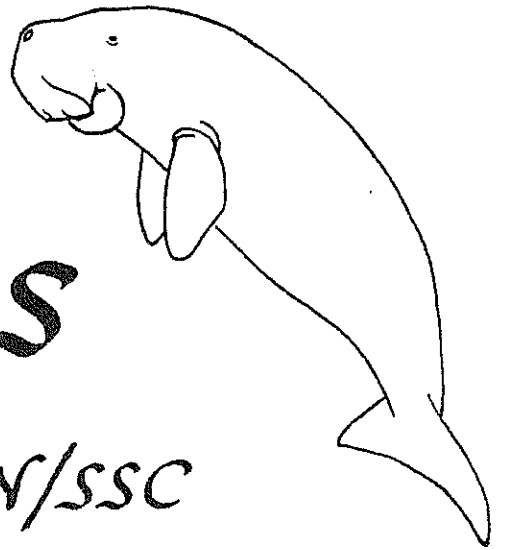


Sirenews



Newsletter of the IUCN/SSC Sirenia Specialist Group

NUMBER 26

OCTOBER 1996

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GOING ... GOING ... DUGONG: CAN AUSTRALIA MEET ITS INTERNATIONAL OBLIGATIONS FOR CONSERVING DUGONGS IN THE GREAT BARRIER REEF REGION?

Since the first international dugong workshop held in Townsville in 1979, it has been recognized that Australian initiatives are vital if dugongs are to be conserved. Australia has a special responsibility for dugong conservation as it provides one of the last strongholds for dugong populations. Elsewhere in the dugong's range, some local populations have been extirpated, and where it still occurs in developing countries, remnant populations are under increasing pressure. Australia is a developed country with a relatively small human population, particularly in the north where dugongs occur. Our capacity to conserve dugongs should be good in the Great Barrier Reef region. The Great Barrier Reef Marine Park is the largest multiple-use marine protected area in the world and a World Heritage Site. The importance of this region as a dugong habitat was one of the reasons it was inscribed on the World Heritage List in 1981. If we cannot manage to conserve dugongs in the Great Barrier Reef region, then it is unlikely that they will survive anywhere else.



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 espèces—Species Survival Commission

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and Sea World, Inc.

In the October 1995 issue of *Sirenews*, I reported that, although dugong numbers appear to have been stable over the last decade in the remote parts of the Great Barrier Reef region, they have declined over much of the urban coast by approximately 50% over the past eight years. Over a large section of the region, this decline is over 80%.

This massive decline in dugong numbers means that the dugong qualifies for classification as "critically endangered" over much of the urban east coast of Queensland. Anecdotal evidence from scientists and traditional hunters suggests that this decline has been occurring since the 1960s or even earlier.

Statistics collected by the Queensland Shark Protection Program reinforce this conclusion. Since shark nets were introduced for bather protection in the 1960s, 541 dugongs have been caught in the Great Barrier Reef region, most in the early years of the program. A total of 241 dugongs were caught near Townsville and 161 off Cairns, the area where there are now so few dugongs that the population cannot be estimated.

The decline in dugong numbers along the east coast of Queensland is embarrassing for Australia, which has responsibility for conserving dugongs under several international conventions. Australia also has a national responsibility to conserve dugongs for future generations of Australians, especially Indigenous Australians, for whom the dugong has special cultural significance.

It is widely recognized that dugong meat and oil are among the most valuable traditional foods of coastal Aborigines and Torres Strait Islanders in northern Australia. Most people assume that traditional hunting is the most serious human impact on dugongs in Australia. But the situation is clearly much more complicated than this in the Great Barrier Reef region. Dugongs are vulnerable to two broad classes of impacts:

- those that kill animals directly, for example netting, traditional hunting, or large-scale losses of seagrass; and
- those that decrease the calving rate by reducing feeding opportunities, for example smaller-scale habitat loss or boat traffic.

Even though Tony Preen and Paul Anderson have discovered that dugongs supplement their seagrass diet with invertebrate animals at the subtropical limits of their range, they are essentially seagrass specialists. This dependence on seagrass means that dugongs have an obligatory association with coastal habitats, which are vulnerable to the impacts of extreme weather events and to human activities such as hunting, fishing, coastal development, and unsustainable agricultural practices.

Since they became aware of the decline of the dugong in the southern Great Barrier Reef region, most of the Indigenous Councils of Elders that control traditional hunting in this region have voluntarily agreed not to harvest dugongs, and there is currently no permitted hunting on the urban coast. One Aboriginal Corporation recently signed an historic agreement with the Great Barrier Reef Marine Park Authority stating that it would be inappropriate for Indigenous hunting to occur within their local area.

It is now up to other stakeholder groups to respond to the challenge of reducing their impacts on dugongs, and there has been major media pressure on the commercial fishing industry to reduce their dugong bycatch. So far this year, Janet Slater of the Great Barrier Reef Marine Park Authority has collated reports of 23 dugong carcasses, at least 10 and possibly 14 of which were suspected net kills. As a result, dugongs have been front-page news in many regional newspapers in Queensland for several weeks, and serious concern is at last being expressed about the problem. I was even flown to Sydney to brief the Australian Minister for the Environment in person.

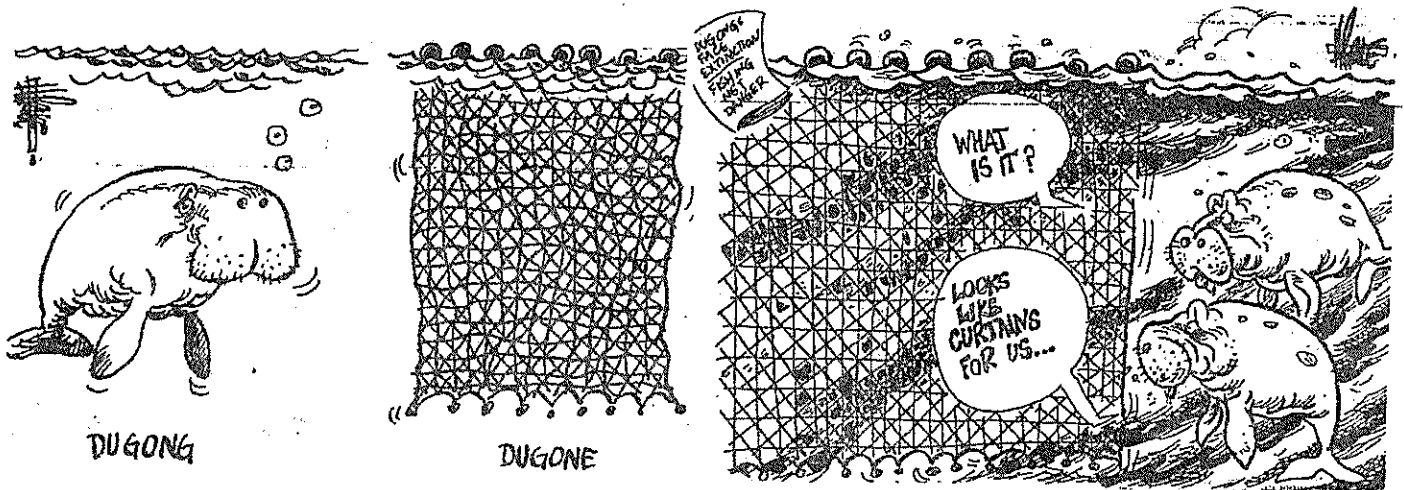
The Queensland Commercial Fishermen's Organisation has publicly acknowledged that the incidental capture and drowning of dugongs in mesh nets is a problem. This organization has supported the development of an education program to inform commercial fishers on aspects of dugong conservation biology and management and on methods to minimize dugong take. It is hoped that attendance at this program will become part of the Trainee Master Fisherman's course and compulsory for Master Fishermen who wish to fish using mesh nets. This initiative is important as many fishers do not appreciate the seriousness of the "Dugong Problem" or the way it threatens the future of mesh netting as a commercial fishing method in the Great Barrier

Reef region. However, I consider that education alone will not be enough.

