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EDITORIAL

As you read this issue of Sirenews, manatee conservation efforts in Florida are culminating in some of the most critical, but hopeful, developments in years. The manatee death rate in the state has reached an all-time high (115 as of 1 September, compared to 133 in all of the record year of 1988), and as usual, boat and barge collisions are by far the leading cause of death. The same cause accounts for an even greater number of human deaths and injuries. In response to these alarming increases in mortality, the Department of Natural Resources (DNR) has proposed a wide-ranging set of recommendations to improve boating safety and manatee protection in the state. A series of public hearings and other meetings on these recommendations is in progress, climaxing in a meeting of the Governor and Cabinet on 24 October where those recommendations not already adopted will hopefully be approved.

Some of the more important recommendations, detailed in a 25-page DNR document, are the following: mandatory boating safety courses for boat operators; establishment of a statewide maximum boat speed limit of 30 mph in or near a marked channel or near a shoreline; establishment of a maximum speed limit of 20 mph in all inland waters accessible to manatees in twelve key counties, except in marked channels where the limit would be 30 mph; creation of several new manatee protection zones where boat speeds would be still more tightly regulated; designation of large manatee preserves from which boats and swimmers would be excluded altogether; and further limitations on construction or expansion of powerboat slips.

Needless to say, these proposals have stirred up considerable controversy in the state, especially on the part of the boating industry. In a number of raucous public meetings, boaters and representatives of the marine industries harshly criticized DNR's recommendations as unacceptable to the boating public. This allegation, however, was dramatically blown out of the water by the recent release of a timely public opinion survey of Florida's registered boat owners. This survey was commissioned by the Save the Manatee Club and carried out by Dr. Suzanne L. Parker of the respected Survey Research Laboratory at Florida State University. It shows beyond any doubt that Florida boaters strongly support not only manatee protection but boat speed limits, installation of propeller guards, stricter enforcement of boating safety laws, higher boat registration fees to pay for the latter, mandatory boating safety courses, and even mandatory

boat operator's licenses requiring written tests. This is especially impressive when one considers that boat operator's licenses are not yet even being proposed, and until very recently were considered politically unthinkable!

In other words, the typical Florida boater is not the irresponsible, reckless driver of an overpowered speedboat, but on the contrary is deeply concerned about safety, the public welfare, and the protection of natural resources, and is willing to make sacrifices to promote all of these. In this respect (s)he is even out ahead of his/her elected officials, who will hopefully see a mandate in the results of this survey and find the political courage to take stronger steps. We all owe the Save the Manatee Club and its Executive Director, Judith Delaney Vallee, a debt of thanks for supplying this badly needed ammunition at a crucial moment in the battle.

Pat Rose, Pam McVety, and their staffs at DNR also deserve thanks for the dedicated work that has brought us to this historic point. If the Governor and Cabinet adopt all of their recommendations at this month's meeting, we will be a large step closer to ensuring the future of Florida's manatees. But many steps on that road remain. The underlying issue of human population growth needs to be still more directly, frankly, and effectively addressed (see Review in this issue), in Florida as in the rest of the world. Good news from Australia and Belize (see below) notwithstanding, the fight for sirenian survival has not yet been won. - DPD

CORRECTION

Randy Reeves has pointed out the error in our last issue's headline. Among marine mammals, not only dugongs but also walruses form leks.

AWARD

Dr. Edgardo Mondolfi, biologist, Venezuelan Ambassador to Kenya, and a member of the Sirenia Specialist Group, was among 114 individuals and groups named on 5 June to receive one of the United Nations Environment Programme's Global 500 Awards. These awards are given to individuals and organizations making significant practical contributions to preserving and improving the environment.

ELECTRONIC MAIL COMMUNICATIONS

For those wishing to send news articles or other material to Sirenews, we can now be reached via BITNET at the following address: MMDAN01@HUMAIN. Please indicate "Subject: Sirenews" in addressing material to us.

LOCAL NEWS

AUSTRALIA

Dugong Numbers in Western Australia. - Through the work of Paul Anderson and Bob Prince, it has been known for more than a decade that Shark Bay and Exmouth Gulf in Western Australia are major dugong areas. The Western Australian Department of Conservation and Land Management (CALM) funded Keith Saalfeld and myself to travel to Western Australia in July 1989 in order to conduct an aerial survey of these areas using the same techniques as we had been using in Queensland and which Bill Freeland and Peter Bayliss have used in the Northern Territory. The remainder of the survey crew were from CALM and included Bob Prince. Paul and Donna Anderson gave us the valuable benefit of their considerable local knowledge which was a great help in stratifying the survey in Shark Bay.

