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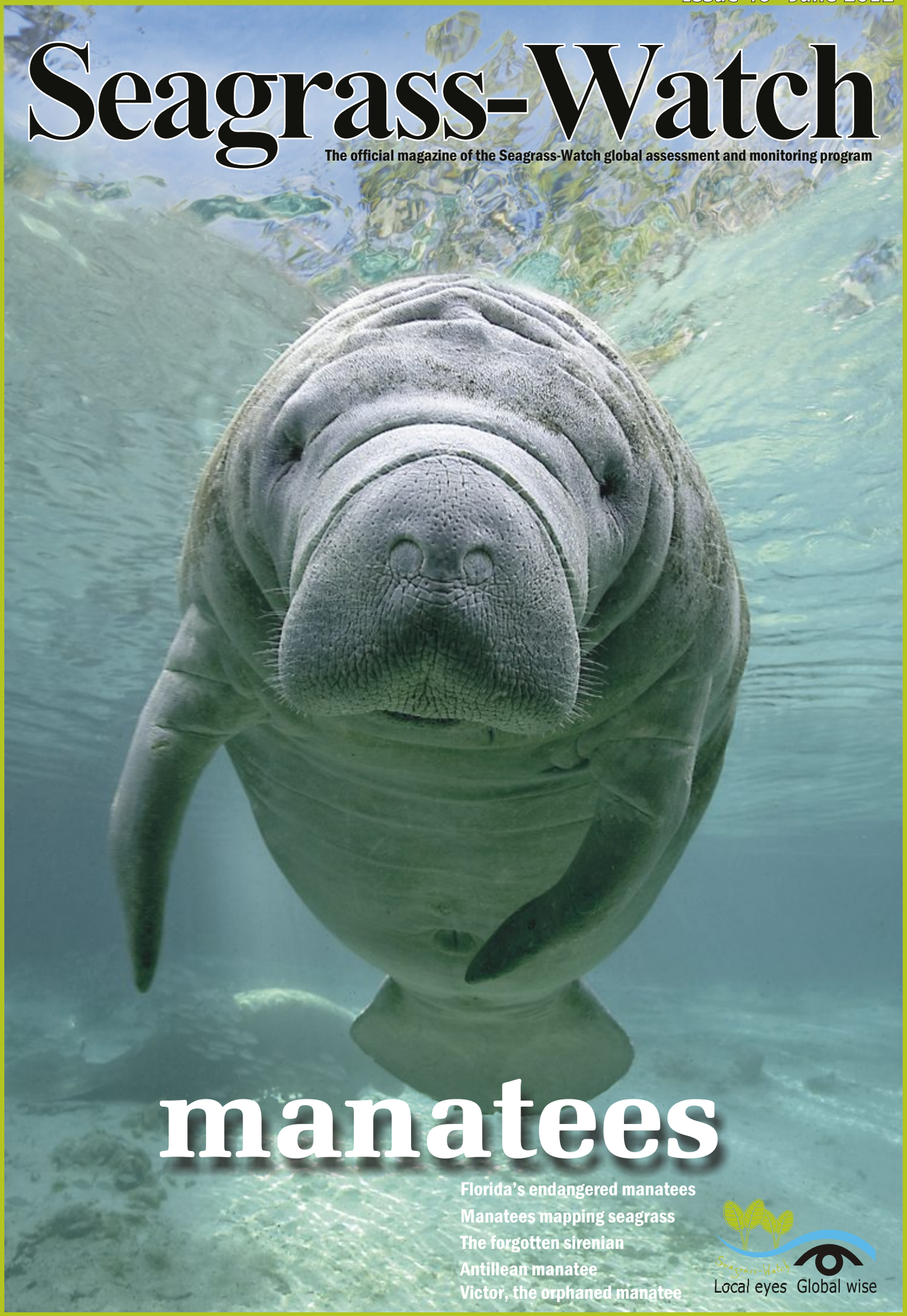
Seagrass-Watch

The official magazine of the Seagrass-Watch global assessment and monitoring program



manatees

Florida's endangered manatees
Manatees mapping seagrass
The forgotten sirenian
Antillean manatee
Victor, the orphaned manatee

Seagrass-Watch
Local eyes Global wise

In this issue:

From the editors

Compared with the dugong which is a seagrass community specialist, all four species of manatee eat a wide range of aquatic plants. Nonetheless, seagrasses are important components of the diets of two of the three species of manatees: the West Indian manatee (and its subspecies the Florida manatee) and the West African manatee, all of which are featured in this special issue. We are particularly delighted to include an article on the West African manatee, the 'forgotten sirenian'.

Understanding the relationship between manatees and seagrasses is difficult, especially in turbid environments and in developing countries and remote regions. These articles demonstrate how tracking manatees using satellite and GPS technology can be used to map seagrass communities, just as aerial surveys for dugongs have been used to locate seagrass meadows in tropical Australia.

In this issue, you can also read about how stable isotope techniques are being used to unravel the relationship between manatees and seagrasses in West Africa and Brazil, as well as the challenges of conserving manatees and their habitats in the face of rapid costal development in Florida.

COVER:
Camera curious juvenile manatee, Kings Bay, Crystal River, Florida, USA.
Photographer Gregory Sweeney

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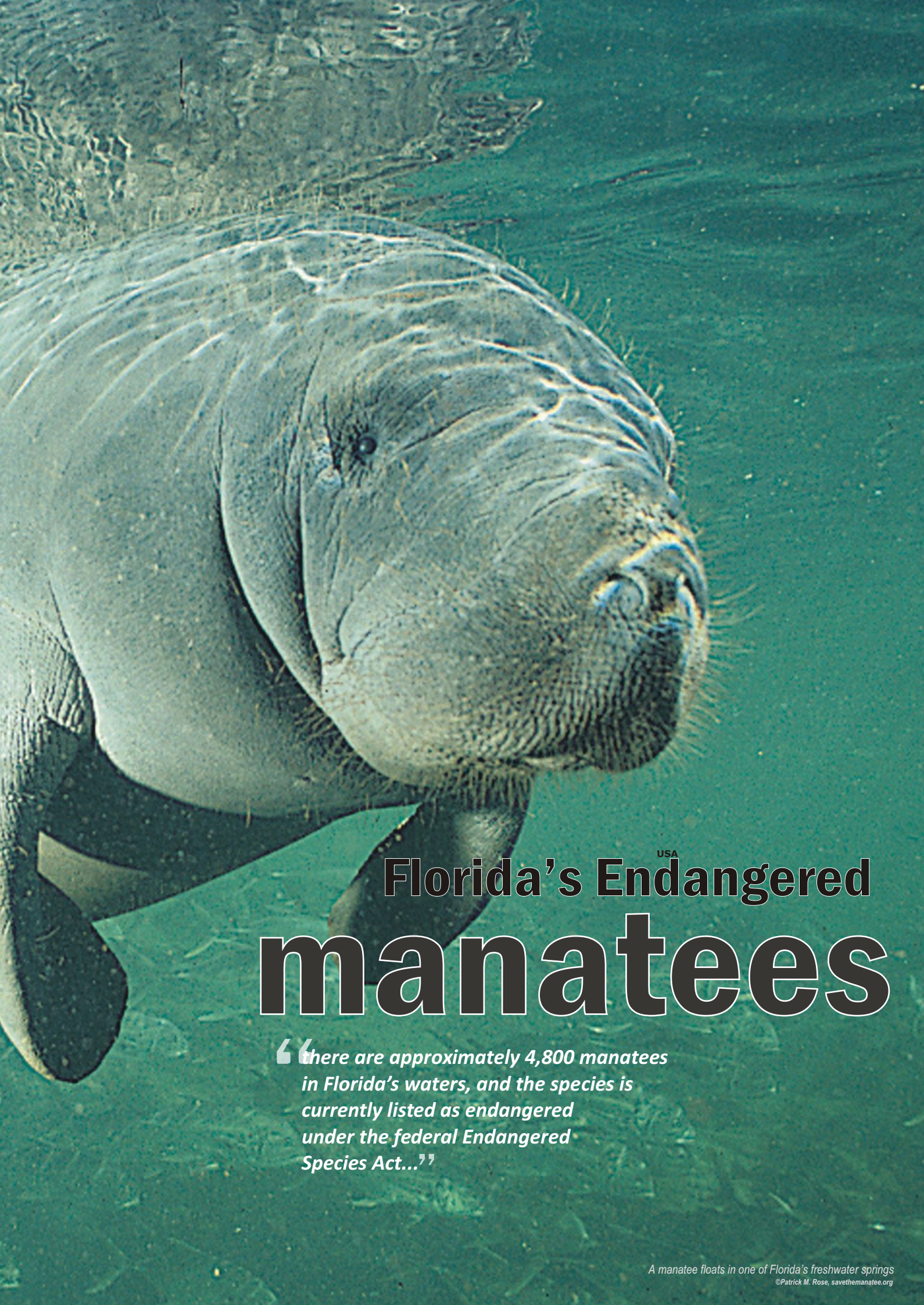