Given the large number of net fishers and vessels involved in the industry on a part-time basis, an observer program to obtain statistics on the numbers of dugongs drowned in mesh nets on the east coast of Queensland would be expensive and logistically difficult. Solution of this problem requires a multifaceted joint approach by the relevant Queensland and national agencies and the commercial fishing industry. I have assessed the comparative risk of dugongs drowning in mesh nets in various sectors of the Queensland coast on the basis of dugong density, mesh net density, and enforcement capability as a first stage in developing a strategy for reducing the bycatch of dugongs. An urgent solution is required to avoid further polarization of the stakeholders involved in the problem and to minimize the further impacts of mesh netting on dugongs on the east coast of Queensland.

The Queensland Shark Protection Program is also being reviewed to address bycatch issues. Baited lines, which do not catch marine mammals, have replaced nets at many beaches in the Great Barrier Reef region in recent years, but nets remain at several locations. A decision to replace all nets with baited lines would be controversial, as some scientists believe that nets as well as lines are needed if inshore shark numbers are to be maintained at a level where the risk of their attacking people is acceptably low. Other scientists consider that any bycatch of marine mammals in shark nets is unacceptable in a World Heritage Area, given the extremely low risk of a bather being attacked by a shark.

The greatest challenge will be the conservation of inshore seagrass beds in the region. Experience has shown that it is hard to convince a prospective developer that a resort may have adverse impacts on dugongs and their habitats. It will be even harder to convince a farmer that erosion from his property may threaten the survival of sea cows grazing on submarine pastures many kilometers downstream! - Helene Marsh



(cartoons reprinted from *The Daily Mercury*, Sept. 1996)

NEW JOURNAL

A new periodical which can be expected to include sirenian items on a regular basis began publication in June 1996. Entitled *Manati: Zeitschrift des Vereins der Tiergartenfreunde Nürnberg e. V. und des Tiergartens der Stadt Nürnberg*, it is the official publication of the Nuremberg Zoological Garden, which has been so successful in breeding West Indian manatees. According to a notice in *Säugetierkundliche Mitteilungen* 38(1), the new journal's first issue begins with a general account of the animal by Prof. Dr. H. F. Moeller (Heidelberg), and also includes a report on seacows by Dr. B. Blaszkewitz (Berlin-Friedrichsfelde) (see

Recent Literature, below). Other articles cover a variety of other animal species. *Manati* supersedes the earlier series entitled *Tiergarten Aktuell* (1985-1995), and its first volume accordingly receives the number 11.

THANKS AGAIN, SEA WORLD!

Sea World, Inc. has once more assisted the publication of *Sirenews* with a contribution of \$1000. On behalf of the Sirenia Specialist Group and IUCN, we thank Sea World and Dan Odell for their generous support.

LOCAL NEWS

FLORIDA

Manatee Die-off Attributed to Red Tide. - The disastrous mass mortality of manatees that occurred in southwest Florida between 5 March and 27 April 1996 has been officially diagnosed as the result of a red tide, according to a 2 July press release by the Florida Department of Environmental Protection (FDEP).

The die-off involved the deaths of some 158 Florida manatees whose carcasses were recovered between Englewood in the north and Marco Island in the south.

The announcement came as the conclusion to four months of intensive research by state, federal, and international agencies, which ruled out other possible causes such as infectious diseases, parasites, and man-made toxins. The dead manatees' nutritional condition was good and there was no visible trauma, meaning that cold stress and boat strikes were not to blame.

Evidently the animals died as a result of inhaling and/or ingesting high levels of red tide toxin (brevetoxin) while feeding on seagrasses and associated organisms which may have concentrated the poison. FDEP red tide specialist Dr. Karen Steidinger, writing in the *Save the Manatee Club Newsletter* (Sept. 1996), suggested that four unusual circumstances coincided to precipitate the unusual mortality. First, early 1996 brought some of the coldest temperatures in recent history to the area, causing large numbers of manatees to congregate in warm-water refugia up the Caloosahatchee River. Second, there was a warming period when the manatees dispersed into Pine Island Sound and Matlacha Pass. Third, there were high salinities at the mouth of the Caloosahatchee and

throughout Pine Island Sound, which favored the survival of the dinoflagellates that cause red tide. Fourth, from the beginning of March to the end of April, the red tide concentrations in the area were high enough to kill fish and the highest they had been in the area at that time of year since 1982, when the other circumstances also co-occurred and a similar manatee die-off took place. Steidinger speculates that when the manatees dispersed down the Caloosahatchee, they encountered the hot zone of red tide, triggering the mass mortality.

Prior to this die-off, the most recent population estimates indicated a Florida manatee population of over 2600. As of 16 October, 369 manatees have died in the state this year, including the 158 attributed to this event. This far exceeds the previous record set in 1990, when a total of 206 Florida manatees died in the entire year.

GUINEA BISSAU

African Manatees Captured for Display. - Reports have reached us that two West African manatees were captured in Guinea Bissau this past summer by a team from the Toba Aquarium in Japan, where the animals are destined for public display. These would be the first specimens of *Trichechus senegalensis* displayed in a public aquarium in many years, and they would join the pair of dugongs already in captivity at Toba. However, no further details were obtainable from the Toba Aquarium or other sources as of press time. We hope to provide a full report in our next issue.

INDIA

The Vanishing Mermaids of Andaman and Nicobar Islands. - In the recent past, the urgent need to study the seagrass habitat and its associated animal life in Andaman and Nicobar was felt by several workers. Thus, a study was initiated by Salim Ali Centre for Ornithology and Natural History with financial support from the Ministry of Environment and Forests, Government of India, in order to evaluate the habitat status, resource potential, and conservation value of this unique ecosystem.

Seagrasses being its staple food, the dugong is intimately associated with the seagrass habitat. Once widely distributed, the dugong has disappeared from many parts of its realm and is under serious threat in most of the remaining area. In India, the dugong occurs in the Gulf of Kutch, Gulf of Mannar, Palk Bay, and Andaman and Nicobar Islands. The latter islands have large areas of seagrass, rich in diversity, flourishing in clear, relatively low-nutrient coastal waters.

The primary objective of the study was to identify the potential seagrass habitats for conservation, but information regarding dugongs was also collected. Surveys by motor boat and rowboat in Ritchies Archipelago, North Reef, Marine National Park - Wandoor, and off Diglipur during 1994, and Little Andaman, Camorta, Pilomilow, Little Nicobar and Great Nicobar islands during January and March 1995 failed to locate dugongs. These surveys were undertaken without any particular pattern and with the help of the local hunters and fishermen from morning to evening. The main source of information was interviews with the local tribes and settlers. As dugong poaching is illegal, the local fishermen were reluctant to share information. Therefore the interviews were done informally. On two occasions, bones could be examined.

Dugongs were common in the 1950s, but the population has dropped drastically in the recent past, as evidenced by sporadic sightings and rare records of poaching. Most of the tribes, namely Andamanese, Onges and Nicobares, traditionally hunt dugongs with iron harpoons tied to the boat (*dunghi*). Shompens have no knowledge about dugong hunting, and hostile tribes (Sentinalese and

Jarawas) were not interviewed. Settlers, although they have no knowledge about hunting, at times get the animals in fishing nets close to seagrass beds. None of the tribes, except Andamanese of Strait Island, go on regular hunts because of the time and effort it takes to catch a dugong. The settlers from mainland India are mostly Hindus (Bengali- and Hindi-speaking) and do not like dugong meat as it looks and tastes like beef; so the killing is always unintentional. To avoid legal problems they hand over the animals to the tribes who are exempted from the Wildlife (Protection) Act of 1972.

The fishermen had sighted five dugongs on separate occasions between 1990 and 1994 along the northwestern side of Camorta Island, five near Dugong Creek and Hutby, and four each in Little Nicobar and Great Nicobar islands. Besides those in the southern Andaman Islands, dugongs were seen by fishermen and local residents around Ritchies Archipelago on at least five separate occasions during 1990-1994. Most sightings took place in seagrass beds during high tides in the early evening.

The primary reason for the decrease in the dugong population in this island group is habitat loss, which has resulted from increasingly heavy boat traffic and faulty land use practices such as conversion of forests to banana, areca nut and coconut plantations. Natural calamities like cyclones and high-energy tidal storms may also be partly responsible. In fact, a wounded and dead dugong was noticed by Andaman Public Works Department workers near Pilo Kunji on Great Nicobar Island after a cyclone in July 1989.