The results are very exciting. We estimate that there are at least 10,000 dugongs (10,146 +_ s. e. 1478) in Shark Bay and a further 2000 (1964 +_ 363) in the Exmouth Bay-Ningaloo Reef area.

The distribution of animals in both areas was unexpected. Although there were the expected large numbers of animals along the eastern shore of Dirk Hartog Island, there were also many dugongs in water 11 to 19 m deep extending right across the central third of the Bay. This distribution pattern will be easier to interpret when we obtain the satellite maps of thermal gradients in the Bay at the time of the survey. However, it certainly suggests that further investigations are needed into the distribution of seagrasses and dugong movements within the Bay.

The dugongs were distributed along the western side of Exmouth Gulf as we expected, but we were surprised to find that about half the dugongs in the region were outside Exmouth Gulf in the lagoon of the Ningaloo Reef complex in exceptionally clear water. Whether this is a seasonal phenomenon is unknown, but the clear waters of Ningaloo Reef certainly offer the best conditions I have seen to obtain good underwater photographs of dugongs, as evidenced by the excellent photographs that have been obtained by a local diver. - Helene Marsh

Update on Dugong Numbers for Australia. - Minimum population estimates +_ s.e. (corrected for submerged dugongs and those missed on the surface) are listed below for the various regions of Australia surveyed so far:

Shark Bay	10146 +_ 1478
Exmouth Bay-Ningaloo Reef	1964 +_ 363
Northern coast of the Northern Territory	13800 +_ 1125
Western Gulf of Carpentaria	16816 +_ 2946
Torres Strait	12522 +_ 1644
Northern Great Barrier Reef Region	8110 +_ 1073
Southern Great Barrier Reef region	3479 +_ 459

Southeast Queensland (Hervey & Moreton Bays) 2429 +_ 365

TOTAL: 69266 +_ 4057

The Kimberley coast of Western Australia and the Gulf of Carpentaria coast of Queensland are still to be surveyed. - Helene Marsh

Dugongs in Deep Water. - The importance of water 10-20 m deep to dugongs is increasingly apparent. Rob Coles and his group from the Queensland Department of Primary Industries recently completed a survey of the seagrass beds in the northern Great Barrier Reef region between Lookout Point, Barrow Point, Lizard Island (30 km offshore), the Howick Islands and the mid-shelf reefs. The survey was funded by the Great Barrier Reef Marine Park Authority in response to my observations that an estimated third of the dugongs in this area were sighted more than 20 km offshore in an aerial survey in November 1984 [see Sirenews No. 6]. Coles and his team found seagrass on more than 95% of their dives and at depths to 28 m. Halophila was the only genus of seagrass below 10 m. Dugong feeding trails were seen down to 23 m in areas with about 10% cover of Halophila spinulosa and Halophila ovalis/decipiens. - Helene Marsh

BELIZE

Manatee Status in Belize Remains Healthy. - Under authorization of the Belize Ministry of Agriculture, Forestry, and Fisheries, we undertook a brief status survey of the West Indian manatee in Belize, including aerial counts over selected areas, in May 1989. The survey was carried out with support from the Save the Manatee Club, Lowry Park (Tampa) Zoological Garden, British Forces Belize, and several helpful individuals.

Accounts from 10-20 years ago (see Charnock-Wilson, Oryx 9: 293-294, 1968 and Oryx 10: 236-238, 1970; Bengtson & Magor, Jour. Mamm. 60: 230-232, 1979) reported that manatees were relatively common in Belize in comparison with other nations of the Caribbean and Central America. However, aerial counts had not been attempted in Belize since 1977. We made overflights of five key areas that in the 1977 aerial surveys were notable for the occurrence of multiple sightings of manatees: Four Mile Lagoon and the lower New River; the lower Belize River; keys (cays) off Belize City; Southern Lagoon; and Placentia Lagoon.

Numbers of manatees seen were comparable to or greater than those seen in each of these areas during 1977, although all the usual caveats about numbers obtained in manatee aerial surveys should be kept in mind. A total of 103 were noted in 5.4 hours of search time in May 1989. A unique circumstance was noted for the inshore Southern Lagoon, where some 55 manatees were counted (in turbid water) over a relatively small area, apparently drawn to an upwelling freshwater spring. Nowhere else in the greater Caribbean have comparable numbers or densities of manatees hitherto been observed, except for the southern part of

Quintana Roo near the Bay of Chetumal bordering Belize, as reported by Luz del Carmen Colmenero Rolon and her colleagues in a recent agency report.

