Sirenews

Newsletter of the IUCN Sirenia Specialist Group

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Special Issue on the Biology and Conservation of Manatees

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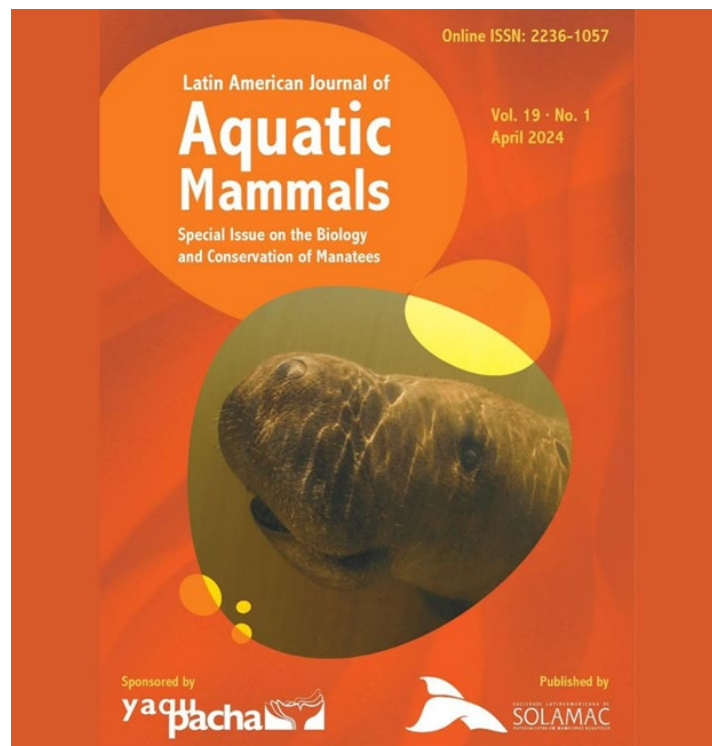
LAJAM's Special Issue on the Biology and Conservation of Manatees cover was published in April 2024.

IMPORTANT CONTENT
The world leader conference. Abu Dhabi 2024

As co-chairs of the Sirenia Species Specialist Group, we had the privilege of attending the IUCN Leaders' Meeting in Abu Dhabi, United Arab Emirates, from October 25–28. This 5th edition of the meeting focused on sharing experiences and lessons learned by the Species Survival Commission (SSC) groups during the current quadrennium (2021–2025). The event brought together approximately 300 delegates from around the globe.

The program, which featured over 100 sessions, was structured around the Assess-Plan-Act cycle—the core framework of SSC activities. Each day was dedicated to one component of the cycle, with additional sessions devoted to networking and communication.

Among the taxonomic Specialist Groups relevant to our work, the Seagrass Specialist Group and the Cetacean Specialist Group stood out. Cross-cutting groups such as the Marine Conservation Group and the Freshwater Conservation Group, both supported by salaried coordinators funded by IUCN, also played a significant role. Additionally, groups like the Climate Change Specialist Group, Conservation Genetics Specialist Group, Human-Wildlife Conflict and Coexistence Specialist Group, Conservation Translocation Specialist Group, and the Young Professionals Group, along with task forces like the Key Biodiversity Area and Important Marine Mammal Protected Area Taskforces, were instrumental in advancing conservation efforts.

The 20 Centers for Species Survival, with their 43 staff members, further bolster the mission of the SSC, providing vital support to Specialist Groups.

During the meeting, we gained valuable insights into how Specialist Groups can collaborate with multijurisdictional environmental authorities, such as CITES and the Convention for Migratory Species of Wild Animals. The IUCN system for planning and collaboration has become notably more structured. As part of this framework, we presented a poster detailing the work of our Specialist Group.

The SSC operates on a quadrennial planning cycle, with the next cycle beginning in 2026. Each Specialist Group is required to develop a Quadrennial Plan with targets organized under the headings: Assess, Plan, Act, Network, and Communicate. We have drafted preliminary ideas for our next Quadrennial Plan and will be seeking input from the Regional Chairs of the Sirenia SSC to refine these targets.

In line with the SSC's goals, we will be reviewing our membership to ensure an appropriate balance of knowledge, skills, and diversity in terms of age, gender, and geography. To this end, we are developing a questionnaire to better understand our members' expertise and how they wish to contribute over the next five years. Additionally, we aim to recruit new members with expertise aligned with the evolving needs of our group.

Following the conference, we spent an extra day visiting key institutions, including the African Manatee exhibit at the National Aquarium, the dugong at SeaWorld Abu Dhabi, the Abu Dhabi Environment Agency, and the Dugong MOU Secretariat.

As Sirenia co-chairs, we are available to help connect you with relevant cross-cutting IUCN groups that could support regional and local research and conservation projects. These groups offer valuable resources, including guidelines, protocols, toolkits, and best practices in their respective fields.

For more information on these groups, feel free to reach out but you can also find information about them in the links below.

-Conservation Planning Specialist Group: [Together, we are planning a future for wildlife | Conservation Planning Specialist Group](#)
-Conservation Genetics Specialist Group: [CGSG Conservation Genetics Specialist Group -](#)
-Climate Change Specialist Group: [CCSG IUCN – Climate Change Specialist Group](#)
-Human Wildlife Conflict and Coexisting Specialist Group: [IUCN SSC Human-Wildlife Conflict & Coexistence Specialist Group](#)
- Conservation Translocation Specialist Group: [IUCN SSC Conservation Translocation Specialist Group | The Conservation Translocation Specialist Group (CTSG) of the International Union for the Conservation of Nature (IUCN) is working with others to face emerging threats, battle against extinction, restore species, and thereby yield wide-ranging benefits for nature and people.](#)
-Young Professional Task Force: [IUCN SSC Young Professional | IUCN](#)
-Key Biodiversity Areas Task Force: [Key Biodiversity Areas | IUCN](#)
-Important Marine Mammals Areas Task Force: [Important Marine Mammal Areas - IMMAs - Marine Mammal Protected Areas Task Force](#)

-Anmari Alvarez and Helene Marsh
Sirenia Specialist Group Co-Chairs

Sirenia Specialist Group

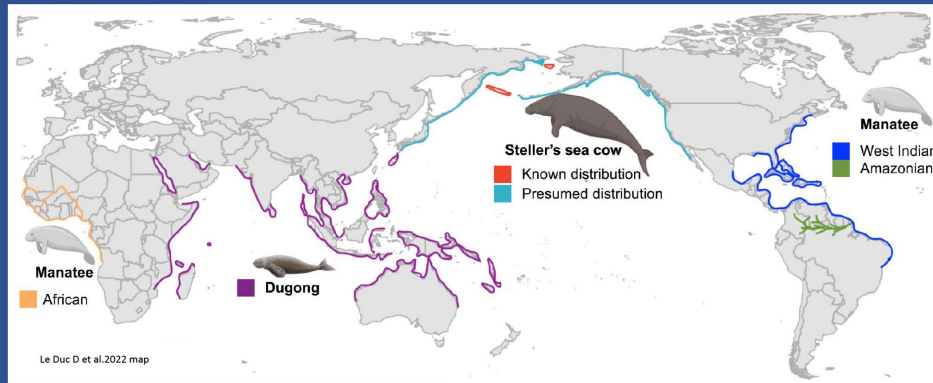## Sirenian global status and threats
Two families, five species

Dugongidae

1. Steller's seacow: Extinct
2. Dugong: Vulnerable

East Africa subpopulation: Critically Endangered
Japan subpopulation: Critically Endangered
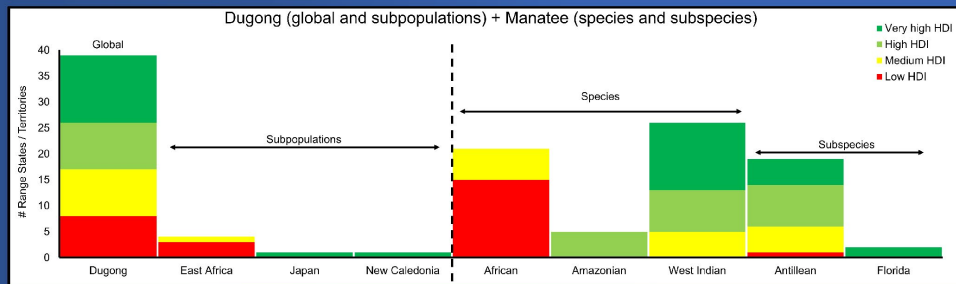*New Caledonia subpopulation: Endangered*

-Habitat loss-
-Pollution-
-Watercraft collision-
-Interaction with fisheries-
-Poaching-
-Cold stress-
-Red Tide-

Trichechidae

3. American (West Indian) manatee: Vulnerable

Florida subspecies: Vulnerable
Greater Caribbean subspecies: Endangered

4. Amazonian Manatee: Vulnerable
5. African manatee: Vulnerable

Steller's sea cow
Known distribution
Presumed distribution

Manatee
West Indian
Amazonian

Manatee
African

Dugong

Le Duc D et al.2022 map

Sirenians have vast ranges and socially and economically diverse Range States with very different conservation challenges as evidenced by their Human Development Indices

Dugong (global and subpopulations) + Manatee (species and subspecies)

Very high HDI
High HDI
Medium HDI
Low HDI

Global

Range States / Territories

Subpopulations

Species

Subspecies

Dugong East Africa Japan New Caledonia African Amazonian West Indian Antillean Florida

Specialist Group Organization
Dugong and manatee specialist group co-chairs,
8 regional co-chairs, 80 members
Sirenews Bulletin

Helene Marsh
Dugong co-chair

Anmari Alvarez-Aleman
Manatee co-chair

Projected impact 2021–2025

(1) increase knowledge of sirenian species and populations across their ranges

(2) support and strengthen network of dugong and manatee researchers and conservationists

(3) share conservation and research initiatives among this network and provide status updates for Red List assessments

(4) support and promote conservation planning and management actions at regional, national, and local levels

IMPORTANT CONTENT

IUCN Red List Assessments Complete for West Indian Manatee and Subspecies

As the official newsletter of the IUCN Sirenia Specialist Group, Sirenews is the perfect forum to announce that status assessments of the West Indian Manatee and its two subspecies (the Florida manatee and the Antillean or Greater Caribbean manatee) have been completed and are now available on the IUCN Red List of Threatened Species website. Red list categories have been assigned as follows:

- The global assessment of the West Indian manatee is Vulnerable, under criterion C1. Deutsch, C.J. & Morales-Vela, B. 2024. *Trichechus manatus*. The IUCN Red List of Threatened Species 2024: e.T22103A43792740. Accessed on 16 November 2024.

- The Florida manatee (*T. manatus* ssp. *latirostris*) is Vulnerable, under criterion C1. Deutsch, C.J. & Valade, J. 2024. *Trichechus manatus* ssp. *latirostris*. The IUCN Red List of Threatened Species 2024: e.T22106A43794045. Accessed on 16 November 2024.

- The Greater Caribbean manatee (*T. manatus* ssp. *manatus*; a.k.a. Antillean manatee) is Endangered under criterion C1. Morales-Vela, B., Quintana-Rizzo, E. & Mignucci-Giannoni, A. 2024. *Trichechus manatus* ssp. *manatus*. The IUCN Red List of Threatened Species 2024: e.T22105A43793924. Accessed on 16 November 2024.

To meet the criteria for Vulnerable based on C1 ("small population size and decline"), the number of mature individuals across the species' (or subspecies') range must be less than 10,000 and there must be "an observed, estimated or projected continuing decline of at least 10% over three generations." To meet the criteria for Endangered based on C1, the number should be less than 2,500, with a similar decline of at least 20% over two generations. These red list assessments were last completed in 2008, so updating them was long overdue. The red list categories remained the same for the species and the *T. m. manatus* subspecies, but was changed from Endangered for the Florida subspecies.

This update is the result of a long, multi-year process of searching for, compiling, and interpreting a wide variety of data sources and information on geographic range and distribution, population abundance and trends, habitats and ecology, direct and indirect threats, and conservation efforts. We solicited and incorporated the judgements of specialists on both subspecies. This was particularly important for *T. m. manatus* where there are still major information gaps on population status in most countries. We are grateful to all of these colleagues for generously sharing their knowledge.

The geographic range map of the species identifies each segment of the range with codes that denote presence (e.g., extant, extinct, and other categories), origin (e.g., native, vagrant), and seasonality (breeding, non-breeding, passage, resident). There is also extensive supplementary information, including a table of population size by country and distribution codes by country or region.

In addition to our esteemed coauthors (Tony Mignucci, Esther Quintana, and Jim Valade), we thank the following colleagues for providing constructive peer-reviews of species and/or subpecies assessments: Helene Marsh, Alejandro Ortega-Argueta, Dan Slone and Bob Bonde. We also are grateful to Francesca Cassola for working with us to generate and revise the shapefile range maps. So the final products are most definitely the result of a collective team effort!

-Chip Deutsch[1] and Benjamín Morales[2]

[1] Research Scientist, Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, Gainesville, Florida, USA; IUCN Sirenia Specialist Group

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LOCAL NEWS

AUSTRALIA

Additional dugong library now available!

We're excited to announce a new resource for marine conservationists, researchers, and enthusiasts alike—a curated bibliography focusing on the global distribution and population status of dugong. This extensive collection of peer- reviewed journal articles, reports, and data is publicly available via Zotero (https://www.zotero.org/) and Endnote (https://clarivate.com/innovation-exchange/solution/endnote/). The instructions for accessing the bibliography are listed below.

This bibliography was created while writing the new CMS publication 'A global assessment of dugong status and conservation needs', an update to Marsh et al.'s (2002) publication 'Dugong: status reports and action plans for countries and territories'. The new report is being formatted by the CMS Office - Abu Dhabi and is planned for launch as soon as possible after that – likely early next year.

