# Sirenews

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## IN THIS ISSUE:



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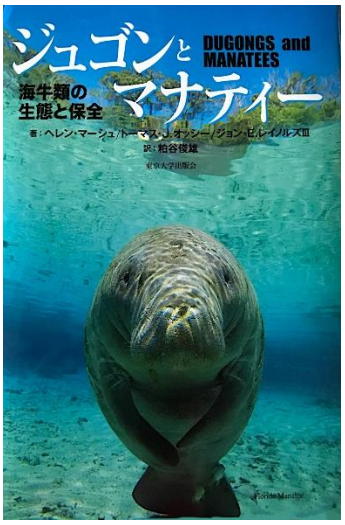


**Ecology and Conservation of the Sirenia: Dugongs and Manatees by Helene Marsh et al. (2011) translated into Japanese by Toshio Kasuya and published by the University of Tokyo Press in 2021.**


UNION INTERNATIONALE POUR LA CONSERVATION DE LA NATURE ET DE SES RESOURCES
INTERNATIONAL UNION FOR CONSERVATION OF NATURE AND NATURAL RESOURCES
Commission de la souvegarde des especes - Species Survival Commission

SSC Species Survival Commission

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CLEARWATER MARINE AQUARIUM RESEARCH INSTITUTE

## Note from Sirenia Specialist Group Co-Chairs:

Donna Kwan leaves the Secretariat of the Dugong MOU

After 12 years in the lead role, Donna Kwan has resigned from the Secretariat to the Convention on the Conservation of Migratory Species of Wild Animals (CMS)-Dugong Memorandum of Understanding (MoU) administered by the United Nations Environment Programme (UNEP) in Abu Dhabi to return to Australia. A feature of Donna's time in this role was her leadership in implementing the Dugong MoU Conservation and Management Plan (CMP) through large-scale projects in dugong range states in developing countries funded by the Global Environment Facility and the IKI Seagrass Ecosystem Services Project. These projects have greatly increased the capacity of local people to conserve local dugongs and seagrass habitats. Even though Donna has small feet, she leaves big shoes to fill and will be greatly missed.

**Helene Marsh and Anmari Alvarez Aleman**

## Chapter 10 in Ecology and Conservation of Sirenia:

*Ecology and Conservation of the Sirenia: Dugongs and Manatees* by Helene Marsh et al. (2011) was translated into Japanese by Toshio Kasuya and published by the University of Tokyo Press in 2021. In addition to chapters 1 to 9 of the English version, the Japanese version contains an additional chapter 10, Dugongs of Okinawa (p.397-434) written by Toshio and Taro Hosokawa.

*Chapter 10. Dugongs of Okinawa, an abstract*

10.1 Origin of the common name, and 10.2 Contact with Japanese people

The Nansei Shoto [South West Islands] is an island chain that lies between NE Taiwan and southern Kyushu (latitudinal range of 24.5º-31ºN), and consists of Yaeyama Islands (ca.24º-24º20'N), Miyako Islands (ca.24º20'-24º30'N), Okinawa Islands (ca. 26ºN-26º30'N), Amami Islands (ca.27º20'N-28º30'N) and Osumi Islands (ca.28º30'N-31ºN). The Okinawa Islands are located near the middle of the Nansei Shoto and consists of Okinawa Island and several smaller islands. "Okinawa" is often used for "Okinawa Prefecture", which consists of the Okinawa Islands and other island groups further south.

The people of Okinawa called dugongs Zan or Ke-ba (Marine Horse). The former probably originates from Duyung in the Malaysian language. The current Japanese name Jugon reflects the term Dugong used in a German zoology book in 1815, when the species was believed to be common in the Nansei Shoto [South West Islands] area of Japan.

Since the 7th century, people on the main islands of Japan occasionally recorded Ningyo (human-like fish) from marine and freshwater habitats from northern Kyushu (33ºN) to Aomori (41º30'), the northernmost Japanese territory of the time. This northern distribution suggests that Ningyo had nothing to do with the dugong.

10.3 Duong hunting in Okinawa

10.3.1 Prehistoric time (up to 12th century)

Products (tools and ornaments) made of dugong bone have been found from numerous archaeological sites. The hunting method is unknown.

10.3.2 Under local rule (up to 1879)

The people of this time on several islands had ballads of dugong hunting using a net. The people of Aragusuku Island paid tax with dugong meat. They placed a net across a channel leading to feeding trails inside of the reef, and caught dugongs that visited there at night. There is no evidence of hand-held harpoons being used in dugong fisheries (the possibility of this happening has not been eliminated). This taxation system ended around 1880, but dugong hunting by local people continued.

10.3.3 Under Japanese government (to 1940s)

In 1879, the Japanese government obtained full control of the entire Nansei Shoto area, including the Okinawa Islands. Aragusuku Island is part of the Yaeyama Islands.

Dugong meat taxation ended with Japanese occupation, but hunting of dugongs continued using "explosives." Although the use of explosives was banned in 1903, hunting of dugongs remained legal. Therefore, explosive hunting probably went underground, which is suggested by newspaper articles that reported fishermen injured by explosives (reports continued to 1940).

Statistics of dugong hunting are available in fishery statistics of the Okinawa Prefecture dating from 1893. They recorded a take of a total of 332 dugongs from 1893-1916, zero catch for 1917-1920; there are no records since 1921. Most of the catch (247 dugongs) were from Yaeyama Islands, followed by the Okinawa Islands (60) and Miyako Islands (25). A peak catch of 33 dugongs was recorded in 1909.

10.3.4 and 10.4.1 During and after World War II

The Okinawa Battle of March to May 1945 could have caused considerable damage to the dugong population of Okinawa, but the magnitude of such damage has not been evaluated.

After the war, using explosives left in the battlefield, people of the Nansei Shoto caught dugongs as well as fish for their own consumption and for selling. The results of these operations are not in the official statistics.

Kasuya and his group surveyed Nansei Shoto south of Okinawa Islands in 1979 and 1998-1999. The second more extensive survey confirmed several dugongs surviving in the coastal waters of the Okinawa Island and feeding trails.

Records for post-war dugong hunting are almost absent. More or less reliable records of incidental mortality and intended killing are available since 1950, which recorded 34 dugongs including animals found in fishing gear and later released (Table 10.3). The geographical range of these incidents covered the entire latitudinal range of the Nansei Shoto, and the incidents included intended captures (3 animals), found in trap nets (9 animals), taken in gillnets (7 animals), found drifting/stranded (14 animals), and unknown cause (1 animal).

10.4.2 Fate of remnant population around Okinawa Island

This finding of a remnant dugong population around Okinawa Island occurred almost at the same time with the plan of constructing a military air base around Henoko Point near the middle of dugong habitat on the east coast of Okinawa Island. In 2001, the Ministry of Environment started surveying seagrass meadows and dugongs around Okinawa Island and confirmed the presence of three individuals (later identified as A, B, C) and possibly another two unidentifiable individuals. The Okinawa Defense Bureau undertook monitoring as a part of their activities to identify the effects of the air base construction on the surrounding environment, including dugongs. Because their survey was

limited to coastal waters of the Okinawa Island (and did not cover other islands), we have no information on destination of the individuals that disappeared from the Okinawa Island area.

(1) Unidentifiable dugongs: Such individual(s) were last recorded in October 2018 on the west coast of Okinawa Island.

(2) Dugong A: This individual was likely an adult male, and was identified for 15 years (November 2003 to September 2018). During 2007-2014, before the construction started, this individual spent daytime hours near the coral reef in front of Kayo Beach (maximum length of the beach is about 8 km) usually within 1 km from the reef edge (at most within 3 km). Its night feeding on Kayo Beach inside of the reef was confirmed using photography.

Activities associated with the heliport construction began in 2015 including seabed boring (from August 2014), concrete block setting (from January 2015) and other construction activities (from October 2015). The Okinawa Defense Bureau confirmed in January-November 2015 that Dugong A abandoned western 3x3 km portion of his daytime area (no change in the eastern range). After a temporary pause in the construction activities from March 2016 to January 2017, construction of the embankment started in April 2017 and filling inside the embankment started in December 2018. Data reported by the Okinawa Defense Bureau for February 2017 to January 2018 revealed that the range of daytime locations of this Dugong A moved further eastward by 3.5 km and 5 km offshore from reef (within 1 km) and that his weight decreased). The eastward shift of the day-time range would not benefit night time feeding of the animal because there are no seagrass meadows to the east of Kayo Beach. Dugong A was last sighted in the Okinawa Island area in September 2018.

Above observation indicates that Dugong A shifted location by about 3.5 km eastward and 2 km offshore, perhaps to avoid the construction noise. Okinawa Defense Bureau estimated construction noise levels of over 100 dBre: 1µPa off Kayo where Dugong A used to spend his daylight hours. (We believe that the calculated noise levels should have been confirmed with actual measurements, but this was not done.) This calculated noise level was over the minimum level where dolphins are likely to alter their behavior (80 dBre: 1µPa). We suggest that Dugong A probably shifted the daytime location apart from the construction cite while using the same nighttime feeding site, but with increasing noise level it finally abandoned this habitat and moved somewhere else.

(3) Dugong B: This individual is the mother of Dugong C. The weaning process is analyzed below. This individual was first identified in February 2005. She lived mostly off the west coast of Okinawa Island, but was also sighted on the northern part of the east coast. When found dead due to a ray injury on the west coast of Okinawa Island on 18 March 2019, she measured 290cm in body length and 480.3kg in body weight. She had only left tusk erupted.

(4) Dugong C: This animal was a calf of Dugong B, and made occasional movements between the east and west coasts of Okinawa Island. This individual had 12 sighting records within and near the entrance of the Oura Bay, including two records in May and June 2009. Therefore, this individual was thought to have probably created feeding trails that continued to exist within the Oura Bay till July 2014. These seagrass meadows were abandoned from August 2014, when seabed boring started.

Dugong C left the east coast to move to west coast in September 2014, and disappeared from Okinawa Island area in June 2015.

Note: Henoko Point is located in around 26º31'N, 128º03'E at southern corner of entrance of the Oura Bay. This bay extends to north-west direction for about 5 km and has southward opening of 5km width. On the northern corner of the entrance there is a Kayo Beach where the Dugong A used to feed in night. Thus, distance between the location of air base construction and the Kayo Beach is about 5km.

10.5.1 Daily movement of adults

Using helicopters, the Ministry of Environment and Okinawa Defense Bureau followed behavior and locations of several individual dugongs. Some of them (e.g. Dugong A) showed small movements (4-5 km during 3.5 hours of observation to 7.7 km during 8 hours of observation), others showed considerable unidirectional movements. Using the latter data, we estimated their cruising speed at 2.6km/hr. to 4.0km/hr.

The cruise distance, via northern coast, between habitats on the west coast of Okinawa Island in 26º49'N and the east coast habitat in 26º25'N (both are recently confirmed southernmost habitats) is about 100 km, which could be travelled by dugongs in one or two days' period.

10.5.2 and 10.5.3 Mother-calf bond

In order to confirm mother-calf bond reported for dugongs in other area, we attempted to analyze the weaning process of a suspected mother (Dugong B) and calf (Dugong C) pair. We do not have definite evidence of Dugong B and C being mother and calf, but Dugong C was apparently suckling when they were first sighted on 25 February 2005. Its date of birth is unknown. We classified their sighting records into three types to analyze weaning process.

[BC]: The two individuals were found within distance of 10m or 3 body lengths during each encounter from 25 Feb. 2006 to 5 Feb. 2009 (one record of 2015 was omitted because it is likely other kind of social behavior).

[BC] + [B/C]: Both cases of "close association of two individuals [BC]" and "distance of over 10 m and less than 2 nautical miles [B/C]" were recorded during period of single encounter. This was recorded from 25 March 2008 to 18 Jan. 2009.

[B/C]: Distance between the two individuals was over 10 m and less than 2 nautical miles during each single encounter. This behavior was recorded from 11 April 2008 to 7 Feb. 2009 (one record of 2014 was omitted because it is likely other kind of social behavior).

[B] or [C]: Only one of the two individuals was sighted, which occurred from 21 May 2008.

Length of single encounter ranged from 26 minutes to over 10 hours. From the above we concluded that weaning is a slow process and mother/calf bond can last 3-4 years if the process is not interrupted by the mother having a subsequent conception.

10.5.4 Habitat acquirement of calf

Calves of Florida manatees seem to learn their habitat from their mothers, and dispersal to other habitat is uncommon. We considered such behavior unusual, and analyzed the sighting records of Dugongs B and C available from Ministry of Environment and Okinawa Defense Bureau to confirm it also occurred in Okinawa dugongs. Locations of these individuals were plotted for three separate periods of weaning (Fig. 10.3),

(1) 25 Feb. 2005 to 18 May 2008 when only [BC] or [B/C] was recorded (we had limited quantity of data for this period);

(2) 21 May 2008 to 7 Feb. 2009 when all of the [BC], [B/C], [B], [C] were recorded;

(3) 16 May 2009 to 21 May 2014 when either [B] or [C] was recorded.

