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Tico's Rescue in Venezuela (Photo: Joan Daniel González Zambrano, Audiovisualmasterpro)

UNION INTERNATIONALE POUR LA CONSERVATION DE LA NATURE ET DE SES RESSOURCES
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Repeating the note from IUCN SSC Global Center for Species Survival:

The Species Survival Commission is now encouraging species specialist group members to include their SSC affiliation on all relevant documents and publications, in addition to their respective home institutions. This is a win-win situation, in that it gives further IUCN credibility to members and their publications, and allows the SSC to track specialist group contributions. As a member of the Sirenia Specialist Group, please feel free to add the following affiliation to any work you deem relevant to Sirenia conservation:

IUCN Species Survival Commission Sirenia Specialist Group

LOCAL NEWS

AUSTRALIA

Status and trends of the dugong, *Dugong dugon*, in Australia

Extract from: Clark G, Fischer M, Hunter C (2021). *Australia state of the environment 2021: coasts*, independent report to the Australian Government Minister for the Environment, Commonwealth of Australia, Canberra, [DOI: 10.26194/AANZ-RF46](https://doi.org/10.26194/AANZ-RF46).

Introduction

The biodiversity and cultural values of the dugong, *Dugong dugon*, are exceptional. One of four extant species in the mammalian order Sirenia and the only extant species in the family Dugongidae, it is the only herbivorous mammal that is strictly marine. In addition, the dugong is a cultural keystone species for Aborigines and Torres Strait Islanders living adjacent to its Australian range (Butler et al. 2012). The Australian dugong population is the most important in the world and the dugong is explicitly mentioned in the statements of Outstanding Universal Value of two World Heritage Areas: Shark Bay and the Great Barrier Reef (Figure 1).

Current state

The dugong is the most abundant marine mammal in the coastal waters of northern Australia (Marsh et al. 2011). It is a Matter of National Environmental Significance and is protected under the EPBC Act as a listed migratory and marine species. The dugong is listed as Other specially protected fauna (OS) in Western Australia and Vulnerable in Queensland.

Standardized aerial surveys provide data on the distribution and abundance of the dugong in Australia. These surveys reflect jurisdictional rather than bioregional or genetic boundaries and their timing is not coordinated. Surveys demonstrate that the conservation status of the dugong is uneven across its Australian range (Figure 1; and Table 1), however confidence in this assessment varies because of regional and temporal differences in survey methodology. The Pollock et al. (2006) and Hagihara et al. (2014, 2018) methods address the detection biases associated with aerial surveys, but the latter method is superior because it corrects for water depth as well as environmental conditions. This is especially important in the Torres Strait where a high proportion of sightings are in deeper water and the latest population estimates for Torres Strait are many times higher than previous estimates.

The most robust trend data are from the east coast south of 10°S where Bayesian statistics have been used to detect trends (Marsh et al. 2019).

Important Marine Mammal Areas (IMMAs) are defined as discrete portions of habitat, important to marine mammal species that have the potential to be delineated and managed for conservation (di Sciara et al. 2016). In 2020, Important Marine Mammal Areas with dugongs as a qualifying species were identified in Australian waters using an internationally-accepted, expert process (see Figure 2).

Pressures

The main threat to the dugong is loss of seagrass habitat associated with extreme weather events, especially floods, cyclones and marine heatwaves. Habitat loss is associated with increased mortality at the end of winter (Meager and Limpus 2014) and reduced recruitment with a 1.5-2-year lag (Fuentes et al. 2016; Bayliss et al. 2018). Recruitment (proportion of sightings that are attendant calves) is a robust index of population health.

Management Approaches

The rate of change in dugong populations is most sensitive to adult mortality (Marsh et al. 2011). Initiatives to reduce mortality are most developed on the east coast of Queensland and Torres Strait and include the Torres Strait Dugong Sanctuary; commercial fisheries closures, especially closures to gill-netting; localized initiatives to reduce the risk of vessel strike and agreements with Traditional Owners (Marsh et al. 2011, 2020). The incidence of unreported incidental catch in commercial gill-nets in Queensland and the Northern Territory is unknown because of inadequate surveillance.

Outlook

The outlook for dugongs in the Southern Great Barrier Reef Queensland is poor (Figure 1; Table 1). The outlook in the remainder of the range is good in the short-term, but will likely deteriorate in the long term if there is further development in the remote north of Australia, or if seagrass meadows and dugong demography and health are significantly affected by climate change.

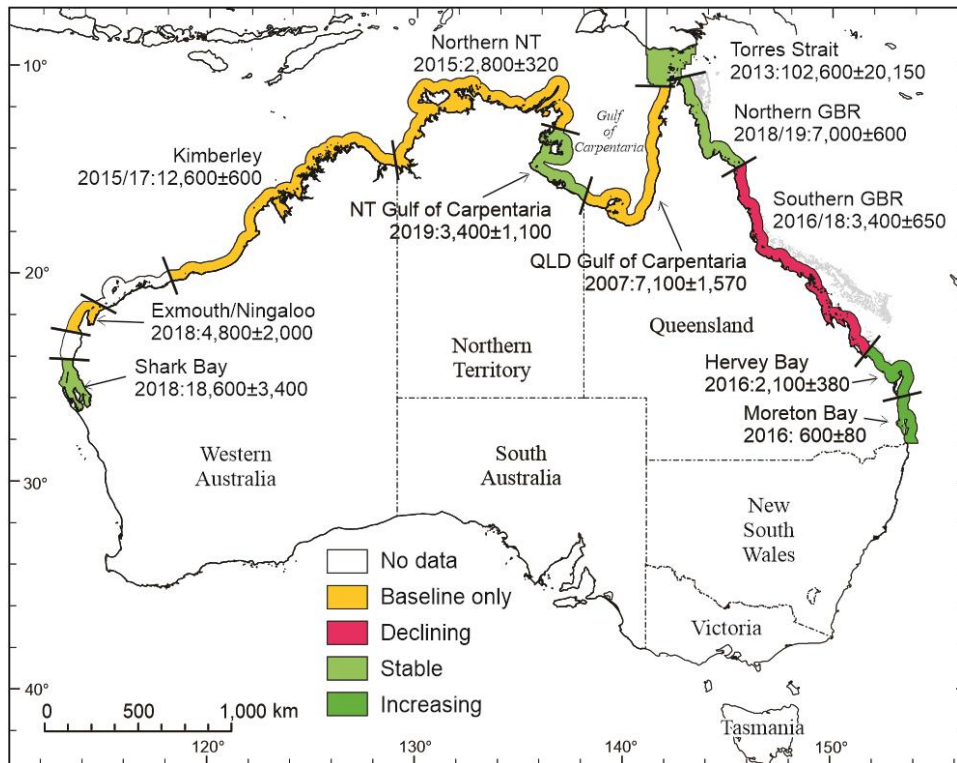


Figure 1. (a) Range map showing the latest estimates of dugong population size and trends of various components of the dugong population in Australia. The data are from standardized aerial surveys conducted using the Pollock et al. (2006) method (northern coast of Northern Territory and Gulf of Carpentaria coast of Queensland) and Hagihara et al. (2014, 2018) method (remainder). Baseline: trend unavailable or low confidence (Marsh et al. 2008; Groom et al. 2015, Bayliss et al. 2017, 2018). The trend assessment for Shark Bay (Bayliss et al. 2018) and the Gulf of Carpentaria coast of the Northern Territory Northern Territory (Griffiths et al. 2020) are based frequentist statistics. The assessment for Torres Strait is based on several lines of evidence (Marsh et al. 2015) but recent Traditional Owner observations are generally consistent with widespread seagrass dieback, which is likely to have adverse impacts on the dugong population; those for the east coast locations are based on data from Sobtzick et al. 2017 and Marsh et al. 2020 and Bayesian statistics (Marsh et al. 2020 and Marsh and Rankin unpublished).



Figure 2. Important Marine Mammal Areas in Australian waters for which the dugong is a qualifying species identified by an expert workshop in 2020; see <https://www.marinemammalhabitat.org/immas/>.

Table 1. Regional assessment of the status and trends of the dugong in Australian waters based on standardized aerial surveys (See Figure 1 for details).

| Region | Assessment | Trend | Confidence |
|---|------------|---------------|-------------------|
| Shark Bay WA | Good | Stable | Somewhat adequate |
| Exmouth/ Ningaloo WA | Good | Stable | Very limited |
| Kimberley coast, WA | Good | Stable | Very limited |
| North coast of Northern Territory | Good | Stable | Very limited |
| Northern Territory: Gulf of Carpentaria coast | Good | Stable | Somewhat adequate |
| Qld: Gulf of Carpentaria coast | Good | Stable | Very limited |
| Torres Strait, Qld | Good | Stable | Somewhat adequate |
| Northern Great Barrier Reef, Qld | Very good | Stable | Adequate |
| Southern Great Barrier Reef, Qld | Poor | Deteriorating | Adequate |
| Hervey Bay, Qld | Good | Improving | Adequate |
| Moreton Bay, Qld | Good | Improving | Adequate |

Table 2. National assessment summary of the state and trends of the dugong.

| | Assessment | Confidence | Comparability |
|------------------|------------|-------------------|---------------------|
| State | Good | Somewhat adequate | Somewhat comparable |
| Trend since 2016 | Stable | Somewhat adequate | Somewhat comparable |

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BRAZIL

Additions to the food items consumed by Amazonian manatees (*Trichechus inunguis*) according to Negro River (Amazon, Brazil) riverine inhabitants: Does fruit represent a seasonal delicacy?

The Amazonian manatee (*Trichechus inunguis*) is the largest river mammal in Brazil, and endemic to the Amazon River Basin (Best, 1984; Rosas, 1994). As strict herbivores, these animals act in the biological control of aquatic and semi-aquatic plants when feeding, and their feces and urine contribute to river fertilization (Best, 1984; Junk & da Silva, 1997; Guterres-Pazin et al., 2014).

Although they are extremely important, most studies on Amazonian manatee feeding habits were conducted on stomach contents or field observations, which provide only short-term information (Crema, 2017). Therefore, complementary approaches, such as those that consider the knowledge of traditional Amazon populations, are required for the expansion of scientific databases and development of effective management and conservation strategies (Huntington, 2000).

This study was conducted during a survey on artisanal fishing, fish fauna composition and climate change effects, carried out within the scope of the project entitled “Food Ecology in Amazon Rivers: temporal and spatial assessments”, supported by Fundação de Amparo à Pesquisa do Estado de São Paulo – FAPESP no. 2021/05468-7.

A total of 31 Negro River riverside community residents were interviewed in a dialogic and volunteer manner concerning the identification, presence and feeding habits of Amazonian manatees. The survey took place between September 1st and 14th, 2022, across nine communities in the Iranduba and Novo Airão municipalities, located in the Lower Negro River region in the state of Amazonas, Brazil (Figure 1).