USA

Florida's Endangered manatees

"there are approximately 4,800 manatees in Florida's waters, and the species is currently listed as endangered under the federal Endangered Species Act..."

A manatee floats in one of Florida's freshwater springs

Small, informal gatherings

Evolving with few natural enemies, manatees have not needed the protection or cooperation of a herd. Consequently, they are semi-social, somewhat solitary animals. They sometimes gather in small, informal groups, but they have no leader or real herd structure. Manatee aggregations (gatherings) are largely due to common habitat requirements such as warm water, fresh water, or food sources.

Source: savethemanatee.org

Article by **Katie Tripp**
Photography by
Patrick M. Rose (savethemanatee.org),
Gregory Sweeney, Mark Evans
& Ken Arrison

MANATEES HAVE INHABITED the coastal waters of Florida for more than one million years. Today, there are at least 4,800 manatees in Florida's waters, and the species is currently listed as endangered under the federal Endangered Species Act. Although indigenous peoples of Florida are known to have historically hunted manatees, their greatest challenge is from modern Floridians, whose boats, development, pollution, and natural resource consumption provide them with unprecedented threats.

More than 18 million people now call Florida home, with 72% of those people living and working along the state's 1,926 km of coastline. The state's human population is expected to reach at least 28 million by 2030. Amidst all of Florida's development pressures are manatees, whose preservation is contingent upon the protection of their aquatic habitat.

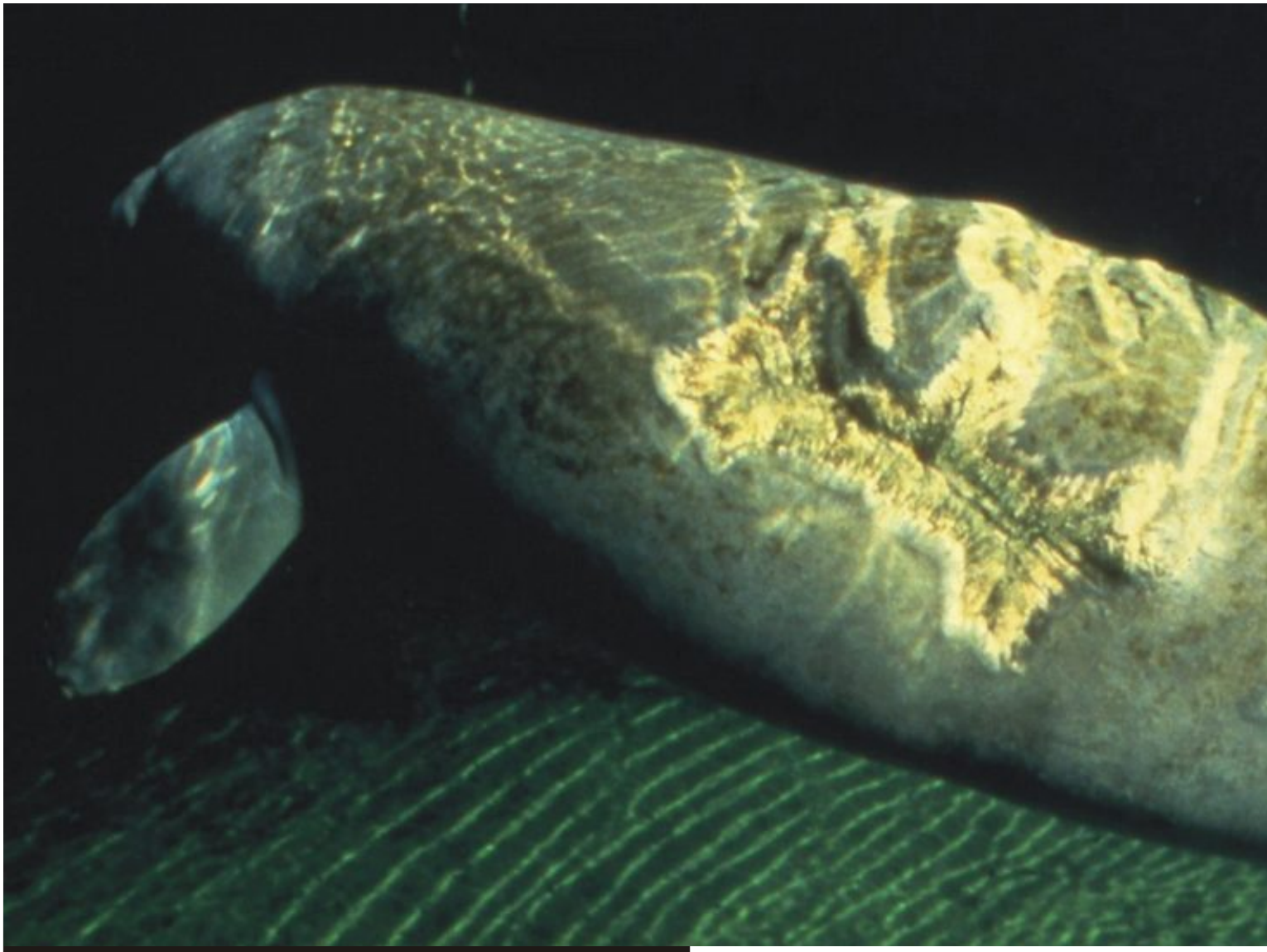
Manatees are an iconic species within the state of Florida, representing an endangered aquatic ecosystem in need of special protections. Measures that conserve manatees also help to protect aquatic systems.

