

Sirenews



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SIRENIA SPECIALIST GROUP MEMBERSHIP

One of the decisions made at the Edmonton conference was to reorganize the Sirenia Specialist Group in order to streamline its functioning. On the one hand, it was considered desirable to include a diversity of individuals active in sirenian-related affairs; but on the other hand it was recognized that for any committee to function efficiently it must remain relatively small. As a compromise, two categories of membership were provisionally set up: a small group of executive members and a larger group of corresponding members. A current membership list follows.



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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- Dr. Thomas J. O'Shea, U.S. Fish and Wildlife Service, 412 N.E. 16th Ave., Gainesville, Florida 32601 USA (Deputy Chairperson)
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LOCAL NEWS

AUSTRALIA

Torres Strait Dugong Workshop. - The Torres Strait Treaty requires that Australia and Papua New Guinea use their best endeavors to identify and protect species of indigenous fauna and flora that are or may become threatened with extinction.

Evidence based on research conducted by Helene Marsh from James Cook University of North Queensland indicates that dugong numbers in Torres Strait have declined, and unless management initiatives are developed and implemented, dugongs may become rare or extinct in this area.

Australian fisheries management bodies agreed that a workshop to discuss dugong management with Islander communities should be conducted in the area of Australian jurisdiction in the Torres Strait Protected Zone.

The Torres Strait Dugong Workshop was conducted from 1 to 5 March 1986 in the communities of Kubin, Badu, St. Pauls, Mabulag, Saibal and Boigu in the Western and Top Western regions of Torres Strait.

Mr. Joey Nona (chairman of Badu) convened the workshop and wrote to the chairmen of the above islands seeking their cooperation. Helene Marsh was invited to participate in the workshop and discuss the findings of her research with the members of the various communities. Dr. Marsh travelled to the communities with Australian Fisheries Officers Geoff Williams and Peter Channells, and an Islander interpreter, Mr. Ephraim Bani. Mr. Joey Nona attended the Badu and Kubin meetings.

An excellent response was received at all communities visited, with a total of over 100 hunters and other interested community members attending the series of meetings. Dr. Marsh gave an introduction to each meeting, giving a detailed account of her 10 years' research into the life history and population status of Australian dugongs. Lively discussions ensued in which the hunters related their knowledge of dugongs and their perceptions of the current dugong problem. Mr. E. Bani, who is fluent in all Island dialects, was instrumental in the success of these discussions, as many of the Islanders, especially the

older, more experienced hunters, are reticent to communicate in English, but converse freely in their own language.

The meetings agreed that there is a dugong population problem in Torres Strait. They further agreed that the causes of this problem were:

- 1) Overhunting.
- 2) Low birth rate (Dr. Marsh explained how it takes a population of at least 100 dugongs to sustain an annual catch of 5 dugongs).
- 3) A devastation of the Torres Strait seagrass beds in the mid-1970s. This was manifested by large numbers of "sick" dugongs. Dr. Marsh told the meeting that this sickness was consistent with symptoms resulting from starvation/malnutrition. Dr. Marsh also reported that extremely low pregnancy rates were observed in dugongs caught at this time.
- 4) The increased use of aluminum dinghies and outboard motors both to hunt dugongs and for use in the lobster fishery in the last decade. This has frightened dugongs away from traditional hunting grounds.

Several approaches to the problem were suggested by the communities, including:

- a) Capture of male dugongs only.
- b) Banning the capture of pregnant female dugongs.
- c) Establishment of an area where dugong hunting is not permitted, so that dugong numbers can increase.

The former two approaches were considered inappropriate by all communities because the younger hunters are unable to distinguish a male from a female dugong or a pregnant female dugong from a non-pregnant female. (A pregnant dugong is normally the preferred catch.)

The establishment of a protected area was unanimously agreed upon by all communities visited. The boundaries of this proposed area will first be delineated by each community and then reduced to a single map which will be circulated to all chairmen for approval. When agreement is reached in all communities, a recommendation along these lines will be submitted to the Torres Strait Fishing Industry and Islanders' Consultative Committee on Thursday Island in April of this year.