To identify the manatee species, an Amazonian manatee illustration was presented to the interviewees, while food item identification was performed through the question “What does the manatee eat?”. Most of the 31 respondents were male (74%) and only 8 were female (26%), aged between 18 and 78 years old, and all (100%) claimed to know the manatee. Of the total number of respondents, 58% (n=18) mentioned food items eaten by manatees, usually identified by direct observations or consumption evidence. The interviewees mentioned 15 different aquatic and semi-aquatic plant and fruit species consumed by *T. inunguis*, comprising grass (61%) and batatarana (22%), followed by wild rice (17%), “rama” (submerged vegetation) (17%), cipó grass (17%), murirú (11%), sludge (11%), urana or “bush bean” (11%) and embaúba (11%). Some items were reported only once, but are worth mentioning, namely maracarana (fruit), membeca, araçá-do-mato, “leaves”, fruits and “grass”.

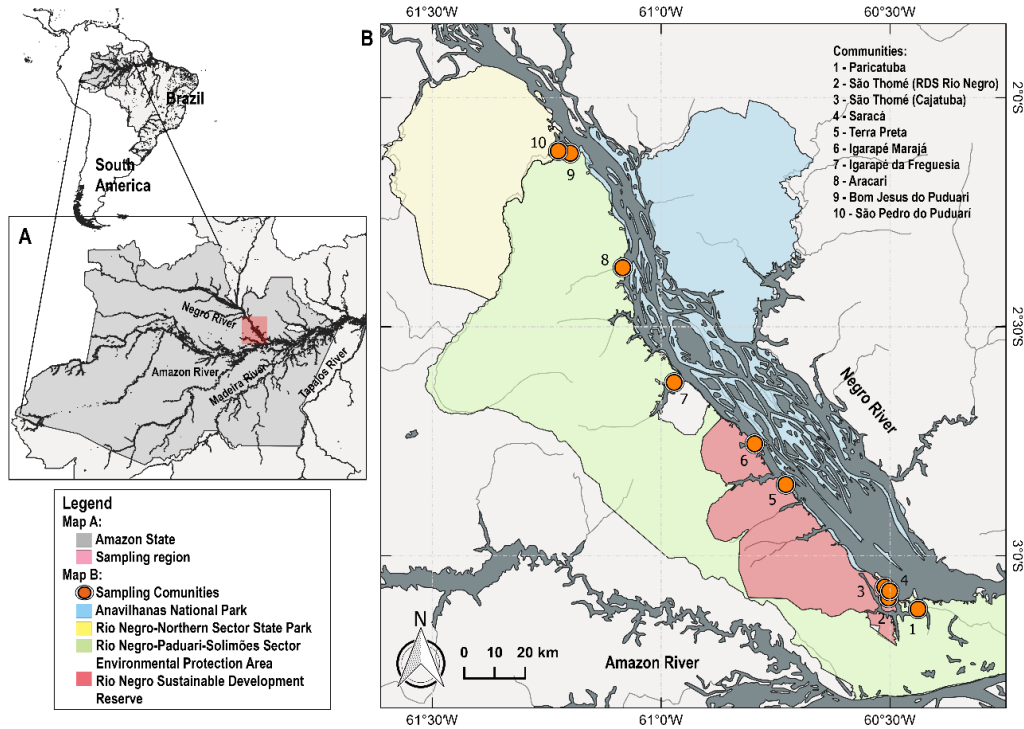


Figure 1. Communities visited during the surveys conducted at the Lower Negro River region, Amazonas, Brazil, in September, 2022.

Some of these reported ethnospecies deserve special attention when referring to the literature on the plants consumed by Amazonian manatees. Best (1981), Guterres-Pazin et al. (2014), Crema (2017), Crema et al. (2019, 2020) and Pantoja (2021) had previously reported some of these items, including batatarana (Amaranthaceae, *Alternanthera hassleriana* or Asteraceae, *Mikania micrantha*, or Convolvulaceae, *Ipomoea* spp.); embaúba (Urticaceae, *Cecropia* spp.); cipó-icica (Apocynaceae, *Tassadia berteriana*), murirú (Pontederiaceae, *Eichhornia azurea* and *E. crassipes*) and/or Alismataceae (*Sagittaria sprucei*) and/or Araceae (*Pistia stratiotes*) and/or Araliaceae (*Hydrocotyle ranunculoides*), Pteridaceae (*Ceratopteris pteridoides*), Salviniaceae (*Azolla filiculoides* and *Salvinia* spp.), membeca (Poaceae, *Paspalum repens*) and arroz-selvagem (Poaceae, *Oryza glumaepatula*), maracarana (Polygonaceae, *Coccoloba pichuna*), urana or “bush bean” (Fabaceae, *Phaseolus* cf. *pilosus*, *Aeschynomene* sp., *Clitoria glycinoides*, *Sesbania exasperate*, *Cymbosema roseum* and *Vigna lasiocarpa*).

The citation of “sludge” was previously being discussed in Franzini et al. (2013), Crema et al. (2020) and Siciliano et al. (2021). Our record for wild guava fruit (Myrtaceae, “araçá-do-mato”) consumption is significant. Guterres et al. (2008, 2014) and Pantoja (2021) reported the “arati” (*Eugenia inundata*) on a list of consumed food items by *T. inunguis* inside the Amanã and Mamirauá Reserves and in the Atalaia do Norte municipality, located at the lower Javari River, in the state of Amazonas, respectively. Thus, our survey comprises the first mention of a Myrtaceae member as a manatee dietary item at the Negro River. Notably, 16% of the respondents indicated that various fruits

are a staple part of manatee diets in that Negro River region, which, added to a previous record of “castanharana” (Siciliano et al., 2021), comprise at least four fruit ethnosppecies consumed by Amazon manatees. Guterres et al. (2008) also reported that the leaves and fruits of several trees (*Cecropia cf. latifolia*, *Elaeoluma glabrescens*, *Oxandra riedeliana*, *Symmeria paniculata*, *Genipa spruceana*, and *Duroia genipoides*) were observed in manatee diet analyses during both the flood and drought periods at the Amanã and Mamirauá Reserves, and were also reported by local inhabitants as potential food items for this species during the wet season. Therefore, both literature data and our survey confirm that fruits seem to represent a relevant part of manatee diets, which certainly diversify vitamin and mineral sources that are probably not included in ingested leaves only. The availability of these fruits may be higher during the flooding period, from May to September, when manatees enter the flooded forest or igapó (Figures. 2 and 3).

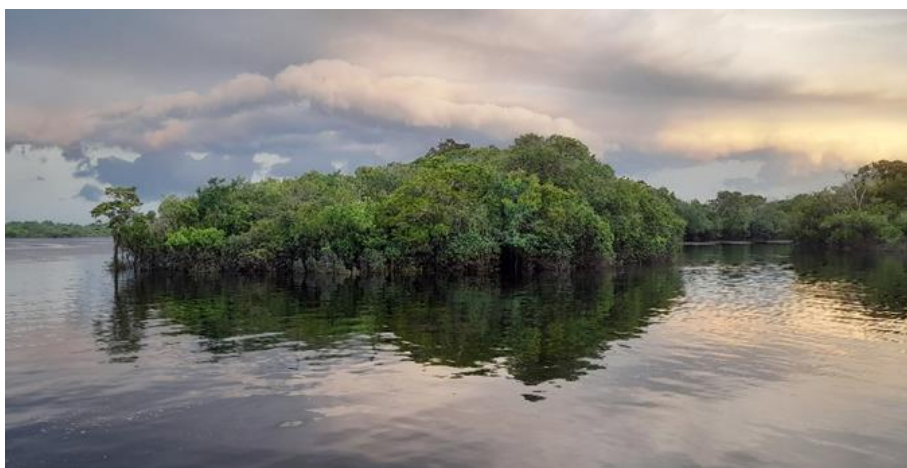


Figure 2. Flooded forest (igapó) during September, 2022, at Bom Jesus do Puduari, Lower Negro River, Amazonas, Brazil. Picture by S. Siciliano.



Figure. 3 – Inside the flooded forest (igapó) during September, 2022, during the high-water level. Picture by S. de Souza Bolina.

Wild guavas ('araçás', Myrtaceae) are known for their high vitamin C, β -carotene and macro minerals (potassium, calcium, sodium, zinc, molybdenum, chromium and cobalt) contents (Yuyama et al., 2000) alongside pharmaceutical properties. One species, the camu-camu (*Myrciaria dubia*), is now highly prized in the international market for its elevated vitamin C contents (Zapata and Dufour, 1993). The ingestion of this fruit by Amazonian manatees may not be accidental or underestimated, but rather represent an important source of nutrients to sirenians, at least seasonally. Thus, studies in this regard become paramount, as the current climate change scenario may cause potentially irreversible impacts on the biodiversity and balance of the world's largest tropical forest, especially native fruit tree species (Evangelista-Vale et al., 2021), directly affecting manatee dietary food items and comprising another threat to the species.

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Cauxi (Porifera, Demospongiae), a new food item in the diet of the Amazonian manatee (*Trichechus inunguis*)?

A recent survey with lower and middle Negro River inhabitants in the state of Amazonas, Brazil, on the occurrence and status of Amazonian manatees (*Trichechus inunguis*), has reported new food items consumed by this endangered aquatic mammal species. A total of 31 riverine inhabitants were interviewed, 23 men (74%), and 8 women (26%), aged between 18 and 78 years. All of them indicated they are familiar with the manatee and 58% mentioned food items consumed by this species, usually identified by direct observations or evidence of consumption. Among the cited food items, one respondent drew attention to the cauxi (Porifera, Demospongiae), a freshwater sponge also known as cauxi, caiuxi, caixi and cauí in the Amazon (Farias, 2019; this study), as a food resource frequently consumed by manatees.

The interviewee from the Bom Jesus do Puduari Community, in Novo Airão, Amazonas (Figure 1), was in fact a good resource on manatee diet information. During two dialogic and voluntary interviews carried out with the same informant, on September 10th and 11th, 2022, cauxi citations appear among several plant species consumed by manatees, such as grass, embaúba, murirú, urana beans, sludge and ica grass. These quotes point to a refined knowledge of the plants consumed by local manatees, with the cauxi quote specifically drawing attention.

