Aquatic Mammals 2024, *50*(6), 465-468, DOI https://doi.org/10.1578/AM.50.6.2024.465

Short Note

Remote Underwater Video Confirms the Presence of Dugongs (*Dugong dugon*) at Ashmore Reef Australian Marine Park in the Eastern Indian Ocean

John K. Keesing,[1,2] Cindy Bessey,[1] Nick Mortimer,[1]
Hazel Mortimer,[1] and Logan Hellmrich[2]

[1]*CSIRO Oceans and Atmosphere, Indian Ocean Marine Research Centre, Western Australia, 6009, Australia*
E-mail: john.keesing@csiro.au
[2]*School of Molecular and Life Sciences, Curtin University, Bentley, 6102, Australia*

Dugongs (*Dugong dugon*; Müller, 1776) are specialist seagrass feeders and are the only herbivorous mammal confined to marine waters. They have a widespread tropical Indian Ocean and western Pacific Ocean distribution (Marsh et al., 2002). Dugongs are subject to a wide range of threats, such as habitat degradation and fishing-related fatalities (Avila et al., 2018), and are listed as "Vulnerable to Extinction" by the International Union for Conservation of Nature (Marsh & Sobtzick, 2019).

Dugongs occur along the Australian coastline and adjacent islands from Shark Bay (*ca*. 27° S) in the west to Moreton Bay (*ca*. 26° S) in the east (Marsh et al., 2002). Ashmore Reef is part of the Australian territorial seas and lies 350 km northeast of the Australian mainland within the Ashmore Reef Marine Park (Director of National Parks, 2018) and 150 km south of the Indonesian island of Roti. Ashmore Reef is extensive, covering more than 200 km^2 with extensive reef flat and lagoon habitat. The dugongs at Ashmore Reef, therefore, are more isolated from mainland Australia and are probably the least known population of Australian dugongs. The limited data available from Ashmore Reef (two of just three dugongs sampled) suggest dugongs there have a low level of connectivity to the widespread and restricted lineages found throughout the rest of Australia (Blair et al., 2014). Dugongs also occur in Indonesian waters to the north of Ashmore Reef and, while once common there, are now regarded as rare (Marsh et al., 2002). Dugongs are known to travel long distances (Sheppard et al., 2006), with occasional reports of dugongs from Cocos Keeling Islands, the most recent sighting in 2005 (Hobbs et al., 2007).

The only survey of dugongs at Ashmore Reef was in 1996 (Whiting, 1999; Whiting & Guinea, 2005a, 2005b). Whiting (1999) reported dugongs, including calves, at Ashmore Reef, suggesting a breeding population. Whiting's 1996 survey was facilitated by an opportunistic flight rather than an exhaustive survey and estimated the population at Ashmore Reef at over 100 individuals, which was based on sighting only eight dugongs within 6% of the reef area. Between 1996 and 2005 (including the 1996 aerial survey), there were 25 dugong sightings for a total of 42 dugongs, with seven as the largest group observed (see Figures 1 & 2 in Whiting & Guinea, 2005a). The dugongs observed included a mother–calf pair; this suggests that parturition (at least), if not breeding, may occur on the reef (Whiting & Guinea, 2005a). There have been no subsequent records of dugongs from Ashmore Reef by these researchers (Scott Whiting, pers comm., 24 October 2023; Michael Guinea, pers comm., 24 October 2023) and no other published records. The predominant seagrass at Ashmore Reef is *Thallasia hemprichii* (Westlake et al., 2022), and seagrass surveys in 1998 (Skewes et al., 1999) recorded 470 ha of seagrass over a total area of 227 km^2 of reef surveyed (240 sites—average cover 2.07%; see Appendix D in Skewes et al., 1999). In 2019, a survey of 65 reef flat sites at Ashmore Reef found mean cover of 2.8 ± 0.7% (range: 0 to 30%) with just seven sites exceeding 10% cover (Keesing et al., 2021). Extrapolating to the total area of reef flat at Ashmore Reef (82.5 km^2; Keesing et al., 2021) would give a total estimated seagrass area of between 173 and 289 ha. This is less than what was recorded by Skewes et al. (1999), but the methods are not directly comparable, and both are derived from substantial extrapolation. The difference can be attributed partly to the calculation from Keesing et al. (2021) that included the whole

reef flat, while as Brown & Skewes (2005) point out, the seagrass on the reef flat does not extend to within 100 m of the reef edge. Nevertheless, there is substantial seagrass at Ashmore Reef, and Brown & Skewes concluded that the reef could sustain a population of 100 or more dugongs, even allowing for turtle grazing; thus, the 1996 estimate of this population size was plausible. However, due to the location and isolation of the region, this estimate of the dugong population remains uncertain and unsuitable as a basis for management or as a performance indicator of the population status or to estimate Limits of Acceptable Change (Hale & Butcher, 2013). Limits of Acceptable Change is an approach used to determine metrics of change in natural values in Ramsar convention wetlands due to human impacts (Newall & Fisk, 2023).

