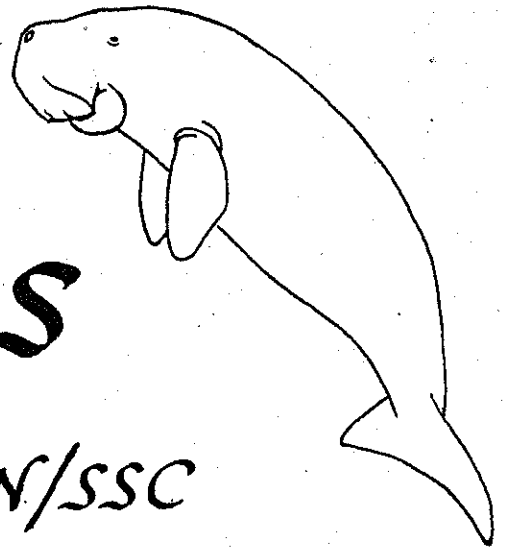


Sirenews



Newsletter of the IUCN/SSC Sirenia Specialist Group

NUMBER 18

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IN THIS ISSUE: - FIRST FOSSIL DUGONG FOUND: IN FLORIDA! (p. 14)
- NEW MANATEE PROTECTION EFFORTS IN BRAZILIAN
NORTHEAST (p. 9ff.)

EDITORIAL: TIME FOR A CEASE-FIRE IN FLORIDA

The history of manatee conservation efforts in Florida has traditionally been marked by a high level of cooperation among the many local, state, and national governmental agencies, business firms, private organizations, and individuals involved. This outstanding record of collaboration was marred earlier this year by a controversy arising from a most unexpected quarter.

In 1981, the Governor of Florida created the Save the Manatee Committee under the chairmanship of popular singer Jimmy Buffett. This organization was affiliated with the Florida Audubon Society so that it could accept donations using Audubon's tax-exempt status. The Committee proceeded to set up the Save the Manatee Club and act as its governing board. Since then, the Club, under the leadership of its Executive Director, Judith Delaney Vallee, has built an enviable record of fundraising, public education, lobbying, and funding of research on behalf of manatees in Florida and elsewhere.

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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U.S. Marine Mammal Commission and U.S. Fish & Wildlife Service.

In February of this year, the Save the Manatee Committee announced its intention to incorporate itself as an organization independent from Florida Audubon, as it had intended to do from the start. On March 4, Audubon removed Ms. Vallee as Executive Director and seized the Club's office, records, and other assets, including its 30,000-member mailing list and \$640,000 budget. This action was apparently prompted by fears that loss of affiliation with the Club would cut deeply into Audubon's income, much of which is reportedly generated by public interest in manatees. The Committee then sued Audubon for the return of its assets (see Sirenews No. 17).

On June 26, a Circuit Court judge found in the Committee's favor and granted a temporary injunction restoring Ms. Vallee to her post and affirming the Committee's authority to control the Club's affairs. The judge explained that although "the purpose of a temporary injunction is ... to preserve the status quo until the final hearing when full relief may be granted," the granting of the injunction is based on "a substantial likelihood" that the Committee "will ultimately prevail on the merits."

As might be expected, this dispute has attracted considerable media publicity, and the tide of opinion has run strongly against Audubon. Not yet having had enough, however, Audubon's officers are reportedly continuing their appeal of the judge's decision. This is unfortunate for all concerned, especially the manatees. The months of confusion over who was running the Save the Manatee Club, and the bad publicity surrounding this affair, understandably created a major slump in the Club's fundraising. These distractions also prevented the Club's participation in some important public hearings and regulatory meetings where its support for enhanced protective measures for manatees was sorely missed. Fortunately, with Ms. Vallee back at the helm, the Club's effectiveness was quickly restored; but time was lost and damage was done.

It is time for this needless, senseless, and scandalous episode to end, and for the leaders of Florida Audubon to accept defeat and put their energies back into protecting the environment. The Save the Manatee Club is to be congratulated on its victory as well as on this, the tenth anniversary of its founding, and we look forward with confidence to the continuation of its superb efforts on the manatee's behalf. - DPD

SIRENIA WORKSHOP - SYDNEY, 1993

John Reynolds and I have been given permission to arrange a one-day Sirenia Workshop as part of the Sixth International Theriological Congress to be held at the University of New South Wales in Sydney, Australia from July 4 to 10, 1993. Among the 37 Symposia and 10 Workshops scheduled for the Congress, there will also be a Symposium on the Status of Marine Mammals which will include invited review papers on the status of dugongs and manatees.

The daily schedule adopted by the conference conveners is as follows:

0830 - 1100 hours for poster session
1100 - 1200 hours for plenary session
1330 - 1730 hours for spoken papers

John Reynolds and I would like to organize a specialist session on Sirenian Feeding Ecology and Habitat Status for most of the afternoon spoken paper session. This is a topic where there have been some interesting developments of late, as is evidenced by this issue of Sirenews.

We suggest allowing at least half an hour for each paper, including 20 minutes for questions. This would provide time for seven papers assuming half an hour for afternoon tea. If the demand is greater than this we could shorten the total time for each paper (and afternoon tea) to 20 minutes, which would provide time for 11 papers.

The editors of Wildlife Research have indicated their willingness to consider publishing symposium proceedings in areas appropriate to their journal. Please indicate if you would be willing to have the Proceedings of our spoken papers published in this manner. The manuscript would have to reach the editor by July 10, 1993, and would be subject to normal refereeing procedures.

Could those of you who would be interested in contributing to such a session please contact John by the end of November 1992 so that we can determine whether this session is viable? [Dr. John Reynolds, Eckerd College, 4200 54th Ave. South, St. Petersburg, FL 33711 USA; fax 813-864-8388]

The morning of the Workshop would then be devoted to a session of posters on any aspect of sirenian biology and management. Please also contact John by November 30, 1992 if you would like to present a poster.