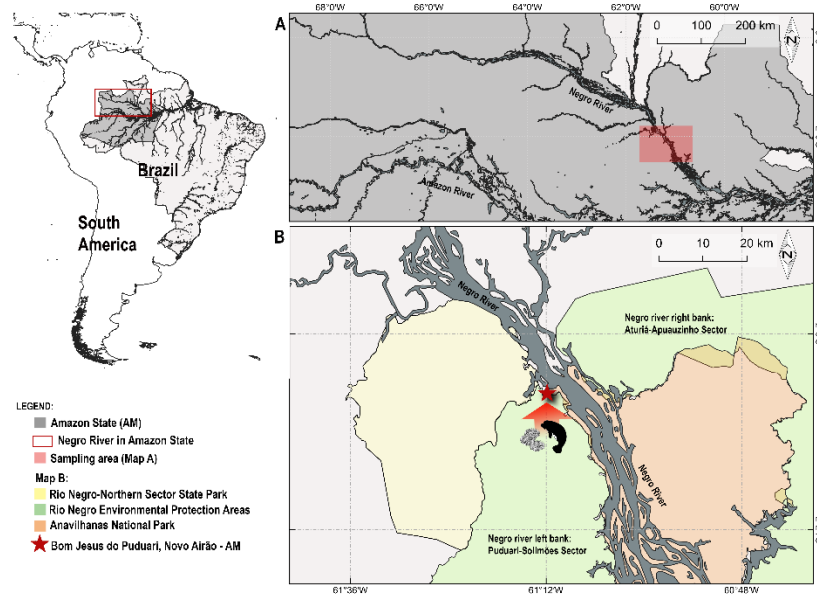


Figure 1. Location of the Bom Jesus do Puduari Community, Negro River, Amazonas, Brazil

A search of specific literature concerning Amazonian manatee food items retrieved no citation for sponge consumption in any Amazon region. In fact, the Amazonian manatee is treated as exclusively herbivorous (Best, 1981, 1982, 1983, 1984; Guterres-Pazin et al., 2014). The accidental ingestion of other elements such as sand and small invertebrates, including crustaceans, was initially pointed out by Colares (1991). Subsequently, Colares and Colares (2002) reported the consumption of “non-identified algal filaments, animal fragments, grains of sand, and decomposing vegetable matter”, suggesting that these items were attached to consumed vegetation, thus being accidentally ingested by Amazonian manatees when foraging on plants. Similar observations were made by Guterres-Pazin et al. (2014) at the Amanã and Mamirauá Reserves. On the other hand, the marine manatee (*Trichechus manatus*) has been identified as an active consumer of the *Chondrilla caribensis* sponge (Fitt, 2020), and a study has reported manatee’s sponge consumption, as well as other invertebrates, in Belize, in the Caribbean (Allen, 2014). Thus, it is plausible that the Amazonian manatee may also be an active sponge consumer, as sponges are abundant throughout Amazon rivers, including in the Negro River (Figures 2 and 3).

In fact, the first spongofauna survey in black water environments was carried out in Lake Tupé, on the Negro River, near Manaus, indicating a high abundance of sponge species belonging to three families, such as *Metania reticulata*, *M. subtilis*, *Acelle recurvate*, *Drulia browni* and *D. uruguayensis* (Metaniidae), *Trochospongilla gregaria*, *T. paulula* and *T. pennsylvanica* (Spongillidae), and *Oncosclera navicella*, *O. spinifera* and *O. intermedia* (Potamolepidae) (Volkmer-Ribeiro and Almeida, 2005). These authors mention that the high biological Amazon diversity also includes sponges, although studies are restricted to ecological and taxonomic surveys, with chemical studies and predation studies still lacking. It is, thus, noteworthy that a sponge is mentioned as a food item for manatees in the Negro River region. Consequently, future assessments regarding manatee diets should include specific assessments concerning freshwater sponges (i.e., spicule identification), which would allow for better

assessments on the presence and importance of this resource in the diet of an aquatic mammal treated to date as exclusively herbivorous.

It is important to note that the current climate change scenario verified worldwide is becoming extremely damaging to both marine and freshwater sponge species (Aguilar-Camacho et al., 2017; Conway et al., 2017), which may represent a potential threat to the already endangered Amazonian manatee if sponges are indeed a staple part of this species diet.



Figures 2 and 3. Cauxi (Porifera) covering the bottom of Negro River during the dry season. Pictures by Isabel Pellizzer.

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Are manatees still eaten nowadays? The sad description that *Trichechus inunguis* are still harvested for their meat

Historically, local indigenous peoples have hunted manatees throughout the Amazon basin to consume their meat. However, during the 1930s the number of animals slaughtered skyrocketed when their hide and blubber began being exported to Europe (Marmontel et al., 2012). In 1967, the Wildlife Protection Law was instated, halting this mass exportation, nevertheless, Amazonian manatees are still illegally harvested for food and other uses like traditional medicine, despite being considered vulnerable to extinction by the International Union for Conservation of Nature (IUCN) (Marmontel et al., 2016). Due to its wide distribution, enforcement of *Trichechus inunguis* protection law is limited. Still, data from illegal harvesting can be obtained by interviews and meat availability in local markets and can be used to assess to what degree manatees continue to be consumed in the Amazon region.

This study interviewed people from Coari, a city in the mid Solimões River, in northern Brazil. Two groups of people were interviewed, one of them was made up of local market regular buyers (n=50), and the other was made up by randomly selected people from the federal university in town (n=50). No significant difference in bushmeat consumption pattern was observed between the two groups. Bushmeat is consumed by 82% of people, and 57% said they still eat manatee meat, fresh or prepared as “mixira” (fried meat preserved in its own fat). Most people who eat manatee meat buy it directly from hunters (27%), followed by people who live in riverine communities (16%) and directly from the city market (15%). The people interviewed were asked whether or not they thought manatee hunting should be legalized. A few believe it should be allowed (2%), but most think it should not (80%) or did not have an opinion on the matter (12%). Most people (57%) have never had any type of instruction about the biology or the ecological importance of the Amazonian manatee. Manatee meat was found in markets in only 10 months over the three-year period of this research. But, as we already know, most of the people buy it directly from hunters or in riverine communities, showing that our

data is underestimated. The price of one kilogram of “mixira” or fresh meat varied between 15 to 25 reais (3 to 5 dollars), which is more than one kilogram of industrialized chicken, that varied between 6.75 to 12.8 reais (1.35 to 2.56 dollars) in the same period. Our data shows that people are still eating manatee meat because it is cultural, not because it is cheaper than other meats.

The culture of eating bushmeat is still around, and while there are frequent buyers, there will still be hunting and selling to feed this trade. It is hard to end a practice so culturally engrained, but the fact that most people still believe it should not be legal gives hope that raising awareness about the impact this practice has on local ecology and population dynamics of manatees might help change the current scenario.

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CUBA

Antillean manatee conservation planning in Cuba.

A workshop with the goal of gathering experts in the fields of manatee protection, wildlife conservation, and protected area management in Cuba took place in August 2022. The goal was also to update the current state of knowledge of the Antillean manatee in Cuba and to commence a conservation planning process for the species. The event was held at the headquarters of Zapata Swamp National Park on July 11th and 12th, coordinated by the Clearwater Marine Aquarium (CMARI) and the Center for Marine Research at the University of Havana (CIM-UH) (Figure 1). Funds and sponsorship were provided by the Columbus Zoo & Aquarium, as well as the Enterprise for the Conservation of Zapata Swamp (ECOCIENZAP-GEFF). A total of 24 people participated from 13 national entities and CMARI. The Cuban institutions included CIM-UH, National Center for Protected Areas (CNAP-CITMA), Office of Environmental Regulation and Safety (ORSA-CITMA), Flora and Fauna Enterprise (GEFF), the National Aquarium of Cuba, the Aquarium of Baconao-Santiago de Cuba, CUBANACAN (MINTUR), Alejandro de Humboldt National Park, Guanahacabibes National Park, Cayos

de San Felipe National Park, Desembarco del Granma National Park, Ciénaga de Zapata National Park (ECOCIENZAP) and Lanzanillo-Pajonal-Fragoso Fauna Refuge. The workshop agenda was prepared with guidance and recommendation of the IUCN SSC, Conservation Planning Group. The stated problem was that the manatee population in Cuba is presumed to be deteriorating, with decreasing numbers of animals, and possible low genetic diversity.

The workshop focused on the status and main threats to *Trichechus manatus* populations in Cuban territory, and the identification of objectives and actions for their effective protection and recovery. The agenda included work activities and presentations in order to inform and guide the planning process (Figure 2). Seven threats were identified and incorporated into the 10-year draft plan: poaching and illegal commerce, incidental capture, boat collisions (analyzed as a localized threat but with the potential to increase in the future), habitat loss, climate change, pollution and deficient management. Thirty-five objectives were proposed in order to mitigate and reduce the identified threats and for each one, a short, medium and/or long-term action was identified with the associated national entity linked to each task.

The information captured during the workshop is being utilized to inform a national plan of action, which has been already drafted; over the next six months, CMARI and the Center for Marine Research will continue to improve this draft.



Figure 1. Workshop participants.



Figure 2. Group activities, discussions and presentations during the workshop in Cuba.

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MALAYSIA

Conservation initiatives by Twin Beach Resort, Sibuland, Malaysia as a follow up to the GEF Global dugong and seagrass conservation project

The dugong and seagrass conservation project ended in 2018 with the hope that the conservation and research would continue in a global effort to save the dugong. Out of 40 projects one project entitled 'Community understanding and management of dugong and seagrass resources in Johor, Malaysia' (MY3) was located in Sibuland and Tinggi Island Johor, Malaysia. This project (which was initiated by the first author) sought to assist local communities in understanding the ecological and economic importance of conserving dugong and seagrass resources and to improve local capacity to manage these resources more effectively in harmony with social, cultural and economic needs. A public education campaign was done, employing posters, educational materials and the distribution of a dugong education storybook, targeting all sections of the community including school children, housewives and fishermen. The public was taught best practices associated with dugong and seagrass management, including: boating activity and safe boat speeds; first responses for the rescue of live stranded and incidentally caught dugongs; seagrass habitat protection and safe waste management. A dugong monitoring program was also introduced to local people, conducted every six months to stimulate interest in dugong conservation, record reported sightings and develop a digital map of incidences which will be shared with local residents. Management initiatives included managing seagrass areas in front of their home which entailed monitoring who came to visit these sites, reporting illegal activities to Marine Parks, conduct responsible waste disposal management, reducing boat speeds and preventing the physical damage of seagrass by limiting use of propellers, anchors, and other physical disturbance in seagrass areas.



Figure 1. Scouting a prime view for dugong watching

As a follow up, in 2022, Twin Beach Resort took the initiative to rebrand their resort to become an eco-friendly one. Alternative energy sources such as solar energy are being considered for use instead of petrol. Twin Beach Resort has also undergone a full water quality analysis of its water supplies to learn of any improvements to make for water quality. In the pipeline are education programmes, conservation initiatives for dugong and seagrass and research support which are part and parcel of Twin Beach resort's sustainable tourism practices and United Nations Sustainable Development goals (SDG) goals.

The two authors met up on the beautiful island of Sibu on the 17th of September, 2022 at the latter's invitation. Discussions were held on the way forward to dugong and seagrass conservation on the island as well as sustainable activities environmental educational programs that could be done for this. On September 18th, 2022 Twin Beach resort conducted a clean-up of its beach together with resort staff and guests to kick start sustainable activities on the island. The authors got up early to go to the south of the island on the 19th of September where dugongs were usually sighted to get a glimpse of this elusive creature (Figure 1). However, there was no luck this time. We also looked for a dugong sighting spot for guests of the resort. After that, we visited the village plastic recycling centre which had a brand new plastic press machine. It is hoped that the initiatives by Twin Beach Resort can be an important case study to showcase the trials of local resort-based management in relation to dugong and seagrass.