The study concludes that dugongs are less abundant than in the recent past. Although dugong numbers are greatly reduced and large populations are no longer seen, dugongs still exist at least around Ritchies Archipelago, North Reef, Little Andamans, Camorta (Allimpong and Pilpilow), Little Nicobar and parts of Great Nicobar islands. The best way to protect dugongs in these island groups is by: (1) initiating education programs, (2) identification and conservation of potential habitats, (3) enforcing strict legislation to protect dugongs, and (4) regular monitoring by government and non-government agencies. The study also advocates an aerial survey of dugong populations to determine

thereafter. - H. S. Das (Scientist, Wetland Ecology Division, Salim Ali Centre for Ornithology and Natural History, Kalampalayam, Coimbatore 641 010, India)

KENYA

Dugong Festival Week Raises Awareness. - The Sea Turtle/Dugong Conservation Committee, comprising representatives from the Kenya Wildlife Service (KWS), Fisheries Department, Coast Development Authority (CDA), National Museums of Kenya (NMK), Wildlife Clubs of Kenya (WCK), hoteliers and individual conservationists, in collaboration with the Dugong Inter-Agency Advisory Committee comprising KWS, World Wide Fund for Nature (WWF), Japanese International Cooperation Agency (JICA), WCK, East Africa Wildlife Society (EAWS), Fisheries Department, United Nations Environment Programme (UNEP), World Conservation Union (IUCN), Africa Wildlife Foundation (AWF), Eden Wildlife Trust (EWT), and CDA, organized a Dugong Awareness Festival Week, 22-27 April 1996.

The aims of the festival were to:

- (1) raise public awareness concerning the plight of dugongs among fishermen and local communities;
- (2) obtain information from the fishermen and local people on the occurrence of dugongs;
- (3) involve the coastal people in dugong conservation by introducing them to measures they can implement to curb dugong mortality; and
- (4) seek the views of fishermen on appropriate ways to enhance dugong conservation.

During the festival week, a series of meetings was held in the key fishing villages along the Kenya coast. Seminars and workshops, together with audio-visual presentations, were the main modes of communication during the one-week awareness program, which saw the conservationists move from Vanga Ngomeni, Kipini, Lamu, Takwa, Pate, Kizingitini, Kinyaole (Robinson Island), and other fishing villages. The coordination team was led by the chairman of the Kenya Sea Turtle/Dugong Conservation Project, Mr. George Wamukoya, with Eden Wildlife Trust (EWT) supporting the ground logistics by providing transport. The awareness team comprised Kakuko Nagatani

(WCK), George Wamukoya (KWS), Jane Mbendo (Fisheries Dept.), Said Mwanguni (CDA), Hassan Mohammed (Fort Jesus Museum), Fakihi Mbwana (KWS), Sirya Karisa (KWS), and Joseph Eriya (volunteer). Dugong posters created a lot of enthusiasm among the local people, as many of them had not seen a dugong before.

In most of the fishing villages, the local communities pledged to form conservation subcommittees, which will serve to monitor dugong movements and their conservation needs and those of other endangered species such as sea turtles. This will make it easier to control poaching of these animals. Model subcommittees are operating in Kipini and Lamu, whereas in Ngomeni and Kizingitini, the conservation subcommittee modalities are being worked out. The interaction between the awareness team and the fishermen yielded useful information on dugong sightings in areas such as Vanga, Watamu, and Ngomeni, which had been presumed to have depleted their local stocks. Appropriate surveillance mechanisms have been put in place in these areas for monitoring of dugong movements by the local people.

The climax of the festival week was held in Lamu town on 27 April 1996. Before the public rally, a series of entertainment activities was organized by the Lamu organizing committee. First, a peaceful demonstration was organized along Lamu streets, with participants carrying posters of "Save the Dugong" and singing in praise of dugongs and the need to conserve them. Other events which marked the highly successful day included a swimming competition, dhow race, donkey race, and poetry recitals. The latter was directly relevant to the plight of the "mermaids", whose numbers have dropped drastically from about five hundred in the last decade to only six at last count in February 1996. The most characteristic event, and a crowd puller, was the donkey race, which was won by a standard six pupil from Manda Primary School, "Jockey" Kassim Athman, who shrugged off stiff competition and marshaled the donkey to a first finish after being flagged off by Dr. Monica Borobia (UNEP OCA/PAC). Cash prizes were given as rewards for the winners, and this served as a great incentive to the participants.

The guest of honor was the KWS Deputy Director, Biodiversity, Mr. Wilbur Ottichilo,

together with a high-powered delegation from KWS headquarters including the Assistant Director in charge of Community Programmes Mrs. Agnes Masika. In attendance also were the DC, Lamu and representatives of UNEP, WCK, JICA, NMK, CDA, Fisheries Department, WWF, and the local community leaders. Mr. Ottichilo underscored the need to integrate the local communities in conservation activities and applauded the coastal people for their support and the pivotal role they continue to play in dugong and sea turtle conservation. He pledged the continued support of KWS in community-based projects which will enhance the sustainable use of the marine resources, with a view to raising the living standards of the coastal communities.

From the festival week, it is crystal clear that the English/Swahili dugong posters and audio-visual presentations and the mammoth crowd that attended the Lamu function created significant awareness about dugongs and their conservation obligations among the coastal communities. The community suggested that the Dugong Festival be held annually as a way of sensitizing the local people, particularly fishermen, on their roles and support in dugong conservation. This will enhance exchange of information on the few remaining "mermaids" and their movements. They also suggested that participants be invited from Somalia and Tanzania in order to strengthen regional efforts to conserve dugongs and turtles. The Dugong Festival will now become an annual event, with the hope of becoming a regional and international event. - **George M. Wamukoya** (Kenya Wildlife Service, P.O. Box 82144, Mombasa, Kenya)

VANUATU

Dugong Loses Patience with Divers. - The July 1996 issue of *Backbone* (Newsletter of the Department of Vertebrate Zoology, National Museum of Natural History, Smithsonian Institution, vol. 9, no. 4, pp. 8-9) carried a report by ichthyologist Jeff Williams of an unusual encounter with a dugong that he and other members of a Smithsonian collecting expedition had in May-June 1996. It is reprinted here with permission.

"A village at the southeast end of Tanna advertises a dugong as a tourist attrac-

tion. We anchored in the harbor, just off the village, to seek shelter from the constant ocean swells and were told by Captain Hendry [Taiford] that a male dugong comes up to the beach in front of our anchorage. While swimming out from the boat to find a good place to collect fish, Mark [Westneat] met the dugong and Jeff [Williams] joined them near the front of the boat. The dugong was very calm and gentle, probably curious to see people staying underwater and blowing air bubbles out of funny looking mouthpieces. He soon left us and we continued on to collect some fish. But that was not the last time Jeff would see this dugong. That afternoon at a collecting station near the mouth of the harbor, Jeff was attacked by the dugong. He was evidently not pleased that divers were swimming around in his territory! At first Jeff thought the dugong was gently hitting him on the back with his flipper, but it was soon clear after a couple of full body slams that Jeff was not welcome! After taking cover in coral crevices a couple of times, Jeff finally managed to slip away from the big guy. Although we could hear the dugong's high pitched call (warning?), he left us alone for a while, but Jeff was constantly looking over his shoulder to see if he was going to be attacked again. Sure enough, just before dark, the dugong swooped in and gave Jeff another slap on the back.

"Jeff hid in a coral cave and when the dugong crossed over the reef, Jeff decided to call it quits and headed up to the boat. During that dive, the dugong attacked Jeff, Mark and Di [Bray], but Dave [Smith] never even saw it."

In a conversation, Williams added that the dugong had put Mark Westneat's shoulder in his mouth and jerked him backward, leaving the shoulder sore for a couple of days.

As more and more people start diving in waters inhabited by dugongs, more such incidents can be anticipated. So far no one is known to have been seriously injured by a dugong, but divers should be aware that (to quote Paul Anderson) the dugong is not a manatee, and the placid, gentle image associated with the Florida manatee may not apply to a territorial male dugong armed with sharp tusks. Though not replicated by recent scientific observations, accounts do exist of bull dugongs disembowelling a shark with the

tusks (J. Promus, 1937, *Walkabout* 3(5): 40-41) and nearly killing a crocodile by repeatedly jumping out of the water and landing on top of it (G. H. Sunter, 1937, *Adventures of a Trepang Fisher*, London, Hurst & Blackett, p. 60). Believe these stories or not, but treat dugongs (and all large marine animals) with respect!

