

# Sirenews

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## 24th Biennial Conference on the Biology of Marine Mammals

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### **Note from Dr. Benjamin Morales-Vela. Sirenia Specialist Group Co-Chair:**

I wish to announce my resignation as Co-Chair of the Sirenia Specialist Group, effective as of December 31st. I have been honored to serve as Co-Chair of the Sirenia Specialist Group for several years, first with John Reynolds and then with Helene Marsh. I must thank you for all your respect and affection shown to me in all these years, which fills me with pride and satisfaction, but it is time that a new manatee leading takes my position. We consider appropriate first to invite the regional manatee Co-Chairs to express if they would be interested in taking my position. Some responded that at the moment, they could not assume this responsibility, as a result of their other commitments, and wished that some of the other wonderful people invited could accept. Anmari Álvarez-Aleman, Meso-America regional Co-Chair, expressed her interest in having this opportunity. I am sure that Anmari will be an exceptional Co-Chair of the Sirenia SG, enjoying working near Helene Marsh. Her postulation was submitted to the Steering Committee of the Commission. Anmari was named co-Chair. ¡Congratulations Anmari!. We will work together in the coming weeks to formally transition. She will serve as Co-Chair for the group during the period 2021-2024.

One of my last tasks will be to finish the update on the West Indian Manatee Red List information. Thanks for the honor of serving in this position, and I appreciate your multiple actions and support over several years.

Benjamin Morales-Vela (bmorales@ecosur.mx)

**Editor's Note:** We would like to thank Benjamin for his many years of hard work, sage advice and time he has contributed to the Sirenia Specialist Group.

Both Anmari and I would also like to thank everyone for their contributions to this issue of *Sirennews*. It is heartening to read about all the important work that has continued in the face of this horrific pandemic. These efforts demonstrate the dedication of sirenian scientists, curators, veterinarians, volunteers and conservationists around the globe. We extend our warmest best wishes for the holiday season and hope that everyone stays safe and healthy.

## LOCAL NEWS

### BRAZIL

#### COVID-19 and the impact in the future of a manatees in Brazil

The state of Amapá/Brazil is an important manatee conservation area, however little is known in this area about the species. In this region, it stands out for having the two species of manatee existing in Brazil: Antillean manatee and Amazonian manatee, in addition to some possible hybrid manatees. The Brazilian government, through the Amapá Wild Animal Sorting Center/Brazilian Institute of the Environment and Renewable Natural Resources (CETAS/IBAMA) and the Chico Mendes Institute for Biodiversity Conservation/National Center for Research and Conservation of Aquatic Mammals (ICMBio-CMA) has been carrying out conservation actions in the State.

In September 2013, a manatee calf stranded in Amapá and with the help of partners, CETAS/IBAMA and ICMBio/CMA provided care for the manatee. The manatee received the name Victor Maracá and became such a concern for the team that, during these years, studies were carried out to define the best place for release.

After many studies, Oiaopoque, on the border with French Guiana, was identified as the best release site. Other regions were considered, but among the factors that led to the choice, is the fact that in this region there is no “pororoca” phenomenon that exists in other locations in Amapá coast.

In a pioneering project, the Brazilian government made partnership with the indigenous tribes of that place, who began to be trained to receive Victor Maracá and then participate in some stages of his life: from receiving the animal at the place, feeding and monitoring him.

In October 2019, Victor was finally taken to Oiaopoque, to an enclosure built by the indigenous themselves under the guidance of CETAS/IBAMA and support of ICMBio/CMA, ICMBio/Cepene and ICMBio/APACC. In the first months of adaptation, Victor Maracá remained, being taught to eat in this place, as part of adaptation process. For this reason, the plan was to release Victor Maracá in the second half of 2020.

With the pandemic caused by COVID-19 all over the world, activities needed to be reassessed, as Victor Maracá could no longer remain with the indigenous tribes. Due to the risk of contamination of the indigenous, people who do not belong to the tribe would be prohibited from entering the tribe, as well as maintaining physical contact with the indigenous. Therefore, manatee care became unviable and a greater risk to the indigenous, who needed to be totally isolated. To ensure the animal's health and regular feeding, the team decided to move him back to the rehabilitation center (CETAS/IBAMA) as it was no warranty that the animal would be able to receive his food and other care needed.

The COVID-19 pandemic interfered with Victor's adaptation to the natural environment and reflecting on the conservation of the species. The team involved continues to maintain the priority of ensuring Victor's health and well-being with the dedication of the team of the two institutions.



Figure 1: Victor the manatee being transported to Oiaopoque.



Figure 2: Enclosure built by the Indians themselves under the guidance of CETAS/IBAMA in Oiaopoque.

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## **Brazilian guidelines of interaction with marine mammals**

The National Aquatic Mammal Center – CMA/ICMBio, Brazil, published a manual to advise people how to conduct responsible tourism of watching and interacting with marine mammals in Brazil, including manatees (Figure 1). The interaction with cetaceans and manatees has some prohibitions by law in Brazil. Usually it's not everyone who understands legislation. The manual makes the rules accessible to all, through simple language and explanatory illustrations.

It was not common to have people watching manatees in Brazil as the coastal water is not clear as it is in many other countries and manatees do not migrate to clear rivers as they do in Florida. The only kind of manatee tourism was to visit those animals in captivity. However, during the years 2008 – 2015 CMA/ICMBio has released several animals in the Protected Area Costa do Corais, Alagoas state, where the water is very clear mainly during the spring and summer time. Since the first releases local people began to show the animals to tourists and this kind of activity has been increasing daily. To organize the visitation and protect the animals ICMBio/CMA, with support of local mayors, has created some rules and did guide training. Over time other areas like Paraíba state also began to develop this activity which nowadays is covering more states.

This manual helps local people, fishermen, researchers, students, and tourists to understand what responsible watching of those animals is because it brings information about the correct distance to be maintained between people and animals, time of observation, and some others aspects to be respected.

The CMA/ICMBio is a government organization responsible for national research and conservation of aquatic mammals and the team has great involvement in manatee conservation actions throughout the country. The concern with manatees, as well as the risks of improper approach of people to animals, motivated the CMA team to publish this book. You can download the manual here:

[https://www.icmbio.gov.br/portal/images/stories/comunicacao/publicacoes/publicacoes-diversas/manual\\_de\\_boas\\_praticas\\_em\\_interacao\\_com\\_mamiferos\\_marinhos\\_2019.pdf](https://www.icmbio.gov.br/portal/images/stories/comunicacao/publicacoes/publicacoes-diversas/manual_de_boas_praticas_em_interacao_com_mamiferos_marinhos_2019.pdf)

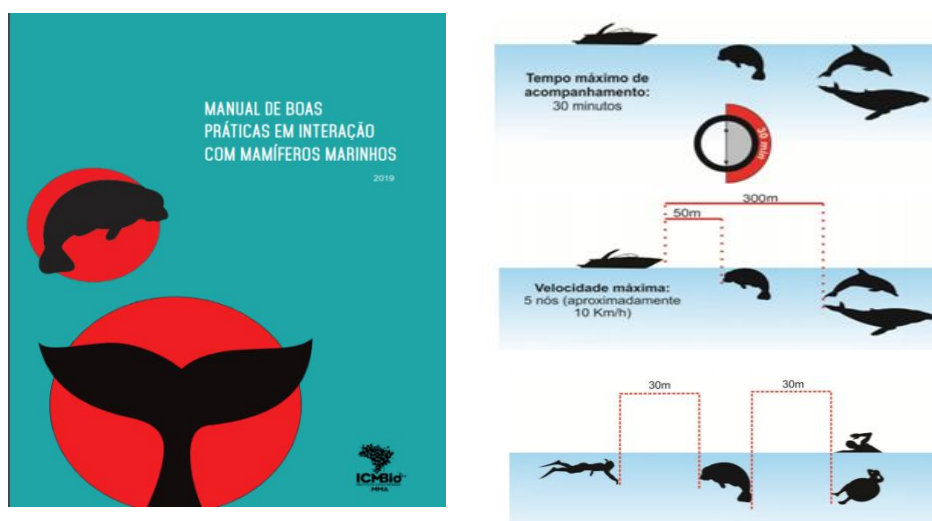


Figure 1: Manual of good practices in the interaction with marine mammals during touristic activities.

**-Fábia de Oliveira Luna<sup>1</sup>, Fernanda Loffler Niemeyer Attademo<sup>3,4</sup>, Adriana Vieira Miranda<sup>1</sup>, Gláucia Pereira de Sousa<sup>1</sup>**

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## **Manatee Trees: culture and conservation in Amazonia, 2020 Fundación Natutama, Bogotá (a book about the manatee research at Natutama)**

This is the story of a community-based program to understand and protect the Amazonian manatee. It shows how working with an indigenous community to revive manatee stories and culture made it possible to stop manatee hunting in the Puerto Nariño area of the Colombian Amazon. An orphaned calf, Airuwe, was raised and released into the wild, while Ticuna fishermen and former hunters followed the manatees, discovering their seasonal habitats and interpreting their life under the water. Regular monitoring of the lakes and rivers resulted in over 5000 sightings in 16 years, establishing detailed migration patterns. Ticuna elders helped us to see the manatees from within their culture, giving us a different perspective on the relationship between people and animals. Out of this developed a long-term conservation and education program focused on the Natutama Interpretation Centre, run by Ticuna educators and guides.

**-Sarita Kendall**

Fundación Natutama, Bogotá



**Note: The author would be happy to send anyone interested this digital version. Please e mail to [saritaken@yahoo.com](mailto:saritaken@yahoo.com) or [sirennews@sea2shore.org](mailto:sirennews@sea2shore.org)**

## **Some accounts on manatees in Brazilian natural history books in the 20th Century**

The purpose of this note is to present available information on manatees in popular natural history books published in Brazil between the late 30's to 90's. A broad search was made on reports covering manatees and their relationship with the 'caboclo' and 'marajoara' lifestyle, including their habits, and customs in the Amazon region during the 20th Century. This is not intended to be a comprehensive survey but a compilation of the most curious accounts on manatees available for the public during that period. Original spelling of Portuguese words was conserved. Reports usually cover aspects of the distribution, hunting and use of manatees in a time that they were part of their daily life. Hunting, although considered illegal since 1967, was regularly mentioned. Curiously, some rudimentary taxonomy is presented, often referring to the sirenians as members of the cetacean fauna.

Detailed description of manatee hunting in Brazil is given by Barroso (1954), Von Ihering (1967), Veríssimo (1970), Rodrigues (1992) and Friaes (1997). Uses of manatees as food and tools are described in Moraes (1931) and further commented by others. Interestingly, there are reports on how to find their path along the aquatic vegetation as follows: "Um sirênio, o peixe-boi, que os portugueses, desde os primeiros dias da Conquista do Brasil assim haviam apelidado, atentos às suas formas e aos seus hábitos, pastava nos rios e nos lagos [do Marajó] como um bovino, e era encontrado, amamentando o filho, à embocadura desses rios, entre as plantas submersas e flutuantes dos lagos por eles formados. ... As tartarugas e os peixes-bois não só davam carne ao homem; seu azeite seria empregado na iluminação individual e das vilas e cidades que iam se erguendo" (Pereira, 1956); and here: "Ele vai no rastro do Peixe-Boi (*Manatus inunguis*) tão bem como um de nós ao andarmos por um caminho terrestre. Aqui é um capim quebrado, ali amassado, enfim indícios de que o cetáceo [sic] passou." (Barroso, 1954).

Moraes (1931) mentions its scarcity in the River Gurupá, Pará, in the early 30's and Miranda Neto (1976) mentions that manatees were rare in the Marajó Island in the late 70's: "... e o peixe-boi – muito procurado, mas já raro nas imediações de Marajó". The famous 'mixira' food also appears in Moraes' accounts: "Mixira – Conserva na gordura do peixe-boi, grande cetáceo [sic], de banha branca, compacta; é excelente isoladora do ar. ... quando o peixe-boi, abundantíssimo, dava para carregar os navios holandeses no porto de Gurupá, ponto em que actualmente não existe mais nenhum desses cetáceos [sic]". And, by the end, its common native names appear in Von Ihering ("PEIXE-BOI ou, na linguagem indígena, 'Guarabá', 'Guaraguá' ou 'Maná' ('Manatí'?)" and gender-specific names in Portuguese are given by Rodrigues ("Peixe boi – (*Manatus inunguis* ou *Trichechus inunguis*) – Cetáceo [sic] de grande porte, pertencente à família dos Triquequídeos, tendo vida exclusivamente aquática ... denominado de MANATI para o macho e PEIXE MULHER para a fêmea").

In summary, there is a rich literature on manatees in Brazil in books of the 20th Century, covering a multitude of aspects of their behavior, ecology, hunting and use by humans and conservation. This literature should be widely considered in current and future studies of manatees in Brazil.

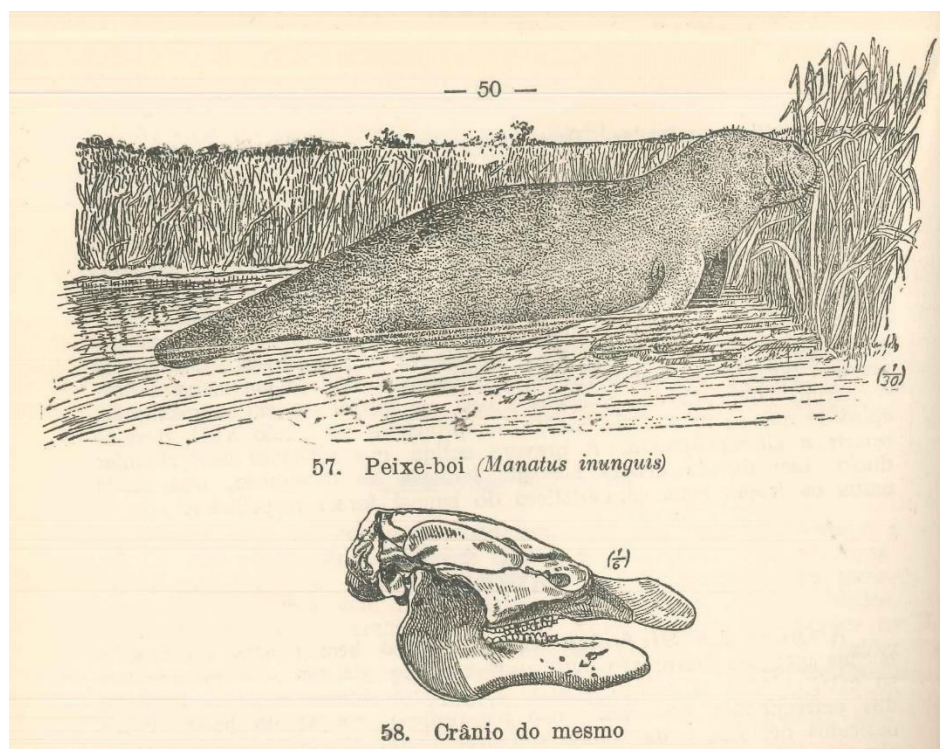


Figure 1. Manatee grazing and detail of a manatee skull available in Von Ihering (1967), page 50.