In the course of discussions, Islanders expressed a view that more research into dugong populations and their distribution in Torres Strait is highly desirable. Islanders also expressed a wish to have some involvement in any future aerial survey(s) if possible. Dr. Marsh commented that this approach had been successfully used at the Lockhart River community during recent surveys. - Helene Marsh

FLORIDA

Manatee Movements on the Southwest Coast of Florida. - The U.S. Fish and Wildlife Service and Florida Department of Natural Resources, in cooperation with the Florida Power and Light Company (FPL), are conducting a 2-year study of manatee movements and habitat use on Florida's southwest coast. The information obtained is helping to identify areas important to manatees in

the nonwinter seasons.

Sixteen manatees were captured and radiotagged at the warm-water effluent of the FPL's electrical generating plant near Fort Myers on 7 January 1985 [see *Sirenews* No. 3]. The radio tag includes a floating transmitter package that overcomes the problem of saltwater attenuation of radio signals.

Between 7 January and 20 February 1985, 90% of all daily locations of individual manatees were in the Upper Caloosahatchee River or the Orange River in the general vicinity of the power plant. From 21 February through 31 March, manatees dispersed out of the Caloosahatchee River, and close to 50% of all daily locations were in Matlacha Pass. During late spring and summer, over 60% of the daily locations were in Charlotte Harbor, including both the Peace and Myakka Rivers. With the exception of one, all documented manatee movements from the Caloosahatchee River were to the north through Matlacha Pass. The exception was an adult female and her calf that first moved north, but then left the Charlotte Harbor/Myakka River area in June and moved down the coast. By mid-July they reached Chokoloskee Bay in the Everglades, where they stayed until at least mid-September. Other areas that were used by several tagged manatees are Tarpon Bay on Sanibel Island and Tampa Bay, including the Little Manatee and Manatee Rivers.

On 6, 7, and 28 January 1986, 16 manatees were equipped with radiotag assemblies, again at the FPL plant near Fort Myers. In addition, 3 manatees received satellite transmitters. In contrast to the 1985 dispersal, after which radiotagged manatees did not return to the Caloosahatchee River, 1986 manatee movements have included many returns to both the Orange and Caloosahatchee Rivers, and a few individuals have not yet left the Caloosahatchee River. Matlacha Pass and Charlotte Harbor are again important areas for migrating manatees. So far, only one manatee, a satellite transmitter-tagged adult female, has moved south of the Caloosahatchee River, to Marco Island. - Lynn W. Lefebvre (U.S. Fish and Wildlife Service)

PALAU

Dugong Status. - As a follow-up to the U.S. Fish and Wildlife Service's 1977 and 1978 surveys [see *Sirenews* No. 3], the Service again conducted a series of aerial surveys around Palau in August 1983. Two total-count censuses of the entire archipelago were completed, with 11 dugongs sighted on the first survey and 37 on the second. These data compare favorably with the maximum sighted (34) in 1978 (Brownell et al., 1981, The status of dugongs at Palau, an isolated island group. Pp. 19-42 in H. Marsh, ed., *The Dugong*, James Cook Univ., Townsville, Australia). Based on interviews with local residents, poaching is still a problem, however, and it is not clear whether the small population of dugongs in Palau can withstand the losses. We doubt it. - Galen Rathbun, Robert L. Brownell, Jr., and Kathy Ralls

SAUDI ARABIA

Dugong Replenishment Project. - The Saudi Arabian

Meteorology and Environmental Protection Administration's (MEPA) Dugong Replenishment Project has now been in operation for six months, during which time a quantitative aerial survey of the Arabian Gulf waters of Saudi Arabia and Bahrain has been completed. Using a dedicated helicopter (Bell 206), all waters out to the 25 m depth contour (approximately 25 nautical miles from the coast) have been surveyed at an altitude of 500 feet, for a coverage intensity of approximately 10%. While very few dugongs were found in Saudi waters during this winter survey, a large herd of 300 to 500 dugongs was discovered east of Bahrain.

This discovery establishes the Gulf as a significant region for dugongs. Happily, it is now apparent that the deaths of at least 38 dugongs coincident with the disastrous 1983 Nowruz oil spill did not reduce the Gulf's dugong population to below a viable level, as feared at the time [see ~~Sirenews~~ Nos. 1 and 4].

This herd was only 5 nm from Qatari waters and 20 nm from Saudi waters, and so these dugongs are likely to be multinational in their range. Fortunately the Gulf states are aware of the importance of the dugong and are keen on a cooperative approach to issues such as conservation. Consequently MEPA has been greatly assisted by the Bahrain Environmental Protection Committee and discussions are currently taking place with the Governments of Qatar and the United Arab Emirates to facilitate the extension of the survey into these areas.