Williams' testimony that the same animal on the same day behaved differently in different locations certainly suggests some form of territoriality. What resource might it have been defending? Is it possible that dugongs in Vanuatu, as at Shark Bay, form leks? - DPD

WASHINGTON, D.C.

Sirenian Bibliography Published. - Donning's *Bibliography and Index of the Sirenia and Desmostylia* has finally (!) been published as Number 80 in the series *Smithsonian Contributions to Paleobiology*. It is an exhaustive, annotated and indexed compilation of 500 years of scientific and popular literature on the biology, paleobiology, and ethnobiology of sirenians and desmostylians. It also includes appendices on serial publications devoted to Sirenia, additional sources on the history of sirenian studies and conservation, coins and postage stamps depicting sirenians, and the classification, complete synonymy, and scientific nomenclature of sirenians and desmostylians.

Since the Smithsonian does not retail its series publications to the general public, the Save the Manatee Club (SMC) has obtained a limited supply of copies for sale to individuals. The retail price is only US\$25.00 per copy for this 611-page volume. To order, please contact the Save the Manatee Club, 500 N. Maitland Ave., Maitland, Florida 32751, USA (phone: 1-800-432-5646).

Some of you placed your orders long ago and have experienced a long delay in having them filled. Please don't blame SMC: it was the Smithsonian that fumbled the ball and delayed filling SMC's order for two and a half months after publication! However, the books have now been shipped to Florida, and orders should be filled promptly from here on out.

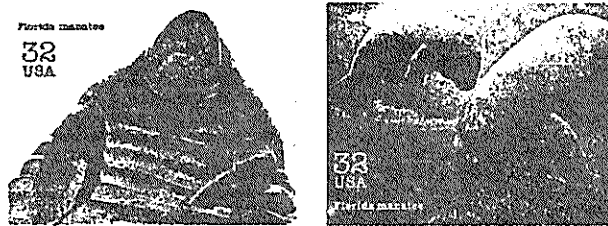
Since many active workers on sirenians are located in countries whence purchas-

es in U.S. dollars are difficult or impossible, I have also made alternative arrangements so that this important research tool can be available to those who may have the greatest need for it. If you are unable to remit in U.S. dollars, please write to the Remington Kellogg Library of Marine Mammalogy, National Museum of Natural History, Washington, DC 20560, USA, and request a copy of the bibliography. If you can pay in U.S. dollars, please order from SMC and help support manatee research! - DPD

Manatee Postage Stamp. - The first U.S. postage stamp depicting a sirenian is now available. The 32-cent blue and green stamp, part of a sheet of 15 designs portraying 15 different endangered species, was issued in San Diego on 2 October as part of National Stamp Collecting Month.

Of historical interest is the fact that the design of the Florida manatee stamp was changed in response to public criticism. The original design was taken from a photograph by wildlife photographer James Balog and showed a ventral view of the head and chest of a manatee calf at Sea World in Orlando, propped up in a sitting position. The resulting portrait, dominated by rolls of blubber, was deemed unaesthetic by many manatee fans, so the Postal Service sent Balog back to Florida for more pictures. Finally chosen was a more conventional view of two manatees in a tank at Lowry Park Zoo in Tampa.

When interviewed by the newspaper *Florida Today*, which was highly critical of the original design, Balog explained that he had initially sought to capture the animal on film in an unusual way. He commented that Americans always prefer their art to be in an unchallenging form. "Here, we'd rather consume the very familiar, very comfortable, very familiar things and not have to think very hard," he said. - (Source: *The Washington Post*, 3 May 1996.)



The original design of the manatee stamp, left, drew so much criticism that another photo was chosen for the endangered species stamp, right.

ABSTRACTS

The following abstracts are of papers and posters presented at the XXI Reunión Internacional para el Estudio de los Mamíferos Marinos, Chetumal, Mexico, 8-12 April 1996.

RECOMMENDATIONS FROM PARTICIPANTS ATTENDING THE MANATEE TOUR GUIDE WORKSHOPS IN BELIZE CITY, PLACENCIA, GALES POINT, CAY CAULKER AND SAN PEDRO

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P.O. Box 148, Belize City, Belize C.A.

The objective of this series of workshops was to get interested tour guides to become aware of the problems that actually are being faced by the manatee population of Belize. Subjects such as orientation, boat approaches, interaction with the animals, number of boats in the area, speed limits and zones, proposed protected areas for the manatees, tourist information and brochures, stiffer penalties and fines for manatee killing, additional seminars and workshops and general educational material to be disseminated to schools and tour operators; those of which were discussed. From these workshops a series of recommendations and guidelines were drafted, all being proposed by the participants of the workshops who ranged from tour guides to law enforcement officers, and NGO educators to interested people of the public. It was noted that there were interested people and that they were aware of the problems presently being faced by the manatee population of Belize.

RECOMENDACIONES DE LOS PARTICIPANTES DEL TALLER PARA GUIAS DE MANATI EN LA CIUDAD DE BELICE, PLACENCIA, GALES POINT, CAY CAULKER Y SAN PEDRO

El objetivo de esta serie de talleres fue atraer guías de turismo para que lleguen a enterarse de los problemas que en la actualidad enfrenta la población de manatíes de Belice. Se discutieron temas como el de orientación, el acercamiento de lanchas, interacción con los animales, número de lanchas en un área, límites y zonas de velocidad, propuesta de áreas protegidas, información turística, penas y multas más rígidas contra la captura de manatí, seminarios y talleres adicionales y material educativo para que sea distribuido a las escuelas y a los guías de turismo. De estos talleres una serie de recomendaciones y directrices fueron redactadas, todas propuestas por los participantes que fueron guías de turismo, oficiales de la ley, educadores y público en general. Se notó mucho interés en los participantes, los cuales tomaron conciencia de los problemas que enfrenta la población de manatíes en Belice.

ANÁLISIS DE LAS VARIABLES QUE DETERMINAN EL USO DE HABITAT DEL MANATI DEL CARIBE (*Trichechus manatus manatus*) EN LA COSTA OESTE DE LA BAHIA DE CHETUMAL, QUINTANA ROO, MEXICO.

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Mediante el análisis de dirección, se analiza la influencia directa e indirecta de las principales variables que determinan el uso de hábitat del manatí (vientos, nubosidad, temperatura atmosférica, profundidad, temperatura del agua, salinidad, pastos y algas), en dos periodos del año: nortes y secas. El diagrama causal propuesto por el análisis de dirección fue validado, con los datos de cada temporada, concluyéndose que es un buen descriptor de las relaciones causales, pero no del comportamiento de los datos, cuando sus distribuciones presentan sesgos extremos. En la temporada de nortes el diagrama no fue significativo, por lo que los resultados no pueden ser considerados cuantitativamente, no obstante, el nivel jerárquico de influencia de las variables es correcto. La variable con mayor influencia, fueron los vientos (al aumentar su intensidad, aumentó el número de manatíes en las áreas de resguardo y disminuyó en las áreas expuestas); mientras que la temperatura del agua y la nubosidad, no tuvieron influencia significativa en la distribución de los manatíes. En la temporada de secas el diagrama fue significativo. El alimento disponible fue quien determinó la presencia de la especie. La temperatura del agua y la atmosférica, no tuvieron influencia significativa en la presencia del manatí.

PRINCIPAL FEATURES THAT INFLUENCE THE HABITAT USE OF THE MANATEES (*Trichechus manatus manatus*) IN THE WEST COAST FROM CHETUMAL BAY

Path analysis was used to analyze the mean variables that determinate the manatee's habitat use (winds, cloudiness, atmospheric temperature, depth, temperature and salinity of the water, submerged vegetation during the winter (when north winds are dominans) and dry seasons. The casual diagram proposed by the path analysis, made a good description of the casual relationships, but not for the data behavior, when its distributions have biases. The diagram did not have significance for the winter season, so that the results cannot be qualitatively considered; however, the hierarchic influence level of the variables is correct. Winds were the mean variable (increasing of its intensity, increased the number of manatees within the protected areas and decreased in shore); water temperature and cloudiness did not have significant influence on the distribution of manatees. During the dry season the diagram was significant. The available food determinated the presence of manatees; while the water and atmospheric temperature did not significantly influenced the presence of manatees.

