

## DUGONGS: UNDERWATER SEAGRASS DETECTORS THAT HELP SCIENTISTS PROTECT IMPORTANT ECOSYSTEMS

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### YOUNG REVIEWERS:



**AVINESH**

AGE: 13



**DAVID**

AGE: 9



**HARSITH**

AGE: 13



**MATHI**

AGE: 10



**THIAGO**

AGE: 9

Can you picture cows grazing on a meadow of grass? Did you know that there are also “cows” under the sea that graze on seagrass meadows? Dugongs—a type of sea-cow—are threatened with extinction, mainly as a result of human activities and loss of their main food source, seagrass. Seagrasses are a group of flowering plants that grow in the ocean! Seagrasses are important not only as a food source for dugongs, but they provide a home for many animals, absorb carbon dioxide aiding in climate change mitigation, and so much more! However, seagrasses are declining globally, which is bad news not only for dugongs, but for humans as well. Luckily, dugong presence can aid scientists in understanding the health of seagrasses in an area, as well as help scientists locate and protect our important seagrass ecosystems.

## INDIGENOUS PEOPLE

Communities consisting of the original inhabitants of a region, with strong cultural ties to the local land and sea and many stories and experiences about changes in the land over time.

### Figure 1

(A, B) Dugongs feeding on seagrass on the ocean substrate. You can see their unique snouts and how these animals use it to munch on their favorite food: seagrass. (C) A map showing (in orange) where dugongs can be found [Figure credits: (A, B) Ahmed Shawky; (C) The International Union for Conservation of Nature (IUCN) 2015. *Dugong dugon*. The IUCN Red List of Threatened Species. <https://www.iucnredlist.org>.

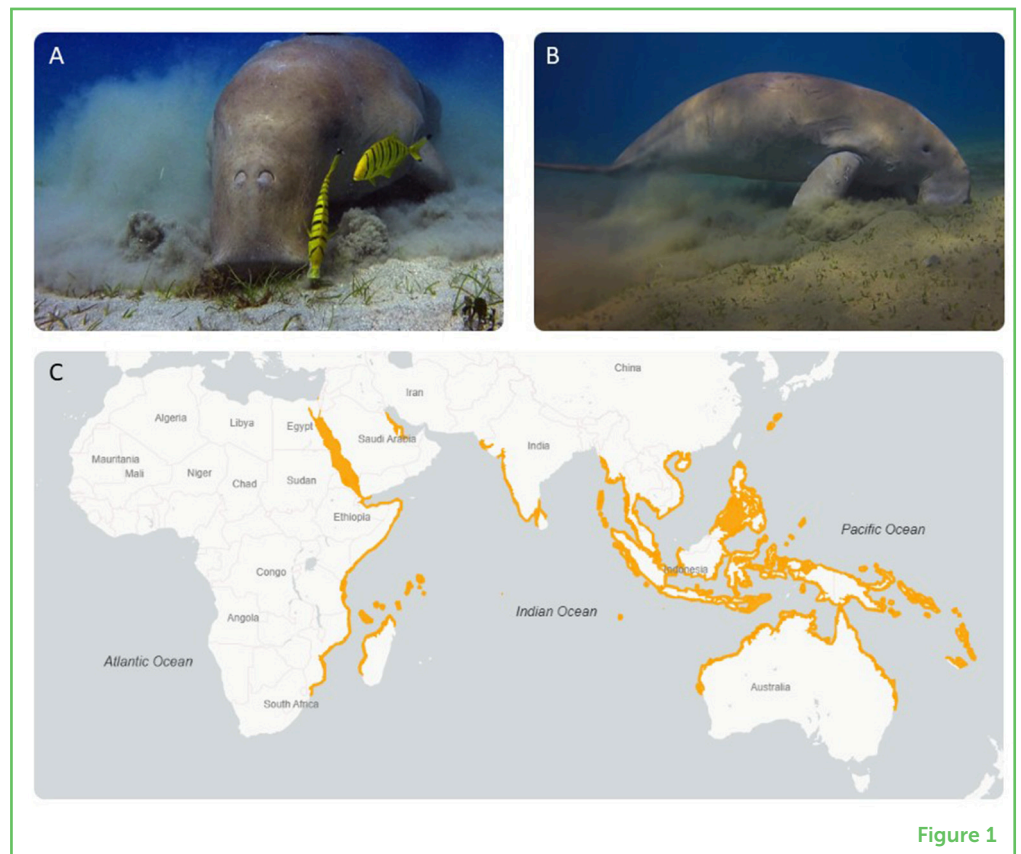


Figure 1

Dugongs belong to the order (a group of animals which are similar) Sirenia, which contains only four species worldwide [1]. Three of these are different species of manatees (found in North and South America and West Africa), which are somewhat larger and look slightly different to dugongs, with paddle-shaped tails, a different mouth shape, and “nails” on their flippers. The fourth species is dugongs. Dugongs and manatees are both herbivores, which means they are vegetarians that only eat plants. Both dugongs and manatees are known as “sea cows” because their diet consists mainly of seagrass, the only flowering plant found in the sea. Dugongs are only found in marine

## BIRTH RATE

The rate at which a species produces babies. Birth rates can be used to understand how quickly a species can recover, which can help us know if a species needs protecting.