Contingent upon the outcome of radio and satellite tracking trials to be conducted by Helene Marsh and Galen Rathbun on captive dugongs in Jakarta, an attempt may be made to track some of the Bahraini dugongs to determine the extent of their movements. Resultant data would help determine the likelihood of natural repopulation of Saudi waters and identify possible actions that may be taken to protect this population. - Tony Preen (Field Team Leader, Dugong Replenishment Project)

VENEZUELA

Manatee Survey. - A major survey of manatees in Venezuela is now being carried out by Dr. John G. Robinson (University of Florida), Dr. Thomas J. O'Shea (U.S. Fish and Wildlife Service), Mr. Martin Correa-Viana (Servicio Nacional de Fauna Silvestre, Venezuela), and Mr. Mark Ludlow (University of Florida), and funded through the Florida Foundation. From 10-25 January 1986, Correa-Viana was trained in manatee biology, conservation, and research techniques in Florida. During February and March, the team members interviewed knowledgeable persons, including professionals and commercial fishermen, in the following areas: along the Caribbean coast from Punta Cardon at the entrance of the Golfo de Venezuela in Falcon State to Carupano in Sucre State; the mangrove forests bordering the Golfo de Paria in Monagas State; the Orinoco River delta in the Delta Amacuro Territory; and the middle Orinoco as far upstream as Caicara, and the Lake Maracaibo region. The objectives of the interviews were to determine manatee distribution, threats to remaining populations, traditional importance of manatees to indigenous people, and general biological information about the species. Subsequent to these status interviews, aerial surveys will be

conducted (during late March and early April) over selected regions. The aircraft will also be used to interview at outposts with airstrips in roadless areas of the Orinoco drainage system. Following completion of the remaining fieldwork by Ludlow and Correa-Viana, a detailed report will be prepared.

Manatees are absent from the Caribbean coast of Venezuela. Nearly all fishermen in this area were completely unfamiliar with manatees, many having never heard the word in their lives. The absence seems to be due to habitat unsuitability, not overexploitation. We specifically sought interviews with old fishermen to determine if manatees formerly occurred along this coast and had been subsequently extirpated, but this was found not to be true. Men in their eighties who had worked as fishermen and lived on the coast their entire lives also had no knowledge of manatees. Although there are areas with sheltered lagoons and year-round freshwater streams, most of the coastline is rocky and mountainous with high-energy beaches. The north coast of Venezuela may constitute an ecological barrier between manatee populations along the Atlantic coast of South America and the Caribbean coast of Central America from Lake Maracaibo westward.

Manatees seem to be relatively abundant along the Golfo de Paria in Monagas State, throughout the Orinoco delta, the middle Orinoco, and its tributaries. All persons interviewed throughout these regions were familiar with the species and many relatively recent sightings were reported. The Orinoco system appears to constitute one of the largest continuous habitats occupied by West Indian manatees from Florida to Guyana, and may harbor a substantial population. Much of this system is characterized by silt-laden waters with poor conditions for aerial observation; even the crudest attempts at estimation of total numbers will be difficult to achieve, although some exceptional regions and techniques may prove useful as trend indicators using aerial survey methods. Specifically, the Rio Morichal Largo and the Rio Caura have relatively good visibility during the dry season, and should be considered as areas for long-term trend surveys. Timing of surveys along margins of mangrove forests at high tide should also maximize the probability of sightings in silty waters because at these times manatees will be near the surface at the banks feeding. In addition to the manatees in the Orinoco-Golfo de Paria system, a second population occurs in Lake Maracaibo, but is thought to be less dense and probably in decline in comparison.