Between 2005 and 2019, Ashmore Reef had been surveyed four times to determine the health status of coral reef fish, invertebrates, and sea snakes as well as the impacts of illegal fishing (Keesing et al., 2021). However, these surveys had not made even incidental observations of dugongs until a single observation was made in this study in May 2022 on a reef flat *T. hemprichii* bed using remotely deployed underwater cameras. This may or may not indicate that dugongs are rare at Ashmore Reef because, although the 2013, 2019, and 2022 dive, manta tow, and boat-based surveys (Ceccarelli et al., 2013; Keesing et al., 2021; Keesing, unpub. data, May 2022) were particularly extensive, they were not designed to survey dugongs. Thus, the absence of sightings may just reflect the secretive nature of dugongs at Ashmore Reef.

We deployed three weighted camera frames in each of two *T. hemprichii* seagrass bed sites (SGTC1: 12.2248° S, 122.9778° E; SGTH5: 12.2544° S, 122.9588° E) on the reef flat at Ashmore Reef (Figure 1) between 18 and 23 May 2022. These are the same sites used by Westlake et al. (2022) whose study measured substantial grazing rates on the seagrass, which they attributed primarily to turtles, even though they did not observe any grazing. The primary objective of the camera deployments in this study was to identify grazers on *T. hemprichii* and record grazing rates. Each frame carried two GoPro-9 cameras in stereo configuration mounted 30 cm above the seabed. The cameras were set to

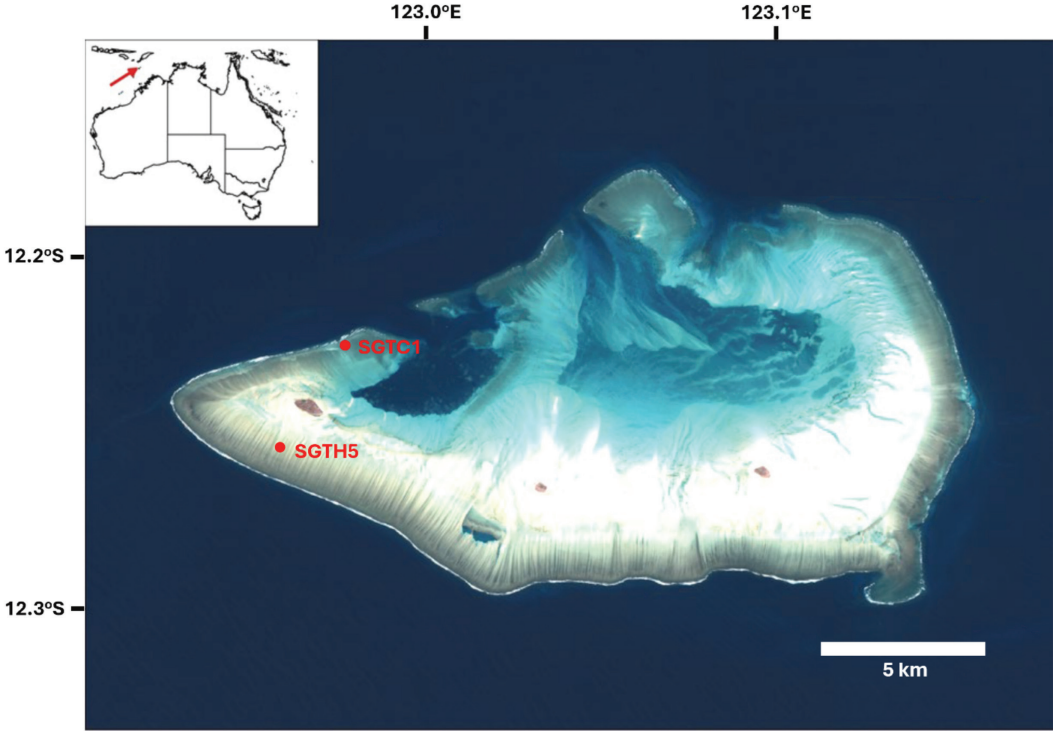

Figure 1. Ashmore Reef, showing location of sites where cameras were deployed. Site names are common to this study and that of Westlake et al. (2022). (Imagery was produced from European Space Agency remote sensing data, https://www.copernicus.gov.au.)

