Sirenews

Newsletter of the IUCN Sirenia Specialist

April 2016 Funded by the U.S. Marine Mammal Commission Number 65

IN THIS ISSUE

U.S. FISH AND WILDLIFE SERVICE PROPOSES TO DOWNLIST THE WEST INDIAN MANATEE

The U.S. Fish and Wildlife Service (Service) announced on January 7, 2016 its proposal to downlist the West Indian manatee, including both the Antillean and Florida subspecies. The Service proposed to downlist the West Indian manatee from its current status of "endangered" to that of "threatened" on the U.S. Endangered Species Act's (ESA) List of Threatened and Endangered Species. The Service conducted a review of the status of this species in response to a petition from the Pacific Legal Foundation (PLF), which petitioned for a review of the status of the West Indian manatee, including both its subspecies. The PLF was acting on behalf of Save Crystal River, Inc., a group "created to represent the interests of the citizens of Crystal River against excessive government regulation of Crystal River and the resources of the surrounding area."

The Service's proposal includes a review of the range-wide manatee population and country-specific threats to manatees inside and outside the United States. Consistent with the requirements of the ESA, the Service conducted a five-factor threats analysis that reviewed: (A) the present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the

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

SSC Species Survival Commission

Sirenews (ISSN 1017-3439) is published in April and October and is edited by
Cynthia R. Taylor and James A. Powell
Sea to Shore Alliance, 4411 Bee Ridge Rd. #490, Sarasota, FL 34233 USA

Sea to Shore Alliance

Sirenews is available online at http://sea2shore.org/publications/sirenews/ and www.sirenian.org/sirenews.html

inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. The review included Runge et al.'s 2015 Manatee Core Biological Model Open File Report (Florida manatees) and Castelblanco-Martinez et al.'s predictive model that reviews the potential effect of human pressure and habitat fragmentation on Antillean manatees. The Service concluded that the West Indian manatee was not on the brink of extinction (an endangered species) and proposed that the manatee be reclassified to threatened.

The public comment period closed on April 7, 2016. The Service will review comments and substantial information and will make its final decision, a decision that will likely be published in 2017.

-Jim Valade (jim_valade@fws.gov)

ON THE USE OF A POPULATION VIABILITY MODEL FOR THE ANTILLEAN MANATEE AS AN ARGUMENT TO DOWNLIST THE WEST INDIAN MANATEE IN THE UNITED STATES

On January 7, 2016 the U.S. Fish and Wildlife Service released the proposed downlisting of the West Indian Manatee (*Trichechus manatus*), and the proposed rule to reclassify the species as Threatened under the Endangered Species Act of 1973 (U.S. Fish and Wildlife Service, 2016). The agency has based its decision partly on our paper entitled *Potential effects of human pressure and habitat fragmentation on population viability of the Antillean manatee* Trichechus manatus manatus*: a predictive model* (Castelblanco-Martínez *et al.*, 2012). The model focuses on one of the two West Indian manatee subspecies, *Trichechus manatus manatus*. Although we appreciate that our study was used and reviewed to evaluate the status of the species, we regret that some misinterpretations of our results may mislead the agency's conclusions. Therefore, we would like to make our findings clearer to try to avoid the use of our study as an argument to make this transcendental decision for manatees in the United States and elsewhere.

On the species/subspecies level

The agency's decision is based on Castelblanco-Martínez et al.'s (2012, pp. 129–143) population viability analysis (PVA) model for the West Indian manatee that describes a metapopulation with positive growth (pp. 1000 in U.S. Fish and Wildlife Service, 2016). We would like to clarify that our paper only addressed a potential growing trend in the population of the Antillean subspecies (*Trichechus manatus manatus*), which is found throughout the Wide Caribbean, Gulf of Mexico and northeastern South America, but it did not address a growing trend of the Florida manatee population (*Trichechus manatus latirostris*) or manatees occurring in the Bahamas. The methodological procedures of the model were explained in detail in the section called 'Metapopulation structure' (pp. 130-131, Castelblanco-Martínez *et al.*, 2012).

We would like to recommend a more appropriate source of information for the agency's evaluation. In 1997, Marmontel and collaborators published a PVA model for the Florida manatee entitled *Population viability analysis of the Florida manatee (*Trichechus manatus latirostris*)* (Marmontel *et al.*, 1997). This PVA model projected a slightly negative growth rate (-0.003) and an unacceptably low probability of persistence (0.44) over 1000 years for the Florida manatee. The differences between the PVA designed for the Antillean manatees and the one designed for Florida manatees could be explained by intrinsic variations between subspecies related to population size and mortality. For instance, the population size of the Antillean manatees is larger, since the distribution area is significantly more extensive than Florida. Although more individuals may imply less risk of extinction, a larger distribution area also means more challenges for appropriate management and

enforcement, and a higher risk of habitat fragmentation. In fact, the Antillean manatee subspecies has several distinct populations with a very patchy distribution and this is expected to become more severe as human population increases. Furthermore, the viability of Florida manatees is strongly affected by massive mortality associated with cold fronts and red tide episodes, which is not the case for the Antillean manatees.

It is a fact that the conservation scenarios of the two subspecies are very dissimilar. Therefore, it is important to understand the biology of each subspecies and take into consideration that a wide variety of factors affect their population differently including the subspecies natural behavioral differences, their geographical ranges (and therefore, variations in ecological and climate aspects), and local anthropogenic effects, which in the case of the Antillean subspecies include illegal hunting and incidental entanglement in fishing nets. Additionally, studies indicate that the Florida manatee population and the geographically nearby manatee populations (Puerto Rico, Mexico, Belize) are genetically distinctive and thus, the management of those populations needs to be addressed separately (Hunter *et al.*, 2010; Hunter *et al.*, 2012; Nourisson *et al.*, 2011). We believe that the apparent population growth of the Florida subspecies must not be extrapolated to the whole West Indian manatee population, and therefore, that the corresponding management strategies (like the conservation status) should not be generalized for both subspecies.

Misinterpretation of a 'positive' population growth

After an extensive review of the natural or manmade factors affecting the continued existence of manatees, including watercraft, fishing gear, water control structures, harmful algal blooms, cold weather, loss of genetic diversity, tropical storms, and climate change (pp. 1020-1023,U.S. Fish and Wildlife Service, 2016), the agency concluded that "Both Castelblanco *et al*. (2012, entire) and Runge *et al.* (2015, entire) project increasing populations under these threats as they currently exist (…) Thus, we consider the threats identified under this factor to be moderate".

We believe that our results have being misinterpreted. In our PVA, both the positive growth of the Antillean manatee population and the extinction time equal to 0 correspond to an optimistic baseline scenario (Model 1), i.e. with low human pressure and a relative low frequency of stochastic events. However, when we modeled the population under different levels of risk on manatee survival, the predictions for this subspecies were not that optimistic: "increasing human-related mortality led to extinction in all the other models (Models 2, 3, 4, 5, 6, 8)" (Castelblanco-Martínez *et al.* 2012, pp. 138). As the title of our paper implies, human pressure and habitat fragmentation are the factors that are likely affecting more severely the viability of the Antillean manatees. Unfortunately, both problems continue to be of great concern or are unknown throughout the distributional range of the Antillean subspecies. Moreover, the positive growth of the Antillean manatee in our model is for the whole study area; yet, it is known that for various countries the population sizes are critically low (Quintana-Rizzo & Reynolds, 2010). In conclusion, our model did present a positive population growth of the Antillean subspecies under an optimistic baseline scenario, but it also showed that the same population could crash under an increase of habitat fragmentation and/or human pressure. It is also important to mention that our model did not take into the account the effects of climate change that could definitively add an important impact on the population viability, for example, by increasing the frequency and intensity of stochastic events.

Manatee conservation in the United States

The proposed reclassification of the Florida manatee was also based on a manatee Core Biological Model (Runge *et al.*, 2015). However, this model does not consider several particular events having a

big impact on the manatee population during the last few years. For example, the Florida manatee population has experienced a number of unusual events since the last 5-year status review (U.S. Fish and Wildlife Service, 2007) that are not yet reflected in the analysis in the report: severe cold in the winters of 2009–10 and 2010–11; extensive loss of seagrass habitat in the Indian River Lagoon in Brevard County, Florida, in 2011 and 2012; severe red tide events in the Southwest region in 2013; and an unusual mortality event of unknown cause in Brevard County in 2013 (Runge *et al.*, 2015). Those events caused the death of thousands of manatees, and although this appears to be 'unusual', it seems to be an important aspect that was not considered in the model. According to the authors, the potential effect of those events is being explored, and we suggest waiting for the final outcome of the model before concluding on a population status of the Florida manatee.

Manatee conservation outside the United States

The agency states "Our review of the best scientific and commercial information available and analyses of threats and demographics conclude that threats are being addressed and reduced throughout the species range". This conclusion seems overreaching since the most current Management Plan for the West Indian manatee designed with the support of the United Nations Environment program (Quintana-Rizzo & Reynolds, 2010) strongly shows that the opposite is true. Antillean manatees are affected by a variety of factors. Manatees continue to be killed by illegal poaching, incidental entanglement in fishing gear, and boat collisions, just to mention a few factors affecting the subspecies throughout its range. Furthermore, more recent examples show an impressive increase in manatee mortality rates by boat collisions in Belize (2015) and that manatees continue to be threatened by severe droughts in Colombia (See for instance Grattan, 2016). Additionally, in several countries, accurate data are still not available on manatee distribution, population size and threats.

Other important aspects to consider are that some Latin America and Caribbean countries have specific laws that protect local manatee populations, but many others do not. Additionally, local enforcement of such laws are very complex due to the social-economic problems exhibited by developing countries. International laws provide some framework for conservation but resources to protect manatees and implement conservation strategies are scarce. To our knowledge, as biologists and manatee specialists of the Latin America region, there is not one reported case of local threats being properly and completely addressed. As mentioned in our paper and cited by the agency: "experts and local people throughout the region agree that the numbers of manatees sighted per year has decreased over time". We believe that the best scientific and commercial information and analyses available were not used and that threats are neither being addressed nor reduced throughout the species range. Thus, we are really concerned about such a conclusion released by a federal agency of the U.S.

Conclusions

As biologists working on manatee conservation in developing countries, we are very concerned that the decision to downlist the West Indian manatee in the United States could affect the conservation status of the species in other countries. This message will affect the worldwide public awareness about manatee conservation and the availability of international funding for manatee research and conservation in Latin America. The West Indian manatee is distributed in more than 15 countries. Yet, the United States is the only country that is considering downlisting the species. The United States is also the only country where the Florida subspecies is found. Since Puerto Rico, a United States territory, is also part of the distribution range of the Antillean manatee and faces some of the same problems of other Caribbean countries, perhaps a better approach is to examine the status of each subspecies separately. As explained previously, the populations of the Antillean and Florida manatees are intrinsically different,

but the decision to downlist the whole species does not seem to take this into consideration. We would like to request that if our PVA model is used, the document is revised using the clarifications provided here including the fact that the model was not created for the Florida subspecies. We suggest a proper interpretation of the population growth estimates and trends included in our model. We welcome the opportunity to discuss or clarify any other information presented in the paper in more detail. **-Nataly Castelblanco-Martinez[1,2], Coralie Nourisson[1], Ester Quintana-Rizzo[1,3], Janneth Padilla-Saldivar[4]** ([1]Sirenian Specialist Group, IUCN; [2]Consejo Nacional de Ciencia y Tecnología, Universidad de Quintana Roo; [3]Boston University, Guatemalan Recovery Manatee Team; [4]El Colegio de la Frontera Sur; Email: castelblanco.nataly@gmail.com)

References

Castelblanco-Martínez, D.N., Nourisson, C., Quintana-Rizzo, E., Padilla-Saldivar, J.A., Schmitter-Soto, J.J., 2012. Potential effects of human pressure and habitat fragmentation on population viability of the Antillean manatee *Trichechus manatus manatus*: a predictive model. Endanger Spec Res 18, 129-145.