Unfortunately ITC has no funds to offset travel, accommodation, or registration costs. We will try to obtain some assistance for speakers from developing countries. Please indicate your need for support when you contact John. - Helene Marsh

WANTED: DATA ON SIRENIAN CARCASS COMPOSITION

Statistics on past and contemporary exploitation of manatees and dugongs are available from several parts of the world. However, these statistics usually take the form of tabulations of weights of meat, fat, hides, or other products rather than numbers of actual carcasses (see, for example, Domning, Biol. Conserv. 22(2): 101-126, 1982; Sirenews No. 15, p. 6, 1991). For purposes of estimating the impact of such exploitation on sirenian populations, it is obviously necessary to calculate the number of animals taken; but accurate conversion factors are not available for any sirenian species.

It would be very desirable if those involved in carcass salvage, or (preferably) those having opportunities to observe butchering of sirenians by hunters using traditional methods,

would make a special effort to collect such data. Most important to collect would be the weight of fresh meat obtained, as a function of total body length and body weight. For manatees other than T. inunguis, such data would be especially valuable if they pertained to animals less than 3 m long (i.e., in the size range of T. inunguis), so that they could be used provisionally to interpret the catch statistics on Amazonian manatees pending the collection of such data from actual Amazonian manatees.

Also useful would be data on weights of fat, oil, hide, dried or cooked meat, or other products obtained from carcasses. The exact methods of butchering and processing used should be recorded. Of course, the larger the sample, the better; however, even one or two specimens analyzed in this way would significantly enhance our knowledge and our ability to interpret past records. - DPD

AN APPEAL FOR FUNDING FOR DUGONG/MARINE MAMMAL AERIAL SURVEYS IN THE PHILIPPINES

Marine mammal research in the Philippines is still at an early stage. Data on all aspects of the biology and ecology, particularly the stocks status, of these animals are basically wanting. Compounding the problem is the archipelagic nature of the Philippines, which has more than 7,000 islands.

Extensive preliminary surveys on the species composition of Philippine marine mammals, by Aragones, Dolar, Leatherwood, and Hill in 1991, confirmed the presence of 15 species (14 cetaceans and 1 sirenian). The list includes: Risso's, bottlenose, pantropical spotted, long-snouted spinner and Fraser's dolphins; melon-headed, short-finned pilot, pygmy killer, Blainville's beaked, sperm, pygmy sperm, humpback, minke, and Bryde's whales; and dugongs. Most of the species confirmed are taken incidentally in fishing operations, while others are directly targeted. We have strong reasons to believe that there are more marine mammal species in Philippine waters. Therefore there is a need for more surveys. In addition, the stocks of the existing species must be determined for proper management. Reference specimens of the various species are being held at the Biology Museum of Silliman University and the Museum of Natural History of the University of the Philippines at Los Banos.

As part of my Ph.D. degree at James Cook University of North Queensland, under the supervision of Helene Marsh, I am training to carry out aerial surveys of dugong stocks within the waters of the Great Barrier Reef. I am confident of applying this method in determining not only the abundance and distribution of dugongs in the Philippines, particularly Palawan (which is one of the areas of high conservation value left in the Philippines), but also all other marine mammals and even sea turtles as well. Unfortunately, the Philippine government is not capable of funding such an endeavor. Therefore I am appealing on behalf of the Philippine government for funding for aerial surveys of marine mammals in Philippine waters. I believe that if we act now we may still be able to save and manage the marine mammal resources of the Philippines. With the help of the newly appointed Secretary of the Department of Environment and Natural Resources of the

Philippines, Dr. Angel Alcala, the Philippine environment will hopefully take a turn for the better.

Anyone interested in helping or knowing more about marine mammal research in the Philippines may contact me at the following address. - Lemnuel V. Aragon (Environmental Studies, James Cook Univ., Townsville, Qld. 4811, Australia)

OIL SPILL CONFERENCE

The Third International Conference on the Effects of Oil on Wildlife will be held in New Orleans, Louisiana, 27-29 January 1993. It will comprise papers, workshops, and panel discussions on governmental concerns and contingency planning, critical habitat and resources at risk, wildlife rehabilitation and research, and a special session on the spill in the Middle East. For more information contact Eileen Muller or Joyce Ponsell, Tri-State Bird Rescue & Research, Inc., 110 Possum Hollow Road, Newark, Delaware 19711; phone 302-737-7241 or 302-737-9543, FAX 302-737-9562.

LOCAL NEWS

AUSTRALIA

Deep-water Foraging and Forage Resources for Dugongs in Shark Bay. - Because a comprehensive aerial census of dugongs in Shark Bay, Western Australia, flown by Helene Marsh in July 1989, led to a much higher estimate of dugong numbers than previously suspected and found major concentrations of dugongs in deep-water areas, questions were raised as to an apparent lack of sufficient high-quality forage to support so large a population and as to why dugongs should occur in deep-water areas where seagrass was believed to be absent and foraging would have a high cost in travel time. With the intention of resolving the latter question I mounted an expedition to the Bay between 30 June and 19 July 1992.

Hypotheses which might explain the large number of dugongs in waters > 8 m deep in the east-central Bay, a region not known to support seagrasses, were that it was a thermal refugium, and/or that a substantial forage resource (seagrass or invertebrate) existed there. Selected aerial transects flown in 1989 were replicated on 3 July and 14 July 1992. Distribution of dugongs on these transects closely approximated that found in 1989. In the interval between the two flights, sites of dugong activity, precisely located using GPS, were visited with the sailing catamaran Nortrek, and the sea floor was examined using a remotely controlled underwater video camera (ROV).

The examination revealed the existence of a hitherto undiscovered pure stand of Halophila spinulosa at depths of 9 to 14 m which is at least 50 square nautical miles in extent and which very likely extends along the entire western edge of the Wooramel seagrass bank (if so, a monospecific "prairie" of around 250 square nautical miles).

Dugong abundance and deep diving activity correlated with the H. spinulosa distribution in the block examined. Excellent

infrared satellite imagery is available for both the 1989 survey and the 1992 study, and surface water temperatures were taken to provide ground truthing for satellite imagery in 1992. It will thus be possible to integrate information on surface temperature patterns and winter forage resources in the final report on this study.

