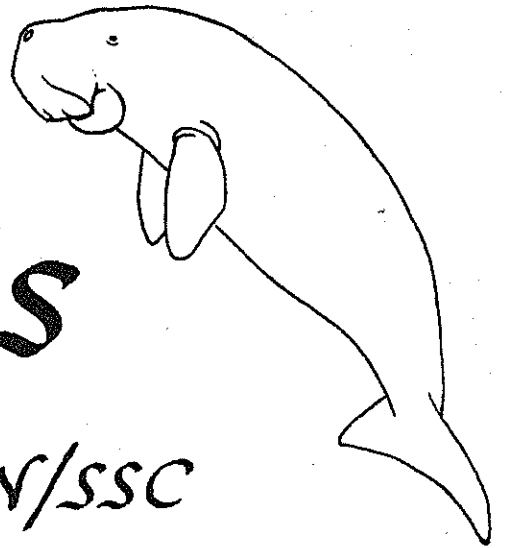


Sirenews



Newsletter of the IUCN/SSC Sirenia Specialist Group

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IS THE CATCH OF DUGONGS IN TORRES STRAIT SUSTAINABLE?

The results of the aerial survey I conducted in 1992 indicate that at least 24,225 \pm s.e. 3,276 dugongs live in Torres Strait, the tract of sea between northern Australia and Papua New Guinea (PNG). Torres Strait is thus the most important dugong habitat in Australia and probably the world.

Torres Strait is a relatively pristine environment and the major impact on dugongs is traditional hunting. Thanks to a comprehensive study by Aubrey Harris and his co-workers from CSIRO, we now have better information on this dugong fishery than ever before.

Dugong hunting, a traditional test of manhood, is still solely a male activity. The skilled hunter enjoys considerable prestige in the community and hunting is considered to be an important expression of Islander culture, which is undergoing a resurgence coincident with the increasing recognition of the rights of Indigenous Australians. Dugongs are still a prized traditional food source for Torres Strait Islanders and for the Kiwai people of the Western Province of PNG. The meat of dugongs still ranks highest among traditional foods in Torres Strait, and



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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no celebration is considered complete without dugong on the menu. This is reflected in the seasonality of catch, which is highest in the period of festivity leading up to Christmas and the New Year. This is also the season when the weather is most suitable for hunting.

In the early 1980's, Brydget Barker-Hudson questioned the sustainability of the Kiwai dugong catch. Harris' data indicate that the catch from the Australian islands is much higher than the catch recorded by Barker-Hudson in PNG.

Harris conducted a comprehensive quantitative study of traditional hunting and fishing conducted by the residents of 14 communities in the Protected Zone, the area covered by the Torres Strait Treaty, an international agreement between PNG and Australia. He did not collect data from communities outside this area, i.e., along the Papuan coast or from Australian islands south of the Zone.

Harris estimated that the wet weight of dugongs landed in the Protected Zone in 1991-93 was higher than the weight of any other component of the seafood catch, including finfish or turtle. On an average day, four boats land $645 \pm \text{s.e. } 102$ kg of dugong in the Zone. This equates to an estimated annual harvest of 1226 ± 204 dugongs or 5% of my minimum mean estimate of the dugong population of the whole region. Given that the catch statistics do not include any data from outside the Protected Zone, these figures are worryingly close to the estimated maximum sustainable yield if my mean estimate of the dugong population is close to an absolute estimate.

It is impossible to evaluate the situation more accurately without information on:

- absolute estimates of dugong numbers,
- catch statistics for PNG, and
- current life history statistics for dugongs in Torres Strait,

but the situation certainly warrants close scrutiny.

Fortunately, the Torres Strait Islanders are demanding increasing responsibility for the management of their marine resources. They are involved in the ongoing monitoring of the dugong catch and hunting effort and the aerial surveys. - Helene Marsh

WANTED: INFORMATION ON SIRENIAN LEGISLATION

Professor Patricia Birnie has been commissioned by UNEP to undertake a comprehensive review and analysis of the existing legal system for the protection of all aquatic mammals. She is having difficulty finding examples of legislation specifically concerning sirenians, and would appreciate receipt of copies of such legislation from all sirenian-range countries. Materials should be sent directly to her, as follows: Prof. P. W. Birnie, 78 Windmill Street, Brill, Aylesbury, Bucks HP18 9TG, England; tel. & fax: 44-844-237-880.

SPANISH-LANGUAGE MANATEE LEAFLETS AVAILABLE

The Florida Power & Light Company has produced a Spanish version of its 1992 leaflet entitled "Guidelines for Protecting Manatees." This leaflet is designed for use in Florida and includes facts about manatee biology as well as guidelines for swimming and boating in manatee areas. Limited quantities of the new "Guia para Proteger al Manati" are available from Dr. J. Ross Wilcox, Chief Ecologist, Environmental Affairs, Florida Power & Light Co. P.O. Box 088801, North Palm Beach, Florida 33408-8801.

LOCAL NEWS

AUSTRALIA

Satellite Tracking of Dugongs in Northern Australia. - I've been satellite-tracking dugongs in a remote area of the Gulf of Carpentaria since May. Aerial surveys in 1984-5 indicated that this area had one of the highest dugong concentrations known. However, in the following two years the area was pounded by two cyclones and most of the seagrass areas were lost. We do not know what impact this had on the dugong population, but preliminary data suggest that there are far fewer dugongs in the area today. An October aerial survey should clarify this.