Grattan, S.J., 2016. 20 endangered manatees slaughtered in Colombia, Latin Correspondent,Date accessed: 04/04/2016. http://latincorrespondent.com/2016/02/20-endangered-manatees-slaughtered-in-colombia/

Hunter, M.E., Auil-Gomez, N.E., Tucker, K.P., Bonde, R.K., Powell, J., McGuire, P.M., 2010. Low genetic variation and evidence of limited dispersal in the regionally important Belize manatee. Anim. Conserv. 13, 592-602.

Hunter, M.E., Mignucci-Giannoni, A.A., Tucker, K.P., King, T.L., Bonde, R.K., Gray, B.A., McGuire, P.M., 2012. Puerto Rico and Florida manatees represent genetically distinct groups. Conserv. Genet. 13, 1623-1635.

Marmontel, M., Humphrey, S.R., O'Shea, T.J., 1997. Population viability analysis of the Florida manatee (*Trichechus manatus latirostris*), 1976-1991. Conserv. Biol. 11, 467-481.

Nourisson, C., Morales-Vela, B., Padilla-Saldívar, J., Tucker, K., Clark, A., Olivera-Gómez, L., Bonde, R., McGuire, P., 2011. Evidence of two genetic clusters of manatees with low genetic diversity in Mexico and implications for their conservation. Genetica, 833–842.

Quintana-Rizzo, E., Reynolds, J.E., 2010. Regional management plan for the West Indian manatee. United Nations Environment Programme. United Nations Environment Programme. CEP Technical Report, Kingston, Jamaica, p. 178.

Runge, M.C., Langtimm, C.A., Martin, J., Fonnesbeck, C.J., 2015. Status and threats analysis for the Florida manatee (*Trichechus manatus latirostris*) 2012. U.S. Geological Survey, p. 23.

U.S. Fish and Wildlife Service, 2007. West Indian Manatee Five-Year Status Review, in: U.S. Fish and Wildlife Service Southeast Region. Jacksonville Ecological Services Office, J., Florida. Caribbean Field Office, Boquerón, Puerto Rico (Ed.), p. 79.

U.S. Fish and Wildlife Service, 2016. 12-Month Finding on a Petition To Downlist the West Indian Manatee, and Proposed Rule To Reclassify the West Indian Manatee as Threatened. 81, 1000-1026.

SEVENTH INTERNATIONAL SIRENIAN SYMPOSIUM

On December 13, 2015 the Seventh International Sirenian Symposium was held in conjunction with the 21th Biennial Conference on the Biology of Marine Mammals in San Francisco, California. This Symposium is an ongoing initiative to give scientists a platform to present relevant research on

sirenians. The full-day event was attended by more than 100 individuals representing 19 countries. The agenda included five sessions, consisting of Monitoring and Survey Techniques, Conservation, Physiology, Genetics, and Foraging Ecology (*abstracts are included below in this edition*). There were 26 different presentations including two plenary speakers that opened up the day. The first, Dr. Helene Marsh from Townsville, Queensland, Australia, presented information on current efforts underway by the Sirenian Specialist Group, under the direction of the International Union for Conservation of Nature (IUCN), to assess the status of sirenians around the globe. The second speaker, Dr. Donna Kwan, presented updates regarding the contributions to dugong and seagrass conservation from the UNEP/CMS Dugong MoU Secretariat to assess the global status of dugong populations. Several posters were also submitted and available for viewing during the breaks. The entire day was possible because of generous funding from the Columbus Zoo and Aquarium and the Secretariat of the Dugong MoU-Convention on Migratory Species Office in Abu Dhabi. In addition, the Environmental Agency of Abu Dhabi assisted with the design and production of the manatee and dugong USB flash drives produced for the Symposium, as well as book donations from Dr. Antonio Mignucci and Dr. Robert Bonde. This year three individuals from Japan, Brazil, and the Bahamas were awarded small travel grants to attend the Symposium. The next Sirenian Symposium is planned for October 2017 in Halifax, Nova Scotia, Canada, in conjunction with the next Biennial Conference. **-Nicole Adimey (adimey22@gmail.com)**

LOCAL NEWS

BRAZIL

Has the West Indian manatee (Trichechus manatus) gone extinct from southern Bahia, Brazil? It is widely accepted that West Indian manatees (*Trichechus manatus manatus*) have long vanished from a vast stretch of the Brazilian coast. For over 1,500 km of coastline, from Salvador (12°58'S) to Vitória (20°18'S), corresponding to the actual states of Bahia and Espírito Santo, there has been no reliable sighting or stranding of a wild, non-captive manatee in the last 150 years or more. As a matter of fact, very limited historical information on manatee occurrence south of Salvador is provided such as the singular report from Father Anchieta, a Spanish Jesuit missionary to the Portuguese colony of Brazil in the second half of the 16th century. Father Anchieta reported the presence of manatees in the mouth of Doce River (19°37'S), presently Espírito Santo State, southeastern Brazil (Anchieta, 1876: 279). This represents the southern historical limit of manatee distribution in the western South Atlantic. More recently, Whitehead (1977) revised available descriptions of New World manatees (*Trichechus* spp.) and provided useful information on early accounts by explorers and naturalists in Brazil. Whitehead mentions that "Curiously enough, one of the very first animals to be reported from Brazil was the manatee. Its description occurs in the only complete account, by an anonymous participant, of Cabral's historic voyage". The locality was Cabrália (16°21'S), southern Bahia. Whitehead (1977) mentions that "Later confirmation that manatees occurred along this southern coast comes, *inter alia*, from the explorations of Prince Maximilian zu Wied-Neuwied in 1815-17. He did not see manatees himself but the local people reported to him at Vila Nova that large marine animals were caught in the Rio Doce, which he believed were either seals or manatees (Wied-Neuwied, 1820: 195). Further reports, this time definitely of manatees, from the Rio São Mateus and from Alcobaça at the mouth of the Rio Itanhém (17°31'S) were confirmed (Wied-Neuwied, 1820: 226)". In a later and more detailed account Prince Wied-Neuwied added the Lagoa de Juparanã (19°09'-21'S), a large lake connected with the lower Rio Doce (Wied-Neuwied, 1826: 602). Curiously, the report of a manatee living in the Lagoa de Juparanã, was propagated in the late 1980's and early 1990's, without any conclusive evidence (S. Siciliano, pers.

observ.). In addition, early surveys conducted in the early 1970's and 1980's have all failed to locate manatees in Bahia (south of the border with Sergipe) and Espírito Santo (Anonymous, 1976; Albuquerque and Marcovaldi, 1982). An extensive survey conducted in 1990 based on interviews with fishermen confirms the local extinction of manatees in the state of Sergipe, adjacent to Bahia, and points to their existence as far as Pontal do Peba (10°25'S), in Alagoas, to the north (Lima et al. 2011). It is noteworthy to mention the extensive survey of stranded aquatic mammals along the coast of Bahia, north of Pardo River (15°42'S) and the mouth of São Francisco River (10°29'S), in Sergipe, conducted by Velozo (2007), from October 1991 to March 2006, which does not mention any manatee record.

A single manatee rib found in the midst of a pile of weathered bones of humpback whales in Barra de Caravelas (17°43'S), Bahia, on 8th September 1990, poses an intriguing question on manatee presence in such waters in relatively recent times. The humpback whale bones were assembled and displayed in a decorative way in the gardens of a hotel in Barra de Caravelas. The saved manatee rib was deposited in Museu Nacional, Rio de Janeiro, labeled as "*Trichechus manatus* MN 30493 (S. Siciliano and I. de G. Câmara cols.)" (Siciliano and Franco, 2005). This single piece of bone does represent the only evidence of the presence of *T. manatus* south of Salvador since colonial times. Is it possible that suitable mangrove and estuarine habitats of southern Bahia sheltered manatees not so long ago? Some clues may be taken from artisanal whaling operations off Bahia. Humpbacks were hunted off Caravelas since 1847, and the last humpback whale was caught in 1924 (Ralile, 1949). Hence, the humpback whale bones found in Barra de Caravelas were older than, at least, 66 years of age in 1990. Although searched, why were no more manatee bones subsequently found in the area? Another clue comes from the whales: their bones were regularly collected during the mid-20th century and sold to farmers for fertilizing the soil. It is reasonable to believe that bones from manatees had the same destination as the whales. Further north, Ott (1944) had already mentioned the disappearance of manatees in the rivers running to the Todos os Santos Bay, in Salvador. Along the coast of Ilhéus (14°48'S) to Canavieiras (15°37'S), southern Bahia, where manatees once thrived (Gândavo, 1576), one of the authors (MLVBF) has interviewed over 150 artisanal fishermen, from 17 to 88 years old, from 2006 to 2015. There was no positive answer on manatee occurrence or any mention of their ancient presence. Thus, manatees have been presumed to be locally extinct. See Figure 1 for locations mentioned in the text.

In conclusion, the likely extinction of manatees from the coasts of Bahia and Espírito Santo States in Brazil seems plausible, remaining alive only in historical accounts. However, could a single rib shed some light on manatee existence in a relatively recent time in southern Bahia? Indeed, this region deserves new investigation on the presence of manatees combining multiple traditional and modern techniques in order to better clarify their occurrence and status. -**Salvatore Siciliano (**Instituto Oswaldo Cruz/FIOCRUZ, Pavilhão Mourisco – sala 122, Av. Brasil 4.365, 21040-360, Rio de Janeiro, RJ, Brazil) and **Márcio Luiz Vargas Barbosa-Filho (**Programa de Pós-Graduação em Etnobiologia e Conservação da Natureza, Universidade Federal Rural de Pernambuco, Rua Dom Manoel de Medeiros, s/n, Dois Irmãos 52171-900, Recife, PE, Brazil).

References

Albuquerque, C. and Marcovaldi, G. Ocorrência e distribuição das populações do peixe-boi marinho no litoral brasileiro (*Trichechus manatus*, Linnaeus, 1758). Simpósio Internacional de Ecossistemas Costeiros: Poluição e Produtividade. FURG/DUKE University. Rio Grande, 1982.

Anchieta, J. 1876. Chartas dos Padres Jesuítas sôbre o Brasil, desde o anno de 1549 até o ano de 1568. Annaes Bibliotheca Nacional, Rio de J., I: 44-75, 266-309 (continued 1877, ibid., 2: 79-1 27-ed by J. A. Teixeira de Mello).

Anonymous, 1976. A preliminary status survey of *Trichechus* in Northeastern Brazil.