## RHIZOME

A section of a plant that runs along the ground or sediment, connecting the roots and leaves together. Rhizomes can store energy made through photosynthesis, which can be used in times of stress.

## PHOTOSYNTHESIS

The process plants use to make their own food (sugars) using carbon dioxide, water, and the energy of sunlight.

(saltwater) environments, while manatees rely on both freshwater and saltwater. This makes dugongs the only vegetarian mammals that live in the sea.

Dugongs have a long lifespan—they can live up to 70 years. However, dugongs have a low **birth rate** (one calf every 3–7 years) and take many years to start having calves (babies), which live with their mothers for around 2 years. These characteristics makes dugongs vulnerable to decreases in their numbers. Being large animals, dugongs do not have many natural predators, but dugong calves and sick or injured dugongs are vulnerable to being eaten by large sharks, killer whales, and saltwater crocodiles. However, the main threats to dugongs are caused by humans, including, loss of their seagrass habitats, being hit by boats, and getting tangled in fishing nets. As a result, dugongs are decreasing worldwide and are vulnerable to extinction. Therefore, dugongs and their seagrass habitats need extra attention and protection.

## SEAGRASS—CHAMPIONS OF THE OCEAN!

Seagrasses are extremely important for animals that live underwater, and even for humans! They are the main food source not only for dugongs, but also for other marine animals like fish and turtles [2]. Seagrasses are also home to many animals, including fish that humans like to eat. These plants are also champions in our battle against climate change, because they help to lock carbon away into the sediment.

Seagrasses have leaves, roots, and **rhizomes**, just like many of the plants that grow on land, but they live underwater! Seagrasses reproduce through seeds developed from flowers, creating genetically unique plants, but they can also create exact copies (clones) of themselves (Figure 2B). Because seagrasses are plants, they need light to undertake **photosynthesis**, so are generally found in shallow waters. Seagrasses come in all shapes and sizes. Some seagrasses, like paddle weed, are very small and have paddle shaped leaves the size of your thumb, while others, like ribbon weed, resemble large blades of grass and can grow to the length of your arm, or even taller than you. You can find seagrasses all around the world, off the coasts of all continents except Antarctica, where it is too cold for seagrass to grow. In fact, temperature plays a large part in where seagrasses live, with some species living in warm tropical oceans and others in cool temperate waters.

Over the last 100 years, the world has lost around 19% of its seagrasses, and unfortunately, in some places we are still losing one to two football fields of seagrass every hour! Seagrass meadows are being damaged by coastal development, like harbors, and more recently, by climate change. When we lose seagrasses, we also lose all the benefits



that they provide to the environment and to us, including providing a food source for dugongs.

## Figure 2

(A) Dugongs eating their favorite food (seagrass!) and creating bare sand patches called “feeding trails”. (B) Adult seagrass, as well as seagrass seeds that are produced by flowers. Seeds can sprout on the seafloor, turn into seagrass seedlings, and then grow into adult plants to complete their lifecycle. (C) Dugong poo can contain seagrass seeds, which can germinate into seagrass seedlings. Therefore, when dugongs move, they can help spread seagrass seeds to new areas (Image credit: Tori Gorham Illustration).