The area is of considerable interest as it is the site of a large lead and zinc mine development. A port for the export of this ore is being constructed smack in the middle of important dugong habitat. The dugongs are hunted by the traditional owners of the area, the Yanyuwa people, who are understandably very concerned about the impacts of ore spillages and boat traffic on the dugong population. They are also concerned about the level of dugong mortality in nets used by professional barramundi fishers. It is hard to determine how many dugongs die as a result of hunting and gillnets, so the scale of the problem remains unclear.

The tracking is being used to identify the dugongs' important habitat areas and determine their movement patterns. Previous attempts met with limited success, primarily because of difficulties keeping the PTT transmitters on the animals. This is not simply a matter of having a strong tether that does not constrict or irritate the dugong. It must also have a weak link, allowing the PTT to be shed if caught amongst mangrove roots or coral outcrops. The transmitter must also detach from the dugong before the batteries expire, so it can be retrieved and re-used.

Our earlier attempts used modifications of the weak link and corrodible link used on manatees. Perversely, our dugongs seem to live in a much more corrosive and shark-infested environment than their northern cousins. The corrodible links lasted 6 weeks instead of 6 months, and large sharks had a propensity to test the weak links. After trying various variations on the manatee

theme, it became apparent that a new approach was required. In collaboration with Andrew Hunter, an engineer at James Cook University, we developed an all-new tether incorporating a stack of camera batteries, a computer chip, and an explosive fuse. The chip acts as a clock and is wired to explode the fuse at a set time (3.5 or 7 months in our case). The fuse shatters the end-cap of the canister, and the silicon-sheathed nylon webbing that ties around the dugong's peduncle is released. By being able to anticipate when the PTT will be shed, it is possible to be in the area, thus maximizing the chances of recovering it. The weak link was also redesigned, and the method of adjusting the fit of the webbing was greatly simplified. I also simplified the tagging operation, which now involves just one boat and three people, although an aircraft is very useful to help locate and pursue the dugongs.

Two dugongs were tracked for 113 and 114 days, and at this writing (early October) another three tags are still on after 136 days (4.5 months). If all goes well, these animals will be tracked until about 21 November. Of the first two, one PTT was shed as a result of an unusual and, as yet, inexplicable break in the 3-m flexible nylon rod that connects the peduncle tether and the buoyant PTT housing. The second PTT was due to release from its dugong after about 90 days, but failed to do so. Fortunately we were able to recapture this animal and remove the transmitter. It turned out that at least one of the batteries in the tether was faulty. Due to the phase-out of mercury batteries (owing to their contribution to mercury pollution), it looks like we got one that had been on the shelf too long. The other tethers may also have bad batteries. We have now modified the tether to use lithium batteries.

The five dugongs have so far provided three important pieces of information. First, dugongs are not just dugongs, they are individuals. Second, the dugongs in this area are highly social, and third, they move over much larger areas than previously thought.

Starting with the last point, the dugongs thought nothing of popping 50 km along the coast to spend a day or two with some other dugongs, and then hopping the 50

km back to their current core area. The five dugongs were all caught from one herd of about 200 near the Bing Bong Creek area. Three spent time at a site 50 km to the west (Rosie Creek area). Two of these also spent time 100 km west of the capture site (Limmen Bight River). One spent some time 50 km east of the capture area. One that had spent over two months in the Limmen Bight River-Rosie Creek areas then traveled, apparently without significant stops, 400 km east of the capture area, where she has spent the past two months. Hence, her range has spanned more than 500 km of coastline.

While that dugong has been very mobile, another has been remarkably sedentary. With the exception of one or two brief sojourns about 10 km to the east, she has spent the past 4.5 months within a couple of km of the site of her capture. The other three dugongs have tended to divide their time unevenly between two or three sites separated by about 50 km. It would be premature to generalize too much about the movement patterns of the Bing Bong dugongs; they are surprisingly individualistic.

They are also highly social. As I have said, each has used 1-3 preferred areas. Excluding the area 400 km to the east (about which I know very little), the five dugongs collectively use just five preferred areas. Aerial surveys have confirmed that herds of 50-200 dugongs occurred at each of these preferred sites. So although they move about a lot, and move about independently of one another, they have all been moving among the same five dugong herds. Significantly, very few were seen on the shoreline aerial surveys that were not in these herds.

I also attached time-depth recorders (TDRs) to the tethers of the five tagged dugongs. I have data from one of these, and a very preliminary scan indicates that the data are very interesting. Watch this space! -
Tony Preen

CUBA

Manatee Workshop. - Representatives from governmental organizations, the Ministries of Agriculture, Fisheries, Science and Technology, the University of Havana, the Center for Marine Studies and the Academy of Sciences attended a two-day national workshop on the conservation of the

West Indian manatee which was held on 19-20 May 1994 in Havana.

Various sectors of the government expressed their willingness to join efforts in the management of manatees, and act cooperatively to accomplish the tasks they agreed should be tackled first. Some of the topics covered were the biology and status of the manatee in Cuba; the manatee in Laguna del Tesoro and the experiment conducted on manatee capture, transport and handling. The National Plan for the Conservation of the Manatee in Cuba was also presented.

Some of the conclusions included the need for a) the preparation of a general proposal to try to obtain financial support for the activities in the next few months; b) production of the proceedings of the meeting; c) starting of a manatee national network; and d) convening of a second workshop in November 1995.

