperature*. Climate.gov. <https://www.climate.gov/media/15021>

Appendices

Table 1-Australian Government. (2005). *Species Profile and Threats Database*. Department of Climate Change Energy. The Environment and Water. http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=28