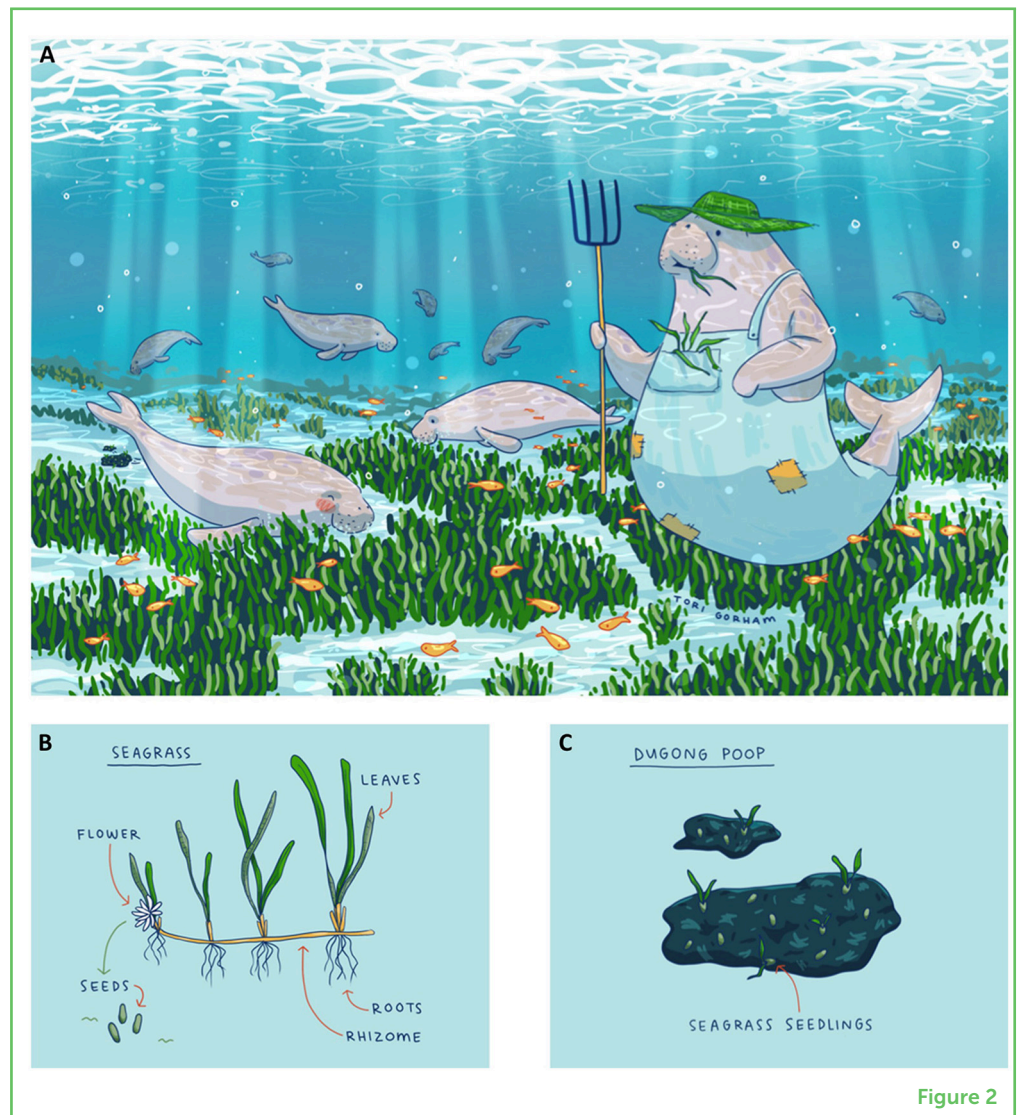


Figure 2

## DUGONGS CAN BE GOOD “SEAGRASS FARMERS”

Dugongs spend much of the day feeding on seagrass, farting (eating a vegetarian diet will do that to you), and poeing. They eat a lot: about 40 kilograms of seagrass every day, which is equal to 130 lettuce heads. Dugongs eat both seagrass leaves and rhizomes, leaving bare sand patches through the seagrass meadow as they feed (Figure 2A). In some areas they are considered “seagrass farmers”, because over time their feeding behavior changes which seagrass species are most commonly found in a meadow [3]. Small, fast-growing species are generally the first to form a seagrass meadow, which are the species dugongs prefer to eat. Smaller seagrass species have high nutritional value, and by dugongs continually removing small seagrasses as they eat, over time, they stop other slower growing seagrass species, that



### POSITIVE FEEDBACK LOOP

A process in which a change causes effects that make the change grow even more, like a snowball rolling down a hill and getting bigger.

### GENETIC DIVERSITY

A range of different features that can be passed from parents to offspring. An example is different eye colors in humans.

### TROPICAL CYCLONE

Is a circular storm that forms over warm oceans. This can bring strong winds and heavy rain.

are less nutritious, from taking over. This process of dugong grazing influencing which seagrass species are present is known as a **positive feedback loop**, keeping the ecosystem in a state that is favorable for dugongs. Another positive feedback loop occurs when dugongs poo. If the poo contains seagrass seeds, new seagrass plants can also establish and grow from this nutrient-rich fertilizer package (Figure 2C). In fact, seagrass seeds that pass through a dugong are more likely to germinate and grow than seeds that do not. By spreading seeds this way, dugongs also increase the **genetic diversity** of seagrass meadows. You can think about diversity of a species like Superhero characters. For example, when Thor and Black Widow (both human superheros) combine their strengths, they are stronger in the face of enemies. When a single seagrass species (for example paddle weed) has both Thor's and Black Widow's in the meadow, they are stronger in the face of human impacts, including climate change.