Gândavo, P. de M. 1576. História da Província Santa Cruz, a que vulgarmente chamamos Brasil. Available at: http://www.gutenberg.org/files/28122/28122-h/28122-h.htm

Lima, R.P., Paludo, D., Soavinski, R.J., Silva, K.G. and Oliveira, E.M.A. Levantamento da distribuição, ocorrência e status de conservação do peixe□boi marinho (*Trichechus manatus*, Linnaeus, 1758) no litoral nordeste do Brasil. 2011. Natural Resources, Aquidabã, 1: 41□57. http://sustenere.co/journals/index.php/naturalresources/article /view/ESS2237-9290.2011.002.0006

Ott, C. F. 1944. Os elementos culturais da pescaria baiana. Boletim do Museu Nacional, 4: 1-67, Série Antropologia.

Ralile, B.P. 1949. Monografia Histórica de Caravelas. Tipografia São Miguel, Salvador. 109 p.

Siciliano, S. and Franco, S.M. 2005. Catálogo da Coleção de Mamíferos Aquáticos do Museu Nacional. FIOCRUZ: ENSP, 44 p.

Velozo, R.S. 2007. Encalhe de mamíferos aquáticos entre a foz dos Rios Pardo (BA) e São Francisco (SE). Universidade Estadual de Santa Cruz, Programa de Pós-Graduação em Zoologia. Ilhéus, Bahia. 111 p.

Whitehead, P. J. P. 1977. The former southern distribution of New World manatees (*Trichechus* spp.). *Biological Journal of the Linnean Society*, 9: 165-189.

Wied-Neuwied, Príncipe M.A.P. zu. 1958. Viagem ao Brasil nos anos de 1815 a 1817. Biblioteca Pedagógica Brasileira, Brasiliana (Série Grande Formato), Série 5ª., Vol. 1. Direção de Américo Jacobina Lacombe. Companhia Editora Nacional, São Paulo, 536 p.

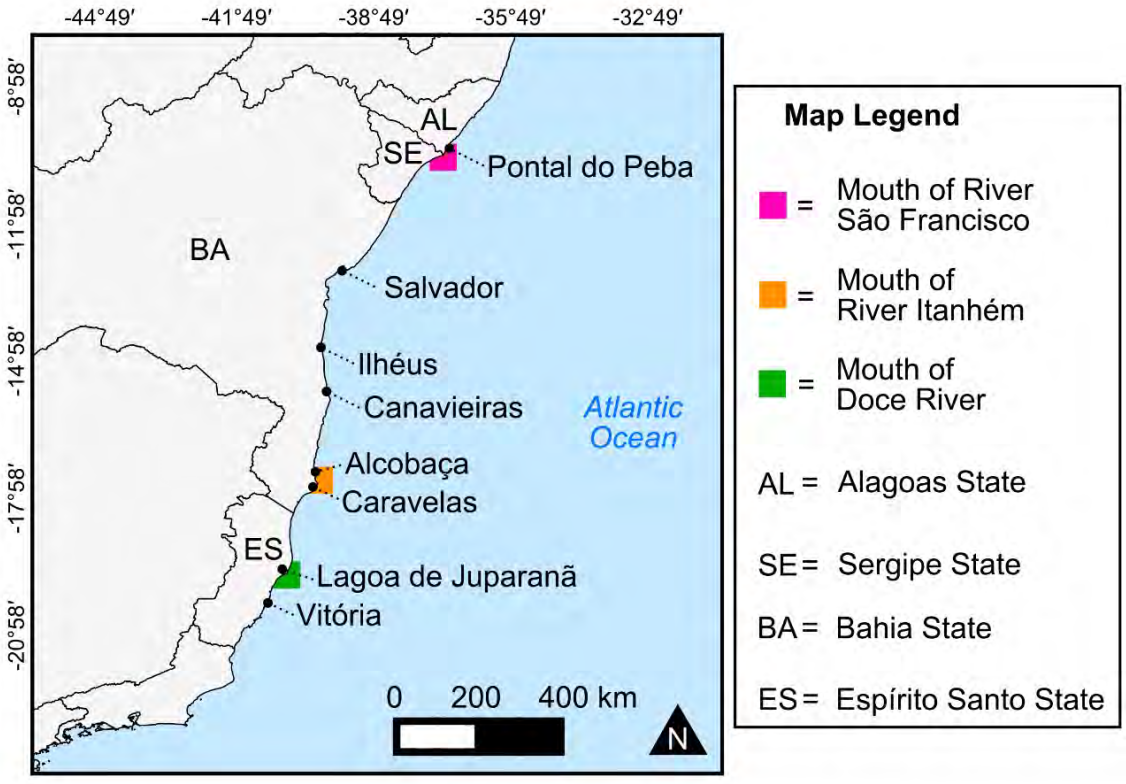

Figure 1. Localities of some previous records of the West Indian manatee (*Trichechus manatus*) along the coasts of Bahia (BA) and Espírito Santo (ES) States, Brazil. Map kindly prepared by Davi C. Tavares.

Release of rehabilitated Amazonian manatee in Brazil. On February 18th, 2016, the Mamirauá Institute for Sustainable Development (MISD) performed its fourth release of a rehabilitated Amazonian manatee. Cassí do Betel, a 124 cm, 45 kg large calf became entangled in a fishing net on August 25, 2014 and was rescued by a fisherman and maintained at a local community in the Amanã Sustainable Development Reserve (ASDR), western Brazilian Amazon. Local inhabitants involved in the environmental education practices developed by the Research Group on Amazonian Aquatic Mammals prevented it from being killed and called upon MISD´s research group. Estimated at 8-10 months of age, Cassí was housed at the Community-based Rehabilitation Center for Amazonian Manatees, in ASDR and cared for over 18 months. Prior to release Cassí had a belt-mounted VHF radio-transmitter (built in cooperation with USGS-Sirenia Lab) adapted to its caudal peduncle. At 186 cm and 129.8 kg Cassí was released in a lake under permanent protection status within ASDR and is being monitored sporadically by manual telemetry. Four other animals from a previous release in 2015 (Sirenews 63) are similarly being monitored.

Cassí was released directly into a lake that provides access to another water body during all periods of the hydrological cycle. We made sure this lake had the distinct macrophytes consumed by the species, such as memeca (*Paspalum repens*), mureru (*Eichhornia crassipes*), arroirana (*Oryza grandiglumis*) and uamã (*Luziola* spp.) and the signs of the presence of wild manatees.

The first Amazonian manatee release occurred in the Mamirauá Sustainable Development Reserve, in 2000. The Rehabilitation Center is authorized by the Brazilian environmental protection agency under permit 561063. Given the extreme economic crisis affecting Brazil at this moment, the operation of the Center for the past few months has been made possible by generous contributions from individuals and institutions committed to manatee conservation (Bob and Cathy Bonde, Jim Valade, Lynda Green, Columbus Zoo, Georgia Aquarium, Save the Manatee Club, and SeaWorld and Busch Gardens). Another female, rescued in mid-2010, remains under care at the Center, and represents a more difficult case, as she was harpooned and had her facial nerve affected. Helena do Icé, as she is called, has been weaned and is being monitored for a possible future release. -**Miriam Marmontel, Guilherme Guerra Neto, André G. Coelho, and Camila C. de Carvalho (**Instituto de Desenvolvimento Sustentável Mamirauá, marmontel@mamiraua.org.br)

GUADELOUPE

The Conservation Value of the Guadeloupe Manatee Reintroduction Project. In the previous issue of *Sirenews* (see *Sirenews 64*), a critical statement was published about the Guadeloupe Manatee Reintroduction Project. The statement suggested, among other things, that it was inappropriate to use captive animals from Brazil to start a breeding and reintroduction program in Guadeloupe. The Guadeloupe project managers do not believe that *Sirenews* provides a suitable forum for debate of this issue. However, in the spirit of transparency which always guided those involved in this project, we invite the readers of *Sirenews* and other interested parties to learn more about the project, including its scientific motivations and conservation potential, to consult the note available on-line at the following address: http://www.guadeloupe-parcnational.fr/IMG/pdf/note_for_sirenews.pdf , prepared under the attentive guidance of Expert Working Group members of the project.

ABSTRACTS

All abstracts below are from presentations at the 7th International Sirenian Symposium, San Francisco, USA, 13 December 2015.

Anthropogenic health stressors potentially related to captive management during rehabilitation of Florida manatees (*Trichechus manatus latirostris*).

Ray L Ball[1], Lauren N. Smith[2] and Ashley Barratclough[2]
[1]Tampa's Lowry Park Zoo, Tampa, FL, USA
[2]Department of Large Animal Clinical Sciences Aquatic Animal Health Division, College of Veterinary Medicine, University of Florida, Gainesville, FL, USA

Rehabilitation is an important component to the recovery plan for the Florida manatee (*Trichechus manatus latirostris*). Providing individualized health care yet avoiding the complications associated with the captive care of wild animals has challenges. Issues revolving around nutrition are common in managed wildlife and may also arise in manatee rehabilitation. The highly efficient digestive strategies that manatees have pose unique challenges and problems related to obesity that are now being recognized. Social issues, especially in orphans, can lead to social maladjustments once these manatees are released. Problems attributable to long-term captivity, where the animal may experience non-reproductive periods of 10–15 years, have been identified in several mammal species. Evidence suggests that prolonged exposure to endogenous sex steroids or extended periods of reproductive quiescence may induce "asymmetric reproductive aging" in captive animals. Steroid hormone-dependent tumor development and growth by estrogen and progesterone have been well established and may explain some of the findings in captive, non-reproducing yet continually cycling mammals. Leiomyomas are known to be estrogen induced, and the cumulative effects of constant estrus activity are the basis for this tumor. A reproducing wild manatee reaching sexual maturity at 5 years of age, with 12-14 months gestation, a 3 year inter-calf interval, and a reproductive life of 35 years will have approximately 12 estrus cycles in her reproductive life. A captive manatee will have an estrus cycle once every 28-42 days and thus approximately 8-13 cycles per year. Within 5 years of captivity, a female manatee will have between 40-65 cycles, and well exceed the normal endogenous exposure to estrogen than she would have in a wild setting. It is important to note long-term captive manatees have been excluded from hormone studies in manatees due to concerns about asymmetric aging. Reproductive neoplasms and pathologies in wild and long-term captive female Florida manatees obtained through a carcass recovery program between April 2009 and May 2014 has brought a new awareness to reproductive health of female manatees. Management changes may include: review of feeding strategies to mimic wild foraging manatees; developing a fitness criteria for release instead of weight and length criteria; explore options for releasing orphans earlier; behavioral training when needed to help orphans re-adjust; minimizing human contact during the rehabilitation process; re-enforcing the existing criteria that does not allow rehabilitated manatees to be held long term; and the re-classification of several existing long- term captive female manatees as conditionally non-releasable.