Flexible upper lip and "marching molars":

Manatees have a large flexible, prehensile upper lip. They use their lips to help guide vegetation into the mouth. Vibrissae (whiskers) are found on the surface of the upper lip. Each vibrissa is separately attached to nerve endings and has its own supply of blood.[1]

A manatee's teeth are located in the back half of the lower and upper jaws. Called "marching molars," their teeth are unique because they are constantly replaced (horizontally), as opposed to vertically as in most other mammals. New teeth form at the back of the jaw, wear down as they move forward, and eventually fall out. Tooth replacement is continuous (polyphyodont) throughout their lives, as opposed to that of other mammals that replace a single set of teeth once in a lifetime (diphyodont). This constant tooth replacement is an adaptation to the manatee's diet, which often includes abrasive plants that are mixed with sand.[2]

Source: 1. seaworld.org,
2. savethemanatee.org



Severe boat strike

Ninety percent of Florida's manatee's, bear scars from collisions with one or more motorised vessels. Some wounds leave deep and disfiguring scars, as is the case with this manatee

Manatees are herbivorous, consuming 10-15% of their ~500 kg body weight in seagrass and other aquatic plants daily. They graze on the blades, leaving the rhizomes intact and allowing for regrowth. Seagrass die-offs caused by changes in freshwater flow have been documented in Florida Bay (southeast) and Faka Union Bay (southwest). Most recently, in 2011, some areas of the Indian River Lagoon in Brevard County experienced 100% loss of seagrass due to drought conditions that raised salinity in the estuary, followed by an algal bloom that blocked sunlight.

Seagrass meadows comprise an important habitat area for manatees. In addition to feeding in these areas, manatees may rest, travel, and mate in these shallow water areas. Manatees are at increased risk of vessel collisions while in shallow waters because they cannot dive to get out of the way of an approaching vessel, and often cannot out swim a boat speeding through the seagrass flats. The same vessel activities that result in prop scarring of seagrass also place manatees at risk of injury or death from a boat propeller or crushing impact of a vessel's hull.

Coastal development has had unquantifiable cumulative impacts on manatees and their habitat. Many remaining natural landscapes are slowly being converted into luxurious coastal communities, resorts, and marinas. As wetlands and natural landscapes are paved over for development, stormwater runoff and pollutant loads to the aquatic environment can increase, which further degrades manatee habitat and threatens seagrass meadows.

Mitigation banking of seagrass (whereby seagrass in one area is allowed to be compromised for development in exchange for preservation or replanting of seagrass in another area) has been introduced in recent years. However, concerns remain about whether this practice can ensure that there is no net loss in the productivity and ecosystem service value of seagrasses in Florida's coastal waters. In certain areas of Florida, "No Motor Zones" exist to protect healthy seagrass meadows or to help restore damaged areas and they can also be implemented as a form of mitigation.

Coastal development & reproduction

An aggregation of manatees (top) in shallow waters adjacent to coastal development on Florida's Gulf Coast

The reproductive rate for manatees is low. Female manatees do not sexually mature until they are approximately five years old, and males mature even later, at approximately seven years old. It is believed that one calf is born every two to five years, and twins are rare. The gestation period is about a year. Mothers nurse their young (above) for one to two years, during which time a calf remains dependent on its mother.

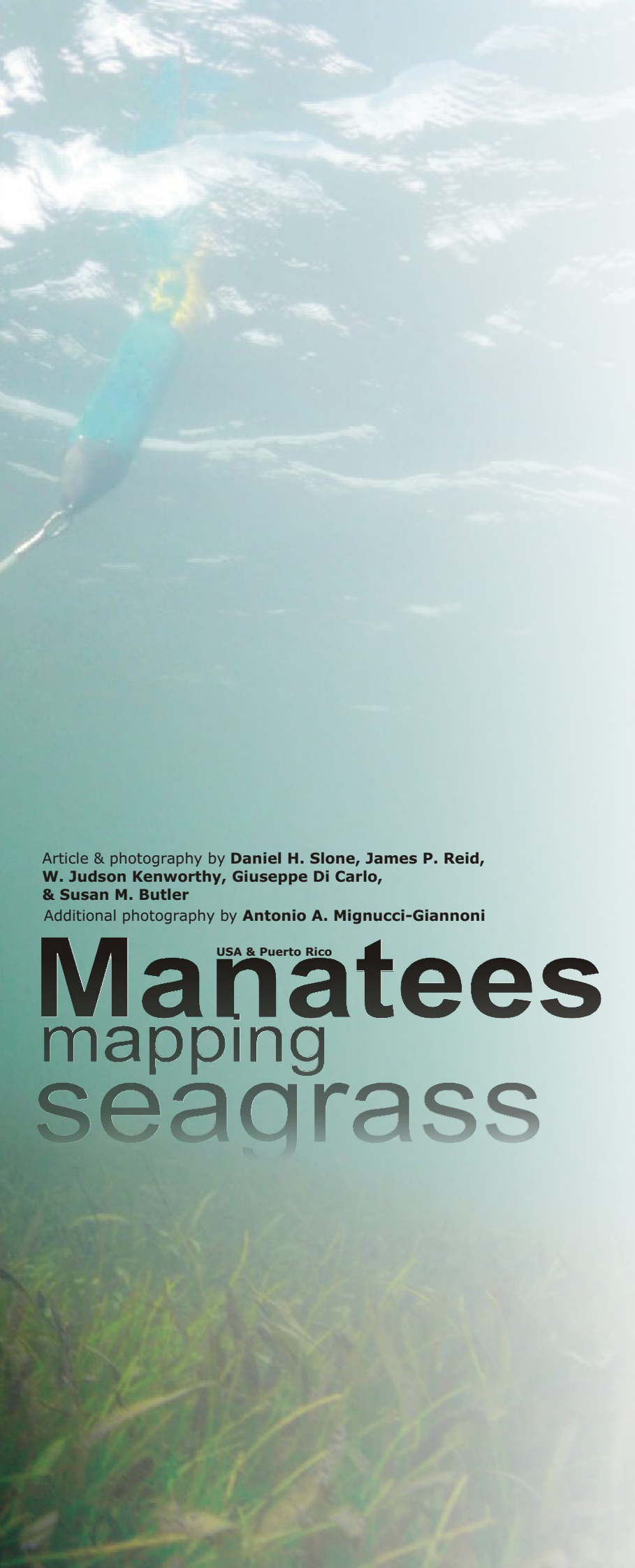
Source: savethemanatee.org

The "No Motor Zones", can also serve as a sanctuary from fast moving vessels, for manatees.

Manatees are an iconic species within the state of Florida, representing an endangered aquatic ecosystem in need of special protections. Measures that conserve manatees also help to protect aquatic systems. Hundreds of thousands of hectares of Florida's coastal environment and the flora and fauna they contain receive protection, at least in part, because of manatees. Florida has experienced unprecedented changes in the last century, which may be surpassed in scope only by what is yet to come.

There are opportunities for humans and manatees to co-exist, but only if sound growth management and conservation strategies continue to be implemented effectively. Growth management and environmental protection laws in Florida are currently being reduced. Federally, the U.S. Fish and Wildlife Service is expected to request that the manatee's conservation status be reviewed with a view to it being changed from endangered to threatened. Although such a down-listing could be considered as a manifestation of the success of management interventions to date, there is concern that this change could reduce federal funding and oversight for this species at a time when Florida's state government is ill-equipped to uphold meaningful protections for manatees and their habitat.

Save the Manatee Club is a membership-based 501c3 nonprofit organization based in central Florida that works actively in all areas of the world where manatees are found. Save the Manatee Club's primary funding is received through a unique "Adopt-a-Manatee®" program. The Club works in the areas of outreach and education, research, and advocacy to protect manatees and their habitat. Founded in 1981, this organization has served as the voice for manatees for more than 30 years. Learn more at www.savethemanatee.org and watch manatees in action at Blue Spring State Park via webcam: http://www.savethemanatee.org/savethemanateecam.html



Article & photography by **Daniel H. Slone, James P. Reid, W. Judson Kenworthy, Giuseppe Di Carlo, & Susan M. Butler**
Additional photography by **Antonio A. Mignucci-Giannoni**

USA & Puerto Rico

Manatees mapping seagrass

West Indian manatees (Trichechus manatus) are secretive creatures. While some of their behaviours at winter aggregation sites in Florida are readily visible to the casual observer, many of their habits and movements are difficult to observe. They rely on submerged vegetation for nutrition, and seagrasses are one of their most important food sources.