For more information contact: Dra. Delice Salabarría, Ministerio de Ciencias y Tecnología, (COMARNA), Avenida 17, No. 5008 e 50 y 52 Playa, Código Postal 11300, La Habana, Cuba; telephone (537) 330102; telefax (537) 330101. - (reprinted from *CEPNEWS* (UNEP) 8(3), Sept. 1994.)

FLORIDA

New Staging Area for "Soft" Releases of Manatees. - The Captive Manatee Interagency/Oceanaria Group (CMIG) was created several years ago to advise the Florida Manatee Recovery Team on issues related to captive manatees. The CMIG first discussed the concept of a pre-release enclosure over 2 years ago, as a means of conditioning long-term captives, especially manatees born in captivity, before releasing them into the wild. The cost of maintaining manatees in captivity is high, and the five major facilities currently holding manatees must release some of their long-term residents to make room for sick or injured manatees in need of veterinary care.

The soft-release enclosure program has been a cooperative effort, headed by the U.S. Fish & Wildlife Service's Field Office in Jacksonville. Other cooperators include the National Biological Survey's Sirenia Project, Merritt Island National Wildlife Refuge, Kennedy Space Center, Florida Department of Environmental Protection, Sea World, and

Save the Manatee Club.

The work conducted in the enclosure this past summer could be regarded as a pilot project to assess: (1) the suitability and safety of the enclosure design; (2) if and when manatees in the enclosure would begin feeding on available vegetation; (3) the impact of manatee grazing on the vegetation within the enclosure; and (4) manatee behavior in the enclosure and interactions with those outside. The Sirenia Project also conducted PTT transmitter accuracy tests using the impounded manatees.

Construction of the enclosure was completed in August. It lies within the Merritt Island National Wildlife Refuge and the Kennedy Space Center, and comprises three adjacent pens with a total area of 4.5 acres.

The first manatee placed in it was a rehabilitated male who had been in captivity for 6 months. He immediately began interacting with wild manatees outside the enclosure, and within 5 days was grazing on seagrasses growing inside it. He then received a companion, an orphaned 3-year-old male, who was next to the first animal within minutes of his introduction into the pen. They remained together constantly at first, but the periods of time when they were apart increased in frequency, duration, and distance over time.

Both animals were recaptured at the end of August to be reweighed and blood-sampled. Neither had lost or gained an appreciable amount of weight. They were then put back into separate pens, and the second manatee was placed with another young orphaned male. The first manatee was released to the wild with a radio tag on 1 September. He has since stayed in the upper Banana River, but has not come back to the enclosure site.

The other two stayed close together, feeding on algae and seagrass, and often interacted with manatees outside the fence that were apparently attracted to the site by the captives. Both were recaptured and returned to Sea World on 15 September. Although they appeared to adapt quickly to their new saltwater surroundings, they must be given ample time to find warm water sources before cold weather arrives. They will probably be among the first manatees placed in the enclosure next spring, and will make good "mentors" for captive-born manatees that have never been exposed to

natural conditions.

Comparison of before-and-after aerial photographs and vegetation maps of the enclosure should allow a reasonable estimate of biomass removal. While grazing impacts were evident, the overall impact on seagrasses has not been as large as expected. This may be explained by the presence of large amounts of algae (primarily *Gracilaria* spp. and *Chaetomorpha*), which the manatees readily consumed; their tendency to spread out their grazing activity; and the possibility that they were eating less than normal amounts. We also may have overestimated their consumption rate.

This first trial of the soft-release program was encouraging. The enclosure design appears safe and "manatee-proof," though keeping the structure free of encrusting organisms and drift vegetation may become a problem. Learning by example from experienced manatees within the pen, and possibly from wild ones outside, may expedite feeding and other behaviors. Grazing impacts should allow at least a crude estimate of carrying capacity. Grazed areas within the enclosure should recover by next summer. Monitoring of released manatees will still be necessary, to determine if long-term captives can find their way to warm water sources and other resources used by wild manatees. - Lynn Lefebvre

GERMANY

Manatee Breeding Successes in Nuremberg. - Recently, my husband and I visited the zoological park in Nuremberg, Germany to meet with the veterinarian, Dr. Anton Gauckler, and observe the West Indian manatees at their facility. Our visit was sparked by a concerned visitor's letter to the Save the Manatee Club regarding the manatees in the zoo.

The zoo is located on 63 hectares within the city limits and is home to approximately 2000 animals from around the world. The manatees are housed in the "Tropical House" in an approximately 80 m² (750 ft²) by 1.8 m (6 ft) deep cement/Plexiglas pool. The Tropical House opened in 1977 and contains other tropical animals such as the hippopotamus, tapirs, etc.

In 1979 the zoo acquired a male and female (both about 2 years of age) wild-

caught manatee pair from Guyana. On 27 July 1981 the pair gave birth to their first calf. This was celebrated as a big event as this was only the second baby manatee born in captivity in all of Europe. Unfortunately the calf was not accepted by its mother, but was successfully hand-raised. Following this, 12 calves were born (including two sets of twins), of which 10 were successfully raised by the mother. The other two calves died as a result of heart degeneration and a condition known as hydrocephalus (an accumulation of cerebrospinal fluid in the brain).