Manatee habitat in Belize is excellent, human population density is low, the gill-net fishery is small, and there is no strong tradition of manatee hunting. Manatees are protected by law. These factors easily explain why manatee population status seems healthy and little changed. Manatees were easy to approach in boats, indicating an absence of the strong fear of man seen where they are hunted. Illegal killing is reported, but seems to be at a very low level. Manatees we approached on the water or saw from the air did not have noticeable propeller scars, indicating that collisions with boats are not a major problem as in Florida.

This population could serve as a source for natural recolonization in nearby countries if conditions elsewhere improve and at the same time do not deteriorate in Belize. We hope that as development proceeds such deterioration does not occur. This can be guarded against by maintaining legal protection for manatees, continuing to restrict gill-netting, creating manatee reserves in areas like Southern Lagoon, and continuing with manatee conservation education programs similar to the existing efforts of the Belize Zoo. - Tom O'Shea and Lex Salisbury

FLORIDA

Opportunity for Research on Captive Manatees. - In late 1990, the Lowry Park Zoological Garden in Tampa will be completing a manatee display, research and rehabilitation facility. The manatee complex will consist of two (one 75,000-gallon and one 125,000-gallon) mixed-species, freshwater ozonated tanks with underwater viewing. Additionally, there will be three 25,000-gallon rehabilitation tanks and a manatee hospital (critical care facility). Situated between the 4' deep, 75,000-gallon pool and the 8' deep, 125,000-gallon tank will be a 750-square-foot underwater observation office with clear views of both tanks through large windows. From this office it will be possible to conduct ethological studies and filming of the animals in the tanks. There will also be opportunities for acoustical research, as conduits will be run for hydrophones, although no hydrophones will be provided by the zoo.

We will offer this facility as a resource to institutions wishing to conduct research on manatees. Grant monies will be necessary for capital equipment required for projects. Lowry Park Zoo will simply supply the work station.

We anticipate approving projects by early next year for research to be conducted in late 1990 or early 1991. Interested parties should send their research proposals for evaluation to: C. Lex Salisbury, General Curator, Lowry Park Zoological Garden, 7530 North Boulevard, Tampa, Florida 33604 USA. - Lex Salisbury

JAMAICA

Alligator Hole River Project. - On 23 September 1989 I had the opportunity to visit the Alligator Hole River on Jamaica's south coast near the Milk River mineral bath resort. Here, a beautiful spring-fed stream flowing 1.9 km through a Phragmites marsh into the Caribbean has been set aside as a nature reserve. This environmental project, which has included the impoundment of several manatees, was the subject of a 1987 University of Florida master's thesis by Larry Hurst.

The facilities at Alligator Hole River presently include a small building overlooking the river's headwaters and containing charts and displays illustrating the basic natural history of the area, including several manatee posters. There are also picnic tables and toilets for the use of visitors, and a skiff and a couple of aluminum canoes that visitors can borrow to explore the river. There is no charge for the use of these, but donations are welcomed.

The caretaker on duty stated that there are four manatees impounded in the river at present, all females. In earlier years of the project, manatees were kept in the river by a fence at the river's mouth and/or by being tethered by their tails with ropes. Now, however, he said that there is a sandbar at the river's mouth that keeps in the manatees in lieu of a fence. He also said that the manatees prefer to stay near the mouth and only come up into the headwaters at night when it is quieter. Therefore it seems unlikely that the average visitor will ever see one. Hurst's recommendation that a barrier be erected to keep one or more of them in the headwaters and visible to visitors has not been implemented. The headwaters appear to contain abundant Ceratophyllum, the manatees' main food in the river, so it does not seem that the present four animals have exceeded the river's carrying capacity. Unfortunately, time did not permit me to visit the lower reaches of the river.

The visitors' register gave evidence of only a few visitors per week, and those mostly foreign. A two-page questionnaire solicited visitors' comments on the reserve and its facilities. My main criticism was that the site, which lies two and a half miles from the nearest bus line, seems insufficiently accessible to the poorer inhabitants of the region, who are of course the ones most in need of environmental education. Greater human use of the area, on the other hand, would entail greater expenditures for facilities and park rangers and result in at least some degree of harmful impact.