It is evident from Fig. 10.3 that the dugong calf used habitat inherited from its mother plus additional habitat explored by itself.

10.6 Dugong conservation in Japan

Although we are uncertain if the Japanese dugong was listed earlier as a natural monument, we know that the Local Government of Okinawa listed the dugong in 1955. The Government of Japan succeeded this situation in 1972 when the entire Nansei Shoto returned to Japan. In 1993, the government placed the species under the protection of the Fishery Resources Protection Act. These protection measures prohibited the killing of dugongs and requested fishers to report dugongs found dead in fishing gears. The effectiveness of these 'conservation measures' was limited.

Responding to the finding of remnant population of dugongs in the Okinawa Island area (10.4.1), the Mammalogical Society of Japan passed a resolution in 2000 requesting that the Japanese Government protect the dugong population. It requested to determine a conservation zone on the east coast of Okinawa Island to have three actions: (1) operation of gillnet and trap net fishery, which are known as harmful, should cease with necessary consideration to fishers, (2) future modification of marine environment should be allowed with evidence of harmlessness, (3) existing other fisheries and military activities should be evaluated from the view point of dugong conservation, and efforts should be made to eliminate them if found harmful. The resolution also identified the need to recover the dugong population to safe levels and requested establishment of long-term projects for dugong population recovery and conservation of seagrass ecosystem.

With this resolution I (TK) met the head of Fishing Ground Conservation Division of Fisheries Agency. He stated that the agency had no intention of suppressing existing fisheries for dugong conservation. In those days Fisheries Agency was the government section responsible for dugong

conservation. Although the task was later moved to the Ministry of Environment, the Fisheries Agency retains responsibility for controlling fishing activities.

The Ministry of Environment made a large effort in collecting information on habitat, behavior and history of dugongs around Okinawa Island, but it made little achievement for the protection of the dugong population except for creating a manual for releasing dugongs found in trap nets. This was most likely due to conflict between government sections. One such conflicting section was the Ministry of Defense. It hoped to construct a military air base at Henoko (see 10.4.2), and could have feared "saving dugong" would help "stop air base".

The Okinawa Defense Bureau (ODB), which is one of the sections of the Ministry of Defense, collected various information concerning the effects of the airbase construction on the environment, including dugong survival. Although ODB never concluded that the airbase construction had negative effects on the environment, it quite disagreed with our interpretation of data presented by ODB (see 10.4.2). We know that the seagrass meadow off the south coast of Henoko (outside of Oura Bay) is used by dugongs for feeding, and that it will disappear by filling the area for air base. The adverse effect on long-term survival of Okinawa dugongs was ignored by the ODB. If the ODB identifies any unacceptable effect of the construction on environment, then of the plan for airbase construction will be greatly affected. We see in this issue a "conflict of interest", and believe the existing system is unsuitable for the purpose of conservation.

10.6.2 and 10.6.3 Future actions

As mentioned above, some dugongs that lived near Okinawa Island area have disappeared, but we don't know if they are dead or alive somewhere else. In 2019, both the Ministry of Environment and Okinawa Prefecture expanded the dugong study area from the Okinawa Island area to the broader area of the Nansei Shoto. The results are promising. They obtained information of recent sightings as well as their own confirmation of feeding trails. These are summarized below:

(1) Within Okinawa Islands (other than Okinawa Island): feeding trails.

(2) Miyako Islands: reports of sightings and feeding trails.

(3) Yaeyama Islands: reports of sightings and feeding trails.

These waters should be further investigated to confirm status of dugongs and necessary conservation actions should be implemented.

***Abstract of chapter 10 was prepared by Toshio Kasuya in October 2021.***

# LOCAL NEWS

## BRAZIL

### Challenges for rescuing and transporting a manatee calf during the SARS-CoV-2 pandemic in the Brazilian Amazon

On April 10th, 2020, in the beginning of the COVID-19 pandemic, an Amazonian manatee (*Trichechus inunguis*) calf was found in a lake close to the Fazenda Grande community, Jutaí River, 70km from Almeirim (Pará State, Brazil, Figure 1). The calf, named Gigi, was rescued and originally kept by volunteers, at the Municipal Secretariat of Environment (SEMMA). A local veterinarian evaluated the animal that weighted 10kg and still had vestiges of the umbilical cord. Gigi was initially maintained in a water tank, and was then transferred to a 1400l plastic pool at SEMMA. However, with the change of administration, the calf had to be transferred to another public facility, until August 2021, without further local specialized care.

Biologists and veterinarians from the Sirenians in the Amazon Estuary Research and Conservation Network, and BioMA/UFRA (the research group on Biology and Conservation of Amazonian Aquatic Mammals from the Federal Rural University of Amazon) supported local volunteers remotely providing information on handling and feeding since April 2020.

With the closest rehabilitation center (the University of the Amazon Zoo – ZooUNAMA, located in Santarém) at full capacity, the National Institute for Amazon Research (INPA) (located in Manaus, Amazonas State) agreed to receive the animal. An online fundraising campaign was created to gather resources for Gigi's transportation to Manaus. This provided resources for logistical support (e.g., travelling of the team, medication, new pool). The Aquatic Mammal Center from Chico Mendes Institute for Biodiversity Conservation (CMA/ICMBio) provided funds for the transportation by boat.

On August 27th, 2021, Gigi was taken on board a four-day boat trip from Almeirim to Manaus (~845km) (Figure 2), while assisted by a team of two veterinarians, from SEA and SEMMA, and a volunteer (her main caregiver, for the past months). The vets observed intense diarrhea, and continuous curved posture, to which she was medicated. Her capillary refill time (>4 seconds), temperature cardiac and respiratory frequency were normal.

Gigi was initially transported in the vessel's lower hull, but due to discomfort and rejection of food, likely because of noise and trepidation, she was moved up to the front of the boat. Afterwards she accepted food and the remaining days followed with no problems. Our team arrived in Manaus on the night of August 30th, and transported Gigi (using a pickup truck) with INPA's team to the latter's rehabilitation facility. There veterinarians conducted initial procedures (biometry and bloodwork), and Gigi was placed on a 5000l fiber pool.

The situation experienced by Gigi is increasingly common throughout the Brazilian Amazon region, especially in the Estuary. Stranding numbers are even higher, and there are no vacancies at current rehabilitation centers to fulfill this demand. Civil society and local institutions have secured the survival of orphaned calves, but with profound financial and logistic limitations. We need to

understand the real causes of such stranding events, increase awareness of local populations to the problem, build capacity for immediate release of calves, and undergo a concerted effort to release rehabilitated manatees currently in captivity. We also urge for a greater involvement of government agencies with manatee rescue and rehabilitation efforts. There is a long waterway ahead.

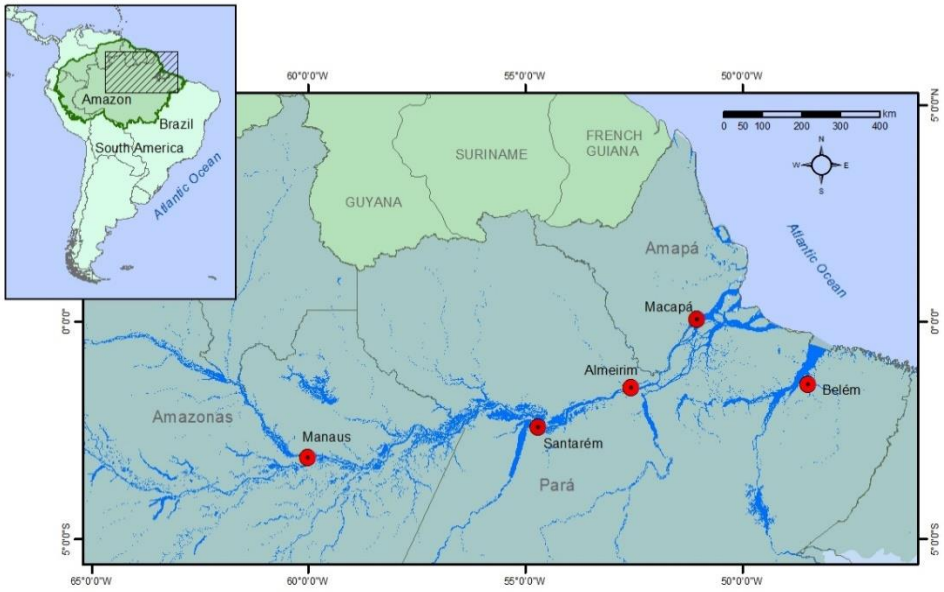


Figure 1. Map illustrating the rout of Gigi's transportation.

Figure 2. Gigi's transportation by boat.

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## Rescue, rehabilitation and transportation, challenges to manatee care and conservation in the Amazon Region

The Amazonian manatee (*Trichechus inunguis*) is classified as vulnerable based on the population decline associated with the past commercial exploitation of the species. Human activities such as poaching by local communities, habitat degradation, bycatch and boat traffic are the main threats to the species conservation. These activities may lead to the death of adult females, resulting in orphaned calves being taken out of the wild by local communities. When rescued, these animals are often sent to environmental agencies, NGOs and/or research groups for rehabilitation. This scenario is posing great challenges for such institutions that generally lack financial resources and/or proper structure to manage and rehabilitate manatee calves, and ultimately create programs to return these animals to the wild. Three manatee calves (*Trichechus* cf. *inunguis*), with age estimated between 2-3 months were rescued by riverside communities in Limoeiro do Ajuru (female, 14kg, April/2018); Cametá (male, 15kg, January/2020) and Santa Cruz do Arari (male, 12kg, March/2020), Pará State Brazil. All of them presented a good sanitary and nutritional state when rescued. The respective riverside communities notified the National Center for Research and Conservation of Marine Biodiversity from Northern Brazil (CEPNOR/ICMBio), which in turn solicited support from biologists and veterinarians from the research group on Biology and Conservation of Amazonian Aquatic Mammals (BioMA) and Bicho D'água Institute. These institutions maintained the calves (female and male 1, BioMA and CEPNOR; male 2, Bicho D'água) in Belém, Pará up to September 2020 when calves were air-transported by the BioMA team to the Zoo Park of the University of the Amazon (ZooUNAMA) (Figure 1). The activities of handling and transport of calves were authorized under SISBIO (Nº 44915-4) and Secretariat of Environment and Sustainability of Pará State (SEMAS Nº 23913/GEFAP/CINFAP/DLA/SAGRA/2020), respectively. Given the increasing numbers of manatee strandings in the Amazon Estuary and the urgent need for coordinated efforts, the SEA (Sirenians in the Amazon Estuary Research and Conservation Network) was created in October 2020, to promote articulation among different social actors for sirenian conservation. This group of researchers and conservationists aims to obtain financial resources, build capacity among local teams, conduct research, and support manatee conservation in the unique habitat that is the Amazon Estuary.


Figure 1. Aerial transportation of three manatee calves between Belém and Santarém, Pará State, Brazil.

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## Returning lives to the wild: Once again INPA and AMPA promote the largest Amazonian manatee release

Since 2008, the Aquatic Mammals Laboratory of National Institute of Amazonian Research (INPA), supported by the Friends of the Manatee Association (AMPA), has released rehabilitated Amazonian manatees in the wild as a strategy for the conservation of the species in Brazil. Between 2016-2019, a total of 31 captive manatees were released in the Piagaçu-Purus Sustainable Development Reserve (4º05', 5º35'S and 61º73', 63º35'W), located in the Purus River. All release phases had the support of the local communities for protection and post-release monitoring of the animals. Our experience shows that combining the releases with environmental education activities has effective conservation results for the species.

After this long period of social distancing due to the COVID-19 pandemic, and the twice postponement of the manatee's release (in March 2020 and then in April 2021), we are happy to announce that in July 2021, our team was able to release 13 healthy manatees in the Piagaçu-Purus Reserve, the largest group to date. Whilst overcoming big challenges, this moment was unique and extremely important for Amazonian manatee conservation. These complex activity was carried out based on a rigorous evaluation of the sanitary conditions, including the increased number of vaccinated people and reduction of the SARS-CoV-2 cases in the Amazonas State, which also led to the re-opening of the Amazonas State Protected Areas. In addition, the team also evaluated the water

level of the Purus River and availability of aquatic vegetation in the area to ensure safe and adequate conditions for the manatees after release.