RADIO TRACKING OF FLORIDA MANATEES

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Life history and behavioral data have been collected since 1986 from radio-tagged manatees inhabiting the east coast of Florida. This study of 81 manatees (28♂, 53♀) utilizes both VHF field-monitored transmitters and UHF satellite-monitored platform transmitter terminals (PTT) to track movements of manatees. Generalizations on manatee movement patterns and behavior have emerged from preliminary analyses: (a) individual manatees tend to return to the same warm-season sites from one year to the next. (b) Similar site-specific preferences also occur around certain warm-water effluents in winter. (c) There is considerable individual variation among tagged manatees in the timing and extent of migration and the amount of time spent at warm water sites. (d) There is considerable variation in individual ranges. Movement rates of 50 km/day for several consecutive days have been documented. (e) Certain areas constitute suitable habitat and are used frequently by many manatees. (f) Some manatees spend considerable time in areas where boat traffic and human activity are restricted. (g) The survival of captive rehabilitated manatees released into the natural environment looks promising, but additional tracking will be needed to assess reintroduction success of long-term captives and captive-born animals. Locations of tagged manatees obtained during this study have been used extensively by researchers and managers to develop a better understanding of local abundance, distribution, and habitat utilization.

UTILIZACION DE RADIOTELEMETRIA PARA LOCALIZACION DE MANATIES EN FLORIDA

Desde 1986 se han colectado datos de historia natural y comportamiento de 81 manatíes con radio-transmisor (28♂, 53♀), de la costa este de Florida. Este estudio utiliza transmisores VHF, monitoreados en tierra y transmisores UHF, monitoreados por satélite (PTT). Algunos aspectos sobre movimiento y comportamiento, han surgido de los análisis de radiotelemetría: (a) algunos manatíes tienden a volver a los mismos sitios de alimentación durante los meses de calor, (b) otros presentan preferencia por sitios específicos durante el invierno, como afluentes de agua tibia, (c) en cuanto al tiempo y la extensión de la migración, existe fuerte variación individual entre los animales marcados, (d) el igual que con el tamaño del área utilizada. Hay tasas de desplazamiento de hasta 50 Km/día durante varios días. (e) Ciertas áreas constituyen hábitat disponible, por lo que son utilizadas frecuentemente por varios manatíes. (f) Algunos manatíes pasan un período considerable en áreas donde el paso de botes y actividades humanas están restringidas. (g) La sobrevivencia de manatíes rehabilitados en cautiverio y liberados se ve prometedora, sin embargo, se necesitan más estudios para determinar el éxito de las reintroducciones de animales en cautiverio por largos períodos de tiempo. Estos estudios han sido útiles para conocer la abundancia local, distribución y utilización de hábitats.

LA PESCA ENTRE LOS MAYAS PREHISPANICOS EN LA BAHIA DE CHETUMAL, QUINTANA ROO, MEXICO

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A través de consulta bibliográfica sobre la pesca entre los mayas prehispánicos, se sabe que existieron asentamientos humanos que se dedicaban a esta actividad en las costas quintanarroenses y beliceñas. A lo largo del litoral que cubre el lado mexicano de la bahía de Chetumal se han registrado diversos sitios arqueológicos, destacando unos montículos de piedra subacuáticos que aparentemente fueron empleados como artes de pesca tipo trampas de atajo, en la cercanía de la orilla de la costa de la bahía de Chetumal, para la captura y conservación, por un tiempo, de los peces (Ciclidos, Gerreidos, Lutjanidae, Dasyatidae) y manatí (*Trichechus manatus manatus*). La cultura maya en esta zona estuvo basada en la pesca en combinación con la agricultura.

FISHING AMONG PREHISPANIC MAYAN IN CHETUMAL BAY QUINTANA ROO, MEXICO

By consulting bibliography about prehispanic mayas fishing, showed us there were human settlement who dedicated to fish in Quintana Roo and Belize coast. Length the shore in mexican territory in Chetumal Bay where we have found several archaeological places, being notorious underwater stone little mounts that were used as fish cunning like inter capturing traps near on the banks off coast of Chetumal Bay, for capturing and conservation of fishes for a while (Ciclidos, Gerreidos, Lutjanidae, Dasyatidae) and manatee (*Trichechus manatus manatus*). The mayan culture in this zone was based in fishing and agriculture.

ESTUDIO PRELIMINAR DEL MANATÍ (*Trichechus manatus manatus*) EN
EL MUNICIPIO PLAYAS DE CATAZAJA, CHIAPAS, MEXICO

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Este trabajo es el resultado de 213 horas de observación en el período comprendido de septiembre a diciembre de 1995, en donde se logró observar a 15 individuos. En este estudio se trabajó arduamente con comunidades de pescadores circundantes a la laguna, realizando actividades de educación ambiental enfocadas a la protección del manatí y el ecosistema. El estudio se realizó en la laguna Catazaja, ubicada en el municipio del mismo nombre, con una extensión de 16000 hectáreas. Esta laguna es de aguas turbias, debido a la gran cantidad de sólidos suspendidos, lo que dificulta la observación de manatíes y hace más difícil el trabajo. Para conocer la situación actual del manatí se efectuaron recorridos en lancha y observaciones mediante barridos con binoculares en estaciones de muestreo. Los lugares fueron seleccionados al azar en un principio y posteriormente se tomaron en cuenta las sugerencias de los pescadores sobre los sitios donde ellos los observan. Se determinaron las zonas donde con más frecuencia se pueden observar manatíes, además de obtener otros datos a través de las encuestas, que permitieron conocer en parte los hábitos y biología de estos animales dentro de la laguna. Los datos obtenidos en esta fase, servirán como base para estudios posteriores que la Secretaría de Ecología, Recursos Naturales y Pesca del Gobierno del Estado pretende realizar en esta zona.

PRELIMINARY STUDIES OF MANATEES (*Trichechus manatus manatus*) IN
THE MUNICIPALITY OF PLAYAS DE CATAZAJA, CHIAPAS, MEXICO

This work is the result of 213 hours of observation in the period September to December 1995, in which we observed 15 manatees. During this study we worked hard with fishermen communities near the lagoon, making environmental education activities focused on manatee protection. The study was developed in the Catazaja lagoon, with an extension of 16000 hectares. Due to large quantities of suspended solids matter, the lagoon is muddy, conditions which obstruct the observation of manatees. To recognize the actual situation of the manatee, we made observations from the boat with binoculars, in several sampling sites. Places were selected initially in an alleatory way, and then changed some of them following fishermen suggestions. The zones in which manatees can be more frequently detected, were determined. We obtain other data on biology and behavior of these animals within the lagoon, by direct questioning to local people. Results obtained during this phase will support future surveys which are to be developed by the Secretaría de Ecología Recursos Naturales y Pesca del Gobierno de Chiapas in this zone.

REGISTROS RECIENTES DE MANATÍ *Trichechus manatus* EN
ISLA HOLBOX, BAHÍA DE LA ASCENSIÓN Y BAHÍA ESPÍRITU SANTO,
QUINTANA ROO, MEXICO

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En 1994 y 1995 se realizaron recorridos en lancha con motor fuera de borda para el estudio de toninas en la laguna de Yalahau, la bahía de la Ascensión y, en agosto de 1994, en la bahía de Espíritu Santo. Durante estos recorridos en lancha se tuvieron dos avistamientos de manatí. En el primero de ellos, ocurrido en agosto de 1994 en la bahía de Espíritu Santo (19° 19' 55" N 87° 38' 26" W), se observó a un macho de más de 2.5 m de longitud. El segundo avistamiento tuvo lugar en julio de 1995 en bahía de la Ascensión (19° 41' 53" N 87° 28' 57" W). En esta ocasión se observó un grupo de cuatro individuos, dos de los cuales corresponden a una hembra y su cría. Se tuvieron dos registros más, correspondientes a la recuperación de restos óseos en la laguna de Yalahau, uno en Isla Pájaros (21° 32' N 87° 21' W), en diciembre de 1994 y otro en la parte oeste de Isla Holbox (21° 30' 58" N 87° 23' 30" W) en noviembre de 1995. Estos registros confirman la presencia reciente de individuos de esta especie en la parte norte y centro de Quintana Roo.