Globally, dugong populations are facing numerous threats, including habitat loss, entanglement in fishing gear, and climate change. Our bibliography addresses these issues by providing a comprehensive overview of the latest research and findings from around the world. With over 1,000 entries, it covers current dugong population distribution and status and explores conservation strategies and habitat protection in each Range State.

Researchers can easily locate studies from specific regions, track changes in dugong populations over time, and identify key trends in their conservation status. For conservationists, the bibliography offers a wealth of information to support evidence-based decision-making and policy development. Additionally, it serves as an educational tool for anyone interested in deepening their understanding of dugongs and the challenges they face.

By making this resource publicly available, we aim to foster collaboration and knowledge-sharing within the scientific community and beyond. We hope that it will inspire new research, drive conservation efforts, and ultimately contribute to the protection of dugongs and their habitats. Please use the links to instructions below to create your Zotero account and access the bibliography using the following link: https://www.zotero.org/groups/5608300/dugonglibrary2024. Click 'Join' and an administrator will approve your request! Please note that in order to make this extensive library publicly available, a yearly storage subscription was paid, expiring in October 2025. Ensure you don't miss out by logging in and downloading the library before the expiry date!

Links to Zotero instructions and other helpful information:

·   Zotero desktop app installation instructions: https://www.zotero.org/support/installation
·   Zotero quick start guide: https://www.zotero.org/support/quick_start_guide
·   Accessing a shared group: https://www.zotero.org/support/groups

Please note that the library is a public, closed membership group type. This group type is necessary to allow for file sharing. As a member you will not be able to edit the group library. It is recommended that you sync your account to the desktop application and copy the library to a new folder which you can edit.

- Syncing Zotero https://www.zotero.org/support/sync
- Other Zotero help guides: https://www.zotero.org/support/start

Endnote users: The library is also available in Endnote. Endnote library sharing is limited to 400 accounts. Please contact Luisa (luisa.schramm@jcu.edu.au) to be added to the shared list for this library.

Explore the bibliography today and join us in the effort to safeguard these incredible marine mammals for future generations!

-Luisa Schramm and Helene Marsh
James Cook University

BRAZIL

Fifty years of research and conservation of the Amazonian manatee project - aquatic mammal's laboratory – INPA

The Projeto Peixe-boi of the National Amazon Research Institute (INPA) was established in 1974 when Canadian biologist Diana Magor, working in Leticia, Colombia, rescued a baby manatee from a fisherman. Lacking the funding and logistical support needed for the animal's rehabilitation, she sought assistance from INPA's then-director, Dr. Warwick Kerr. Dr. Kerr provided space and modest financial support, enabling her to begin her research in Manaus, Brazil. Since then, the Projeto Peixe-boi has been based in Manaus. Over the past 50 years, it has hosted numerous researchers and collaborators from Brazil and abroad while supporting the training of countless scientists who have significantly advanced our knowledge of this species.

Between 1978 and 1986, the Projeto Peixe-boi was led by Canadian biologist Robin C. Best, followed by Brazilian researchers Elton Colares, Fernando Rosas, and Vera da Silva. They continued the research and conservation activities focused on this charismatic and endangered species.

Among the researchers who visited and contributed to the Amazonian Manatee Project, several stand out. Paleontologist Daryl Domning worked on the project in Manaus from 1976 to 1978, publishing classic works on the anatomy, morphology, tooth replacement, and feeding behavior of the species. Canadian physiologist J. Gallivan conducted research on metabolism and physiology. Ted Bullock developed studies on the hearing capacity of the Amazonian manatee, while J.W. Kanwisher used his inventions with telemetry devices to study dive control, electrocardiograms, and other physiological aspects of the species. G. Montgomery contributed pioneering telemetry studies using VHF radios, among others.

In 1980, De Jong W.W. and Zweers, in collaboration with LMA researchers, conducted one of the first molecular studies to classify the species and investigate how the manatee evolved and adapted to the Amazon rivers. In 1988, Assis and collaborators provided a complete description and characterization of the Amazonian manatee's karyotype, revealing chromosomal differences between the marine *T. manatus* and the Amazonian manatee.

Another pioneering study was conducted by Cantanhede et al. (2005), who used mitochondrial DNA to examine the phylogeography and population differentiation of the species. They found no geographic structure, a weak correlation between geographic and genetic distances, and a large panmictic population. These results were key to establishing the reintroduction program for rehabilitated orphan manatee calves.

During this period, we also gained insights into the reproductive aspects of the Amazonian manatee, including births at INPA. Based on the composition of Amazonian manatee milk, an artificial milk formula was developed, successfully feeding calves under rehabilitation. Ecological studies in the manatee release project have led to the release of nearly 50 manatees into the wild, with the recapture of a pregnant female 18 months after release.

Between 1974 and 2024, 165 publications on the Amazonian manatee (*Trichechus inunguis*) were produced. Of these, nearly 53% (88 works) were carried out by INPA/Laboratory of Aquatic Mammals (LMA) or in collaboration with other institutions. Additionally, 33 theses and dissertations were developed with manatees in the INPA program, much of which was conducted through the Graduate Program in Freshwater Biology and Inland Fisheries (BADPI/INPA).

Over these 50 years, much has been learned about the species. However, the Amazonian manatee remains under severe pressure, not only from human activities but also from environmental changes, particularly those linked to climate change.

We would like to thank all those who contributed, both directly and indirectly, to the success of the Projeto Peixe-boi and to the conservation of this species.

-Vera M. F. da Silva [1,2*], Rodrigo de S. Amaral [2,3], Gisele C. M. Valdevino [1,2], José Anselmo d' Affonseca Neto [2,4]

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Extreme droughts drive unprecedented hunting pressure on Amazonian manatees in Brazil

The Amazon region has experienced several extreme drought events in the last two decades, with the utmost records of low water levels in 2023, with the record updated in 2024. Due to the region's human impacts and climate change, large extensions of the main river channels and lakes were dry or with

isolated ponds of different sizes but generally quite shallow. This scenario affects not only the fauna and flora but also human communities, producing unprecedented humanitarian and environmental emergencies.

Despite being protected by laws and classified as "Vulnerable" by the IUCN (2016), Amazonian manatees are still hunted for subsistence and illegal commerce in almost all its distribution areas. During the normal dry season, manatees are hunted when accessible. With the extreme droughts in the region, manatees stay trapped in deeper pools called "poços" becoming easy prey for people without experience of hunting and poachers selling the meat in urban markets of towns.

Interviews with residents of communities in the Purus River after the severe drought of 2010, revealed that hundreds of individuals of different sexes and ages were hunted (Brum *et al*. 2021), mainly in large "terra firme" lakes. Similar reports occurred in several localities, with estimated thousands of individuals killed throughout the Brazilian Amazon (Brum *et al*. 2021). In 2023, according to local fishermen around the lower-middle Purus River, about 400 manatees were hunted in the Jari Lake and Purus River channel. During the same period, a resident of Lake Ayapuá (Rio Purus) reported that a large number of manatees were hunted only in this area.

In November of 2023 at the Coari Lake, at least 42 records of manatee body parts (i.e.: head, intestines, lungs, pectoral fins, ribs, and other bones) were found in an area of approximately 17 km through this lake. Among these, 14 parts were found semi-buried on a beach (Figure 1), probably the place the hunters were using to chop the carcasses to sell them in the city markets (UFAM, Sea Shepherd Brazil, Mamirauá Institute, unpublished data). During the intense drought season of 2023 in the Coari area, locals mentioned that only one poaching group managed to hunt 100 manatees.

During the current drought of 2024 in the same location, residents report that there were an estimated 50 canoes operating at the same time, and about 15 manatees were killed per day before the presence of an environmental group and the military police started patrolling the area (Sea Shepherd Brasil, unpublished data). Two dead manatees, a juvenile male, and a lactating female, waiting to be processed, were found. Manatee meat can be found year-round in the city of Coari (De Souza *et al*. 2022). In November 2023, a kilogram of fresh manatee meat was sold for 7 reais (~1,25 US dollars), the same price as a kilogram of chicken.

This information refers to only two river basins in Brazil; however, this scenario may have occurred throughout almost the entire distribution of the species. Local TV news reports that 100 manatees were hunted in the Manacapuru River (near Manaus) in 2023, and again in 2024, the hunt was intense in the same place. This tragic situation of manatee hunting during the worst drought in the history of the Amazon shows the enormous fragility of the species in the face of climate change, opening to opportunistic behavior from poachers and casting doubt on the resilience of the species populations in the future.

The official environmental agencies must take action to protect the already known critical areas of manatees, reinforce the existing legislation, and control boats transporting meat and other products from manatees. Planning an adaptation welfare structure in periods of extreme drought, such as temporary governmental support to the population, also educational campaigns should be promoted not only in riverine communities but also in urban areas to reduce the demand for meat from this species, which could lead to a significant drop in the hunting of *T. inunguis*.

Figure 1. Skin from a hunted Amazonian manatee found on the shore of Coari lake, during the extreme drought of 2024. Credit: Sea Shepherd Brasil - Marina Monteiro.

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Five Amazonian manatees were released in the wild in Uatumã River, Amazon, Brazil

In the Amazonas State, Brazil, there are three Amazonian manatee rehabilitation centers today. One of them is the Center for the Protection and Research of Chelonians and Aquatic Mammals (CPPMQA) under the responsibility of the company Eletrobras Eletronorte. Since 1992, CPPMQA has kept manatees under human care, and 50 individuals were housed in fiber tanks and an external sand-bottom tank.

In 2022, the Associação Amigos do Peixe-boi - AMPA collaborated with Eletrobras Eletronorte to promote the first release of the manatees maintained at this Center. An extensive health survey was carried out for all individuals with blood tests, physical exams, and molecular surveys of viral, bacterial, and parasitic potentially pathogenic agents. A subgroup of 15 manatees completely free of pathogens was transferred to a semi-natural lake with 5.000 m2 and 1.8 m average depth, where they remained for 18 months, searching for natural food and receiving supplementation of

Figure 1. Captive manatees held in tanks at CPPMQA by Eletrobras Eletronorte.

Figure 2. Semi-captivity lake for the adaptation of Amazonian manatees before their release into the wild.

aquatic plants and cultivated vegetables. The excavated lake receives water from the Uatumã River and is home to several species of fish, caiman, chelonians, birds, and other aquatic organisms.

While the animals were in this adaptation period for future release, several field expeditions were made in the Uatumã River, in and outside the Balbina dam area, to choose the best place to release them. The criteria for selecting the

release area, established by Souza *et al*. (2018), were applied, and the Uatumã Sustainable Development Reserve, far 100 km from CPPMQA, was chosen. The release site has abundant aquatic plants, deep and calm water with many streams, and is protected by the local communities.

All 22 riverine villages of the Reserve and those surrounding this area, the public authorities, and civil society organizations active in the region were also contacted, confirming their interest and the experience of the communities with conservation projects. To increase and strengthen the protection of the released manatees, environmental education activities have been and continue to be developed in partnership with local schools. One of these initiatives is the creation of educational materials with the participation of local students. In this way, the communities are being sensitized to the importance of the manatee for the region, to the ecosystem of the Uatumã River and the Amazon.

Figure 3. Environmental education activity in the local community school, Uatumã Reserve, led by AMPA team.

Of the animals eligible for release, three males and two females with an average of 13 years old were selected. The mean weight and length were 152 kg and 208.6 cm, respectively. They were transported on foam mattresses placed in a covered truck, by 35 km on a dirty road on the 10 May 2024. The animals were constantly wetted and monitored by an experienced veterinarian and assistant, transferred to fiber tanks with water placed in a regional boat, and traveled for another 12h until they arrived at the Maracarana community, close to the release site. The local community school that hosted the event, in partnership with the project's environmental educator and collaborators, held a welcome party for the manatees with music, poems, and thematic plays; also, people visited the manatees at the boat.

All animals, received a VHF belt, attached to the caudal peduncle, to be constantly monitored by trained local assistants. On 8 October 2024, 150 days after release, the transmitters continued to emit signals, and all animals were still monitored. The manatees are exploring suitable habitats for the species. They are now using deep areas called locally "poços", and are surviving the biggest dry season of history in the Amazon region. Considering the promising results so far, Eletronorte Eletrobras and Ampa, in partnership with INPA (National Institute for Amazonian Research) are planning another release of manatees for the next rainy season.

Figure 4. Release of one of the five manatees in the Carabar Lake at the Uatumã Reserve. They are the first manatees maintained by Eletronorte Eletrobras to be returned to the wild.

We thank M. Ross of Clearwater Marine Aquarium Research Institute for building the tagging devices; the keepers and staff of the CPPMQA for their support and assistance; the collaborators of the environmental education program, and the teachers and students of the schools of the Uatumã Reserve for their constant support of the Project.

Figure 5. Local field assistant monitoring of post-release manatees in the Uatumã River, using VHF telemetry.

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The Alliance for Manatees: Strengthening Conservation Efforts Across South America

The Alliance for Manatees is a regional initiative dedicated to the conservation of the Greater Caribbean manatee (*Trichechus manatus manatus*), a subspecies increasingly threatened by habitat loss, climate change, and human activities. Coordinated by Dr. Carol Meirelles under the guidance of the Marine Mammal Research Unit (MMRU) at the University of British Columbia, the Alliance brings together researchers across South America to address pressing conservation challenges through collaborative, science-based approaches. The MMRU, directed by Professor Andrew Trites, is globally recognized for advancing marine mammal research and conservation, making it an ideal home for this initiative.

With financial support from Nuremberg Zoo, Pairi Daiza Foundation, Yaqu Pacha e.V., and the IUCN Species Survival Commission, the Alliance focuses on identifying critical habitats, advocating for effective protection policies, and supporting local efforts to safeguard these gentle aquatic mammals.