Manatees co-occur with seagrasses in a wide variety of conditions ranging from warm low nutrient waters in Puerto Rico to shallow turbid regions of Florida and Central America. Utilisation of these environments by manatees involves complex movements among foraging areas and other locations that provide essential living requirements such as freshwater and resting space. With the advent first of VHF radio-tracking tags, then satellite telemetry tags, and finally GPS tags, researchers have been able to follow these elusive animals as they move through their environment. The USGS Sirenia Project has been tracking manatees with floating, satellite-linked GPS tags[1,2] for more than a decade. Because of the high resolution of the GPS tags (the majority of locations are accurate to <5m), we have been able to develop post-processing analyses that can identify where manatees travel and help us to learn more about their behaviour.

Data from two locations - southeastern Puerto Rico and the Ten Thousand Islands region of southwest Florida, illustrate how manatee tracking data is being used to better understand the distribution and abundance of their forage resources. Telemetry data from the two locations were analysed in the same way: consecutive pairs of points were measured for distance and speed, and then lines between the points were aggregated into travel paths of differing speed. The maps included here show travel speed <1kph, which is indicative of foraging or other local resource use.

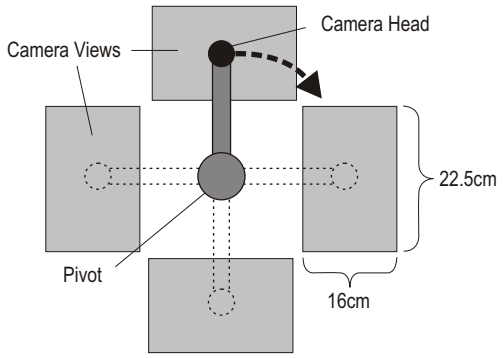
In the clear waters of southeastern Puerto Rico, seagrasses grow in dense and nearly continuous meadows[3,4]. Seagrass meadow delineation is accomplished though aerial surveys to determine extent, and SCUBA divers use sampling quadrats to determine local abundance and species composition.

A telemetry tagged manatee foraging on the lush seagrass meadows in the clear waters of southeast Puerto Rico (Caribbean)

Image © A. Mignucci, Puerto Rico Manatee Conservation Center

The Turbid waters *(above) of the Ten Thousand Islands (Florida, USA), limits seagrass growth*

Quad-Cam *(above): is used to sample seagrass meadows in the turbid water of the Ten Thousand Islands (Florida, USA).*
Seagrass (right), as viewed through the Quad-Cam.
Diagram (below) of the four views that are sampled by the Quad-Cam

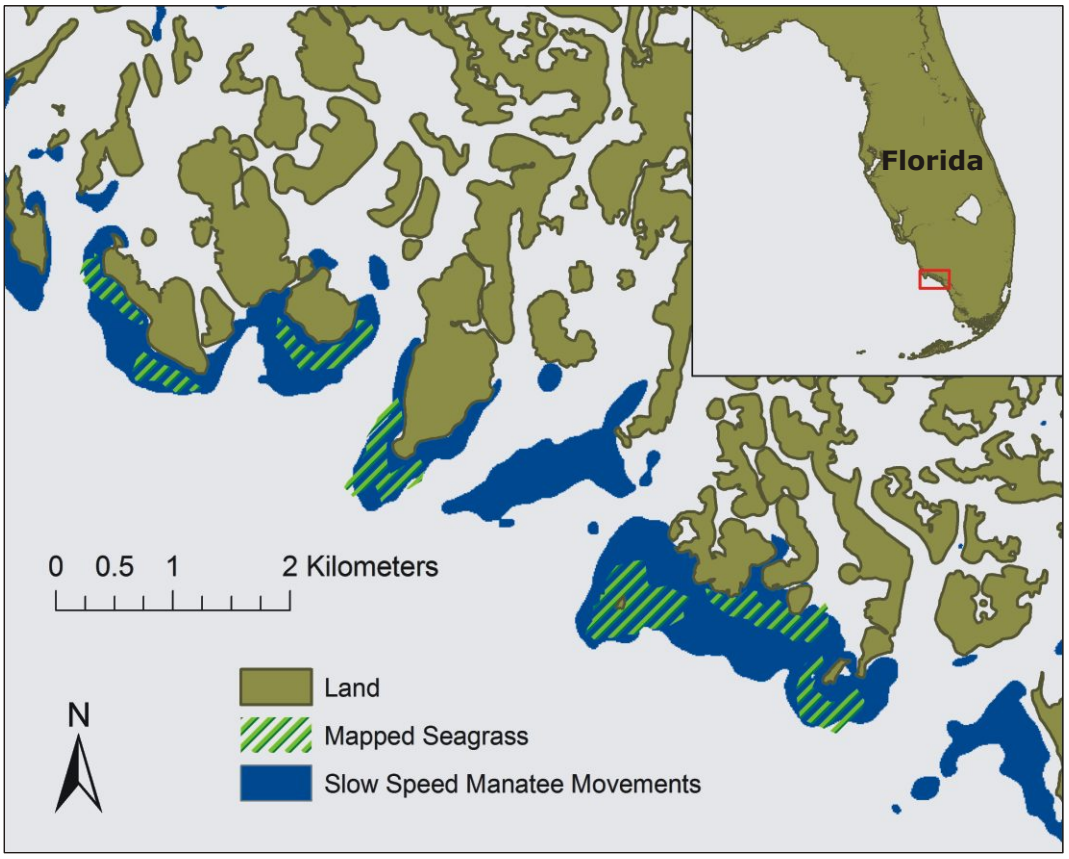


Despite the wide availability of their food, manatee movements suggest that they have specific preferred areas for feeding as indicated by travel speed.

In the Ten Thousand Islands, the water is generally very turbid - a very different environmental situation from that in Puerto Rico. Water visibility is often <50cm, and only rarely >120cm. Aerial surveys have been unable to adequately delineate the seagrass resources[5], and standard quadrat sampling is difficult due to the low visibility. By using manatee movement data from the GPS tags, we hoped to locate areas for intensive sampling and delineate the unmapped seagrass meadows.