#### -Salvatore Siciliano

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## **How the Covid-19 pandemic is affecting the capacity of Amazonian rescue centers to take care of baby manatees.**

The activities of the Aquatic Mammal Laboratory (LMA) of the National Institute of Amazonian Research (INPA) began with the arrival of an Amazonian manatee calf in 1974, starting a project that persists until today. However, in the last 20 years, the Projeto Peixe-boi da Amazônia has been carried out with different actions towards the conservation of the species.

The partnership of INPA and The Friends of Manatee Association (AMPA), sponsored by the Petrobras Socioambiental Program/Projeto Mamíferos Aquáticos da Amazônia, has been working with the University of Kyoto (Japan), the Museu na Floresta Project, and other partners as ITOCHU, Aquarium of São Paulo, SeaWorld Conservation Fund and the Amazonas State Foundation (FAPEAM) for the conservation and study of Amazonian manatees. These institutions supported the Amazonian manatee Project in different moments, such as with the rescue, rehabilitation, and release of the rehabilitated manatees into the wild (for more details see Souza et al., 2018), the monitoring of the released individuals, and the research on health assessment and welfare of captive manatees (Amaral et al., 2010; Pantoja et al., 2010; De Mello et al., 2011; Mathews et al., 2012; Carmo et al., 2013).

In the last two decades (2000 to 2020), a total of 199 Amazonian manatee calves, with an average of nine animals per year, were rescued and brought to the Robin Best Aquatic Center (RBAC) at INPA in Manaus (Fig. 1). Most calves were aged from just a few days old up to 6 months old, and the majority arrived very debilitated due to the prolonged time in inappropriate captive facilities and care. Today we still have 22 orphaned manatees receiving a modified milk formula (Maduro et al., 2020).

In 2019, in an attempt to reduce the number of calves arriving at INPA and prioritizing to keep them with their mothers in the wild, we launched a campaign (Sou amigo do Peixe-Boi - como liberar filhotes capturados acidentalmente - I am a friend of manatees- how to release healthy Amazonian manatee calves accidentally caught). This educational campaign aimed to teach the fishermen and the inhabitants of Amazonian communities to evaluate the physical condition of calves and to release them as soon as possible in order to maximize the chances of encounter with their mothers. This action is particularly efficient for calves that are caught accidentally in fishing nets for short periods of time (see Sirenews no69 for more information), with a high chance of the mother being nearby.

Due to the COVID-19 pandemic, the activities in schools, communities and fisherman associations were suspended, interrupting the campaign. Furthermore, several areas in the Amazon region were isolated and in lockdown, including Protected Areas and Indigenous Land. The suspension of fieldwork, of the visits to the communities, and the paralyzation of environmental education campaigns have directly affected the conservation activities for the Amazonian manatee. Even with

fieldwork activities interrupted and the restrictions imposed by the pandemic, the number of rescued calves arriving at INPA increased in 2020, with the arrival of 10 live manatees in a very short time.

Further deepening the problem, in the last years other Amazonian manatee rescue centers gradually stopped receiving orphaned calves, directing most of the animals to the RBAC at INPA. As a consequence, the Center's capacity is already above the number of the regular captive population.

The high costs of aerial transport and the long distances to travel by boat increased the time between the calves' rescue and their arrival at the RBAC. During this period, most calves were kept in non-ideal conditions from weeks to months, leading to subnutrition and increasing risks of health problems and death (Fig. 2 A, B). Of fifteen manatee calf rescue requests in different areas of the region during the pandemic, only ten were rescued. The transportation of these manatees was done with the support of the Batalhão Ambiental (State Environmental Police) and the Environmental Secretaries of Amazonas and Pará States (SEMA). The manatees were brought to the RBAC at INPA (n=6), to ZooUnama (n=3) in Pará State, and to Bioparque (n=1) in Amapá State. Unfortunately, five other animals (33,3%) died while kept in the villages without adequate care.

While the COVID-19 pandemic precluded the follow up of the field activities, the number of orphaned calves reported from other states of the Amazon region has also increased. All efforts have been made to maintain these orphaned calves in ideal conditions, however, the limited rehabilitation centers and the reduced number of pools and space at the RBAC may present a huge challenge to properly accommodate this high number of calves in the near future.

More actions and an intensive campaign must be launched to avoid the removal of healthy manatee calves from their natural environments when recently caught. Female manatees are dedicated parents, taking care of their calf for over two years. It is unlikely that its mother would abandon an entangled calf in a fishing net in a short period.



Figure 1: Partial view of the nursery area at the Robin Best Aquatic Center (RBAC) at INPA, in Manaus.



Figure 2: (A, Left) Rescued calf kept in an old refrigerator box as an improvised pool in a community. The animal is very debilitated and thin. (B, Right) Baby bottle produced by the local people to feed the rescued baby manatee.



Figure 3: Rescued Amazonian manatee calves under care in two communities.



**-Vera M.F. da Silva <sup>1,2</sup>, Daniela M.D. de Mello <sup>1,2</sup>, Rodrigo S. Amaral <sup>2,3</sup>, Anthony Ferreira <sup>2,4</sup>, Christian Lourinho <sup>1,2</sup>, José A. d’Affonseca Neto <sup>2,4</sup>, Diogo A. de Souza <sup>2</sup>**

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### Case report: Amazonian manatee rescue and the pandemic

During the World Pandemic COVID-19, the Instituto Bicho D’água (IBD) received a call on February 28th, 2020. An Amazonian manatee calf (*Trichechus inunguis*) was stranded at Santa Cruz do Arari city, Marajó Island, Pará State, Brazil.

Local people were oriented to seek the manatee mother. However, it was not be found, the calf was transferred to Belém city, Pará State on March 3rd, 2020. Weighing 13.9 kilograms, 105-centimeter length, and about two months, the animal arrived with intestinal issues, probably because of the long time eating wrong food like roots and mud (Figure 1).

Arari, named honoring the place it was retrieved, spent two months at the Zoobotanic Park of Museu Paraense Emílio Goeldi by the volunteer caregivers of the Instituto Bicho D’água (IBD). During the first months, the animal had several health complications, such as aphtha, constipation, colic, and fungal infection. An ultrasound was performed to check the intestinal tract, and an enema was given to



adjust the intestinal transit. The fungal infection was treated with Itraconazole, oral administration, and Ketoconazole, topical treatment. Additionally, Silymarin was administered as a liver protector.

Due to the advancement of the Coronavirus Pandemic, Belém was under lockdown. Part of the IBD team was positive to COVID-19, therefore, the IBD decided to transfer the calf to another place to accomplish the animal's treatment and keep the team healthy. IBD had an exceptional and emergency protocol authorized for the Government (IBAMA) due to the COVID to transfer the animal, but it is not an ordinary procedure in Brazil.

On May 1st, 2020, Arari was transferred to an IBD biologist's house, weighing 12.8 kilograms and 105 cm length. The biologist spent 17 weeks taking care of the animal by herself. The veterinary team had support remotely by cellphone. Weekly the biometry data was collected, the fungal lesions evaluated, as well as the behavior repertoire and feed protocol measure. The animal responded to treatment at the end of August, weighing 30.4 kilograms and 120 cm in length, and no fungal lesions (Figure 2).

On September 16th, the animal was transferred to Santarém city. This is the first air transport of this specie in the Pará State. The transport was made by the Grupamento Aéreo do Estado do Pará (GRAESP) in partnership with Instituto Bioma and the Centro de Pesquisa e Gestão de Recursos Pesqueiros do Litoral Norte (CEPNOR). Currently, the animal is under rehabilitation at ZOOUnama. Arari's development has been satisfactory and, if it continues in these conditions, approximately two years from now, it will be part of the program to release Amazonian manatees.



Figure 1: The manatee, Arari, was weighing 13.9 kilograms, 105-centimeter length, and about two months, the animal arrived with intestinal issues and some fungal lesions. Picture from March 2020, until the treatment.



Figure 2: The manatee, Arari, after the treatment, in August 2020, weighing 30.4 kilograms and 120 cm in length, and no fungal lesions.

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### **Acknowledgement**

The IBD team would like to thank Thatiana Figueiredo and Emilio Goeldi Museum staff for all the help during the Arari Zoobotanic Park stay. Many thanks to CoraLab (Marina Brito) and Labvet for offering laboratory tests. Special thanks to Dr<sup>a</sup> Alexandra Costa and Dr<sup>a</sup> Fernanda Attademo for all support during the Arari treatment. At last, thanks to ICMBio-CMA and CEPNOR from the feed supply.

## COLOMBIA

### **Movements of five Caribbean manatees (*Trichechus manatus manatus*) released in the marsh complex Zarzal-El Tupe-Capote, Bolívar, Colombia**

In December 2019, Fundación Omacha with an environmental authority (Cardique- Canal del Dique regional environmental authority) and local community members, released seven Caribbean manatees (*Trichechus manatus manatus*) in the marsh complex Zarzal-El Tupe-Capote, Bolívar, Colombia. These manatees had lived in semi-captivity for three years, and their release presented an outstanding opportunity to assess this species' local migration throughout the year, which is why five of the animals were equipped with telemetric radars (VHF) to follow their movement patterns. The first follow-up, done right after their release, helped to establish the areas they were settling in; a second monitoring, done in the dry season of February 2020, showed a change in the manatees' distribution in the marsh complex.

In April 2016, Fundación Omacha, environmental authorities and the local community rescued ten Caribbean manatees that were under physiological stress in the marsh complex Zarzal-El Tupe-Capote. This was due to one of the worst El Niño events in recorded history, which lasted 17 months between 2015 and 2016 and caused heavy droughts in the northernmost part of South America (Contreras, 2016). In the marsh complex, the effects led to the disappearance of shallow ponds, increased water temperature and overall reduction of the depth of water and of feeding areas for this species.

The rescued animals were taken to a lake in a military base within the Canal del Dique basin, to be fed and treated in semi-captivity until the environmental conditions were adequate for them to return to the wild. A male adult did not survive this process, while two individuals still remain in the lake.

In the first monitoring, in December 2019, all tagged animals were settling close to the release area, between El Zarzal and Ciénaga Muerta. Later, the monitoring done in February 2020 showed the manatees had dispersed to the north of the complex. For example, Lila moved more than four kilometers, from El Zarzal all the way up to El Tupe, in the north; Hugo and Sebastian showed a similar migration pattern (

Figure 1).

There is very little information regarding actual distribution of the Caribbean manatee in Colombia, although much is known about its habitat restrictions, potential distribution and ecology (Caicedo-Herrera *et al.*, 2005). This species' distribution changes with time, responding mainly to climatic variations, that in Colombia adhere to a bimodal wet and dry regime, with dry peaks from January to April and June to August, and rainy seasons in between (Ruíz and Cadena 2014).

This assessment showed most of the released animals moved in the complex from December to February, moving mainly to the north; Esperanza and Tico were the exceptions to this trend, staying very close to the release site. Even though it is still early to draw any conclusions on the causes of their movement, this exercise is an outstanding opportunity to evaluate the drivers for this behavior, which is

why Fundación Omacha is eager to do a long-term monitoring of these animals with the help of the local community.

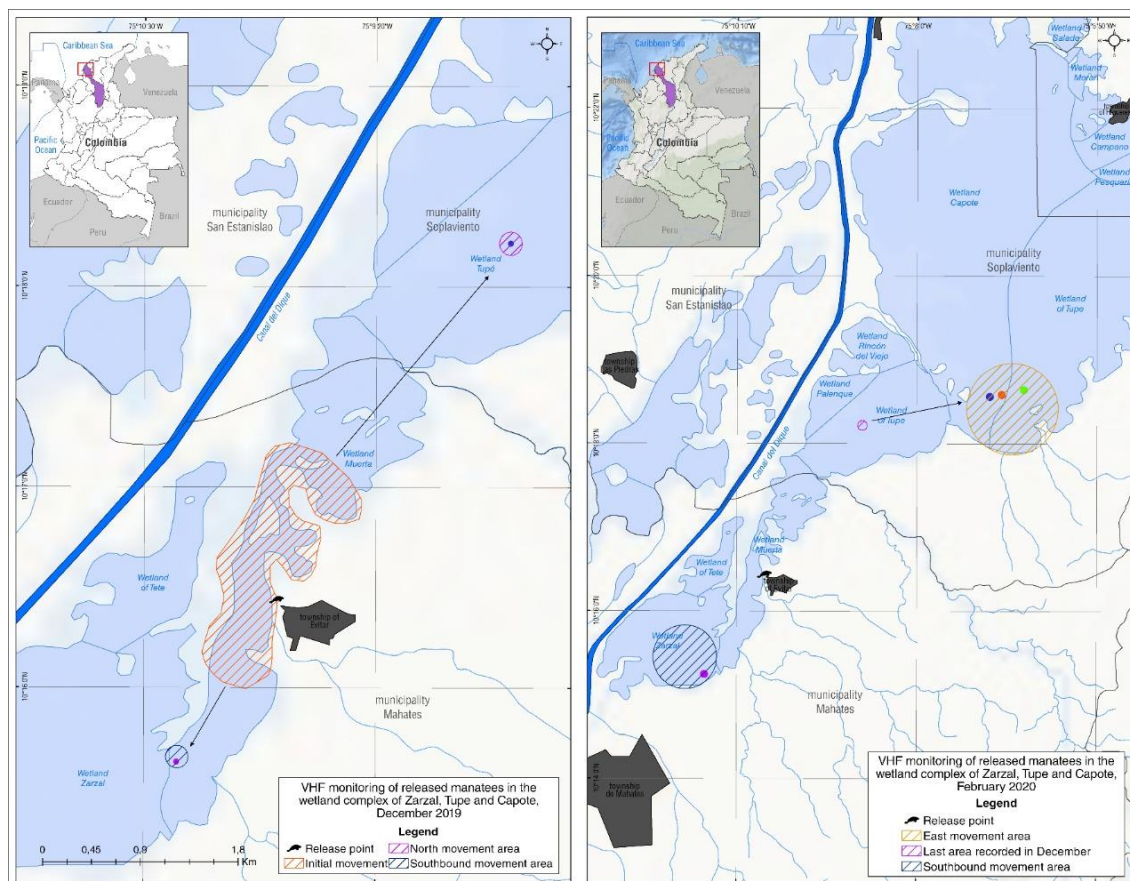


Figure 1. Tracking of the manatees released in the marsh complex Zarzal-El Tupe- Capote. Left: Tracking of the transition period, December 2019. Right: dry season, February 2020.