As H. spinulosa is a species with succulent rhizomes similar to those of Halodule uninervis, and thus appears to be prime dugong forage, deep-water foraging in the study area can be explained, and the picture of abundance and distribution of dugong forage resources in Shark Bay has changed dramatically. The discovery that the Shark Bay dugong population may rely heavily on beds of Halophila spinulosa at depths down to 14 m or more has important management implications, since the H. spinulosa community may be extremely vulnerable to destruction by trawling for scallops or prawns. - Paul K. Anderson

The Occurrence of Dugongs in New South Wales in Winter/Spring 1992. - The southern limit of the dugong's range on the east coast of Australia is usually considered to be Moreton Bay, which extends south from about 27° S nearly to the Queensland-New South Wales border at 28° 10' S. Even Moreton Bay may be thermally marginal for dugongs in winter; the water in their favored feeding area is below 19°C for three months each year. Tony Preen's work (see abstract below) shows that dugongs regularly migrate to oceanic waters outside Moreton Bay during winter to spend time in the East Australian Current, which may be up to 5 degrees warmer than inside the Bay.

Prior to 1992, there were only eight records of dugongs from the New South Wales coast, all single incidents in any one year. However, a resident of Port Macquarie reports occurrences of dugongs as far south as Port Macquarie (32° 30' S) between 1930 and 1940.

Location	Latitude Longitude	Date	Record	Length (metres)	Sex	Comments
Yamba	29°26' 153°22'	pre 1990	Dead			
Eden Cocorra Beach	37°04' 149°53'	10/11/86	Live			
Clarence River mouth	29°25' 153°23'	2/10/83	Live			Prawn net
Hawkesbury River	33°33' 151°17'	1980a				
Port Kembla	34°28' 150°55'	-/12/60	Dead			
Sydney S. Port Hacking	34°04' 151°10'	12/2/59	Dead		M	
Sydney Harbour Potts Point	33°52' 151°15'	?	Dead			Skull A.M.
Port Macquarie	N of 32°30'	1930- 1940				

(a = approximately, F = female, M = male, A.M. = Australian Museum)

1992 RECORDS

Location	Latitude Longitude	Date	Record	Length (metres)	Sex	Comments
Port Stevens Cabbage Tree	32°04' 152°13'	approx 9/10/92	Live			? several animals
Mullaway	30°04' 153°13'	8/10/92	Dead	1.8		Necropsied
Port Stevens	32°43' 152°10'	2-7/10/92	Dead	2.33		Decomposed
Kurnell Peninsula	34°00' 151°13'	6/10/92	Live			
Port Stevens Cabbage Tree	32°41' 152°13'	22/9/92a	Live			
Diggers Camp S. of Yamba	30°02' 153°13'	20/8/92- 15/9/92	Live	3.0a	?	3 times
Patches Beach 10km S Ballina	28°57' 153°31'	18/9/92	Dead	2.3	?	No necropsy
Barri Point S. of Yamba	29°27' 153°22'	11/9/92	Dead	2.74	F?	Decaying
Brunswick River	28°33' 153°33'	11/9/92	Live			
Botany Bay Sydney	33°57' 151°10'	10/9/92	Dead	2.04	M	
Port Stevens, Tomaree Head	32°43' 152°10'	8/9/92 onwards	Live	1.7a	?	18°C Numerous
Clarke's Beach Byron Bay	28°38' 153°38'	7/9/92	Dead	1.97	F	
Byron Bay Lighthouse	28°38' 153°38'	1/9/92	Live			
Port Stevens Fingal Bay	32°45' 152°11'	18/8/92a	Live			
Nowra, Currarong	35°00' 150°50'	6/8/92	Dead	2.82	F	
Green Point S. of Yamba	29°28' 153°21'	13/6/92	Live			

(a = approximately, F = female, M = male)

The winter and spring of 1992 have been remarkable for an unprecedented spate of sightings of live and dead dugongs on the New South Wales coast as far south as 37°S. Comparison of satellite imagery of the south-flowing East Australian Current in September 1992 with corresponding imagery from 1991 indicates that the current was warmer, stronger, and flowing closer to the

coastline this year than last year. Waters above 19°C extended along most of the coast north of about 31°S. I have not been able to establish how unusual this is in the longer term.

Of the eight pre-1990 records listed above, some are verbal, but the Eden and Clarence River are on the National Parks and Wildlife Service WILDATA database, and the Port Hacking and Port Kembla records were reported in Victorian Naturalist 101(4): 157, 1984. The Sydney Harbour specimen is believed to be in the Australian Museum, Sydney.

Notes on 1992 records:

- o The Port Stevens Cabbage Tree Island report was a single sighting by divers and is almost certainly different from the Tomaree Head dugong, which was seen over a couple of weeks in the vicinity of a marina. This animal was reported to have survived a collision with a boat and may be the animal dead on 7/10/92.
- o The Digger's Camp sightings were reported by a Mr. Grant Farrington just off the rocks on the northern end of Digger's Camp Beach in Yuraygir National Park. The dugong was seen three times over three weeks while Mr. Farrington was setting his lobster pots. It was reported to be about 3m long, slow and lethargic, and frequented sheltered shallow water where it was probably feeding.
- o The Patches Beach animal was badly decomposed and could not be necropsied, but blubber samples were taken.
- o The Barri Point, Botany Bay, Clarke's Beach, and Nowra specimens were necropsied and tissue samples were taken where possible for heavy metal and pesticide determination. Morphometric data were also collected. Liver tissues were also taken for genetic studies. The skulls were collected for the Australian Museum, and the remainders of the carcasses were buried for later excavation if necessary.
- o The stomachs of these dugongs were, in most cases, full of seagrass and samples of the contents were taken for later identification.
- o Nematode parasites were present in the stomach of the Botany Bay animal, and the full autopsy report of the Clarke's Beach animal from J. Boulton, Regional Veterinary Laboratory, Wollongbar, indicated the presence of multiple parasitic granuloma within the mucosa of the small intestine. Both the Clarke's Beach and the Nowra specimen had numerous lesions on them from cookie-cutter sharks.
- o The Brunswick River, Byron Bay Lighthouse, and Green Point observations were single sightings of live animals.