From October 14–17, 2024, the Alliance held a milestone workshop in Ceará, Brazil, gathering 22 experts from 17 institutions across the region, spanning countries from Brazil to Mexico (Figure 1). Participants validated habitat maps (Figure 2), assessed

Figure 1. Participants of the I Alliance for Manatees Workshop, held in the state of Ceara, Brazil, October 14th-17th, 2024. From left to right, standing: Benoit De Thoisy, Lorenzo von Fersen, Katherine Choi-Lima, Let;icia Gonçalves, Thaís Chaves, Vitor Carvalho, Renata Sousa-Lima, Maria Danise Alves, Catherine Vancsok, Nataly Castelblanco-Martínez, João Borges, Saioa Alfonso, Katerin Arévalo-Gonzales, Adda Manzanilla-Fuentes, Iran Normande. From left to right, sited: Larissa de Oliveira, Andrew W. Trites, Danielle Lima, Carol Meirelles, Monique Pool, Gabriel dos Santos, Jaime Jimenez. (Photo: MMRU).

regional threats, and deliberated solutions to critical issues such as hybridization, habitat fragmentation and degradation, and the impacts of climate change. In addition to the discussions, participants visited the Aquasis' Marine Mammal Rehabilitation Center in Iparana and the floating manatee acclimatization pen in Icapuí (Figure 3), gaining firsthand insight into innovative conservation practices and rehabilitation efforts.

Figure 2. Alliance for Manatees Workshop participants discussing habitat maps during workgroups activities (Photo: Andrew W. Trites/MMRU)

Key outcomes of the workshop included consensus on the importance of robust rehabilitation strategies, stronger conservation policy advocacy, and the development of a comprehensive database to support habitat mapping efforts. Regional discussions highlighted the unique challenges faced by manatees in South America, emphasizing the importance of localized and cross-border conservation actions. Looking ahead, the

Alliance plans to refine habitat maps, organize targeted workshops, and continue fostering collaboration among researchers, policymakers, and conservation practitioners.

Figure 3. Alliance for Manatee Workshop participants visiting the Aquasis' manatee acclimatization floating pen in Icapuí (Photo: Carol Meirelles/MMRU) This image was published with the authorization of the technical team from the Marine Mammal Program of Aquasis. It was taken during a technical visit to the institution. According to IBAMA Normative Instruction No. 07/2015, the Natural Environment Acclimation Enclosure, located at Peroba Beach, Icapuí - CE, is not open to visitors.

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DOMINICAN REPUBLIC

Collaborative Workshop for the Conservation of the West Indian Manatee in the Dominican Republic

From August 7–9, 2024, the Dominican Republic hosted a pivotal workshop aimed at advancing the conservation of the American manatee (*Trichechus manatus*) and its habitats. This collaborative effort brought together national and international experts, researchers, policymakers, and community stakeholders to develop a comprehensive action plan and strengthen the region's stranding network.

As part of the regional context Dr. Anmari Álvarez-Aleman presented a regional overview, emphasizing the genetic relationships between manatee populations and subspecies across the Caribbean. She highlighted the genetic analyses of manatees sampled in the Dominican and some of the preliminary results revealing a possible phylogenetic connection between populations in Belize and the Dominican Republic, suggesting the existence of previously unidentified migratory corridors.

On a national level, Valeria Herrera, from the University of Buenos Aires, Argentina, reviewed existing knowledge on manatees in the Dominican Republic, including findings from the first National Census. This study confirmed critical hot spots of distribution and habitat use. Panel discussions further explored current conservation efforts led by governmental and non-governmental organizations, as well as complementary research conducted in the country.

Figure 1: Stakeholders from 15 institutions participated virtually and in-person in the workshop (FUNDEMAR, CEBSE, Grupo Juragua, CODOPESCA, CIBIMA-UASD, Fundacion Punta Cana, Fundacion CAP CANA, IDARD, ANAMAR, Corredor Biologico del Caribe, CMARI, Acuario Nacional de Santo Domingo, "Viceministerio de Recursos Marinos y Costeros" and "Viceministerio de Areas Protegidas y Biodiversidad").

Key Activities and Outcomes:

Collaborative Vision and Action Plan Development:

- ✓ A long-term, shared vision for manatee conservation was collectively constructed.
- ✓ A participatory threat analysis identified 12 major issues, which were consolidated into key strategic lines.

Strategic Priorities: Specific actions, responsibilities, indicators, and timelines were defined for the following priority areas:

- Population research and monitoring.
- Pollution and disease management.
- Prevention of poaching, bycatch, and maritime traffic impacts.
- Habitat conservation and restoration.
- Environmental education and community engagement.
- Institutional capacity building.

Legal and Institutional Strengthening:

- Discussions underscored the need to legally formalize the Aquatic Species Rescue and Rehabilitation Center (CERREA) to enhance the protection of manatees and other marine species.

Stranding Network Development:

- The existing network structure was reviewed and improved, with clear roles, members, and allies identified.
- A long-term vision, general goals, and specific objectives were defined, ensuring alignment with international standards.

Importance and Next Steps:

This workshop, part of the "Dominican Republic 30x30" initiative and aligned with the Global Biodiversity Framework, represents a significant milestone in manatee conservation efforts. By integrating scientific knowledge, policy development, and community engagement, the event laid a strong foundation for sustainable, long-term conservation strategies.

Key accomplishments, such as the identification of threats, strategic planning, and institutional strengthening, are critical for ensuring the survival of this iconic species. The emphasis on environmental education and community participation will help garner public support, while the formalization of legal frameworks will solidify the structural and operational integrity of conservation initiatives.

The workshop's outcomes underscore the Dominican Republic's commitment to protecting not only the West Indian manatee but also the rich coastal ecosystems upon which this species—and human communities—depend. The collaborative efforts initiated here, promise to enhance regional conservation and foster sustainable management of marine biodiversity in the Caribbean.

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HAITI

Human-Manatee Interactions in Haiti: Insights from a Recent Survey

As part of my master's thesis in archaeology at NTNU (Norwegian University of Science and Technology) on the use of manatees in the Caribbean, I conducted a survey to assess the current relationship between humans and manatees. The survey covered contemporary perceptions of manatees, including cultural beliefs, historical knowledge, practices, and conservation topics. Bivariate descriptive statistics were used to identify relationships between variables, revealing patterns in manatee perceptions and management in, primarily, present-day Haiti. For a full report and overview of the results mentioned below, refer to the ZIP file provided by Saint-Victor (2024b).
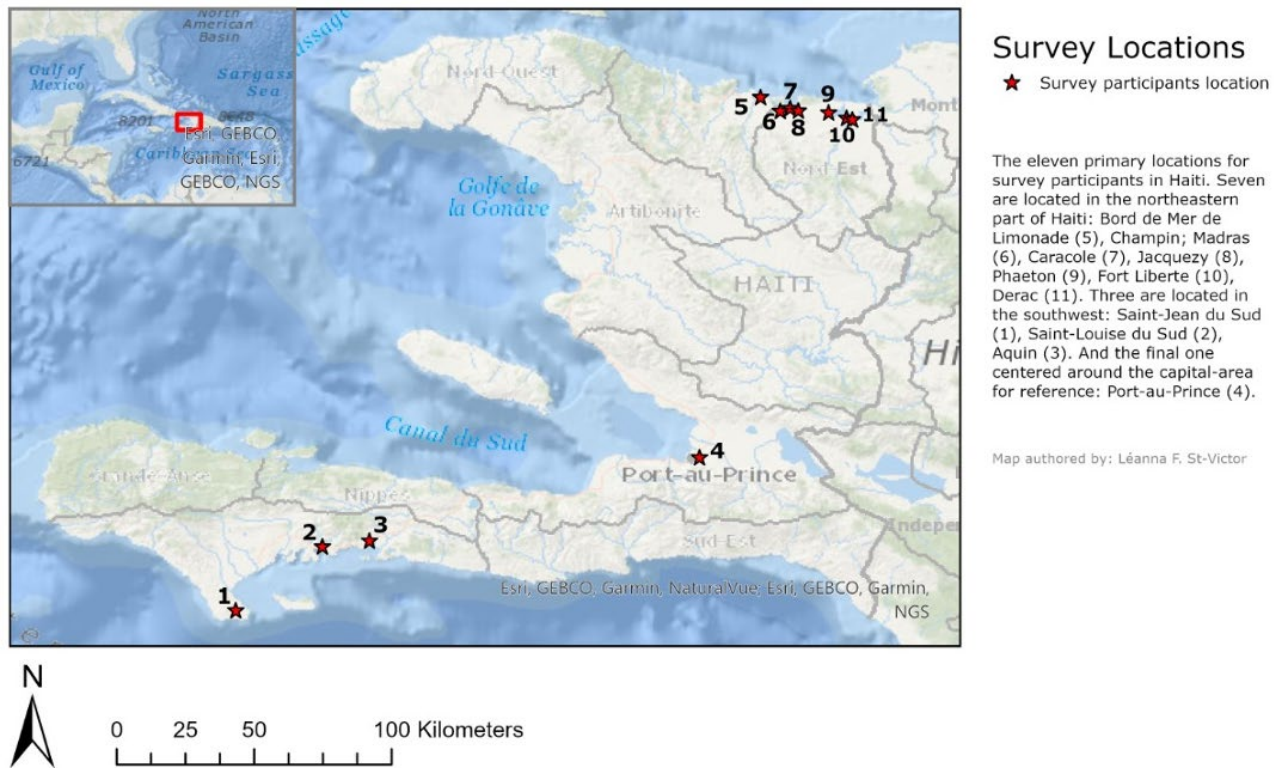
Figure 1: Map of survey locations (Haiti). Source: Saint-Victor, 2024a.

The survey received 83 responses: 25.6% women and 74.4% men. Most participants were over 50 (36.1%) or between 35-44 years old (27.7%). A majority, 86.7%, were from Haiti, mainly the northeast and southwest regions (see fig. 1). The rest were from Cuba, the Dominican Republic, the U.S., Senegal, and Norway. Among them, 53.7% worked in the fishing industry.

48.8% of respondents had heard about manatees more than four times, while 12.2% had never heard of them. Similarly, 34.2% had seen a manatee in the wild more than four times, whereas 27.6% had never seen one. Additionally, 61.1% regarded manatees as endangered, with over 50% emphasizing their environmental importance.

Only five participants had connections with Indigenous groups, and nearly half had never heard mythological stories about manatees. Some mentioned mermaids, sirens (15.2%), or other legends. Notably, some believed manatee meat tasted like pork and beef, their breath could overturn boats, and that one should never ride on a manatee's back.

Traditional perceptions of manatees varied: 36.3% saw them as exotic commodities, 27.5% considered them sacred and not to be hunted, 20% noted a taboo on hunting them, and 25% viewed them as prime targets due to their non-aggressive nature and high fat content. Other views included treating manatees

as gifts and hunting them within specific families. Regarding past generations, respondents indicated their grandparents' either never saw manatees (35.8%) or saw them more than four times (19.8%). The scarcity of manatee bones in archaeological sites was attributed to their rarity (38%), difficulty in capture (31.6%), or processing at the shoreline (16.5%).

The survey revealed a correlation between age, profession and popular opinions (see fig. 2 and 3). Older respondents (50+ and 35-44 age brackets) in the fishing sector valued manatees for their endangered status and as a food source. Younger respondents recognized the endangered status but were less likely to see manatees as food.
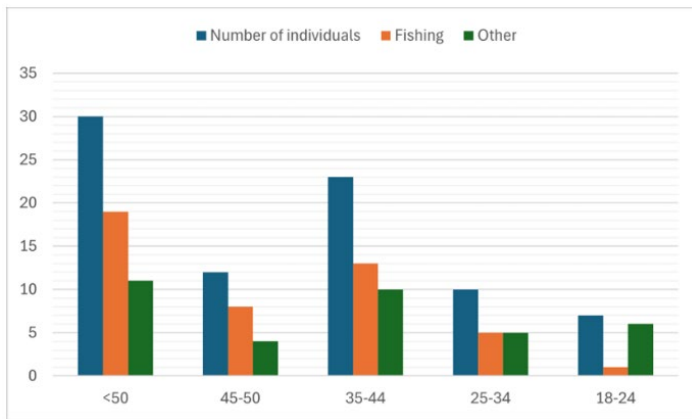

Figure 2: Relationship between age and profession. Source: Saint-Victor, 2024a.
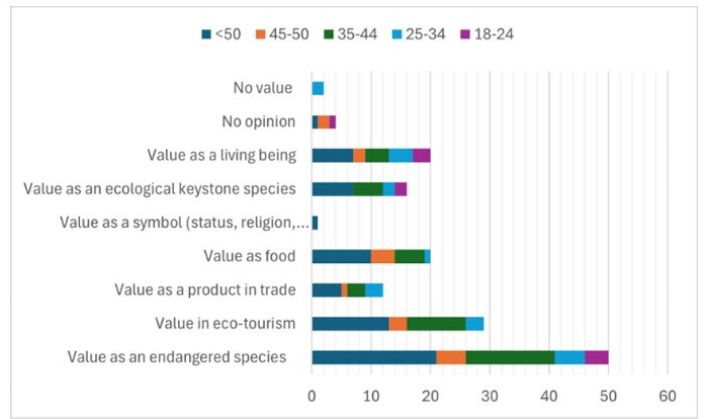

Figure 3: Relationship between opinions and age. Source: Saint-Victor, 2024a.

Another intriguing finding was the high number of respondents who had seen manatees in the wild (65%) and in captivity (54%). Jean Wiener (director of FoProBiM) initially expressed skepticism about this part of the survey, suggesting responses might be scarce in Haiti. However, my findings suggest that manatee populations in Haiti may be higher or more accessible than previously thought (Saint-Victor, 2024a).