Figure 2. Beach Clean-up at Twin beach resort on the 18th of September,2022.



Figure 3. Getting to know the brand new plastic press machine at the village recycling centre.

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PHILIPPINES

Category 5 Super Typhoon Noru hits the Polillo Island dugong priority conservation area in the Philippines

Category 5 Super Typhoon Noru (Philippine name: “Karding”) hit Polillo Island (Latitude 14.737499°N, Longitude 121.924558°E) on September 25, 2022 with winds up to 225-235 kph (140 - 146 mph), a >3m storm surge, 4.1 - 7m (13.5 – 23 ft) waves and heavy to torrential rains (PAGASA 2022a, 2022b; Zoom Earth, 2022). Sadly, “Karding” went on to affect millions of people.

Polillo Island is one of the 23 dugong conservation priority areas that had been identified by Philippine dugong specialists (Ong et al., 2002) and has been reported as having a dugong population for over 40 years (Marsh et al., 2002; Kataoka et al., 1995; Nishiwaki et al., 1979). The UNEP-CMS Dugong MOU Standardised Dugong Catch and Bycatch Questionnaire survey was implemented in Polillo Island where 93.6% of the respondents reported seeing a dugong (Pilcher 2017). A smaller percentage (9.8%) of respondents had seen dugongs within the year compared to the 73.2% who saw dugongs >10 years ago; thus, giving support to those (34.8%) who say dugongs in Polillo are decreasing. On January 2014, Villanueva (2014) reported that an orphaned dugong calf named “Binu” was rescued in Binulasan, Infanta, Quezon (Latitude 14.734096°N, Longitude 121.693893°E) about 20 kilometers from Polillo Island. Sadly, before Binu's release in Polillo's coastal waters could be planned, he died in a rehabilitation facility (PHIL ECON, 2014).

Given the focus on disaster response and recovery, the effects of Super Typhoon “Karding” on the dugong population and the seagrass habitats around Polillo Island are still unassessed. Although no dugong deaths have yet been reported after “Karding”, an article by Preen and Marsh (1995) illustrates how a 1992 Category 2 tropical cyclone and flooding events can be linked to the loss of 1000 square kilometers of seagrass habitat as well as dugong emigration from the impact site and even deaths of some dugongs which travelled up to 900 km away.

The World Meteorological Organization noted Noru's “explosive” intensification (WMO, 2022). Examining Noru's wind speed (in kph) and pressure (hPa) data as tabulated by Zoom Earth (2022) in 3-hour intervals would provide insight into the term “explosive”: evolution from a tropical storm with 100 kph winds on September 24, 2PM to a “Super Typhoon” with wind speed of 250 kph after 12 hours.

With increasing frequency, such extreme weather events are negatively affecting dugongs and their habitats in the Philippine dugong priority conservation areas. In Polillo Island which has already dwindling dugong populations and in similar locations elsewhere in the Philippines, there is a quickly closing window of opportunity in which to work and act toward mitigating exposure to such rapidly intensifying tropical cyclones.

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QATAR

Strandings of baby dugongs in Qatar since July 2022

On 5 July 2022 a baby dugong (Table 1) was found stranded on a beach near the south east shore of Qatar. It was discovered by a diver who reported the stranding to Qatar's government and was instructed to take it to the turtle hatchery. The author, a ministry marine scientist with previous experience with the species, was instructed to take care of the dugong. Upon examination, the dugong was a female with a body length of 110cm and a weight 28kg. She was named Ocean. The author gave clear instruction to the hatchery manager to feed the baby dugong 2000 ml per day of camel milk (Figure 1), which was available with a higher mineral and fat content than cow milk. The dugong was fed by the author in the morning and the manager arranged to feed her in the afternoon and evening. The author also asked the manager of the hatchery to weigh the dugong regularly, and provide a daily report. Another male baby dugong named Oscar was found stranded on 23rd July. He was put into the pool with Ocean. The original planned feeding and weighing schedule was not carried out. The manager of the hatchery did not provide the daily feed information until the end of the month. It was only realized then that the evening feed had been omitted and that the dugong had only been weighed twice using a beam and canvas with a non-digital weight. Such uncooperative attitude has adversely impact the dugongs. The author recommended immediate release of the rehydrated and wound treated baby dugong back to the sea where there is herd of dugongs, hoping that she will be adopted by a nursing female dugong or at least she may eat seagrass. But the release was delayed for a week.



Figure 1. Feeding Ocean with a syringe.



Figure 2. Behavior of Ocean while in the rehab facility.

The dugongs, Ocean and Oscar, died of malnutrition and possible shock from stress by attempted force tube feed by a veterinary surgeon. Only a third rescued baby dugong Oliva, the bigger and stronger, had survived (Figure 3). Against the author's advice, she was released to the north instead of the southeast water where they were found. She was strong and had a better chance to survive as she was already eating seagrass.



Figure 3. Calves rescued and treated in July 2022, in Qatar.

Unfortunately, at present there is no adequate facility nor staff in Qatar to keep dugongs for an extended time. Stranded live dugongs are being rehydrated, wounds treated and then returned to the sea as soon as possible.

Table 1: Dugong calves stranded alive and treated during July 2022.

| Dugong | Date | Length (cm) | Weight (Kg) |
|-----------|----------|-------------|-------------------------|
| 1.Ocean | 5 July22 | 110 | 28 |
| | 31 July | 110 | 22-munch seagrass |
| | 4 Aug | Died | |
| 2. Oscar | 23 July | 120 | 35 |
| | 31 July | | 26-eat sea grass |
| | 5 Aug | Died | |
| 3. Olivia | 27 July | 130 | 40 Estimated |
| | 31 July | | 38 |
| | 5 Aug | | Return so the sea alive |
| | | | |

Table 2: Other dugong calves stranded.

| Dugong | Date | Length (cm) | Weight (Kg) |
|----------------|-----------|----------------------|-------------------------|
| 1.Found dead | 21 July22 | 110 | 27 |
| 2. Found alive | 13 Oct | 130-150 estimated | Return so the sea alive |
| | | | |

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VENEZUELA

Rescue of a West Indian Manatee (*Trichechus manatus*) in La Blanquilla, Venezuela

The West Indian manatee (*Trichechus manatus*) is protected in Venezuela since 1970 under the national Wildlife Protection Law (Venezuela 1970). It is included on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES; <https://cites.org/eng/app/appendices.php>), and listed as Vulnerable on the IUCN Red List of Threatened Species (Deutsch et al. 2008). The Red Book of Venezuelan Fauna considers it Critically Endangered at the national level (Boede et al. 2015).

On August 31, 2022, through the Caribbean Mammal Preservation Network (<https://www.car-spaw-rac.org/The-CARI-MAM-project-and-network>), researchers at the Instituto Venezolano de Investigaciones Científicas (IVIC) became aware of an alert about the presence of a tracked individual of *Trichechus manatus* between Venezuelan Caribbean waters and the vicinity of Trinidad and Tobago (Figure 1). It was an animal rehabilitated after stranding and raised under human care for eight years in

Brazil, released with a satellite tracker on July 6th off the coast of Praia de Peroba, Icapuí, state of Ceará, Brazil, to monitor its reintroduction to nature. The program is led by the Associação de Pesquisa e Preservação de Ecossistemas Aquaticos (AQUASIS) (Camargo 2022).

Brazilian researchers, communicating through the Caribbean Mammal Preservation Network, publicly requested support to recover this animal, given that manatees from Brazil present distinctive genetic features that probably separate them taxonomically from populations that range from the Caribbean Sea to Florida (Lima et al. 2021, Luna et al. 2021). Likewise, it was considered that the life of this male individual, poorly adapted to the wild and disorientated outside its original range, was possibly in danger or seriously compromised.



Figure 1: Tico's route from Brazil to Venezuela.

When this news was communicated to the General Direction of Biological Diversity of the Venezuelan People's Power Ministry for Ecosocialism (MINEC), also CITES National Focal Point, institutional efforts were initiated to evaluate the possibility of a rescue and coordinate the complex logistical tasks involved.

Once an operation plan for the rescue was approved, and with knowledge of the geographical position of the animal, a deep-sea towing vessel of the Venezuelan Navy (AB "Miranda" RA-11) was

prepared and sailed during the night of September 4 from Morro Valdéz (Margarita island) to La Blanquilla (Figure 2). Simultaneously, wildlife experts from MINEC and technicians from Waterland Mundo Marino (Waterland), a marine life exhibition park located in the city of Pampatar, Isla de Margarita, supported by members of the AQUASIS technical team (connected online), discussed the guidelines and designed a rescue drill in Margarita. The crew and members of the rescue mission patrolled the perimeter of La Blanquilla on Monday, September 5th, and with the help of local fishermen managed to locate the manatee in the area of Playa Muerta, northwestern sector of the island. Immediately, the team carried out the capture maneuver with relative ease, managing to board the manatee without major setbacks. This task was probably facilitated by the fact that it was an animal accustomed to the presence of humans.

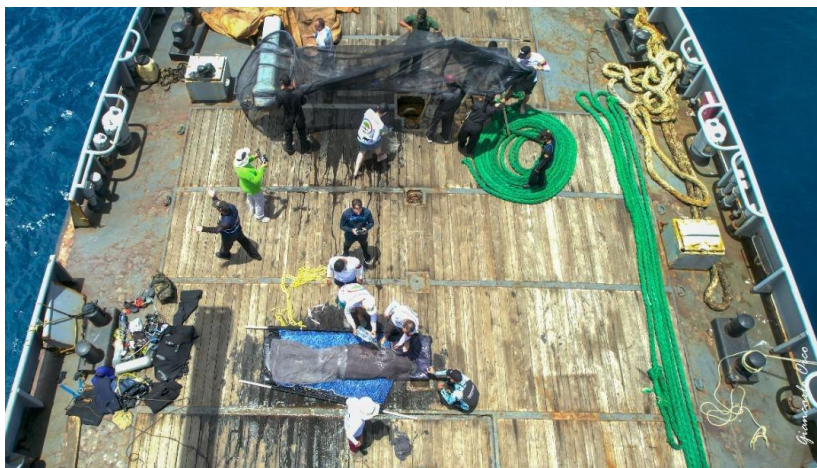


Figure 2: Deep-sea towing vessel of the Venezuelan Navy (AB "Miranda" RA-11).

Veterinarians on board proceeded with the physical and emotional stabilization of the manatee and its clinical examination (Figure 3). The individual showed signs of disorientation and moderate dehydration (10%), poor body condition, barnacles adhered to the skin, and lacerations to the tail and forelimbs. A blood sample was taken to evaluate hematological parameters at the time of rescue and compare these values with the historical record of the individual, provided by AQUASIS experts.