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## **CUBA**

### **Manatee presence in La Coloma coastal community, Pinar del Rio**

La Coloma is a coastal community in the southern province of Pinar del Río, Cuba. Sightings of this species have been reported in the area in the last five years, but these have been sporadic and usually consisting of solitary animals. This year the reiterated sighting of six manatees has caused a commotion among the local people in this coastal area (Figure 1). This unusual fact aroused the interest of staff from MPAs closer to the sightings area, who have worked on characterizing the species' habitats and monitoring them for more than 15 years in this coastal region.

Since the 90s, biologists from the San Felipe National Park have been collecting anecdotal information from fishermen about manatee presence and threats in part of the coastal area of south Pinar del Rio. In 2011, a habitat characterization was carried out in some potential manatee habitats. Although it was not until 2012 that direct evidence began to be collected. In January 2020, a group of approximately six manatees started to be observed, so the local MPA staff decided to continuously monitor the evolution and behavior of these individuals in this area.

This coastal community strongly depends on fishing activity. The place where the six manatees have been constantly observed since early 2020 is a port for 42 state-owned commercial fishing boats and around 121 private boats. Despite the fact that the site does not have ideal conditions due to the constant presence and traffic of these boats, the six individuals remained during the months of February to April, coinciding with the mating season of the species. After April around two to three manatees continue to be observed. It is possible that the source of freshwater from Rio Colon (Figure 2) and abundant vegetation are the main reasons why these animals have been observed with such frequency.

The National System of Protected Areas in Cuba is an example of an extraordinary government effort to preserve the marine environment of Cuba, with the inclusion of almost 25% of the marine shelf under some sort of protected status (CNAP 2013). However, the mainland of Cuba, located in the southwest of this archipelago, is poorly represented in this system, and more than 250 miles of coastline remain relatively unprotected despite an abundance of potential good habitat for the endangered Antillean manatee and many other imperiled species. The lack of protection is directly corelated to a dearth of knowledge about species in the region. Therefore, it is important to continue monitoring the presence of the species in this coastal area in order to increase the protection of critical habitats.





Figure 1: Manatee sighting in La Coloma coastal community, Cuba.



Figure 2: Rio Colon, La Coloma, Cuba.

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## DOMINICAN REPUBLIC

### For the first time, the Dominican Republic will release rehabilitated manatees

Juana and Pepe are two West Indian manatees (*Trichechus manatus*) rescued in 2012. Juana suffered more than 10 stab wounds as a small calf in the Bayahíbe area, in the southeast coast of Hispaniola island. A fisherman tried to take her away, but it was not possible. She was found injured under a pier, and personnel from FUNDEMAR and the National Aquarium of the Dominican Republic intervened and managed to save her life (Figure 1). Just two months later, in October, a small manatee was reported under similar circumstances, but this time in the vicinity of the Haina River marina, in the Dominican capital.

The National Aquarium's veterinarian in charge of manatees, Francisco de la Rosa, explains that keeping the animals has never been an option, although he considers that there has been resistance to their release due to survival risks.

Handling Pepe and Juana already represented complicated logistics due to their large size, when another young manatee was rescued in 2018, this time in Luperón, in the north coast of the country. Her name is Lupita. Other manatees have been brought to the Aquarium under circumstances that compromised their lives and have not been able to survive.

Under instructions from the Ministry of the Environment and Natural Resources, the first manatee release plan is being promoted, which includes placing a tracking device on each manatee and then carrying out a direct release of Lupita in the Luperón area. This approach is proposed since Lupita already has wildlife experience and has only been in captivity for two years. In the case of Pepe and Juana, a “soft release” will be carried out in Bayahíbe, which implies preparing a confinement pen in the area and completing an adaptation period prior to the release. The reason behind this approach is that Pepe and Juanita have been in captivity for 8 years and they both arrived at the Aquarium at only a few months of age.

In order to implement the project, it is necessary to have work teams in place at both sites to ensure the protection of the released manatees. The proposal is being prepared by the National Aquarium based on existing protocols and similar experiences in Puerto Rico.

In the case of Bayahíbe, marine patrolling must be reinforced and a coastal zone delimited by buoys must be provided, in addition to SENPA personnel with a boat, captain and the tools needed to be able to proceed against any infraction, such as the presence of fishing nets in the zone.

To date, two medical checks have been carried out to assess the health status of the three manatees (Figure 2 and 3), while changes in their diet and feeding method have been implemented. Fruits and vegetables are being gradually replaced by seagrasses, sinking them to the bottom to simulate a seagrass meadow.

The results are encouraging and it is expected that by the end of the year Lupita will be released first, and the other two animals will be sent to a sea pen in Bayahíbe, in preparation to be released before mid-year of 2021.



Figure 1: A visitor watches Juana at the Santo Domingo National Aquarium in October 2020 (Photo: Marvin del Cid)



Figure 2: Veterinarians and specialists perform an electrocardiogram on Lupita during one of the medical interventions in October 2020 (Photo: Marvin del Cid)



Figure 3: Veterinarians and specialists exfoliate and take blood samples from Pepe during one of the medical interventions in October 2020 (Photo: Marvin del Cid)

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## FLORIDA

### Manatee/Green Sea Turtle Behavioral Interactions: Interspecies Play?

The eminent neuroethologist, Theodore Bullock (1986), proposed that play and complexity of social interaction are candidates for establishing a more complete view of animal intelligence than provided by traditional learning theory. A recent review of marine mammal intelligence (Bauer, Cook, & Harley, 2020) revealed a paucity of information on manatee cognition. We make a small contribution to addressing this deficit by reporting on play in an adult, male Florida manatee (*Trichechus manatus latirostris*) and an adult, male green sea turtle (*Chelonia mydas*) housed together at Mote Marine Laboratory where they were observed to interact frequently.

#### Methods

**Subjects:** The Florida manatee, Hugh, was a male, 34 years old, and born in captivity. The green sea turtle, Harry, was rehabilitated after a boat injury in 2007. He lived with Hugh and another manatee, Buffett, from 2009-2019. Both Hugh and Harry were visually impaired.

**Procedures:** Forty-five minute video sessions were recorded between 5/14/19 and 6/17/19 (N=29). Two observers coded interactions independently. We judged interactions between Buffett and

Harry to be incidental (e.g., bumping into each other while engaged in other tasks), so they were dropped from analysis and only Hugh-Harry events were considered.

## *Results*

Preliminary video analysis indicated that both Hugh and Harry participated in the following interactions as shown in these video-captures: flipper-torso touch, face-to-face touch, turtle riding manatee (Figure 1). Face-to-torso touch and tandem swimming (not pictured) were also coded and tabulated. Interactions were initiated and terminated by both animals.

## *Discussion*

These activities might be attributed to a variety of motivations. Hugh might have been treating Harry as a passive enrichment item, but this is at least an incomplete explanation since both the manatee and turtle-initiated interactions. Another possibility is suggested by the similarity with the behaviors Hugh displayed toward Buffett during this observational period, a period of heightened sexual activity. The complexity and eccentricity of the behaviors, however, suggest another alternative: play. The behaviors were consistent with Burghardt's (2005) five criteria for play:

- 1) Limited in immediate function
- 2) Spontaneous, apparently intentional, or autotelic ("done for their own sake")
- 3) Structurally or temporally different than ethotypic behavior
- 4) Repeated but not rigidly stereotyped
- 5) Initiated in an apparently relaxed field (e.g., free from hunger, adverse health, or stressful conditions) or competing systems (e.g., feeding, mating, predator avoidance)

This report provides unusual examples of possible play by both manatee and turtle. Furthermore, it provides rare documentation of manatee and turtle interspecies interaction. Ongoing analyses will expand the number of observed behaviors and breakout the analyses by behavior. Taken within Bullock's framework, these observations provide an unexpected example of cognitive sophistication not traditionally attributed to manatees or sea turtles.





Flipper-Torso Touch



Face-to-Face Touch



Turtle Riding Manatee

Figure 1. Interactions between a manatee and green sea turtle

Table 1: Frequency of interactions initiated, received, and terminated between manatee and turtle.

Initiator	Frequency	%	Recipient	Frequency	%	Terminator	Frequency	%
Harry	11	7	Harry	145	93	Harry	41	35
Hugh	145	93	Hugh	11	7	Hugh	75	65
Total	156	100	Total	156	100	Total	116	100

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<sup>2</sup>Mote Marine Laboratory and Aquarium

### Acknowledgements

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## **Increase of sublethal boat strikes on manatees during winter seasons at Blue Spring State Park**

Most adult Florida manatees can be identified by unique scar patterns (Hartman 1979; Beck/Reid 1995; Beck et al 1982) and scars on manatees have been used to estimate rates of reproduction, adult survival, and population growth (Beck & Clark 2012). In fact, 47 individual scar patterns have even been documented on a single manatee carcass (FWC, pers. communication). Manatee mortality from watercraft has been on the rise in recent years with around 20% of mortalities each year being attributed to watercraft collision, with the exception of years that saw severe red tides or cold events (FWC data). In addition, between 20-25% of manatee rescues each year list watercraft collision as the reason for rescue.

While manatee rescues and mortalities in Florida are well documented, sublethal boat strikes on manatees have not been studied as closely. As stated by O'Shea, "...the number one objective of the Florida Manatee Recovery Plan is to identify and minimize causes of manatee injury and mortality," but the focus has been largely on mortality (O'Shea 2001) and the "incidence of wounding by boats on Florida manatees is probably unparalleled in any marine mammal population around the world." Florida leads the nation with a total number of 961,266 registered vessels in 2019 (FWC report), which does not include vessels that are registered in other states and brought to Florida.

During each winter season at Blue Spring, Save the Manatee Club documents new boat strikes on manatees that are inflicted upon the animals in the course of the season. In recent years we have seen a drastic increase, culminating in 104 manatees sharing 107 boat strikes during the 2019-20 season (Figure 1).

Most new boat strikes occur around the major holidays (Thanksgiving and Christmas), as well as generally after warm spells when the manatees leave the protected sanctuary to forage. Data from 2016 – 2020 indicates that 72.66% of boat strikes occurred to the manatee's back and 15.92% to the tail, indicating that most likely the manatee was trying to dive down or swim out of the way when hit. (Figure 2). Thirty-six percent of strikes were caused by a propeller and an almost equal amount (34.77%) of strikes were caused by a combination of the skeg and propeller (Figure 3).

These numbers are reason for concern. Although Blue Spring is a protected warm water sanctuary for manatees during the winter months and surrounding waters are designated idle or slow speed zones, sublethal boat strikes are increasing. Manatees need to leave the safety of the sanctuary to forage and venture to areas south and north of the spring, including Lake Dexter, Lake Beresford, and Lake Woodruff. Several manatees have recently been observed venturing into the Wekiva River, both during the summer and winter months. This is an area that has little protection, and boaters may not be aware that manatees use the river. With warming winters, manatees seem to spend more time outside the sanctuaries, which would put them at increased risk of being killed or injured from boat collisions. As pointed out by O'Shea, in addition to ethical questions of inflicting wounds on a protected

species, it is unknown if sublethal injuries may inflict problems for reproductive females, therefore affecting the population as a whole. Additional enforcement and education as well as inclusion of sublethal boat strike data for evaluation of the manatee population and manatee protections is urgently needed.

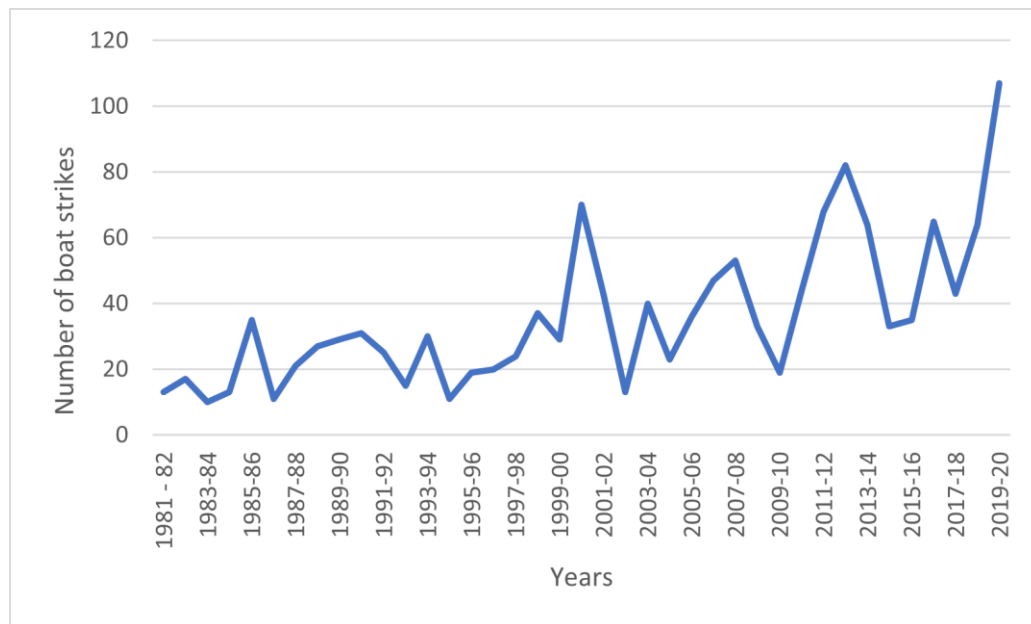


Figure 1: Number of sublethal boat strikes on manatees at Blue Spring State Park during winter season 1981-2020.