The pool is presently the home of 6 manatees, ranging from large adults to a young nursing calf. The others are located in other zoos or sea life parks internationally, including Japan and Singapore. The Nuremberg zoo has found that their animals thrive extremely well on an English ray grass, *Lolium perenne*, which they grow themselves on a large farm nearby. They also supplement the grass with corn, wheat, Antibe lettuce, cabbage, and minerals.

The animals are in a freshwater recirculating pool with a UV light as a water disinfectant unit. They do not chlorinate the pools as numerous facilities in the U.S. do; thus the pools have a patchy slight green algal growth which is similar to the natural environment. In addition, the water is seined in a decreasing-size metal mesh before going into the sand filtration system. As anyone who has worked with manatees knows, the voluminous amount of feces the animals produce is a constant challenge to filtration systems, and I found their system to be very efficient.

The pool appears to be a bit crowded with the number of animals it holds. They have plans to enlarge it into the adjacent tank in the near future, which should allow the animals much greater mobility.

They plan to participate in genetic studies with Freiburg University, and when I asked Dr. Gauckler if he would be interested in participating in such a study with the Caribbean Stranding Network and investigators in the United States, he agreed.

Dr. Gauckler has traveled to Guyana and is quite familiar with the animals' natural habitat. He studied in Munich and Vienna, and has been a zoo veterinarian for 23 years. I would like to thank him for taking the time to show us the entire facility and the dolphin-

arium. This was a spontaneous visit and he spent several hours discussing at length the manatee facility and future expansion plans, as well as numerous veterinary medical and nutritional aspects of manatees in captivity. - Dr. Debra P. Moore (Caribbean Stranding Network, Puerto Rico)

[EDITOR'S NOTE: Eleven completed pregnancies in 15 years, starting at the age of 2 or 3, is an unprecedented record for a nursing manatee mother, as is a pair of twin births in captivity. This report is doubly surprising as, to my knowledge, no reports of the births at Nuremberg subsequent to the first one have found their way into even the popular, let alone the scientific, literature. Artificial insemination was, however, reportedly used. Further documentation of this breeding program would be welcome.

I also note with a certain smug satisfaction the zoo's dependence on pasture grass as a source of manatee fodder. Since our success with raising manatees on this kind of food years ago at INPA in Manaus, I have often and unsuccessfully urged U.S. oceanaria to adopt this inexpensive expedient. Manatees, in my view, are designed to run best on ordinary grass (Gramineae) of various sorts; certainly they keep well on it, and it has always seemed to me to be a better and cheaper option than the usual lettuce. Hydroponically-grown grasses have the apparent advantage of being available year-round, but somehow the Nuremberg zoo seems to be getting a year-round supply of farm-grown grass even at the temperate latitudes of Germany! Again, more details would certainly be welcome.

Finally, can any correspondents fill us in on the previously unreported manatee facility in Singapore?]

MADAGASCAR

Status and Exploitation of Madagascar's Coastal Marine Resources. - In an effort to assess and monitor the coastal zones of western Indian Ocean states, the Centre for Dolphin Studies - Port Elizabeth Museum (CDS-PEM), South Africa, began in 1991 a cooperative, long-term program of coastal zone research and monitoring of the southwestern Indian Ocean region. Primarily, this work is aimed at determining, through the status of marine mammals and reptiles in

particular, the 'health' of the coastal zone systems of western Indian Ocean states. Circumstantial evidence suggests a decline in numbers of these species in almost all areas, possibly due to coastal zone degradation, including the increased use of gillnets by artisanal fishermen. The CDS-PEM has so far undertaken or planned limited preliminary studies in Mozambique, Kenya and Madagascar.

The uniqueness and diversity of Madagascar's terrestrial biota are well recognized, and an immense amount of effort and money is spent educating Madagascans in its value and the need for its conservation. In contrast, little thought is given to the fauna and flora of the coastal marine environment, which is equally diverse and deserving of conservation.

CDS-PEM conducted a preliminary investigation of these resources in August through November of 1993. Time, financial and language constraints precluded a survey of the entire 4500 km of Madagascar's coast. Nevertheless, observational, anecdotal and incidental data were gathered from individuals and organizations in as many areas as possible.

Primary survey effort was restricted to two areas:

- The west coast, especially the southwest, where most turtle hatcheries occur and there are also extensive seagrass beds, a known food of both dugongs and turtles. Also, though the Toliara region has a relatively high human population and the coastal zone is, therefore, quite heavily exploited, the west coast generally has a lower human density and probably less exploitation.

- An area on the northeast coast, the Masoala Peninsula, provided comparative data for a relatively unpopulated area on the east coast.

The two areas differ greatly in oceanographic and climatic features. The Toliara region is semi-desert, with a coral barrier reef. Mangroves occur throughout, but are concentrated near river mouths. The Masoala Peninsula is covered in coastal lowland rain forest. Coral and mangroves are found on both sides of the peninsula, the latter principally bordering river mouths.

Information gathered by an interview survey indicates that dugongs occur only on the west and northeast coasts of Madagascar, though their distribution appears to be highly

fragmented and not continuous.

On the west coast, fishermen report seeing a group of about 5 to 10 dugongs in an area approximately 100 km south of Toliara. However, in the Toliara region itself, dugongs have not been seen since the mid-1960s and young fishermen do not know the Malagasy word for dugong.