The outlook for this species in the Golfo de Paria and Orinoco system is encouraging. Hunting of manatees has been prohibited since 1978 and the laws are working. We interviewed several former manatee hunters and found it to be a dying art. All were older men, and all noted that young men were not learning the skills required because of the law and a lack of interest. Knowledge of the law protecting manatees was universal among all people interviewed in the Orinoco system, and meat and fish vendors expressed an unwillingness to sell manatee meat for fear of prosecution. Thus without an appreciable market or skilled hunters, and with a widespread acceptance of the protection laws, hunting does not seem to constitute a serious

threat. However, manatee hunting by indigenous people still occurs in remote regions and efforts should continue to discourage these practices. We found that manatees were of comparatively little traditional or economic importance to the Warauno Indians of the Orinoco delta, beyond a few interesting legends and beliefs, and stricter enforcement of the law among these people should not present hardships to them. In some regions manatees may rely completely on browsing mangrove forests at high tide for food. Exploitation of the forests for lumber is occurring, but in Monagas State cutting is carefully controlled and managed under a well-planned program that mitigates otherwise potentially dangerous effects on the manatee population of the region. Such a plan should also be adopted for the Delta Amacuro Territory. - Tom O'Shea

WASHINGTON, D.C.

New "Missing Links". - For years, some students of evolution (not to mention creationists) have been harping on the supposed lack of intermediate forms in the fossil record. Whatever may be the case in other, less distinguished groups, the Sirenia and their relatives have long provided good examples of gradual evolution, going back at least to Abel's turn-of-the-century studies of the reduction of the sirenian pelvis. The recurrent pattern seems to be that when you find a fossil of this group intermediate in age between two other known species, other things being equal, as often as not it turns out to be intermediate in morphology as well - which is not what devotees of "punctuated equilibrium" would have us expect.

In a study now in press (*Smithsonian Contributions to Paleobiology*), Daryl Domning, Clayton Ray, and Malcolm McKenna describe a new genus and two new species of desmostylians from Oligocene rocks of Oregon and Washington State. These are the most primitive known desmostylians, and are in many respects morphologically intermediate between desmostylians and proboscideans. Together with certain fossil mammals (anthracobunids) previously known from southern Asia, they convincingly document the close relationship between these two orders, which may both be descended from *Minchenella*, an animal from the Late Paleocene of China. Sirenians appear to be the sister group of proboscideans + desmostylians, and these three orders, which make up the Tethytheria of McKenna (1975), probably do constitute a strictly monophyletic group, as suggested by several lines of biochemical and other evidence.

Also in press (*Transactions and Proceedings of the Palaeontological Society of Japan*) is the description by S. Takahashi, D. Domning, and T. Saito of a new species of *Dusisiren* from the Late Miocene of Yamagata Prefecture, Japan. Corresponding to "Dusisiren Species D" of Domning (1978), it is a dramatic "missing link" between *Dusisiren jordani* and *Hydrodamalis cuestae*, the direct ancestor of Steller's sea cow (*H. gigas*). Although it still possessed functional teeth, the new species had a profoundly modified, clawlike flipper with greatly reduced phalanges. This is the first tangible evidence in support of Steller's sometimes-doubted statement that *H. gigas* lacked

phalanges entirely. (The Japanese, incidentally, fully appreciate the importance of this discovery; a life-sized replica of "The Great Yamagata Sea Cow" was unveiled with appropriate fanfare on Christmas Day, 1985, in the town where it was discovered.)

Domning is just beginning (with Elwyn Simons of Duke University and Baher El-Khashab of the Cairo Geological Museum) the study of a new fossil skull from the Fayum district of Egypt. It is thought to be Oligocene in age, and appears to be morphologically as well as chronologically intermediate between *Eosiren* from the Eocene of the Fayum and *Halitherium* from the Oligocene of Europe and elsewhere. Thus it may finally plug the gap between these two well-known fossil dugongids.

Halitherium, in turn, seems to have given rise to the common Miocene and Pliocene genus *Metaxytherium*. The European record of this evolutionary sequence seems clear and straightforward, proceeding through two successive species of *Halitherium* and four of *Metaxytherium* to end in extinction in the cooling Late Pliocene Mediterranean. This is supported by a cladistic analysis of the European representatives of these genera, done by D. Domning and H. Thomas and soon to be published in a volume on the Sahabi fauna of Libya by Alan R. Liss, Inc., New York. Other *Metaxytherium* had meanwhile spread to the New World, where some of them gave rise to *Dusisiren* and ultimately *Hydrodamalis*, as mentioned above. So at least the common and best-known fossil dugongid taxa seem to fit together well in a coherent evolutionary picture extending from the Eocene almost up to the present. It's among all those rare and poorly-known ones that the real work remains to be done! - DPD

ICZN OPINION 1320

The International Commission on Zoological Nomenclature has officially sanctioned the scientific names presently in use for Steller's sea cow and the Amazonian manatee, thereby protecting these names against the possible resurrection of unused senior synonyms.