Redefining cold stress syndrome in the Florida manatee (*Trichechus manatus latirostris).*

Ashley Barratclough[1,2*], Bobbi Conner[3], Ruth Francis Floyd[2], Roger L. Reep[2] and Ray L. Ball[1]
[1]Veterinary Sciences, Tampa's Lowry Park Zoo, Tampa, Florida, 33604 USA
[2]University of Florida, Department of Large Animal Clinical Sciences, Aquatic Animal Health Division, College of Veterinary Medicine, Gainesville, FL, 32610, USA
[3]University of Florida, Department of Small Animal Clinical Sciences, College of Veterinary Medicine, Gainesville, Florida, 32610, USA

The exact pathophysiology of cold stress syndrome (CSS) in the Florida manatee (*Trichechus manatus latirostris)* was previously unknown. The condition was hypothesized as a nutritional, immunological and metabolic disturbance due to prolonged exposure to water temperatures <20°C. Following extensive research into the coagulation system, we confirmed that CSS is a severe thromboembolic disease. We established the normal coagulation parameters in 40 wild manatees performing a coagulation panel including prothrombin time (PT), partial thromboplastin time (PTT), platelet count, fibrinogen level, and D-dimer level. These levels were used as standards for comparison with CSS cases. We found CSS cases had statistically prolonged PT, PTT, increased D-dimer and fibrinogen and reduced platelet count, consistent with disseminated intravascular coagulation (DIC).

Furthermore we characterized the normal clotting process, performing coagulation factor assays in 20 wild manatees and thromboelastography (TEG) in 29 wild manatees. We found that manatees were naturally hypercoagulable identifying the following mean (SD) normal TEG parameters: reaction time R = 2.1(0.77) minutes, clotting time K = 0.8 (0.0) minutes, α angle 83.1° (2.0), maximum amplitude MA = 75mm (7.6) and clotting lysis LY30 = 0.41% (0.68). In comparison we found

CSS cases to show increased coagulability supporting our hypothesis of CSS predisposing them to thromboembolic disease. The coagulation factor assays demonstrated activity of antithrombin III and of factors; VII, VIII, IX, X, XI and XII in manatees with CSS cases showing statistically significantly lower levels of antithrombin III and factor XI activity consistent with a consumptive coagulopathy. We propose that prolonged hypothermia results in a coagulopathy which ultimately links to the clinical signs in CSS such as epidermal bleaching, enterocolitis and anorexia. We established the abnormal levels of PTT, PT, D-dimer, fibrinogen and platelet count which can be used to indicate the presence of DIC and ultimately as a prognostic indicator in CSS.

Conservation of the African manatee (*Trichechus senegalensis*) through catfish aquaculture as an alternative livelihood for hunters in Owode-Ise, Lagos State, Nigeria.

Bolaji Dunsin Abimbola[1], Oluwafemi Samuel Fakayode[1], Oluwakemi O. Aliu[1], I. K. Ayaobu-Cookey[1], Abiola Akintayo[1], Sabinus Opurum[1], Tomas Diagne[2], Deborah K. Bolaji[3], and Lucy Keith Diagne[2,4]

[1]Nigerian Institute for Oceanography and Marine Research, 3, Wilmot Street off Ahmadu Bello Way, P.M.B. 12729 Lagos, Nigeria

[2]African Aquatic Conservation Fund, BP 449, Ngaparou, Mbour 33022, Senegal, West Africa

[3]Aquatic Life Resources Nigeria Limited (ALRES), Lagos, Nigeria

[4]Sea to Shore Alliance, 4411 Bee Ridge Road, #490, Sarasota, FL 34233, USA

The African Manatee (*Trichechus senegalensis*) is heavily hunted throughout its 21 country range and is listed as Vulnerable on the IUCN Red List. In Nigeria it is protected by law but still hunted throughout the country. In the Owode-Ise community on Lekki Lagoon in Lagos State, the species is hunted as a means of livelihood, predominately using wooden trigger traps. In the year prior to this study, 11 traps were used to hunt a total of 132 African manatees. Beginning in 2013, this project trained manatee hunters in catfish (*Clarias gariepinus*) aquaculture as an alternative livelihood in exchange for permanently removing their traps and stopping hunting. Over two years we taught fifty-five training sessions; topics included floating frame fish cage construction, fish care and maintenance, injecting fish in preparation for breeding, stripping fish of eggs, fertilization procedures, and preparation of adult fish for market. Participants were provided with all cage materials, fingerling catfish, and fish food. Eleven hunters were trained and 11 traps were removed from the lagoon, resulting in no manatees killed during 2013-2014. The former hunters constructed 14 fish cages and harvested approximately 1,219 kg of catfish in the first year, and have now proven that catfish aquaculture is a more reliable and larger source of income than manatee hunting over the long-term. Profits were used for fish food and to re-stock fish cages, and their operations are now self-sustaining. The success of this project has led to three additional Lekki Lagoon communities requesting aquaculture training in exchange for ending manatee hunting, and even two non-hunters constructed cages and invested in catfish production. This is the first aquaculture project in Africa to successfully create sustainable alternative livelihoods to effectively end manatee hunting, and it provides a viable solution that can be replicated in other African countries.

Rehabilitation, release and wild reproduction of an Antillean manatee (*Trichechus manatus*) in the Sinú basin, Córdoba-Colombia.

Dalila Caicedo-Herrera[1], Yenyfer Moná Sanabria[2], Antonio A. Mignucci-Giannoni[3] and Rafael Espinosa-Forero[4]

[1]Omacha Foundation, dalila@omacha.org

[2]Omacha Foundation, yenyfer@omacha.org

[3]Puerto Rico Manatee Conservation Center, Inter American University of Puerto Rico, mignucci@manatipr.org

[4]Corporación Autónoma Regional de los Valles del Sinú y San Jorge –CVS, rafael.espinosa@cvs.gov.co

Some of the activities that have decimated populations of manatees in Colombia are hunting and incidental fishing with gillnets. Since this species is considered endangered, the environmental authority of the department of Córdoba in Colombia (CVS) formulated in 2003 in association with the Omacha Foundation and other NGOs, the "Management and conservation plan for the manatee (*Trichechus manatus*) in the middle and lower basin of the Sinú river". A cornerstone of this plan is the social work with fishing communities, promoting environmental awareness of the ecological value of this species in the aquatic ecosystems of the region. In 2009 the community rescued a female manatee calf, which was assessed under veterinary treatment and rehabilitated. In 2011 it was released to the wild. This manatee is known as *María del Mar*, and has become an icon of conservation of the species in the area.

María del Mar, was released with a VHF tag, that allowed us to monitor her movements and preferred habitat for a year. After loossing the transmitter, the monitoring was carried out through reports from fishermen. In April 2015 an external examination was performed and monitoring was increased due to the presumption of pregnancy; in September 2015 the community reported *María del Mar* to be with a calf, and an unusual cautious behavior in the presence of people. We confirmed individual identity of *María de Mar* by a notch in her fluke, and that in fact it had given birth and is caring for her

calf with obvious maternal behavior patterns. This is the first record in Colombia of wild reproduction and successful birthing of a rehabilitated manatee initially brought as an orphaned calf.

Status of manatee research in Colombia during the last 25 years: a review.
Nataly Castelblanco- Martínez [1,2] and Gloria Katherine Arévalo-González[1,3]
[1]Consejo Nacional de Ciencia y Tecnología/Universidad de Quintana Roo, Mexico
[2]Fundación Internacional para la Naturaleza y la Sustentabilidad – FINS
[3]Cabildo Verde Sabana de Torres

Two of the three extant species of endangered manatees, the Amazonian manatee (*Trichechus inunguis*) and the Antillean manatee (*Trichechus manatus manatus*), inhabit rivers, floodplains, swamps and coastal areas of Colombia. The large availability of suitable habitats for manatees suggests that important relicts of both species could still be present in the country. However, the local scientific research on manatees seems to be incipient. The available information on manatee research yield during the last 25 years was reviewed. We found 84 published and unpublished documents including Conference Proceedings (42,9%), BSc. Thesis (20,2%), Book Chapters (16,7%), Journal articles (8,3%), Intern reports (3,6%), MSc. Thesis (3,6%), Notes (3,6%), and Books (1,2%). The number of peer-reviewed papers in specialized journals is low (only seven), but has increased during the last five years suggesting that Colombian researchers are becoming more interested in publishing their results and/or the research quality has been improved. Most of the research is dedicated to Antillean manatees (70,2%), 19 % is devoted to Amazonian manatees and 10.7% correspond to research on both species. This can be due to the limited accessibility of areas where Amazonian manatees are distributed. Most of the research (29,8%) aimed to describe the ecology, habitat use and distribution of manatees in a specific area. Also, 17,9% of the work is devoted to describe threats and conservation status of manatees. Other important subjects of research include behavior, ethno-knowledge and environmental education. Mostly, the methodological approach used consisted in interviews and boat-based surveys. However, research depending upon more sophisticated techniques as genetics, captures and telemetry is still very scarce. Research of manatees in Colombia is challenging due to ecological and socio-economic factors. Although basic information from some areas is still necessary; it is recommendable to invest efforts and resources in innovative methods for manatee research in the wild.

Isotopic assessment of the diet of free-ranging African manatees (*Trichechus senegalensis*) in Senegal and Gabon.
Lucy Keith Diagne[1,2], Amanda Demopoulos[3], Karen Bjorndal[4] and John Krigbaum[5]
[1]African Aquatic Conservation Fund, BP 449, Ngaparou, Mbour 33022, Senegal, West Africa
[2]Sea to Shore Alliance, 4411 Bee Ridge Road, #490, Sarasota, Florida 34233 USA
[3]U.S. Geological Survey, Wetland and Aquatic Research Center, Benthic Ecology Laboratory, 7920 NW 71st Street, Gainesville, Florida 32653 USA
[4]Department of Biology, University of Florida, Gainesville, Florida 32611 USA
[5]Department of Anthropology, University of Florida, Gainesville, Florida 32611 USA

African manatees are rarely observed feeding and opportunities to collect stomach samples from carcasses are rare, yet >70 species of plants have been documented as food sources for the species, and reports of manatees eating fish (from nets) and mollusks exist throughout their range. Therefore, stable isotope analysis offers the best method for confirming the diet of this species. Reference food samples (n= 266) and manatee periotic bones opportunistically collected from Senegal (n= 16) and Gabon (n= 8) were processed and analyzed for carbon and nitrogen stable isotopes. As this is the first stable isotope study of any sirenian to use ear bones, we developed a processing technique that included sampling two different sections of each bone, and each sample was analyzed for both bone collagen and apatite. We examined whether isotopic differences were present in African manatee lifetime average diet in freshwater and marine systems, if the sampled manatees consumed mollusks and fish in addition to plants, and compared Senegal manatee ear bones collected >70 years ago to recent samples to investigate possible differences in diet due to changes in habitat over time. Scatterplot analysis with trophic correction boxes assuming manatee diet-tissue enrichment values of +4‰ for $\delta^{13}C$ and +3‰ for $\delta^{15}N$, and Bayesian mixing model analysis software SIAR estimated proportional contributions of potential food sources. Stable isotope values of both $\delta^{13}C$ and $\delta^{15}N$ were significantly higher in Senegal than Gabon. Within countries we found no significant difference in stable isotope values between bone layers or locations. For Senegal, there were also no significant differences between marine vs. freshwater, or historic vs. recent samples. The $\delta^{15}N$ values indicate that some manatees in both countries were secondary or tertiary consumers, and throughout their lives were likely consuming invertebrates and fish in addition to plants. Therefore, the African manatee is omnivorous.