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LATIN AMERICA

Special Issue of the Latin American Journal of Aquatic Mammals Dedicated to Manatees: A Pan-American Collaborative Effort

The Latin American Journal of Aquatic Mammals (LAJAM) published its first special issue (Volume 19, Issue 1) dedicated exclusively to manatees in April 2024, titled "Special Issue on the Biology and Conservation of Manatees." This landmark publication highlights the collaborative efforts of researchers from across the Americas, reflecting a shared commitment to understanding and protecting American (*Trichechus manatus*) and Amazonian manatees (*T. inunguis*) throughout their range.

The special issue includes ten original research articles and three short notes that explore key aspects of manatee biology, ecology, and conservation:

Main Topics of the LAJAM Special Issue on Manatees:

1. Diet and Behavior

- ✓ Dietary Diversity: New observations expand the known diet of manatees, including the consumption of previously undocumented seagrass species.
- ✓ Behavioral Richness: Research highlights the positive effects of larger home ranges on the behavioral diversity of rehabilitated and released manatees, demonstrating the importance of post-release monitoring.

2. Anatomy and Health

- ✓ Clinical Case Study: The first documented case of an oral cleft in an Amazonian manatee is presented, providing insights into its potential causes and implications for handling and rehabilitation.
- ✓ Digestive Tract Morphology: A detailed morphological and histological analysis of the digestive tract of the Antillean manatee highlights its adaptations for a herbivorous diet.

3. Detection and Population Monitoring

- ✓ Challenges of Low Detection Rates: The cryptic nature of manatees and limited visibility in many of their habitats pose significant challenges for abundance and density estimation.
- ✓ Innovative Detection Techniques:

- Active acoustics, such as side-scan sonar, show promise for accurately estimating manatee abundance in turbid waters.
- The use of drones for detecting manatees is evaluated, identifying challenges and future directions for improving this method.

4. Distribution and Habitat Use

✓ Habitat Preferences: Studies examine the relationship between manatee distribution and environmental factors such as food availability, freshwater, and seagrass cover, emphasizing the impacts of climate change and habitat loss.

✓ Protected Areas: Research underscores the role of environmental conditions in shaping manatee area use within protected zones.

5. Conservation and Threats

✓ Regional Conservation Challenges: Reviews of conservation status highlight emerging threats such as reduced food availability, pollution, and disease, alongside strategies for mitigation.

✓ Awareness and Perceptions: Evaluations of community perceptions of threats to manatees stress the need for increased awareness and local engagement in conservation efforts.

6. Stranding Events

✓ Calf Stranding: Several studies link increasing calf strandings to environmental degradation, such as habitat changes caused by industrial activities.

✓ Stranding Response Networks: Analysis of stranding data over more than a decade highlights the need for improved response mechanisms to address this growing conservation concern.

This special issue underscores the importance of cross-border collaboration in addressing shared conservation challenges. Researchers from countries across Latin America and the United States contributed to this milestone, emphasizing the interconnected nature of manatee habitats and the necessity of cooperation. The editors—Dr. Ana Carolina O. de Meirelles, Dr. Rodrigo Amaral, Dr. João Carlos G. Borges, and Dr. Nataly Castelblanco-Martínez—hope this issue will foster further integration of scientific knowledge into effective conservation actions.

Manatees face increasing threats from habitat loss, climate change, and human activities throughout the Americas. This issue demonstrates the creativity and resilience of researchers addressing these challenges, offering innovative methodologies and collaborative approaches that transcend national borders. The special issue is freely available online at LAJAM Journal, providing a valuable resource for researchers, conservation practitioners, and policymakers across the Americas who are committed to safeguarding the future of manatees.

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MEXICO

Tangible positive impacts of a community-based strategy for manatee recovery: Second year of the Biocultural Corridor for Manatee Conservation and Monitoring (Quintana Roo, Mexico)

The coasts of the Mexican state of Quintana Roo, located within the Mesoamerican Coral Reef, is home to hundreds of Greater Caribbean manatees (*Trichechus manatus manatus*). This subspecies is classified as Endangered due to numerous uncontrolled threats, primarily stemming from human activities (SEMARNAT 2020). With rapid growth in tourism along the Mexican Caribbean, there is concern that this expansion could negatively impact manatees and their habitats. To ensure effective protection, community-based initiatives are essential for monitoring and implementing targeted conservation actions for manatees in the region.

In 2022, we launched the Biocultural Corridor for the Conservation and Monitoring of the Manatee in Quintana Roo, Mexico, with support from One Earth and Grounded (Casteblanco-Martínez et al. 2023). In its second year, the project has also received backing from Daughters for Earth, and is now a project from the Laboratory of Aquatic Mammals of El Colegio de la Frontera Sur (ECOSUR). This long-term initiative is built around three key pillars: 1) environmental education and awareness, 2) transforming tourism practices to promote the appreciation of manatees as an icon rather than a resource for direct use, and 3) citizen-led monitoring and surveillance.

In the second year, we continued conducting semi-structured interviews with fishers, lobster harvesters, and tour operators to gather their perceptions and traditional ecological knowledge about manatees across the state. In total, along with previous interviews, we have now spoken to 274 local residents from Chetumal (25.5%), Xcalak (21.5%), Mahahual (14.6%), Punta Allen (11.3%), Holbox (8.0%), and other six communities (Figure 1). The results are currently being curated and analyzed by LEL-S and EL-J.

Figure 1: Interviews conducted during the second year of the Manatee Biocultural Corridor. Photos F. Corona-Figueroa.

We also identified key communities in Quintana Roo to host the first workshops focused on building capacity for manatee conservation and monitoring. These 2-day workshops were held in Xcalak, Punta Allen, Chiquilá, and Holbox. In total, we engaged 80 adults, including local authorities, fishers, boat operators, and tourism providers (Figure 2). The first day of the workshop included presentations on three main topics: 1) manatee biology and conservation, 2) methods for manatee observation and data collection, and 3) protocols for responding to manatee (and other marine mammals) strandings. On the second day, participants joined a boat trip to observe manatees in the wild. Low-speed tours (under 10 km/hr) were conducted in areas known or suspected to be frequented by manatees. When a manatee was spotted, the group quietly waited to observe the animal's breathing patterns and assess the number and size of individuals. Participants also had the opportunity to learn how to gather data on GPS locations, the number and size of manatees, their behavior, and relevant environmental conditions.

We implemented a citizen science program to monitor manatees in Quintana Roo. By leveraging information shared through social media, WhatsApp groups, and Google Forms, we are building a comprehensive database of manatee sightings reported by the public. To date, we have documented 224 sightings, 73.21% of which are accompanied by photos and/or video footage. Through careful analysis of photos and videos, we are developing a community-based photo-identification catalog for this manatee population. Currently, we have successfully photo-identified 28 individuals based on scars, notches, and other identifiable body marks (Figure 3). From the photo-identified manatees, 35.71% have been also sexed. The majority of subaquatic images were provided by local snorkelers and scuba divers from Mahahual and Xcalak (Arrecifes de Xcalak National Park), however, we plan to expand this initiative across the entire corridor. The photo-ID catalog is an important and inexpensive monitoring tool for manatees (Landeo-Yauri et al. 2020), and its creation represents a crucial step in strengthening community-led manatee conservation efforts in Quintana Roo.
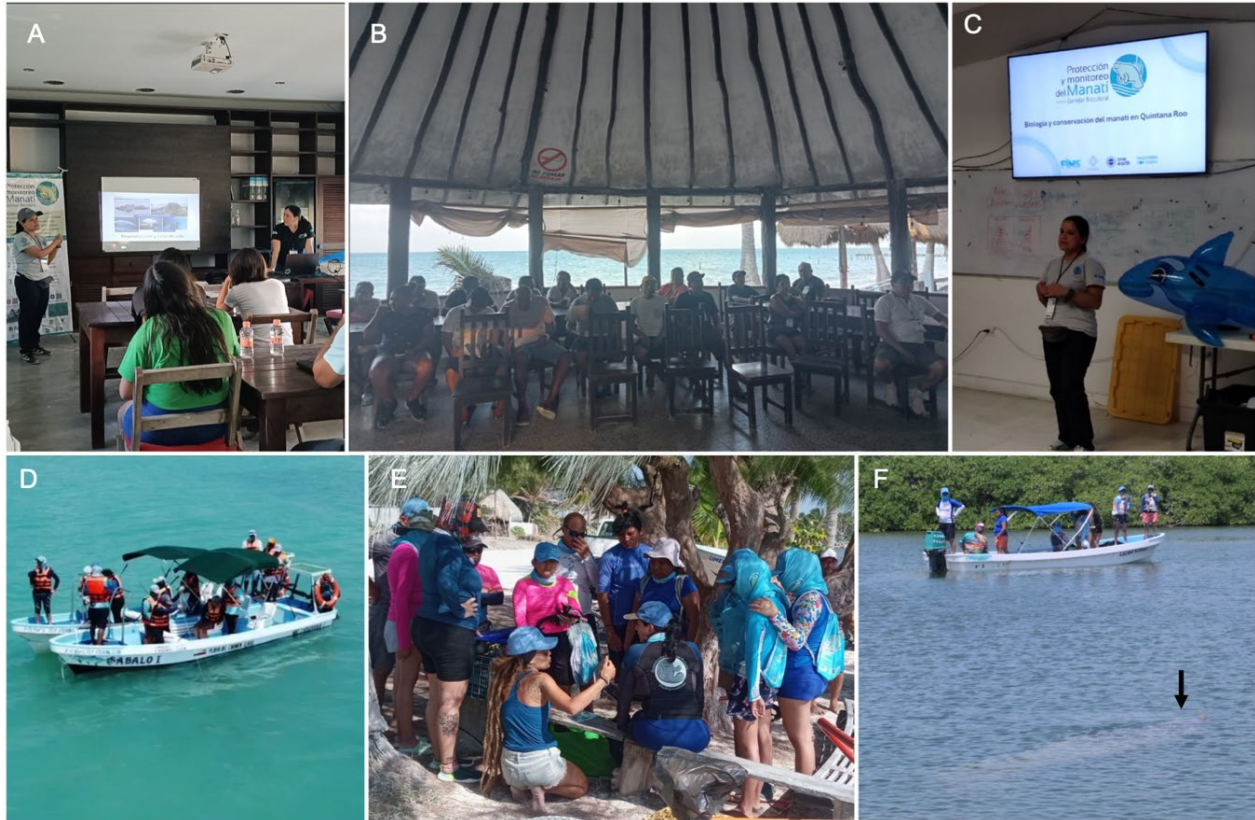
Figure 2. Theory (A-C) and practical (D-F) workshops conducted during the second year of the Corridor. Photos by C. Ocampo-Carvajal (A), F. Corona-Figueroa (B and E), M. García-Enríquez (C), C. Escamilla (D), and N. Castelblanco-Martínez (F). The black arrow signals an observed manatee.

The community network, facilitated through WhatsApp groups that include boat operators, scuba divers, fishers, and other stakeholders from the workshops, has proven to be a simple yet effective communication tool. For instance, through this network, the Punta Allen community (within the Sian Ka'an Biosphere Reserve) alerted us to the presence of a manatee with mobility issues, named 'Globito', which required capture and health evaluation. Community members, particularly boat drivers, played a crucial role in notifying, rescuing, monitoring, and caring for the animal (Figure 4). Thanks to their dedication and selflessness, we were able to track the condition of this ailing manatee in remote areas of the state.
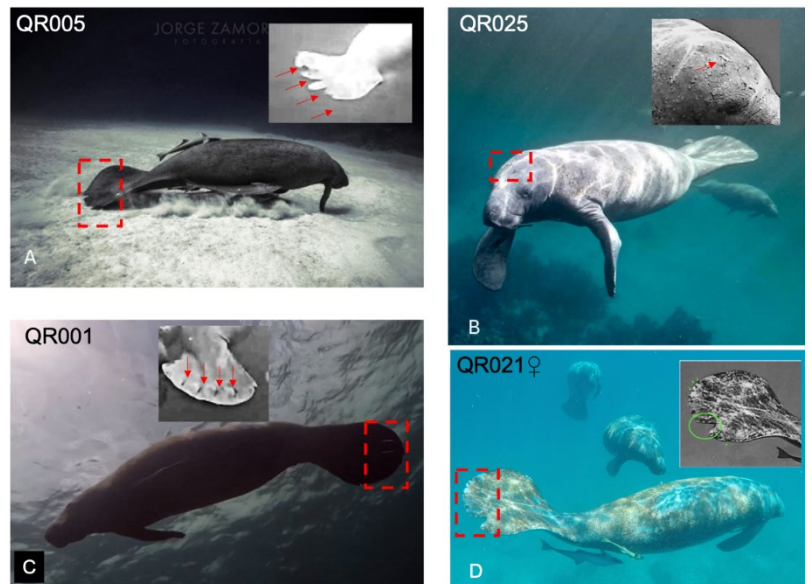

Figure 3. Some manatees photographed by citizens and photo-identified in the Mexican Caribbean. (A) Manatee with four notches on the tail, photo by J. Zamora; (B) manatee with a scar on the front of his head, photo by J. García; (C) male manatee named "Rayitas", with several cuts in the tail; photo by R. Aguado, (D) female manatee with conspicuous notches on the tail; photo by S. Baptiste.

Raising awareness about manatees has been key to encouraging local community involvement in rescue efforts. We suggest that the growing interest in manatees, along with a deeper understanding of their biology and behavior, was likely fostered by the Biocultural Corridor initiative.

Additionally, the Biocultural Corridor through the community network has also helped the collection of information on cetaceans in the region, regarding distribution, group sizes, age composition, and habitat use. Also, the citizen network has been a valuable tool for timely reporting and supporting cetacean strandings.