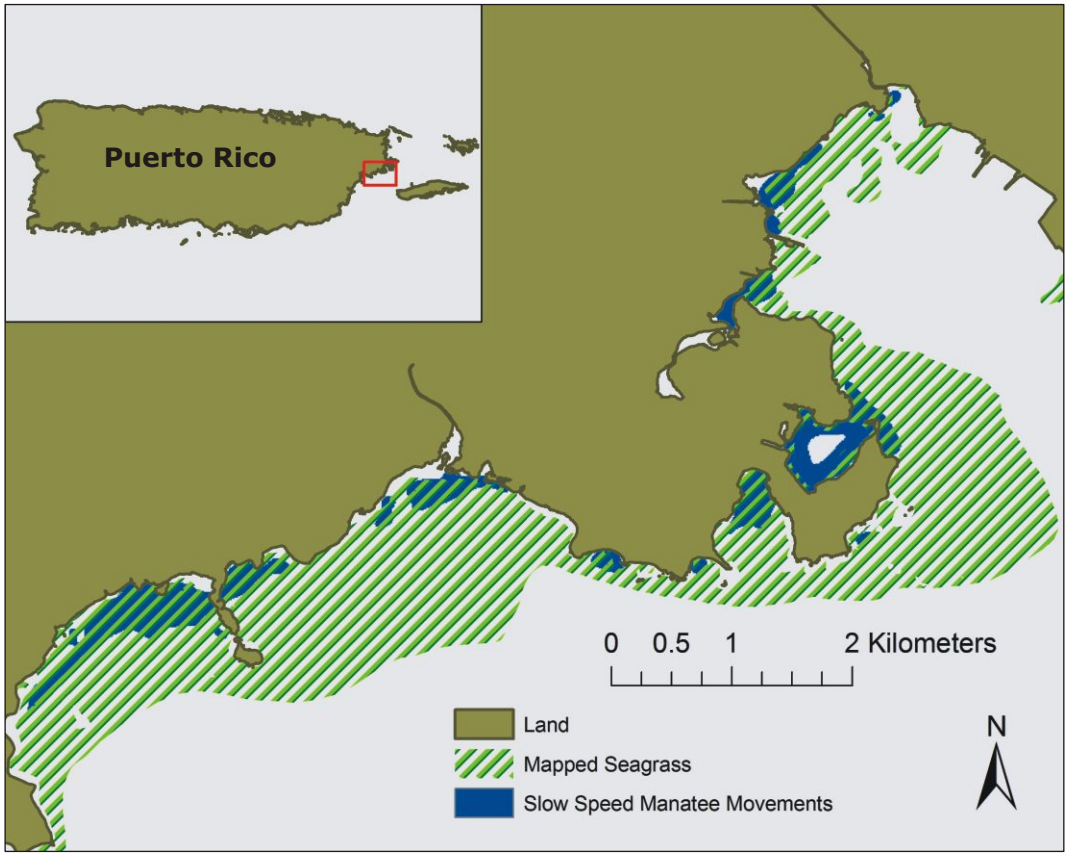
To view the bottom in these low-visibility conditions and to characterise seagrass species composition and abundance, we developed a video-based sampling device called the "Quad-Cam". It consists of a low-light, high resolution video camera (Sartek Industries SDC-CAL with 2.9mm lens and a resolution of 720 x 480 pixels) mounted on a swivelling PVC frame, with the camera viewing straight down at a distance of 13cm above the substrate. The view of the seafloor is 22.5cm x 16cm, so the pixel size on the substrate is approximately 0.3mm x 0.3mm. The camera frame attaches to a PVC pole with a flexible U-joint, keeping the frame upright on the seafloor and allowing the operator to rotate the camera head assembly within the frame to capture four quadrats on video. The camera output is recorded on Mini-DV tape or a laptop hard drive.

The camera is deployed from a 6.5m pontoon boat which is ideal for stability and working deck space. To locate each sampling station, a buoy anchored with a weight and a depth data logger is deployed at the location. The boat is kept on station with engine power or an anchor. We have deployed the camera down to 4.5m with suitable extensions on the handle, and in calm conditions this depth is not difficult. In the more usual offshore conditions with some wave chop, it can be more difficult to orient the camera in depths >3.0m. However, once on the sea floor, the weight of the camera is sufficient to keep the view steady except under strong currents.



Above: *Manatee use of all known seagrass meadows in the Ten Thousand Islands (Florida, USA) determined by GPS telemetry from 2000-2005* [6]

Below: *Manatee use of a small subset of seagrass meadows in eastern Puerto Rico (Caribbean) determined by GPS telemetry from 2005-2006* [7].



Field sampling in the Ten Thousand Islands showed that the slow speed manatee locations were a good proxy for seagrass locations. Within high density areas of slow speed tracks, 90% of the sampling locations contained seagrass, while in the surrounding waters that had no slow speed tracks, we found seagrass in only 5% of the sampling locations[6]. Overall, we found approximately four times the spatial extent of seagrass than was shown on previous maps of the area[5], suggesting that the manatee tracking method produced an efficient and improved assessment of seagrass area in the Ten Thousand Islands. The Quad-Cam system was effective at characterizing seagrass species composition during ground-truth efforts in turbid waters.

Manatees have highly tuned senses for locating and exploiting seagrass resources. We have successfully demonstrated the utility of using GPS tagged manatees to map seagrass meadows in turbid waters and locate critical, preferred feeding habitats (or areas). Future research will focus on forage-based carrying capacity and the effect manatees have on seagrass meadows do they influence the successional state of the seagrass meadows and species composition, or are they responding to existing differences in seagrass meadows to determine their preference? Both are possible, and very well may have differing relative influence in areas with a large number of manatees relative to available seagrass (Ten Thousand Islands [6]), compared to a high wave energy area with abundant seagrass resources relative to the local manatee population(SE Puerto Rico [7]).

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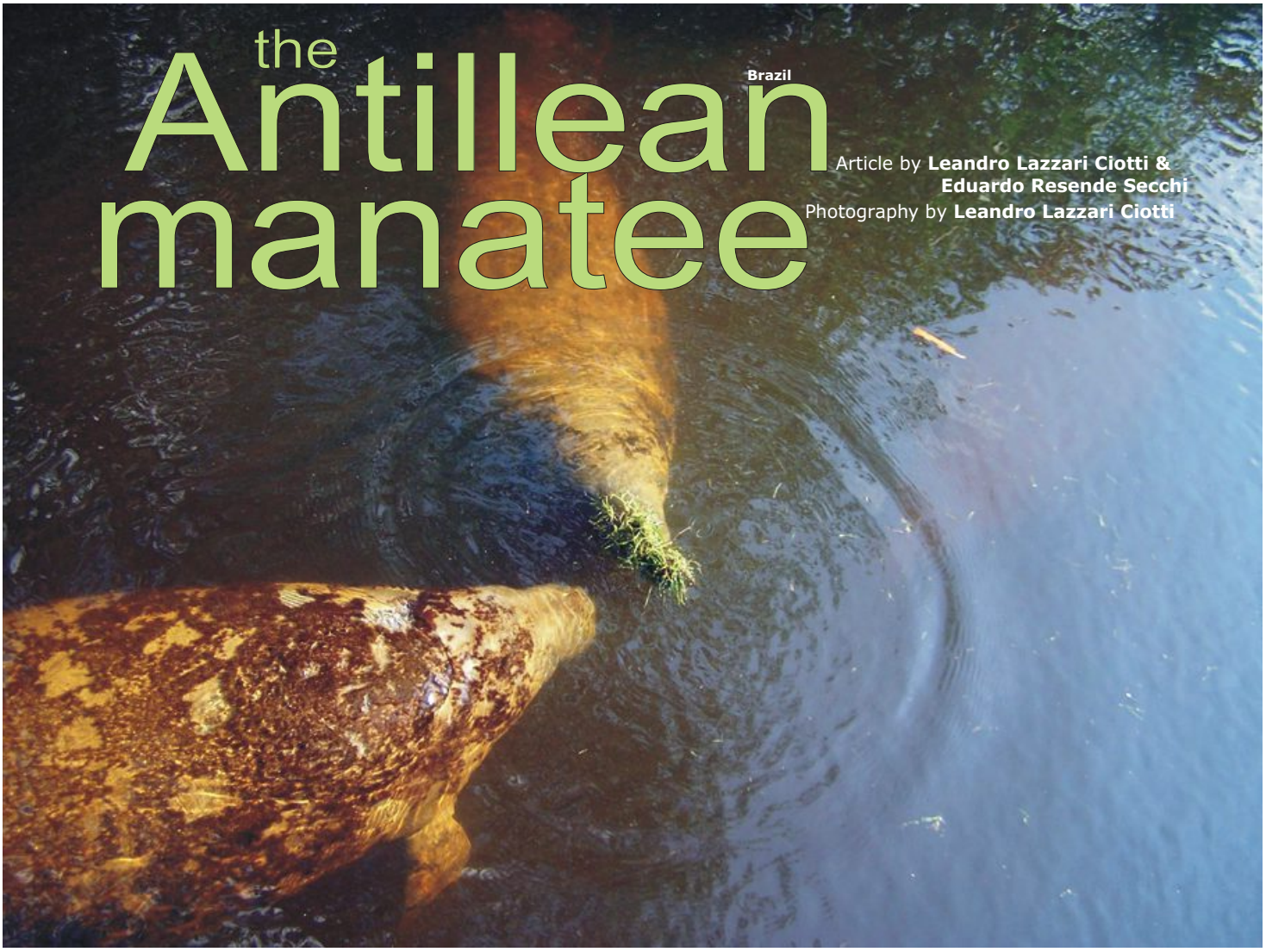