Figure 3: Clinical examination of Tico after his rescue and transportation to land.

Once the manatee was landed and appropriately placed in a freshwater tank at Waterland, an inter-institutional working group was appointed to care for it, paying special attention to following an

ad hoc effort of preventive medicine, behavioral monitoring, feeding and environmental enrichment. Previous experience with manatee strandings in Venezuela, as well as established conservation priorities for the species, served as a reference for this intervention (Boede and Mujica-Jorquera 2016, Boede and Mujica-Jorquera 2017, Ferrer et al. 2017).

Currently, the travelling Brazilian manatee, named “Tico” when it was rescued as a newborn in 2014, is recovering favorably and sheltered in the facilities of Waterland, where it is under human care, with veterinary support and a balanced diet agreed between the work groups in Venezuela and their place of origin in Brazil.

In the most recent working meeting of the coordinating rescue team and representatives of accredited wildlife research and management institutions in Venezuela, the decision was made to temporarily transfer this manatee to Bararida Zoological and Botanical Park, in the city of Barquisimeto, where there are more appropriate facilities for keeping it under human care. This is a national reference zoo, with fully trained personnel and professional experience accumulated over thirty years in the breeding and care of manatees (Boede and Mujica-Jorquera 2016, Boede and Mujica-Jorquera 2017). The permanence of Tico in the aforementioned institution will guarantee the adequate maintenance of its sanitary status while the pertinent liaisons and the technical and legal procedures with the authorities of the Brazilian government are fulfilled for its prompt repatriation.

Acknowledgments

We are grateful to the Armada Bolivariana de Venezuela, the Comando de Guardacostas de Nueva Esparta y La Blanquilla, as well as the VIII Región Estratégica de Defensa Marítima e Insular (REDIMAIN), Instituto Nacional de Parques (INPARQUES) and Waterland Mundo Marino (Porlamar, Margarita island) for their valuable help and logistical support. Photos taken by Joan Daniel González Zambrano, Audiovisualmasterpro

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SYMPOSIA/CONFERENCES

WORKING MEETING OF SOUTH AMERICAN SPECIALISTS IN AQUATIC MAMMALS (RT), IV LATIN-AMERICAN SYMPOSIUM OF MANATEES (SILAMA) AND "SOLAMAC CONGRESS (LATIN AMERICAN SOCIETY OF SPECIALISTS IN AQUATIC MAMMALS)

September 12, 2022
Praia do Forte-Bahia-Brazil



OBJECTIVES OF THESE MEETINGS

- 1) Review the progress of the research and conservation of manatees in the Latin American area.
- 2) Exchange experiences and advancements in the *in situ* and *ex situ* management and conservation of the species
- 3) To discuss methodological approaches in order to address current research needs, in concordance to local environmental and economic scenarios.
- 4) To discuss alternatives and opportunities for promoting international cooperation in the research and conservation of manatees in Latin America

ORGANIZERS:

João Carlos Gomes Borges Fundação Mamíferos Aquáticos Projeto Viva o Peixe-Boi-Marinho Programa de Pós-Graduação em Ecologia e Monitoramento Ambiental – Universidade Federal da Paraíba
Miriam Marmontel Instituto de Desenvolvimento Sustentável Mamirauá
Nataly Castelblanco-Martínez Universidad Autónoma del Estado de Quintana Roo Consejo Nacional de Ciencia y Tecnología

Note from editors: The collection of abstracts was obtained from the Book of Abstracts that was created after the meeting by the conference organizers. They are presented as submitted to the conference in Spanish and Portuguese.

ABSTRACTS

AMENAZAS PARA EL MANATÍ AMAZÓNICO (*Trichechus inunguis*, Natterer 1883) EN TRES COMUNIDADES CERCANAS AL PARQUE NACIONAL YAGUAS (LORETO-PERÚ)

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El manatí amazónico es una especie protegida en todos los países donde está presente, pero amenazas como la caza de subsistencia, captura incidental y tenencia ilegal aún persisten. En el Perú, la información respecto a estos riesgos es escasa y desactualizada, incluso en áreas naturales protegidas. Como parte de la estrategia para la conservación del manatí amazónico en el Parque Nacional Yaguas (PNY), en el año 2021 se realizó un diagnóstico de riesgos para la especie en tres comunidades situadas en la zona de influencia del PNY, en la cuenca baja del río Putumayo (frontera Perú – Colombia). Usando el método “bola de nieve” y consultando a las asociaciones de pescadores, se efectuaron entrevistas semiestructuradas a la mayoría de personas con experiencia en pesca (n=30), que representa el 16% de la población adulta en las tres comunidades. Por medio de las entrevistas se registraron al menos 12 casos de captura incidental (enmalle en redes de pesca) y 21 eventos de caza entre los años 1974 y 2021. La caza se describió como oportunista y esporádica, para consumir la carne y grasa. El 30% de entrevistados comentó haber cazado manatí en alguna ocasión, mientras el 20% de entrevistados tuvo experiencias de enmalle. En el período 2019-2021, se evidenció un mayor número de enmalles (n=7) en comparación a los eventos de caza (n=3). Adicionalmente, se registraron tres casos de tenencia ilegal de crías, aunque no hubo registros de comercialización de estas. También se reportaron tres varamientos con causa de muerte desconocida. El presente estudio contiene información base que servirá para el monitoreo de riesgos a través del registro anual de eventos de caza, enmalle, tenencia ilegal y varamientos de manatí, como complemento del monitoreo poblacional de la especie y las campañas de educación ambiental que se vienen ejecutando desde el año 2022 en las comunidades evaluadas.

Palabras clave: Entrevistas. Caza. Enmalle. Río Putumayo

Agencia de financiación/patrocinio/apoyo: Centro de Rescate Amazónico (CREA), Fundación Internacional para la Naturaleza y Sustentabilidad (FINS), Universidad Nacional de la Amazonía Peruana (UNAP), Instituto del Bien Común (IBC).

HISTÓRICO DE VIDA DO PRIMEIRO PEIXE-BOI-MARINHO (*Trichechus manatus*) REINTRODUZIDO NO BRASIL

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A partir dos esforços implementados na década de 80 para a conservação dos peixes-boismarinhos, em 1989 os encalhes de filhotes começaram a ser reportados. Este trabalho teve por objetivo reportar o histórico de vida de Astro, um dos primeiros peixes-bois-marinhos resgatados e reintroduzidos no Brasil. O espécime foi resgatado em 1991 no Ceará, transferido para reabilitação em Itamaracá/PE e, após três anos, encaminhado para o recinto de readaptação em Paripueira/AL, local que permaneceu por 70 dias até sua soltura em 1994. O espécime foi monitorado por telemetria, possibilitando o seu acompanhamento entre os estados de Pernambuco e Alagoas, período em que esteve interagindo com a fêmea Lua (solta na mesma ocasião). Em 1998 deslocou-se para o litoral de Sergipe, local em que os peixes-bois-marinhos foram considerados extintos, apesar de ser área de

ocorrência histórica da espécie. Permaneceu no estuário do Rio Vaza-Barris por dez anos até estabelecer-se no complexo estuarino Piauífundo-Real, atuais sítios de fidelidade. Ao longo deste período, constatou-se a adaptação do espécime quanto a obtenção de alimentação, suprimento de água doce e apresentou condições clínicas satisfatórias. No entanto, diversos eventos de molestamentos foram observados e o espécime apresenta alto grau de domesticação, o que contribuiu para os atropelamentos ocasionados por embarcações motorizadas, acentuados pela falta de ordenamento náutico na região. A permanência de Astro no litoral dos estados de Sergipe e Bahia tem propiciado iniciativas de sensibilização ambiental, além de indicar a disponibilidade de recursos ecológicos requeridos para a permanência da espécie. Com isto, futuras reintroduções poderão ser idealizadas e assim contribuir para o repovoamento nessa área de ocorrência histórica. E por se tratar de um dos primeiros filhotes reabilitados e reintroduzidos no país, a experiência com Astro subsidiou melhorias no manejo em cativeiro e nos protocolos atuais de reintrodução.

Palavras-chave: Astro. Sirênios. Protocolos de reabilitação. Monitoramento. Reintrodução.

Agência financiadora/Patrocínio/Apoio: Os autores agradecem ao Projeto Viva o Peixe-Boi-Marinho, realizado pela Fundação Mamíferos Aquáticos em parceria com a Petrobras por meio do Programa Petrobras Socioambiental; aos colaboradores do Centro Mamíferos Aquáticos/ICMBio e Fundação Mamíferos Aquáticos.

MÉTODO ALTERNATIVO DE CAPTURA DE PEIXE-BOI-MARINHO NATIVO NO LITORAL LESTE DO CEARÁ

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Por se tratar de espécie criticamente ameaçada, compreender padrões ecológicos, comportamentais e sanitários do peixe-boi-marinho em seu ambiente natural torna-se essencial para subsidiar estratégias de conservação. O objetivo do trabalho foi testar um método alternativo de captura de peixe-boi nativo e acompanhar o deslocamento do animal via radiotelemetria e monitoramento satelital. Um espécime juvenil que constantemente aproximava-se do cativeiro de aclimação, localizado em Icapuí, Ceará, foi selecionado para a tentativa. No dia 17/03/22 foi instalada uma rede divisória no recinto, separando os animais em aclimação de uma área livre para a entrada do peixe-boi nativo. Após a constatação da presença do indivíduo, a rede que delimita o cativeiro da área externa foi abaixada e este entrou espontaneamente. Uma vez no recinto, a captura deu-se através da técnica de arrasto com rede. Após a realização da biometria (comprimento total = 247 cm; peso = 294,7 kg) e dos exames clínicos, o equipamento de telemetria (transmissor Nortronic/FMA) foi acoplado ao pedúnculo caudal. Não houve alteração nos parâmetros hematológicos e bioquímicos, o que conjuntamente com o exame físico atestou o ótimo estado de saúde do peixe-boi. O animal foi monitorado somente por sete dias, em virtude do desprendimento do equipamento, totalizando 45 coordenadas geográficas. A maior distância em linha reta de leste a oeste entre as localizações foi de 7 km. Em relação à costa, a coordenada mais distante registrada foi a 800 m, com profundidades inferiores a 20 m. O peixe-boi utilizou uma área próxima a rochas, e dispersouse para locais onde é relatada a presença de alimento e olhos d'água. Embora monitorado por poucos dias, o experimento mostrou novas possibilidades de captura, trouxe informações relevantes sobre o uso da área pelos animais nativos e mostrou a aplicabilidade do sistema satelital GlobalStar em área marinha aberta, subsidiando as solturas de animais cativos na região.

Palavras-chave: *Trichechus manatus*. Telemetria. Nordeste. método de captura.