Figure 4. Tourist guides and boaters from Sian Ka'an Biosphere Reserve actively participate in the monitoring, rescue, transportation and care of an ill juvenile manatee 'Globito'.

In summary, community-based initiatives such as the Biocultural Corridor are a cornerstone of effective manatee conservation in the Caribbean, because they harness local knowledge, empower communities, and foster a sense of ownership. By involving local people in conservation actions, these initiatives create a foundation of long-term, sustainable practices that can protect manatees for generations to come. However, without sustained financial support, these initiatives risk becoming ineffective, fragmented, or unsustainable.

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PUERTO RICO

Pulmonary pulmonicolosis in Greater Caribbean manatees

This new open-access publication in the journal Diseases of Aquatic Organisms focuses on a previously undocumented cause of mortality in Greater Caribbean manatees (*Trichechus manatus manatus*), titled Verminous bronchitis and pneumonia by nasal trematodes in Greater Caribbean manatees from Puerto Rico. The study investigated five adult manatees, two found alive and three dead, on the Caribbean Island between 2018 and 2022. The live-stranded manatees exhibited a range of clinical signs, including emaciation, weakness, arrhythmia, nasal mucus discharge, and respiratory difficulties. Postmortem

examinations revealed adult trematode *Pulmonicola cochleotrema* in the lungs, serosanguinous, mucohemorrhagic, or suppurative exudate in the bronchi, pulmonary abscesses, and assorted comorbidities like enteric chiorchosis, gastric heterocheilosis, malnutrition, trauma related to watercraft collision, disseminated toxoplasmosis, bacterial peritonitis, and interstitial nephritis. These comorbidities suggest a link between immunosuppression and the development of lower respiratory tract pulmonicolosis. Histological analysis showed eosinophilic bronchopneumonia of varying severity, chronic erosive to eosinophilic tracheobronchitis, squamous metaplasia, and intralesional trematodes and eggs. Molecular analysis was employed to confirm the identity of the trematodes as *P. cochleotrema*. Pulmonicolosis was considered a primary or contributing cause of death, highlighting the importance of its diagnosis and management. This research provides the first comprehensive clinical and pathological descriptions of verminous tracheobronchitis, and pneumonia caused by *P. cochleotrema* in Greater Caribbean manatees. It underscores the importance of accurately diagnosing, treating, and managing this parasitic infection and disease. As scientists, marine biologists, veterinarians, and conservationists, it is our responsibility to document and understand the health aspects that affect the survival of this species. Studies like this, underscore the crucial need for continued research and conservation efforts to protect this endangered species. This study provides vital information for understanding the impact of *P. cochleotrema* infection on Greater Caribbean manatees and

Figure 1: Pulmonary pulmonicolosis in stranded Greater Caribbean manatees *Trichechus manatus manatus* from Puerto Rico.

motivates us to double our efforts in the face of increasing threats such as climate change, pollution, and habitat degradation.

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PHILIPPINES

Preliminary information on dugongs in Palaui Island, northern Philippines

After a 7.1 magnitude earthquake struck Japan on August 8, 2024 (USGS, 2024), Toba was among the areas covered by the "great earthquake warning" (JMA, 2024). As part of the Philippine team which cared for the dugong "Serena" at Toba Aquarium in 1987, there was much concern for the safety of Toba Aquarium friends and "Serena". Links between the dugong populations of the Philippines and Japan have been a topic of research (Ozawa *et al*. 2024) with mtDNA studies suggesting strong kinships between dugongs in the Philippines and Japan (JME, 2003). However, knowledge of dugongs in northern Philippines is sparse. In this article, initial documentation is provided about data gathered during a northern Philippines trip organized by Engr. James Esguerra and Architect Therese Santiano in May 2019. I volunteered to help on the UNEP CMS Catch/By-Catch Questionnaire in exchange for a chance at bird photography. Architect Santiano provided a camera then gave permission for the dugong data to be included in this article.
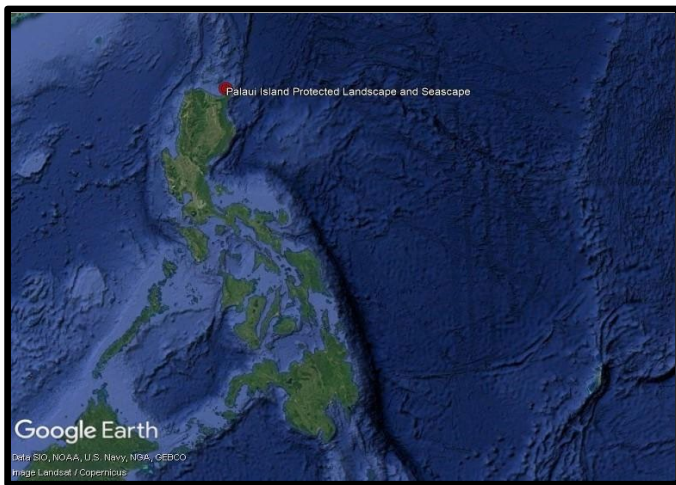
Figure 1. Location map of the Palaui Island Protected: Landscape and Seascape (PIPLS). Inset shows the boundaries of the PIPLS. (Sources: Pres Proc No 447 s 1994 for geographical coordinates; Google Earth Pro for rendering visualization).

After undergoing practical exercises, interviewers (native speakers of the language in the area, Ilocano) used the UNEP CMS Standardized Catch and By-catch Questionnaire (Pilcher and Kwan, 2012). Some (40%) of the 15 fishers interviewed saw dugongs around Palaui Island from 1980 to 2019. Most sightings were during the dry season (e.g. May), but one was seen in August (wet season). Sadly, a dead dugong was seen on the island in October 2018.

Palaui Island (18° 32' 46" N, 122° 8' 11" E; Figure 1) had been declared as a Marine Reserve (Proc 447 s 1994) then designated a National Park in the category Protected Landscape and Seascape (RA 11038, 2018).

After a critically endangered leatherback (*Dermochelys coriacea*) nested from May to June 2024 in Santa Ana, Cagayan right across Palaui Island, the Department of Environment and Natural Resources (DENR) Secretary Maria Antonia Yulo Loyzaga announced plans to set-up a marine scientific research station near the Palaui Island Protected Landscape and Seascape (DENR 2024). This augurs more information on marine megafauna in the area will soon become available.

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INDIA

Collaborative conservation efforts needed for dugong conservation in the Palk Bay: Outcomes from a multi-stakeholder workshop

Palk Bay, a sheltered bay located between south-east coast of India and the west coast of Sri Lanka supports probably the largest remaining dugong population in South Asia, making it a focal point for regional conservation efforts (Srinivas et al. 2020). The bay's seagrass meadows serve as essential foraging grounds for dugongs and act as nurseries for several commercially important fishes (Ramakritinan & Anand, 2016). Conservation efforts in Palk Bay are crucial not only for dugongs or seagrasses but also to sustain the livelihood of millions of coastal communities dependent on it.

On September 3, 2021, the Government of Tamil Nadu announced in the State Assembly, the establishment of a Protected Area in the Palk Bay. This announcement was followed by the issuance of orders officially notifying the Dugong Conservation Reserve (DCR) on 21 September 2022. The DCR spans 448 sq. km in the coastal waters of Thanjavur and Pudukkottai Districts, being the only marine mammal focused Protected Area in India.

To facilitate stakeholder engagement and initiate collaborative actions to improve the management and conservation of the DCR, the Wildlife Conservation Society - India, in collaboration with the Tamil Nadu Forest Department and the OMCAR Foundation, organized an intra-regional multi-stakeholder workshop titled "Developing strategies to support dugong conservation in the Palk Bay" in October 2023. This workshop, held over two days, brought together 34 participants from various government agencies, the Bay of Bengal – Inter Governmental Organization, NGO´s, academic institutions and CMS Dugong - MoU.

The workshop featured 13 case studies that involved an overview of the DCR, planned conservation initiatives, population monitoring of dugongs, geospatial mapping of the seagrass meadows, community conservation initiatives, and traditional use of dugongs on either side of Palk Bay among other topics. This was followed by group discussions, to identify the strengths, challenges, and opportunities of stakeholders pertaining to three thematic groups: i. Knowledge and Science, ii. Capacity Development, and iii. Conservation Policy and Intervention.

The key recommendations derived from the workshop focus on three main areas:

1. Capacity Development: Conduct trainings on marine mammal stranding, safe release, and seagrass restoration. Prioritize the creation of a "blue cadre". Establish a Palk Bay Marine Conservation Coordination Centre, involving community, NGOs, and government partners. Promote marine education for fishermen and youth through outreach programs in Tamil for schools and colleges.
2. Research & Monitoring: Establish a digital database for Palk Bay, employ technological tools such as satellite tagging, UAVs, genomics, and acoustic surveys for monitoring, support research on biodegradable materials for seagrass restoration.
3. Inter-agency Cooperation: Form a regional working group, develop a Regional Plan of Action for Dugongs, establish transboundary network between India and Sri Lanka for joint research.

The workshop's outcomes (report available at http://dx.doi.org/10.13140/RG.2.2.26598.84806) serve as a foundation for future conservation strategies and policy developments in Palk Bay, marking a significant milestone in dugong conservation efforts in the region. The workshop highlighted the collective efforts needed to conserve the dugong population and their habitat in the Palk Bay. By

addressing identified challenges and capitalizing on opportunities, stakeholders can work together to ensure the long-term preservation of this vital marine ecosystem.

Figure 1: Participants of the Intra-regional workshop titled "Developing strategies to support dugong conservation in the Palk Bay" held on 19-20 October 2023, Mahabalipuram, Tamil Nadu.

Figure 2 - Thematic group discussion on Capacity Development during the workshop

Figure 3: Participants engaged in thematic group discussion on Conservation Policy and Intervention during the Workshop

India Supporting Trust (RIST) and MPA Fund (30x30 Ocean Accelerator Fund), Wildlife Conservation Society for the financial support.

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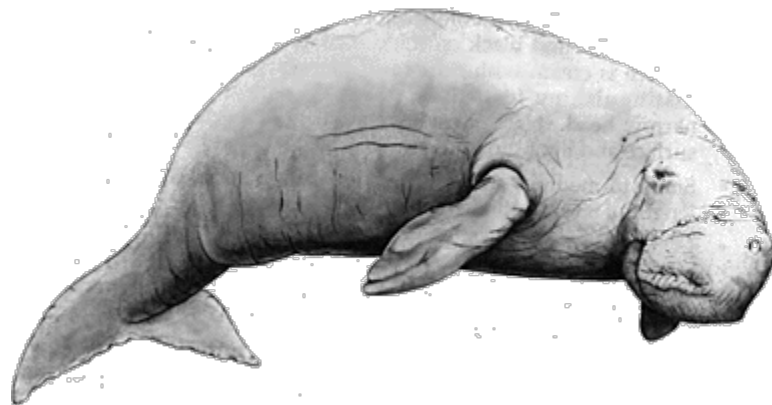
Sirenews – Dugong
(End of Local News)

SOLAMAC 2025

HOLD THE DATE!

Comunicación de Solamac

Estimadas/os socias y socios,

En esta ocasión nos comunicamos con ustedes para ponerlos al tanto de la situación relacionada con nuestro próximo encuentro. Como ustedes recordarán en la última asamblea realizada en Bahía, Brasil, se habían propuesto dos potenciales sedes para realizar el 20 º Reunión de Trabajo de Especialistas en Mamíferos Acuáticos y XIV Congreso Solamac . Las opciones propuestas eran Ecuador y México, en esta última el congreso se realizaría en conjunto con la Sociedad Mexicana de Mastozoología Marina (SOMEMMA). Si bien se había definido a Ecuador como sede para el 2025, la inestable situación del país en los últimos meses conllevó a que el grupo organizador de la RT en Ecuador en conjunto con nuestra directica , pensáramos que la ejecución en el 2025 podría trae r complicaciones inesperadas, por lo que decidimos cambiar la ubicación del evento.

Por este motivo, la directiva de SOLAMAC, se contactó con la directiva de SOMEMMA y la comisión organizadora del próximo congreso de la SOMEMMA . El objetivo fue evaluar la posibilidad de realizar ambos Congresos en conjunto en 2025, algo que no ocurre desde hace 19 años .

Gracias a la buena disposición y colaboración de los colegas Mexicanos, nos alegramos enormemente de informarles que nos veremos en Mayo de 2025 en Veracruz, México.

Toda la información nueva se publicará en el sitio web de Solamac (solamac.org) y se enviará por correo electrónico.

Atentamente,
Directiva Solamac
2022 2025

Communication from SOLAMAC

Dear Members,

We are reaching out to inform you about the situation regarding our upcoming meeting. As you may recall, during the last assembly held in Bahia, Brazil, two potential locations were proposed for the 20th Workshop of Aquatic Mammal Specialists and the 14th SOLAMAC Congress. The proposed options were Ecuador and Mexico, with the latter planned as a joint event with the Mexican Society of Marine Mammalogy (SOMEMMA).

Although Ecuador was initially chosen as the venue for 2025, the country's unstable situation in recent months led the organizing group in Ecuador, along with our board, to reconsider. We determined that holding the event there in 2025 might bring unexpected complications, prompting us to change the event's location.

Therefore, the SOLAMAC board reached out to SOMEMMA's board and the organizing committee of SOMEMMA's next congress. The goal was to evaluate the possibility of holding both congresses together in 2025, something that has not happened in 19 years.

Thanks to the willingness and collaboration of our Mexican colleagues, we are delighted to inform you that we will meet in May 2025 in Veracruz, Mexico.

All new information will be published on the SOLAMAC website (solamac.org) and sent via email.