The manatees (7 males and 6 females), aged between 4 and 14 years, were transported in fiberglass pools with water, during a 24-hour trip in a regional boat (Figure 1). The animals were monitored during the entire route. To reduce the risk of Coronavirus spread among participants, the transportation and release of the manatees took place with a minimum team of experienced biologists, veterinarians and keepers. The team followed all sanitary and biosafety protocols established for Public Use activities in Protected Areas in the Amazonas State, and without any contact or interaction with the communities of the Reserve (Figure 2).

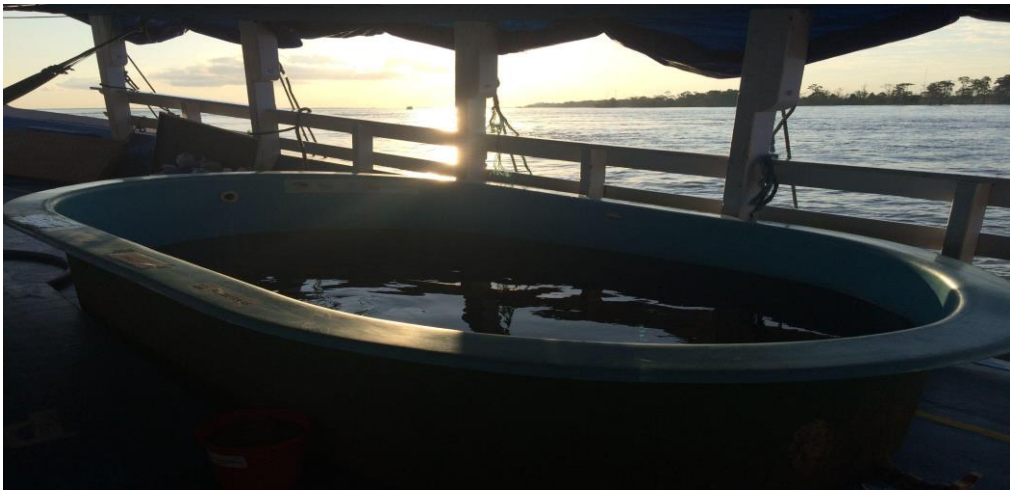

Figure 1. Transportation of the manatees in a regional boat for the 24 hour-long journey.

After arriving at the release site, a huge and pristine lake in the flooded forest of the Piagaçu-Purus Reserve, manatees were released one by one over two days. Five animals were released with a VHF-transmitter belt adapted to the caudal peduncle (Figure 3). Post-release manatees are monitored by trained local assistants (former manatee hunters) using the radiotelemetry system. Two months after release, the monitoring of the released animals continues, and has followed the animals exploring and using adequate habitats for the species, including proper food availability and large water bodies.

The Amazonian manatees Release Program is conducted by INPA and AMPA, under support of the Projeto Mamíferos Aquáticos da Amazônia from Petrobras, Kyoto University, Itochu (Japan), São Paulo Aquarium, Fazenda Seringal 25 de Dezembro, Amazonas State Foundation (FAPEAM), IBAMA, Environmental Police of Amazonas, and State Secretariat of Environment of Amazonas (SEMA). We are also grateful to Dr. Monica Ross for all her support with the VHF belts.


Figure 2. INPA and AMPA 2021 Manatee Release Expedition Team.


Figure 3. Release of a female Amazonian manatee in the Piagaçu-Purus Reserve.

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## Antillean manatee population in Maranhão, Brazil, monitored under a community-based conservation initiative.

Maranhão (MA) is one of the most important states for the conservation of the Antillean manatee (*Trichechus manatus manatus*) in Brazil. It has been described as one of the areas with the largest remaining populations along the species' range in the country. According to Whitehead (1978), aggregations of up to 300 individuals have been historically described. Luna et al. (2008) verified that Maranhão state still holds an important population of this species. The evaluation was made by interviews with local people, indicating concentrations of up to 30 manatees in a region named Tubarão Bay. Due to the difficulty in accessing the area, with extensive and remote mangrove forests, it was only possible to estimate the current abundance based on the extensive knowledge of the local surrounding communities. In addition, the elusive behavior of Antillean manatees combined with the peculiar morphology of the Maranhão state coast, make it truly hard to get data on the presence of this key species in its natural environment. Community-based conservation (CBC) is a model that brings together the concept that conservation and development could be simultaneously achieved (Berkes, 2004).

In this context, a training course on marine mammal biology, conservation and stranding rescue offered to local stakeholders in June 2021 by ICMBio/CNPT and partners (ICMBio/CMA, ICMBio/NGI São Luís, GEMM-Lagos/Fiocruz, and UENF) has been a step-point for strengthening a CBC initiative along the Maranhão coast dedicated to marine mammal management. It notes that good results have been achieved, following our previous report of a stranded newborn Antillean manatee found floating on 22nd January 2021 in Mapari River, eastern Maranhão, part of the Baía do Tubarão Extractive Reserve (Vidal et al. 2021). Its skeleton was recovered and will be part of a local exhibition (Figure 1). Three recent manatee strandings were reported and sightings have been confirmed. On April 7th 2021, there has been a stranding of a decomposed carcass, body length (BL) 3.10m, on Praia de Itapiranga, Guimarães, western coast of Maranhão (Figure 2), followed by another carcass found floating on August 30th, in Mearim River, Arari (Figure 3). This very recent record was of a large male, BL 3.15m in advanced decomposition, without signs of interaction with fishing or marks of sharp objects. One live stranding was recorded in April 25th. It was a newborn male found in São José de Ribamar. With a BL of only 1.0m, the calf was kept under intensive care as it presented two fractures in the bones: one in its pectoral fin and another in the zygomatic arch. The calf had difficulty accepting food, and did not survive after two 2 months in captivity (Figure 4). The locations of all manatee records are presented in Figure 5.

Figure 1. The skeleton of the newborn manatee from Mapari River being recovered in Humberto de Campos, Maranhão, in August 2021. It will be exhibited locally as part of an educational program.

Figure 2. Manatee found dead at Praia de Itapiranga, Guimarães, Maranhão, on April 7th 2021.

Figure 3. Manatee carcass found in Mearim River, Arari, Maranhão, on August 30th, 2021.

The observations and records on a cellphone of a group of eight manatees, including a calf, on August 5th 2021, in the vicinities of Ilha do Gato, Humberto de Campos, by a local fishermen and community leader, has shown the importance of such monitoring and empowerment built by a CBC initiative. Not only data on strandings and sightings are being constantly provided, but increased interest in the conservation of manatees and their potential as a tourist attraction is being shown. Samples of all specimens were collected for genetic studies and evaluation of contaminant loads.


Figure 4. Male newborn calf stranded on April 25th 2021 in São José de Ribamar, Maranhão. A) Calf feeding attempt; B) Feces with the presence of mangrove roots; C) Right fin with fracture; D) Left fin without fracture E) Zygomatic arch fracture.

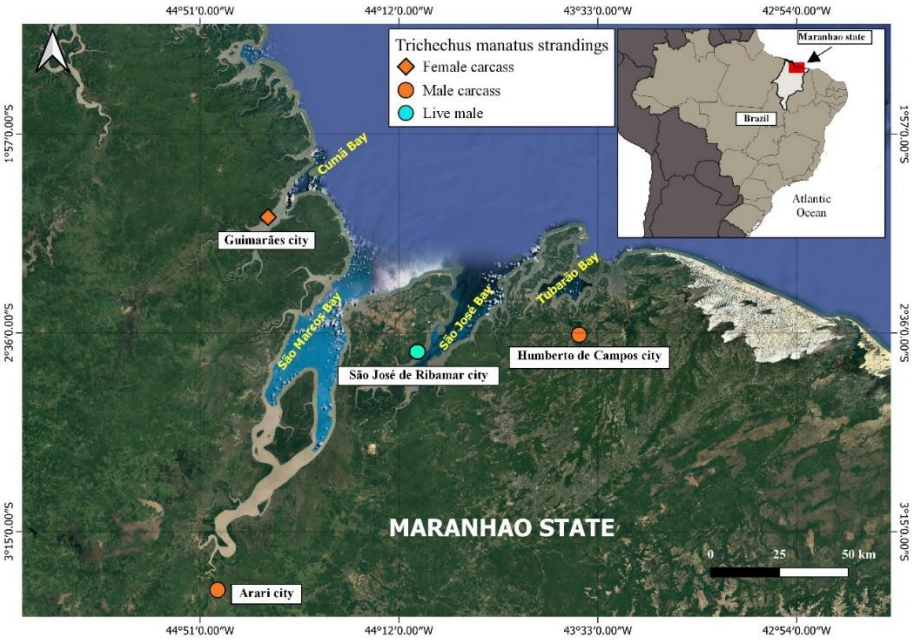


Figure 5. Locations of Antillean manatee records along Maranhão state coast, Brazil, during the SARS-CoV2 pandemic 2020-2021. Map prepared by Laura Reis (ICMBio).

We know that community-based conservation is a dynamic process (Martin et al. 2011), and local people's motivations for conservation will change over time (Ruiz-Mallén et al. 2015). Some authors recognize CBC as controversial. Our challenge is to bring together local interests allied with the management of such an elusive and endangered species as the Antillean manatee in northern Brazil. This is all happening in the context of a deep national economic crisis and the SARS-CoV-2 pandemic, that is affecting both the income and social perspectives of local communities. We acknowledge the contribution from Zeca, Jorge e Sérgio (Humberto de Campos), José Itamir (Guimarães) e Joel (Arari), the communication team Heveny, Rubem and Geylson and in the aquatic mammals monitoring programme of Instituto Chico Mendes de Conservação da Biodiversidade.

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## Partnership for the conservation of manatees in the extreme North of Brazil

The success of rescue and rehabilitation programs of manatee calves depends on financial resources, professional experience, and collaborative actions. In general, cooperative actions bring stability and longevity to a program, either by minimizing logistical efforts, securing financial resources for implementation, or by sharing technical knowledge. In addition, they may offer local communities the opportunity to become engaged in wildlife management, promote enhancement of the rehabilitation process, and raise environmental awareness (Adimey et al., 2012).

The rescue of manatee calves has become more frequent in the Brazilian Northern coast. We believe that digital communication tools have influenced local inhabitants – having been exposed to conservation actions in the region, they better understand the importance of contributing to the care of the calf, and return it to the wild in the future. In the last few months, local dwellers reported stranding/entanglement events of neonates within and around Amapá. This has allowed spontaneous and collaborative measures to be taken by several institutions, aiming at offering the best possible first response and destination to the animals.

Since January 2020, such actions involved the Environmental Battalion of the Military Police of Amapá (BPMAP), which proceeded to rescue animals in need; the Arinaldo Gomes Amazon Biopark Foundation (Bioparque) which has received and stabilized the calves under emergency and provisional manner; and the Mamirauá Institute for Sustainable Development (IDSM), which offers technical advisory to the previous institutions and takes part in routine and emergency treatments. In addition, the Prosecution Service of Amapá (MPAP), the Institute for Scientific and Technological Research of Amapá (IEPA), the Federal Institute of Amapá (IFAP) and the Network for Research and Conservation of Sirenians in the Amazonian Estuary (SEA), also collaborate, each entity offering their competencies and expertise.

Because the state of Amapá does not have a rehabilitation center for manatees, the MPAP legally advised Bioparque to receive and stabilize those animals, under the technical advisory of IDSM/SEA. Three manatees were taken to Bioparque which proposed, along with IDSM/SEA, to guarantee their health and well-being, with the ultimate goal of releasing them back to nature. Due to a previous unclear understanding about the legal competence to receive manatees in Amapá, one rescued animal was taken to IEPA, under emergency, where it was also offered specialized treatment by IDSM/SEA.

To guarantee the success of future actions, a communication flow was established. In addition to the financial and logistical resources needed to reach remote areas, and the institutional responsibility to execute all needed actions, it has been clear that the personal commitment makes a difference in the alliance for manatee conservation.

Even though network actions are not unknown in Brazil, to execute them in Amazonia, effectively, and especially in the estuarine region, has proved a great challenge in the past few years, stimulating the adoption of regionally distinct conservation strategies. The presence of West Indian (*Trichechus manatus*) and Amazonian (*T. inunguis*) manatees in Amapá, as well as hybrids from interspecific crossing, highlights the particularity of rescues in the region and the need to execute cohesive and effective actions. – SEA is supported by grants from the Save the Manatee Club.

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## Network for Research and Conservation of Sirenians in the Amazon Estuary

Actions for the conservation of manatees (*Trichechus manatus* and *T. inunguis*) in the Amazon is a constant challenge, especially in the coastal and estuarine region. This is due to the peculiar environments found in this portion of the country, to the logistic complexity in accessing these habitats and scarce financial resources, yet there is no priority of government bodies to secure/gather these funds.