## WHEN SEAGRASS DISAPPEARS, SO DO DUGONGS

If a seagrass meadow disappears because of an extreme weather event (e.g., cyclone), dugongs will move to find seagrass elsewhere, sometimes, far away. Scientists have tracked some dugongs traveling hundreds of kilometers between patches of seagrass. In fact, the longest distance recorded by one dugong is 1,000 km [4], which is the same as traveling from Paris to Berlin. When there is not enough seagrass to eat, dugongs will delay having calves until seagrass becomes healthier. Over time, this can mean that the number of dugongs in an area will decrease.

Near a small coastal town in Western Australia, there is a beautiful body of water called Exmouth Gulf. It is home to a diversity of marine life, including dugongs and seagrass. Dugongs can be found grazing on seagrass throughout the year, and the Gulf contains critical habitat for dugongs in this part of the world. However, in 1999, something interesting happened. Widespread damage to seagrass in Exmouth Gulf occurred from a **tropical cyclone**. The following year, dugong numbers in the Gulf were unusually low, but 400 km south, in a location called Shark Bay, there was an increase in the number of dugongs. Shark Bay is known for its lush seagrass meadows, and during the cyclone, these meadows did not experience the same damage as the meadows in Exmouth Gulf. Scientists believe that the dugongs in Exmouth Gulf undertook the long journey south to find food [5]. Because it is difficult to identify individual dugongs and there was no tracking data, it is hard to know how long the dugongs may have stayed in Shark Bay. However, several years later, there were larger numbers of dugongs back in Exmouth Gulf, suggesting that the seagrass had returned.

## INDICATOR SPECIES

A species that can provide scientists with information on ecological changes simply based on their presence. This can give scientists an indication on the health of an ecosystem.

## DUGONGS CAN HELP SCIENTISTS FIND SEAGRASS

For the tropical seagrasses that dugongs eat, dugongs are an important **indicator species**, meaning they can aid in telling scientists about the presence and health of seagrass meadows [6]. Seagrass meadows occur on the seafloor, often in murky water, making it hard to keep track of where the seagrass is and how well it is doing. Dugongs feeding on seagrass come to the surface every few minutes to breathe, so they can be detected from the air across these seagrass habitats. Scientists can fly planes or drones over these large areas and record where the dugongs are, which then tells them where the seagrass may be.

## YOU CAN HELP PROTECT DUGONGS AND THEIR HOMES TOO!

We need to protect and conserve our seagrass meadows to ensure dugongs can thrive in the future. Many people, both scientists and communities, are helping to protect these ecosystems and you can become part of the team. Here are some tips on how you can help!

- First, if you live near the ocean, you can be a “dugong detective” by visiting your local seagrass meadow (Figure 3). There are 72

**Figure 3**

“Dugong detective” examining different seagrass species to choose its favorite!



**Figure 3**

seagrass species globally, and you can find them on [this website](#). Pick your favorite seagrass and raise awareness of the importance of seagrass with your friends and family.

- Next, you can help protect seagrass and dugongs by looking after the ocean. An easy way to do this is by recycling, reducing single-use plastics (like water bottles and food containers), and by putting rubbish in the bin.
- You can also celebrate World Seagrass Day on March 1 each year. This day helps to raise awareness of how important seagrasses are and what activities threaten their health and survival.
- Finally, you can find local researchers or protectors and help them save seagrass. The good news is that there are a lot of them, and they may have community projects you can get involved in. Check out [Project Seagrass](#), [Seagrass Watch](#), and the [World Seagrass Association](#) as good places to start learning.

## ACKNOWLEDGMENTS

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## YOUNG REVIEWERS



### AVINESH, AGE: 13

My favorite subjects are Science, Math, and History. Some of my favorite things to do in my free time are to watch TV, play chess, and go outside with my friends, especially in the summer. I am part of my school’s Science Olympiad team, and I also do Speech and Debate and learn to play the piano. Most important of all, I have a very strong interest in science, and love opportunities to learn about different science topics, just like this article.



### DAVID, AGE: 9

Hi, my name is David and I live in México. I study at home. I like to learn to play the piano and learn English. I have a pet. His name is Tizoc, is a rooster. In my free time, I like to draw shopping centers. I like to know different animals. I love frogs because they come in different sizes and colors. My mom is a biologist and she talks to me about protecting our planet.