time-lapse mode recording five times normal speed. Approximately 88 h of video across the six systems were captured, which equates to 440 h in real-time video observation or just over 3 d per system. No lights were used, so no imagery was captured at night. In addition, cameras were above water for approximately 3 h each day when the reef was exposed during low tide. The video footage was reviewed post-voyage. Only one dugong was captured on video, at site SGTH5, during the entire expedition. The dugong remained in view of the camera for only 3 s (15 s in real time) and was not observed feeding. This is the first study to our knowledge to detect dugongs in their natural habitat using remote underwater video. (The supplemental video for this short note is available on the *Aquatic Mammals* website.)

This observation was made at a site close to where previous dugong sightings had been made (see Figures 1 and 2 in Whiting & Guinea, 2005a) and confirms the continued presence of dugongs at Ashmore Reef. This represents the first confirmed sighting since those reported in 2005. The population size and structure, and the conservation status of dugongs at Ashmore Reef Marine Park remain unknown, and a study specifically designed to survey the dugong population is urgently warranted. At present, there is no reliable baseline against which to evaluate if any anthropogenically caused changes in dugong population size, which might occur over time, are within the Limits of Acceptable Change. Traditionally, dugong surveys have been undertaken by fixed wing aircraft (Marsh & Sinclair, 1989). However, the remoteness of Ashmore Reef and the absence of any landing strip make a thorough survey using this method logistically and economically unfeasible. New guidelines for the survey of dugongs and other marine mammals (Department of Climate Change, Energy, the Environment and Water [DCCEEW], 2024) recommend the use of unmanned aerial vehicles (drones) for dugong survey(s), and this method has been used successfully for these surveys (Hodgson et al., 2013). At Ashmore Reef, we suggest the use of drones operated from small vessels and the four islands complemented with the use of long-run cameras on reef flat seagrass beds, such as those used in this study, to examine patterns and frequency of habitat use.

Note: The supplemental video for this short note is available in the "Supplemental Material" section of the *Aquatic Mammals* website: https://www.aquaticmammalsjournal.org/supplemental-material.

Acknowledgments

We thank Daemon Bass of Terrafirma Offshore and the crew of the *Adrianus*. David Blakeway, Matt Frapple, Lauren Hardiman, Tim Harriden, Mick Haywood, and Mark Tonks assisted with diving and camera deployment. This research was funded by Parks Australia and the CSIRO and was conducted under an animal ethics research permit (2019-017) issued by the CSIRO Wildlife and Large Animal Ethics Committee.

Literature Cited

Avila, I. C., Kaschner, K., & Dormann, C. F. (2018). Current global risks to marine mammals: Taking stock of the threats. *Biological Conservation*, *221*, 44-58. https://doi.org/10.1016/j.biocon.2018.02.021

Blair, D., McMahon, A., McDonald, B., Tikel, D., Waycott, M., & Marsh, H. (2014). Pleistocene sea level fluctuations and the phylogeography of the dugong in Australian waters. *Marine Mammal Science*, *30*(1), 104-121. https://doi.org/10.1111/mms.12022

Brown, K., & Skewes, T. D. (2005). A preliminary assessment of the ecology of seagrasses at Ashmore Reef. *The Beagle: Records of the Museums and Art Galleries of the Northern Territory*, Supp. 1, 143-152. https://www.biodiversitylibrary.org/page/55246053#page/153/mode/1up

Ceccarelli, D., Williamson, D., Ayling, T., Ayling, A., & Pratchett, M. S. (2013). *Ashmore Reef National Nature Reserve marine survey 2013 – Methods field test*. Produced for the Department of Sustainability, Environment, Water, Population and Communities, ARC Centre of Excellence for Coral Reef Studies, James Cook University, Townsville. https://parksaustralia.gov.au/marine/pub/scientific-publications/Ceccarelli%20et%20al%202013%20Ashmore%20survey%20report%20FINAL.pdf

Department of Climate Change, Energy, the Environment and Water (DCCEEW). (2024). *National guidelines for the survey of cetaceans, marine turtles and the dugong* (Version 1.0). DCCEEW, Canberra. CC BY 4.0. https://www.dcceew.gov.au/sites/default/files/documents/national-guidelines-survey-cetaceans-marine-turtles-dugong.pdf

Director of National Parks. (2018). *North-west Marine Parks Network Management Plan 2018*. Director of National Parks, Canberra. https://parksaustralia.gov.au/marine/pub/plans/north-west-management-plan-2018.pdf