On the positive side, the reserve is still in pristine condition and does not seem to be threatened by development in the near future. But it must be doubted whether the continued impoundment of manatees in the river is justifiable, given that they are thereby removed from the already very small breeding population in Jamaican waters and that there is minimal opportunity for the public to see them under the present circumstances.

The Alligator Hole River Project is under the jurisdiction of the Natural Resources Conservation Division (NRCD) (Dr. Marcel Anderson, Principal Director). I subsequently was able to talk with Mrs. Beverly A. Miller, Senior Programme Officer of UNEP's Caribbean Environment Programme Regional Coordinating Unit. She stated that her unit is attempting to draw up an intergovernmental management plan for manatees throughout

the Caribbean area, and that she expects this task to be completed within a couple of years. She also said that NRCD will be creating a management plan of its own specifically for Jamaican manatees. An existing plan for creating a system of national parks in Jamaica, which would include the Alligator Hole River and the surrounding area, has yet to be carried out.

The Sirenia Specialist Group stands ready to assist these and other such efforts throughout the world with whatever technical advice or information we have at our disposal, and we encourage the Jamaican agencies involved to develop their management plans without delay. The pressures of growing human populations throughout the Caribbean basin leave little time (and less money) for manatee protection; but the present is the only opportunity we have to preserve the future. - DPD

The World's Oldest Sirenian. - Also in September 1989, I spent a week in search of additional fossil specimens of Prorastomus sirenoides, the oldest and most primitive known sirenian. This beast was originally described in 1855 by Sir Richard Owen on the basis of a single skull from Freemans Hall, Jamaica; the unique type specimen resides in the British Museum (Natural History). No other specimens have hitherto been reported. Although the postcranial skeleton was unknown, the extremely primitive features displayed by the skull had led to the suspicion that Prorastomus may still have been an amphibious animal with functional hind legs. Hence the collection of limb bones was a high priority for fieldwork.

Together with veteran fossil seacow collector Frank Garcia (Museum of Science and Industry, Tampa, Florida) and Steve Donovan and Hal Dixon from the Department of Geology, University of the West Indies (Kingston), I visited the Freemans Hall area in Trelawny Parish and searched for limestone nodules of the sort that produced the original specimen. Recent geological studies indicate that the most likely source beds of the latter are not Middle Eocene (as nearly all published works state) but late Early Eocene in age. This makes Prorastomus somewhat older than any other fossil sirenian yet named (50 million years in round numbers), and supports the possibility that it may be an actual ancestor as well as a structural ancestor of other sirenians. Unfortunately, we failed to turn up any bones in these strata.

We also visited a spot where a new species of fossil crocodile was discovered in 1968, in northern Manchester Parish near the charmingly named village of Dump. Here we were more successful: in beds of early Middle Eocene age, we recovered skull fragments and teeth indistinguishable from those of Prorastomus, and with them several vertebrae and ribs. We still did not get any hindlimb bones, so the question of amphibious vs. purely aquatic locomotion is not definitively settled; but at least we demonstrated the possibility of collecting more material of this enigmatic creature and shedding further light on the origins of the Sirenia. - DPD

WASHINGTON, D.C.

Grant Awarded for Sirenian Bibliography. - The Smithsonian Institution's Atherton Seidell Endowment has awarded a generous grant to aid in the indexing phase of the sirenian bibliography project during 1989-90. This will enable me to spend a large part of my sabbatical leave this academic year on indexing the most essential of those works in the database that have not already been indexed, and on entering the index into the computer. Computerization of the main bibliographic entries, A-Z, was completed this past summer. Once the high-priority indexing and computerization of the index are finished, it will be possible to produce camera-ready copy for publication of a first edition. The Smithsonian Press has expressed interest in publishing the work in its new occasional series Smithsonian Research Monographs; it will most likely comprise two sizable volumes.

I wish to express my thanks and those of the entire sirenian research and conservation community to the Seidell Endowment, and to Dr. Clayton E. Ray for his indispensable help in obtaining this grant and his enthusiastic support of this project over many years. - DPD

REVIEW

What is Statistics? Videotape produced by the Chedd-Angier Production Co. for the Consortium on Mathematics and its Applications (COMAP), 1989. (Available from the American Statistical Association, 1429 Duke St., Alexandria, Va. 22314 USA. Price US $50.00.)