the Antillean manatee

Brazil

Article by **Leandro Lazzari Ciotti & Eduardo Resende Secchi**
Photography by **Leandro Lazzari Ciotti**

The West Indian manatee Trichechus manatus inhabits coastal, estuarine and riverine waters in the western Atlantic, from northeastern Brazil to southeastern USA. Two subspecies have been proposed: the Antillean manatee (T. m. manatus), in the South and Central Americas, and the Florida manatee (T. m. latirostris), in the North America.

In Brazil, the Antillean manatee occurs in the northern and northeastern regions, from Amapá State (4°N) to Alagoas State (10°S). However, in the past, it is thought that the distribution of the species extended further south down to Espírito Santo State (20°S).

The current major threat to the species in Brazil is thought to be habitat degradation. However, in the past, intensive hunting for consumption and exploitation of meat, fat and skin resulted in a drastic population decrease. Today, the species distribution is fragmented along the coast and the population abundance is very low. It is now included in the "List of the Endangered Species of Brazilian Fauna" by the Ministry of Environment.

Manatees are opportunistic herbivores, grazing upon a variety of aquatic and semi-aquatic macrophytes, from rivers, estuaries and seas, usually in shallow waters and preferably on submerged vegetation[1]. In Brazil, the species feed on a wide range of plants, including leaves of mangroves (e.g. Rhizophora *mangle* and *Laguncularia racemosa*), seaweeds (e.g. *Caulerpa prolifera*, *Padina gymnospora* and *Hypnea musciformes*) and coastal water seagrass *Halodule wrightii* (shoal grass) is considered the main food source for these animals.

Studies on the feeding ecology of manatees are performed traditionally by direct observation of animals in the wild and analysis of stomach contents and scats. However, because of the difficulty in conducting observational studies in nature and the constraints of stomach contents and faecal analysis, stable isotopes are being used to provide insights on the feeding habits of *T. manatus*[2].

Stable isotopes are atoms of the same chemical element that have the same numbers of protons, but different numbers of neutrons and do not decay; for example, isotopes of carbon (^{12}C and ^{13}C) and nitrogen (^{14}N and ^{15}N). The proportions between the heavy and the light isotopes ($^{13}C/^{12}C$ and $^{15}N/^{14}N$) vary within the environment; these same proportions are incorporated into the tissues of primary producers (e.g. seagrass, seaweed) from the assimilation of nutrients from the environment and, through the food chain, incorporated in the tissues of consumers[3]. Thus, these elements might show differences in concentrations among locations dominated by different primary producers.

the species distribution is fragmented along the coast & the population abundance is very low, it is included in the "List of the Endangered Species of Brazilian Fauna" by the Ministry of Environment.

Furthermore, isotopic analysis has been used for identifying ecological stocks of marine mammals[4]. The identification of ecological stocks might be useful for a local basis short-term management and conservation of endangered populations. Then, since the threats to the manatees and their habitats vary in nature and degree along the species range, it is crucial to identify discrete populations or ecological stocks for conservation purposes.

With this in mind, researchers from the Marine Mammal and Turtle Laboratory - Institute of Oceanography (Universidade Federal do Rio Grande FURG) started a study aimed at determining the relative importance of the three main groups of aquatic vegetation (seagrasses, seaweeds and mangroves) in the manatee's diet as well as identifying ecological stocks of *T. manatus* in Brazil through stable isotope analysis. Plants as well as teeth and bones samples from stranded (dead) manatees collected along the coast of Alagoas, Paraíba, Ceará, Piauí and Maranhão States will be used to determine the carbon and nitrogen stable isotopes. Correlation between isotopic concentrations from the animals and the plants will be verified along the sampling locations.

This study will expand our knowledge about the trophic ecology and habitat use of the Antillean manatee in Brazil. Hopefully, the results will be crucial to the development and implementation of strategies for conservation of the species.

This study is funded by YAQU PACHA (Germany) / ODENSE ZOO (Denmark) and is conducted in collaboration with the Association for Research and Preservation of Aquatic Ecosystems (Associação de Pesquisa e Preservação de Ecossistemas Aquáticos AQUASIS) and the National Center for Research and Conservation of Aquatic Mammals/Ministry of Environment (Centro Nacional de Pesquisa e Conservação de Mamíferos Aquáticos CMA/ICMBio).

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Images:

Rehabilitate : *Two Antillean rescued manatees (opposite) feeding on seagrass Ruppia maritima at Porto de Pedras, Alagoas State, Brazil. The AQUASIS and CMA/ICMBio rescues, rehabilitates and reintroduces manatees to the wild.*

Manatee mortality: *A sub adult male Antillean manatee (below) found dead at Icapuí, Ceará State, Brazil*

West Africa

the forgotten sirenian

Article & photography by **Lucy Keith Diagne**

The West African manatee (Trichechus senegalensis) is an elusive and little studied marine mammal that lives along the Atlantic coast, and in estuaries and rivers of Africa, from the Senegal River at the southern border of Mauritania to the Longa River in central Angola. Its closest relative is the better known West Indian manatee which lives in Florida, the Caribbean, Central and South America as illustrated by the other articles in this magazine issue.

Although protected by law in every country in which they occur, West African manatees are still intensively hunted in many places, and their meat is openly sold in markets. Other threats to the species include incidental capture in fishing gear, entrapment by dams, and habitat destruction. West African manatees live in some of the remotest parts of Africa, often in murky or muddy water, and are very wary of people, all of which makes them very difficult to study.

In some parts of its range the West African manatee is relatively common in coastal waters. Sightings are frequently reported in central and southern Senegal, coastal Guinea-Bissau and in the Bijagos Archipelago, Guinea, Sierra Leone, Ivory Coast, Ghana, Nigeria, and Cameroon[1; 2; 8]. In Senegal and Guinea-Bissau a network of freshwater springs along the coast and within estuaries provide a vital resource for manatees that need to drink freshwater to survive in the saltwater environment. Manatees in Florida and the Caribbean are known to eat seagrass as a major component of their diet[3;4], but in Africa manatees have primarily been observed eating freshwater aquatic plants, emergent vegetation at the edges of waterways, and mangroves (specifically *Rhizophora racemosa* and *Avicennia germinans*)[1; 8]. There have been reports of West African manatees eating seagrass[5; 1], but no direct observations by scientists to date. This is partially due to the elusiveness of the species, and partially due to the lack of previous African manatee field research in coastal seagrass habitats. There are only two species of seagrass that occur within the range of the West African manatee, *Cymodocea nodosa* and *Halodule wrightii*[6]. *Cymodocea nodosa* only overlaps with the range of the West African manatee in Senegal, The Gambia, and Sierra Leone, while *Halodule wrightii* is more widespread and found or believed to occur in most of coastal West Africa as well as the Gulf of Guinea.