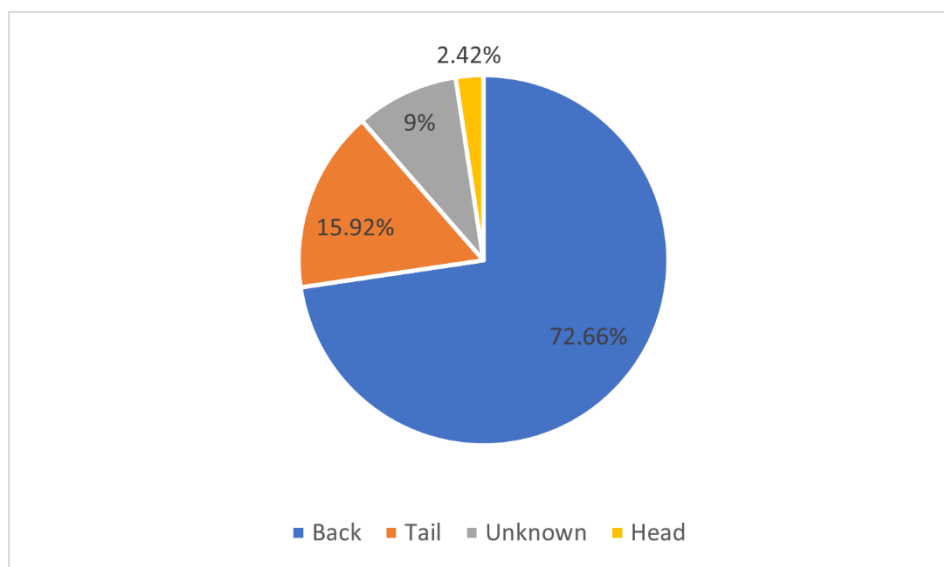


Figure 2: Location (back, tail, head, or unknown) of sublethal boat strikes on Blue Spring manatees 2016-2020.

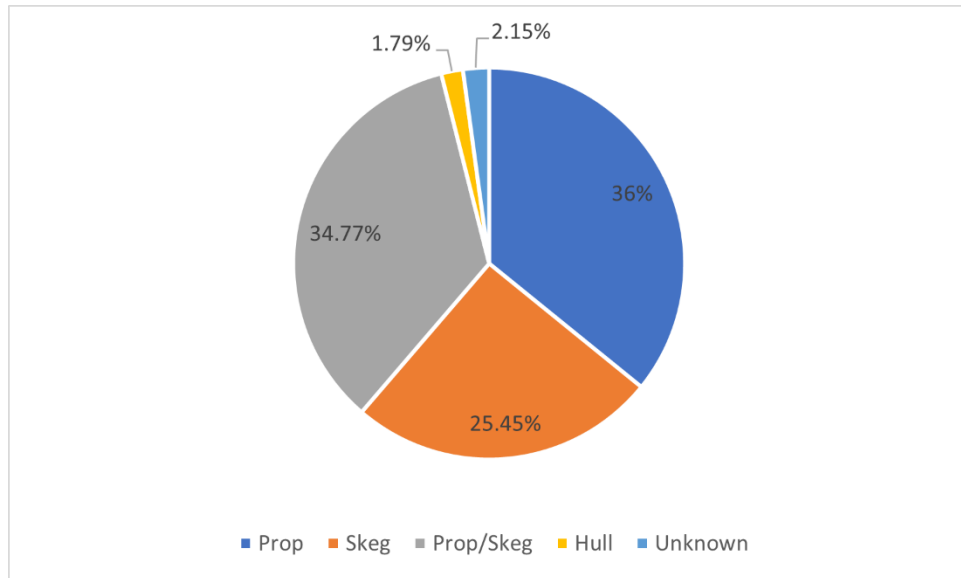


Figure 3: Type (Prop, Skeg, Prop/Skeg, Hull, and unknown) of sublethal boat strikes on Blue Spring manatees 2016-2020.



Figure 4: BS988 'Freya' with a sublethal boat strike injury, inflicted in December 2017 (left) and healed in November 2019 (right). Photos: Save the Manatee Club

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## INDIA

### **First time celebration of 'Dugong Day' in India: a social media campaign to highlight dugong conservation issues in India amidst COVID-19 pandemic**

Dugongs, threatened globally, are regionally endangered in India (Marsh & Sobotzick, 2015). Due to their low population size, fragmented foraging habitats and high negative interaction with fisheries, Government of India has placed them under Schedule-I of the Wildlife Protection Act, 1972 according highest protection status. Further, as a signatory to the 'CMS-UNEP Dugong Memorandum of Understanding', it constituted a 'Task Force for Conservation of Dugongs' for proactive management of dugong habitats and implementation of the Endangered Species Recovery Program for dugongs. In 2015, the Government of India assigned the task to Wildlife Institute of India to conduct scientific monitoring of dugong populations and seagrass habitats, create awareness on dugong conservation and build capacity of frontline agencies to enable dugong population recovery. This program is currently under implementation at all three dugong distribution sites in the states of Gujarat (Gulf of Kutch), Tamil Nadu (Palk Bay & Gulf of Mannar) and Andaman & Nicobar Islands (Sivakumar et al. 2019).

Under the aegis of Dugong Recovery Program, 28th May 2020 was recently celebrated as 'Dugong Day' in India. This was the first time a day was dedicated for dugong conservation awareness anywhere in the world. The significance of the day comes from signing of the CMS-UNEP Dugong MoU by India on 28th May 2008 for the conservation and management of dugongs and their habitats. Due to the ongoing COVID-19 pandemic and restrictions on travel and organizing gatherings, this day was commemorated as 'Dugong Day' with online events conducted over a period of ten days. It included a social media campaign from 19th to 28th May 2020 with the theme of 'Save Dugong and Save Livelihood'. The campaign was organized in collaboration with ENVIS Resource Partner "Wildlife and Protected Area" (<http://www.wiienvis.nic.in>), and it was channelized through social media platforms like Facebook, Twitter and Instagram.

The campaign included daily posting of one infographic poster on dugongs on social media platforms and online painting, slogan and quiz competitions. The painting competition was organized under the age categories, 6 - 13 years, 14-18 years and, 19 years and above to engage people from all age groups. The slogan competition was for all age groups in English as well as four Indian languages of



Hindi, Tamil, Gujarati and Bengali. The quiz competition consisted of 30 questions related to dugongs and marine conservation topics was open for everyone to participate.

The campaign saw an active participation of more than 10000 people from across the country making it one of the biggest events so far on dugong conservation in the country. A total of 2659 people (50.7% male, 49.2% female) participated in the quiz competition and were awarded the quiz participation certificate. More than two hundred entries each were received for slogan (210) and painting (227) competitions. The awareness material generated for Dugong Day celebration can be accessed from the links

[https://twitter.com/CAMPAdugong\\_WII](https://twitter.com/CAMPAdugong_WII)

<https://instagram.com/dugongsforever>

<https://www.facebook.com/dugongsforever>

This event generated huge public interest in dugongs and their conservation issues highlighting the reach of social media platforms for conservation awareness. Since, there is no such day marked for dugong conservation awareness across the world, we may recommend to mark a day as 'World Dugong Day' by the UN as dugong habitats supports livelihoods of millions of people across the world. Dugong conservation goals would benefit by investing in engaging people from different strata of society, improving communication between conservationists and local communities and augmenting environmental education, particularly at the primary school level. Celebrating World Dugong Day at the global scale would bring the focus on threats facing dugongs across its distribution range and would help bring the experiences and lessons on a common platform. Lastly, we urge the Sirenian Specialist Group to consider this idea and initiate mechanisms to host the World Dugong Day from next year onwards.

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## **PHILIPPINES**

### **Simultaneous Dugong Monitoring in Calawit Island, Busuanga, Palawan, Philippines (2020)**

Since 2017, I have been fortunate to be working in partnership with C3 Philippines (an NGO based in Busuanga) and the Nurutan ang Calamian Tagbanua yang Calawit may Quezon (NTCQ). This is a spin off from my 1989-1990 stint as a University of the Philippine Master of Science researcher, when I established a simultaneous monitoring technique for studying dugongs in Calawit Island, Busuanga, Palawan (i.e. Aragonés 1994). In 2010, the Tagbanwa people regained ancestral rights to the area including stewardship and management of their environment and natural resources. This included their desire to protect the dugongs, being part of their traditions and culture, especially since they have been running a dugong watching eco-tourism program since 2017. Moreover, the community initiative of NTCQ to pursue the monitoring program for dugongs has been instrumental for the continuous protection and conservation of this critically endangered marine mammal of the Philippines.

This year, despite this novel coronavirus pandemic, the C3PH and UP-IESM together with NTCQ continued the simultaneous dugong monitoring (SDM) in Calawit Island and other adjacent areas from 23 to 25 July 2020. We were able to proceed as we have trained local Tagbanwa People in the islands (Calawit, Dimipac, and Malatanobon) since 2017. This citizen science approach was first employed in 2015 through C3 Philippines and UP-IESM when we established the Bantay Dugong program in the area. 'Bantay' is a local word, meaning to protect. They were literally filling up forms and submitting reports of sightings, strandings and deaths of dugongs in their areas. We recruited most of these Bantay Dugong rangers to become our observers. To date, we have deployed 70 plus of them to 32 stations (paired observers) we have around these islands. We are now in our 4th year and this year (2020) we are fortunate to be funded by the Marine Conservation Action Fund (MCAF) at the New England Aquarium. The initial results from these annual surveys have been a valuable guide in identifying critical habitats for dugongs in the area. Hopefully, next year I will be able to join them personally and share updates from this year's survey!



Figure 1: Group photo of participants given a short briefing by C3 Philippines personnel who facilitated the SDM this year. Note that the participants were oriented in three groups as the capacity of their community center is small as per COVID-19 protocols in their area. So, the orientation was repeated three times.



Figure 2: Filling up sighting datasheet and showcasing the view from their perspective





Figure 3: Another observer in the same station as they are paired per station

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#### **Acknowledgement**

First, this endeavor is an IP-NGO-Academe collaboration. I am humbled to be entrusted by these people! Photos (all courtesy of C3 Philippines, who facilitated this year's survey)

### **Panay Island complex in the Philippines: An important dugong conservation area**

In the Philippines, the concept of identifying important conservation areas originally used for birds has been applied to terrestrial and marine Key Biodiversity Areas as well as in prioritizing areas for a National Biodiversity Strategy and Action Plan (Ong et al. 2002). This process resulted in the recognition of 23 priority dugong conservation areas including the southern and eastern nearshore zones of Panay Island (Ong et al. 2002).

A decade later, the Red List Status of Marine Mammals in the Philippines included dugong occurrence along the western nearshore zone of Panay Island in (Aquino et al. 2012), although the northeastern portion was no longer included. A much larger area of occupancy along the western nearshore zone was indicated after conducting the Philippine leg of the UNEP-CMS Dugong Catch/By-Catch Questionnaire Survey (Pilcher et al. 2017).

By 2019, dugong presence in the northeastern zone had been reconfirmed (Alquitran, pers. comm). Significantly, this northeastern zone had been devastated by the Category 5 Typhoon Haiyan in 2013.

Meanwhile, as early as 2014, dugong presence had been reported in the northern section of Panay Island (Mondaymorgue 2014). With this reported occurrence, nearshore zones of Panay Island (i.e. southern, eastern, western and northern) now have reported post-Haiyan dugong presence thus indicating that Panay Island (including the associated islands and islets; Figure 1) could be regarded an important dugong conservation area.

Further study will examine if presence of dugongs along the nearshore zones surrounding Panay Island had been a factor in explaining why dugong presence was maintained in the northeastern zone after Typhoon Haiyan.

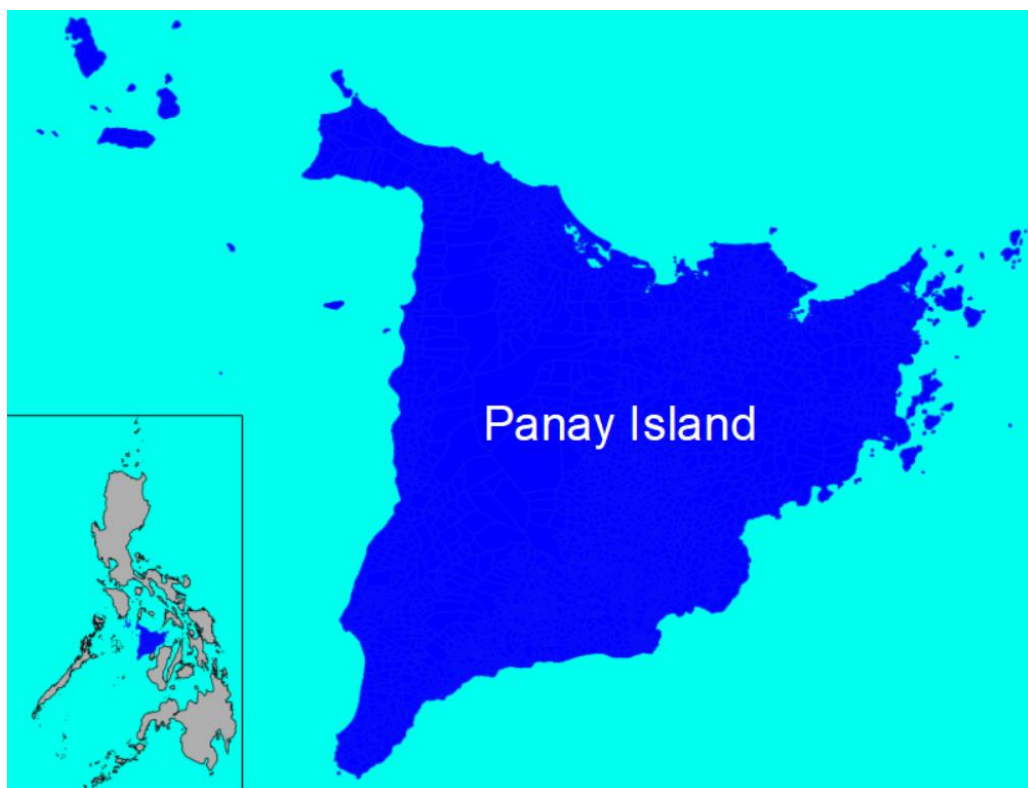


Figure 1. Location of Panay Island showing the associated small islands and islets. Inset shows the central position of Panay Island relative to the Philippine archipelago.