The effect of plant availability and primary compounds on manatee food choice in Tabasco, Mexico.

Daniel Gonzalez-Socoloske[1] and Leon D. Olivera-Gomez[2]
[1]Department of Biology, Andrews University, Berrien Springs, MI 49103 USA
[2]División Académica de Ciencias Biológicas, Universidad Juárez Autónoma de Tabasco, Carretera Villahermosa-Cardenas Km 0.5, Villahermosa, Tabasco, C.P. 86150, Mexico

Understanding foraging ecology is an important element of effective conservation strategies. Manatees (Mammalia: Sirenia), along with the closely related dugongs, are the only herbivorous marine mammals. Manatees consume a wide variety of vascular plants and algae in both marine and freshwater habitats. However, little is known about what characteristics influence food selectivity, especially in freshwater habitats, which represent a large portion of the available habitat for the Endangered Antillean manatee, *Trichechus manatus manatus*, in Central and South America. In this study, we tested two classic herbivore food selection theories: 1) nutritional quality and 2) availability of the food items. This study is the first to directly examine the effect of plant availability and primary compounds on Antillean manatee food choice. Plant availability to manatees was evaluated by conducting monthly plant surveys from July 2010-July 2011 in four contact lakes in the wetlands of Tabasco, Mexico. Manatee food selectivity was examined by conducting food selection experiments on a wild adult manatee during the low water season with 54 plant species representing 25+ genera. The nutritive components (i.e. crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), hemicellulose (HC), and ash) and plant availability values for selected and non-selected plants species were evaluated to determine their relationship with manatee food selectivity. Of the plant characteristics tested (i.e. nutritive components and plant availability), only digestible fiber (HC) was significantly related to manatee food selection (binary logistic regression, p=0.025), selecting plants with higher HC content. Unlike other herbivorous mammals, manatee food selectivity was not influenced by CP, NDF, or ADF, but rather by digestible fiber (HC). Due to their efficiency at digesting fiber, manatees might be thought of as fiber specialists, in that they can exploit plants with high levels of fiber due to specializations of their dentition and alimentary canal.

Education and awareness programs for conservation of dugongs: a case study from Abu Dhabi, UAE.

Maitha Al Hameli[1], Hind Al Ameri[1] and Himansu S. Das[1]
[1]Environment Agency Abu Dhabi, PO Box: 45553, Abu Dhabi, UAE.

Dugongs (*Dugong dugon*) and their foraging habitats and migratory routes in the United Arab Emirates are protected under Federal Law 23 and 24 (1999). With a population size of around 2800 dugongs, UAE has an international obligation to protect its dugongs. In spite of years of survey and monitoring of dugongs and their habitats and declaration of Marine Protected Areas, the incidences of mortality continued to be high. To address this issue, the Environment Agency Abu Dhabi initiated intensive education and awareness campaigns through their outreach programs. Stakeholder engagements through meetings and workshops, teachers training program, student's activities, interaction with fishermen and sea-goers were part of the campaign. While success of these campaigns are yet to yield results in minimizing mortality of dugongs in abandoned and/or unauthorized nets, level of awareness amongst the coastal communities of Abu Dhabi has shown a positive trend. The presentation elaborates customized education and awareness programs for different stakeholders.

Movement patterns of West Indian manatees (*Trichechus manatus*) in the Bahamas.

Felice Knowles[1], Diane Claridge[1], Cathy Beck[2] and James Reid[2]
[1] Bahamas Marine Mammal Research Organization, P.O. Box AB-20714, Marsh Harbour, Abaco, Bahamas
[2] U.S. Geological Survey, 7920 NW 71st Street, Gainesville, FL 32653, USA

The Bahamas Marine Mammal Research Organization (BMMRO) and the U.S. Geological Survey/Sirenia Project (USGS) have been monitoring the occurrence and health of West Indian manatees (*Trichechus manatus*) in The Bahamas for over fifteen years. Historic evidence of manatees in The Bahamas is limited to only two sightings from 1904 and 1975, suggesting The Bahamas has not had a persistent manatee population. However, manatee sightings increased significantly during the 1990's commensurate with the increase in the Florida manatee population and greater public awareness and reporting of sightings to local environmental organizations, such as BMMRO. Through the use of photo-identification and the location and timing of sightings, at least fifteen individual manatees are currently known to inhabit The Bahamas, three of which had previous sighting histories in Florida. Three (Rita, Georgie, and Gina) were periodically radio-tagged to document their movements and habitat use patterns. Tracking and photo-identification data show persistent local resource use and occasional long-distance, deep-ocean movements between islands. Rita and Georgie, tagged as a mother-calf pair, were observed negotiating local habitats, making repeated moves from the Berry Islands to Andros Island. Post-weaning, Georgie left the Berry Islands and twice traveled across the deep waters of the Great Bahama Canyon to Abaco Island (minimum distance of 50km). Gina resided in the northern Berry Islands for fourteen years, and then arrived in Eleuthera in 2014

(100km away) where she was tracked among nearshore habitats and making two, possibly exploratory movements 30km offshore into waters with depths >4,000m. An adult male, Blackbeard, has been photo-documented at Long, Cat, Eleuthera, and New Providence islands, with some repeated trips among these islands. Photo-identification and radio-tracking of individual manatees in The Bahamas have provided insights in the navigational capabilities of individuals to occupy large home ranges, negotiate repeated long distance moves and survive deep-water crossings.

The effect of body size on chewing cycle duration and interspecific difference in manatees.
Mumi Kikuchi[1], Daniel Gonzalez-Socoloske[2], Diogo A. de Souza[3] and Vera M.F. da Silva[3]
[1]Wildlife Research Center of Kyoto University, 2-24 Tanaka-Sekiden-cho, Sakyo-ku, Kyoto 606-8203, Japan
[2]Department of Biology, Andrews University, Berrien Springs, Michigan 49104, USA
[3]Aquatic Mammals Laboratory (LMA), National Institute of Amazonian Research (INPA), Av. André Araújo, 2936, Aleixo, CEP 69060-001, Manaus, Brazil

All sirenian species are listed as endangered or vulnerable by the IUCN. In order to implement appropriate protective measures, an effective methodology for population assessment is needed. However, it is quite difficult to monitor sirenians in tannin-stained or turbid environments. While passive acoustic surveys are common for aquatic mammals, it is less feasible for sirenians because they vocalize infrequently and they don't echolocate. Sirenians are the only completely aquatic mammals that are herbivorous. In this study, we focused on differences in mastication sounds in relation to body size and manatee species. Mastication sounds were captured by a suspended omnidirectional hydrophone and recorded on a digital recorder of 20 captive Amazonian manatees (body size range 1.3-1.9m) in Brazil and 10 captive Antillean manatees (body size range 1.7-3.0m) in Mexico. Sounds from both sexes were recorded. The absolute start times of each chewing sound were noted, which were used to calculate chewing cycle duration (CCD). The result shows that captive Amazonian and Antillean manatees tended to increase CCD with body length, where larger individuals chewed slower than smaller individuals. Slope estimates for CCD in Amazonian manatees show a higher slope than in Antillean manatees. Rhythmic chewing is controlled at its most basic level by the masticatory central pattern generator (CPG). The CPG can produce rhythmic movements without input from extrinsic sources, but peripheral sensory receptors in the oral mucosa, teeth, and jaw muscles provide sensory feedback to modulate the final motor output. There is a possibility that inter and intra-specific differences in peripheral masticatory structures may affect in CCD. The passive acoustic monitoring of feeding sounds could provide not only information about the presence of manatees, but also information about body size.

Contributions to dugong and seagrass conservation from the UNEP/CMS Dugong MOU.
Donna Kwan[1]
[1]UNEP/CMS Dugong MOU Secretariat

The UNEP/CMS Dugong MOU would like to present on key achievements over the past 2 years and introduce ongoing and some new major initiatives underway. A major achievement has been securing USD 5.88 million for the GEF Dugong and Seagrasss Conservation Project now being implemented across 8 countries in the Indian and Pacific Oceans, namely Madagascar, Mozambique, Sri Lanka, Indonesia, Malaysia, Timor Leste, Solomon Islands and Vanuatu. The Dugong MOU continues to provide technical advice and support to Mohamed bin Zayed Species Conservation Fund, the Executing Agency responsible for implementation Dugong and Seagrass Conservation Project (2015-2018).

The Dugong MOU Secretariat has also successfully developed a Seagrass and Dugong Data Standardization Project Proposal (US $985,000) which was selected as a Priority Project for funding by the Eye on Earth Special Alliance. Working with support from the Environment Agency – Abu Dhabi and sponsorship from Total Abu Al Bukhoosh, we are also developing an easily accessible e-Resource kit (Dugongs, Seagrass & People Tool Kit) for decision making about appropriate methodologies for dugong and seagrass studies. The tool is proposed for use by researchers, non-government/civil society managers, decision-makers in dugong range states. The e-Resource kit will be a significant contribution to dugong and seagrass conservation initiatives being led by organizations in the UAE, including CMS Dugong MOU Secretariat Environment Agency – Abu Dhabi and Total Abu Al Bukhoosh, and Mohamed bin Zayed Species Conservation Fund. Significant meetings planned include a technical workshop in Thailand 15-18 February 2015 and the 3rd Signatory State Meeting of CMS Dugong MoU in 2017.

Getting our Feet Wet: Converting to Online and the Infusion of Interdisciplinary Views into a Manatee Health and Conservation Course.
Iskande V. Larkin and Heather T.D. Maness

The majority of Chief Academic Officers consider distance learning key in long-term strategic planning. However, significant concern exists about educational quality, integrity, and effectiveness in online classrooms. This has initiated a nationwide (and global) conversation that is likely to help improve all classroom settings by emphasizing instructional design based upon pedagogical theory. With this in mind, the Aquatic Animal Health Program at the University of Florida cautiously entered into online education. In our Manatee Health & Conservation course we utilized technology to:

- Increase participation by expert lecturers
- Diversify students in the course (upper level undergraduates, graduate students, veterinary students and professionals, both at the University of Florida, across the nation and internationally) providing student to student learning opportunities
- Vary student interactions with the content:
    - Recorded lectures
    - Adobe Connect discussion sessions with the expert lecturers
    - Open book quizzes for material review
    - Homework assignments: web search, power point presentation, term papers, and discussion board topics
- Track student satisfaction

Students enrolled in our online courses provided feedback (N = 81) on each format/tool. Students responded favorably to the recorded lectures and online discussion sessions (N = 43 and 49, respectively) with the majority noting a similar level of learning as a classroom-based course. Furthermore, a strong proportion responded that they learned more or significantly more with recorded lectures (N = 21). Overall, the technologies used are viewed as successful methodologies for learning. The vast majority of students felt the technology allowed them to understand the material better (N = 58) and over half felt it increased their interest in the subject matter (N = 44). Thus, program resources will continue to be allocated for further development of distance education curricula and additional technologies will be explored for continued improvements in education within this specialized field.

Call comparison among *Trichechus manatus* from different geographic regions.

Daiane Vanine Pereira de Lima[1] and Renata S. Sousa-Lima[1]
[1]LaB – Laboratory of Bioacoustics – Department of Physiology, UFRN (Universidade Federal do Rio Grande do Norte), Natal, RN, Brazil.