Therefore, in October 2020 the Network for Research and Conservation of Sirenians in the Amazon Estuary (SEA) was created, an effort of 15 social actors/researchers from Brazil and French Guiana that are active in manatee research and conservation in the region. As an initiative of the Mamirauá Institute by means of the Center for Studies on Amazonian Wetlands, the SEA has been working along the coasts of Amapá and Pará states and an estuarine region associated with the mouths of the Amazon and Tocantins Rivers, acting for the conservation and expansion of knowledge on the genus *Trichechus*. This geographical scenario was chosen due to the necessity of better understanding the occurrence, distribution and strandings of manatees in this region, as well as the genetic mapping of individuals resulting from interspecific breeding.

The expertise of this team is evident by the participation in research on manatee species like the evaluation of anthropogenic impacts, genetic, demographic and ethnoecological studies, and rescue, rehabilitation and release. In addition, several of the group members are involved in the construction and execution of public policies and regulations.

Since its creation, SEA has engaged in collaborative actions to assist stranded animals, as well other manatee-related emergencies in the region. Capacity building and exchange of experiences have been planned and conducted in order to train local human resources. Moreover, the articulation between public and private sectors with organized civil society, as well as publicizing the network on

public forums (e.g. stranding networks, conservation action plans meetings) and social networks has demonstrated the efficacy of this coalition in a local context.

A considerable increase of manatee strandings, mainly newborn calves, has increased our concern, given that there is no adequate rehabilitation (which is a long, costly and highly specialized process) facility for sirenians in the Amazon Estuary. Then, SEA began its activities due to the need for adequate structure and more specialized human resources for the rescue, stabilization and rehabilitation of manatee calves. The current situation still consists of an absolute absence of any local protocols on the rescue and destination of manatees, and articulation between municipal, state and federal authorities related to the assistance of stranded animals.

Members of SEA and partner institutions have been directly working on the rescue, first aid and the articulation for a proper destination of assisted animals, aiming towards the rehabilitation and release of animals back into the wild. In addition, investigations on hybridization are being conducted aiming for better management of individuals, since the Amazon Estuary is a known manatee hybrid zone [special area for conservation (Vilaça et al., 2019)]. Therefore, in the mid to long-term, our actions have the potential to support creation of new protected areas, and/or using manatee conservation for supporting better management of those (existing and new) areas. – SEA is supported by grants from the Save the Manatee Club.

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# BELIZE

## Antillean manatee (*Trichechus manatus manatus*) strandings decreased during the COVID-19 Pandemic in Belize

For the past ten years, the Belize Marine Mammal Stranding Network has been recording a steady increase in Antillean manatee strandings. The highest number of manatee strandings ever recorded in Belize were in 2018 and 2019 with 44 and 40 strandings respectively (Galves et al in press). While most causes of manatee stranding in Belize go underdetermined due to the advanced state of decomposition, the dominant known cause is watercraft collision. Watercraft collision accounted for 14 strandings in 2018, and 13 strandings in 2019. In 2020, there were a total of 26 Antillean manatee strandings. Watercraft collision accounted for five strandings in 2020, which was a major decline compared to the previous two years (Figure 1). This decline could be attributed to the COVID-19 pandemic which resulted in the closing of Belize's borders, restricted movement, and the temporary closure of the tourism industry. The preliminary stranding total for 2021 is 20, of which four were a result of watercraft collision.

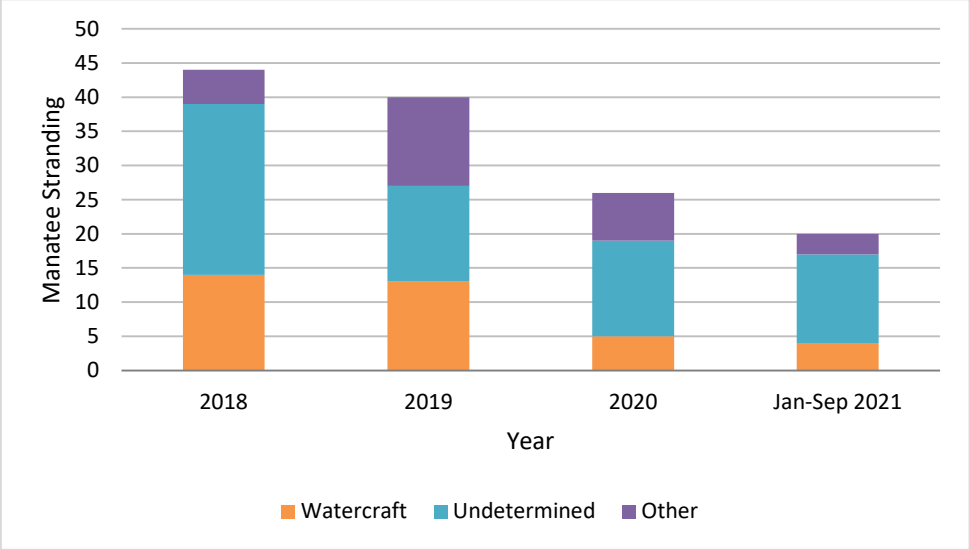


Figure 1. Antillean manatee stranding in Belize from January 2018 to September 2021.

The year-over-year percent change in the total manatee stranding was calculated from 2018 to 2021 to compare pre-pandemic and pandemic manatee stranding numbers in Belize. In 2019, there was a 9% decrease in total manatee strandings compared to 2018. In 2020, there was a 35% decrease in the total number of manatee strandings compared to the pre-pandemic total in 2019. With the preliminary stranding numbers for the period of January to September 2021, there has been a 23% decrease in total manatee strandings compared to 2020.

2020 records a major year-over-year percent decrease in both the total number of strandings and watercraft strandings when compared to the pre-pandemic numbers in 2018 and 2019. The year-over-year percent change for total strandings and watercraft strandings in the year 2020 were -35% and -62% respectively (Table 1). This drastic decrease could be attributed to the COVID-19 pandemic which restricted movement and tourism activities, resulting in a decline in boat traffic in Belize.

Table 1: Belize Antillean manatee watercraft stranding, total stranding, year-over-year change, and year-over-year percent change in stranding numbers from January 2018 to September 2021.

| Year | Watercraft Stranding | Total Stranding | Year Over Year Change (Total Stranding) | Year over Year % Change (Total Stranding) | Year Over Year Change (Watercraft Stranding) | Year over Year % Change (Watercraft Stranding) |
|---|---|---|---|---|---|---|
| 2018 | 14 | 44 | | | | |
| 2019 | 13 | 40 | -4 | -9% | -1 | -7% |
| 2020 | 5 | 26 | -14 | -35% | -8 | -62% |
| Jan-Sep 2021 | 4 | 20 | -6 | -23% | -1 | -20% |

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# CUBA

## A coastal community caring for an endangered species

On the north coast of Havana, manatees have been historically observed with some sort of frequency and in different types of habitats, from coastal lagoons, estuaries and river mouths. The community of Santa Fe, located in North Havana, is an area where sightings of this species sporadically occurred. The location with a higher frequency of observation is the entrance and canal of the Hemingway Marina (Figure 1). These sightings are usually reported by boaters, coastguards and athletes from the Provincial Academy of Nautical Sports or the Children's and Youth Sailing School. Since the last couple of years, manatee sightings in this community became scarce. Until last September, when a visitor decided to explore this area.


Figure1. Location of the manatee sightings in North coast of Havana, Cuba. 1. Santa Fe fishing port, 2. Marina Hemingway.

On September 17th, a manatee (*Trichechus manatus*) was observed in the fishing port of Santa Fe (Figure 2). The individual was identified by the fishermen as a female, but the sex wasn't corroborated by biologists. After that day, the same manatee continued to being observed between Santa Fe and La Marina Hemingway, for two weeks (Figure 1). A group of fishermen started to report these encounters (which lasted one or two hours each day) in videos that were sent to biologists from Havana (Fishery Research Center and Marine Research Center). Fishermen and other members of the community manifested feelings of amazement during the encounters (noticed in the videos), which indicate the rarity of events like this one. Fishermen showed also joy and happiness for the opportunity of seeing such a magnificent animal so close.

Figure 2: Manatee reported by fishermen at the fishing port of Santa Fe community.

Three main points were significant from this event. First and extremely important is the response observed in the community that immediately reported the sightings. Documenting encounters like this one help manatee biologists in their understanding of the species distribution, habitat use and interaction with humans all of which will translates into better conservation actions toward the recovery of this population. Fishermen in this community seemed very aware of the importance of protecting these creatures. In this case they were very protective of this specific manatee, taking care to not hurt her with the boats.

The second significant point was the extremely friendly behavior displayed by this individual, which was unlike what is usually recorded for the species in Cuba (Alvarez-Aleman et al. 2016, Alvarez-Aleman et al. 2018a). She was observed drinking water from a hose, very close to boats, and unperturbed by the presence of people and urban noise. Cuban manatees typically show evasive behavior, mainly due to historic anthropogenic pressures such as poaching (Alvarez-Aleman et al 2021). Nonetheless, other friendly manatee encounters have been recently reported before for the northwest northcentral coast of Cuba (Alvarez-Aleman, pers comm), which requires closer attention to these events.

The third point was the fact that this individual had two set of scars, on the back and above the peduncle, in addition to a tail mutilation (Figure 3). The photos of the manatee were sent for comparison with documented individuals in the Manatee Individual Photo-identification System (MIPS) (Beck and Clark 2012). This system is a cooperative effort of different agencies in the United States (Rood et al. 2012) and uses the photo-documentation of scars, mutilations, or other marks to identify individual Florida manatees (Beck and Clark 2012). In the past, the movement of manatee between Florida and areas in the Caribbean, such as Cuba and Mexico have been reported (Alvarez-Aleman et al 2010, Alvarez-Aleman et al 2018b, Rood et al 2020, Castelblanco-Martinez et al 2021). This specific manatee did not match any of the known manatees from the MIPS.

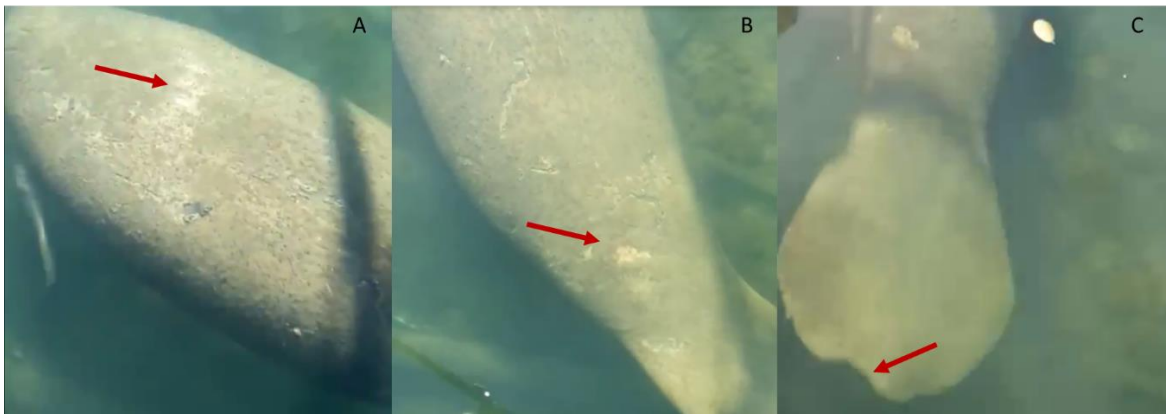

Figure 3: Two sets of scars (A: anterior dorsal and B: Above the peduncle) and a tail mutilation (C) observed in the manatee reported in Santa Fe, North Havana, on September 2021

This event was so interesting in the country that the story was presented on the national TV and also by the news agency, Reuters:

https://twitter.com/ReutersLatam/status/1448097434295574528?t=gM831-5tIYwC2T6RA59A5g&s=08).

Events like this are important as they aid the understanding of the presence of endangered species such as manatees in urban areas. The participation of fishermen and other members of coastal communities is vital in the development of citizen science which integrates community knowledge and experiences into research programs existing in universities and other government agencies. The main outcomes of events like this one are better knowledge, improved science and more conservation which will safeguard the future of the species.

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# DOMINICAN REPUBLIC

## First release of rescued calf in Dominican Republic

On the afternoon of September 10th, a manatee (*Trichechus manatus*) calf was reported by the community of La Cienaga (Barahona) as being lost and close to the coast, due to bad weather. The local authorities and the National Aquarium were informed, but by the time the National Aquarium arrived to the area to evaluate the situation, inexperienced people had already taken the calf out of the water and placed her into an inflated pool. The calf was then transferred to the National Aquarium facility in Santo Domingo during the night. However, it was vital to try to find the mother within 24 hours in order to reunite them r again.