Agência financiadora/Patrocínio/Apoio: Projeto de Monitoramento de Praias Bacia Potiguar (PMP-BP), iniciativa desenvolvida para o atendimento de condicionante do licenciamento federal, conduzido pelo Ibama, das atividades da Petrobras de produção e escoamento de petróleo e gás natural na Bacia do Ceará.

PADRÕES DE ADEQUABILIDADE DE HABITAT E IMPACTOS PARA O PEIXEBOI-MARINHO, *Trichechus manatus*, NA COSTA BRASILEIRA

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O peixe-boi-marinho, *Trichechus manatus*, é classificado globalmente como Vulnerável pela IUCN e como Em perigo de extinção no Brasil. No país, a principal ameaça para a espécie atualmente é a perda e fragmentação de habitats. Para investigar a qualidade dos habitats remanescentes para a espécie ao longo da costa brasileira, bem como o grau de impacto acumulado, este estudo utilizou ferramentas de modelagem de adequabilidade de habitat. Foi gerado um modelo de consenso a partir de 120 modelos construídos utilizando os algoritmos BIOCLIM, Domain, Mahalanobis, GLM, Maxent e SVM, baseados em variáveis ambientais importantes para a distribuição da espécie. Os resultados de adequabilidade obtidos foram utilizados para a construção do mapa de distribuição potencial da espécie e relacionados ao grau de impacto acumulado observado para a costa do Brasil. Áreas de baixa adequabilidade para o peixe-boi-marinho foram encontradas na Foz do Rio Amazonas, e em trechos do litoral do Maranhão, Rio Grande do Norte e Bahia. Já as áreas de alta adequabilidade estão principalmente entre o litoral leste do Ceará e o litoral de Alagoas. Trechos de alta adequabilidade também foram encontrados no litoral dos estados do Piauí e Maranhão. O limite sul de distribuição potencial observado foi a Baía-de-Todos-os-Santos, no estado da Bahia. As análises de impacto acumulado indicam que 36,24% das áreas de alta adequabilidade estão em áreas de alto impacto. As áreas adequadas e de alto impacto acumulado estão concentradas na costa do nordeste do Brasil, especialmente nas proximidades das capitais estaduais. Trechos contínuos de alto impacto acumulado também foram observados do Delta do Rio Parnaíba até a divisa Piauí-Ceará e em todo o litoral do estado de Pernambuco. Os resultados encontrados nesse estudo podem auxiliar na elaboração de estratégias de conservação para a espécie ao longo de toda a costa do Brasil, apoiando a tomada de decisão e a destinação de recursos de forma mais eficiente.

Palavras-chave: Ensemble; Modelagem de distribuição; Distribuição potencial; Impacto acumulado; Sirênio.
Agência financiadora/Patrocínio/Apoio: CNPq, CAPES, PPGECO/UFRN, AQUASIS, FMA e PCCB/UERN.

CARACTERIZACIÓN DEL HÁBITAT Y DETECCIÓN DEL MANATÍ ANTILLANO (*Trichechus manatus manatus*) EN DOS RÍOS TRIBUTARIOS DEL LAGO DE IZABAL, GUATEMALA

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En Guatemala, el manatí antillano habita en el Lago de Izabal y en las costas del Atlántico. Actualmente no existen estudios sobre el manatí realizados en los ríos tributarios del Lago de Izabal, los cuales pueden brindar condiciones heterogéneas favorables para su presencia. El objetivo del estudio fue determinar la presencia de manatíes y la caracterización de su hábitat en dos ríos de aguas oscuras de Izabal. Se realizaron recorridos acuáticos de marzo a julio de 2022 en los ríos Oscuro y Lagartos, dentro del área protegida Bocas del Polochic, comprendiendo transectos de siete y seis kilómetros, respectivamente. Se midieron las variables fisicoquímicas y antropogénicas de cada río. Se utilizó una metodología mixta para la detección de manatíes, que incluía el uso de un sonar de barrido lateral (SBL), observación directa y búsqueda de heces. El esfuerzo de muestreo fue de 42 horas. Durante los muestreos se registraron 5 posibles detecciones de manatí con el SBL, 4 avistamientos oportunistas y se colectó una muestra de heces. El tipo de fondo es arenoso con escasa vegetación sumergida y dispersa; sin embargo, la vegetación flotante y de las orillas es abundante; el bosque húmedo es el principal uso de suelo circundante. Los promedios de los principales factores físicos en río Oscuro fueron 27.3 °C y 4.63 m de profundidad; mientras que en río Lagartos fueron 28.5 °C y 4.01 m de profundidad. El promedio de paso de transporte acuático fue de dos embarcaciones, principalmente en los primeros tres segmentos de cada río. Los resultados indican que los manatíes usan los ríos tributarios del Lago de Izabal, lo cual podría deberse principalmente a las condiciones de temperatura, profundidad de los ríos y vegetación. Se considera que la alta influencia antropogénica podría estar afectando la presencia de la especie, principalmente el tráfico de embarcaciones y el uso de redes de pesca. Se recomienda fortalecer las actividades de manejo y vigilancia en el área protegida.

Palabras clave: Sirenia, Conservación, Perturbación, Sonar de barrido lateral, Vaca marina.

Agencia Financiadora/Patrocinio/Apoyo: Fundación Defensores de la Naturaleza, Autoridad para el Manejo Sustentable de la Cuenca del Lago de Izabal y Río Dulce -AMASURLI- e Idea Wild Foundation.

ECOLOGIA DO MOVIMENTO DE PEIXES-BOIS-MARINHOS (*Trichechus manatus manatus*) NO NORDESTE DO BRASIL: RESULTADOS PRELIMINARES

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A ecologia do movimento busca entender os fatores que dirigem a movimentação dos organismos e gera importantes informações para a conservação. Muitos aspectos dos deslocamentos e uso do habitat por peixes-bois-marinhos (*Trichechus manatus manatus*) ainda não foram esclarecidos. Aqui objetivamos identificar os aspectos internos e externos que influenciam estes padrões. Quarenta e quatro peixes-bois (20 fêmeas e 24 machos) foram marcados com transmissores satelitais em 54 eventos de marcação entre a Bahia e o Ceará. Destes, 30 eram animais recém liberados à natureza, 13 liberados e já adaptados e 11 nativos, totalizando 9.395 dias de monitoramento e 158.164 pontos de localização. As áreas de vida (AV) foram calculadas a partir do método

Kelner fixo (Home Range - QGIS 3.10). Foram gerados mínimos polígonos convexos para os períodos seco e chuvoso e diurno e noturno através do Moveapps (n=28). Foram testados se o sexo, massa e história de vida influenciam a AV (GLM) e se houve diferença da AV entre os períodos do dia (diurno e noturno) e estações (período seco e chuvoso); (Teste T). As AV variaram de 203,77 a 0,152 km². Peixes-bois machos possuem maior área de vida (p = 0,0142), bem como os de maior massa corporal (p = 0,0461). Comportamento sexual promíscuo e maior demanda calórica podem explicar as maiores AV para animais machos e de maior massa corporal, respectivamente. A história de vida dos indivíduos não influenciou no tamanho da AV (p = 0,4305 e p = 0,4282), indicando similaridade no uso do habitat pelos grupos e sugerindo sucesso na adaptação à vida livre. Não houve diferença no tamanho da AV entre os períodos seco e chuvoso (p = 0,9136) e diurno e noturno (p = 0,8861), indicando pouca variação sazonal e diária no uso do habitat. Para os próximos passos devemos analisar a frequência de utilização de cada tipo de habitat e a influência de atividades antrópicas no uso do ambiente, subsidiando assim ações de conservação para proteção para a espécie e seu habitat.

Palavras-chave: Área de vida. Conservação. Sirenia. Telemetria satelital. Uso do habitat.

Agência financiadora/Patrocínio/Apoio: ICMBio, Petrobras e Fundação Toyota do Brasil.

PEIXES-BOIS-MARINHOS (*Trichechus manatus*) REABILITADOS USAM O LITORAL DE SERGIPE E NORTE DA BAHIA, BRASIL

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A partir de 1994, início do Programa de Reintrodução dos Peixes-Bois-Marinhos no Brasil, os filhotes resgatados e reabilitados foram soltos nos estados da Paraíba e Alagoas. Este trabalho teve por objetivo relatar a ocorrência de peixes-bois-marinhos soltos utilizando áreas de distribuição histórica da espécie no nordeste do Brasil. Sete peixes-bois-marinhos (Astro, Assú, Tico, Arani, Sereno, Tinga e Tupã) foram identificados a partir de avistagens, localizações emitidas por transmissores satelitais e registros de encalhes, utilizando o litoral de Sergipe e Bahia, áreas em que a espécie foi extinta. Astro utiliza o litoral de Sergipe desde 1998, onde permaneceu no estuário do Rio Vaza-Barris até definir sítios de fidelidade no complexo estuarino Piauí-Fundo-Real. Em 2013 Sereno teve a sua ocorrência reportada na Baía de Camamu, Bahia. Arani foi registrado em 2014 no litoral norte de Sergipe, onde foi encontrado morto. Em 2021 e 2022, Tupã foi observado no complexo estuarino Piauí-Fundo-Real e utilizando áreas do litoral norte da Bahia. Tinga foi registrado de 2020 a 2022, usando áreas costeiras de todo o litoral de Sergipe. Assú deslocou-se por todo o litoral de Sergipe, utilizando o estuário do rio Vaza Barris e posteriormente foi resgatado (devido a complicações clínicas) na praia do Forte, Bahia. Outras duas solturas foram realizadas, sendo o

espécime resgatado nas imediações de Salvador, Bahia. Tico, após ser solto, fez um deslocamento em direção ao sul, sendo capturado a cerca de 100 km da costa (aproximadamente 100 m de profundidade), entre Sergipe e Bahia. As áreas de uso dos peixes-bois-marinhos podem ser influenciadas por disponibilidade de recursos alimentares, fontes de água doce, e presença de águas rasas e protegidas. Desta forma, os registros dos animais em Sergipe e Bahia, onde historicamente a espécie foi extinta, são dados relevantes e indicativos que estes locais continuam apresentando recursos ecológicos propícios para a existência da espécie.

Palavras-chave: Sirenia. Reintrodução. Monitoramento. Distribuição.