RECENT RECORDS OF MANATEE *Trichechus manatus* IN
HOLBOX ISLAND, ASCENSION BAY, AND ESPÍRITU SANTO BAY,
QUINTANA ROO, MEXICO

In 1994 and 1995, boat surveys were conducted in Yalahau Lagoon, Ascension Bay, and Espíritu Santo Bay (in the last location surveys were made only in August 1994) to study bottlenose dolphins. During this surveys two sightings of manatee were made. The first sighting, a male 2.5 m long, was made in Espíritu Santo (19° 19' 55" N 87° 38' 26" W). In the second sighting, a group of four individuals (mother/calf pair and two more animals) were observed in Ascension Bay (19° 41' 53" N 87° 28' 57" W). Manatee bones were also recovered in Yalahau Lagoon, at Pájaros Island (21° 32' N 87° 21' W) on December 1994, and in the west edge of Holbox Island (21° 30' 58" N 87° 23' 30" W) on November 1995. The four records reported in the present work confirm the recent presence of manatee in the northern and central coast of Quintana Roo.

POPULATION GENETIC STRUCTURE OF THE WEST INDIAN MANATEE
Trichechus manatus BASED ON mtDNA LINEAGES

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The mtDNA D-loop region in 64 samples from seven locations was analyzed to study the genetic structure among populations of the West Indian manatee *Trichechus manatus*. Twenty three samples were collected from Florida, one from Cuba, three from the Dominican Republic, twelve from Puerto Rico, fifteen from Colombia, four from Venezuela, and six from Brazil. Thirty three haplotypes were observed. Two haplotypes were found in the Florida samples, one in Cuba, two in the Dominican Republic, nine in Puerto Rico, nine in Colombia, four in Venezuela and one in Brazil. No haplotypes were shared among sample sets, except for three individuals in Puerto Rico and one individual in the Dominican Republic, which shared the most common Florida haplotype. Haplotypes in Florida, Cuba, Puerto Rico, and the Dominican Republic constitute a cluster of closely related mtDNA lineages. Venezuelan and Colombian samples comprise a second cluster, and the Brazilian haplotype constitutes a third. A relatively deep genetic partition (~ 5%) distinguished these three clusters. These results indicate strong geographic structuring among West Indian manatee populations, and three phylogeographic units within the species. To provide a yardstick for differences within *T. manatus*, we included the Amazonian species *T. inunguis*.

ESTRUCTURA GENÉTICA POBLACIONAL DEL MANATÍ *Trichechus manatus*
BASADO EN LINAJES DEL ADN MITOCONDRIAL

La zona D-loop del ADN mitocondrial fue analizada en 64 manatíes provenientes de siete regiones, con el objeto de estudiar la estructura genética entre poblaciones de *Trichechus manatus*. En Florida se colectaron 23 muestras, una en Cuba, tres en República Dominicana, 12 en Puerto Rico, 15 en Colombia, cuatro en Venezuela y seis en Brasil. Fueron observados 33 haplotipos. Dos haplotipos fueron encontrados en las muestras de Florida, uno en Cuba, dos en República Dominicana, nueve en Puerto Rico, nueve en Colombia, cuatro en Venezuela y uno en Brasil. No se observó haplotipos compartidos entre muestras, con excepción de tres en Puerto Rico y uno en República Dominicana, los cuales comparten el haplotipo más común presente en Florida. Haplotipos en Florida, Cuba, Puerto Rico y República Dominicana constituyen un agrupamiento de linajes matriciales cercanamente relacionados. Las muestras de Colombia y Venezuela constituyen un segundo agrupamiento y el haplotipo de Florida constituye un tercer grupo. Una división relativamente grande distingue a los tres grupos (~ 5%). Estos resultados indican una estructura geográfica definida entre las poblaciones de manatíes, así como tres unidades filogeográficas dentro de la especie. Para tener una medida de referencia con respecto a las diferencias existentes dentro del género *T. manatus*, incluímos la especie del Amazonas, *T. inunguis*.

DISTRIBUTION AND ABUNDANCE OF MANATEES IN BELIZE

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Manatee distribution and abundance were investigated based on results of three aerial surveys carried out in 1994 and 1995. Distribution reflected a close association with habitat type, with temperature possibly causing a southward shift in the population during cooler months. Specific high-use sites or areas of concentration were identified. Comparison of these results with those of surveys carried out in 1977 and 1989 demonstrated that the manatee population has remained stable, with a high percentage of calves. Additional surveys, however, are required to determine variations in distribution at specific times of the year and clarify possible relationships with temperature, rainfall and other factors.

DISTRIBUCION Y ABUNDANCIA DE MANATÍES EN BELICE

Se estudió la distribución y abundancia del manatí con base en los resultados de tres censos aéreos realizados en 1994 y 1995. La distribución reflejó una fuerte asociación con el tipo de hábitat, también la temperatura posiblemente influyó causando un movimiento de la población hacia el sur durante los meses más fríos. Se identificaron sitios específicos de alto uso o áreas de concentración. Comparaciones de estos resultados con los de los censos realizados en 1977 y 1989 demostraron que la población de manatí se ha mantenido estable, con un alto porcentaje de crías. Se requieren censos adicionales para determinar las variaciones en la distribución en temporadas específicas del año y aclarar posiblemente las relaciones con la temperatura, lluvia y otros elementos.

FOOD PREFERENCES OF CAPTIVE FLORIDA MANATEES (*Trichechus manatus latirostris*)

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The manatee is the only fully aquatic large mammalian herbivore known to man. With a range primarily limited to Florida (*Trichechus manatus latirostris*), this endangered species inhabits coastal areas and freshwater rivers where it consumes seagrasses and freshwater plants, respectively. The objectives of this study were to determine if captive manatees prefer certain freshwater plant species over others. Results will be important for management of aquatic plants, and free-ranging and captive manatees. Four manatees residing in captivity at Homosassa Springs State Wildlife Park were used as subjects in feeding preference trials utilizing five freshwater plants. Four replicate samples of each of five plant species were weighed and attached to 2D randomly assigned locations on a feeding frame. The frame was then presented to an individual manatee for each trial. A total of 40 trials was conducted in an isolation cage measuring 6.5m x 13m x 2m. The aquatic plants used in the trials included tapegrass (*Vallisneria neotropicalis*), water hyacinth (*Eichhornia crassipes*), hydrilla (*Hydrilla verticillata*), southern naiad (*Najas guadalupensis*), and paragrass (*Panicum purpurascens*). All the preference data were analyzed by the Bradley Terry test which established an overall preference order of southern naiad, hydrilla, paragrass, water hyacinth, romaine lettuce, and tapegrass. The preferred plants were southern naiad and hydrilla and were ranked closely together at the top of the preference order.

PREFERENCIAS ALIMENTICIAS DE LOS MANATIES DE FLORIDA (*Trichechus manatus latirostris*) EN CAUTIVERIO

El manatí de Florida (*Trichechus manatus latirostris*) es el único mamífero herbívoro acuático conocido por humanos. Distribuida principalmente en la Florida, esta especie en peligro vive en áreas costeras y ríos de agua dulce donde come pasto marino y varias plantas de agua dulce. El objetivo de este estudio fue determinar si los manatíes en cautiverio prefieren ciertas plantas de agua dulce sobre otras. Los resultados serán de ayuda para el manejo de plantas acuáticas y de manatíes en la vida libre y en cautiverio. Cuatro manatíes que viven en cautiverio en Homosassa Spring State Wildlife Park fueron sujetos a exámenes de preferencia de comida usando cinco plantas de agua dulce. Cuatro ejemplos replicados de cada una de las especies de plantas fueron pesados y colocados en veinte diferentes lugares en cuadrantes, colocados aleatoriamente. Cada cuadrante fue presentado a un manatí individual en cada examen. Un total de cuarenta exámenes fueron hechos en jaula aislada con dimensiones de 6.5m x 13m x 2m. Las plantas acuáticas usadas en los exámenes incluyen: *Vallisneria neotropicalis*, *Eichhornia crassipes*, *Hydrilla verticillata*, *Najas guadalupensis* and *Brachiaria mutica*. Todo los datos fueron analizados por la prueba de Bradley-Terry, que sirvió para establecer el orden de preferencia de las cinco plantas. Las plantas más seleccionadas fueron *Najas guadalupensis* y *Hydrilla verticillata*.