-- Leighton C. Llewellyn (New South Wales National Parks & Wildlife Service)

BRAZIL

New Manatee Research Center Established. - The "Centro Peixe-boi Alagoas", the Manatee Center for the State of Alagoas, Brazil, has recently been established by the federal conservation agency IBAMA in the state capital of Maceio, with the support of the National Center for the Conservation and Management of Manatees (based at Itamaracá Island, Pernambuco, Brazil). The manager of the new center is Mario Antonio de Mello. His address is: Mr. Mario Antonio de Mello, Gerente de Projetos SEMAM/PR, Coordenador do Centro Peixe-boi Alagoas, C.P. 494 - Centro - CEP 57001, Maceio, Alagoas, Brasil.

Public Education Campaigns and Surveys of Distribution and Conservation Status of the West Indian Manatee Along the Northeast Coast of Brazil. - The National Center for the Conservation and Management of Manatees of IBAMA, with the support of the Marine Mammal Foundation and WWF, have created a Mobile Unit called "Igarakue" to carry out the first two stages of its General Work Plan: to bring to the coastal communities of the Northeast coast an elaborate public education campaign for protection of the West Indian manatee and its habitat, and to carry out a detailed survey of the species' occurrence and status. "Igarakue" was one of the terms used for the manatee in the language of the Brazilian Indians.

In January 1990, the Mobile Unit began to travel through the Northeastern littoral, beginning at the Rio Fundo (Bahia/Sergipe) and arriving at the Rio Parnaíba (Piauí/Maranhão) in April 1991. It visited 199 coastal villages in seven states, logging approximately 2000 km of coastline. Interviews of 552 fishermen provided valuable information on localities and seasons of occurrence, catch and mortality, strandings of calves and other data (Lima et al., 1992).

The surveys collected much historical and present-day information. Twenty-five manatee hunters, specialists in the art of handling their small boats and sharp harpoons, furnished very important data. They indicated that the use of harpoons to capture manatees in the Northeast is doomed by the small number of animals remaining and by their sons' lack of interest in learning this technique (Lima et al., 1992).

Along the Northeast coast today, the main causes of death and capture of manatees are the constant use of nylon nets, both beach seines [redes de encalhes] and trawls [redes de arrasto]. Regular strandings of orphaned calves were also recorded, which led the IBAMA Manatee Center to establish a Rehabilitation Unit for orphaned calves at Itamaracá Island in Pernambuco.

It appears that manatees have disappeared from the Rio Fundo estuary in Sergipe, which was identified by Albuquerque (1982) as the species' southern limit of distribution. The beach of Pontal do Peba in Alagoas is today the most southern point in Brazil where they are sighted, singly or in pairs (Lima et al., 1992).

The manatee's situation is most secure in Paraíba, Rio Grande do Norte, and Piauí. The principal areas for preservation of the species and its habitat are the estuary of the Rio Mamanguape, Paraíba, where the first Protection and Research Base

of the IBAMA Manatee Center is installed; the Guarayras lagoon and adjacent coastal zone, Rio Grande do Norte; and the estuary of the Rio Timonhas and adjacent coastal zone, Piauí (Lima et al., 1992).

Based on the maximum number of animals commonly seen by the fishermen in each locale visited, the manatee population on the Northeast coast can be estimated at less than 250. The number of animals and the frequency of sightings are said to be diminishing every year (Lima et al., 1992).

Habitat correlates of sightings indicate that 78% of the manatees are seen along the seacoast near reefs and sheltered beaches (Lima et al., 1992).

Aware of the difficulty of saving the manatee and its habitat in the principal locales where it persists, the Manatee Center made a special effort to bring to the communities of the Northeastern coast the manatee protection message and to secure the effective participation of the public in manatee conservation. With a large body of ecological and behavioral data and information on the main problems to be confronted in manatee conservation, we are now working to establish Support Bases for Manatee Protection and Research in the principal areas of manatee occurrence and to monitor other areas of occurrence in various ways, these being the next steps in the General Work Plan of the IBAMA Manatee Center.

The organization of a Mobile Unit for expeditions to the northern coast (Maranhão, Pará, and Amapá) is planned for 1992-93, as is the commencement of work with the Amazonian manatee. [Translated from Portuguese] - Regis Pinto de Lima (Centro Peixe-Boi/IBAMA, Estrada do Forte s/n, Ilha de Itamaracá, CEP 53.900, C.P. 01, Pernambuco, Brasil)

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Manatee Investigations in Paraíba. - Paraíba is, together with Rio Grande do Norte, the only state on the Brazilian Northeast coast in which the West Indian manatee has a continuous

distribution; that is, this rare and threatened marine mammal may occur at any point along the Paraíba coast. Also in Paraíba is one of the principal areas of occurrence of the manatee in the Northeast: the estuary of the Rio Mamanguape, 80 km from João Pessoa in the municipality of Rio Tinto.

In order to preserve the West Indian manatee in Brazil, the IBAMA Manatee Center has been carrying out studies since 1986 in the areas of manatee occurrence, as well as public education campaigns in the coastal communities. As a result of these studies we now know the principal areas of manatee occurrence in the state: the Rio Goiana, on the border with Pernambuco, as far up as the port of Congarari; the Pedras das Galéas, Picão and Boró Beach, in Pitimbu; the vicinity of the mouth of the Rio Abiaí; the estuary of the Rio Gramame (municipality of Conde) and its vicinity; the beaches of Nossa Senhora da Penha and Nossa Senhora do Poço, in João Pessoa; the coastal platform of Bomsucesso, in Lucena; the mouth of the Rio Miriri; the estuary of the Rio Mamanguape, municipality of Rio Tinto; and the vicinity of the Rio Guajú, on the border with Rio Grande do Norte.

In these localities the public education campaign was concentrated, using talks, films, distribution of educational material, posters, and signs. We then proceeded to a detailed survey of the traditional significance of the manatee for the fishing communities of the state, capture techniques, and manatee folklore. By means of interviews with fishermen and field trips, we evaluated the animals' frequency of occurrence and the importance of coastal environments in their life cycle.