A team from the NGO, FUNDEMAR (Dominican Foundation of Marine Studies), upon notification by the Ministry of Environment, started an evaluation in the area in order to locate the mother of this prematurely rescued calf. The search team included a drone specialist, which facilitated the search for the adult manatee, presumably the mother. Information obtained from the local community indicated that an adult manatee was near the area where the rescue took place. An adult individual, probably the same indicated by the community before was located during the first flight at a 120 m of altitude in the same area. This manatee had a distinctive dark large mark. While the search team kept a close monitoring of the adult manatee, another team was working on the transportation of the calf back to the area where she was rescued a few hours before. The identified manatee then moved to a protected bay, where the team waited until the arrival of the calf from the National Aquarium.

The presumed mother was observed until dusk, when she was not spotted again; the calf arrived at night. The calf, completely healthy, as indicated by the National Aquarium veterinary team, was released in the bay and started to swim in circles around the team and vocalize (Figure 1). For half an hour, the calf continued to swim in the area until she stopped the vocalizations and started away; she was not spotted again that night. The search team remained in the area for another hour without seeing the mother or calf again or hearing any other vocalization.

The team is confident that there was a mother-calf re-unification due to: -the presence of an adult, presumably the mother, inside the bay that night, and -the behavior of the calf moving and

vocalizing close to the team and then suddenly disappearing (the team had a previous experience with another calf in Bayahibe, that showed the same behavior).

Figure 1. Calf release in Barahona, Dominican Republic.

On September 11th, the team used a drone to survey the area again. After 50 minutes of searching, the same adult (with a dark mark in the tail) appeared with a calf, 100m behind the wall of rocks breaking the waves of the bay (Figure 2). The pair was seen in close proximity for several minutes of drone surveys.

Figure 2 Mom and calf the next day following the release

Two weeks later, a team from FUNDEMAR, went back to the wider region where this event occurred in an attempt to corroborate if the pair was actually mother/calf. Drone surveys were implemented, with the observation of one individual in the Los Patos zone, reported with another one and always in the place, but the body shape was thinner and different from the mom.

The area was surveyed for two more days until the observation of one adult with a calf. The dark mark wasn't very visible anymore, because algae on the body changed. After several flights trying to take the best picture to identify the adult and compare it to two weeks before, the team could

conclude thanks to the double notches on the adult tail, that it was the same couple (Figure 3). The adult was confirmed as a mother due to several observations of nursing behavior.

Figure 3. Mom and calf day following the release / 2 weeks later / mom before calf´s release

**-Rita Sellares[1], Rachel Plekaniec[1], Marvin Del Cid[2]**

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## Rehabilitation process of manatee's previous release in Dominican Republic

In the Sirenews No.72 (November 2020) you can find an article title "For the first time, the Dominican Republic will release rehabilitated manatees". This note told the story of Juanita, Pepe and Lupita, three Antillean manatees rescued in 2012 and 2018, and held in captivity in the National Aquarium of Santo Domingo. In 2020, the government of the Dominican Republic through the Ministry of Environment and Natural Resources, in collaboration with the Dominican Foundation of Marine (FUNDEMAR) and the National Aquarium, began a soft release program with the three rescued manatees. From December 2020 to June 2021, the three manatees were in a fenced natural adaptation bay (Figure 1), in Bayahibe, southeast of the Dominican Republic.

On the 13th of December, 2020, the three manatees were transported from the Aquarium in Santo Domingo to the natural enclosure where the soft release process was going to take place, a small bay in Bayahibe (Figure 2). Four trucks were used to transport the animals, one for each manatee plus one to transport all the equipment needed. A crane was used in case one animal had to be moved from one truck to another and sent back to Santo Domingo and also to move the animals from the

truck to the bay. No major incident happened, except that Pepe always prefers to stay on his back, and decided to flip while the crane was taking him out from the pool.

Figure 1. Natural enclosure where the soft release process for three Antillean manatees took place in the Dominican Republic.

During the first week in the bay we could see Lupita moving a lot more than Pepe and Juanita, the three of them were staying closer together frequently. During the six months of pre-adaptation, their diet started with 50% of natural manatee food (seagrasses, algae and coastal vegetation) and 50% vegetables from human consumption (lettuce, banana, celery, apple) and by the end of this period they were consuming 100% seagrasses and algae. Seagrasses were collected by a dive team five days/week. The food (200kg/day) was given 3 times a day in structures (Figure 2) attached close to the bottom and in different places every time, marked with buoys. The bay presented fresh water coming out naturally from shores. They also improved the breathing rate from 2-3 min to 5-8 min, during resting they could hold their breath for 15 minutes. There was a noticeable change in the social behavior of the animals. For example, Pepe started the soft release process showing interactions with every person that enter the water; after six months he showed no interest for humans around him. Juanita and Lupita also showed more indifferent behavior by the end of the soft release process.

Figure 2. Underwater feeder.

During the soft release, the manatees were monitored 24 hours a day and seven days a week. During the day, a team of five people in total was in charge of preparing the food and monitoring: checking the fence, breath monitoring (4 times/day), water monitoring (twice a day) checking feces, gases, new wounds, different sounds emitted, counting contact with observers, drone monitoring (3 times/day). Every two weeks, corporal size measurements were taken to monitor any weight change. Also thermal monitoring was done using four hobos placed in different parts of the bay. During the night, two watchmen were in charge to report any beaching, or movements from wild manatees close to the fence. Before the release a medical assessment was done with the support of veterinarians and technicians of the National Aquarium. Also, PIT tags and tracking devices were placed with the support of the CMA Research Institute. For the capture, each manatee was guided to come voluntarily into a net settled in shallow water close to the shore (Figure 3).

Figure 3. Buddy Powell (CMARI) free belting Lupita before her release back into the wild.

Showing positive nutritional and behavioral changes, the three manatees were declared healthy and ready to be released. On June 27th of 2021, Juanita, Pepe and Lupita saw the fence separating them from the open sea be removed. The sequel to the next episode.

**-Rita Sellares[1], Rachel Plekaniec[1], Marvin Del Cid[2]**

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# EAST AFRICA

## Aerial Survey for dugongs (*Dugong dugon*) in Bazaruto Archipelago National Park in 2021

The dugongs (*Dugong dugon*) in the Bazaruto seascape, which includes Bazaruto Archipelago National Park (BANP), remain the last viable population along the East African coast. A study during May 2021 confirms this community's persistent presence throughout the area. A total of 325 ± 145 (CV = 0.39; mean ± standard deviation) dugongs were estimated from three replicate sample counts. Observers detected 135 dugongs, of which 15 (11%) were calves, from 69 different sightings. Results generated using two different survey designs, distance (311 ± 155) and strip (325 ± 145) sampling,

were not significantly different. Ultimately, the fidelity between these results and those from surveys conducted in 2006 – 07 (359 ± 137) suggests that the population's size has not changed significantly over the past 15 years. Densities remain far lower in the Bazaruto seascape than in Australia, a key dugong stronghold. This abundance estimate and the geographic distribution of observations offers further justification for the expansion of formal environmental protected areas (EPAs) around BANP.

Management Recommendations are:

1) Management must aim for zero unnatural mortality throughout the entire Bazaruto seascape given 25-year population modeling estimates.

2) Key estuaries to the north of Inhassoro should be afforded the highest degree of protection possible if an EPA is established in or around the Bazaruto seascape. These zones are likely crucially important for the last viable dugong population along the East African coast. These refuges would require support through law enforcement and community development activities.

3) A more diverse array of research and monitoring methods like acoustics, genetics, and potentially telemetrics should be introduced to help understand, manage, and protect this vulnerable population. Given their large uncertainties, biannual aerial surveys are not adequate to dynamically manage such a cryptic and rare animal. Modeling suggests it could take between 15 – 33 years to detect a significant increase in the population's size using aerial surveys.

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# GUADELOUPE

## "Maman-dlo" – film about manatee reintroduction in Guadeloupe

Guadeloupe, a French island in the Lesser Antilles, lost its last manatee in the early 1900s because of excessive hunting. Almost a century later, the Guadeloupe National Park announced a challenging project of the species reintroduction. It was followed by a construction of a Breeding and Care Centre and a training of a local team of keepers and veterinarians. In 2016, the first two captive Antillean manatees from Singapore Zoo were transferred to the facilities in Guadeloupe. The successful relocation was unfortunately followed by the death of one of the animals seven weeks later. Post mortem and histopathology analysis revealed kidney failure as a cause of death. Frozen serum collected in the years preceding relocation were tested for SDMA (Symmetric dimethylarginine) – early kidney biomarker, and revealed an early stage of a kidney disease that went undiagnosed due to lack of visible clinical symptoms. The second manatee, however, adapted to the conditions in Guadeloupe progressively.

A second transfer of captive manatees from Mexico was being planned but never realized, due to the obstacles faced by the project in 2018. Lack of engagement from the side of local politics and stakeholders has subsequently led to the loss of the financial support of the European LIFE program. As a result, the reintroduction project was suspended. The only remaining manatee was transferred to Paris National Zoo in France for welfare reasons.

Wildlife reintroductions are still relatively new tools of biodiversity conservation. Their result depends on multiple factors and requires commitment and cooperation of professionals from various sectors. The success of such operations is measured after years of post-release monitoring. Although the Guadeloupe manatee project met difficulties in its early stages, it was decided by the local scientific committee to not stop it definitely, but rather work on the necessary improvements and redefine a new strategy.

Production of a film project about manatee reintroduction in Guadeloupe is currently underway. It will present the lessons learned so far from this unique experience. It will discuss the potential of Guadeloupe habitat as a reintroduction site, as well as the projects' potential in supporting local development and environmental conservation. The objective of the film is to increase the engagement of the local community and to gain the support of stakeholders and politics.

The teaser can be watched online via the following link: https://vimeo.com/629056127 (you can activate English subtitles).

The documentary film premiere is planned for 2022.

**-DVM Natalia Rozniewska (Independent veterinarian)**

# LIBERIA

## African Manatee (*Trichechus senegalensis*) Threat Assessments in LIBERIA

The African manatee (*Trichechus senegalensis*) has not been documented in Liberia before. This is due to a number of reasons; the brutal war that took place in the country and safety risks for health during the Ebola crisis. This has led to a lack of management by the Forest Department and an overall inactivity in their role for the conservation of the wildlife and forests in Liberia. Nonetheless, Liberia is the only country in the neighboring regions with an intact old forest and the least developed infrastructure leading to pristine natural ecosystems.

Geographical Range: The species occurs in coastal, estuarine and river waters on the west coast of Africa. The species occurs in some of the major estuarine and river systems of Liberia and we have documented it at Lake Piso's surrounding tributaries.

Habitat and Ecology: The habitat requirements of the species are thought to include sheltered water and access to freshwater. Documented sightings, photographs and collected bones and penises

indicate the species inhabits coastal lagoons and mangrove areas with abundant mangroves, seagrasses and/or emergent vegetation. The species is generally solitary except for mother and calf social units, although they may rest in groups during the day. The species feeds primarily in rivers especially on over-swamped agricultural land.

Threats: Unregulated hunting and traps have been cited as the main cause for the decline of the species. The level of these threats is thought to be increasing. Other threats include the destruction of habitat by palm oil companies. The species is now listed as an Evolutionarily Distinct and Globally Endangered (EDGE) species under the EDGE of Existence program.

Methodology: *Trichechus senegalensis* occurs in Liberia; this is an undocumented species and no previous research of value has been conducted. Interviews and collection of evidence were conducted in the period 2016-2018, during the dry and rainy seasons. Madiana and Jorni Sambolah are two target villages situated along the Mafa river where these are two identified areas for *Trichechus senegalensis*. We conducted 54 interviews with local fishermen and interviewed two manatee hunters and documented their interviews by video and photographs.

Future Plans: Plans are ahead to establish a baseline but conservation efforts we have started with good results.

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# MEXICO

## Pompeyo: a manatee calf rescued in Laguna Milagros, Quintana Roo, Mexico

On August 6th of 2021, local people from the community of Huay-Pix (15 km west from Chetumal, Quintana Roo) spotted a lone manatee calf in Laguna Milagros (18.51027N, 88.42801W) and

reported the incident to the authorities. After confirming that the small manatee was without its mother for at least 24 hours, staff from the Stranding Network of Marine Mammals of Quintana Roo (Red de Varamientos para la Atención de Mamíferos Marinos del Estado de Quintana Roo, RVMMQR) successfully captured it and performed the initial health status evaluation. The 92 cm-length male Antillean manatee (*Trichechus manatus manatus*) did not show any alarming sign of health complications. The manatee was transported to the CARMA (Centro de Atención y Rehabilitación de Mamíferos Acuáticos), located at 22 km North from Chetumal City, where it is currently kept in an enclosure within Laguna Guerrero, a traditional area for the species (Figure 1).

Figure 1. Pompeyo in the rehab center, Laguna Guerrero.