- **Daniel Torres (Independent researcher; 1E-mail: [dantuors@gmail.com](mailto:dantuors@gmail.com))**

#### **Acknowledgement**

Much thanks to Keziel Jade Alquitran for information on dugong strandings in northeastern Panay Island.

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## **Spatial and temporal distribution of orphaned dugong calves reported in the Philippines, 1986-2014: Initial results**

Learning from experiences with orphaned dugong calves may lead to appropriate care protocols, and, perhaps, even orphaning prevention regimes. If a knowledge base is constructed for dugong calves reported from the Philippines, best practices and lessons could be extracted or derived. As a case in point, Thai scientists cared for orphaned dugong calves in 2019 using some techniques devised by a joint Japanese-Philippine team in 1986 (Norikyo 2019).

Initial results of the ongoing literature search are summarized in Table 1. Sex of four calves still need to be clarified, while three were male and two were female. Reported dugong calves peaked in May and October (Figure 1). Meanwhile, Figure 2 helps visualize Palawan Island as having the highest number of calves (3) reported. Two each were reported from Mindanao Island and the Panay-Guimaras islands.

More cases of orphaned dugong calves are expected with an expansion of the literature search. A decade later, the Red List Status of Marine Mammals in the Philippines included dugong.

Table 1. Initial list of reported dugong calves from the Philippines, 1986 to 2014.

	Month	Year	Given "Name"	M/F	Municipality/City	Island	Source
1	Oct-10	1986	"Serena"	F	El Nido	Palawan	Kataoka et al. 1995
2	Jun-08	1992	"Joanna"	F	Culion	Palawan	Kataoka et al. 1995
3	May-06	1993	"Inday"	M	Agnipa	Romblon	Kataoka et al. 1995
4	May	1998	"Bikoy"	?	Puerto Princesa City	Palawan	Aquino (pers. comm.)
5	Oct-20	2000	none	?	Hinatuan	Mindanao	Bryne 2001
6	?	2003	"Klong-klong"	?	Pandan	Panay	Gobuyan 2003
7	Apr-24	2004	none	?	Jordan	Guimaras	Espina 2004
8	Nov-26	2008	"Zam"	M	Zamboanga City	Mindanao	Covarrubias 2008
9	Jan-09	2014	"Binu"	M	Infanta	Luzon	Villanueva 2014

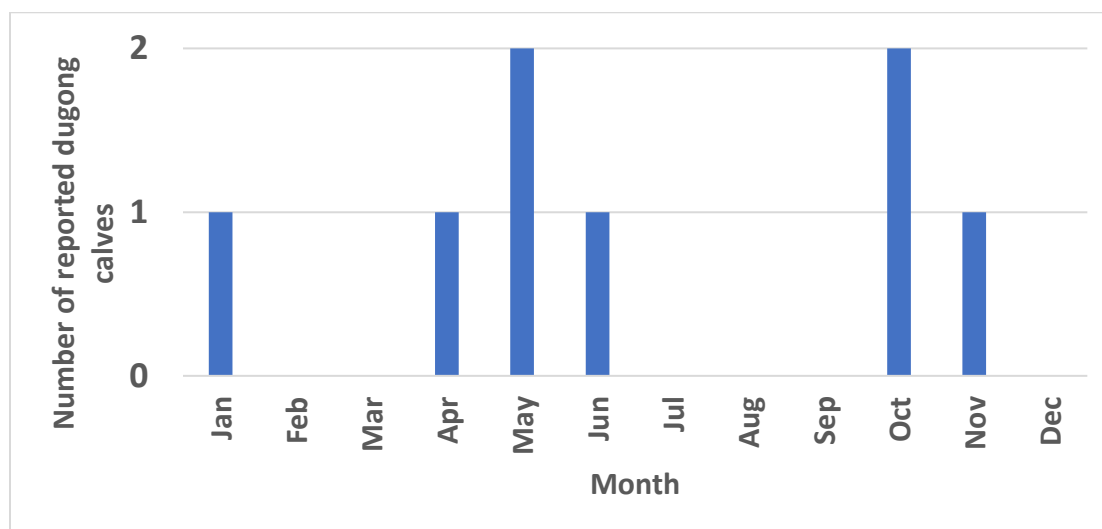


Figure 1: Initial monthly distribution of reported dugong calves from the Philippines.



Figure 2. Initial spatial distribution of reported dugong calves from the Philippines.

- **Daniel Torres<sup>1</sup>, Marie Saballegue<sup>2</sup>**

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## **SOUTHEAST ASIA**

### **Progressing our knowledge of dugong and seagrass distribution and overlaps with local fisheries in Southeast Asia under the Covid-19 pandemic**

Understanding the spatial overlaps between dugong populations and artisanal fisheries is a critical ingredient of conservation responses. This is more so in remote sites in the developing world where resources, technical capacity and funding are limited, yet this is where these overlaps threaten the existence of dugong populations. Dugongs are classified as Vulnerable throughout their range, but it is likely that in vast expanses of their distribution they could be considered Endangered or Critically Endangered sub-populations, given the small population sizes, frequent bycatch in coastal fisheries, and occasional direct takes.

Under the aegis of the Seagrass Ecosystem Services (SES) Project, “Conservation of biodiversity, seagrass ecosystems and their services – safeguarding food security and resilience in vulnerable coastal communities in a changing climate,” Indonesia, Malaysia, Philippines, Thailand and Timor-Leste are spearheading novel and innovative ways to protect seagrass habitats and dugongs, as well as supporting community livelihoods through innovative business models.

In the initial phase of the project the teams have been documenting baseline information on dugongs and seagrass distribution, alongside data on fisheries pressures and spatial coverage. However, as the project was to get underway, the Covid-19 pandemic caused local shutdowns and research teams were confined to their homes, often far from the communities they work with. Undaunted, several teams took up the challenge to learn the techniques via a series of online training courses, and as travel restrictions were slowly relaxed, get out to the communities and gather data. The methodology followed a questionnaire system developed for the CMS Dugong MOU (Pilcher et al.

2017), and the typical two-day in-person course was adapted for online learning. The sessions were kept short to prevent participant fatigue and were spaced over multiple days providing opportunities for participants to trial the questionnaire in-house, then among a small group of fishers, and finally amongst wider coastal communities. The final training session brought the teams together to learn how to upload the data into electronic format, where data analysis is standardized, and through which sharing of files is simplified.

To date, a total of 181 questionnaires in Sangihe and another 80 were delivered in north Sulawesi, Indonesia; 100 in Roxas, Philippines; and 30 questionnaires in Nam Rap, 60 in Mod Tanoy, and 20 in Chao Mai, Thailand. The questionnaires provide immediate feedback on dugong presence, trends, bycatch, direct captures, and fishery activities. Importantly, the questionnaires have a built-in spatial component that allows for rapid visualization of spatial overlaps and potential hotspot areas for dugong bycatch (Figure 1). The questionnaires also expand on our knowledge of seagrass distribution, providing valuable information on important sites for the next steps in the SES Project. These include understanding seagrass ecosystem services and valuation, blue carbon studies, and development of business models that rely on these important ecological services.



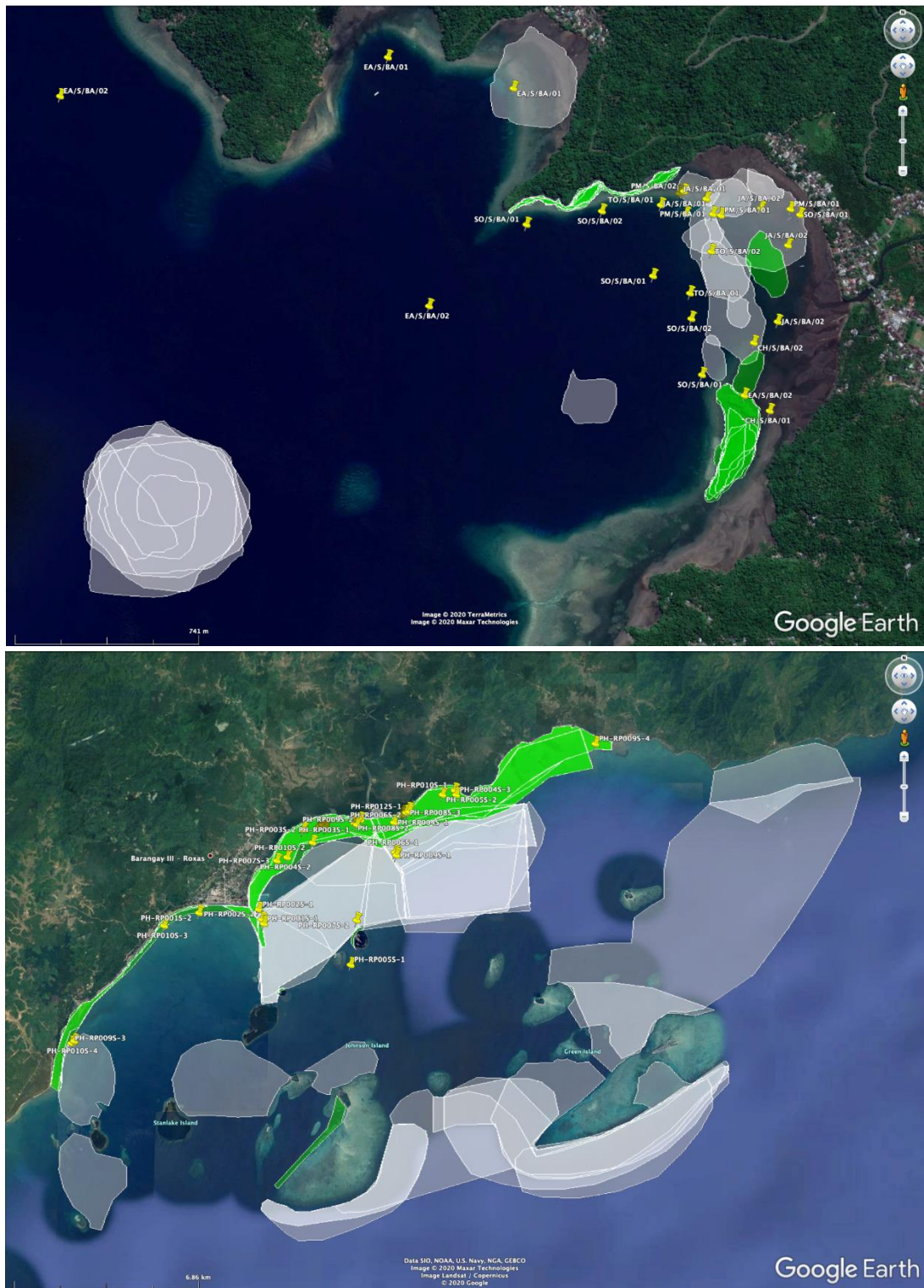


Figure 1: Preliminary spatial data for one village on Sangihe Island (Indonesia; top) and for Roxas, Palawan (Philippines; bottom). Green polygons are reported seagrass habitats, while white polygons are fishing areas. Each polygon represents a response by one fisher. Dugong sightings are shown with yellow symbols. These graphics allow a rapid visual identification of dugong and fishery overlaps. Data sets and graphics courtesy of Yapeka Foundation and C3 Philippines.

**-Nicolas Pilcher<sup>1</sup>, Ami Raini Putriraya<sup>2</sup>, Elisabeth Astari<sup>2</sup>, Reynante Ramilo<sup>3</sup>, Mary Rose Lopez<sup>4</sup>, Wironrong Kuntaro<sup>5</sup>, Maneewan Sanlee<sup>5</sup> & Nicola Piludu<sup>6</sup>**

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### **Acknowledgements**

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<https://doi.org/10.1371/journal.pone.0190021>

## **Regional Seagrass Ecosystem Services Project addresses dugong conservation, food security and climate resilience in five southeast Asian countries.**

The Convention on Migratory Species (CMS) Dugong MoU Secretariat, based in Abu Dhabi, United Arab Emirates, is managing an innovative project to improve the conservation of dugongs and seagrass meadows in Indonesia, Malaysia, Philippines, Thailand, and Timor-Leste. The project, titled 'Conservation of Biodiversity, Seagrass Ecosystems and their Services – Safeguarding Food Security and Resilience in Vulnerable Coastal Communities in a Changing Climate' is funded by the International Climate Initiative (IKI) of the German government and started with a kick-off meeting in January 2020 in Manado, Indonesia, which was attended by representatives from all project partners.

Dugongs and seagrass meadows face several threats, including climate change, coastal development and destructive fishing practices. The project pioneers a holistic approach to community-based conservation, engaging local NGOs and coastal communities in participatory science, policy making and developing business models. Working together with leading dugong and seagrass scientists, the project trains and supports NGOs and communities to deliver ecological assessments, identifying locally important seagrass meadows for dugong conservation and evaluating the ecosystem services they provide. The participatory approach of the project enables local communities to gather data to share and discuss with relevant decision-makers, ensuring that community input is considered

in policy making. In parallel, the project develops alternative business models (spirulina farming, ecotourism and carbon credit schemes) in order to diversify livelihoods and reduce reliance on marine resources, as well as providing a sustainable source of financing for dugong and seagrass conservation.

The partners are adapting to the new restrictions caused by the COVID-19 pandemic, finding new and creative ways to work. Training workshops on methods for dugong and seagrass assessments are being developed and delivered online, building the capacity of local NGOs to conduct fieldwork without relying on international travel. In preparation for the implementation of business models, community assessment surveys are also being developed online, empowering volunteers in project sites to collect key data on their own communities using phone apps. The project is demonstrating how a flexible approach that engages local NGOs and communities and embraces new technology can better respond to external shocks, ensuring the continuity of conservation activities in key sites for marine biodiversity.