Fishermen report that six dugongs were caught in October 1992 in Morombe, approximately 200 km north of Toliara, though there are apparently no dugongs between the two areas. Though the coast north of Morombe, as far as Mahajunga, is isolated and relatively uninhabited, fishermen report the existence of extensive seagrass beds and there are confirmed reports of dugong captures in Soalala. One dugong was captured in the Mahajunga region in 1991. For the coast between Mahajunga and Diego Suarez there is little information, as this area is also sparsely populated and seldom frequented, even by tourists (the exception is the popular resort at Nosy Be). Nevertheless, the northwest coast is characterized by large sheltered bays, apparently with extensive seagrass meadows.

There are no recent reports of dugongs on the east coast between Fort Dauphin and Tamatave. Divers and tourists report sightings of two dugongs at Isle Saint Marie, north of Tamatave, prior to spring 1992, but there are no recent confirmed sightings. No information is available for the area between Tamatave and Maroantsetra, but the area is relatively densely populated, suggesting that dugong occurrence is unlikely.

Between Maroantsetra and Antalaha, fishermen rate dugongs as abundant, but report that their numbers are declining, and attribute their apparent decline to fishing pressure (F. Odendaal, pers. comm.). There has been only one reported recent (since 1992) dugong capture from the villages visited on the Masoala Peninsula. However, prior to 1992, there were many reports of dugong captures. In Ambohitralana, up to two dugongs per week were caught until 1990, but only one subsequently (December 1993). Most recent sightings for the area are from the Bay of Antongil and Cap Est. Dugongs are also reported north of Antalaha, up to Diego Suarez, with a confirmed sighting in the Bay of Diego Suarez.

Large seagrass beds were found in both the southwest and northeast regions. Seagrass generally occurs at depths of about 1-10 m. In the Toliara region, four species were identified, *Thalassia hemprichii*, *Thalassodendron*, *Syringodium isoetifolium* and *Cymodocea* sp., although other species are known to have occurred. Seagrass beds generally occur between the coral reef flat and the shore and none were observed outside the reef areas in the Toliara region. On the windward side of the Masoala Peninsula, extensive seagrass beds were found and their distribution and species composition appeared similar to the Toliara region. On the leeward side, there are some seagrass meadows as well as mixed seagrass and algal beds.

Coastal zone resources are used extensively by the coastal communities. In large areas, the sea provides the only protein source for the local population. The pressure on coastal resources increases in times of drought, when agriculture is abandoned and food gathering is done exclusively in the coastal zone. Vegetation is also destroyed for salt pan and large-scale shrimp farm construction. Mangroves are cut for firewood and building material. A variety of shells, crabs, corals, shark jaws, and other inshore fauna and flora is sold to tourists by street vendors in the larger towns.

The areas surrounding algae and seagrass beds are extensively fished. Fishermen generally use handlines, small-mesh gillnets (deployed from piroques), or beach seine nets, the latter often damaging both types of beds. Sea cucumbers and molluscs are also harvested, although sea cucumbers appear to be severely depleted, even in remote areas. Seaweed is collected in some areas, but not extensively. The influence of this on seagrass beds is unknown. Large fish traps, extending from the shore up to 150 m in to the sea, are used in the lee of the Masoala Peninsula.

Industrial pollution is limited to the major coastal towns. There are reports that the waste from the sugar cane refineries on Nosy Be has hurt large areas of coral. Human waste constitutes the bulk of pollution in the rural coastal areas. As the population increases, this may pose a considerable human health threat, and may eventually also cause eutrophication in coastal waters.

Though little siltation of reefs or man-

groves was observed in either the Toliara or Masoala regions, large siltation plumes can be seen from the air off many rivers, especially on the west coast. These plumes are probably a result of erosion caused by overgrazing and destruction of riverine vegetation in the higher reaches of river catchment areas. Siltation of coral reefs between Morondava and Mahajunga is reported by divers and it is likely, therefore, that seagrass beds in the region are also adversely affected.

Although intense deforestation occurs on the Masoala Peninsula, crops are planted in these areas immediately, limiting topsoil loss. However, slash and burn deforestation ('tavy') on river banks and steep hill slopes causes substantial erosion, especially after cyclones.

Spears and harpoons are used to catch crayfish, octopus, dolphins, dugongs and turtles. Though gillnets are seldom intentionally set for dolphins, dugongs or turtles, these species are actively pursued once observed. If dugongs are frequently seen in an area, nets are set for them.

Fishermen from established villages (older than 5 years) report that they never see dugongs over inshore seagrass beds during the day, but only between dusk and dawn. Dugongs apparently move out to sea during the day. In more recent settlements, fishermen report dugongs during the day in areas where seagrass beds occur. All fishermen report that dugongs avoid contact with humans and are generally seen alone - even smaller animals, with only one group larger than two reported.

Poverty and a growing population's need for food are the biggest problems facing conservation in Madagascar. Cash and subsistence crop production is hampered by either seasonal droughts or floods, as well as poor transport and marketing facilities. Consequently, exploitation of the inshore region of Madagascar fulfills two basic, immediate needs of the local people, food and money. Unfortunately, the inshore zone is already heavily exploited and many of the methods used are either indiscriminate or destructive. Fortunately, the fishermen interviewed were aware of a decline in catches and expressed an interest in alternative fishing methods and a sustainable fishing resource. Despite this, in view of the growing population and its need for food and wealth,

destructive exploitation of coastal resources is likely to continue, and probably increase. This is already evident in the increase in shark gillnetting in recent years and the continued decline in fish and coral resources. As the destructive exploitation of coastal resources is caused primarily by coastal communities, the solutions to the problem seemingly lie with these communities.