This short video (about 15 minutes) provides a quick overview of the kinds of problems to which statistical analysis can be applied. The dozen or so examples are taken from medicine, baseball, meteorology, industrial quality control, political polls, gambling, social science research, and other fields. These are excerpted from a much more elaborate, 26-part series from the same producer entitled Against All Odds: Inside Statistics, which presents the elementary statistical concepts underlying the applications. These videos are well produced and would be suitable for high school students or the general public.

My reason for reviewing them in these pages is that the short tape includes a 35-second segment on Florida manatees (I have not been able to view the longer segment in the 26-part series of which this is presumably an abridgement). This short segment shows footage of manatees and a power plant, and states that the significant correlation of manatee deaths with number of boat registrations in Florida was important evidence leading to the creation of speed regulatory zones. The data were supplied by the Florida Department of Natural Resources (DNR).

What strikes me as impressive about this is the following: the manatee death/boat registration correlation is evidently so clear and striking that it was one of only about a dozen examples chosen by professional statisticians to illustrate the most basic concepts in a 15-minute introduction to their own field. However, I have never seen this particular correlation emphasized or illustrated in any of the education materials created to inform the public about manatee protection. Sure, we talk incessantly about boat kills; but a simple, compelling

graph of deaths against boat registrations (an index of human population growth), or better yet, against population growth itself, would have an impact at least as valuable to our sales pitch as it is to the statisticians'.

I understand from DNR that they are now making these points in their presentations to public hearings. My advice is that these points cannot be made too often or too vividly. Not just unsafe operation of boats but sheer numbers of boats, and ultimately numbers of people, are the heart of the crisis. To my great surprise, however, I was recently told by two DNR officials that these facts are now so well known by the Florida public that they are taken for granted (and hence not necessary to emphasize?). I hope this is true, but given the American public's widespread lack of awareness of the dimensions and effects of overpopulation, I am inclined to doubt it. Even if the facts are accepted, their political implications are not; and if growth management legislation is going to be made to stick, a lot of people, and especially elected officials, still have to be beaten over the head with the obvious. - DPD

ABSTRACTS

Applications of the Geographic Information System to Manatees (Trichechus manatus) in West Tampa Bay, Florida (Paula Houhoulis). - From November 1987 through November 1988 aerial surveys were conducted in Tampa Bay. At least 88 manatees occupy Tampa Bay, with up to 52 manatees in Pinellas County waters alone. Using a computer program called the Geographical Information System to map data it has been shown that manatees concentrate at certain locations in western Tampa Bay (specifically near Florida Power Corporation's Bartow Power Plant and Coffeepot Bayou) where resources such as seagrasses, warm water effluent, and fresh water sources can be found. Areas occupied frequently by manatees or areas which provide critical resources for the species need to be protected from coastal development and from boat traffic, both of which can have negative impacts on manatees and their habitat. [Abstract of a senior thesis in Marine Science submitted to Eckerd College, St. Petersburg, Florida, in May 1989 and supervised by J. E. Reynolds, III.]

Zoogeography of Marine Mammals in Puerto Rico and the Virgin Islands (Antonio A. Mignucci Giannoni). - A zoogeographical analysis of the marine mammals in the waters of Puerto Rico, US Virgin Islands and British Virgin Islands was conducted to document the presence of the different species found, and to relate their occurrences to patterns of underwater bottom topography. Past and present knowledge on the biology and life history of the whales, dolphins, manatees and seals inhabiting the northeastern Caribbean are summarized to aid in correcting its actual fragmented and limited nature. A total of 2,776 occurrence records were filed on a specially formatted data base system, and analyzed for distributional and temporal patterns. Species analyzed include the Antillean manatee and 17 species of cetaceans, including 13 odontocetes, three mysticetes, and the humpback whale

[sic]. Each species was characterized in terms of its general description and life history, group composition, spatial distribution, temporal distribution, migration and movement, mortality, population estimates and status, and captivity history. In addition, each species was zoogeographically characterized by depth classes (shelf, shelf edge, or offshore), and by sea floor relief (through the use of a relative slope index measure). The hypothesis that the spatial distribution of marine mammals is highly correlated to the area's bathymetric relief, whether high or low, was generally supported. The possibility that the Caribbean monk seal is not extinct is discussed as part of a review of the natural history of monk seals and the documentation of pinniped occurrences, including captive and escaped California sea lions in waters of Puerto Rico and the Caribbean. A list of the published and unpublished, sighting, stranding and captivity records filed in the data base for each species is presented, together with report sheets and directions on how to document sighted and stranded animals. [Abstract of a master's thesis in Marine Affairs submitted to the University of Rhode Island and supervised by B. E. Marti.]

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