In 2006 I began a long-term study of the West African manatee in Gabon. Over the next few years my research sites expanded to include Angola and Senegal, and I began building a regional network of African manatee research collaborators in 18 countries. The goals of the project are to collect critically needed data about the species by conducting distribution surveys, and collection of manatee biological samples for the first regional population-level genetics analysis and the first stable isotope analysis of the species. The stable isotope analysis will examine the carbon and nitrogen chemical signatures in the food plants that manatees eat, as well as manatee tissues such as hairs, vibrissae (whiskers), and skin samples. This analysis can identify seasonal changes in diets, as well as diversities in diets between different manatee populations and habitat types. Stable isotope research is a non-invasive way to collect valuable manatee foraging data that can greatly benefit managers in knowing what types of habitat are important for the species and add support for conservation of those habitats. It will also give us the first indication of the proportion of seagrass that African manatees consume in relation to other types of plants.

Near the southern end of the West African manatee's range in Gabon, the Atlantic Ocean surf relentlessly pounds the beaches, making near shore ocean habitat too energetic and turbid for

African manatee distribution

Countries of occurrence include: Angola, Benin, Cameroon, Chad, Congo, The Democratic Republic of the Congo, Côte d'Ivoire, Equatorial Guinea, Gabon, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo. *T. senegalensis* occurs in most of the coastal marine waters, brackish estuaries, and adjacent rivers along the coast of West Africa from southern Mauritania (16°N) to the Loge, Dande, Bengo and Cuanza Rivers, Angola (18°S). They ascend most major rivers within their range until cataracts or shallow water prevents their progress. In some rivers, such as along the Benue River, manatees seek refuge during the dry season in permanent lakes that communicate with the rivers during high water but are cutoff when river waters subside. Manatees can be found 75 km offshore among the shallow coastal flats and mangrove creeks (with abundant seagrasses and calm water) of the Bijagos Archipelago of Guinea-Bissau as well as Casamance (Senegal). In recent times manatee populations have also been permanently isolated above hydroelectric and agricultural dams in many major rivers, including the Niger River (Markala Dam in Mali completed in 1945, and the Kainji Dam in Nigeria, built in 1968), the Senegal River (Diama Dam, built in 1984) and Lake Volta, Ghana (Akosombo Dam, built in 1964).

Source: Powell, J. & Kouadio, A. 2008. *Trichechus senegalensis*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2

seagrass. This high energy surf is caused by a narrow continental shelf and three major currents, the Benguela current running from south to north, the Guinean current from west to east, and the Southern Equatorial current that pushes water from east to west[7]. However, in areas where I found manatees in Corisco Bay at the northernmost edge of Gabon, and inside the mouth of N'gowe Lagoon in central Gabon, I also found *Halodule wrightii*. Both of these locations are sheltered from the surf and are manatee "hotspots". Although we couldn't directly see them feeding, they are regularly reported in these places by locals and it is likely that the seagrass draws them to these locations, since there are no other submerged aquatic

Rescued *(above): A West African manatee rescued from behind an agricultural dam in the Senegal River awaits transport to a release site.*

Observing manatees *(right): The people of Pt. St. George, Senegal, are interested developing manatee eco-tourism, and have built an observation tower, and plan to install buoys around the spring (where manatees drink) to keep boats out. This tower will hopefully encourage eco-tourism and provide an alternate livelihood to more members of the community, thereby keeping manatees alive, rather than hunting them.*

Halodule wrightii *(below): The mouth of N'gowe Lagoon at the Atlantic Ocean (seen in the top of the photo) provides a sheltered area with good salinity for Halodule wrightii. Halodule wrightii collected in Corisco Bay, Gabon (insert)*

plants (there are also algae and seaweeds found in Corisco Bay, but manatees are not known to regularly eat these). Samples of *H. wrightii* were collected and will be used in the upcoming stable isotope analysis. These are the first documented records for *H. wrightii* in Gabon.

Further research is now planned for the summer of 2012. At the northern end of the West African manatee's range in Bijagos, Guinea-Bissau, my colleagues and I plan to attach satellite telemetry tags to several manatees to study their behaviour and track their movements to begin to understand their use of coastal habitats and seagrass meadows. This research will be the first time West African manatees have been studied in the marine environment. This research area is important as preliminary genetic analyses have indicated that this manatee population has a high level of genetic diversity[8]. Nearby in the Casamance region of southern Senegal, I am also planning further work with a local community that has given up manatee hunting to develop manatee ecotourism along the coast. The community has built an observation tower next to a freshwater spring where manatees come daily at low tide to drink fresh water, and this is one of the only places in Africa where it's possible to almost guarantee daily sightings of these shy animals. From here we also hope to study the behaviour of Manatees in order to better understand and conserve this unique species and the habitats they depend upon.

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victor

Article & photography by **Lucy Keith Diagne**

Hair samples *(top right): Collecting hair samples for stable isotope analysis from Victor, an orphan West African manatee calf that is being raised in captivity in southern Gabon. Manatee tissues such as hair samples are compared to the carbon and nitrogen signatures from the food plants that manatees eat to determine diet and seasonal variation in food consumption. Stable isotope research is a non-invasive way to collect valuable manatee foraging data that can greatly benefit managers in knowing what types of habitat are important for the species, and adds support for conservation of those habitats.*
Scrub down *(right): Victor gets his algae gently scrubbed off after his health assessment.*

Weigh in *(above): Victor's length and girth measurements are taken during each weekly checkup. He has already outgrown the 50 kg scale seen in this photo, and is now weighed by a 150 kg scale hung from a metal tripod*

ON 24 SEPTEMBER, 2010 a live West African manatee calf, approximately one month old, washed up on the beach in Mayumba, a very remote section of southern Gabon in central West Africa. It is unknown where the manatee originated from, but evidence suggests he was travelling with his mother in the ocean and became separated. He was 117cm long and weighed 27kg at rescue. The manatee calf was named "Victor", and despite all odds he has now survived in captivity for 21 months.

The calf was originally rescued by staff from Mayumba National Park, but the oversight of Victor's care has been assumed by an international group of biologists and veterinarians who have been directly involved with his care since his rescue. Three Gabonese staff provide daily care and feeding for Victor, and a Masters student from Puerto Rico who travelled to Gabon for many months to work with Victor has provided invaluable expertise to the local staff. After healing from wounds during his first 6 months in captivity, Victor's health has been good and he has steadily gained weight. He is bottle fed milk formula and vitamins every 3 hours daily, except between midnight and 6am. He began eating aquatic plants within his enclosure in Spring 2011, and these are supplemented daily by collecting plants from the adjacent lagoon.

Victor is the first orphan manatee calf in Africa ever to be successfully raised in captivity, and there are still challenges to overcome for his eventual successful release back to the wild. Unlike West Indian and Amazonian manatees, our medical and behavioural knowledge of this endangered species is almost nonexistent, thus Victor is a true ambassador for his species. This is an exceptional opportunity not only to help this individual, but for scientists to learn more about this elusive species, to promote educational awareness for manatees in Gabon and throughout Africa, and for international collaboration between manatee researchers from around the world.