In response to a petition by D. Domning, ICZN Opinion 1320, published in the *Bulletin of Zoological Nomenclature* 42(2): 175-176, June 1985, placed the names *Hydrodamalis* Retzius, 1794, *gigas* Zimmermann, 1780 (as in *Hydrodamalis* *gigas*), and *inunguis* Natterer in Pelzeln, 1883 (as in *Trichechus* *inunguis*) on the Official Lists of Names in Zoology. The names *Manati* Steller, 1774 (a senior objective synonym of *Hydrodamalis*) and *exunguis* Natterer in Diesing, 1839 (a senior objective synonym of *T. inunguis*) were formally suppressed under the Commission's plenary powers and placed on the Official Indexes of Rejected and Invalid Names in Zoology.

The names of the taxa in question are correctly cited as follows:

Hydrodamalis Retzius, 1794

Hydrodamalis *gigas* (Zimmermann, 1780)

Trichechus *inunguis* (Natterer in Pelzeln, 1883)

MANATEE SPECIES AND SUBSPECIES

In a paper recently accepted for publication in *Marine Mammal Science*, D. Domning and L. Hayek report the results of a statistical analysis of interspecific and intraspecific variation in manatee skulls [see *Sirenews* No. 3]. Their analysis supports the taxonomic distinction of Florida manatees (*Trichechus manatus latirostris*) from other West Indian manatees, which are all assigned to *T. manatus manatus*. They also propose the vernacular name "Antillean manatee" for *T. manatus manatus*, which presently lacks a generally accepted common name. Alleged subspecific distinctions within *T. senegalensis*, however, have no demonstrated basis. A cladistic analysis of the three manatee species suggests that *T. manatus* and *T. senegalensis*, which are phenetically the most similar, may also share a more recent common ancestor than either does with *T. inunguis*.

BBC NATURE PROGRAMS

The BBC is looking for newsworthy scientific developments, discoveries, or stories to form subjects for its television documentaries. "Nature", the BBC Natural History Unit's topical magazine series, consists of 30-minute programs each containing a selection of items ranging from 2 to 20 minutes. If you have any sirenian- or other nature-related items that you think may be suitable, or can anticipate any significant news about to break, please contact (as far in advance as possible) Jan Ratcliffe, Researcher, "Nature", BBC Natural History Unit, Broadcasting House, Whiteladies Road, Bristol BS8 2LR, England (telephone 0272 732211, ext. 2424 & 2423; Telex 265781 BSA).

ABSTRACTS

The following two abstracts were accidentally omitted from the last issue. These papers were presented at the Fourth International Theriological Congress, Edmonton, Canada, Aug. 13-20, 1985, but were not part of the Sirenian Workshop.

PAENUNGULATA: A COMPARISON OF THE HEMOGLOBIN SEQUENCES FROM ELEPHANT, HYRAX, AND MANATEE. Traute Kleinschmidt*, Morris Goodman**, and Gerhard Braunitzer*, *Max-Planck-Institute für Biochemie, Abteilung Proteinchemie, Martinsried bei München, West-Germany. **Dept. of Anatomy, Wayne State University, School of Medicine, Detroit, Michigan 48201, USA.

As direct copies of the genetic material, the protein sequences are suited for the reconstruction of phylogenetic relationships, especially in cases where morphological methods do not provide unequivocal results, as in the case of Paenungulata. The primary structures of the hemoglobins of the Rock Hyrax (Procavia habessinica, Hyracoidea) and the Indian and African Elephant (Elephas maximus and Loxodonta africana, Proboscidea) have been determined earlier. After the recent elucidation of the primary structure of the globin α - and β -chains from Manatee (Trichechus inunguis, Sirenia) it is now possible to compare the three orders classed among the Paenungulata. Identical amino acid residues in the Paenungulata hemoglobins, which are not observed in other species, suggest a relationship between elephants, Hyraxes and sea cows. The Paenungulata hemoglobin sequences are also compared with the known sequences of Ungulata hemoglobins.

MAMMALIAN PHYLOGENY: COMPARISONS OF MORPHOLOGICAL TO MOLECULAR RESULTS.