In the Rio Mamanguape estuary, manatees are seen in groups of up to 11 which form, mainly in summer, for breeding. The area includes 6000 hectares of mangroves, important not only for manatees but for the sustenance of the fishing communities of the region (the villages of Tramataia, Coqueirinho, Camurupim, and Barra de Mamanguape, among others). The mangroves are important nurseries for fish and shrimp.

Since 1987 IBAMA has had a Support Base for Manatee Protection and Research on the Mamanguape estuary, and has monitored manatees and their environment in the area. Barra de Mamanguape has become the primary Area of Environmental Protection (APA) in Paraíba, and the only coastal conservation unit in the state.

An APA is a type of conservation unit that does not rule out human use of an area, but orders it according to a management plan. This plan is nothing more than the plan for development of the region in accord with human needs and environmental limitations.

Examples of this type of regulation are already being implemented in the area, such as regulation of navigation in the area in cooperation with local fishermen and the Port Captaincy, control and inspection of drains and sewers (and, independently, of discharges from sugar-cane plants) in cooperation with SUDEMA, control and observance of environmental legislation for the real-estate developments being planned and carried out in the coastal zone, the contacts made with ranchers, factory owners, tourists, municipal administration, fishing colonies, and public and private entities for development of diverse works of organization

and improvement of use of the area.

A Nucleus of Environmental Education has been constructed and is presently being furnished at the Manatee Center in Barra de Mamanguape. This facility, intended principally for the local communities, will also serve tourists in the region, informing them about the importance of the local ecosystem. For the IBAMA Manatee Center, the work in Barra de Mamanguape represents a more mature phase of its strategy of action. Once manatee hunting has died out, its efforts will be invested in maintenance and improvement of the quality of the environment and consequently of human life, fundamental to the peaceful coexistence of man and nature. [Translated from Portuguese] - Danielle Paludo (Centro Peixe-Boi/IBAMA, Av. Dom Pedro II, no. 3484, CEP 58.040, João Pessoa, Paraíba, Brasil)

CARIBBEAN REGION

Manatee Research in Colombia and Venezuela. - Save the Manatee Club (SMC) and the U.S. Fish and Wildlife Service's Sirenia Project (FWS) funded the Caribbean Stranding Network (CSN) to conduct base-line research on the little-known Colombian and Venezuelan manatee this past summer. Marine biologists Antonio Mignucci (from Puerto Rico) and Rubby Montoya (from Colombia) visited eight localities in Colombia and Venezuela, examining a total of 23 semi-captive or captive Antillean manatees and two captive Amazonian manatees.

Mignucci and Montoya's research dealt with the history of each manatee (how they came to be captive or semi-captive) and their health status. After conducting interviews relating to the capture of the manatees, they used benign techniques of morphometrics and blood and fecal sampling to assess the health of each animal. A small piece of skin was also taken for genetic studies to be conducted by FWS.

In most instances, the animals were originally captured by fishermen as calves from nearby rivers to be butchered and sold in the local market. Most of the animals examined were rescued by either CSN's participants, concerned citizens, or government agencies before they were sold. Mignucci and Montoya believe that fishermen actually capture both mothers and calves, but the large females are either killed or, with their strength, break loose from the nets, leaving the more easily-handled calves in the hands of the fishermen. They then attempt to sell the live calves in the market for meat, but when CSN participants or government officials learn about it, they confiscate the animals, transporting them to protected semi-captive or rehabilitation facilities in Colombia.

During the past three years, CSN participants in Colombia have been involved in the rescue of over 15 manatees, creating three protected semi-captive colonies in artificial lakes and a rehabilitation facility where animals are safe from poaching. One of these colonies consists of 10 animals and the other two have two animals each. The rehabilitation facility has at present a colony of five manatees. In two of the colonies, to the surprise of Montoya and Mignucci this summer, two babies were born - one conceived in the semi-captive environment, while the other was

born from a female rescued already pregnant and close to giving birth.

External examinations and the blood analyses revealed that most of the manatees were in good health, except for an animal kept by the Barranquilla Zoo, which for the past three years has been kept in extremely inhumane conditions. The pool occupied by this seven-foot female - named Zallida - is only 18 inches deep, impeding her swimming and normal growth. She is also even fed meat at times! The CSN is leading efforts with the Colombian government's natural resources agency to rescue Zallida from this precarious condition and send her for rehabilitation to one of the CSN-sponsored semi-captive colonies where she could convalesce and live in a healthy, spacious, and protected manatee community.

The funding provided by SMC to the CSN during the past two years has enabled Latin American biologists in Puerto Rico and Colombia to begin studying manatees in areas where they have not previously been studied, and where their chances of survival are severely hampered by direct and heavy poaching by fishermen. SMC funds have also aided in beginning education campaigns in these areas which will help change the attitudes of Latin Americans, and move toward better protection of manatees throughout their entire range. - Antonio Mignucci

FLORIDA

Sirenia Project News. - Tom O'Shea, former Sirenia Project Leader in Gainesville, Florida, took the position of Assistant Director of the National Ecology Research Center (NERC) in Ft. Collins, Colorado, in late July 1992. Since the Gainesville Sirenia research lab is a field station of NERC, we haven't lost him; we're just sharing his many talents. Tom has long wanted to return to Ft. Collins, where he and his wife Sherry went to college, and where Sherry's parents still live. Lynn Lefebvre has been serving as Acting Sirenia Project Leader, and is currently in the process of officially applying for the position.

Lynn Lefebvre, Galen Rathbun (Sirenia Project Leader before Tom), and John Reynolds III visited Chetumal, Mexico, in early September to discuss current and future manatee research and management efforts in the state of Quintana Roo, Mexico, and its neighbor to the south, Belize. The Centro de Investigaciones de Quintana Roo (CIQRO) hosted the meeting, and representatives from CIQRO and the Belize Ministry of Natural Resources and Coastal Zone Management Project also participated. Lynn has since prepared a study proposal to initiate a cooperative project on manatee conservation in the Chetumal Bay-Belize region, which is being submitted to the U.S. Fish and Wildlife Service's Office of International Affairs. The U.S.-Mexico Joint Committee will review proposals at their meeting in Texas in early December.