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IMPLEMENTACIÓN DEL MONITOREO DE MANATÍ AMAZÓNICO (*Trichechus inunguis*, Natterer 1883) EN EL PARQUE NACIONAL YAGUAS (LORETO-PERÚ): REGISTROS PRELIMINARES 2018 - 2021

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El Parque Nacional Yaguas (PNY) tiene entre sus objetivos promover la conservación del manatí amazónico, considerando el monitoreo de la especie para implementar acciones de gestión basadas en los datos obtenidos. En el año 2021 se elaboró un protocolo de monitoreo de manatí para el PNY, para lo cual se usó información de exploraciones previas y evaluaciones preliminares. En el período 2018 - 2021 se efectuaron 6 ingresos al PNY, con fines de detección y estimación de abundancias relativas de manatí amazónico. Se evaluó principalmente el río Yaguas y ocasionalmente quebradas afluentes, incluyendo épocas de vaciante y creciente de aguas. El método se basó en recorridos mediante una embarcación por el centro del cauce (velocidad entre 7 a 13 km/h) para la detección de registros directos e indirectos de manatí, a través de la búsqueda visual y el uso sonar de barrido lateral (SBL). Se grabaron videos cortos de las imágenes proyectadas en el SBL y se capturaron imágenes in situ con posibles registros. Luego del proceso de revisión en gabinete, todas las imágenes que incluyeron posibles manatíes pasaron por un proceso de calificación por pares ciegos para determinar el número de animales detectados. Se hicieron recorridos con un mínimo de 77.8 km y un máximo de 280 km de esfuerzo. Se obtuvieron abundancias relativas entre 0.004 y 0.077 manatíes/km recorrido (0.025+ 0.027), y se detectaron díadas (posiblemente madres con cría) en noviembre del 2018, mayo y octubre del 2021. Se detectaron manatíes en todas las épocas evaluadas. No se obtuvieron registros indirectos. Las evaluaciones preliminares permitieron probar metodologías, capacitar personal, definir los tramos de monitoreo y la temporada de evaluación adecuados, además de obtener una base de registros previos. A la fecha, se ha estandarizado el protocolo de monitoreo como resultado de este proceso, incluyendo 203 km de recorrido y considerando como temporada de evaluación la media vaciante (Julio).

Palabras clave: Sonar de Barrido Lateral (SBL), Área Natural Protegida (ANP), Protocolo de Monitoreo.

ACCOMPLISHMENTS AND CHALLENGES OF THE RESEARCH ON ANTILLEAN MANATEE: A BIBLIOMETRIC ANALYSIS

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Antillean manatees (*Trichechus manatus manatus*) are an endangered subspecies of the West Indian manatee inhabiting countries of South America, Meso America and the Caribbean. Basic and applied research is necessary to inform management plans for the effective recovery of the subspecies. The purpose of this study was to systematically review literature regarding Antillean manatees. After an exhaustive review, a database was created consisting of 446 documents published between 1892 and 2022; of which peer-reviewed literature represent the most important type (67.52%), followed by theses (26.6%). The literature on Antillean manatee has significantly expanded over the last two decades across the region (positive correlation $r=0.97$), with most academic production taking place in the last five (25.4%) to 10 (44.6%) years. Most of the research (63.9%) was conducted on wild manatees and the most common topics of study were distribution, abundance and conservation. The majority of research was developed in Brazil (26.6%) and Mexico (19.9%). Two significant trends in first authorship have developed over time. First, the publications prior to 2000 were predominantly first authored by males ($\bar{x}=79.6\%$), however since 2000 the proportion of female first authorship has continued to increase. Overall, 55.8% of first authors were female, however in the last five years it has averaged 66.7%. Second, prior to 1990, first authors were predominantly American/British (73.6%), however during the last 25 years, more than 80% of publications were first-authored by Latin American researchers. An important amount of research remains published as theses in Portuguese or Spanish (68.7% of theses), limiting the dissemination of results. Relevant barriers for research and publication in Latin American countries may have an impact on the published literature on Antillean manatees, including scarce funding, poor facilities, language-related difficulties, and lack of a publication culture.

Keywords: Sirenia, *Trichechus manatus manatus*, Endangered species.

Funding Agency/Sponsorship/Support: Viva o Peixe-Boi-Marinho Project, carried out by the Aquatic Mammals Foundation in partnership with Petrobras through the Petrobras Socioenvironmental Program. US Fulbright Award to Brazil to D.G.S. Proyecto Vida Silvestre carried out by WCS Colombia in partnership with Ecopetrol and Fondo Acción.

PERCEPÇÃO DOS SERVIÇOS ECOSISTÊMICOS ASSOCIADOS AO PEIXE-BOI MARINHO (*Trichechus manatus*) NO BRASIL

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Os serviços ecossistêmicos são os benefícios que obtemos dos ecossistemas que ocupamos. Esses serviços estão relacionados à biodiversidade e essa interação garante o funcionamento dos processos necessários à sua própria manutenção. Os serviços ecossistêmicos podem ser agrupados em quatro categorias: suporte, provisionamento, regulação e cultural. O objetivo deste estudo foi identificar a percepção dos profissionais que trabalham com o peixe-boi marinho (*Trichechus manatus*) sobre esses serviços. A coleta de dados foi realizada por meio de formulários preenchidos de forma autônoma pelos profissionais que participaram da elaboração do Plano de Ação Nacional para a Conservação dos Sirênios no Brasil. As análises estatísticas foram realizadas usando o programa R. Utilizamos a análise de variância unidirecional para avaliar a existência de diferenças na percepção dos serviços ecossistêmicos. Uma correlação de Pearson também foi utilizada para investigar a relação entre os impactos sobre o peixe-boi e os serviços ecossistêmicos associados. Não foram observadas diferenças na percepção quanto à presença das categorias de serviços ecossistêmicos, ou seja, os pesquisadores acreditam que todas as categorias foram relevantes em sua área geográfica de atuação. Encontramos uma correlação positiva e significativa ($r = 0.88$, $P = 0.001$) entre pressões e ameaças para os peixes-boi, que atualmente afetam os serviços ecossistêmicos e devem continuar no futuro. As comunidades pesqueiras tradicionais foram consideradas os agentes que mais se beneficiam dos serviços ecossistêmicos. Observamos também que alguns serviços culturais associados ao peixe-boi são particulares de cada localidade de sua ocorrência. Essa constatação reforça o interesse, cada vez maior, dos turistas em conhecer locais onde o peixe-boi está presente. Além disso, fortalece as manifestações culturais de cada estado e uma maior inserção das populações locais na cadeia do turismo.

Palavras-chave: biodiversidade. ameaças. manifestações culturais. turismo.

Agência financiadora/Patrocínio/Apoio: O projeto recebeu apoio financeiro da Universidade Estadual de Santa Cruz (UESC).

BEHAVIOR AND OCCURRENCE OF THE ANTILLEAN MANATEE (*Trichechus manatus manatus*) IN RELATION TO HABITAT CHARACTERISTICS AND THE INFLUENCE OF HUMAN ACTIVITIES IN AN ENVIRONMENTAL PROTECTION AREA IN NORTHEASTERN BRAZIL

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The occurrence of the Antillean manatee (*Trichechus manatus manatus*) is mainly influenced by the presence of aquatic vegetation, freshwater, and human impacts, and as well as variation in tides, temperature, and salinity. The manatee in Brazil is classified as Endangered. The present study investigated the behavioral patterns of the manatees of the Barra do Rio Mamanguape Environmental Protection Area (EPA) in northeastern Brazil, and the relationship between these patterns and the biotic and abiotic characteristics of this estuarine environment.

Records of surface behavior were obtained by the ad libitum sampling of the native animals (not identified) and the focal animal sampling of released (identified) subjects. Anthropogenic impacts were recorded qualitatively and quantitatively during the monitoring of the manatees. Warmer water (30–31°C), reduced turbidity (1–2 m), and sandy sediments had a significant influence on the behavior of the studied subjects. High water temperatures (27–31°C) were the abiotic factor that most influenced the presence of the animals in a given area. Anthropogenic impacts did not affect the behavior of the study animals, with neutral and negative behavior being observed more than expected by chance than positive behavior. Water temperature was an important determinant of the occurrence of the study animals. The results of the present study, which focused on a protected area, provide important new insights into the behavioral ecology of an endangered species. This is the first systematic study of the influence of biotic and abiotic factors on the behavior and ecology of Antillean manatees in a tropical region.

Keywords: estuarine environment. fishing impacts. seagrass. sirenian. surface behavior.

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FORTY YEARS OF AMAZONIAN MANATEE RELEASE: CHALLENGES, PROGRESS AND FUTURE PERSPECTIVES

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The release of *Trichechus inunguis* into the wild has occurred since 1979, as a strategy for the conservation of this vulnerable species. However, a comprehensive update of the outcomes of these programs has never been conducted. Release programs are complex and the high costs and logistic difficulties often make the Amazonian manatee release infeasible. In this study, we examined the spatial and temporal distribution of release actions to evaluate how much effort has been invested in this conservation approach, the main challenges and the progress for implementation, and discussing the perspectives of these programs throughout the distribution range of the species. We made a literature search within the online database (Scopus, Web of Science and ScieELO) using a set of keywords (Amazonian manatee, release, *Trichechus*), and information by researchers working with the species. During 1979–2022, a total of 103 rehabilitated manatees were released in six areas of the Amazon region; 74 (72%) in Brazil, 28 (27%) in Peru, and one (3%) in Colombia. Piagaçu-Purus Reserve in Brazil was the site with the higher number of released manatees (n=44; 43%). Best et al. (1981) released the first captive manatee; after a big gap the manatee release program started again in 2000. However, 92% of these initiatives were conducted over the last decade, indicating an important temporal change in release actions. Information on the successes and failures in post-release animals' adaptation is practically non-existent, which makes it difficult to strengthen the species' protocols. Today, about 150 Amazonian manatees are in rehabilitation centers, waiting to be released. We expect that governments and maintenance institutions should expand the *T. inunguis* release agenda in order to be more effective against the biodiversity crisis, reflecting the species conservation concerns. The combination of release events and environmental education is an effective conservation tool for the species.

Keywords: conservation. management. rehabilitation. Sirenia. *Trichechus inunguis*.

Sponsorship: Programa Petrobras Socioambiental, Fundação de Amparo à Pesquisa do Amazonas (FAPEAM) and ITOCHU.

INTERNET DAS COISAS (IoT) COMO DISPOSITIVOS TECNOLÓGICOS DESTINADOS AO MONITORAMENTO DOS PEIXES-BOIS-MARINHOS (*Trichechus manatus*)

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Em alternativa aos transmissores VHF e satelitais utilizados no monitoramento dos peixes-boismarinhos e diante o crescimento da Internet das Coisas (IoT), vem surgindo uma nova tecnologia, denominada LoRa. Este trabalho teve por objetivo desenvolver transmissores IoT/LoRa destinados ao monitoramento dos peixes-bois-marinhos. O transmissor LoRa foi arquitetado com base nos módulos transceiver RN2903, com antena associada, controlado por uma plataforma microcontrolada. O módulo GPS integrado foi dotado de processador com capacidade para 77 canais, baixo consumo de energia, provisão para turn-off e antena integrada. Os pontos coletados foram processados e armazenado na memória do microcontrolador. As recepções dos sinais emitidos ocorreram por meio de duas estações fixas (gateways) implantadas na Barra do Rio Mamanguape, Paraíba. O gateway foi arquitetado sobre um módulo com dois transceivers, controlado por uma plataforma microcontroladora, operando na faixa 902-928 MHz e concentrador de dados. Contou com um painel fotovoltaico, regulador de carga e bateria, integrados num gabinete estanque. Para teste dos equipamentos, os transmissores foram mantidos em pontos conhecidos (dentro do estuário); em embarcações que percorreram transectos previamente definidos; e realizou-se a marcação de um peixe-boimarinho. Todos os dados recebidos pelas estações foram disponibilizados aos usuários via Internet, sendo estes salvos na plataforma IoT Tago.IO. A partir das estações receptoras, os sinais foram captados até 5 km de distância. O animal marcado foi monitorado por 43 dias, com transmissões diárias (2.780 coordenadas geográficas), conforme a programação definida. As duas estações de recepção, possibilitaram a cobertura da maior parte das áreas de uso conhecida para os peixes-bois-marinhos que utilizam o estuário do rio Mamanguape. De forma inédita, foi possível conceber uma nova alternativa tecnológica, de baixo custo, destinada ao monitoramento dos peixes-bois-marinhos.