J. Shoshani, Department of Biological Sciences, Wayne State University, Detroit, Michigan 48202 USA.

The morphological part of this study includes results from parsimony analyses of 172 non-dental osteological characters on 213 extant and extinct species (205 mammals and 8 non-mammals). The molecular part includes unweighted pair group method results from 1,310 immunodiffusion (IMDFN) comparisons conducted with chicken antisera on 101 mammalian species and maximum parsimony analyses of amino acid sequences of α and β hemoglobins as well as sequences of other proteins published (representing most mammalian orders). In all phylogenetic reconstructions, the class Mammalia is depicted as a monophyletic taxon. Within Eutheria: (1) Proboscidea, Sirenia, Desmostylia, Moeritheriidae, and Hyracoidea are closer to each other than to other mammals; (2) in the IMDFN and lens a crystallin results, Tubulidentata (TUB) is part of Paenungulata (PAEN), while in the morphological analyses TUB is a sister-group to Ungulata (UNC = Artiodactyla and Perissodactyla); (3) in all studies, Cetacea is depicted closer to condylarth derivative UNC and/or PAEN; (4) Rodentia and Lagomorpha affinities are uncertain in the molecular studies while in the osteological, they are closely related (the Glires hypothesis), with Macroscelidea being a sister-group to Glires. Discussion will concentrate on the degree of congruence between the molecular and morphological results, and how these results are compared to hypotheses of other workers. Supported, in part, by NSF grant BSR83-07336.

The following abstracts are of papers and posters presented at the Sixth Biennial Conference on the Biology of Marine Mammals, Vancouver, British Columbia, Nov. 22-26, 1985.

THE DIGESTIVE STRATEGY AND EFFICIENCY OF THE WEST INDIAN

MANATEE, *Trichechus manatus*.

Burn, Douglas M.

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Sirenians are considered ecologically unique in that they are the only truly aquatic mammalian herbivores. Although the anatomy of the digestive tract of the West Indian manatee (*Trichechus manatus*) has been well described, little work has been done regarding the digestive processes of this species. During the winters of 1982/83 and 1983/84, the digesta from 7 manatee carcasses was sampled sequentially along the length of the gut. All samples were analyzed for dry matter content, organic matter, crude protein, crude fat, acid-detergent fiber, lignin, and cellulose. Apparent digestibilities were calculated using the lignin-ratio method. The voluminous large intestine is responsible for considerable water reabsorption, as well as being the major site of organic matter, crude protein, crude fat, and cellulose digestion. Based on these results, the manatee appears to use a postgastric cellulose fermentation system similar to terrestrial herbivores such as the horse. Unlike the horse, however, the manatee also digests the majority of the soluble components of the diet in the hindgut as well. Overall digestibility coefficients for organic matter (71.1%), crude protein (61.0%), and crude fat (77.3%) are comparable to those of domestic herbivores. Manatees have one of the highest digestibility coefficients for cellulose (79.6%) of any known mammalian herbivore. This high efficiency of cellulose digestion is most likely due to an extremely slow rate of passage. Other seagrass consumers, the dugong (*Dugong dugon*) and the green sea turtle (*Chelonia mydas*) also have high cellulose digestibility coefficients, suggesting that dietary composition may also be responsible for the high efficiency of cellulose digestion found in the manatee.

EVALUATION OF MANATEE HABITAT ON THE NORTHWESTERN COAST OF FLORIDA

Packard, Jane M., and Orjan F. Wetterqvist
University of Florida, Gainesville, Florida

Protection of an endangered species requires careful planning on a site-specific basis when threats to its survival vary throughout its range. The research described in this paper forms the basis for a research/management plan developed to protect manatees along the northwest coast of Florida. Via use of a new version of the overlaying mapping techniques practiced in urban and regional planning, the importance and vulnerability of various components of manatee habitat were assessed. Habitat characteristics were mapped and evaluated in juxtaposition with relevant characteristics of human use of the area, to identify areas of potential manatee/human conflicts in need of reconciliation. Areas ranked as most important manatee habitat within this region include Crystal Bay and River, Homosassa River, and the Suwannee River estuary. Existing overlap of human activities with important manatee habitat is most critical near the urban communities of Crystal River and, to a lesser degree,