The manatee is a marine species currently divided into two subspecies: 1) the Florida manatee (*T. manatus latirostris*) and the 2) Antillean manatee (*T. manatus manatus*) (DOMNING & HAYEK 1986). However, there is a large genetic difference among populations of South America (Venezuela, Brazil and Guyana), Florida, and the Greater Antilles (Puerto Rico and the Dominican Republic) (VIANNA *et al.,* 2006). Based on this information, this study aims to describe the variation in call parameters of 16 individuals from Brazil (*T. manatus manatus*) and compare the mean values with the results of Nowacek *et al*. (2003) that describe calls from manatees in Belize and Florida (*T. manatus latirostris*). One hundred eighty four (184) calls were analyzed from Brazil. The manatees were recorded at the Aquatic Mammal Center facility (ICMBio) located in Itamaracá Island, Pernambuco and also on a brackish water lagoon located on the southern coast of Alagoas. The software Raven Pro 1.5 was used to extract the parameter values from the calls. Brazilian mantee calls had mean fundamental frequency of 2.44 kHz, dominant frequencies between 0.55–12.91 kHz with levels between 68.8–108.9 dB. Call durations varied from 0.09 to 0.58s, with mean of 0.36s. Complex harmonic frequency modulated calls were observed in all 3 regions (Brasil, Belize e Florida). Another similarity among all manatee calls was the second or third harmonic band with more energy than the fundamental frequency. The results for the four acoustic parameters measured from the vocalizations of Brazilian manatees are within the range of values of those obtained from Belize and Florida manatees. The overlapping distribution of sound duration, peak frequency, signal strength and fundamental frequency values indicates that future developments for passive acoustic detectors can be base in the same algorithm. Call discrimination may not be a good candidate mechanism for reproductive isolation between these populations. The potential lack of call subspecies recognition can be a disadvantage if the goal is to maintain the genetic differences between populations. Management decisions should take the potential lack of mate recognition into account to avoid loss of genetic diversity.

Variation in call parameters of Amazonian manatees *Trichechus inunguis.*

Lara Cunha Loppes[1],Vera M.F. da Silva[2] and Renata S. Sousa-Lima[1]
[1]LaB – Laboratory of Bioacoustics – Department of Physiology, UFRN (Universidade Federal do Rio Grande do Norte), Natal, RN, Brazil.
[2] LMA – Aquatic Mammals Laboratory – INPA (Instituto Nacional de Pesquisas da Amazonia), Manaus, AM, Brazil.

Trichechus inunguis, NATTERER (1883) occurs widely in the Amazon basin but is still considered a vulnerable species internationally and in Brazil threatened with extinction. This species is difficult to observe in the wild and population monitoring is challenging. Passive acoustic monitoring could be applied to identify the species presence in the wild based on automated detection algorithms. To develop such automated tools call characterization is needed and the variation of each acoustic parameter fed into the algorithm needs to be provided. Inasmuch the aim of this study is to characterize the variation of Amazonian manatees calls based on the following parameters: signal duration (s), dominant frequency (kHz), dominant frequency level (dB) and peak fundamental frequency (kHz). Calls were collected from 16 isolated individuals in 3 different captivity facilities in Brazil and were selected and analyzed using Raven Pro 1.5 and histograms showing the distribution of each parameter's values were done in SPSS Statistics 21.0. Calls were analyzed as individual notes within sequences and as call sequences (up to 4 consecutive notes emitted in a vocalization bout).

The calls are mostly harmonic series, with a frequency modulation that varies among individuals. Signals were, in its majority, composed by only one note either harmonic or noisy with non-harmonic components as described in the literature. Signal duration of notes within a sequence (vocalization bout) was smaller than half the duration of single isolated notes. Call sequences (N=224) had the following mean parameters: Dominant Frequency peak of 6.4±2.5 kHz; dominant frequency level 88.8 ±9.4 dB; peak fundamental frequency of 4.9±0.8 kHz and duration of 262±112ms. Isolated notes (N=97) had mean dominant frequency of 6.7±2.8 kHz, mean dominant frequency level of 79.5±8.3 dB, mean peak fundamental frequency of 4.9±0.8 kHz, and mean duration of 103±53ms. The majority of vocalization bouts (80%) were recorded from young individuals. Characterization of the acoustic parameters of Amazonian manatees may enable passive acoustic monitoring of populations in the wild and may even be a means of identifying young individuals based on the note duration and interval between notes.

Determining the status of Sirenians.

Helene Marsh[1]
[1]College of Marine and Environmental Sciences, James Cook University, Townsville, Queensland, Australia

Understanding the conservation status of each species of sirenian is an indicator of the likelihood of their continuing to exist. The IUCN Red List of Threatened Species (Red List) produced by the Species Survival Commission of the International Union for Conservation of Nature (IUCN) is the best-known global conservation status listing and ranking system. The IUCN has assessed sirenians since the Red List was initiated in the 1960s. The first assessments were qualitative and relied on expert opinion. In 1986, Steller's sea cow was classified as extinct; the four extant species have been classified as Vulnerable since 1982. The nature of the assessments has become increasingly data-driven and objective. The Red List currently classifies species into nine categories. Species classified as Critically Endangered, Endangered, and Vulnerable are referred to as Threatened. These categories are assigned by one or more of five criteria or decision rules: warning signals that are highly correlated with extinction probability: population reduction (Criterion A); a small distribution area in combination with fragmentation, decline or extreme fluctuations in population size (Criterion B); small population size in combination with population decline (Criterion C); extremely small population (Criterion D) and a quantitative analysis of extinction probability (Criterion E). The numerical thresholds associated with each criterion are different for each of the threat categories. The only criterion that applies to the dugong, the West African manatee and the Amazonian manatee is population reduction because the size of their populations and ranges are thought to exceed the thresholds of Criteria B, C, D and the data are not available for Criterion E.. The West Indian manatee is listed under Criterion C. More robust assessments of sirenians will require better data on population sizes and trends at a global scale. The Red List criteria were developed to assess the probability of extinction of a species at a global scale that masks the heterogeneous status of widely distributed species, such as the dugong and regional assessments would be stronger and more appropriate divers of conservation policy, which is typically is developed and implemented within geopolitical borders

Spatial and temporal variation in the effects of climatic variables on dugong calf production and neonatal survivorship/

Helene Marsh[1], **Mariana M.P.B. Fuentes**[1,2], **Steven Delean**[3], **Jillian Grayson**[1], **Sally Lavender**[4], **Murray Logan**[5]
[1]College of Marine and Environmental Sciences, James Cook University, Townsville, Queensland, Australia
[2]Earth, Ocean and Atmospheric Science, Florida State University, Tallahassee, Florida, United States
[3]School of Biological Sciences and The Environment Institute, The University of Adelaide, Adelaide, South Australia, Australia
[4]CSIRO Oceans and Atmosphere Flagship, Aspendale, Victoria, Australia
[5]Australian Institute of Marine Science, Townsville, Queensland, Australia

Knowledge of the relationship between environmental forcing and demographic parameters is important for predicting responses from climatic changes and to manage populations effectively. We explore the relationship between climatic drivers and demographic parameters of the dugong, *Dugong dugon*. Historical data were used to investigate how the proportion of dependent calves in a population is affected by various climatic covariates (rainfall anomaly, SOI, NINO 3.4, and tropical cyclones) at a range of spatially distinct locations in Queensland, Australia, a region with relatively high dugong density. The relationship between this demographic parameter and climatic drivers varied spatially and temporally, with climatic drivers influencing dugong calf production and neonatal survivorship at local scales. Given the variability and local scale relationships between the proportion of dependent calves in a population and climatic drivers, we recommend that the assessments of and management response to indirect climatic threats on dugongs should be at local scales.

Qatar: a renewed research initiative.

Christopher D. Marshall[1], Mehsin Al Ansi[2] and Jennifer Dupont[3]
[1]Texas A&M University, Department of Marine Biology
[2]Qatar University, Department of Biology and Environmental Sciences
[3]ExxonMobil Research Qatar

The Arabian Gulf is consistently cited as home to the largest dugong population outside of Australia and the State of Qatar shares two of the three most important regions for dugongs in the Gulf. The largest single dugong group ever recorded, 577 individuals, was found in the region between Qatar and Bahrain during a Gulf-wide survey in 1986. However, little research has been conducted since then to further characterize the dugong population abundance and distribution in Qatar. As part of a renewed dugong research initiative in Qatar, our team has conducted beach and boat-based surveys to locate stranded and live dugongs, respectively. As of May 2015, we have located and responded to reports of 22 strandings, spanning most of the coast of Qatar. Morphometrics were taken of individuals when possible. Tusk, skulls, and gonads were collected for future histological analyses. In addition, we conducted four boat-based surveys in the northwest region of Qatar from January to March 2015 to locate dugongs. During the initial three surveys, the team consistently located a large group of dugongs between Qatar and Bahrain comprised of several hundred individuals. Two readers used overhead UAV photographs to quantify the size of this large herd and the number of cow-calf pairs (508 individuals; 51 cow-calf pairs). Underwater surveys verified the presence of cow-calf pairs, and indicate that the major activity was foraging upon a mixed stand of *Halodule univernis* and *Halophila ovalis* in clear, shallow water (<6 m). Due to glare conditions in the photographs, we were not able to count all individuals within the entire group. Therefore, our group size is likely an underestimate. Additional beach and boat surveys will continue in this region and elsewhere in Qatar in preparation for country-wide aerial surveys.

Preliminary results of manatee habitat characterization using side-scan sonar in Isla de la Juventud, Cuba.

Mindy J. McLarty[1], Daniel Gonzalez-Socoloske[1], Anmari Alvarez-Aleman[2], Jorge Angulo-Valdes[2] and Roamsy Volta[2]
[1]Department of Biology, Andrews University, Berrien Springs, MI 49103 USA
[2]Center for Marine Research, University of Havana, Havana, CUBA

The Antillean manatee (*Trichechus manatus manatus*), a subspecies of the West Indian manatee (*T. manatus*), inhabits coastal tropical waters of Latin America and the Caribbean. Habitat use is poorly studied in large portion of this range, including Cuba. Manatees are known to use the Siguanea Gulf region of Isla de la Juventud, Cuba from previous studies using boat-based surveys and the movements of two satellite tagged manatees. Two highly used areas within the Siguanea Gulf, Buena Vista and San Pedro, were characterized using side-scan sonar to evaluate the benthic environment. The environmental complexity of both regions was measured by imaging the benthic environment and measuring water depth variations. Sonar images were ground-truthed by visual confirmation from the surface or by snorkeling. The availability of permanent freshwater sources was evaluated. The number and length of creeks and channels was recorded as an indicator of the abundance of sheltering areas. Buena Vista is composed of several large, shallow lagoons ranging in depth from 0.78 m to 3.36 m interconnected and with access from the sea by channels between 0.66 m and 6.04 m deep. San Pedro is composed of two large, deep lagoons ranging in depth from 0.21 m and 9.37 m. The channels in the San Pedro area were between 0.1 m and 8.52 m deep. There were also several smaller lagoons with depths less than 2 m. San Pedro had a greater degree of complexity than Buena Vista. The water depths varied more and there were a greater number of channels and lagoons. San Pedro also had freshwater sources, which Buena Vista lacked. Despite the difference, both of these areas appear to be important to manatees in the region and may provide different resources (e.g. food, shelter).