Sincerely,

The SOLAMAC Board

Comunicação
da Solamac
Estimadas/os sócias e sócios,
Estamos entrando em contato com você para atualizá l a(o sobre a situação
relacionada ao nosso próximo encontro. Como vocês devem lembrar, na última
assembleia realizada na Bahia, Brasil, foram propostos dois locais potenciais para a realização do 20º Encontro de Trabalho de Especialistas em Mamíferos Aquáticos e X IV Congresso Solamac As opções propostas eram Equador e México, neste último o congresso seria realizado em conjunto com a Sociedade Mexicana de Mastozoologia Marinha (SOMEMMA) Embora o Equador tenha sido d efinido como sede para 2025, asituação instável do país nos últimos meses levou o grupo organizador da RT no Equador em conjunto com a nossa diretoria , a pensar que a realização em 2025 poderia trazer complicações inesperadas, por isso decidimos mudar o l ocal do evento.

Por este motivo, a direção da SOLAMAC contactou a direção da SOMEMMA e a
comissão organizadora do próximo congresso da SOMEMMA . O objetivo foi avaliar a possibilidade de realizar ambos os Congressos em conjunto integração que não ocorre já há 19 anos .

Graças à boa disposição e colaboração dos nossos colegas mexicanos, temos o
prazer de informarque nos veremos em maio de 2025 em Veracruz, México.

Todas as novas informações serão publicadas no site da Solamac (solamac.org) e e nviadas por email.

Cordialmente,

Diretoria Solamac 2022 2025
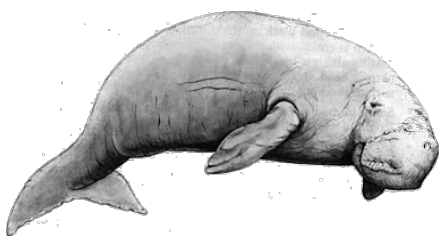
Sirenews – Dugong
(End of upcoming conferences)

¡ NOS VEMOS EN VERACRUZ 2025!

REQUEST FOR CONTRIBUTIONS
Sirenian Bibliography

For those who may be new to the sirenian research and conservation community, or who may not have the current address for the online Bibliography and Index of the Sirenia and Desmostylia, here it is:

https://sirenianbiblio.org

I am trying to keep it up to date, so I would appreciate it if those of you who publish new papers on these groups would send me copies or links to them. Also, if you notice mistakes in the existing online database, or know of publications that should be included and aren't, please let me know that too. (NOTE: I do not generally include abstracts; other limitations are outlined on pp. 5-6 of the Introduction.) Thanks for your help!

Daryl Domning

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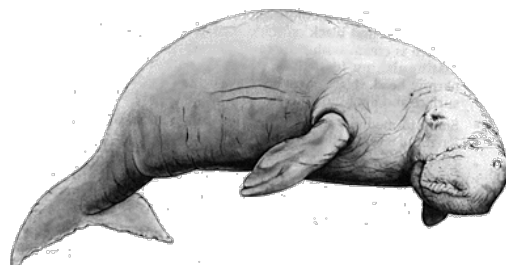
Sirenews – Dugong

SYMPOSIA/CONFERENCES
TENTH INTERNATIONAL SIRENIAN SYMPOSIUM

In conjunction with the
25th Biennial Conference on the Biology of Marine Mammals
Perth, Australia
Sunday, November 10, 2024
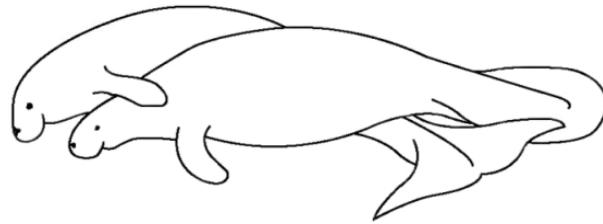
The Tenth International Sirenian Symposium was held in Perth, Australia on November 10, 2024, in conjunction with the 25th Biennial Conference on the Biology of Marine Mammals. There were more than 60 attendees representing 14 countries. The day included 18 speaking presentations and four poster presentations on various aspects of sirenian research being conducted from around the globe. The plenary was given by Dr. Janet Lanyon who presented an overview of the research she, along with her students and numerous colleagues, have been working on over the last 30 years. The invited speaker, Dr. Helene Marsh, presented information regarding findings from a collaborative initiative involving over 60 co-authors to assess the global conservation status of dugongs. The day finished with a newly released documentary focused on dugongs in Pulau Sibu, Malaysia. The next Sirenian Symposium will be held in Puerto Rico in October of 2026.

Abstracts
<u>PLENARY</u>

A deep dive into dugong biology contributions from a long-term research program

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One of the most accessible and highest density dugong populations in the world is found in Moreton Bay at the southern extent of the dugong's range in eastern Australia. These dugongs forage year-round over extensive shallow seagrass beds situated only a few kilometres offshore from an urban centre, Brisbane. The relatively clear water in this area facilitates capture and sampling of individual animals to some extent, but the shy nature and underwater habits of the dugong challenges deployment of most traditional research approaches. Consequently, over the past thirty years, the dugongs of Moreton Bay have been the focus of a continuous hands-on capture-mark-recapture sampling program that has developed and/or deployed innovative methods to answer critical biological and ecological questions. This talk outlines some of the major findings from this program, including population structure and movements through genetic, genomic and genealogical approaches, social behaviour through social network analysis and acoustics, foraging ecology through habitat survey, tracking and stable isotope analysis, digestive physiology through necropsy and *ex situ* digestibility trials, energetics and habitat requirements through metabolic rate trials, and health status through a longitudinal health assessment program. The Moreton Bay dugongs are probably the most intensively studied in the world, and many of the biological and ecological insights obtained from this unique population may be applied to other more-difficult-to-study populations.

<u>INVITED SPEAKER</u>

Key learnings from the 2024 global assessment of dugong conservation status and trends

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With the assistance of the United Nations Environment Program and more than 60 co-authors, we reviewed the dugong's conservation status and trends. The 40+ dugong range states are culturally and socio-economically diverse and include some of the world's richest and most highly developed countries as well as some of the poorest and most war-torn. Extensive dugong habitat occurs in the waters of several very highly developed countries, especially Australia, that should have the capacity to implement effective conservation. Thus, the conservation prospects for the dugong at a global scale are better than for any other sirenian. Nonetheless, the dugong's global status of Vulnerable masks a critical situation in many countries. IUCN has listed the following dugong 'subpopulations' at a regional scale: East Africa Coastal (Critically Endangered); Nansei, Japan (Critically Endangered); New Caledonia (Endangered). We identified a further 10 'subpopulations', including three transboundary 'subpopulations', as appropriate for assessment for IUCN listing including Aldabra (Seychelles); Comoros (Mohéli); Red Sea; Arabian Gulf; the Gulf of Kutch (India), Gulf of Mannar /Palk Bay between India and Sri Lanka; Andaman and Nicobar Islands (India); Palau; China; and Ashmore Reef between Australia and Timor. We used the area of seagrass in waters shallower than 20 m as a crude index of dugong carrying capacity. Isolated

islands with low seagrass extent and a relatively small area of shallow sea are likely to present precarious prospects for dugong conservation. While not all shallow coastal waters are potential seagrass habitat, the area of seagrass known with moderate to high confidence as a proportion of the area of shallow coastal waters shows the need to undertake additional seagrass mapping in all regions of the dugong's range, especially the Red Sea, the Asian regions and the Pacific Islands. The direct and indirect threats to dugongs are relatively consistent across their range, although their root causes differ with socio-economic context. An important initiative would be to evaluate the relative risks, including the climate risks, to the globally and regionally important dugong habitats we identified. Regional cooperation on dugong conservation management and research is uneven. It would be highly desirable for each of the regions in the dugong's global range to consider developing or updating regional action plans to guide the development and delivery of practical and resource-efficient strategies to enable them to collaborate in, and implement, regional initiatives for the conservation of dugongs and their habitats and associated megafauna.

RESEARCH TALKS

An update on the dugongs in the Great Barrier Reef and the transition to aerial imagery surveys

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Since the mid-1980s, standardized aerial observer surveys have provided critical data on the distribution and abundance of dugongs across various regions of Australia, including the Great Barrier Reef World Heritage Area. We will provide an update on the current status of dugongs in this region. We will then focus on the rapid development of aerial imagery-based technologies, which presents an opportunity to significantly improve the monitoring of dugongs and other marine megafauna within the Great Barrier Reef and beyond. A key step toward adopting these advanced survey methods involves the development and field-testing of imaging systems and AI-based data processing tools. During the 2022-2023 monitoring period, we conducted extensive aerial surveys of the Great Barrier Reef, integrating traditional observer methods with newly developed camera and telemetry systems. Over the course of this project, approximately 2.62 million images were collected, with a subset manually reviewed to train an AI model for animal detection. This training dataset included labels for 2,513 dugongs, 4,667 turtles, 176 dolphins, 169 sharks, 1,370 rays, and 65 sea snakes (including resights). The performance of our AI model was assessed against other AI models and tested on previously unseen image datasets. Preliminary results indicate that our model effectively filtered out images lacking animals, provided rough estimations of animal locations, and minimized false positives. However, further training is required to improve the model's accuracy in pinpointing animal locations within images. The fast and accurate processing of large image datasets remains a significant challenge for the cost-effective application of aerial imagery in dugong surveys. Continued research is essential to enhance the viability of these methods for future monitoring efforts.

Life in the shallows: Buoyancy regulation of a shallow diving marine mammal (*Dugong dugon*)

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[2]*Centre for Sustainable Aquatic Ecosystems, Harry Butler Institute, Murdoch University, Western Australia, AUS*

For shallow diving animals, like the Dugong (*Dugong dugon*), there is an inherent challenge in balancing the cost and efficiency of diving in shallow waters where there is likely a trade-off between dive duration, activity and the animal's relative buoyancy. The challenge for shallow diving air-breathing marine mammals is that a lung full of air will likely contribute to positive buoyancy in shallow waters, therefore making it difficult to dive and maintain position in the water column without expending energy. The ability to regulate lung volume prior to diving in shallow waters would be advantageous as it enables neutral or negative buoyancy to be achieved, putatively aiding the animal to dive cost efficiently. However, a reduced volume of air in the lungs would be expected to limit aerobic diving duration as the amount of oxygen available for aerobic metabolism is reduced. We investigated the lung regulated buoyancy control of dugongs using multi-sensor tags equipped to seven mature dugongs in New Caledonia, 2019 (n=2) and Exmouth Gulf, Western Australia 2021 (n=5). Our study demonstrates that dugongs dive on inhalation and regulate their buoyancy by controlling the extent that they inhale prior to diving. Depth that gliding commenced increased with maximum dive depth during descent (Multiple R^2=0.87, N= 199, *P<0.05*) and ascent (Multiple R^2=0.75, N= 973, *P<0.05*). As depth where gliding commenced is a proxy for the dugong's buoyancy shifting from positive to negative or vice versa, these results indicate that inhaled air volume is correlated with maximum dive depth. Alongside this, body angle, fluke beat frequency and activity in the descents and ascents increased with increasing maximum dive depth suggesting that dugong's dive with a larger inhaled air volume in deeper dives. Dugongs actively swam to overcome initial positive (descents) or negative buoyancy (ascents), once overcome the animal glides the remainder, putatively conserving energy. These results further indicate that by diving on inhalation, therefore controlling their inhaled air volume prior to diving, dugong buoyancy control contrasts most other marine mammals (e.g. phocid seals dive on exhalation).

Dugong bits and bones: using modern and ancient DNA to elucidate the population history of a marine mammal in Australia

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Australia represents a stronghold of dugongs (*Dugong dugon*) around the world, with about 165,000 animals found in its coastal waters from Shark Bay in Western Australia to Moreton Bay in Queensland. Dugongs are vulnerable to extinction, with very low numbers recorded in most of the 40+ countries where they occur. Dugongs are not only a culturally and spiritually important animal for the Indigenous communities in Australia, they are also ecologically important as their main food source is seagrass. Aerial surveys and satellite tracking have been used to assess dugong numbers, movement and habitat use in Australia. In this project, we will be adding to this knowledge by using population genomics, focusing on remote regions of Australia, e.g. in Western Australia and the Northern Territory, where aerial surveys and satellite tracking studies have been scarce. In order to do this, we are collaborating with Indigenous communities in these regions, actively sampling during fieldwork, and using museum specimens. We are setting up a two-way collaboration for dugong research, equipping rangers and communities with sampling kits and doing hands-on workshops on tissue sampling. The Indigenous communities will also be involved in the interpretation and dissemination of results, with the potential to directly influence culturally appropriate management decisions for individual dugong populations. Using genomics, we can assess gene flow, inbreeding, and other parameters important for management decisions. Furthermore, we are using bones and teeth of dugongs to extract ancient DNA from long-dead specimens to learn about the genetic diversity in the past in comparison to today. This project will give us insight into the connectivity and demography of dugong populations, thereby improving dugong management practices and conservation.

Dugong at risk: Genetic analysis to support conservation of the endangered New Caledonian population

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Recent research into the abundance and genetic diversity of the New Caledonian dugong population has led to its reclassification as « endangered » on the IUCN Red List in 2021. With the population last estimated at fewer than 800 individuals between 2008 and 2012, urgent conservation action is needed to halt its decline. Modern genetic techniques offer a promising approach to understanding spatial genetic differentiation and gene flow across New Caledonia's extensive lagoon habitats. In this study, we analyzed an expanded dataset of 68 skin samples collected from live and stranded dugongs between 2003 and 2023, adding 14 more samples to the latest genetic analysis by Garrigue et al. (2022). Our study employed a variety of genetic markers to investigate population size and connectivity at different levels: the Indo-Pacific scale with mitochondrial DNA control region sequences, the Coral Sea scale with 13 microsatellite loci genotyped across 50 individuals, and the New Caledonian archipelago scale with 2,499 single nucleotide polymorphism (SNP) genotyped across 49 individuals. The results confirm that the New Caledonian dugong population has extremely low genetic diversity, with 97% of sampled individuals sharing a single mitochondrial haplotype (DduNC01). The effective population size N_e was alarmingly low, estimated between 105.35 and 159.31 individuals. Moreover, the New Caledonian population is genetically differentiated from those in North and South Queensland, Australia. Within the archipelago, our study identified significant isolation by distance, with two major genetic clusters located north and

south of the town of Bourail along the mainland's west coast showing reduced gene flow. This spatial differentiation aligns with previous satellite tracking studies, which showed that none of the tagged dugongs crossed this natural boundary. While these findings could refine conservation strategies by considering this newly discovered population structure, they also raise serious concerns about the viability and the resilience of this isolated population, which may soon warrant an upgrade to "critically endangered" status.