#### **-Nicola Piludu and Siri Quade**

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#### **Acknowledgement**

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## **VENEZUELA**

### **Report of the presence of manatees (*Trichechus manatus manatus*) in the westernmost end of the Orinoco river basin in Venezuela: the Apure River.**

A dead adult manatee (*Trichechus manatus manatus*) was reported on July 16, 2020 through social networks, the images show a young adult specimen with no signs of harpooning or the typical lacerations caused by outboard motors (Figure 1, 2). The incident occurred on July 15 in Quintero, a town on the banks of the Apure River located in the Muñoz Municipality of the Apure state, Venezuela, coordinates 7.7889932°, -69.8144623°. This species has been in total ban in Venezuela since 1978, according to Ministerial Resolution No. 127 published in Official Gazette No. 31,570 and considered in danger of extinction according to Decree No. 1,486 published in Official Gazette No. 36,062. Likewise, the Environmental Penal Law published in Official Gazette No. 39,913, contemplates the crimes of illegal hunting and invasion of protected areas for the management of wildlife.

On July 20, 2020, the Venezuelan National Guard arrested a man who was charged by the Public Prosecutor's Office with jurisdiction in environmental with the crime of illegal hunting. The detained citizen said during his statements that the specimen was already dead and in the process of decomposition when he found it in the middle of the river, near the town. After the photos, he

discarded the corpse in the river because he already perceived the smell of putrefaction. During the investigations, the Public Prosecutor's Office could not find any rest of the specimen and the six witnesses interviewed in the same area corroborated the information of the accused, none could identify the sex of the specimen or the way in which he died. The case remains open.

In Venezuela, various studies on the distribution and abundance of *Trichechus manatus manatus* indicate its presence in Maracaibo Lake and the Orinoco River basin. However, the Plan of Action for the Conservation of Aquatic Mammals of Venezuela: freshwater dolphins, otters and manatees 2017 - 2027, reflects that there are information gaps due to the wide extension and spatial heterogeneity of their habitats, therefore systematic investigations are required in the middle Orinoco basin, tributaries such as the Apure River and the Arauca - Orinoco confluence. These information gaps are due to various factors such as economic, logistics and security problems, among others. This event constitutes the most recent report of the presence of *Trichechus manatus manatus* in the westernmost end of the Orinoco River basin in Venezuela, since the reports in Boca del Rio Portuguesa in 1985 and in the Arichuna population in 1992, both sites on the banks of the Apure River. We consider of the utmost importance the support of initiatives that promote strategies that allow deepening the study of this species in Venezuela.



Figure 1: Detail of the head of the manatee (*Trichechus manatus manatus*) found dead floating in the Apure River, near the town of Quintero, Apure state, Venezuela. Author: unknown.





Figure 2: The manatee specimen found dead was recovered by local residents who took photos with the specimen before discarding it in the river due to the smell of putrefaction. Quintero, Apure state, Venezuela. Author: unknown.

**-Silva, Carlos<sup>1, 2</sup>, Ovalle–Moleiro, Leonel<sup>3, 4</sup>**

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<sup>3</sup> Zoológico Leslie Pantin

<sup>4</sup> Parque Zoológico y Botánico Bararida

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## **RESEARCH ANNOUNCEMENT**

### **Call for information: Sirenian vocalizations and acoustic recordings**

Hello fellow sirenian colleagues!

We (Beth Brady, Eric Ramos, and Athena Rycyk) are starting a comparison of sirenian vocalizations from different species and populations. We have several large sets of manatee vocalizations already but would like to incorporate samples from a wide variety of locations. We are hoping to connect with fellow researchers who may also have audio recordings of sirenians (old or recent). To this end, we are asking if you have manatee or dugong vocalizations or recordings in areas manatees/dugongs inhabit that you haven't examined yet to fill out the survey below. This first step is just collecting information about recordings and doesn't obligate you to share your recordings. We would be happy to share the results of the survey with the community. If possible, please fill out the survey before February 1st. Feel free to share this with anyone who may be interested. If you have any questions, please email us.

Survey link: <https://forms.gle/HabFGnYZ1HdnfkeM8>

Beth Brady, [biobbrady@gmail.com](mailto:biobbrady@gmail.com)

Eric Ramos, [eric.angel.ramos@gmail.com](mailto:eric.angel.ramos@gmail.com)

Athena Rycyk, [arycyk@ncf.edu](mailto:arycyk@ncf.edu)

## UPCOMING SYMPOSIA/CONFERENCES

### FIRST AFRICAN MANATEE SYMPOSIUM

## SAVE THE DATE!

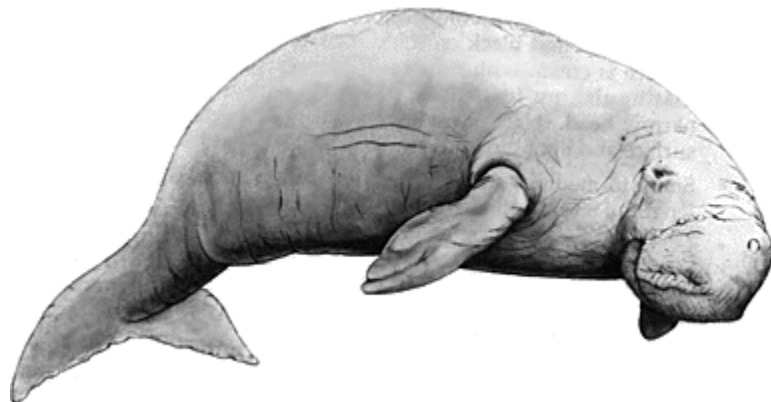
The First African Manatee Symposium  
Will now be ONLINE  
January 18-21, 2021

Organized by



Stay tuned for upcoming details about registration in November at  
<https://africanaquaticconservation.org/symposium/>

For questions, please contact Lucy Keith-Diagne [lkd@africanaquaticconservation.org](mailto:lkd@africanaquaticconservation.org)



**Sirenews – Dugong**  
(End of local news, announcements and upcoming conferences)

## **SYMPOSIA/CONFERENCES**

### **THE 3RD ANNUAL MANATEE RESEARCH SYMPOSIUM**

#### **UNIVERSITY OF FLORIDA**

**SEPTEMBER 10, 2020**

The 3rd Annual Manatee Research Symposium was held on September 10, 2020, in a virtual Zoom format. This all-day event was hosted by the University of Florida Aquatic Animal Health Program, with the purpose to share current research findings in manatee health, medicine, and conservation. Approximately 250 researchers and students from the United States, Mexico, and Central and South America registered to attend this event which consisted of 21 oral presentations representing 12 different institutions.

### **ABSTRACTS**

#### **ORAL PRESENTATIONS**

(in speaking order)

#### **Estimating age-specific survival probabilities for manatees using genetic-identification**

**Timothy Gowan<sup>1</sup>, Michael Tringali<sup>1</sup>, Jeffrey Hostetler<sup>1</sup>, Julien Martin<sup>2</sup>, Leslie Ward-Geiger<sup>1</sup>, and Jennifer Johnson<sup>1</sup>**

Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, St. Petersburg, FL<sup>1</sup>  
U.S. Geological Survey, Wetland and Aquatic Research Center, Gainesville, FL<sup>2</sup>

Survival estimates for Florida manatees have been primarily based on photo-identification data and therefore limited to adults with scar features. In contrast, the genetic identification of individual manatees facilitates the inclusion of younger individuals in sampling while using an identifier (genotype) that can be ascertained at first encounter and does not change over time. We estimated age-specific survival probabilities for manatees in southwest Florida using 10 years of genetic capture-recapture-recovery data while accounting for uncertainty in the assignment of manatee age. This framework can be used to evaluate the impacts of environmental effects and management actions across different age classes.

#### **Requesting Florida manatee biological samples from the U.S. Geological Survey**

**Jason A. Ferrante and Margaret E. Hunter**

U.S. Geological Survey, Wetland and Aquatic Research Center, Gainesville, FL, USA

The USGS Sirenia Project provides biological samples to students and researchers in support of studies that relate to manatee health, conservation, natural history, and management. As a federally listed species, we must adhere to Federal guidelines regarding the use of samples and/or data. To facilitate this process, we have implemented a sample request form akin to others used in the Federal system. The form asks for the specific numbers and types of samples being requested (from the archive or future health assessments), a description of the research, and justification of the methods. This is the primary opportunity for us to gauge whether a project is relevant,

scientifically sound, and meets programmatic goals. This also allows us to maximize the scientific value of our holdings and to reduce the risk of duplicated research efforts, especially when sample loans involve destructive sampling and/or are from archival stocks. Requests are considered on a case-by-case basis, and on occasion, some revisions may be made to the proposed work or samples requested based on the review process. These sample archive procedures allow the U.S. Geological Survey to provide assistance for the recovery of the manatee and advance research of this emblematic species.

## **Genetic status and structure of the Endangered Antillean manatee in Cuba**

**Anmari Alvarez-Aleman<sup>1</sup>, Tom Frazer<sup>3</sup>, Margaret E. Hunter<sup>2</sup>, James Powell<sup>1</sup>, Eddy Garcia Alfonso<sup>4</sup>, James D. Austin<sup>3</sup>**

<sup>1</sup>Clearwater Marine Aquarium Research Institute

<sup>2</sup>U.S. Geological Survey, Wetland and Aquatic Research Center, Gainesville, FL, USA

<sup>3</sup>University of Florida, Fisheries and Aquatic Sciences

<sup>4</sup>Area Protegida "Lanzanillo-Pajonal-Fragoso", Flora and Fauna, Cuba

In coastal waters surrounding Cuba, Antillean manatees have been in peril for a long time, yet, important information about this population is still missing and as consequence, appropriate conservation-oriented management plans have not been fully implemented. We determined the extent of population genetic structuring and characterized the neutral genetic diversity among regions within the archipelago. We found that the nuclear and mitochondrial genetic diversity of the Cuba manatee population is low and the presence of significant levels of inbreeding. Our results indicate also a non-panmixia across the island, with substantial east-west genetic structure.

## **New long read sequencing resources for the manatee genome and transcriptome**

**Ana Conesa<sup>1</sup>, Ali Mortazavi<sup>5</sup>, on behalf of the LRGASP consortium, Maite De Maria<sup>2</sup>, Mike Walsh<sup>3</sup>, David Moraga<sup>4</sup>, Nancy Denslow<sup>2</sup>**

<sup>1</sup>Department of Microbiology and Cell Science,

<sup>2</sup>Department of Physiological Science,

<sup>3</sup>Department of Comparative Diagnostic and Population Medicine,

<sup>4</sup>Interdisciplinary Center for Biotechnology Research; University of Florida.

<sup>5</sup>Department Developmental and Cell Biology; University of California at Irvine.

Alternative isoforms arise from the alternative splicing of transcripts from the same gene and are an important potential source of functional diversity, especially in higher eukaryotes. Traditional short-reads RNA-seq has serious limitations to accurately establish transcript models and alternative isoforms. Long reads sequencing technologies such as Pacbio and Nanopore, applied to transcriptome analysis have the ability of recovering full-length transcripts without the need of an assembly step. This creates great opportunity of the characterization of the complexity of mammalian transcriptomes and for the identification of alternative isoforms. However, the comparative ability of different sequencing platforms and library preparation methods for transcriptome characterization remains to be established.

The LRGASP consortium is setting up a competition to establish the accuracy of long reads sequencing technologies for the annotation and quantification of mammalian transcriptomes. One of the goals of the project is to evaluate long read transcriptome sequencing in non-model and poorly characterized organisms.

As part of this initiative we have obtained Pacbio (one Sequel I and one Sequel II runs) and Nanopore (2 Minion runs) of the manatee white cell transcriptome. In addition, we have obtained one Sequel I run of the manatee genome, which will be used for genome assembly. As today, only a short-reads based genome, of limited

resolution, of the manatee is available, and transcriptome data are scarce too. The LRGASP contest, by involving world-wide bioinformatics experts that will compete for providing accurate transcriptome model, is a great opportunity for defining a high-quality manatee genome and transcriptome. This initiative will allow an in-depth analysis of manatee's transcriptome and the best available genome necessary for projects understanding the consequences of environmental stressors in manatee's immune system such as cold stress, red tide and contaminants.

In this talk, I will present the LRGASP project and these new manatee resources. I will also describe how long read sequencing can be used to unravel complex transcriptional patterns and isoform diversity and infer isoform function. I will present SQANTI, IsoAnnot and tappAS, bioinformatics tools created in the Conesa lab to process, annotate and analyze long reads transcriptomics data.

## **Cold-related Florida manatee mortality in relation to air and water temperatures**

Stacie Koslovsky Hardy<sup>1</sup>, Charles J. Deutsch<sup>2</sup>, Tiffanie A. Cross<sup>3</sup>, Martine de Wit<sup>3</sup>, Jeffrey A. Hostetler<sup>3</sup>

<sup>1</sup>NOAA NMFS Alaska Fisheries Center

<sup>2</sup> Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute

<sup>3</sup> Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, St. Petersburg, FL

The Florida manatee is highly susceptible to cold stress and death when water temperatures drop below 20°C. We sought to characterize the relationship between reports of manatee carcasses with a cold-related cause of death and fluctuations in water and air temperatures in central-east and central-west Florida during the six winters from 2008-2014. We used a generalized linear model to predict counts of cold-related carcasses using various short-term and cumulative heating-degree-day effects and a categorical winter variable. Quantifying the relationship between cold events and manatee mortality helps us prepare for rescue and salvage operations when extremely cold weather is forecast.