Manatees as sentinels of coastal health in Puerto Rico prompts new efforts towards their conservation.

Antonio A. Mignucci-Giannoni[1]
[1]Puerto Rico Manatee Conservation Center, Inter American University of Puerto Rico

Antillean manatees (*Trichechus manatus manatus*) are an endangered species throughout their Caribbean range. A small population in Puerto Rico of some 600-700 animals, has faced threats from historical hunting, watercraft collision, entanglement on debris, habitat degradation, and human encroachment into their preferred habitats. Nowadays, manatees in Puerto Rico also face a new threat from zoonotic diseases originating from land mammals, as are the recent cases of disseminated toxoplasmosis. Thus, manatees are being considered sentinels of coastal health, which may affect not only this species, but other wildlife and humans as well. While long-term conservation efforts have been implemented, new efforts will now need to include health assessments and monitoring to help this species survive into the next decades.

A new method for making high-resolution optical seagrass map and quantification of dugong trail distribution.

Katsunori Mizuno[1], Akira Asada[1], Yoshinori Matsumoto[1], Tomonori Fujii[2], Kenichi Sugimoto[2], Masumi Yamamuro[3], Monica Sarceda[4], Miguel Fortes[4] and Lea Jimenez[5]
[1]The University of Tokyo, Institute of Industrial Science, Tokyo, Japan
[2]Windy Network Corporation, Tokyo, Japan
[3]The University of Tokyo, Graduate School of Frontier Sciences, Kashiwa, Japan
[4]University of Philippines Diliman, Quezon City, Philippines
[5]Davao Oriental State College of Science and Technology, Regional ICRM Center XI, City of Mati, Philippines

Quadrat method by diving has been widely used for the study of seagrass distribution and measurement of dugong trails. However, this method is affected by observational skills of the divers and it usually requires considerable amount of time and effort for high-resolution sampling. Hence, the reproducibility of data is not always high and assessment of temporal changes in the field is not easy. To overcome these disadvantages, a new method of seagrass mapping and quantification of dugong trail distribution is developed. This new method produces a clear and a high-resolution data using acoustic and optical devices.

The field survey was conducted at Mayo Bay, southeastern Philippines on 24-26 June 2015. Initially, water depth was measured by acoustic device (LOWRANCE HDS Gen2); then, a 20 m×20 m square quadrat made of nylon ropes was set on the sea bottom of the survey area, which included seagrass and dugong trails. To cover the area, continuous optical images were taken using water-proof digital still camera from the sea surface by swimmer. More than 290 photos were obtained in a survey area and overlap rate of adjacent images was over 70 %. Using the software PhotoScan (Agisoft), 3D optical image were generated from the continuous photos. The resolution of 3D optical image is about 4 mm/pixel so that a leaf of Halophila is identifiable. In addition, the seagrass coverage rate and sizes of dugong trails were estimated in the image using simple image processing method. Thus, this quantification method, based on high-resolution optical image generated by continuous photos, can be useful for assessing the status of seagrass (e.g. Halophila) and the distribution of dugong trails. We discuss the results in relation to the conservation of dugong and seagrass habitats.

Post-release monitoring of Antillean manatees: an assessment of the Brazilian rehabilitation and release programme.

Iran Campello Normande[1,2], Ana Cláudia Mendes Malhado[2], James Reid[3], Pitágoras Carlos Viana Junior[1], Patrícia Velloso De Souza Savaget[1], Ricardo Aleixo Correia[2,4,5], Fábia De Oliveira Luna[1], Fernanda L.N. Attademo[1] and Richard J. Ladle[2,4]
[1]National Research Centre for the Conservation of Aquatic Mammals, Chico Mendes Institute for Biodiversity Conservation, Estrada do Forte Orange, s/n, Itamaracá, Pernambuco 53900-000, Brazil. E-mail
[2]Institute of Biological and Health Sciences, Federal University of Alagoas, Maceió, Alagoas, Brazil
[3]United States Geological Survey/Southeast Ecological Science Center, Sirenia Project, Gainesville, Florida, USA
[4]School of Geography and the Environment, Oxford University, South Parks Road, Oxford, UK
[5]Centre for Ecology, Evolution and Environmental Change (cE3c), Departamento de Biologia Animal, Faculdade de Ciências, Universidade de Lisboa, Portugal

Mammalian reintroduction programmes frequently aim to reconnect isolated sub-populations and restore population viability. However, these long-term objectives are rarely evaluated due to the inadequacy of post-release monitoring. Here, we report the results of a unique long term telemetry-based monitoring programme for rehabilitated Antillean manatees (*Trichechus manatus manatus*) reintroduced into selected sites in northeast Brazil with the aim of reconnecting isolated relict populations. Twenty-one satellite-tagged rehabilitated manatees, 13 males and 8 females, were released into the wild from two sites between November 2008 and June 2013. Individual accumulation curves were plotted and home ranges were

calculated through the fixed kernel method using 95% of the utilization distribution. The number and size of the Centres of Activity (COAs) were calculated using 50% of the utilization distribution. Manatees displayed a dichotomous pattern of movement, with individuals either characterized by sedentary habits or by much more extensive movements. Moreover, home range size was not significantly influenced by gender, age at release or release site. COAs were strongly associated with sheltered conditions within reefs and estuaries, and also by the presence of freshwater and feeding sites. Our data confirm that manatee reintroductions in Brazil have the potential to reconnect distant sub-populations. However, pre-release identification of potential long-distance migrants is currently unfeasible, and further analysis would be required to confirm genetic mixing of distant sub-populations.

Phylogeography of the dugong (*Dugong dugon*) based on historical samples.

Stephanie Plön, Vibha Thakur, Leslie Parr and Shane Lavery
[1] Coastal and Marine Research Unit (CMR), Nelson Mandela Metropolitan University (NMMU), Port Elizabeth, South Africa
[2] School of Biological Sciences, University of Auckland, Auckland, New Zealand
[3] Department of Biological Sciences, San José State University, San José, USA

The dugong (*Dugong dugon)* is found throughout the Indo-Pacific, distributed along some 140,000km of coastline across 38 countries. Its overall conservation status is currently classified as 'vulnerable' by the International Union for the Conservation of Nature (IUCN), although the species may in fact be 'endangered' or 'critically endangered' in some parts of its range. As a result, contemporary samples are extremely difficult to obtain due to the scarcity, low numbers, and relative inaccessibility of animals. However, data on population genetic structure are needed to inform the design and implementation of sound and effective *in situ* conservation and management strategies to protect the last remaining viable populations. Here we investigated the phylogeography of the dugong using samples from bones and teeth from 172 individual specimens housed in 14 European and African natural history museum and university collections. These samples range in date from 1869 to 1995 and span the entire historical range of the dugong.

We were able to successfully amplify overlapping fragments of the d-loop region of the mitochondrial DNA (mtDNA) and in total 502 sequences from a 355 bp fragment were included in the final analyses. The resulting data on population structure indicate a number of important points for conservation and management of the species: Several completely new and highly divergent mtDNA lineages were found in the Indian Ocean, and the Madagascar population appears completely isolated and unique, even from other, relatively close, neighbouring populations in the Western Indian Ocean (WIO) region. There is little geographical structuring currently detectable among other populations in the WIO region. All populations from the WIO appear to have historically contained comparatively low levels of genetic diversity and samples from Sri Lanka are genetically divergent from all other populations. These results will aid with conservation and management plans for the species in the region.

First regional aerial survey of Antillean manatees (*Trichechus manatus manatus*) in the Mexico-Belize-Guatemala region of Central America.

Ester Quintana[1], Nataly Castelblanco- Martínez [2,3], Holly Edwards[4], Benjamin Morales[5], Armando Ubeda[6] and Zoe Walker[7]
[1]University of South Florida, USA
[2]Consejo Nacional de Ciencia y Tecnología/Universidad de Quintana Roo, Mexico
[3]Fundación Internacional para la Naturaleza y la Sustentabilidad – FINS
[4]Florida Fish and Wildlife Conservation Commission, USA
[5]Mesoamerica Program Manager, Lighthawk, USA
[6]Wildtracks, Belize
[7]El Colegio de la Frontera Sur, Mexico

Nine observers representing 6 countries (Belize, Colombia, Guatemala, Mexico, Nicaragua and the United States) conducted the first ever international (transboundary) aerial survey of Antillean manatees in the Caribbean waters of Mexico, Belize and Guatemala, Central America from May 2–10, 2014. Surveys were flown to map distribution and estimate manatee abundance in the three countries. Experienced observers (>40 h manatee aerial survey observations) counted a total of 419 manatees: 83 in Mexico, 298 in Belize and 38 in Guatemala. This was the first time a survey was conducted simultaneously over the region, although manatee surveys have been conducted separately for each country. The project was initiated by Lighthawk, a non-profit environmental organization that supports environmental protection efforts by making flight services available to conservation groups. Lighthawk provided the aircraft and pilot, and helped coordinate the logistics to conduct surveys which began in Holbox, Mexico in the Yucatan Peninsula and ended in the Motagua River in Guatemala. Eleven separate segments were surveyed over approximately 40 hours; 3 surveys days in Mexico, 4 days in Belize, and 2 days in

Guatemala. Surveys were conducted following previously established survey flight paths according to manatee experts in each country and using dual observer protocols in which each observer's sightings were recorded independently of one another. Each experienced observer recorded relevant environment information including visibility (turbidity), sea state using the Beaufort scale, cloud cover, and glare. These covariates will be used to calculate observer detectability to help estimate manatee abundance in each country, and region-wide.

Prediction of seasonal availability of the African manatee (*Trichechus senegalensis* link, 1795) in response to water chemico-physical parameters: case of Lake Ossa, Cameroon.

Paul Rodrigue Ngafack[1,2], Theodore B. Mayaka[1] and Kamla Aristide[2]
[1]Department of Animal Biology, University of Dschang, Po.Box 67, Dschang, West Cameroon
[2]African Marine Mammal Conservation Organization(AMMCO), Po Box; 908, Edea- Littoral, Cameroon

The African manatee (*Trichechus senegalensis*) is one of many threatened marine mammals in Africa, with a wild population estimate of less than 10,000. The wide distribution of the African manatee along the west coast of Africa, from Mauritania to Angola, contrasts with the low level of information about the ecology of the species, particularly in Cameroon. This project aims to determine the season, station, time of day and water physical characteristics effects on manatee sighting in Lake Ossa Wildlife Reserve Littoral region of Cameroon.

Between October 2013 and March 2014, data were collected using boat-based point scan methods with the assistance of volunteer. Presence/absence method ensured consistency of data collection. The results indicate that the probability of sighting a manatee was high at Mevia with (P = 0.53, n= 30 scans) than in plantation (P = 0.3, n=30 scans). It is more common to encounter manatee in lake Ossa during dry season (56%, n=30 scans) than wet season (26%, n= 30 scans). The hours between 0500-0800, and 1100-1400 were the best period of the day for sighting a manatee during the wet season and dry season respectively, with 1100-1300 and 1700-1900 hours being the worst periods for sighting them during both wet and dry season. Water pH has a positive significant effect on the detectability of manatee indices in Lake Ossa, while the depth has a negative significant effect. Current reports of sighting of *T. senegalensis* became less frequent than previous reports.