A web-based operational diary for visualizing fishing catch and sales in the dugong conservation area in Talibong Island, Thailand

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There have been long-continued efforts for spatial fisheries managements to mitigate bycatch of marine endangered mammals, such as dugongs, *Dugong dugon*. It is particularly difficult when detailed catch statistics are not available to spatially visualize intensity and benefit of the local fishing activities. The spatio-temporal variation in catch statistics is a key component for planning effective spatial fisheries management. To facilitate such detailed analysis on the fishing activities, we developed a web-based fishing diaries to record daily catch and sales, areas of fishing, and time. Our research was conducted in Talibong Island, that holds Thailand's largest dugong population of about 250 individuals. Each of nine local informants, including fishermen and tour guides, recorded their daily fishing activities on the web-based diaries for one year. Percentages of yearly minimum and maximum sales in the dugong conservation areas around Talibong Island estimated in this study were 4.5% and 28.6%, respectively, of the total sales. A seasonal comparison of fishermen's sales showed that it was 2.38 times higher in the dry season than in the wet season. However, the fishing effort did not change significantly, with 27% operation days in the rainy season and 34% in the dry season. The most profitable fishing method was the crab net for blue swimming with a seasonal fluctuation. Our tool provided total sales in any given location and time periods as a useful economic indicator for monitoring and evaluating marine protected areas. It would contribute to estimate amount of alternative income required for adaptive dugong conservation measures. The method and approach presented in this study can also be applied to other marine protected areas focusing on dugong and/or other coastal marine mammals.

Changes in latitude and changes in attitude: Shifts in distribution and the culture of conservation for manatees in the U.S. outside of Florida

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West Indian manatees have been documented in northern Gulf of Mexico (nGOM) waters since at least the 19th century, but their life history and ecology in this region (when and where they go and what they do) historically received limited attention. The number of manatee sightings and mortalities has increased in the nGOM and other areas outside of Florida in recent years, coincidental with population recovery in Florida and increasing seasonal sea surface temperatures in the nGOM and on the US Atlantic coast. As manatees move into new or formerly occupied areas with greater frequency, there is increasing likelihood of human-manatee interactions and associated risks of harassment or mortality. Even in areas with the highest monitoring, research, and public outreach efforts, preliminary data suggest many residents are uninformed about manatees, and residents and resource managers can have conflicting attitudes towards perceived conservation efforts due to fear of boating and fishing restrictions. Funding for monitoring and research in these areas of growing manatee occurrence is also typically scarce or non-existent, with limited state and local funds favoring economically valuable species over non-game wildlife. Consequently, engendering support for new manatee monitoring and conservation programs from some members of the public and local resource managers remains a challenge. Results from studies that assess attitudes of the public and resource managers could improve community awareness as manatee distributions change, help acquire additional data, identify human-manatee interaction hotspots, and determine the best approaches to motivate engagement and investment in conservation-based activities by local residents and resource managers.

Forage selection by Florida manatees (*Trichechus manatus latirostris*) in response to the decline of seagrass meadows in the Indian River Lagoon

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The loss of seagrass meadows threatens the stability of an increasing number of tropical and subtropical coastal ecosystems worldwide. In the Indian River Lagoon (IRL), Florida, continued harmful algal blooms (HABs) have resulted in a significant decline of seagrass beds, particularly since 2011. Since 2013, two unusual mortality events (UMEs) have resulted in numerous manatee deaths (over 1,000 in 2021 alone), with a high proportion of individuals showing signs of severe emaciation. To understand the drivers of the increasing prevalence of emaciation in the IRL, we investigated the feeding ecology of manatees in relation to seagrass availability over the past 45+ years. The analysis of stomach contents from manatee carcasses collected between 1977–1989 showed that manatees primarily consumed seagrass (61.7%), followed by macroalgae (28.4%). Stomach contents collected in 2013–2015 showed a 44.9% decline of seagrass consumption and a 74.3% increase in macroalgae consumption. Using the Chesson's index, we also found that only seagrasses (mixed-species rhizomes and *Halodule wrightii*) were actively selected by manatees prior to 2011, whereas macroalgae were also actively selected after seagrass availability declined significantly after 2011. The drivers (influence of availability and quality) of forage selection were

then investigated by analyzing the elemental and nutritional components of forage items consumed by manatees. While elemental nutrient content did not differ significantly between macrophyte groups, our results indicate that the fiber content in macroalgae was significantly lower compared to seagrass. This supports previous research suggesting that prior mortalities linked to clostridiosis, specifically the toxic effects of *Clostridium difficile*, which were related to gastrointestinal lesions resulting from a diet deficient in fiber. The increasing mortality of Florida manatees due to malnutrition as exhibited in the IRL, could be more widespread throughout the distribution range of manatees, as seagrass meadows continue to decline.

Acoustic methods improve the detection of the endangered African manatee

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The African manatee (*Trichechus senegalensis*) is an elusive, data-deficient, and endangered species which inhabits marine and freshwater systems throughout Western and Central Africa. A major challenge in understanding the species ecology and distribution is the difficulty in detecting it using traditional visual surveys. The recent invasion of Giant Salvinia (*Salvinia molesta*) at the most important site for the species in Cameroon further limits their detectability and may restrict their movements and habitat use. To investigate method effectiveness in detecting African manatees, we conducted monthly vessel surveys from which visual point scans, 360° sonar scans, and passive acoustic monitoring were conducted simultaneously at ten locations over 12 months in Lake Ossa, Cameroon. Manatee detection frequency was calculated for each method and the influence of some environmental conditions on the methods' effectiveness and manatee detection likelihood was assessed by fitting a binary logistic regression to our data. Detection frequencies were significantly different between methods (p < 0.01) with passive acoustics being the most successful (24.17%; n = 120), followed by the 360° sonar scan (11.67%; n = 120), and the visual point scan (3.33%; n = 120). The likelihood of detecting manatees in Lake Ossa was significantly influenced by water depth (p = 0.02) and transparency (p < 0.01). It was more likely to detect manatees in shallower water depths and higher water transparency. Passive acoustic detections were more effective in uninvaded areas of the Lake. We recommend using passive acoustics to enhance African manatee detections in future surveys.

The African manatee in Guinea: First countrywide assessment of distribution and threats

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The African manatee has been the least studied large mammal in Africa, and it faces many anthropogenic threats across its 21-country range. It lives mostly in very remote locations in murky and dark waterways, and the species is very shy due to illegal hunting and accidental capture in fisheries, making it exceptionally difficult to study. In Guinea, African manatees exist both along the coast and in rivers in the interior, but its distribution, abundance and the impact of threats have been mostly unknown prior to this project, due to few people studying it there. To better understand and protect this vulnerable species, 13 Guinean biologists were trained over three years (2021-2024) to study the African manatee, to identify all locations where the species exists in Guinea, to document manatee food species, and to assess all threats throughout the country. They also led a country-wide educational campaign to raise awareness about the species. Through these exchanges, local people shared information about where manatees occur, seasonal / migratory patterns, and threats. We also collected the first water samples for eDNA in rivers in the interior. Since May 2021, more than 300 people participated in interview surveys and more than 50 environmental education programs reaching 4000 people have been led. Results from the coastal surveys indicate that manatees are well known along the entire coast of Guinea and that habitat is mostly good, with the exception of areas around bauxite ports and where mangroves are being heavily cut. Accidental capture in fishing nets and targeted hunting were also reported. In the interior of the country, we documented manatees in six new rivers, as well as urgent threats including entrapment by a major hydroelectric dam and potential entrapment by two new dams under construction, accidental capture in fisheries, and targeted hunting. This multi-level approach led by nationals will lead to more effective conservation strategies for the species and can be replicated in other countries to preserve African manatees.

Assessing threats to the Amazonian manatee in Peru: A case study from the Yaguas National Park buffer area

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The Amazonian manatee is a protected species in all the countries where it is present, but threats such as subsistence hunting, incidental capture, and illegal possession persist. In Peru, information regarding these risks is scarce and outdated, even in natural protected areas. As part of the conservation strategy for the species within the Yaguas National Park (YNP), a risk assessment was conducted in 2021, evaluating three communities located along the Peru-Colombia border, outlined by the Putumayo River, in the buffer

area of the YNP. Using snowball sampling and references from fishermen associations, semi-structured interviews were conducted reaching out to individuals with fishing experience (n=30), representing 16% of the adult population in the three communities. Through these interviews, at least 12 cases of incidental capture (in fishing nets) and 21 hunting events between 1974 and 2021 were recorded. Hunting was described as opportunistic and sporadic, primarily for the consumption of meat and fat. Thirty percent of respondents reported having hunted manatees in the past, while 20% reported experiences of manatees accidentally caught in fishing gear. During the 2019-2021 period, there were more reports of incidental capture (n=7) compared to hunting events (n=3). Additionally, three cases of illegal possession of calves were recorded, although these were not commercialized. Three strandings with unknown causes of death were also reported. This study provides baseline information that will be used to monitor risks through the annual recording of hunting events, incidental capture, illegal possession, and manatee strandings. This monitoring will complement the population monitoring of the species and the environmental education campaigns that have been conducted since 2022 in the communities evaluated.

Innovative strategies for dugong conservation: Integrating eDNA and drone surveys in challenging habitats

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Long-term data on dugong populations in Malaysia are limited, largely due to the challenges and high costs associated with conventional manned aerial or boat-based surveys in habitats characterized by high water turbidity levels and complex subtidal geo-ecological systems. The difficulty in directly observing, capturing, and/or tagging animals in Malaysia's coastal habitats underscores the need for an alternative survey approach. This study aims to determine the distribution and occupancy of dugongs in the Sibu-Tinggi Archipelago, Malaysia, by employing both environmental DNA (eDNA) and unmanned aerial vehicle (UAV) survey methods. In April and July 2024, water samples were collected opportunistically from areas where dugong groups of varying sizes and densities were sighted and from pre-determined locations along systematic transects. Simultaneously, repeated parallel line-transect surveys were conducted using a small multi-rotor drone to capture images and footage of dugongs. This project is continuing, but preliminary results indicate dugong aggregations within the seagrass meadows, that concur with previously identified feeding hotspots. Despite the few existing studies, there remains a gap in the availability of high-resolution dugong data that meets the spatial and temporal demands of occupancy models. This study will develop an occupancy model that accounts for imperfect detection whilst providing additional validation of eDNA and aerial survey approaches. Ultimately, this work will facilitate the development of new and robust biomonitoring tools for free-ranging and elusive species in remote and challenging marine environments.

Learning about the nutritional health of the Cleveland Bay dugong population through drone-based photogrammetry

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Cleveland Bay, located in the Great Barrier Reef region of Australia, stands out as a high-density dugong area, underlining the need for regular surveys to monitor the population and assess their nutritional health status. Traditionally, aerial surveys have been instrumental in studying dugong population trends on a large scale, while capture-release methods provide detailed health data. However, these approaches are costly, and the latter can be stressful to the animals. Drones offer an affordable alternative for detecting dugongs in small scale surveys while capturing high-quality aerial imagery. We propose using drone-based photogrammetry to obtain reliable body measurements of dugongs. These measurements will enable the estimation of body condition indices, serving as indicators of nutritional health status. Our project aims to assess the seasonal variation in dugong body condition in Cleveland Bay. As part of this study, we propose a methodology for obtaining dugong body measurements using drone-based imagery. Small off-the-shelf drones will be operated to conduct aerial searches in Cleveland Bay. Upon dugong detection, drones will maintain a flight altitude of 20 meters with the camera facing downwards at a 90° angle, while recording high-quality 4K videos. Information from the camera sensor size, image resolution and flight altitude will be used to scale images (convert pixels to meters). Image frames depicting animals near the surface, with the entire body visible and in a straight (non-arched) position, will be extracted from the videos. An image quality scoring system will then be used to select the best images for analysis, and morphometric measurement of the selected images will be done using a custom written script in R. We believe that this approach could be used for a less invasive and cost-effective assessment of the nutritional health of dugong populations, informing management and conservation efforts.