The calf first received soymilk and electrolytes, which was gradually replaced by a formula consisting of a low-lactose, high fat milk replacer (Multi-milk®) supplemented with electrolytes (Pedialyte®), coconut oil, and taurine. The individual has steadily grown in weight and size, and has shown good appetite, reactive behavior and general good health condition. Currently, the manatee is bottle-fed seven times a day, weighs 24 kg with a straight length of 106 cm.

The Federal and State authorities, Procuraduría Federal de Protección al Ambiente, Procuraduría de Protección al Ambiente, and Instituto de Biodiversidad y Áreas Naturales Protegidas (PROFEPA, PPA, and IBANQROO) have assumed the commitment of rehabilitating the manatee, following the recommended protocols to manage orphan calves in Mexico (SEMARNAT 2020). We are implementing national and international recommendations to prepare this animal behaviorally and physically in order to successfully reintroduce it to the wild. Several strategies are or will be implemented to avoid habituation to humans and to promote normal self-protection and foraging behaviors, in order to increase survivorship of the manatee in the wild.

Taking advantage of the Manatee World Day celebrated in Mexico during September (Nourisson & Castelblanco-Martínez 2013), an intense awareness campaign for manatee conservation around manatee rehabilitation was launched with the participation of many institutions. Thirty

children of Quintana Roo between 7 to 12 years old participated in a contest to name the manatee, and the winner name was “Pompeyo”.

Members of the RVMMQR, as well as volunteers from Mexico and Colombia, are actively involved in the care and management of the small calf. However, attitudes and actions of local community regarding the rehabilitation of this manatee is also a key aspect to guarantee the success of the process. This is the second manatee calf rescued and rehabilitated in Quintana Roo, after “Daniel” (Padilla-Saldívar et al 2006, Mercadillo-Elguero et al 2014), an 18-year old manatee that is currently kept in semi-captivity in the CARMA.

**Acknowledgements:** Many people and institutions are involved in the rehabilitation of Pompeyo. We thank the authorities PROFEPA, IBANQROO, Secretaría de Ecología y Medio Ambiente de Quintana Roo, and Comisión Nacional de Áreas Naturales Protegidas. We appreciate the generous donations of Save the Manatee Club, Dolphin Discovery, Grupo Xcaret, Fúlica, Wildtracks, International Fund for Animal Welfare, El Colegio de la Frontera Sur, and AMHAR. Jaime Cuevas, Augusto Lizarazo, Pilar Gómez, Maria Elena Mendoza, Lina María Padilla, Noé Pacheco Coronel, and Daniela García González also donated resources. Thank to Lesly Cabrias, Antonio Mignucci, Fernanda Attademo and Zoe Walker for advising on many aspects of Pompeyo rehabilitation. We also thank Clearwater Marine Aquarium for launching a fundraising campaign to collect funds for Pompeyo’s rehabilitation. We are very grateful to many volunteers that have donated their time to take care of Pompeyo.

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# PHILIPPINES

## COVID-19 pandemic challenges Northeastern Palawan's protected areas' role in connectivity corridors for dugongs in the Busuanga-Calauit-Coron-Culion island complex

Dugongs persisting in the Busuanga-Calauit-Coron-Culion island complex (Torres and Saballegue 2021) faced extreme weather during Supertyphoon Haiyan (2013) as well as strong typhoons Phanfone (2019), Kammuri (2019) and Molave (2020). Preen and Marsh (1995) documented how a cyclone and floods degraded >1000 $km^2$ of seagrass in Australia leading to many dugong deaths due to starvation. Dugongs benefit from connectivity to seagrass habitats less exposed to typhoons.

Northeastern Palawan spans ≈160 km through three protected areas (Figure 1) with lower typhoon exposure (WHOI-CSG 2021) and hosts seagrass habitats. First, the El Nido Taytay Managed Resource Protected Area (11.233333° N, 119.416667° E) was declared in 1998. Second, the Malampaya Sound (10.846371° N, 119.365412°E) which was declared as a Protected Landscape and Seascape (MSPLS) in 2000. And third, the Puerto Princesa Subterranean River (PPSR; 10.192560°N, 118.926583°E) declared as St Paul's National Park in 1971 then expanded in 1999 into the PPSR National Park and inscribed among UNESCO World Heritage Sites because of "outstanding" biodiversity and karst geomorphology (UNESCO 2021).

Over 30 years of dugong reports include aerial surveys traversing Ulugan Bay (10.100507°N, 118.801412°E) through Malampaya Sound then El Nido in May 1986 (Kataoka et al. 1995: 71) and in the mid-1990s (JICA 1997: 18). The 1998 UNESCO World Heritage site nomination report mentioned dugongs in the PPSRNP and its designated expansion area, Ulugan Bay (Villalon et al. 1998). Recently, dugongs in Ulugan Bay and PPSRNP were indicated in the Final Report of the CMS Dugong MOU Standardized Catch and Bycatch Questionnaire (Pilcher et al. 2017: 55). A European Union funded Programme reported dugongs in Malampaya Sound and El Nido-Taytay (NIPAP 2001).

In Malampaya Sound, one of us (BJG) conducted fisheries and bycatch research since 2008. Although focused on the Critically Endangered population of Irrawaddy dolphins (*Orcaella brevirostris*), Gonzales' (2017) inventory of fishing gears, practices and target organisms are readily adaptable to characterizing threats on dugongs that PCSDS (2006) reported in the outer Sound.

Uniquely, La Venta Esplorazioni Geografiche's 2011 biogeophysical survey of the PPSRNP documented a fossilized sirenian skeleton with age estimated at 10-25 million years which was left embedded in the limestone cave wall for future researchers with advanced techniques (De Vivo and Piccinni 2013: 74); a first in Southeast Asia.

COVID-related duties reduced patrols of enforcement agencies allowing increased illegal fishing inside the El Nido and Malampaya protected areas as detected through Visible Infrared Imaging Radiometer Suite (VIIRS)-equipped spacecraft (Mongbay.com 2020). With no tourists during March 15-September 2020 lockdowns, PPSRNP's zero income within those months jeopardized the P50 million needed for operations and its 224 personnel (Miranda 2020).

In a complex, multiscale post-COVID-19 "new normal", using social-ecological systems (SES) framework may inform protected area managements on enhancing resilience and conserving biodiversity, including dugongs and seagrass habitats. Cola et al.'s (1998) Institutional Arrangement Analysis of the pre-PPSRNP as well as Gonzalez's works on conservation governance in Ulugan, St Paul Bay, Malampaya and El Nido-Taytay areas offer unique starting points for SES research.

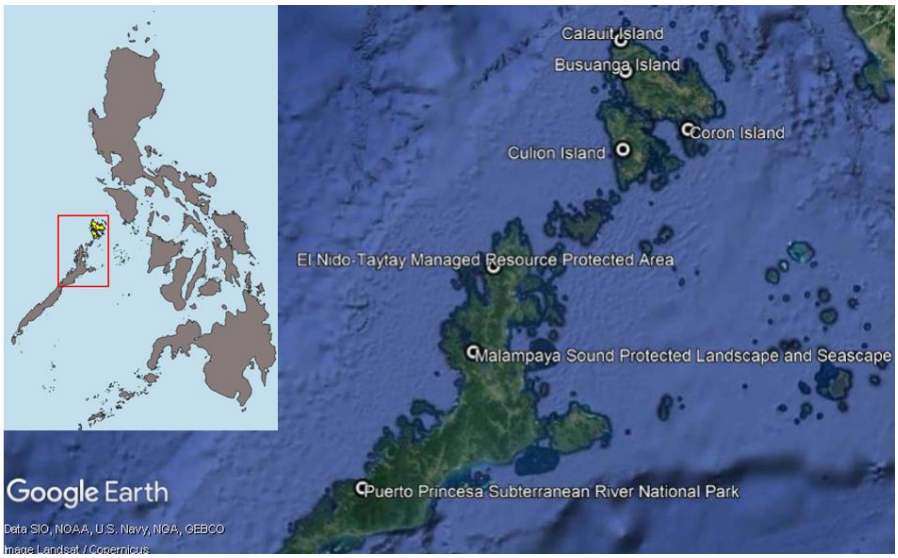


Figure 1. Map showing the location of the Busuanga-Calauit-Coron-Culion island complex in relation to the relative locations of three protected areas, namely: El Nido-Taytay Managed Resource Protected Area, Malampaya Sound Protected Landscape and Seascape, and Puerto Princesa Subterranean River National Park. Inset shows the location of the northern Palawan sites relative to the Philippines.

**Acknowledgements:** Thanks to Keziel Alquitran for reviewing the draft.

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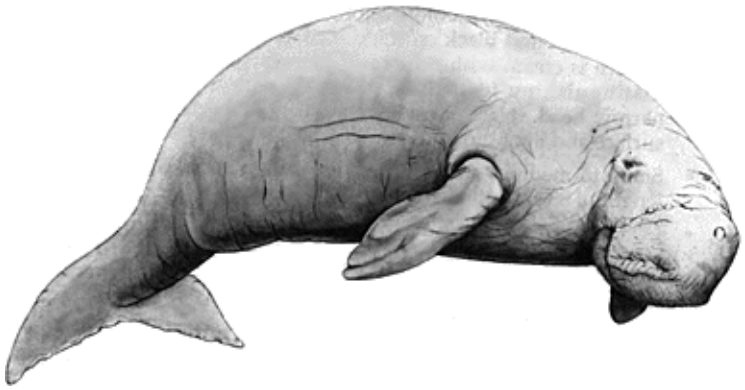


**Sirenews – Dugong**
**(End of local news)**

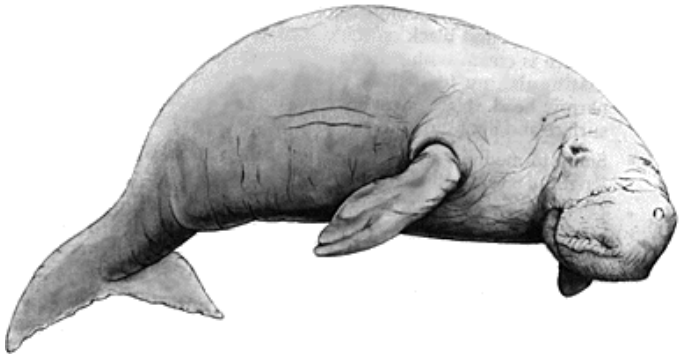
## UPCOMING SYMPOSIA/CONFERENCES

### TENTH INTERNATIONAL SIRENIAN SYMPOSIUM

# HOLD THE DATE!

The International Sirenian Symposium in conjunction with the 24th Biennial Conference on the Biology of Marine Mammals in Palm beach, Florida, USA has been rescheduled until August of 2022. Further details for this Symposium will be forthcoming early next year.

For questions, please contact Nicole Adimey (adimey22@gmail.com)



**Sirenews – Dugong**

**UPCOMING SYMPOSIA/CONFERENCES**

# SMM2021

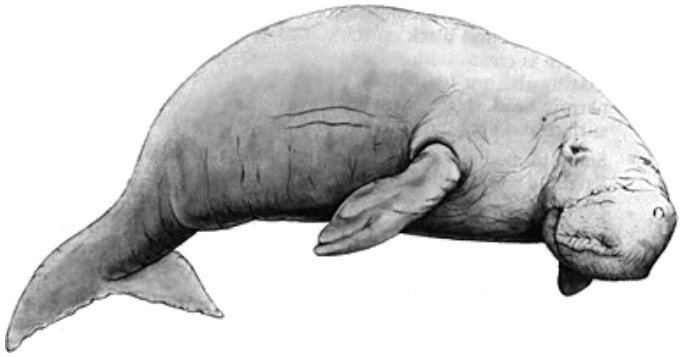
## HOLD THE DATE!

## A SEA CHANGE:
## Transforming Science into Stewardship

UPDATE: Both the in-person and the virtual 24th Biennial Conference on the Biology of Marine Mammals is postponed until 2022. The new dates will be Monday, August 1 to Friday, August 5, 2022 with workshops being held on Saturday, July 30 and Sunday, July 31, 2022. All conference venues will remain the same.

Conference website: (smmconference.org)

24th Biennial Conference on the Biology of Marine Mammals
Palm Beach, Florida • December 13-17, 2021



**Sirenews – Dugong**
**(End of upcoming conferences)**

## ANNOUNCEMENTS

## JOB OPENING ANNOUNCEMENT

The Convention on Migratory Species announces the following job openings in CMS Office – Abu Dhabi:

- Head of the Dugong MOU Secretariat (Programme Management Officer, P4) based in Abu Dhabi. The deadline for receiving applications is **12 November 2021.**
- Project Manager for the Seagrass Ecosystem Services Project (Programme Management Officer, P3), based in Abu Dhabi. The deadline for receiving applications is **19 November 2021**.