CONDUCTA Y ECOLOGIA DEL MANATÍ (*Trichechus manatus*) EN EL CENOTE TANCAH, QUINTANA ROO

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Se realizaron observaciones en el Cenote Tanchah (8 Km al norte de Tulum), Quintana Roo, durante las diferentes estaciones del año. Se observó la presencia de un grupo de manatíes compuesto por un macho adulto, una hembra y una cría. Estos manatíes se introducen al cenote desde el mar, a través de un canal subterráneo de 100 m de longitud, utilizando éste sistema como hábitat, refugio ante cambios climáticos (vgr. tormentas tropicales), depredadores y perturbación humana; así como fuente de agua dulce y alimentación. La mayor actividad de los manatíes dentro del cenote ocurre durante la temporada invernal en época de secas (diciembre a abril), que se relaciona con la mayor productividad en el cenote y las temperaturas de agua más altas. Durante la temporada de lluvias (junio a octubre) lo utilizan para el cuidado y alimentación de las crías. Se identificaron las zonas preferenciales de descanso y alimentación, así como las rutas de paso. Se observaron también las conductas sociales, interacciones madre-cría, alimentación, juego y descanso y algunas interacciones con humanos. Dado que la zona de estudio ha sido visitada por los manatíes desde hace más de 25 años se sugiere que lugares como éste sean conservados para la protección de la especie y de la perturbación producida por el turismo y por las pesquerías locales.

BEHAVIOR AND ECOLOGY OF MANATEES (*Trichechus manatus*) IN CENOTE TANCAH, QUINTANA ROO

Observations were performed at Cenote (skin hole) Tanchah (8 Km north of Tulum), Quintana Roo, over different seasons. A group of manatees composed by an adult male, and adult females and her calf. These manatees enter the cenote from the sea, through and underwater channel about 100 m in length. Manatees use the cenote as an habitat, refuge of stormy weather and predators and from human perturbation; also as a source of food and fresh water. The major activity inside the cenote occurs in winter's dry season (December-April), which are related to an enhanced productivity inside the cenote. During raining season (June-October) it is used for protection and care of the calves. Preferential areas were identified for resting and feeding, as well as passage routes. Behavioral observations were conducted on the interaction between mother and calf, feeding, play and resting, and some interaction with humans. Due that the study area has been visited by these manatees at least for the last 25 years, we suggest that places like this should be preserved for protecting manatees from the perturbation produced by tourism and local fisheries.

SEGUIMIENTO DE MANATIES RADIOMARCADOS EN LA BAHIA DE CHETUMAL, QUINTANA ROO, MEXICO

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En noviembre de 1994, se marcaron dos manatíes con radiotransmisores de VHF en la Bahía de Chetumal, Q. Roo, México, con el fin de probar el sistema utilizado en Florida y registrar los primeros datos sobre movimientos individuales, ámbitos domésticos y uso del área. El presente trabajo muestra los datos obtenidos después de un poco más de un año de seguimiento. El sistema resultó ser muy eficiente en el área. Las hembras marcadas se mantuvieron dentro de ámbitos domésticos relativamente cortos, con movimientos restringidos y mostraron patrones de actividad característicos. El sistema también permitió detectar otros manatíes asociados a los individuos marcados. Se comenta sobre proyectos futuros y sobre la importancia de este tipo de estudios.

RADIOTRACKING MANATEES IN CHETUMAL BAY, QUINTANA ROO, MEXICO

On November 1994, two female manatees were tagged using VHF radiotransmitters in Chetumal Bay, Q. Roo, Mexico, in order to improve the system used in Florida and register the first data on individual movements, home range, and habitat use. This work shows data for more than one year radiotracking. The system resulted to be efficient at the area. The tagged females remained within relatively small home range, with short movements and showed characteristic activity patterns. The system also allowed us to detect other manatees associated with tagged individuals. We comment about future projects efforts and the importance of this kind of works.

INTERACCION DEL TURISMO Y LOS MANATIES EN LA ZONA DE CALETAS DEL NORESTE DE QUINTANA ROO: EL CASO DE XEL-HA

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Del mes de mayo de 1995 a febrero de 1996 se visitó mensualmente la caleta de Xel-ha con el propósito de definir el uso actual del sitio por los manatíes y la interacción con las actividades turísticas. El tiempo total de esfuerzo de observación, desde tierra y por buceo libre fue de 112.68 horas (72.78 horas en la mañana y 39.9 horas en la tarde). Se registraron manatíes dentro de la caleta el 7.36% del tiempo total de esfuerzo (8.3 horas), mostrando un patrón en la preferencia de horario. Se registra la presencia de un grupo de hasta cuatro individuos de diferentes edades y se muestran algunas pautas conductuales hacia los turistas. Se discute la importancia ecológica del parque, ya que presenta los requerimientos esenciales para los manatíes como son la presencia de fuentes de agua dulce y plantas acuáticas; temperatura ideal; zonas someras y protegidas de corrientes y oleaje. Se discute además el hecho de que Xel-ha está sujeto a una fuerte presión de las actividades humanas por ser uno de los sitios más visitados dentro del corredor turístico Cancun-Tulum. Este trabajo forma parte de un estudio más amplio que incluye otros cenotes dentro del corredor turístico.

INTERACTIONS BETWEEN TURISM AND MANATEES IN THE INLETS ZONE OF NORTHEASTERN QUINTANA ROO: THE CASE OF XEL-HA

Xel-ha inlet was visited monthly from May 1995 to February 1996 in order to define the current use of site from manatees and documenting their interaction with tourism. The total time of observation was 112.68 hrs (72.78 hrs in the morning and 39.9 hrs in the afternoon). Manatees inside the inlet were registered 7.36% of the time (8.3 hrs), showing a pattern in the preference of horary. Groups of 4 individuals of different ages including calves are registered, and showing some behavior patterns with tourists. The ecological importance of this park is discussed, due to the presence of good habitat conditions for manatees: fresh water sources; aquatic vegetation, water temperature; shallow waters protected from current and waves. We also discuss that Xel-ha is under high pressure from human activities, because it is the most visited inlet by tourism between the Cancun and Tulum area.

CONTRIBUCION AL CONOCIMIENTO DE LA CONDUCTA Y DISTRIBUCION DEL MANATI (*Trichechus manatus manatus*), EN EL SISTEMA LAGUNAR GUERRERO, BAHIA DE CHETUMAL, QUINTANA ROO, MEXICO

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Se realizaron observaciones directas de los manatíes a través de recorridos en avioneta, lancha y desde una torre fija de observación en el área de estudio, durante las tres temporadas del año: lluvias, nortes y secas. Los registros etológicos desde lancha son poco confiables por el efecto del observador en la conducta. Los registros atológicos desde torre fueron confiables, describiéndose las conductas de: desplazamiento, holgazaneo, y socialización. La distribución de los manatíes dependió de la presencia de zonas de resguardo, el mayor número de avistamientos en las temporadas de lluvias y nortes, se registraron en áreas someras y resguardadas, disminuyendo los registros durante secas; la prueba de χ^2 señala la dependencia entre temporadas y zonas de distribución a un nivel $p = 1.39E-13$. La prueba de χ^2 de bondad de ajuste no indica diferencias significativas entre la probabilidad de observar un grupo de manatíes e individuos solitarios. El tamaño promedio de los grupos fue de 3.6 (± 1.9), observándose con mayor frecuencia los grupos formados por 2, 4 y 3 individuos, que representan el 82 % de los avistamientos totales de grupos.