For both marine mammals and turtles, an increase in coastal resource exploitation will negatively impact local stocks, especially those using coastal resources. This is especially so when local stocks become targeted, because of their value as meat or tourist accoutrements, rather than incidental catches, as has happened in South America. The proliferation of targeted hunting for marine mammals and turtles should be avoided at all costs.

Although 'ecotourism' is hailed as one way to save the environment, it is a two-edged sword. One problem is that it creates high expectations within the local population, who are invariably disappointed when only a trickle of tourists, and even less money, pass their way. Additionally, though ecotourism may have some potential for dugong conservation, dugong behavior may mitigate against its success. Dugongs are apparently shy and will generally avoid contact with humans, especially in areas where they have been hunted. Consequently, using 'dugong watching' to attract tourists may cause the animals to leave an area. Nevertheless, community-based ecotourism (where the community benefits directly from tourists and the money they spend, rather than indirectly, through a hotel, etc.), in combination with engendering an awareness of the need for sustainable use of community-owned resources, is one way of increasing the value of natural resources to local communities.

In Australia, dugongs are known to have large feeding ranges and may migrate seasonally. As a result, fixed protected areas may have only a limited value for their conservation, particularly if fishing and hunting in unprotected areas increases. But the creation of protected, or limited-use, areas may be beneficial, especially where human population density is low. Relatively undisturbed areas still exist in the northwest and northeast of Madagascar and they not only have immense tourist potential, but

could also provide respite for vulnerable inshore resources.

Despite these problems, dugong and turtle conservation is urgent and can probably best be effected through a combination of protected areas, ecotourism, education and 'community legislation' - where the resource becomes the 'royal game', or property, of all community members. This may prevent the exploitation of the resource by only a section of the community and could lead the community, as a whole, to finding the best possible way of using (preserving) its 'common property'. In view of the past, and possibly current, substantial catch of dugongs and turtles throughout Madagascar, a pilot project to assess the effectiveness of such an approach to conservation should be initiated immediately.

Possibly the most pressing immediate need is to establish some 'base-line' estimate of dugong, and concurrently turtle, distribution and abundance. This is best accomplished through aerial surveys. Not only should the unknown areas of the coast be surveyed, but also areas of known dugong occurrence, as identified by this preliminary survey. Subsequently, the movements, feeding dynamics and conservation potential (through community work) of dugongs and turtles in areas where they are abundant should be assessed.

Figures given and conclusions drawn from this survey are preliminary and reflect only information gathered from a small sample of areas and fishermen. Consequently, they should be viewed with caution until such time as more information is available. As an example: Most fishermen questioned reported a decline in dugong sightings and catches. Although this may imply a decline in dugong numbers in most areas, it may also only indicate a change in dugong behavior! Fishing operations often entail considerable disturbance, such as beating the water surface with oars, and fishermen confidently report that dugongs move offshore and are not seen during the day. In conjunction, the latter two facts suggest that sightings and captures have only decreased because dugongs avoid people; that during the day they may move out to deeper seagrass beds, at depths of 30-50 m, where fishermen don't fish.

Given this uncertainty, the vulnerability of marine mammals and turtles to exploita-

tion, and the possibility of local area extinction of some species (e.g., dugongs), it is imperative that further work be done. This should include:

1. Creation and implementation of a coastal zone management plan for Madagascar, particularly areas where dugongs and turtles are still abundant.

2. Increasing local awareness of the need for coastal resource conservation, and developing local expertise in research and conservation.

3. For dugongs and turtles, conducting aerial surveys to identify areas of abundance and estimate numbers.

4. Identifying areas suitable for establishment of marine reserves. With the consent and co-operation of local communities, these should be established (through Governmental legislation, community consensus or both) and biological research on the inshore biota initiated.

5. In established protected areas especially, alternative fishing practices should be investigated and artisanal fishermen instructed and encouraged in their use.

6. The effect of the shark-fishing operation on marine mammals and turtles should be further investigated and methods found to prevent incidental capture of these animals. - **Berthin Pierre Rakotonirina, V.G. Cockcroft, M. Kroese, and Michel Vély**

MARYLAND

New Northern Record for Manatee Distribution. - A wayward Florida manatee recently set a new record for the northernmost scientifically-substantiated occurrence of his species. After having been sighted several times in mid- and late September in the upper Chesapeake Bay, he was finally captured near Queenstown (latitude 39° north) by federal and state wildlife authorities on 1 October. He proved to be a large male (310 cm, 1,416 pounds) in apparent good condition. He was taken to the National Aquarium in Baltimore for several days of observation, then flown to Sea World in Florida. A U.S. Coast Guard C-130 cargo plane was used for the transport, since it allowed control of cabin temperature and pressure. The manatee has numerous healed scars, which will hopefully allow his identifi-

cation and eventual return to his normal home range in Florida waters.

Manatees, especially males, typically range north from Florida during the summer, but occurrences north of Cape Hatteras are uncommon. This animal just barely bested the previous northernmost record, set in August 1980 by a manatee sighted in the Potomac River in Washington, D.C. It is thought that this was the same individual that was found dead at Hampton, Virginia, on 23 October of the same year, underlining the importance of returning such strays to warmer waters as fall approaches.