To read more about Victor, please visit http://mayumbanationalpark.com/victor.htm

Sirenia

How similar are they?

Dugongs and manatees are the only large fully aquatic herbivorous mammals, justifying their common name: sea cows. Throughout history, sirenians have inspired cultural responses, provided people with meat, hides and oils, and stimulated myths and stories. Today they are increasingly being used as 'flagship species' to represent larger environmental causes.

Dugongs and manatees have a long evolutionary history extending back more than 50 million years, but their ancestors diverged some 25 - 40 million years ago. The sirenians possess a suite of morphological, ecological and physiological adaptations to a life of swimming, diving and eating aquatic flowering plants. Although dugongs and manatees look remarkably alike, there are a number of features and characteristics which separate them.

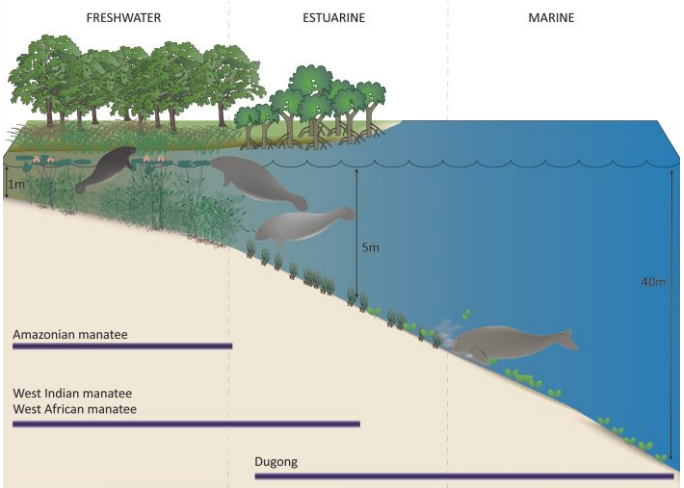
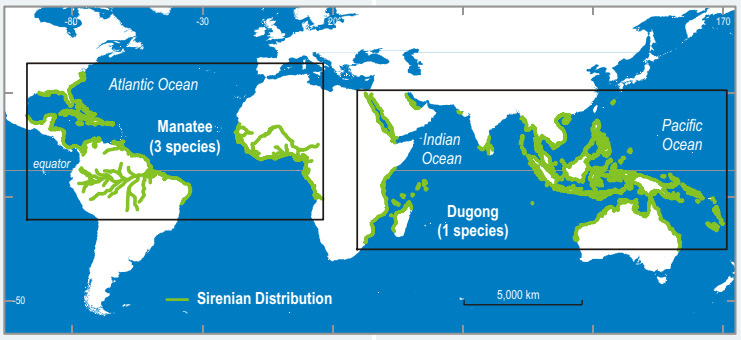
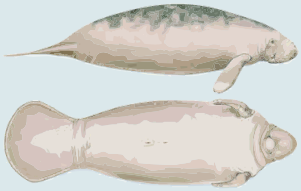
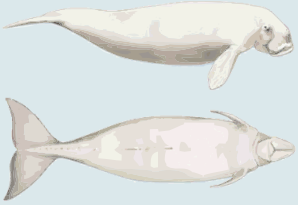


Diagram illustrating the habitats and food plants of the four extant species of Sirenians.
By Catherine Collier, from Marsh *et al* (2011).

	Manatee	Dugong
Species	West Indian manatee (*Trichechus manatus*). Florida manatee (*T. manatus latirostris*), Amazonian manatee (*T. inunguis*) West African manatee (*T. senegalensis*)	*Dugong dugon*
Distribution	 Reproduction of drawing by Adella Edwards	
Adult body length	up to 3.5m	up to 3.3m
Adult body mass	up to 1,620 kg (Amazonian up to 450 kg)	up to 430 kg
Body shape	stout, tapered body ending in a flat, rounded tail 	tapered body that ends in a deeply notched tail, or fluke  © 2003 Encyclopaedia Britannica, Inc.
Body colour	dull grey, blackish, or brown	grey-brown
Forelimbs	• flippers with nails in *T. manatus* and *T. Senegalensis* • used for sculling, turning, bottom walking, and manipulating food	• rounded flippers lacking nails • used for balance
Head features	low rostral deflected snouts (15-52°) to facilitate surface feeding or feeding on natant and emergent vegetation	• high rostral deflected snouts (~70°) to enable benthic foraging • males have tusklike incisors
Social behaviour	primarily solitary but form temporary aggregations of up to 20 at feeding areas, or during breeding	usually observed singly or as pairs. Herds of 12–300 are sometimes seen, with 670 being the maximum recorded
Diving	breathe every 1 - 8 mins, can remain submerged for up to 24 min	breathe every 1 - 6 mins, can remain submerged for up to 11 min
Communication	• faint chirps, squeaks, and grunts • tactile contact by sensory hairs over body with sensitive facial vibrissae	• whistle-like songs by mature males • tactile contact by sensory hairs over body with sensitive facial vibrissae
Reproduction	one calf every 2 to 3 years	one calf every 3 to 7 years
Sexual maturity	about 5 years, but as young as 3 years of age	about 10 years of age
Lifespan	up to 59 years	up to 73 years

sources: *Marsh et al.(2011) Ecology and conservation of Sirenia: dugongs and manatees. Cambridge University Press. 521pp.; Encyclopaedia Britannica, Inc. (2011)*

Photography Mark Evans, Mandy Etpison & Patrick M. Rose *(savethemanatee.org)*

Ecology and Conservation of the Sirenia:
Dugongs and Manatees

Helene Marsh, Thomas J. O'Shea, John E. Reynolds

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Dugongs and manatees, the only fully aquatic herbivorous mammals, live in the coastal waters, rivers and lakes of more than 80 subtropical and tropical countries and territories. Symbols of fierce conservation battles, Sirenian populations are threatened by multiple global problems. Providing comparative information on all four surviving species, this book synthesises the ecological and related knowledge pertinent to understanding the biology and conservation of the Sirenia. It presents detailed scientific summaries, covering Sirenian feeding biology; reproduction and population dynamics; behavioural ecology; habitat requirements and threats to their continued existence. Outlining the current conservation status of the Sirenian taxa, this unique study will equip researchers and professionals with the scientific knowledge required to develop proactive, precautionary and achievable strategies to conserve dugongs and manatees.

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- Addresses human values, food security, poverty and other topics to equip researchers and professionals with the tools to develop successful strategies for conserving wildlife and habitat, in both developing and developed countries
- Summarises the ecological breadth and diversity of extinct Sirenians and their likely origins, providing readers with a greater appreciation of the evolutionary uniqueness of the Sirenia

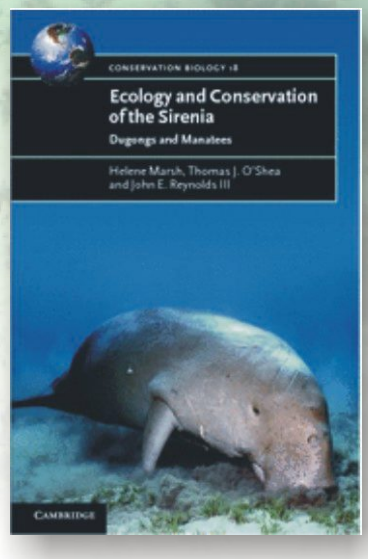

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Image: Manatee at Crystal River Florida. Photography by Gregory Sweeney

Seagrass-Watch

Local eyes Global wise