## **Effects of the extended dry season and/or El Niño phenomenon on manatees (*Trichechus manatus manatus*) in the Magdalena River basin, Colombia**

Belkis Aguilar Rodriguez<sup>1</sup> and Nataly Castelblanco- Martinez<sup>2</sup>

<sup>1</sup> Fundación Sirenas

<sup>2</sup>University of Quintana Roo

Manatees inhabiting rivers and floodplains are adapted to respond to natural annual depth fluctuations, performing relatively predictable seasonal movements. However, when this dynamic is altered, manatees can become trapped in shallow areas, events that are locally known as 'empozamientos.' The objective of this study was to analyze the incidence of manatee pools (locally known as 'pozas') in the Magdalena River Basin. From reviewing news, archives, and personal records, we collected six manatee's pool events. Since 2003, the manatee groups identified were isolated in perennial waterbodies during the low water season, in four lagoon (known as 'ciénagas') complexes: Tupe-Zarzal, La Bodega, Pancegüita, El Totumo.; and in the lower Lebrija River and the ciénaga Paredes. that the empozamiento events apparently occurs when manatees cannot access their refuges during the low water season, which is likely due to the high levels of sedimentation in these areas. This situation causes vulnerable animals to be stuck and at the mercy of local fishers' opportunistic hunting. In the long term, the loss of connectivity could cause genetic fragmentation of populations. In this work, we seek to make visible the problem of the massive pooling and/or trapping of manatees in the Magdalena basin during a prolonged drought.



## **Understanding spatial patterns of Antillean manatee (*Trichechus manatus manatus*) watercraft strandings and risk from watercraft collision in Belize**

Celeshia Guy<sup>1</sup>, A. Marm Kilpatrick<sup>2</sup>, Donald Croll, Jamal Galves<sup>1</sup>, Nicole Auil-Gomez<sup>3</sup>, Kelly Zilliacus

<sup>1</sup>Clearwater Marine Aquarium Research Institute

The risk and spatial patterns of watercraft stranding were analyzed using twenty-five years of stranding data from 1995 to 2020, seven non-consecutive years of aerial survey sighting data, and fifteen years of boat registration data. A stranding incidence was calculated within twelve analysis zones (A to L) to estimate the risk of watercraft stranding per capita. This analysis confirms that there is a significant relationship between watercraft stranding incidence and the number of boats. Spatial distribution was not uniform, with the highest stranding incidence occurring in Zone D, Belize City.

## **Long-term manatee stranding program in Belize: Can there be a future for Antillean manatees?**

Jamal Galves<sup>1</sup>, Celeshia Guy<sup>1</sup>, Nicole Auil Gomez<sup>2</sup>, Robert K. Bonde<sup>3</sup>, James Powell<sup>1</sup>, Anmari Alvarez-Aleman<sup>1</sup>, Nataly Castelblanco-Martínez<sup>4</sup>

<sup>1</sup>Clearwater Marine Aquarium Research Institute

<sup>2</sup>Wildlife Conservation Society

<sup>3</sup>Sirenia Project, Wetland and Aquatic Research Center, United States Geological Survey

<sup>4</sup>University of Quintana Roo

Twenty-five years of manatee stranding incidents reported by the Belize Marine Mammal Stranding Network were analyzed to understand the patterns of threats associated with this endangered population of the Antillean manatee. Complementary information used in this analysis include locality, age, sex, state of decomposition, and the possible cause of stranding. A total of 502 stranding incidents was reported during the 25-year study period. Eighty-two percent of the incidents occurred within the Belize District. Watercraft collisions accounted for the highest known cause of strandings and is considered the leading cause of anthropogenic mortality for this population in Belize.

## **The Significance of Webcams for Continued Manatee Research at Blue Spring State Park**

Cora Berchem and Wayne Hartley

Save the Manatee Club

Since 2011/2012 Save the Manatee Club is utilizing above- and underwater webcams to complement the almost 40-year long body of in-person manatee research at Blue Spring State Park, Orange City, FL. Webcams provide additional sighting footage, as well as the ability to passively monitor manatees of concern. In addition, usage of webcams during the summer months has provided data on increased usage of the spring run by manatees, including expecting mothers and newborn calves, providing additional information on birthing and rapid calf growth in the upper St. John's River manatee population.

## **Manatee welfare in facilities and the wild: Where are we with standards of care, research in facilities, and our approach with wild manatee welfare and their environment? What the future can hold?**

**Michael T. Walsh<sup>1</sup>, Patrick Rose<sup>2</sup>, Craig Pelton<sup>1</sup>**

<sup>1</sup>Comparative Diagnostic and Population Medicine, Aquatic Animal Health Program, College of Veterinary Medicine, University of Florida

<sup>2</sup>Save the Manatee Club

In the United States and Puerto Rico, there are 10 facilities accredited to hold manatees. In Florida where the majority of manatees are resident, there are four critical care facilities (that also have manatee viewing for the public) and one in Puerto Rico, two zoological institutions that house animals outside of Florida for pre-release as part of the socialization for orphans, long term care or for non-releasable animals due to severe injury. In Florida, manatees are also maintained at three other holding facilities including a natural spring in Homosassa Springs state park. The history of manatees being held in facilities in the United States is short with Miami Seaquarium being the first facility in Florida which supported rescue and rehabilitation efforts as well as exhibiting animals to the public. The need for intensive care due to human induced trauma, and through natural mortality causes, has led to the rapid development of medical treatments and increased understanding of diseases common to this species. The basic requirements for habitats are not determined by welfare of physiologic needs in many locations and improvements in habitat design and holding are needed to insure suitable levels of welfare.

Health assessments of wild manatees give us a window on individual and population health as well as providing access to samples for researchers who may be evaluating health, diet, toxicology, and physiology through omics techniques never applied to the species. Critical care facilities handle and treat many animals each year and offer another complementary opportunity similar to health assessments to better understand the factors influencing the health of wild manatees and their environment. Animals captured for relocation or rescued for injury or intoxication and taken to facilities present year-round and from locations across their range. They represent their populations, unique wild environments, and different seasonal involvement. Developing a system which can leverage all sources of health assessment and sampling will benefit the species in unlimited ways and help to insure their long-term welfare in human care and in the wild.

## **Preliminary findings: First characterization of African manatee (*Trichechus senegalensis*) vocalizations**

**Athena Rycyk<sup>1</sup>, Clinton Factheu<sup>2</sup>, Eric Angel Ramos<sup>3</sup>, Beth Brady<sup>4</sup>, Mumi Kikuchi<sup>5</sup>, Hannah Nations<sup>1</sup>, Emily Garcia<sup>1</sup>, Cecilia Hampton<sup>1</sup>, Karianne Kapfer<sup>1</sup>, and Aristide Takoukam Kamla<sup>6</sup>**

<sup>1</sup>New College of Florida

<sup>2</sup>University of Yaounde I, Department of Animal Biology and Physiology

<sup>3</sup>Fundación Internacional para la Naturaleza y la Sostenibilidad (FINS)

<sup>4</sup>Sirenian International

<sup>5</sup>Japan Manatee Education and Study Lab

<sup>6</sup>African Marine Mammal Conservation Organization

We found that African manatees (*Trichechus senegalensis*), like other sirenian species, produce vocalizations and suggest that passive acoustic monitoring is a powerful tool for better understanding this data deficient, vulnerable species. We recorded over 2,000 African manatee vocalizations from two 3-day periods in Lake Ossa, Cameroon using a remote underwater acoustic recorder. Preliminary characterization of a subset of the vocalizations reveal they are short, have a fundamental frequency around 4-5 kHz, and typically contain multiple harmonics, and

occasionally subharmonics. The high number of vocalizations recorded in a short period suggest this is a highly vocal species.

## **The role of touch in captive and semi-captive Antillean manatee (*Trichechus manatus manatus*)**

**Karen Lucchini<sup>1,2</sup>; Rebecca Umeed<sup>1,2</sup>; Luana Guimarães<sup>2</sup>; Iara Sommer<sup>3</sup>; Bruna Bezerra<sup>1,2</sup>**

<sup>1</sup>Programa de Pós-Graduação em Biologia Animal, Universidade Federal de Pernambuco, Centro de Biociências, Departamento de Zoologia, PE, Brasil

<sup>2</sup>Laboratório de Ecologia, Comportamento e Conservação, Universidade Federal de Pernambuco, Brasil.

<sup>3</sup>Centro Nacional de Pesquisa e Conservação da Biodiversidade Marinha do Nordeste – CEPENE, PE, Brasil.

Tactile signals have been neglected in aquatic animal studies, even being a major modality of communication. We aimed to: investigate the representativeness of tactile behaviors in the activity budget of Antillean manatees; investigate the influence of observational methods to detect tactile behaviors, and of age, sex, and housing conditions in this repertoire. We observed 15 individuals from an oceanarium and semi-captivity in Northeastern Brazil. We detected 17 tactile behaviors (three categories: social, self-maintenance, and environmental exploration). Tactile behaviors represented 14.03% of the activity budget. The observation method influenced the detection of self-maintenance behaviors. Focal animal and ad libitum sampling detected more of those behaviors than scan sampling. Age, sex, and housing conditions influenced differently the performance of tactile behaviors. We recommend a careful choice of the observation method when investigating manatee tactile behaviors and highlight the importance of environmental enrichment.

## **Behavior related vocalizations of the Florida manatee (*Trichechus manatus latirostris*)**

**Beth Brady and Jon Moore**

Florida Atlantic University

Manatees produce five broadly defined call types (squeaks, squeals, high squeaks, chirps, squeak-squeals) but their function in social and nonsocial settings is unclear. In this study, multiple hydrophones were used to record manatee vocalizations in four different environments and broad behavioral states. Vocalizations recorded from resting, cavorting, stressed and feeding animals were subjected to mixed linear effects models to test whether vocalizations produced varied with behavior and demographic. Measures of duration, entropy, and frequency modulation were extracted from vocalizations to investigate if structural parameters differ between behaviors. Results suggest that manatees primarily vocalize using three call types and alter structural parameters depending on behavior. The hill-shaped high squeak was significantly correlated with calf presence. Squeals were proportionally higher during cavorting suggesting they may be related to a heightened state of arousal. Squeaks were significantly longer in duration and higher in frequency modulation when animals were stressed. This research provides a foundation for comparative studies on behavior related vocalizations for manatee species.

## **Epimeletic behavior exhibited by Florida manatees (*Trichechus manatus latirostris*)**

**Sean Tennant<sup>1</sup>, Rebeccah Hazelkorn<sup>2</sup>**

<sup>1</sup>Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute

<sup>2</sup>NOAA, National Marine Fisheries Service

Epimeletic behavior, or post-mortem attentive behavior (PAB), refers to a healthy adult animal giving care or attention to a distressed or dead conspecific. PAB is well documented amongst mammals, including primates, African elephants, sea otters, and cetaceans. The only previously known report of a sirenian exhibiting PAB is

Hartman (1979) in which he described an adult manatee keeping a deceased calf afloat for two days. PAB by a Florida manatee was again observed and documented in June 2019 and the behavior lasted for a minimum of eight hours. This additional observation adds evidence to suggest epimeletic behavior occurs within sirenians.

## **Functional Morphology of Copulatory Organs in the Florida Manatee (*Trichechus manatus latirostris*)**

Dara Orbach<sup>1</sup>, Jonathan Cowart<sup>2</sup>, Patricia Brennan<sup>3</sup>

<sup>1</sup>Texas A&M University-Corpus Christi, Department of Life Sciences, Corpus, Christ, TX

<sup>2</sup>University of Florida, College of Veterinary Medicine, Gainesville, FL

<sup>3</sup>Mount Holyoke College, Department of Biological Sciences, South Hadley, MA

Sexual selection is the primary force that drives gross morphological variation of genitalia in many species. As the most direct mechanical interaction between the sexes occurs during intromission, genital coevolution is hypothesized to be present. We assess how female and male copulatory organs have coevolved in the Florida manatee (*Trichechus manatus latirostris*) using multi-faceted techniques that provide a comprehensive view of the morphology and potential fit of these organs. We assess the gross morphology, copulatory fit, and biomechanics of the vagina and penis. Florida manatees have distinctive genital forms among mammals. The vagina is thick-walled, with two distinct chambers that divide the structure into a caudal region and a cranial region. The connecting channel between these two chambers is comparatively narrow. The penis shaft has an inflatable bulbous structure in the middle, that narrows again before terminating in a broad glans with an asymmetric ridge that is very firm. Three-dimensional endocasts of the vaginal lumen and computed tomography scans of the penis penetrating the vagina indicate a close genital shape correspondence between the sexes, an optimal angle of penetration, and a potential lock-and-key mechanism. The bulbous shaft structure may distend in the caudal vagina, while the glans may distend in the cranial vagina, producing an extremely tight fit between the male and the female. Biomechanical testing of the regional stiffness of vaginal and penile tissue and of the forces produced during intromission will assist in elucidating the relationship between form and function. Our research contributes to understanding coevolutionary mechanisms of sexual selection with applications to species conservation in captive breeding programs.

## **Manual collection and semen characterization in a West Indian manatee (*Trichechus manatus*)**

Jonathan R. Cowart<sup>1</sup>, Danielle M. Collins<sup>2</sup>, Antonio A. Mignucci-Giannoni<sup>3,4</sup>, Tamara Alejandro-Zayas<sup>3</sup>, Antonio L. Rivera-Guzman<sup>3</sup>, Iskande V. Larkin<sup>1</sup>

<sup>1</sup> Aquatic Animal Health Program, University of Florida College of Veterinary Medicine, Gainesville, FL, USA

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<sup>3</sup> Caribbean Manatee Conservation Center, Inter American University of Puerto Rico, Bayamón, PR

<sup>4</sup> Center for Conservation Medicine and Ecosystem Health, Ross University School of Veterinary Medicine, St. Kitts, West Indies

Limited information is available regarding male reproductive physiology in West Indian manatees (*Trichechus manatus*). Currently, no reports evaluating any seminal characteristics exists in this species. To fill an apparent gap in knowledge, ejaculate samples were collected and characterized from a single, adult West Indian manatee. Samples were analyzed for the following semen parameters: volume, agglutination, pH, osmolality, viscosity, concentration, total sperm number, motility and kinematic parameters, morphology, plasma membrane integrity, acrosome integrity, chromatin maturation, and chromatin condensation. These results are the first of their kind for this species and suggest high semen quality, based on multiple ejaculates, in this male West Indian manatee.