Jim Reid is in Puerto Rico, radiotracking and retagging manatees that were captured and tagged there last May. The project is providing information on manatee movements and habitat use, particularly in the vicinity of Roosevelt Roads Naval Station. Additional manatees will be radiotagged in Puerto Rico next spring. - Lynn Lefebvre

"Missing Link" in Dugong Evolution Discovered. - Although sirenians in general have a comparatively good fossil record, the extant dugong has remained alone among the three Recent genera in lacking any documentation at all of its immediate ancestry. Even its more remote ancestry within the Dugongidae was unclear until last year, when it became apparent that Dugong dugon is cladistically a member of a group (now renamed the Dugonginae) whose origin and greatest diversity appear to have lain in the Caribbean region (see Sirenews Nos. 7, 14, and 16). My expectation has been that Dugong would prove to have evolved in the Indopacific region (where a useful sirenian fossil record is still lacking) from primitive dugongines that had dispersed across the Atlantic to the Old World and reached the Indian Ocean by way of the Tethys Seaway, probably by the Early Miocene.

This plausible scenario now seems ruled out by the discovery of a fossil skull very similar to that of D. dugon - in, of all places, Florida! The nearly complete and splendidly preserved skull was found in a shell pit near Punta Gorda on Florida's Gulf Coast. It is now in a private collection, but negotiations are in progress to secure it for a museum. It appears to be of Late Pliocene age, perhaps less than 2 million years old, and therefore the latest known record of a dugongid of any kind in the Caribbean-West Atlantic.

Morphologically, the specimen shares several derived character states with the modern dugong, and it would be reasonable to refer it to the same genus. However, it is significantly more primitive than D. dugon in several respects, particularly in its dentition. Most importantly, its cheek teeth are unmodified from the ancestral condition - i.e., brachydont and bunodont with well-developed enamel crowns showing a typical dugongid cusp pattern. D. dugon, in contrast, has vestigial enamel crowns that quickly wear off, as well as ever-growing roots on the last two molars. The fossil species has large, fully-erupted tusks, but these likewise appear to have borne small, conical enamel crowns and seem more primitive than those of the Recent species. On the whole, the Punta Gorda skull is virtually a perfect intermediate form linking D. dugon with the dugongines of the Late Oligocene and Early Miocene, and confirms my expectations that the dental specializations of the modern dugong are of relatively recent origin, like (indeed, even more so than) those of Hydrodamalis and Trichechus.

Totally unexpected, of course, is the discovery that an animal so close to the modern dugong in time and morphology once existed in the New World. It raises numerous and obvious questions - whether and by what geographic route the Caribbean species gave rise to the Indopacific one; whether the same or a similar form inhabited the Indopacific in the Pliocene; how it partitioned the Caribbean seagrass resources with other Pliocene dugongids; what role, if any, manatees invading the Caribbean from South America played in the extinction of dugongs in the New World. All that is clear for the moment is that the sirenian fossil record is far from being completely known. - DPD

INDONESIA

Dugong Seminar. - Hans de Iongh reports that his team hopes to organize a seminar on dugong ecology by the end of 1992 in Ambon, inviting national experts and possibly a number of foreign experts. They are in communication with UNESCO concerning possible financial support. No further details are available at this time.

Dugong Sightings in Indonesia. - Staff of the EC-funded Project for Dugong Conservation and Management recently made a number of field sightings of dugongs, which are a protected species in Indonesia.

The first encounter took place in Kampung Dusun Toisapu, Desa Hutumuri, on the south coast of Ambon. Fisherman Johannes Souhwat had caught a juvenile dugong, nicknamed Nelly, on 8 January 1992 at 22:00 h in his gillnet, which was set close to the village. When project staff arrived, he had tied the animal by the base of the tail fluke to an anchored rope. The animal had a total length of 1.20 m and was still suckling; however, it accepted small amounts of seagrass.

According to local people a larger dugong, probably the mother, tried to approach the calf at night, and it was decided to release the latter the same night at high tide.

On 8 April 1992, another fisherman named Rahman caught a dugong in his gillnet close to Hative village, in the outer Bay of Ambon near the airport. This animal was also tied by the tail with an anchored rope, and when project staff were notified two days later, on 10 April, it had severe abrasions on the skin where the rope was attached. This dugong measured 1.80 m, and was released the same day on the advice of project staff and by order of the local officer of the Nature Conservation Service PHPA.

Finally, project staff encountered an adult dugong while snorkeling in the Bay of Saparoua on 15 March 1992. The animal approached to within 2 m in crystal-clear water and swam past two snorkeling staff members (Tiny Luiten and Janien van Rossum). It had in its mouth a branch with leaves, which was later identified as a mangrove twig (Sonneratia alba), commonly found near the Bay of Saparoua.

Another sighting of a captured dugong was reportedly made on 13 January 1991 by staff of the Ancol Oceanarium and villagers of the Desa Tanjung Jaya in West Java, close to the National Park Ujong Kulon, in the Bay of Miskam. Local people stated that this animal was up to 3.30 m long, but careful analyses of photographs proved that it was perhaps 2.40 m long. This dugong had been caught in a traditional tidal trap (sero) and had also been tied by a rope to an anchor. It was eventually released by order of the local police superintendent.

According to villagers, their tidal traps regularly get destroyed by dugongs, particularly during the West Monsoon, when dugongs tend to seek shelter in the Bay of Miskam near the village. So far, each year two seros have gotten damaged this way, indicating the presence of dugongs or other large marine creatures. In the Bay of Miskam some 50 tidal traps were in use at the time of our visit. - Hans de Iongh

PUERTO RICO

Rescued Manatee Calf Thriving. - Moses, a baby manatee rescued by the Caribbean Stranding Network (CSN) in November 1991 as a two-week-old orphan weighing 60 pounds, had attained a weight of 320 pounds as of August. He is being kept at the Isla Magueyes Marine Laboratories at La Parguera. His milk intake has been reduced from 3.6 to 2 liters of goat's milk and soya formula per day, and he is now eating 40 pounds of plants per day, with complete weaning anticipated by the time he reaches his first birthday. Six months later, he will be transferred to an enclosure in the sea where he can acclimate to a marine environment over the next four to six months. If all goes as planned, he will then be radiotagged and released into the wild.