A framework for understanding the diversity of large-scale movement behavior among Sirenian populations

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Our recent review of radio-tracking studies has provided insights into commonalities and variation in the behavioral ecology of large-scale movements across sirenian populations (Deutsch et al. 2022). More than 1300 individuals of four sirenian species have been tracked using VHF or satellite-linked telemetry over the past four decades. It is clear that all sirenian species have the capacity to undertake long-distance journeys (100s of km), often repeatedly in the form of round-trip seasonal migrations, yet some populations are relatively sedentary year-round. The environmental selective pressures driving seasonal movements vary across species, climates, and ecosystems, but are most commonly generated by predictable fluctuations over the annual cycle in one or more of the following factors: (1) water temperature, in regions where it drops below the animals' thermoregulatory capabilities during winter, causing them to migrate to warm-water habitats to avoid cold-related stress and mortality (Florida manatee, some dugong populations); (2) rainfall, in coastal and estuarine regions with pronounced rainy and dry seasons (some populations of Antillean and African manatees); and (3) water level, in tropical riverine and lacustrine environments where it fluctuates drastically with seasonal flood pulses (inland populations of all three manatee species). Despite the wide diversity in climates, hydrology, and habitats across species and continents, these populations share an important commonality: *habitat that is suitable for foraging, breeding, and other activities for much of the year becomes inhospitable during a particular*

harsh season, forcing the animals to migrate in order to survive. In each case there is a season (winter, dry, or low-water) of heightened environmental and physiological stress where the animals' range is restricted to areas around a key limiting resource (warm water, fresh water, or deep water, respectively), and forage is therefore less available or of lower nutritional quality or both. Because dugongs are strictly marine, do not require fresh water, and mostly inhabit tropical regions, they experience fewer seasonally imposed constraints and are less likely to migrate than manatees. A common finding from tracking studies is that sirenians are individualistic in their movement behavior, some being regular long-distance 'travelers' and others in the same population being 'homebodies,' moving relatively little over the tracking period. This phenomenon, known as "partial migration," should confer adaptability to certain types of environmental change. Understanding large-scale movement behavior is key to taking proper management actions to protect key habitats and travel corridors, and to anticipate how those may be affected by climate change.

Insights and challenges: Utilizing drones for detecting cryptic African and Amazonian manatees in low-visibility waters

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Visual observations are essential for assessing the conservation status of marine mammals, providing data on abundance, distribution, behavior, and body condition. However, for species like sirenians, which spend much of their time underwater, visual monitoring is challenging. African (*Trichechus senegalensis*) and Amazonian manatees (*Trichechus inunguis*) are particularly elusive due to their cryptic surfacing behavior, low densities, and environmental factors like poor water clarity and floating vegetation. Recent advances in commercially available unoccupied aerial vehicles (UAVs) present a cost-effective and efficient solution for surveying these species. However, UAV use for manatee detection has mainly been limited to clear, shallow waters. We conducted 59 UAV surveys across two lagoons in southwest Nigeria, comparing detections with traditional boat surveys and indirect methods (feeding signs and floating feces). Analyses revealed significant variation in detection rates across methods (ANOVA, $X^2_2 = 33.87$, p = $4.41e^{-08}$), with indirect observations outnumbering UAV and boat detections. The UAV detected manatees in twice as many surveys (n = 6) as boat surveys (n = 3), though four UAV detections had low confidence due to the species' low profile at the water's surface. We validated our protocol through controlled UAV surveys at the Rainforest Awareness, Rescue, and Rehabilitation Center in Iquitos, Peru, over an enclosed ex-situ site, containing a known number of Amazonian manatees and mimicking in-situ visibility restrictions. Detection probability at this site was 0.62 (95% CI = 0.23, 0.94), with significant interactions between water depth and clarity affecting detection (α = -0.65; 95% CI = -1.3, -0.007). Based on these findings, we recommend using UAVs in areas with restricted movement, such as foraging sites or enclosed deep areas during the dry season. Future research should evaluate the effects of search patterns, tandem methods, and expand the range of water clarity and population density as factors influencing detection probability.

Ghosts in the darkness: Multibeam sonar as potential survey tool for Amazonian manatees, *Trichechus inunguis*, in the Amazon River basin

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All three manatee species are at risk of extinction due to habitat loss and other anthropogenic pressures. Amazonian manatees are restricted to freshwater habitats and are found in the Amazon River basin. They inhabit a variety of complex habitats (coffee colored dark water flooded forests (*igapó*) and murky water flooded forests (*várzea*)). Amazonian manatees are still hunted in much of their range and are therefore very shy and cryptic, which makes monitoring populations very challenging. As a result, scientists currently have no accurate way to estimate population sizes or monitor population trends, however recent advances in passive acoustics and drones have had promising results. In the past two decades, side-scan sonar has been used successfully to detect manatees in Latin America and Africa. However, there important limitations with this type of sonar which limit their effectiveness on Amazonian manatees. In this study, we tested a novel method of detection using multibeam sonar based on recent success with grey seals in Scotland. We tested multibeam sonar on Amazonian manatees in captivity and in the wild. Taking advantage of the known migratory pattern between the flooded forests during the high-water season and the perennial lakes during the low-water season, we deployed the sonar to capture the migration entering Lake Amanã, Brazil. We employed and worked closely with local hunters to aid us in the best location for deployment and in confirmations of manatee sightings. We successfully detected Amazonian manatees in both captivity and the wild and were able to differentiate them from other sympatric large vertebrate fauna (river dolphins *Inia* spp. and *Sotalia fluviatilis;* large fish *Arapaima* spp.). This new method is a viable way to detect Amazonian manatees and can be developed further into a potential solution to the problem of counting these elusive gentle giants of the Amazon River basin.

Feasibility of using satellite imagery to detect dugong groups: Comparative insights from the Kingdom of Bahrain and Moreton Bay

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Dugongs (*Dugong dugon*) are marine mammals listed as vulnerable to extinction, facing threats from habitat loss and anthropogenic pressures. Monitoring large dugong aggregations is crucial for conservation, especially where populations cross jurisdictional boundaries, complicating traditional monitoring methods. Conventional surveys often face logistical challenges, high costs, and difficulties accessing remote or politically sensitive areas. In such contexts, satellite imagery is an attractive alternative, offering the ability to cover large areas, including transboundary regions, without the need for on-the-ground presence. This study explored the feasibility of using Very High Resolution (VHR) satellite imagery, accessed through Google Earth Pro, to detect dugong aggregations and feeding plumes in the Kingdom of Bahrain and Moreton Bay, Australia. In Bahrain, 62 coordinates for large dugong group

sightings were obtained from various sources, but only 14 had dates corresponding with available satellite imagery. Poor image quality, high natural turbidity, deeper water depths (3-5 m), medium current velocity, and dense dugong groupings hindered detection efforts, with no observed dugongs or feeding plumes. In contrast, Moreton Bay, with its shallow, clearer waters, lower turbidity, and better image quality, allowed for more successful detection. With guidance from recent GPS coordinates obtained from boat-based, drone flights, and aerial surveys, 8 potential feeding plumes were observed in VHR satellite images from 2009 and 2022, using satellites such as GeoEye-1, WorldView-3, and Pléiades Neo 4. While VHR satellite imagery holds promise in detecting marine mammals like dugongs, its effectiveness is enhanced in environments with favourable conditions like Moreton Bay. However, in regions with less ideal conditions, such as Bahrain, it may require targeted investment in higher-quality images. These findings highlight the importance of environmental conditions and satellite capabilities in detecting marine mammals. VHR satellite imagery shows promise for monitoring dugong herds, particularly in transboundary areas where traditional methods are challenging, offering a safer, non-invasive, and potentially more cost-effective solution for conservation.

POSTER PRESENTATIONS

Expanding Florida's Marine Mammal Conservation Community through a Collaborative Institute and a New Interdisciplinary Master's Program at New College of Florida on Sarasota Bay

Gordon Bauer[1], Peter Cook[1], Heidi E. Harley[1], Iske V Larkin[1,2], Athena Rycyk[1], Nicole Vanderberg[1], Amber Whittle[1]

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Manatee conservation requires a collaborative interdisciplinary approach. For example, psychologist Bauer's laboratory data on manatee audition coupled with biologist Rycyk's data on acoustic environments of Florida waterways allowed scientists to shed light on the potential influence of soundscapes on manatee-boat interactions. In order to support collaborative and interdisciplinary approaches, New College of Florida, situated on Sarasota Bay, has expanded their marine mammal science programs: New College and the University of Florida are collaborating to create the Florida Institute of Marine Mammal Science (FIMMS), an institute dedicated to building a culture of conservation and a community of marine mammal professionals at universities, aquariums, governmental agencies, NGOs, and other relevant organizations. FIMMS includes the recently created Florida Manatee Science and Conservation Consortium as well as a new Master's of Science (MS) in Marine Mammal Science program that opened in August 2024. The Master's program, with its inaugural class of 11 students and the authored faculty and staff, emphasizes interdisciplinary *in situ* and *ex situ* work in behavior and ecology, cognition and neuroscience, and acoustics and other sensory-perceptual processes in dolphins and manatees. We welcome international participants. For more information about FIMMS, please contact marmamsci@ncf.edu. For application information about the Master's program, please visit ncf.edu/admissions/.

Dugong phylogeography today and tomorrow

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This poster provides a brief summary of information on dugong phylogeography (the association of genetic variation with geographical distribution of a species), which is discussed in detail in a forthcoming UNEP report on dugong status and conservation needs. The poster will focus on a simplified version of a haplotype (DNA sequence) network based on a short, variable region of the mitochondrial genome of 914 individual dugongs and clearly shows that different clusters of haplotypes (haplogroups) are found in different parts of the dugong's range. Data depicted in the network provide valuable information on regional-scale population structure and dispersal history of the dugong and permit inference of genetic diversity and other parameters. For example, some regions, such as New Caledonia and the Western Indian Ocean, exhibit extremely low mitochondrial diversity, likely because of founding of those populations by very few individuals. Low genetic diversity is often associated with reduced resilience of a population in the face of environmental challenges. Within Australian waters, two different haplogroups occur, reflecting the probable historical existence of geographically separate populations that now overlap. Sea-level fluctuations during glacial periods might explain this finding. The Australian dugong populations appear to be genetically healthy. Studies using genetic markers from the nuclear genome are also discussed in the UNEP report. These supplement and generally agree with the mitochondrial data. For historical reasons, all these studies, mitochondrial or nuclear, have sampled only a tiny portion of the genome. Molecular-genetic techniques, including data-analysis techniques, developed over the last decade or so to analyze complete genomes, promise to vastly increase our understanding of dugong demography past and present, population genetics and genetic health of dugongs and other marine animals. Such techniques will lead to a more comprehensive understanding of the conservation needs of dugong populations.

Biological control of Giant Salvinia to restore manatee habitat in Lake Ossa

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Lake Ossa is a 4000-ha protected lacustrine complex situated in the littoral region of Cameroon. The lake is considered a manatee sanctuary in the country and is home to at least 49 individuals. However, the lake was invaded by Giant Salvinia (*Salvinia molesta*), a free-floating aquatic fern that originates from southern Brazil and is known to cause several ecological damages to aquatic ecosystems. In 2020, Giant Salvinia covered up to 70% of Lake Ossa's surface, limiting fishing activities and choking navigation channels. In addition, this invasive plant outcompetes manatees' major local food, the antelope grass (*Echinochloa pyramidalis*), and its proliferation correlated with the decreasing frequency of manatee spotting in the Lake. Manual removal of Giant Salvinia off the Lake was unsustainable as the plant spreads rapidly and can double in its biomass within 7-10 days. To sustainably control Giant Salvinia proliferation in Lake Ossa, we implemented a biological control using Salvinia weevils (*Cyrtobagous salviniae*). In collaboration with the Luisiana State University, 2,000 Salvinia weevils were imported from the USA to Cameroon. Weevils were acclimatized indoors, then mass-reared over several months. In 2021 Mass-reared weevils were first released in controlled areas of the lake, then gradually spread throughout the invaded area. Two years

after the first release, aerial maps of Lake Ossa show a 90% decline of Salvinia coverage. Manatee spotting frequency is gradually increasing and fishing activities have resumed in previously invaded areas. Though Giant Salvinia is no longer a threat to the biodiversity of Lake Ossa, the lake remains eutrophic, thus vulnerable to the proliferation of other invasive plants, which control might more difficult than that of Giant Salvinia. For a long term protection of this important ecosystem, it is crucial to conduct limnological surveys to identify the main sources of pollution.

Local variation in population characteristics and residency patterns of dugongs (*Dugong dugon*) across two intertidal seagrass beds in Talibong Island, Thailand

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Dugongs (*Dugong dugon*) feed almost exclusively on seagrass. In this study, we describe the population characteristics and residency patterns of dugongs across two intertidal seagrass beds in Talibong Island, Thailand: Site A, covering an area of 2.0×10^5 m^2, and Site B, covering an area of 2.8×10^5 m^2. Transect and individual identification surveys were conducted under clear water conditions using drones: 16 separate days over 11 months at Site A and 10 separate days over 3 months at Site B. Sixty-four individuals were identified from 180 videography sessions. The results confirmed at least two distinct patterns of seagrass habitat utilization among sites located approximately 5 km apart. Site A was characterized by a lower population density, higher site fidelity, occupancy by relatively large individuals, and an absence of feeding aggregations. In contrast, Site B was characterized by a higher population density, lower site fidelity, occupancy by individuals with a wider range of body lengths, and the presence of feeding aggregations. The average population density at Site B was three to five times higher than that at Site A. Site A had a median nearest neighbor distance of 320 m with no significant bias in its distribution, whereas Site B had a median of 20 m with a significant bias. The mean site fidelity index for Site A (0.62 ± 0.08; n = 16) was significantly higher than that for Site B (0.39 ± 0.14; n = 10). Dugongs at Site A might have monopolized this site to some extent, while those at Site B might have benefited from increased opportunities for social interaction provided by aggregations. These findings highlight the importance of fine-scale monitoring of feeding ground utilization by dugongs, taking into consideration individual-specific details such as body lengths and resighting rates for a better understanding of their spatial distribution.

***Sirenews* – Florida manatee**
(Last page of abstracts)

NOTES FROM THE EDITORS: We would like to thank all of those who have contributed articles for *Sirenews*. On occasion, we have taken the liberty to make minor edits in an effort to accommodate our formatting style and provide clarity for our readership. However, we have restrained from making all grammatical edits in an effort to preserve the original intent of the submitting author.

We would also like to encourage you to submit any manatee and dugong sketches or old-time prints for publication in future issues!

⇒ **COPY DEADLINE FOR NEXT ISSUE: March 15, 202** ⇐

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