## **Development of a mass spectrometry-based approach to measure Florida Manatee (*Trichechus manatus latirostris*) sex steroid hormones in plasma**

Elizabeth Brammer-Robbins<sup>1,2,4</sup>, Mohammadzaman Nouridelavar, Nancy Denslow<sup>1,2</sup>, Iske Larkin<sup>4</sup>, Chris Martyniuk<sup>1,2,3</sup>

<sup>1</sup>Department of Physiological Sciences, College of Veterinary Medicine, University of Florida, Gainesville, Florida, USA

<sup>2</sup>Center for Environmental and Human Toxicology, University of Florida, Gainesville, Florida, USA

<sup>3</sup>Genetics Institute, University of Florida, Gainesville, Florida, USA

<sup>4</sup>Aquatic Animal Health Program, Veterinary Medical Center, University of Florida, Gainesville, Florida, USA

**Introduction:** Understanding reproductive status and physiology of the Florida manatee (*Trichechus manatus latirostris*) is important for species conservation. Florida manatees are classified as threatened under the Endangered Species Act and building a strong foundation of manatee reproductive physiology is essential for long term population management. We are currently optimizing an LC MS/MS based approach to determine the concentrations of sex steroid hormones in the blood of wild individuals.

**Methods:** Plasma samples (2ml) were collected from seven healthy adult manatees (2 males, 5 females) from Crystal River, FL during the annual Manatee Health Assessment conducted by the United States Geological Survey (USGS) Sirenia Project.

**Results:** Male and female plasma were pooled and steroids determined. In wild males, we detected 3.97 ng/ml cortisol, 0.017 ng/ml progesterone, 0.015 ng/ml 17-hydroxyprogesterone, 0.066 ng/ml aldosterone, and 0.013 ng/ml estrone. In wild females, we detected 3.21 ng/ml cortisol, 7.32 ng/ml progesterone, 0.022 ng/ml 17-hydroxyprogesterone, 0.042 ng/ml aldosterone, and 0.014 ng/ml estrone. The pooled female samples included three pregnant manatees.

**Discussion:** This rapid method to measure steroids will generate important baseline data for plasma hormone concentrations in healthy male, and pregnant and non-pregnant female manatees for future use in reproductive physiology studies. Sex differences will also be determined for plasma steroid levels.

**Conclusion:** This research will contribute to the limited, but growing collection of data on Florida manatee reproductive physiology. Reproductive health information is crucial to informing management efforts and conservation policies; therefore, this information will improve strategies and is expected to contribute to the preservation of this unique and valuable species.

## **Evaluation of Serum Protein Electrophoresis and Serum Amyloid A in Florida Manatees (*Trichechus manatus latirostris*) Maintained in a Rehabilitation Setting**

Mónica Galván Alma

University of Miami, Department of Marine Mammal Biology

The Florida manatee (*Trichechus manatus latirostris*) is federally threatened and exposed to a variety of threats and resulting health issues, often requiring human intervention. However, many of the common diagnostic indicators of inflammation in animals (e.g., temperature and WBC) are limited in efficacy in manatees, necessitating the identification of alternative diagnostic markers. Acute phase proteins (APPs), generated as part of the acute phase response (APR), have been noted to be a potentially useful biomarker in manatees by Harvey et. al. (2018) and Harr et. al. (2006), and the goal of this study was to elaborate upon their work.

Accordingly, serum protein electrophoresis measurements of albumin/globulin ration, alpha-1, alpha-2, and beta globulins were evaluated by Antech Diagnostics, and Serum amyloid A measurements were conducted utilizing serum samples analyzed by the University of Miami Avian & Wildlife Laboratory. The study subjects were divided into broad categories as follows: diseased, healthy, and expired (excluding serum amyloid A analyses).

Slight, but insignificant increase in the alpha-2 and beta globulin fraction were observed for diseased and expired manatees. On the other hand, a significant decrease in albumin/globulin ratio was observed in diseased and

expired manatees. There was a significant increase in serum amyloid A among diseased manatees when compared to healthy subjects. This further validates the effectiveness of serum amyloid A quantitation in detecting inflammation on manatees. The use of serum amyloid A in conjunction with plasma or serum albumin/globulin ratio seems to be promising for the detection of inflammation when there is suspicion of a false negative result.

## **Exploration of novel PFAS extraction techniques from dried blood spots for prospective marine mammal health assessments**

**Emily K. Griffin<sup>1,2</sup>, Juan J. Aristizabal-Henao<sup>1</sup>, John A. Bowden<sup>3</sup>**

<sup>1</sup>Department of Physiological Sciences, College of Veterinary Medicine, University of Florida

<sup>2</sup>Aquatic Animal Health Program, University of Florida.

<sup>3</sup>Center for Human and Environmental Toxicology, University of Florida

Marine mammals, such as the West Indian manatee, can serve as informative environmental sentinels both for the presence and effect of anthropogenic chemicals, such as per- and polyfluoroalkyl substances (PFAS). Dried blood spots (DBS) are increasingly used in clinical research to measure biological markers and their associations with diet, stressors, and pathophysiological states. DBS offer the potential to reduce human interaction and amount of biological material that must be collected during routine health assessments of endangered or threatened species. In this study, we examined five extraction techniques to determine the optimal analytical method for PFAS profiling in DBS from Florida manatees.

## **Florida manatee exposure to glyphosate and immune consequences**

**Maite De Maria<sup>1,2</sup>, Natalia Garcia-Reyero<sup>3</sup>, Kevin Kroll<sup>1</sup>, Mike Walsh<sup>4</sup>, Cecilia Silva-Sanchez<sup>5</sup>, Jeffrey Abbot<sup>4</sup>, Catherine J. Walsh<sup>6</sup> and Nancy Denslow<sup>1</sup>**

<sup>1</sup>Department of Physiological Science, University of Florida.

<sup>2</sup>Aquatic Animal Health Program, University of Florida.

<sup>3</sup>United States Army Corps of Engineer.

<sup>4</sup>Department of Comparative, diagnostic and Population medicine, University of Florida.

<sup>5</sup>Center for Environmental and Human Toxicology, University of Florida.

<sup>6</sup>Marine Immunology Program, Mote Marine Laboratory

Florida Manatees drink fresh water and they rely on freshwater refuges during winter when they can be exposed to runoff agricultural contaminants. Glyphosate, the most used herbicide worldwide is present in their plasma and chronically in the water of South Florida (Caloosahatchee River and St Lucie Canal). We are analyzing the mechanism of toxicity of glyphosate in manatee's lymphocytes in combination with changes in gene expression and immune response with in-vitro assays. We are detecting a dose-dependent formation of reactive oxygen species and expect to see reduced proliferation capacity and to identify the most sensitive gene pathway of glyphosate toxicity.

## **Investigating the Influence of Glyphosate Pollution on Manatee Forage Quality**

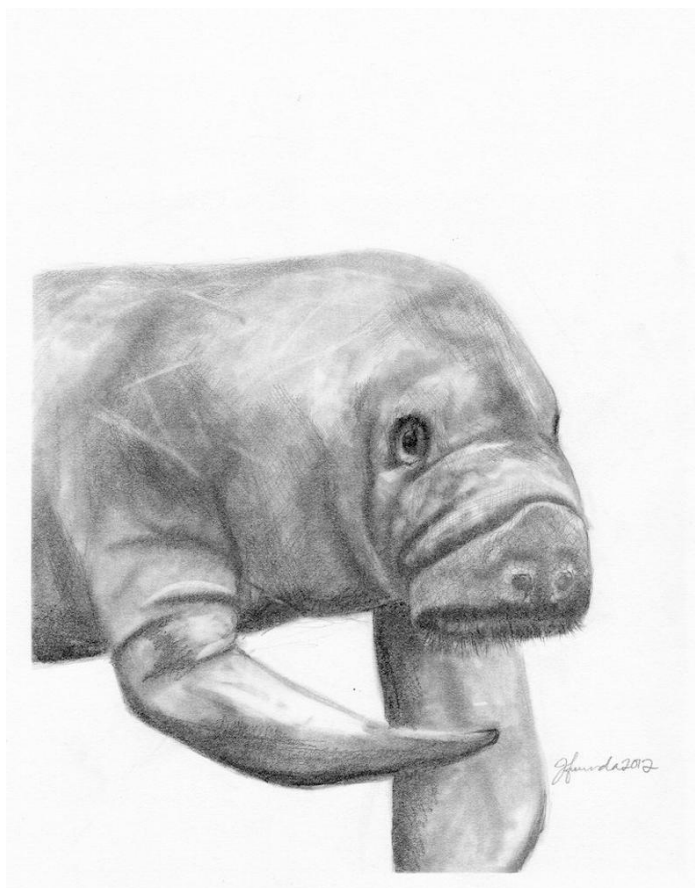
**Megan Opincarne**

University of Florida

Glyphosate-based herbicides (GBH) are intensively used in Florida to control aquatic and agricultural weeds, and to ripen sugarcane. Our lab has discovered that Florida manatees are being exposed to glyphosate; however, the mode of exposure remains unknown. Because non-target plants are known to accumulate glyphosate, we infer



that diet could explain manatee exposure. We devised a study to assess uptake of three GBHs by *V. americana*, a submerged plant and preferred manatee food. Along with GBH uptake, we will analyze inhibition of biosynthetic pathways responsible for forage quality (vitamin and antioxidant content) which are known to be impaired by glyphosate exposure.



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

## RECENT GRADUATE STUDENTS COMPLETED PROJECTS

### **The Use of Multiple Sensory Modalities by the Antillean Manatee (*Trichechus manatus manatus*) To Locate Food in Their Natural Environments**

**Amanda Marie Moore**

Master of Science in Biology

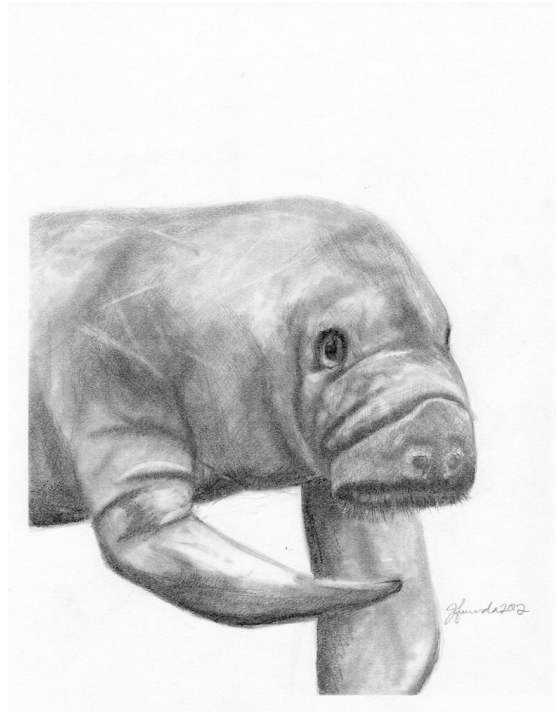
College of Arts and Sciences, Andrews University

2020

**Abstract:** Manatees are herbivorous aquatic mammals found in the coastal and inland waters of the Atlantic Ocean. All three manatee species are currently listed as vulnerable on the IUCN red list and there still remains much unknown about their ecology. It is currently unknown what sensory modalities manatees use to locate their food in the wild. A literature review of the Paenungulata clade (sirenians, proboscideans, and hyracoideans) was conducted in order to compare and contrast what is known about the sensory modalities of the clade, to better understand the sensory modalities of manatees, particularly the ones they use to locate their food. Manatees have a higher frequency range for hearing than elephants, who have the best low-frequency hearing range known to mammals; hearing range of hyrax is unknown. All members of Paenungulata have vibrissae assisting in tactile abilities and potentially compensate for other senses such as hearing or vision. The ability to smell in manatees and hyrax is unknown, but elephants have been found to have an excellent sense of smell. Manatees, elephants, and hyrax have dichromatic vision. A preliminary experiment was designed to test manatee feeding modalities in the wild. The objectives of this study were to determine if the proposed methodology, modified for an aquatic environment from Renda & Roux (2017), was capable of testing manatee sensory use by limiting the sensory cues provided. Sensory modalities used in locating food were tested in two ways: when they know where the food is located, within a short distance, and when the food is placed randomly throughout their habitat, at long distances. In this study, we were able to show that the experimental design works, and provide preliminary data. In the short distance dichotomous choice trials, the percent of correct choices were 67% for the chemoreception + vision, 60% for chemoreception only, and 60% for vision only, with 50% being the rate of chance. For long distance experiments, the mean minimum time in hours it took manatees to consume the food placed randomly along their habitat of San San-Pond Sak River, Panama was 12.0 hours for chemoreception + vision, more than 22 hours for chemoreception only, and 6.89 hours for the control (no box). Due to the small sample size, no definitive conclusion could be made as to which sensory modality manatees use to find food, but our results support the idea that manatees use multiple modalities, chemoreception + vision, to locate food. Additional trials are needed in order to perform statistical analysis on the data.

Moore, Amanda Marie. 2020. The use of multiple sensory modalities by the Antillean manatee (*Trichechus manatus manatus*) to locate food in their natural environments. MS Theses, Andrews University, Berrien Springs, Michigan 183pp.

Recent and future plans: After my master's degree I enrolled in a PhD program in biology at Loma Linda University, Loma Linda CA.



### **Sirenews – Florida manatee**

(Last page of graduate students completed projects)

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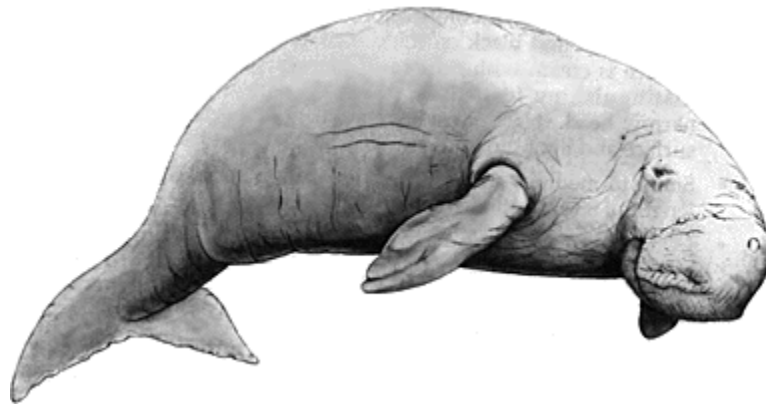
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**Sirenews – Dugong**

**NOTES FROM THE EDITORS:** We would like to thank all of those who have contributed articles for *Sirennews*. 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: April 1, 2021**



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