CONTRIBUTION TO KNOWLEDGE OF BEHAVIOR AND DISTRIBUTION OF THE MANATEE WITHIN THE LAGUNA GUERRERO SYSTEM, CHETUMAL BAY, QUINTANA ROO, MEXICO

The behavior and distribution were studied through surveys by boat, plane and during observations from a tower located in the area, along three seasons of the year (windy, rainy and dry seasons). The behavior patterns were influenced by the presence of the boat, so the ethological records had high biases as consequence of the observer effect. The ethological records were based on the observations of manatees from the tower, describing travelling, idling and socializing activities. The general distribution was determined by the presence of areas protected from wind and tide conditions. The highest number of sightings were recorded during the rainy and windy seasons, within shallow and protected waters; the number on sightings decreased during the dry season. Chi-square analysis reinforced this statement ($p = 1.39E-13$). Chi-square analysis indicated that manatees tend to be found in groups or alone. The group mean size was 3.6 (± 1.9), and groups of 2, 4 and 3 animals were more often sighted, representing 82 % of the total.

ASPECTOS ETNOHISTORICOS DEL MANATI EN MESOAMERICA: IMPORTANCIA CULTURAL EN GUATEMALA

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Los manatíes del Caribe tuvieron gran importancia histórica y mitológica desde el siglo XV. El contacto y uso de manatíes por nativos, transformó la imagen de la sirena mitológica, en un ser jovial y asociado con la abundancia. Su imagen fue colocada en fachadas, retablos, fuentes búncos y otros elementos decorativos dentro de la arquitectura de los siglos XVI y XVIII en Guatemala. Existen referencias realizadas por cronistas durante el siglo XVI. Se incluyen ejemplos de representaciones de sirenas dentro de los elementos arquitectónicos en la ciudad de Guatemala, elaboradas desde finales de siglo XVI hasta el XVIII. En Guatemala en 1959, se emite un acuerdo presidencial para la protección del manatí, sin embargo, aún se siguen cazando. Por la importancia de *Trichechus manatus*, tanto en el campo histórico como biológico, Fundación RAXON, dentro de su programa de reservas naturales, está haciendo un estudio de la población de manatíes de la región costera y ríos en el departamento de Izabal, Guatemala. Sus objetivos incluyen: evaluación del hábitat, capacitar personal técnico y profesional, cuidado y manejo, censo aéreo, materiales educativos y establecer bases para el desarrollo de un programa de conservación.

ETHNOHISTORIC ASPECTS OF MANATEE IN MESOAMERICA: CULTURAL IMPORTANCE IN GUATEMALA

Caribbean manatee seems to have a great importance from historical and mythological view because they were taken as mermaids in the 15th century. Manatee's extensive use by new world natives, changed the image of the mythological mermaid, into a cheerful, and an related with abundance. His image was sculpted on fronts, fountains, and other decorative elements of the architecture during 16th to 18th centuries, in the Capital of Guatemala and other provinces. There are also references to mermaids and manatees were written by chroniclers during the 16th century. There are example of the use of mermaids in architectonic elements in the city of Santiago de Guatemala. It is supposed that the sculptures date from the 16th to the 18th century, before the foundation of the new capital in the Valle de la Ermita. During 1959 in Guatemala arise a governmental interest and a presidential agreement was emitted to protect the manatees. Even though, hunters continue killing manatees because the fins is much lower than the earnings they get. Due to the importance of manatees, in historic and biological aspects, RAXON Foundation through his natural reserve program is beginning a study of the manatee population located in Departamento de Izabal, Guatemala. The goals of this project include the location and status of manatee's habitat; technical and professional training, care and management; population counting; preparation of educational material and the basis for the development of a conservation program.

ESTUDIO PROSPECTIVO DE LA POBLACION DE MANATIES EN EL ESTADO DE CAMPECHE

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De agosto de 1994 a septiembre de 1995, se realizaron recorridos en la zona costera del estado de Campeche y se entrevistó a pescadores y estudiantes, para conocer y ubicar las áreas donde recientemente se han registrado avistamientos de manatí. Se visitaron las localidades de: Isla Aguada, Sabancuy, Champotón, Seybaplaya, Villamadero, Lerma y Campeche. En éstas se aplicaron 150 entrevistas y se comprobó la existencia de manatíes en dos sitios: Lerma e Isla Aguada. Las entrevistas permitieron saber que a finales de los 60', el manatí era cazado con arpónes y vendido para consumo local en el mercado de Champotón, preparado como carne de cerdo (chichara, carne, chorizo, grasa, etc), desechando los huesos. Para algunos pescadores de los ríos Palizada y Candelaria, la migración del manatí hacia el mar es indicador de las crecientes de los ríos. En las entrevistas aplicadas se observó un alto desconocimiento del manatí, por lo que se realizaron 26 pláticas de divulgación y educación ambiental, así como 2 entrevistas en Radio Universidad (Campeche) y 2 notas de divulgación en periódicos de difusión regional.

PROSPECTIVE STUDY OF MANATEE POPULATION IN THE CAMPECHE STATE

In the period of August 1994 to September 1995, we made several trips in the coastal zone of the state of Campeche. Interviews was applied to the fishermen and students. The goal was to know and locate the sighting manatee areas in the recent past. There were visited the locations of Isla Aguada, Sabancuy, Champotón, Seybaplaya, Villamadero, Lerma y Campeche. It was made 150 interviews in this localities and we confirmed the presence of manatee in two places: Lerma and Isla Aguada. The interviews demonstrated that in the 60's, the manatee was hunted with harpoon and was sold in the Champotón Market for the local tax. It was prepared in the same way of the pork, and the bones were waste. To some fisherman of the Palizada and Candelaria rivers, the movements of the manatees to the sea, is and indicator of the flooding. The results of the interview, also demonstrated that it was a great ignorance about the manatee, that is why we made environment, two interviews in the radio of the Campeche University and 2 notes in the regional newspaper.

PROGRAMA DE EDUCACION PARA LA CONSERVACION DEL MANATI EN EL ESTADO DE QUINTANA ROO

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En 1993, se integró un Comité para la protección del manatí en el sur de Quintana Roo, cuyos objetivos fundamentales fueron: conjuntar elementos para integrar una propuesta para declarar la bahía de Chetumal como santuario para los manatíes, organizar y poner en marcha un Programa Educativo sobre conservación de los manatíes y las nutrias que viven en la bahía de Chetumal y río Hondo. Este Comité se integró con representantes de dependencias del Gobierno Federal, Estatal y el Centro de Investigaciones de Quintana Roo, ahora ECOSUR. De junio a septiembre de 1993 se concretó el subcomité de Educación Ambiental el cual mediante una dinámica interactiva, desarrollada en todas las escuelas primarias y telesecundarias ubicadas en la ribera del río Hondo y la bahía de Chetumal, atendió a más de 10,000 estudiantes y maestros de 4º, 5º y 6º grados del nivel básico y de telesecundaria. Se prepararon materiales específicos como: dos videos informativos sobre tópicos bio-ecológicos del manatí, un cuaderno didáctico que reforzara los contenidos de los videos, calcamánias, playeras, trípticos, posters y un cuaderno de divulgación. Este intenso programa sensibilizó a la mayoría de los habitantes de la región sur del Estado y el manatí ahora es una especie clave para la conservación de la fauna silvestre de la región.

EDUCATIONAL PROGRAM FOR MANATEE CONSERVATION IN THE STATE OF QUINTANA ROO

A Committee for manatee protection in the South of Quintana Roo was created in 1993, its fundamental objectives were: to join elements for the integration of a proposal to declare Chetumal Bay as a sanctuary for the manatees, and start an educational program for Chetumal Bay and Río Hondo manatees and sea-otters conservation. This Committee was integrated by representatives of federal and state governmental dependencies and the Centro de Investigaciones de Quintana Roo, now ECOSUR. The Subcommittee of Environmental Education was formed from June to September, 1993, it attended more than 10,000 students and teachers from different basic education school levels and T.V. teaching high schools, by applying an interactive dynamic. This Subcommittee prepared specific material like: manatee bio-ecologic topics informative videos, a didactic book to reinforce the video contents, stickers, t-shirts, brochures, posters, and a divulgation book. This intensive program sensibilized most of the habitants from the southern region of the state, and the manatee is now an important species for the region wild fauna conservation.

MANATEE POPULATION BIOLOGY VOLUME

In our last issue we announced the publication of the workshop volume on manatee population biology edited by O'Shea, Ackerman, and Percival (1995). By request, we present here the complete list of papers included in that volume with their full citations, and call the reader's special attention to the two chapters dealing with dugongs.

Reprints of individual articles may be requested from their respective authors. A supply of the complete volumes is also available; copies may be requested from the addresses below.

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