Applications should be received through the UN Careers platform Inspira using the above links.

CMS Dugong MOU Secretariat

Memorandum of Understanding on the Conservation and Management of Dugongs and their Habitats throughout their Range (Dugong MOU)

Convention on Migratory Species Office - Abu Dhabi • United Nations Environment Programme
c/o Environment Agency - Abu Dhabi • PO Box 45553 • Abu Dhabi • United Arab Emirates
www.cms.int/dugong • www.dugongseagrass.org • @DugongHub

## RESEARCH ANNOUNCEMENT

**Are you an experienced manatee observer? We need your help.**

**Roger Reep and Gordon Bauer**

We are conducting a survey to understand manatee cognition as reflected in their behavior in the wild. Many of the most interesting examples of intelligent behavior are rare. Consequently, they are usually seen and understood only by people who view manatees regularly over long periods. We are very interested in those observations, which will further our knowledge of the range of purposeful behavior seen in manatees, and will guide us in behavioral studies of captive and wild manatees. We intend to publish our collected findings, and will acknowledge all contributors. Among those who have already contributed to this project are: Bob Bonde and Cathy Beck, Tom O'Shea and Buddy Powell, Wayne Hartley and Jen McGee, Lucy Keith-Diagne, Don Dematteis, Monica Ross and Nicole Bartlett, Captain Mike Birns, Cora Berchem and Pat Rose, Susan Butler & Jim Reid

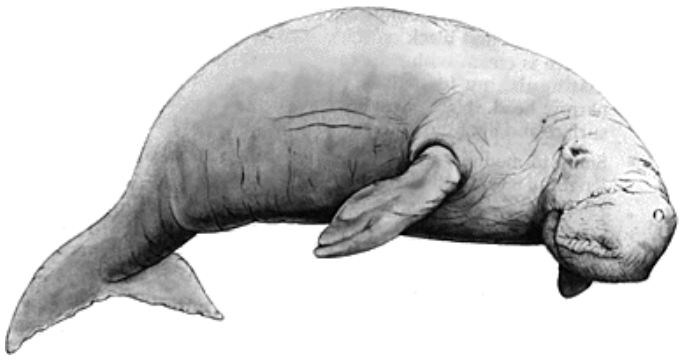
Our survey with some examples of interesting manatee behaviors can be found at this link:

https://ncf.iad1.qualtrics.com/jfe/form/SV_b9FugHRHmLcHdhI

If you find the written survey too time consuming to write all your relevant observations, you can instead do a Zoom interview with us. If you would like to do an online Zoom interview, please contact:

Roger Reep: reepr@ufl.edu

Gordon Bauer: bauer@ncf.edu



**Sirenews – Dugong**

**(End of announcements)**

## SYMPOSIA/CONFERENCES

## THE FOURTH ANNUAL MANATEE RESEARCH SYMPOSIUM

### University of Florida

**SEPTEMBER 9, 2021**

The 4th Annual Manatee Research Symposium was held on September 9, 2021, both in-person at the University of Florida and virtually through Zoom. This 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 180 veterinarians, researchers, professionals, and students from the United States, the Caribbean, Central and South America, and the United Kingdom registered to attend this event which consisted of 14 oral presentations representing 8 different institutions.

## ABSTRACTS

## ORAL PRESENTATIONS

### Florida manatee (*Trichechus manatus latirostris*) hearing, boat noise, and variations in background noise.

Athena Rycyk[1], Gordon Bauer2, Randall Wells3, Joe Gaspard4, and David Mann5

*1New College of Florida, Division of Natural Sciences, Sarasota, FL*
*2New College of Florida, Division of Social Science, Sarasota, FL*
*3Chicago Zoological Society's Sarasota Dolphin Research Program, c/o Mote Marine Laboratory, Sarasota, FL*
*4Pittsburgh Zoo & PPG Aquarium, Pittsburgh, PA*
*5Loggerhead Instruments, Sarasota, FL*

On average, 113 (2015-2019) Florida manatees die from boat collisions each year, and many more are injured, based on scarring patterns. From previous studies we know manatee hearing is sensitive enough to detect the sound of an approaching boat and they have been observed commonly changing their behavior when a boat approaches, well before the vessel is within visual range (based on water clarity). Here we consider the exceptions, under what conditions does background noise interfere with a manatee's ability to detect the sound of an approaching boat. We combine hearing information from laboratory studies, recordings of boat approaches, and sound levels from a range of natural soundscapes to explore how detectability of boat noise varies among locations in Sarasota Bay.

## Lipid and hormone indicators of reproductive status in Florida manatees (*Trichechus manatus latirostris*).

Elizabeth Brammer-Robbins [1,2,4], Mohammadzaman Nouridelavar[2]
, Juan Aristizabal-Henao[1]
, Nancy Denslow[1,2]

[1]*Department of Physiological Sciences, College of Veterinary Medicine, University of Florida, Gainesville, FL*
[2]*Center for Environmental and Human Toxicology, University of Florida, Gainesville, FL*
[3]*Genetics Institute, University of Florida, Gainesville, FL*
[4]*Aquatic Animal Health Program, College of Veterinary Medicine, University of Florida, Gainesville, FL*

Reproductive conservation physiology research is essential to management of threatened wildlife populations, such as the Florida manatee (*Trichechus manatus latirostris*). This research aimed to 1) measure plasma steroid hormones in Florida manatees at Crystal River and Brevard County field sites and 2) determine the relationship between plasma progesterone and lipid concentrations. Progesterone and cortisol were elevated in pregnant Florida manatees. Plasma concentrations of glycerophospholipids, ceramides, sphingolipids, and sterols were associated with indicators of pregnancy. This research contributes to manatee conservation by revealing plasma lipid biomarkers for reproductive status.

## Manatee cognition and conservation

Gordon B. Bauer[1,2]
, Rodger Reep[3]
, Athena Rycyk[1,2], and David
Mann[2,4]

[1]*New College of Florida, Division of Social Science, Sarasota, FL*
[2]*Mote Marine Laboratory, Sarasota, FL*
[3]*University of Florida, College of Veterinary Medicine, Dept. of Physiological Sciences, Aquatic Animal Health Program, Gainesville, FL*
[4]*Loggerhead Instruments, Sarasota, FL*

Manatee cognitive/sensory abilities are well-described in laboratory research but not in the field. Boat captains, field researchers, and other experienced observers of manatees in the wild describe complex behaviors suggesting a rich mental life. Cognition is inherent in the decisions manatees make to adapt in real-time. Here, we highlight the importance of cognition (detection discrimination, and identification of stimuli, learning, memory, problem solving, decision-making, and complex behavior) to conservation. We report preliminary steps to integrate anatomical and behavioral laboratory research with reports of natural manatee behaviors to inform management and conservation practice and suggest new lines of research.

## Research and conservation network for sirenians in the Amazon estuary.

Miriam Marmontel [1,2], Ana Carolina Meirelles [1,2,3], Angélica Rodrigues [1,2,4], Benoit De Thoisy [2,5,6], Claudia Funi [2,7], Claudia Silva [2,7], Danielle Lima [1,2], Fabrício Rodrigues dos Santos [2,8]
, Gabriel Santos [1,2,4], Jairo Moura [2,9], João Carlos Borges [1,2,10], Luiz Sabioni [1,2,11], Sávia Moreira [2,12], and Vitor Luz Carvalho [1,2,3]

*1 Research Group on Amazonian Aquatic Mammals (GPMAA)/Mamirauá Sustainable Development Institute (IDSM), Tefé, Brazil*
*2 Research and Conservation Network for Sirenians in the Amazon estuary (SEA)*

*3 Association of Research and Preservation of Aquatic Ecosystems (Aquasis), Caucaia, Brazil*
*4 Biology and Conservation of Amazonian Aquatic Mammals (BIOMA)/Federal Rural University of the Amazon (UFRA), Belém, Brazil*
*5 Institut Pasteur de la Guyane, Cayenne, French Guiana*
*6 Kwata NGO, Cayenne, French Guiana*
*7 Institute for Technological and Scientific Research of Amapá (IEPA), Macapá, Brazil*
*8 Federal University of Minas Gerais, Belo Horizonte, Brazil*
*9 University of the Amazon Zoological Park (ZooUNAMA), Santarém, Brazil, Santarém, Brazil*
*10 Aquatic Mammals Foundation (FMA), Aracaju, Brazil*
*11 Federal Institute of Amapá (IFAP), Porto Grande, Brazil*
*12 Federal University of Para (UFPA), Bragrança, Brazil*

Increasing human threats resulted in a growing number of manatee strandings in the Amazon estuary, the only place in the world where two manatee species, coexist and hybridize. To improve rescue and rehabilitation efforts and increase knowledge on these animals, in November 2020 researchers from Brazil and French Guiana created the 'Research and Conservation network for Sirenians in the Amazon estuary' (SEA). Since then, several activities were implemented: rescue (1) and handling (4) training courses; signing of technical agreements with zooparks (2); launch of one fundraising campaign; submission of projects (2); approval of one project, by Save the Manatee Club.

## Unprecedented mortality of Florida manatees along the Atlantic coast since December 2020

Martine de Wit[1], Margaret E. Barlas[2], Charles J. Deutsch[3], William D. Greer[4], Amber R. Howell5, Nadia Gordon[6], Andrew J. Garrett[1], David S. Rotstein[7], Teresa Calleson[8], and Leslie I. Ward- Geiger[2]

*1Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, 3700 54th Avenue South, Saint Petersburg, FL*
*2Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, 100 8 th Avenue Southeast, Saint Petersburg, FL*
*3Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, 1105 SW Williston Road, Gainesville, FL*
*4Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, 4020 South Highway A1A, Melbourne Beach, FL*
*5Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, 19100 SE Federal Highway, Tequesta, FL*
*6Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, 370 Zoo Parkway, Jacksonville, FL*
*7Marine Mammal Pathology Services, 19117 Bloomfield Road, Olney, MD*
*8U.S. Fish and Wildlife Service, 7915 Baymeadows Way Suite 200, Jacksonville, FL*

Manatee morbidity and mortality along the Atlantic coast has been unprecedented in regional numbers and cause starting in early December 2020. An Unusual Mortality Event (UME) was declared for this region in March 2021. Preliminarily, 715 manatee carcasses (from all causes of death) were reported within the Atlantic region between December 1, 2020 and August 16, 2021. About half of these carcasses were found in Brevard County waters. Seventythree manatees were rescued (all causes) within this region during this timeframe. The primary cause of the UME is malnutrition, driven by seasonal migration (for warmth) to areas where most seagrass has died off. The Indian River Lagoon (IRL) has experienced significant water quality degradation, leading to the repeated occurrence of harmful algal blooms and widespread loss of seagrass over the past decade. The IRL is central in manatee migration patterns on the Atlantic coast; health effects of starvation were documented well beyond the IRL in manatees that were thought to have migrated south through the IRL in the winter or north from this region in the spring. As manatees dispersed from winter habitat to regions with more forage, carcass numbers returned to a more typical range, starting in May. Individual effects of prolonged starvation, however, were still documented throughout the summer. This starvation event and the loss of forage habitat raise concern for long-lasting effects on population health. In addition to habitat restoration, proactive efforts to plan for and mitigate future events when manatees return for the winter are warranted.

## U.S. Geological Survey Florida manatee biological sample archive

Jason A. Ferrante and Margaret E. Hunter

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

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. To facilitate this process, we have implemented a sample request form and material transfer agreement akin to others used in the Federal system. Samples supplied from manatee health assessments and the USGS biological sample archive have supported graduate work at the University of Florida and others, leading to numerous publications and conference presentations. Through the provision of archive samples, the U.S. Geological Survey continues its work to aid in manatee recovery and advancing research of this emblematic species.

## Serological survey of *Leptospira* spp., Brucella spp., and Toxoplasma gondii in Amazonian manatees (*Trichechus inunguis*) in the Western Brazilian Amazon

Thaís Carnerio Santos Rodrigues1,3, Flávia Batista Ferreira França1, André Luiz Quagliatto Santos1 , Eliana Scarcelli Pinheiro2, Rosa Maria Piatti2, Vanessa Castro2, Ana Beatriz Garcez Buiatte1 , Anna Monteiro Correia Lima1, Vanessa Miranda dos Santos1, Tiago Wilson Patriarca Mineo1, and Miriam Marmontel3

*1 Federal University of Uberlândia, Uberlândia, MG, Brazil*
*2 Biological Institute of São Paulo (IB), São Paulo, SP, Brazil*
*3Mamirauá Sustainable Development Institute (IDSM), Tefé, AM, Brazil*

We investigated the presence of antibodies against *Leptospira* spp., *Brucella* spp., and *Toxoplasma gondii* in serum samples of Amazonian manatees in the Western Brazilian Amazon. Over a third of the manatees presented anti-*T. gondii* antibodies. More than 60% of sera were reactive to *Leptospira* spp. and serovar Patoc was considered the infecting serovar in all positive samples. Titers were generally low, indicating chronic exposure, but active infection was suggested in four cases. Anti-*Brucella* spp. antibodies were not detected. Our study highlights the importance of Amazonian manatees as sentinels of environmental health and disease surveillance in the Amazonian aquatic ecosystem.