During the past ten months, several private firms, as well as the Save the Manatee Club and numerous private citizens, have supported the care of Moses and other marine animals being rehabilitated by the CSN. The CSN is totally dependent on such donations; the cost of caring for the baby manatee alone now amounts to some US\$40 per day, and has so far exceeded US\$20,000, not including the caretakers' time. Those desiring more information about him, or wishing to help with his support, can contact the Caribbean Stranding Network, P.O. Box 908, Lajas, PR 00667. [Translated from Spanish] - Antonio Mignucci

TRINIDAD AND TOBAGO

Manatee Exhibit. - The Trinidad and Tobago Field Naturalists' Club mounted an exhibit on the West Indian manatee as part of a national exhibition entitled "Our Marine Heritage", which took place at the Cruise Ship Complex, Port of Spain, during the period September 22-27, 1992. The exhibit has been designed as an ongoing, interactive educational resource covering broad environmental issues and making a strong statement for the protection of manatees and their habitat. It is designed to be transportable for wider public exposure. We hope to target rural populations in proximity to manatee habitats, encouraging community conservation efforts.

The Club will also be presenting a lecture and panel discussion on manatees at St. Mary's College on March 11, 1993. Please contact us if you can contribute to our ongoing educational efforts in any way (with audio or audiovisual material, manatee models, posters, etc.). - Jalaludin Khan (Trinidad & Tobago Field Naturalists' Club, c/o Mr. Hans E. A. Boos, Curator, Zoological Society of Trinidad & Tobago Inc., Emperor Valley Zoo, St. Clair, Port of Spain)

Manatee Surveys. - In 1991, as part of its ongoing manatee study, the Forestry Division (Wildlife Section) conducted an aerial survey of the North Oropuche/Nariva Swamp areas. The researchers were looking for the characteristic concentric rings made in the silty water when a manatee dives. The research team recorded evidence of four manatees.

This survey was followed up with a 1991 boat survey along the North Oropuche River. This time evidence of manatee feeding

was sought and found.

Manatees in Trinidad and Tobago are threatened by drainage of swamps and wetlands, particularly development of the Nariva Swamp for rice and aquaculture; pesticide runoff and water pollution; and mortality in fishing nets. There have been reports of manatee meat being sold at local markets, but whether this represents deliberate killing for meat is not easy to ascertain. - Debby Seddon [abstracted from an article in the Port of Spain Express, July 8, 1992, p. 42]

ABSTRACTS

The Nutritional Ecology of the Dugong (Dugong dugon) in Tropical North Queensland (Janet M. Lanyon). - The dugong is a large, long-lived marine mammal with a low and highly variable reproductive rate. Within tropical north Queensland its breeding pattern is diffusely seasonal, with most calving occurring between September and November. Dentinal layer deposition in the tusks indicates that growth is also seasonal. This study examined the effects of variation in nutrient availability on growth and reproduction of the dugong in tropical north Queensland. Nutrient availability was considered in terms of diet selection, the digestive structure and function of the animal, and the structural and chemical composition of the diet.

The dugong is a benthic-feeding herbivore grazing almost exclusively on seagrasses. Seagrasses are structurally and chemically distinct from terrestrial monocotyledons, being generally low in total nitrogen, fiber, and lignin and having generally different fracture and digestive properties from terrestrial grasses. Their high breakability is reflected in the specialized mechanical processing organs of the dugong.

The morphology, structural composition, small size, and high variability of the cheekteeth of the adult dugong indicate that the teeth do not play an important role in the maceration of seagrass. In contrast, the development of opposing horny pads provides a highly effective food ingestion and processing organ capable of effectively processing large quantities of low-fiber seagrass during short dive times. The nature of seagrass also makes it particularly amenable to mechanical and fermentative reduction during passage through the long digestive tract. The gut passage rate of the dugong is one of the slowest measured in any mammal.

The high degree of specialization of mouthparts with the loss of functional teeth may impose constraints on the feeding niche of the dugong. Diet selection in the dugong is correlated with the chemical and structural composition of seagrass. The more frequently selected species are lowest in fiber and highest in available nitrogen and presumed digestibility (based on particle size reduction of the digesta). Digestibility is likely to vary depending on the seagrass species selected. One of the most fibrous seagrasses, Zostera capricorni, appears to be the least digestible based on the large particle size in the feces. The preferred species are lower seral or "pioneer" species. Within tropical north Queensland, assemblages of these preferred species are typically found in shallow inshore coastal regions.

The highly specialized dietary requirements of the dugong suggest that only certain seagrass meadows may constitute suitable dugong habitat.

Variation in the abundance of tropical intertidal seagrasses, especially those species preferred by dugongs, follows a seasonal pattern with maximum abundance in the wet season and minimum abundance in the dry season. It appears that wet-season conditions are favorable for maximum seagrass growth. If nutrient limitation occurs, it is likely to be in the dry season when available nitrogen levels are lower and the most digestible and least toxic seagrasses are generally less available.

This seasonal pattern of nutrient availability correlates with the breeding pattern of the dugong. Most births coincide with the time of greatest nutrient availability. During late pregnancy and early lactation, energetic requirements are likely to be greatest for the female dugong. In addition to high interyear variation in nutrient availability, the tropics are subject to longer-term unpredictable fluctuations in rainfall, storm/wind action, and nutrients available for seagrass growth. This variation and unpredictability in nutrient availability may consequently influence the reproductive strategy of the dugong and may be at least partly responsible for its slow and highly variable breeding pattern. [Abstract of a doctoral thesis in Ecology and Evolutionary Biology submitted to Monash University, Australia, in August 1991 and supervised by Gordon Sanson and Helene Marsh.]