MANATEE (*TRICHECHUS MANATUS*) DISTRIBUTION AND ABUNDANCE AROUND POWER PLANTS IN WINTER: 1984-1985 SURVEY RESULTS AND COMPARISONS WITH FINDINGS OF PREVIOUS YEARS

Reynolds, John E. and J. Ross Wilcox

Biology Department, Eckerd College, St. Petersburg, FL and Environmental Affairs, Florida Power and Light Company, Juno Beach, FL

Winter aerial surveys have been conducted in a consistent manner for eight consecutive years to assess manatee (*Trichechus manatus*) abundance and distribution around five Florida power plants where animals predictably seek refuge from cold weather. During 10 one-day surveys in winter 1984-1985, 3804 manatees were observed, with a maximum count of 636 animals for a single survey. The 1984-1985 surveys produced the highest counts on record for 3 plants: Riviera (231 manatees on 22 January), Port Everglades (234 animals on 27 January), and Ft. Myers (338 manatees on 19 January). The Canaveral Plant produced lower counts than in many previous years. Calves represented 10.3% of all manatees sighted near power plants in 1984-1985, a percentage comparable to those calculated for surveys in previous years. Manatee abundance in 1984-1985 was correlated with ambient air and water temperatures at Hobe Sound and the Riviera and Port Everglades Plants. No significant correlations of abundance and temperature were found for the Lauderdale or Canaveral Plants. The high counts for 1984-1985 surveys in general and for Port Everglades, Riviera and Ft. Myers Plants specifically provide evidence that supports a need to revise upward the population estimate for manatees in Florida. The recent high counts may have been induced by any or all of the following factors: 1) very warm December weather followed by extremely cold January weather; 2) seasonal redistribution of animals along the east coast of Florida; and 3) occurrence of surveys during conditions that stimulated manatees to bask at the surface, where their visibility was enhanced.

CONGENITAL ECTRODACTYLOUS MALFORMATIONS OF THE FLIPPER IN THREE WEST INDIAN MANATEES, *TRICHECHUS MANATUS*.

Watson, Alastair G., and Robert K. Bonds^{*}
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Ectrodactyly is defined as the congenital absence of one or more phalanges from one or more digits. Three cases of ectrodactyly of the flipper in manatees were detected after examination of 780 carcasses (1974 through 1984) and each is described, including one case of bilaterally symmetrical cleft hand. Defects of the Apical Ectodermal Ridge (AER) in the developing embryonic hand plate have been shown experimentally to produce similar congenital ectrodactyloous malformations in chickens and mice. Variations in the site, extent, and time of AER defects produce morphological variations of ectrodactyly. We suggest that an AER defect will account for many of the morphological expressions of ectrodactyly found in manatees, man, and other mammals.

AN AUDITORY FREQUENCY DISCRIMINATION IN A CAPTIVE WEST INDIAN
MANATEE (TRICHECHUS MANATEES)
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Only recently has any research been done on information processing in captive West Indian manatees and thus far only the results of research on their visual information processing have been reported indicating that they can make use of differences in brightness, size, shape, colour, motion, left-right orientation and horizontal/vertical orientation and that the manatees can demonstrate transpositional learning, reversal discriminations, learning sets, matching to sample and long term memory over a duration of 17 months. While anatomical research and evoked potentials suggested a capacity to use auditory information nothing other than anecdotal observations provides behavioural evidence of the use of auditory information. At Miami Seaquarium a 3 kHz signal was broadcast into the pool in which a manatee was rewarded for selecting one target if the signal was broadcast into the water and was rewarded for selecting another target if no signal was broadcast. When the manatee solved this problem to criteria the frequency of the signal was varied at intervals from the original signal. The manatee was successful over the full range of the equipment (200 H-12kHz). Next the manatee was rewarded for pressing one target when frequency A (500H) was broadcast and for pressing another target when frequency B (5kHz) was broadcast into the water. A double blind procedure was used in which the experimenter did not know what frequency was broadcast or, when appropriate to the problem, whether an auditory signal was even broadcast. The results are interpreted as demonstrating that manatees (1) can make use of auditory information and (2) the range of frequencies they can use covers at least 200H-12kHz and (3) that the manatee can learn to make discriminations on the basis of auditory cues that differ in pitch. Further research will be conducted to determine what other characteristics of auditory information can be used by manatees and at what level of complexity can this information be processed.

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