## Impacts of glyphosate on in-vitro T-lymphocyte proliferation in Florida manatees

Maite De Maria[1], Nicole I. Stacy[2], Jeffrey Abbott, Ruyiu Pu[2], Kevin J. Kroll[1], Francisco R. Barboza, Catherine Walsh, Michael T. Walsh[2], and Nancy Denslow[1]

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*1Department of Physiological Sciences, College of Veterinary Medicine, University of Florida, Gainesville, FL*
*2 Department of Comparative, Diagnostic & Population Medicine, College of Veterinary Medicine, University of Florida, Gainesville, FL*

The immune system's role is to protect against infectious disease using a two-component complex system of cellular and humoral responses. Glyphosate is the most used herbicide worldwide for agriculture, aquatic weed control, and home use, and is therefore widely present in Florida waterbodies. The objective of this

study was to determine if glyphosate impacts the Florida manatee's adaptive immune response as measured via T-cell proliferation. We isolated lymphocytes from blood samples of 12 free-ranging animals in December (n=8) and-January (n=4) from 2018 and 2019. To measure lymphocyte proliferation capacity, lymphocytes were placed into culture and exposed simultaneously to a mitogen, and to 0, 10, 1000, and 10,000 µg L-1 of glyphosate or to an equivalent high concentration of glyphosate in Rodeo®, an aquatic formulation of glyphosate. The proliferation capacity was significantly affected by the treatments and sampling periods evaluated. Glyphosate caused a dose-dependent reduction in the proliferation capacity of Tlymphocytes with a significant decrease of 27% on average at 10,000 µg L-1 of glyphosate. Sampling period affected several blood analytes, and this may have influenced the reduction in T- cell proliferation in January compared to December samples. The in-vivo effects of glyphosate on health variables of wild manatees have not yet been determined but the findings of this study should be considered in the context of a threatened species that is already facing other environmental stressors affecting their immune response.

## Solitary chemosensory cells in respiratory epithelium of the Florida manatee

Meghan Barboza and Brienne Simmonds
*1Southern Connecticut University, New Haven, CT*

Solitary chemosensory cells (SCCs) play an important role in responding to respiratory infections and have been found in the epithelium of the nasal passage and trachea of all studied mammals to date. SCCs function through taste receptors similar to those in the taste buds of the tongue, which Florida manatees possess in large numbers. Tracheal and nasal tissue from two manatees was stained using immunohistochemistry with antibodies against G-α Gustducin. This protein delineates SCCs from other cells of respiratory epithelium. The presence of these cells in manatees presents an opportunity to further understand the innate immune system of manatees.

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

Francisco Pardo Palacios[1], Maite de Maria[2], Carlos Menor[3], Stefan Goetz[3], Mike Walsh[4], David Moraga[5], Ingrid Ashley Youngworth[6], Angela Brooks[7], Ali Mortazavi[8], Natalia Reyero[9] , Margaret Hunter[10], Nancy Denslow[2], Ana Conesa [11,12], and the LRGASP consortium

*[1]Polytechnical University of Valencia*
*[2]Department of Physiological Science, College of Veterinary Medicine, University of Florida, Gainesville, FL*
*[3]Biobam Bioinformatics, SL, Valencia*
*[4]Department of Comparative Diagnostic and Population Medicine, College of Veterinary Medicine, University of Florida, Gainesville, FL*
*[5]Interdesciplinary Center for Biotechnology Research, University of Florida, Gainesville, FL*
*[6]Department of Biomolecular Engineering UC Santa Cruz; UC Santa Cruz Genomics Institute*
*[7]Department of Genetics, Stanford University, Palo Alto, CA*
*[8]Department Developmental and Cell Biology, University of California at Irvine*
*[9]ERDC-US Army*
*[10]USGS-University of Florida*
*[11]Institute for Integrative Systems Biology-CSIC, Valencia*
*[12]Microbiology and Cell Science Department, University of Florida, Gainesville, FL*

The LRGASP challenge is a community-wide effort to evaluate the suitability of long reads sequencing technologies to accurately define full-length transcripts and resolve alternatively spliced transcripts, which has been an outstanding problem of short-reads technologies. As part of this initiative, the transcriptome of the Floridian manatee is being sequenced to assess long reads sequencing methods on poorly characterized genomes. The LRGASP consortium has obtained a total of ~ 7.8 M Pacbio and ~ 40 M Nanopore reads for the

manatee blood, taken from 9 different individuals, male, female, adult and juvenile. In parallel, the genome of the manatee has been sequenced with Nanopore at a 27x coverage. Assembly of the manatee genome resulted in ~15,602 contigs with an N50 of 488,000. Preliminary analysis indicates significant differences in the read length for both sequencing technologies, although both exhibit a high mapping rate (> 99%) to the Nanopore assembled genome. Isoseq3 analysis of the Pacbio data returned 61,000 putative transcripts and a 95% matching of BUSCO conserved protein families. So far, more than 20 groups have signed up for LRGASP and we expect multiple submissions will be obtained for the analysis of the manatee data. From this effort we expect a well-curated full-length transcriptome of the manatee blood, as well as new guidelines for the utilization of long reads sequencing methods for transcriptome analysis in non-model species.

## Environmental exposure and associated health effects of per- and polyfluoroalkyl substances (PFAS) in Florida manatees

Emily Griffin [1] and John Bowden [1,2]

*[1]Department of Physiological Sciences, College of Veterinary Medicine, University of Florida, Gainesville, FL*
*[2]Center for Environmental and Human Toxicology, University of Florida, Gainesville, FL*

Marine mammals such as the West Indian manatee, can serve as informative environmental sentinels both for the presence and effect of anthropogenic chemicals and other environmental stressors in highly variable and shared environments to humans (e.g., coastal waters). Per- and polyfluoroalkyl substances (PFAS) are a group of anthropogenic chemicals that have been increasingly identified in terrestrial and aquatic ecosystems and have been associated with adverse health effects. PFAS have been measured in manatee whole blood with the use of dried blood spots (DBS), which provide the ability to reduce human interaction and amount of biological material that must be collected during routine health assessments. From an anthropogenic chemical standpoint, most research has focused on species with a well-defined exposure route, such as those that consume fish. However, the presence of these compounds in manatees, an herbivorous species, necessitates further research into potential routes of exposure. In this study, we further examined PFAS concentrations in the Florida manatee's native habitat. Determining to what extent a wildlife population is affected by environmental stressors (e.g., contaminants, algal blooms, climate change) is a central theme of ecotoxicology and wildlife pathology and overall, an important bridge to understanding common overlaps with human health.

## Modeling perinatal manatee populations in order to identify potential hotspots and nursery locations.

Sydney Johnson, Dominic Travis, and Amy Kinsley

*Department of Veterinary Population Medicine, College of Veterinary Medicine, University of Minnesota, St. Paul, MN*

The Florida manatee has been a target for conservation research and initiatives to protect this population. However, little is known about the neonatal and perinatal life stages of the manatee. The objective of this work is to establish criteria for identifying nursery habitats for manatees to identify and protect these areas. In this study we will use spatiotemporal analyses to identify and characterize surveillance data from Florida's major waterways. Using the study findings, potential nursery areas may arise as targets for conservation work and research in the future to evaluate and monitor these crucial life stages.

# Enhancement of selected manatee rescue response parameters: Drone support of capture and medical support in emergency response – why we take all the equipment

Michael T. Walsh[1], Craig Pelton[1], Sarah Balik [2], Dana Lanier[3], Laurie Adler[2], Suzanna Mickey[3], Hannah Walsh [3], John Rouse[4] Monica Ross[5], Nicole Bartlett[5], Kerry Sanchez[6], Melissa Hitzfield[6], Teresa Calleson[7]

*[1]Department of Comparative Diagnostic and Population Medicine, College of Veterinary Medicine, University of Florida, Gainesville FL*
*[2]Large Animal Clinical Sciences, College of Veterinary Medicine, University of Florida, Gainesville, FL*
*[3]UF Marine Animal Rescue, College of Veterinary Medicine, University of Florida, Gainesville, FL*
*[4]Environmental Health & Safety, Risk Management, Office of Unmanned Aircraft Systems, University of Florida, Gainesville, FL*
*[5]Clearwater Marine Aquarium Research institute, Clearwater FL*
*[6]Zoo Tampa at Lowry Park, Tampa, FL*
*[7]U.S. Fish and Wildlife Service, Jacksonville, FL*

A variety of technical and personnel challenges are encountered by rescue teams with ill and injured wild manatees that include surveillance-monitoring, intervention, medical scenarios and transport logistics that can be unpredictable in complexity. Experience in the logistics and application of techniques allows the monitoring team, rescue teams and veterinary personnel to handle this range of possible scenarios through option-based planning with on-site equipment. Response may encompass problematic environments for the relocation and rescue event, a wide variation in illness/body condition and numerous levels of critical care that may impact the outcome. Working with drones to aid in detection and acquisition of animals can allow for more efficient initial location of the target animal, behavioral evaluation, capture boat deployment of materials and personnel for netting, and visual reacquisition of target animal that avoids capture attempts. Relative location, speed, and movement of an animal under drone surveillance can be transferred to the capture boat captain through radio description of the animal's location. With future development, the drone view could be seen directly by the captain or others on board for first hand response on the coordination of the netting event. Veterinarians and rescue personnel are better able to prepare to respond with adequate equipment once an experienced verifier visually assesses the targeted animal's condition for physical and behavioral abnormality, to include level of weakness, injury, and chronic illness. This can allow for response capability from a simple grab and go up to the level of cardiopulmonary complications including oxygen supplementation and intubation. The percentage of manatees with a requirement for intervention with cardiopulmonary complications is very rare but the on-site presence of needed drugs and equipment may provide a higher level of medical intervention. Two manatees monitored by Clearwater Marine Aquarium Research Institute (CMARI) at Welaka Springs showed signs of cold stress and needed rescue. The juvenile individual showed great concern and had also beached itself while observed. Both were captured for transport and treatment with monitoring by a Mavic Air 2 drone and a licensed drone pilot aware of manatee response to drones. The juveniles landing on the boat resulted in a flaccid animal who was non-responsive to stimulation and suggested possible expiration by those on board. After a short delay the animal was given cardiopulmonary assistance while rushing to the boat ramp where additional veterinary support was available with resuscitation drugs including steroids, a respiratory stimulant, glucose, intubated and given oxygen support with a demand valve. The manatee appeared to respond with breathing efforts initially due to the stimulant. Each inhalation start was assisted with oxygen, inspiration pressure held for a short time and the animal transported to SeaWorld while intubated. The animals breathing improved during transport and was extubated on arrival in consultation with Dr. Stacy DiRocco at SeaWorld then placed in a rehabilitation pool. It showed some hesitation in surfacing initially but with critical care provided by the SeaWorld staff and veterinarians has done well. She is gaining weight and a good candidate for future release. The inclusion of resuscitation capability on rescues illustrates a common principle of field work medical response in that you can't go back for what you didn't bring when you need it.

***Sirenews* – Florida manatee**

**(End of abstracts)**

# RECENT LITERATURE


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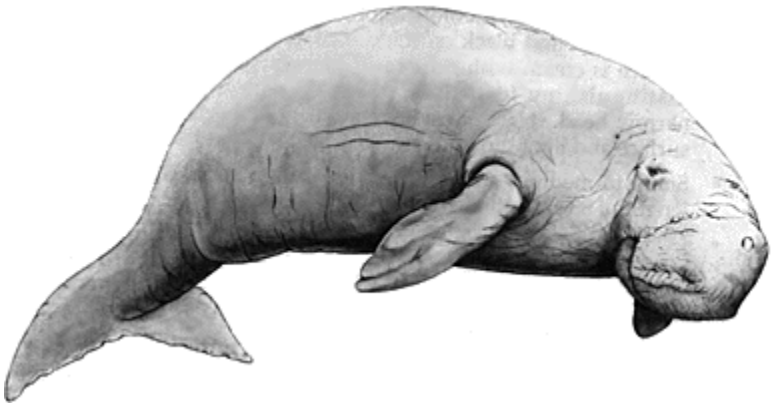

**Sirenews – Dugong**

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

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

**COPY DEADLINE FOR NEXT ISSUE: April 1, 2022**

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