There is anecdotal evidence that manatees were more common summer visitors to the Chesapeake region in past decades. Fossil manatees, probably Pleistocene in age, have been reported from New Jersey, and alleged strandings in Greenland and the North Sea are recorded in the late eighteenth-century literature. It seems possible that animals entrained by the Gulf Stream might have survived long enough to drift to those places, especially if an unusually warm summer and/or a larger manatee population in Florida caused larger-than-usual numbers of animals to disperse northward. - **DPD**

PUERTO RICO

Moises the Manatee Released. - Moises the Manatee, an orphaned 2-week-old calf found stranded in November 1991, had grown to 235 cm and over 286 kg by March 1994, and was moved from La Parguera to Roosevelt Roads Naval Station, where a reintroduction staging area had been prepared. This comprised an approximately 350,000-square-foot area enclosed by a 750 ft. chain-link fence, containing water 1-5 ft. deep over a mostly muddy bottom with *Syringodium*, *Thalassia*, and red mangroves.

Over the next three months, his condition and behavior were intensively monitored. As of mid-June, he was in good physical condition, active, and regularly drinking from a fresh-water hose. However, he had shown considerable resistance to adopting a seagrass diet, despite denial of his accustomed lettuce, and had lost over 7% of his body weight. Supplemental feeding with a mixture of lettuce and seagrass was begun again, and efforts were made to lure wild manatees closer to or within the enclosure so

(Item: It was recently reported that Baltimore, Maryland has the worst postal service in the U.S. The following appeared on the editorial page of the *Baltimore Sun*, 4 October 1994. [Copyright © Cartoonists and Writers Syndicate. Used with permission.]



that Moises could observe and hopefully mimic their feeding behavior. By 17 June he had begun grazing on *Thalassia*; as of 12 September he had joined up with some wild manatees and was exploring the shores of the naval base, carrying a satellite tag. - **Caribbean Stranding Network**

New Baby Manatee Healthy and Growing. - Another orphaned baby manatee rescued in Puerto Rico in May 1993 is doing fine and growing. He arrived at the Caribbean Stranding Network (CSN) facility after being found alone for a week off Ocean Park

in San Juan, on the north coast. The 2-week-old baby, only 4 feet in length and 63 pounds, suffered from intestinal infection and was in critical condition for months. Thanks to aggressive antibiotic treatment, and bottle-feeding with manatee milk sent by the Miami Seaquarium, he has now passed 286 pounds and is being weaned from a soybean and goat milk formula to seagrass. We expect to release him back to the wild on his turning two years of age. - **Caribbean Stranding Network**

Reward Offered for Killer of Manatee. - A US\$5,000 reward was posted on 18 July 1994 for information leading to the arrest and conviction of the killer of an Antillean manatee found in Ceiba, Puerto Rico, with a 5-inch gunshot wound to its chest, an act punishable by imprisonment. The 10-foot adult manatee was found floating just offshore on 15 July, having been shot that morning.

The Caribbean Stranding Network (CSN), which performed a necropsy, believes the shot came from either a shotgun or a power head, a speargun-like weapon used for hunting sharks. The shot ruptured the left ventricle of the heart.

The U.S. Fish & Wildlife Service offered a \$2,500 reward for information leading to the conviction of the manatee's slayer. The Marine Industry Association of Puerto Rico matched the reward.

The U.S. Endangered Species Act, administered by the Fish & Wildlife Service, mandates a year in prison and/or up to a \$100,000 fine for killing a manatee. Nonetheless, humans cause most manatee deaths in Puerto Rico. Last year, six were found dead, most by human agency. One was found shot dead in Fajardo, near the locality of this year's killing. Typically, they are killed by boats or nets. Less common are deaths from natural causes. According to aerial surveys, there are between 60 and 250 manatees in Puerto Rico; it is unknown whether their numbers have grown or diminished since they were declared endangered. - (adapted from the San Juan Star, 19 July 1994)

TRINIDAD AND TOBAGO

Manatee Status Survey Planned. - The Caribbean Stranding Network (CSN) recently visited Trinidad to investigate the feasibility of helping the government and local non-governmental organizations (NGOs) study the status of manatees in this island, where until recently they were thought to be extinct. Antonio Mignucci met with local and government representatives, and visited the Mitán River in the Nariva Swamp to observe manatees from an elevated platform constructed by the local Rotary Club in cooperation with the government's Wildlife Section, the Field Naturalist Club, and other NGOs. About half a dozen manatees

have been documented by volunteers in the river during the past few years, and efforts have been started to develop community conservation programs.

Although local interest was very high and volunteers were very eager to participate in manatee conservation, little is known to date about the Trinidadian manatee. It is not known how many live around the island, nor whether those in the Mitán River leave it to mingle with manatees elsewhere, or if they are naturally impounded there. Concerns have been expressed regarding chemical pollution (pesticides, herbicides, etc.) of the swamp and river by nearby agriculture.

Ms. Nadra Nathai-Gyan, head of the Wildlife Section, expressed the government's high interest in assessing manatee status and encouraging local and international organizations to study and protect the species.