Interactions Between Dugongs and Seagrasses in a Subtropical Environment (Tony Preen). - This study investigated the ecology of dugongs in subtropical Moreton Bay, Australia. The dugongs' distribution, movements, home range, habitat selection, feeding, diet, and food preferences were examined in relation to seagrasses and physical resources.

Seagrasses were quantitatively mapped in two study areas, encompassing 133 sq. km of seagrass, in Moreton Bay. Communities dominated by species of Halophila were the most widespread, covering 51% of the total area, but they accounted for only 9% of the total standing crop of seagrass. In comparison, communities dominated by Zostera capricorni (broad-leaf morph) occupied 38% of the area of seagrass, but contained 75% of the standing crop.

Some areas were rarely, if ever, used by dugongs, while other areas were persistently used. Almost all of the avoided areas were dominated by Z. capricorni. Of the dugongs sighted on seagrass during 28 aerial surveys (n = 8,504), 76% were in areas dominated by Halophila. Likewise, 75% of locations from satellite-tracked dugongs (n = 773) were from Halophila-dominated areas. Dugongs feeding in areas dominated by Z. capricorni (broad) frequently grazed selectively, avoiding patches of Z. capricorni. Excluding the contribution of Z. capricorni (broad), the mean biomass where dugongs were sighted and where tracking fixes occurred was 21.2 g DW/sq. m and 15.3 g DW/sq. m, respectively. In comparison, communities dominated by Z. capricorni (broad) typically contained 100-200 g seagrass/sq. m.

Based on the nutritional composition of the dugongs'

preferred species (Halophila ovalis > Halodule uninervis thin > Halophila spinulosa > Syringodium isoetifolium > Z. capricorni broad), it is apparent that they select primarily on the basis of high nitrogen and low fiber content. They may also select for high soluble carbohydrate content during spring, when they fed on fruiting Z. capricorni (thin-leaf morph).

Grazing dugongs removed 85.6% of shoots, 90.8% of above-ground biomass, 58.5% of rhizome biomass and 25.1% of root biomass from along feeding trails. Total biomass (above- plus below-ground) was reduced by 53.1% along feeding trails, or 65.2% excluding sites dominated by Z. capricorni.

Dugongs in Moreton Bay probably suffer particular nutritional stresses, especially during winter, due to (1) the limitation of nitrogen availability, due to seasonally low levels of nitrogen content and seagrass abundance, and (2) cold water temperatures. For one quarter of each year, the water on the eastern banks is below 19 C, which may be close to the threshold temperature below which dugongs cannot maintain homeostasis indefinitely. The dugongs counter these winter stresses by (1) regularly migrating to an oceanic area outside the Bay (a 15-40 km round trip), thus raising their ambient temperature by up to 5 C, and (2) by maximizing the quality of their diet. They optimize their diet by (1) selectively feeding in communities and patches of favored, nutritionally superior seagrasses, (2) feeding on invertebrates (the remains of ascidians occurred in 73% of fecal samples, constituting, on average, 26% of the bulk of the samples), and (3) "cultivation" grazing.

"Cultivation" grazing occurs when the large herds of dugongs that are typical of, and perhaps unique to, Moreton Bay (median herd size was 140) feed persistently at one location for periods of up to 35 days. As a result, they can reduce the abundance of seagrass by as much as 95% over large areas (40-75 ha). Disturbance caused by "cultivation" grazing can effect changes in the species composition, age structure and nutrient status of seagrass meadows. These changes may result in a meadow-wide increase in nitrogen levels and decrease in fiber levels.

By concentrating their grazing in favored regions, dugongs may alter the composition of seagrass communities over large areas (several square km). It is suggested that grazing by dugongs is responsible for some of the spatial heterogeneity of seagrass communities on the eastern banks in Moreton Bay.

In favored areas, dugongs may consume on the order of 28% of the total seagrass production. This compares with consumption levels of <3-10% of above-ground production only by grazers (invertebrates, fish, waterbirds) in other studies (excluding atypical populations of urchins). Previously, little attention has been paid to the role of large herbivores, such as sirenians and green turtles, in the energy flow through seagrass systems. Consequently, our understanding of the functioning of these systems has been based on the assumption that large herbivores do not consume a significant proportion of production, and therefore do not play a major role in the ecology of the systems. The results of this study question those assumptions. [Abstract of a doctoral thesis in Zoology submitted to James Cook University, Townsville, Australia, and supervised by Helene Marsh.]

Chetumal Bay and its Importance to the Manatee in the Mexican Caribbean (Benjamin Morales V. & David Olivera G.). - In recent years a considerable amount of detailed information has been generated concerning the manatee in Quintana Roo, Mexico. Previously there was only partial information derived from a preliminary reconnaissance of the coasts of the Gulf of Mexico and Mexican Caribbean carried out by Campbell and Gicca in 1976 (Campbell & Gicca, 1978).

This new information has been generated from various field observations such as those of Gallo (1983) in creeks and sinkholes in the northern part of the state, and those of Fuentes and Aguayo (1989) along the coasts of Quintana Roo. With this latter work we began to glimpse a possible north-south gradient of distribution of animals in the state, and the importance of Chetumal Bay began to be evident.

In 1987 and 1988 the manatee research effort was intensified throughout the state. As a result, Colmenero et al. (1988) obtained a population estimate of 110 animals in Quintana Roo, and showed that most of these were found in the extreme southern part of the state within the Chetumal Bay system.

In April 1990 we began a study of the manatees of Quintana Roo, focusing principally on the Chetumal Bay system. In April 1991, at the 16th International Conference on the Study of Marine Mammals held in Nayarit, we presented the first results, among which were a population estimate for Chetumal Bay of 88 ± 17 manatees and the identification of several important areas (Morales & Olivera, 1991). The objective of this work is to demonstrate the importance of Chetumal Bay for the conservation of the manatee in the Mexican Caribbean. [Abstract of a paper presented at the 17th International Conference on the Study of Marine Mammals, La Paz, Baja California Sur, Mexico, April 21-25, 1992. Translated from Spanish.]

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