Palavras-chave: Sirênios. Telemetria. IoT. LoRa. Gateways.

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CATIVEIRO DE ACLIMATAÇÃO FLUTUANTE EM AMBIENTE MARINHO NO BRASIL: NOVAS PERSPECTIVAS E DESAFIOS À CONSERVAÇÃO DE SIRÊNIOS

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No Brasil, a aclimatação de *Trichechus manatus* é realizada principalmente em cativeiros construídos em estuários. Objetiva-se aqui apresentar um novo modelo de cativeiro de aclimatação (CA) em ambiente marinho, como alternativa para regiões com animais que apresentam área de uso majoritariamente marinha. Após avaliações de alguns requisitos no litoral do Ceará, a ONG Aquasis definiu Icapuí como local para implantação do CA e sítio de soltura. Fatores como ausência de áreas estuarinas favoráveis, o hábito essencialmente marinho da espécie na região e características da obra, determinaram a busca por outras alternativas que a estrutura de curral de pesca já utilizada. Uma Matriz de Avaliação discutida com instituições parceiras elegeu os flutuadores modulares em polietileno de alta densidade. Em 2019, ocorreu a implementação do 1º CA para peixes-bois do Ceará, em uma área parcialmente abrigada, distante aproximadamente 200 m da costa. Trata-se de um tanque-rede, com 14 x 8 x 3 m, acoplado no interior de uma plataforma retangular de 22,5 x 12 m, fixa ao substrato por meio de poitas de concreto, possuindo duas áreas: manejo (45,5 m²) e recinto (336 m³). A estrutura pode abrigar até cinco animais, seguindo a IN IBAMA Nº03/2002. O CA é o único atualmente localizado em ambiente marinho no Brasil, mostrando-se eficiente após atender sete animais em dois anos, dos quais quatro foram soltos até o momento. A estrutura oferece vantagens em relação ao manejo e adaptação dos animais às condições ambientais. Por possuir caráter modular, permite a expansão do recinto a curto prazo. As logísticas de rotina se mostram complexas e as manutenções da estrutura são essenciais para minimizar danos à rede e eventuais fugas de animais. Cativeiros de aclimatação são uma das principais estratégias para promover o incremento populacional, o repovoamento e a redução do risco de extinção de *T. manatus*, que recentemente foi avaliado como Criticamente ameaçado de extinção.

Palavras-chave: peixe-boi-marinho. soltura. adaptação. plataforma flutuante.

Agência financiadora/Patrocínio/Apoio: Projeto Manatí III - Patrocínio Petrobras Socioambiental e Projeto de Monitoramento de Praias Bacia Potiguar (PMP-BP), iniciativa desenvolvida para o atendimento de condicionante do licenciamento federal, conduzido pelo Ibama, das atividades da Petrobras de produção e escoamento de petróleo e gás natural na Bacia do Ceará.

¿QUÉ TIENEN QUE VER LOS HIPOPÓTAMOS (*Hippopotamus amphibius*) Y LOS MANATÍES (*Trichechus manatus manatus*) DEL MAGDALENA?

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¹Conacyt/Universidad Autónoma del Estado de Quintana Roo.

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En los 80's, el narcotraficante Pablo Escobar introdujo hipopótamos (*Hippopotamus amphibius*) para su zoológico privado en Antioquia, que años después se reprodujeron y dispersaron por la cuenca del río Magdalena. Modelos desarrollados recientemente predijeron que para el año 2020 habrían al rededor de 100 animales de esta especie en la Cuenca, distribuidos en 2000 km cuadrados. Siguiendo recomendaciones de esta publicación, el MinAmbiente implementó una investigación en campo mediante conteos con tecnología de punta (imágenes de drones RGB y térmicas), censos acuáticos y terrestres, y entrevistas (Moreno-Arias, comm. Pers). Según la entidad gubernamental, los resultados de este estudio (no publicado) revelaron que actualmente la cuenca alberga una población de más de 130 hipopótamos en libertad, que el 48% de la población son juveniles y crías, y que el área de distribución se expande hacia la cuenca baja del río, cubriendo 130000 km cuadrados. Con base en estos hallazgos, en marzo/2022, el hipopótamo fue declarado especie invasora en Colombia por las autoridades ambientales nacionales. A partir de modelos conceptuales simples, se sugiere que los hipopótamos y los manatíes competirán por comida y espacio, ya que ambas especies ocupan nichos ecológicos similares. Los hipopótamos también podrían tener un impacto negativo crítico en el uso del hábitat de los manatíes y en los movimientos a mediana y gran escala. Sin embargo, los impactos más significativos son probablemente los relacionados a su impacto sobre la integridad, estructura física y composición biológica de los cuerpos de agua. El número de hipopótamos ha ido en constante aumento debido a las óptimas condiciones ambientales de la cuenca del río Magdalena; y a la falta de un control efectivo de la población. Por otra parte, se sospecha que el número de manatíes se encuentra disminuyendo, debido a la persistencia de factores que amenazan su viabilidad. Sin un manejo eficiente de los hipopótamos y sin una estrategia de manejo clara para los manatíes, los hipopótamos representan una gran amenaza emergente y aún sin control, para un mamífero acuático nativo que ya está en peligro de extinción.

SOLTURA DE PEIXES-BOIS-MARINHOS (*Trichechus manatus* Linnaeus, 1758) NO CEARÁ, BRASIL: DESAFIOS E APRENDIZADOS

Viana Júnior, P.C.¹, Fraga, A.R.¹, Barbosa, A.B.¹, Queiroz, B.^{1,2}, Alves, M.D.O.^{1,3}, da Silva, I.S., Choi-Lima, K.F.¹, Pereira, L. G.^{1,4}, Ramos, M. K.¹

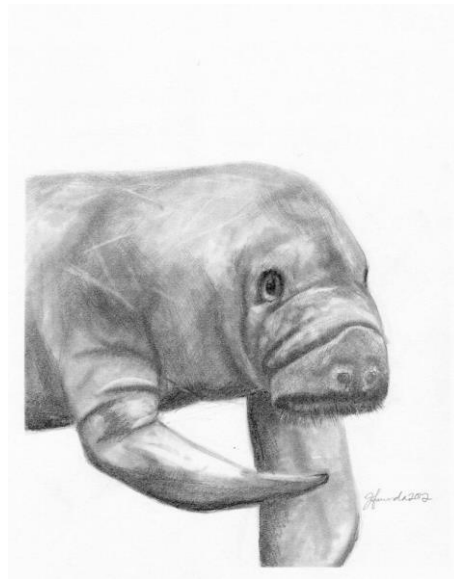
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O Ceará é recordista em encalhe de filhotes de peixe-boi-marinho no Brasil, o que compromete a recuperação da população e torna a soltura de reabilitados uma estratégia de conservação. Objetivou-se descrever metodologia e resultados pós soltura de três peixes-bois soltos em 2021 pela Aquasis. Os animais encalharam em 2013 e 2015, neonatos, e foram soltos com 6 (Maní e Pintada) e 7 anos (Maceió). Utilizou-se o método tradicional de fixação com cinto, tether e transmissor VHF/GPS da rede Globalstar (Nortronic/FMA). O monitoramento variou devido às condições ambientais e padrões comportamentais. Maceió foi monitorado ao longo de 25 km, porém, o transmissor parou de emitir sinais cinco dias após a soltura, localizado em alto mar sem o animal. Após dois meses, Maceió encalhou morto em Luís Correia/PI, provavelmente em decorrência de colisão com embarcação. Pintada iniciou deslocamento a oeste após três dias, percorrendo cerca de 300 km em seis dias. Ela perdeu o transmissor em curral de pesca e foi encontrada no Rio Mundaú/CE, onde foi remarcada e monitorada por três meses, quando perdeu novamente o equipamento e deixou de ser avistada. No quarto mês, foi encontrada no Rio Acaraú e, devido à expressiva perda de peso, retornou à reabilitação para recuperação e posterior soltura. O transmissor de Maní

cessou o envio de sinal satelital no quarto dia após a soltura e, desde então, não houve captação de sinal VHF e avistagem. Um mês e meio depois, nova coordenada foi recebida no Hemisfério Norte (7ºN), tornando a busca inviável. Dentre as dificuldades encontradas nas primeiras solturas no Ceará, estão a perda de transmissores e as interrupções no envio de sinais de GPS em curto período pós-soltura. Os fatores idade de soltura e dinâmica oceanográfica podem influenciar no deslocamento e, conseqüentemente, no sucesso de soltura na região, sendo necessário avaliar tais parâmetros além de novas metodologias de fixação de transmissores e tecnologias de transmissão de coordenadas.

Palavras-chave: Sirênios. Telemetria. Monitoramento satelital.

Agência financiadora/Patrocínio/Apoio: Projeto de Monitoramento de Praias Bacia Potiguar (PMP-BP), iniciativa desenvolvida para o atendimento de condicionante do licenciamento federal, conduzido pelo Ibama, das atividades da Petrobras de produção e escoamento de petróleo e gás natural na Bacia do Ceará.



Sirenews – Florida manatee
(End of Abstracts)

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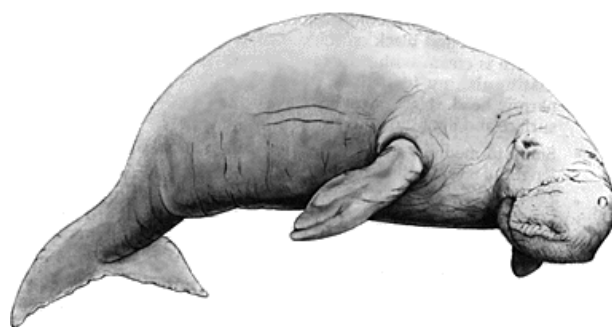
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Sirenews – Dugong

NOTES FROM THE EDITORS: We would like to thank all of those who have contributed articles for *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!



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