Following the initiative of Gupte Lutchmedial, Jalaludin Khan, and Nicole Leotaud, locals who have been very active in sparking interest in manatees in Trinidad and doing base-line work, the CSN is looking forward to assisting the Wildlife Division and local NGOs in 1995. They will present a research proposal and seek funding for aerial surveys, for a research program at the Mitán River on manatee health status, life history, and genetic variability, and hopefully for a radiotelemetry study of manatee movements.

- Caribbean Stranding Network

VENEZUELA

Captive Manatees Examined. - The Caribbean Stranding Network's Scientific Coordinator, Antonio Mignucci, recently visited Venezuela to examine four captive manatees held at different zoos, document their status, health, and life-history parameters, make recommendations for better captive care, and collect skin samples for a research project on genetic identification of manatee populations from different parts of the Caribbean.

The first manatee was rescued from poachers in 1985 as a calf and reared by the Aquarium J. V. Seijas in Valencia. He is now 9 years old. The second and third animals, both females, were also rescued as calves in 1992 in the municipality of Apure and cared for at an aquaculture station. The fourth calf was rescued in 1992 near Marac-

aibo and kept at the Zoologico Miguel Romero Antoni in Barquisimeto, where the smaller female from Apure was also moved early this year.

The two males are healthy and showing normal growth. The females, however, were found to be in need of immediate care, as their growth rate was less than 2 cm/year. The diets of the manatees at Barquisimeto were found to be appropriate, but those of the others were not, and all four animals are in need of improved water quality.

The captive facilities were very willing to make plans to improve the manatees' maintenance, including larger tanks with filter systems and diversified diets. The CSN

will recommend to Venezuela's national wildlife agency (PROFAUNA) that the Barquisimeto Zoo be allowed to take custody of the second female manatee as well. - **Caribbean Stranding Network**

WASHINGTON, D.C.

Progress on Publication of Sirenian Bibliography. - Domning's *Bibliography and Index of the Sirenia and Desmostylia* is presently in galley proofs; publication by the Smithsonian Institution Press is planned for early in 1995. It is anticipated that copies will be purchasable directly from the Smithsonian Press. - DPD

ABSTRACTS

Isolation and characterization of a partial cDNA encoding interleukin 2 from the Florida manatee, *Trichechus manatus latirostris* (Mary Elizabeth Cashman). - Due to the extreme importance of IL-2 production in the mammalian immune response, and because very little is known about the immune response in the endangered Florida manatee, *Trichechus manatus latirostris*, a partial cDNA encoding manatee IL-2 was isolated and characterized. The manatee IL-2 cDNA was molecularly cloned by reverse transcription/polymerase chain reaction (PCR) using primers derived from IL-2 regions conserved among various mammalian species. The resulting manatee IL-2 fragment, which comprised 75% of the human IL-2 open reading frame, consisted of 347 base pairs encoding for a predicted product of 115 amino acid residues. The partial manatee IL-2 cDNA displayed 84%, 79%, 75%, 75%, 72%, and 72% DNA sequence homology and 69%, 65%, 59%, 58%, 55%, and 53% amino acid homology with human, pig, sheep, cow, rat, and mouse IL-2, respectively. [Abstract of a thesis for the degree of Bachelor of Science in Marine Science, submitted to Eckerd College, St. Petersburg, Florida, in 1994.]

Preliminary serum chemistry reference ranges of the Antillean manatee (*Trichechus manatus manatus*) in Colombia and Puerto Rico (Ruby Adiel Montoya Ospina). - Preliminary serum chemistry reference ranges for 20 parameters (alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, total bilirubin, creatine kinase, lactic dehydrogenase, blood urea nitrogen, creatinine, uric acid, glucose, triglycerides, cholesterol, amylase, total protein, albumin, sodium, chloride, potassium, phosphorus and calcium) were determined for two populations of Antillean manatees (*Trichechus manatus manatus*). Values were obtained from 11 wild, apparently healthy manatees captured in Puerto Rico in April 1992 and May 1993 and from 10 apparently healthy semicaptive manatees in Colombia in June 1993. The objectives of this study were to establish reference ranges for this endangered species in order to conduct adequate rehabilitation work and to compare the results with published values from other Antillean manatee populations and from the Florida manatee (*T. m. latirostris*).

Reference ranges were established using the percentile analysis and the comparisons between populations were conducted using the nonparametric Mann-Whitney U-test at a 95% confidence level. It was found that between the Colombia and Puerto Rico populations, 13 out of 19 parameters were significantly different, 9 out of 14 were significantly different between the Colombia and Florida populations, and 6 out of 14 were significantly different between the Colombia and Guyana populations. It was also found that between the Puerto Rico population and the Florida and Guyana populations, 10 out of 14 and 7 out of 13 parameters were significantly different, respectively.

Differences were less pronounced between populations of the same subspecies and those with similar environments and diets. Greater differences were found between populations of different subspecies, although a direct correlation with environmental or dietary variation was not clearly observed. It is possible that habitat, food habits and chemical composition of plants, behavior, metabolism, and perhaps taxonomic variables may have different effects on each of the above parameters and, most probably, the mechanisms to balance these effects are also very complex. The adaptations of each population to specific environmental conditions are manifested, apparently, in different serum chemistry values. In addition, variations due to methods of capture, sampling, techniques of restraining the animals, blood sample handling, and laboratory methodology may have some effect on the serum chemistry values reported here. [Abstract of a thesis for the degree of Master of Science in Marine Sciences submitted to the University of Puerto Rico, Mayaguez, in 1994.]

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