The ecological information obtained through this project are vital for conserving and understanding *T. senegalensis* and also recommending the establishment of Lake Ossa as manatee sanctuary during dry season, conservation actions and improved management of the area by all stakeholders with a vested interested in the perpetuation of the endangered species in Cameroon.

Saving the Amazonian manatee through environmental education in the Peruvian Amazon.

Luis "Zammy" Sandoval
The Dallas World Aquarium

The Amazonian manatee (*Trichechus inunguis*) occurs throughout most Amazon River drainages, from the headwaters in Colombia, Ecuador and Peru. They maintain the health of the body waters by eating the fast growing aquatic plants.

Before 2007, the Amazonian manatee was an unknown species by 90% of the local population of the Peruvian Amazon. Although the Amazonian manatee is a protected species by Peruvian law, it has been hunted by local people for its meat. In some cases, the calves are separated from their mothers to keep them as pets in private ponds, where they die due to undernourishment.

In November 2007, two orphaned Amazonian manatees were rescued near the City of Iquitos; they were placed in a small tank located at the house of one of the rescuers. That same year, The Dallas World Aquarium (DWA) began efforts to support the conservation of this species. A new rescue facility was built, where food, medication, and staff to provide veterinary training and information on the management of the species, were provided to local biologists. It was then that the Association for the Conservation of the Amazonian Biodiversity was created (ACOBIA-DWAZOO).

In 2008, five more orphaned Amazonian manatees were rescued, and the Amazonian Rescue Center (CREA) was created by the DWA and other Peruvian institutions. A formal Environmental Education program began that same year, focusing on environmental issues and conservation efforts of the Amazonian manatee. The scope of the education program involved more than 30,000 children and young people of the Amazon within that year. This program continues today, involving local people and tourists who visit the Amazon Rescue Center.

An important accomplishment of the Environmental Education program has been the decrease in the number of rescued manatees since the program's start. This is a representation that the people of the Peruvian Amazon are learning the importance of the role that the Amazonian manatee plays in the health of the environment.

In conclusion, the Environmental Education program has shown that it is one of the most important tools in the conservation of any endangered species, especially, in remote areas like the communities around the Peruvian Amazon where information is scarce.

What brought a small island in the Caribbean and Brazilian manatees to the focus of a great international dilemma?
Salvatore Siciliano[1,2] and Renata Emin-Lima[2]
[1]Instituto Oswaldo Cruz/Fiocruz. Av. Brazil, 4.365, Manguinhos, Rio de Janeiro, RJ 21040-900 and Instituto Megafauna Marinha, Cabo Frio, Brazil
[2]Museu Paraense Emílio Goeldi, Coordenação de Zoologia, Setor de Mastozoologia, Grupo de Estudos de Mamíferos Aquáticos da Amazônia (GEMAM), Av. Perimetral, 1901, Terra Firme, 66077-530 Belém, PA, Brazil

A plan for re-establishing manatees in the waters of the natural reserve called 'Grand Cul-de-Sac Marin', coordinated by the National Park of Guadeloupe and other entities of this Caribbean island has been launched and widely advertised. Media coverage and several published documents have been discussing all aspects to the planned reintroduction of manatees in Guadeloupe. Considering the several constraints of using wild manatees in the re-introduction program in Guadeloupe, attention has been directed to captive specimens. In this sense, it has been argued that, in northeastern Brazil, there used to be a number of captive Antillean manatees suitable for the re-introduction program. It is reasonable to believe that this has been the first step towards the 'use' of Brazilian manatees in the re-introduction program in Guadeloupe. As years have passed, a national plan for manatee conservation in Brazil was under discussion and has been finally published in 2011 (PAN Sirênios – ICMBio, 2011). The word 're-introduction' [reintrodução, in Portuguese] appears many times in the official document but none is related to the Island of Guadeloupe. It is no surprise that Brazilian scientists and conservationists haven't been fond of the idea of translocating manatees to Guadeloupe. The dilemma of translocating or not Brazilian manatees to Guadeloupe persists until the present days. There was no public and scientifically sound discussion on the issue of translocating Brazilian manatees to Guadeloupe, even though the Ministry of Environment of Brazil publicized it as an achievement. This is an appeal for an international consensus on this important issue. The nationals of Guadeloupe should know that the re-introduction plan hasn't been under careful discussion in Brazil. We just want to have these points clarified and an open discussion as a democratic nation should put in practice.

First mobile Apps for monitoring marine mammal populations in Cameroon.
Aristide Kamla Takoukam[1, 2], Paul Rodrigue Ngafack[2], Robert Bonde[3], Thomas Bacha[4] and Tim Collins[5]
[1]Aquatic Animal Health Program, College of Veterinary Medicine, University of Florida, Gainesville, Florida
[2]African Marine Mammal Conservation Organization, Dizangue, Littoral, Cameroon
[3]Sirenia Project, U.S. Geological Survey, Southeast Ecological Science Center, 7920 NW 71st Street, Gainesville, Florida 32653 USA
[4]International Union for Nature Conservation, Bastos, Yaoundé, Cameroon
[5]Wildlife Conservation Society, USA

There are very limited existing data on the distribution of marine mammals (dolphins, manatees and whales) in Cameroon. Aquatic research requires enormous resources and skills that are absent in most low income countries. Yet, marine mammals of Cameroon face serious threats including hunting, bycatches and pollution. Without an effective monitoring system their populations may go extinct unnoticed. In our first attempt to cost effectively address data scarcity, we established the Siren network made up of about 30 fishermen along the Cameroon coast in 2012. It has successfully reported on marine mammal sightings and carcasses using datasheets and phone calls. However, this reporting system was flawed as it lacked important data such as GPS location, time and photos for ID purposes. Moreover, datasheets were time consuming for fishermen. The objective of the Siren App is to empower fishermen to easily and quickly collect more accurate data and remotely send them to a server to be automatically analyzed and shared for view with the public and decision makers. We developed the Siren App and made it available for free on both iOS and Android versions, and in both English and French. Smart phones with the Siren App installed were distributed to 20 fishermen in the network. The Siren App enables collection and recording of marine mammal sighting data including: Date, time, GPS location, species photo, species name, number seen, habitat, behavior, animal life status, weather status and effort. Collected data are stored in phone memory, uploaded to a server and displayed for query and view on our interactive Webmap (www.ammco.org) as soon as user's phone is connected to internet. Confirmed collected data will provide reliable information on the distribution and trends of the populations. Furthermore, identified hotspots will be used for ecotourism and education purposes.

Puerto Rico manatee aerial surveys – past and present.
Jan P. Zegarra[1]
[1]USFWS Caribbean Ecological Services Field Office

Since 1976, the USFWS has invested numerous resources and efforts to complete manatee aerial surveys in Puerto Rico. Thanks to these efforts, we have learned about manatee distribution on the Island, the species main use areas and population numbers. Given the challenges of counting manatees from the air, manatee population counts have been highly variable. For that reason, since 2010, we have implemented a modified aerial survey method that includes a series of repetitions within certain designated areas. This allows for the calculation of a detection probability that is used to adjust the population estimates with confidence intervals. The most recent results suggest an adjusted mean estimated population size of 532 individuals, with a 95 percent equal area credible interval of 342 to 802 manatees in Puerto Rico.

RECENT LITERATURE

Abbassi, N., D. P. Domning, N. Navidi Izad, and S. Shakeri. 2016. Sirenia fossils from Qom Formation (Burdigalian) of the Kabudar Ahang area, Northwest Iran. Riv. It. Paleont. Strat. 122(1): 13-24.

Attademo, F. L. N., D.C. Balensiefer, A. C. da Boaviagem Freire, G. P. de Sousa, F. A. G. C. da Cunha, and F. de Oliveira Luna. 2015. Debris ingestion by the Antillean manatee (*Trichechus manatus manatus*). MARINE POLLUTION BULLETIN 101(1):284-287.

Balaguer, J. and D. M. Alba. 2016. A new dugong species (Sirenia, Dugongidae) from the Eocene of Catalonia (NE Iberian Peninsula). Comptes Rendus Palevol 15: 489-500 + Supplementary data at http://dx.doi.org/10.1016/j.crpv.2015.10.002.

Chavarria, M. R., J. Castro, and A. Camacho. 2015. The relationship between acoustic habitat, hearing and tonal vocalizations in the Antillean manatee (*Trichechus manatus manatus*, Linnaeus, 1758). BIOLOGY OPEN 4(10):1237-1242.

Crerar, L. D., E. C. M. Parsons, E. C. M., D. P. Domning. 2016. Serendipity in research – investigation into illegal wildlife trade discovers a new population of Steller's sea cows: a reply to Pyenson *et al*. (2016). *Biology Letters* (Royal Society) 12: 20150670, http://dx.doi.org/10.1098/rsbl.2015.0670

Estes, J. A., A. Burdin and D. F. Doak. 2015. Sea otters, kelp forests, and the extinction of Steller's sea cow. *Proc. Natl. Acad. Sci. USA* 113(4): 880-885. www.pnas.org/cgi/doi/10.1073/pnas.1502552112

Frankovich, T. A., J. J. Sullivan, and N. I. Stacy. 2015. Three new species of *Tursiocola* (Bacillariophyta) from the skin of the West Indian manatee (*Trichechus manatus*). *Phytotaxa* 204 (1): 033–048.

Pyenson, N. D., J. F. Parham, J. Vélez-Juarbe. 2016. The dilemma of trade samples and the importance of museum vouchers – caveats from a study on the extinction of Steller's sea cow: a comment on Crerar *et al.* (2014). *Biology Letters* (Royal Society) 12: 20150149, http://dx.doi.org/10.1098/rsbl.2015.0149

Romero-Calderón , A.G., B. Morales-Vela, R. Rosíles-Martínez, L.D. Olivera-Gómez, A. Delgado-Estrella. 2015. Metals in Bone Tissue of Antillean Manatees from the Gulf of Mexico and Chetumal Bay, Mexico. Bulletin of Environmental Contamination and Toxicology, 96(1). DOI: 10.1007/s00128-015-1674-6

Smith, L. N., D. S. Rotstein, R. L. Ball, T. J. Gerlach, M. Kinsel, M. Rodriguez, and M. De Wit. 2015. Reproductive neoplasms in wild and long-term captive female Florida manatees (*Trichechus manatus latirostris*). JOURNAL OF ZOO AND WILDLIFE MEDICINE 46(4):895-903.

Tighe, R.L., R.K. Bonde and J.P Avery. 2016. Seasonal response of ghrelin, growth hormone, and insulin-like growth factor I in the free-ranging Florida manatee (*Trichechus manatus latirostris*). Mammalian Biology 18:247-254. DOI: 10.1016/j.mambio.2016.02.006

⇨ COPY DEADLINE FOR NEXT ISSUE: OCTOBER 1, 2016 ⇦

Material may be submitted (in Microsoft Word format, 500 word limit) to Cynthia Taylor at: **ctaylor@sea2shore.org**

Sirenews is available at:

http://sea2shore.org/news/scientific/sirenews/

or join our distribution list to receive *Sirenews* directly
(please email ctaylor@sea2shore.org to be added to the list)