### HARSITH, AGE: 13

I find sports and computer programming interesting. I like to play cricket, soccer, and badminton. I love to play soccer with my friends and go to try out for soccer teams. I like to spend some time on computer programming like python. I play video games that make me addicted so my interest is to create a video game using the programming method. I also like to explore mind blowing and detailed constructions like castles.



### MATHI, AGE: 10

My name is Mathi. My hobby is drawing. I am studying in 5th grade at Orchard Middle School in Solon, Ohio.



### **THIAGO, AGE: 9**

I like the color red, legos, and telling jokes. I have a lot of friends at school and I practice jiu-jitsu every afternoon. I am a big fan of the Ben 10 cartoon.

## **AUTHORS**

### **NICOLE SAID**

Nicole Said is a marine scientist and ocean enthusiast. Her research focuses on human impacts, such as climate change on seagrasses. Seagrasses are one of her favorite things to see underwater whilst snorkeling and diving, along with all of the creatures you can find amongst them. Her favorite seagrass species is *Halophila spinulosa*, a little fern-like plant that grows in tropical waters. \*[n.said@ecu.edu.au](mailto:n.said@ecu.edu.au)



### **ANNA LAFRATTA**

Anna Lafratta is a lecturer in marine science specializing in coastal vegetated ecosystems, which include seagrass, mangroves, and tidal marshes. She studies the ability of those ecosystems to fight back against climate change. She uses their power to reveal information about the past by looking into their sediments. They are like a big library! Anna loves sharing her knowledge, particularly with communities around the world that rely on coastal ecosystems to survive. She loves diving in the warm waters of the Indo-Pacific region to look for the very small inhabitants of coral reefs, which are difficult to spot but so incredibly beautiful!



### **ALEXANDRA D'CRUZ**

Alexandra D'Cruz is a marine scientist specializing in marine mammals. Alex loves all marine creatures, but her favorites include dolphins, whales, dugongs, and sea lions. She is interested in understanding how human activity impacts marine mammals, and what we can do protect and conserve these charismatic creatures.



### **ANKJE FROUWS**

Ankje Frouws is a marine scientist who loves to be in or around the ocean. She studies the health and genetic diversity of seagrasses and their ability to survive human impacts. Because the ocean is so important for our health and the health of our planet, she thinks we should learn as much as we can about the ocean and improve the way we look after it. Although seagrasses are her absolute favorite, Ankje also loves to visit and work in other coastal ecosystems, like mangroves and coral reefs.



### **CAITLYN O'DEA**

Caitlyn O'Dea thinks seagrass meadows are the coolest thing you will ever see underwater. Whether it is a hungry swan, turtle, or dugong, Caitlyn wants to know how seagrasses are coping with being eaten. Her underwater adventures span from the cold temperate estuaries of southern Australia to tropical paradise on remote islands.





### **KATHRYN MCMAHON**

Kathryn McMahon is a professor in marine ecology who has been lucky to spend many years researching seagrass ecosystems around the world. Her work informs the management and conservation of coastal ecosystems and helps build resilience in these natural systems to human activities and climate change. She loves communicating science to a broad audience and has published seagrass guide-books as well as science publications.



### **CHANELLE WEBSTER**

Chanelle Webster found a passion for the magnificent underwater seagrass meadows back in 2017, snorkeling in Western Australia. That moment began her career in science, running experiments to work out if there are some seagrass populations that can handle climate change better than others, which might be useful for restoration.



### **CHANDRA SALGADO KENT**

Chandra Salgado Kent is an associate professor in marine science specializing in the biology and ecology of marine mammals, which include whales, dolphins, seals, sea lions, and dugongs. She also studies underwater sound in the ocean to learn how these animals navigate through their environment and communicate with each other. Chandra loves being out in the ocean and using mathematics to understand which habitats are critical to the survival of marine mammals and how we can protect them.



### **JENNAH TUCKER**

Jenna Tucker is a marine scientist whose research focuses on the ecology of marine mammals and understanding how these animals interact with humans, each other, and their environment under changing conditions. After growing up wishing she was a fish, she has always had a strong interest in understanding and preserving our ocean-dwelling mammalian counterparts.



### **AMANDA HODGSON**

Amanda Hodgson started researching dugongs back in 2000, when she spied on dugong behavior using a huge helium balloon carrying a video camera. Since then, she has been coming up with different ways to count dugongs and other marine animals like whales, dolphins, and turtles, using new technology like drones and artificial intelligence. Amanda hopes these methods will give us a better understanding of these important animals so we can better protect them.