Hale, J., & Butcher, R. (2013). *Ashmore Reef Commonwealth Marine Reserve Ramsar Site ecological character description*. A report to the Department of the Environment, Canberra. 83 pp. https://www.dcceew.gov.au/sites/default/files/documents/58-ecd.pdf

Hobbs, J. P. A., Frisch, A. J., Hender, J., & Gilligan, J. J. (2007). Long-distance oceanic movement of a solitary dugong (*Dugong dugon*) to the Cocos (Keeling)

Islands. *Aquatic Mammals*, *33*(2), 175-178. https://doi.org/10.1578/AM.33.2.2007.175

Hodgson, A., Kelly, N., & Peel, D. (2013). Unmanned Aerial Vehicles (UAVs) for surveying marine fauna: A dugong case study. *PLOS ONE*, *8*(11), e79556. https://doi.org/10.1371/journal.pone.0079556

Keesing, J. K., Webber, B. L., & Hardiman, L. K. (2021). *Ashmore Reef Marine Park environmental assessment* (Report to Parks Australia). CSIRO, Crawley, Australia. https://parksaustralia.gov.au/marine/management/resources/scientific-publications/ashmore-reef-marine-park-environmental-assessment-report-2021

Marsh, H., & Sinclair, D. F. (1989). An experimental evaluation of dugong and sea turtle aerial survey techniques. *Australian Wildlife Research*, *16*, 639-650. https://doi.org/10.1071/WR9890639

Marsh, H., & Sobtzick, S. (2019). *Dugong dugon* (amended version of 2015 assessment). In International Union for Conservation of Nature (Ed.), *The IUCN red list of threatened species 2019* (e.T6909A160756767). IUCN. https://doi.org/10.2305/IUCN.UK.2015-4.RLTS.T6909A160756767.en

Marsh, H., Penrose, H., Eros, C., & Hugues, J. H. (2002). *Dugong status report and action plans for countries and territories* (UNEP Early Warning and Assessment Report UNEP/DEWA/RS.02-1:1-161). United Nations Environment Programme. ISBN 92-807-2130-5

Newall, P. R., & Fisk, G. (2023). Trajectories in wetland condition: Setting limits of acceptable change. In P. A. Gell, C. M. Finlayson, & N. C. Davidson (Eds.), *Ramsar Wetlands: Values, assessment and management* (pp. 335-355). Elsevier. https://doi.org/10.1016/B978-0-12-817803-4.00010-3

Sheppard, J. K., Preen, A. R., Marsh, H., Lawler, I. R., Whiting, S. D., & Jones, R. E. (2006). Movement heterogeneity of dugongs, *Dugong dugon* (Müller), over large spatial scales. *Journal of Experimental Marine Biology and Ecology*, *334*(1), 64-83. https://doi.org/10.1016/j.jembe.2006.01.011

Skewes, T. D., Gordon, S. R., McLeod, I. R., Taranto, T. J., Dennis, D. M., Jacobs, D. R., Pitcher, C. R., Haywood, M., Smith, G. P., Poiner, I. R., Milton, D., Griffin, D., & Hunter, C. (1999). *Survey and stock size estimates of the shallow reef (0-15 m deep) and shoal area (15-50 m deep) marine resources and habitat mapping within the Timor Sea MOU74 Box: Vol. 2. Habitat mapping and coral dieback* (Report to Environment Australia). CSIRO Marine Research. https://parksaustralia.gov.au/marine/pub/scientific-publications/archive/ashmore-marine-resources-2.pdf

Westlake, E. L., Keesing, J. K., Hardiman, L. K., Tonks, M., & Olsen, Y. (2022). Growth, biomass and productivity of the seagrass *Thalassia hemprichii* at Ashmore Reef, Australia. *Aquatic Botany*, *183*, 103557. https://doi.org/10.1016/j.aquabot.2022.103557

Whiting, S. D. (1999). Use of the remote Sahul Banks by dugongs including breeding females. *Marine Mammal Science*, *15*(2), 609-615. https://doi.org/10.1111/j.1748-7692.1999.tb00831.x

Whiting, S. D., & Guinea, M. L. (2005a). Dugongs of Ashmore Reef and the Sahul Banks: A review of current knowledge and a distribution of sightings. *The Beagle: Records of the Museums and Art Galleries of the Northern Territory*, Supp. 1, 207-210. https://www.biodiversitylibrary.org/page/55246053#page/217/mode/1up

Whiting, S., & Guinea, M. (2005b). *The sea turtles of Ashmore Reef: History, current status and future direction research and management*. Biomarine International & Charles Darwin University.