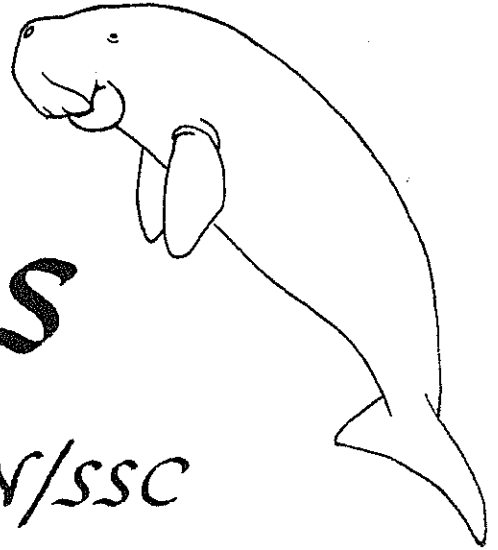


# Sirenews



## Newsletter of the IUCN/SSC Sirenia Specialist Group

NUMBER 28

OCTOBER 1997

- IN THIS ISSUE:
- SIRENIANS PROLIFERATING IN CYBERSPACE (p. 4)
  - MANATEE TWINS CONCEIVED IN CAPTIVITY IN BRAZIL (p. 8)
  - LEGAL FIREWORKS OVER CASINO CRUISES AT CRYSTAL RIVER (p. 8)

### MANATEES AND THE FUTURE OF ELECTRIC UTILITIES DEREGULATION IN FLORIDA

This article deals with some very serious potential problems that Florida manatees may face as a result of the deregulation of the electric utility industry. Due to the complexity of the deregulation issue and the space available in this newsletter, I will confine most of my thoughts to its potential effects on manatees and Florida's environment rather than discussing the details of deregulation's pros and cons for the utility customer.

Background and History. Industrial warm-water outfalls, such as power plant effluents, have played a pivotal role in allowing the manatee population in Florida to experience partial recovery. Their combined contribution may be second only to the cessation of hunting through the implementation of important laws to protect manatees. The relative distribution of these warm-water sources throughout Florida's coastal habitat has allowed manatees to extend their winter range and cushioned what would have been much greater losses during times of extreme cold. After several substantial and near-catastrophic losses of manatees due to cold weather at some of these facilities, and through years of close cooperation among the utility companies, the U.S. Fish and Wildlife Service (FWS), the U.S. Environmental Protection Agency (EPA), and the Florida Department of Environmental Protection (DEP), it deceptively



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

*Sirenews* (ISSN 1017-3439) appears twice a year  
in April and October and is edited by Daryl P. Domning,  
Department of Anatomy, Howard University, Washington, D.C. 20059 USA  
(fax: 1-202-265-7055). It is supported by the U.S. Marine Mammal Commission  
and Sea World, Inc.

appeared we were close to ensuring that we could provide manatees with secure warm-water sources for many years to come.

For example, during the early 1980's the Florida Power and Light Company (FPL) rerouted some of the discharge from newer units to allow the existing warm-water discharge to remain in a safer and more reliable place for manatees. A further example involved the re-powering of the old FPL Fort Lauderdale Inland Power Plant. This was an existing site on which manatees had already become dependent. Through re-powering at an existing site a win/win/win scenario was created whereby FPL saved money, the adverse environmental impacts were minimized, and the site's reliability for manatees was improved through several physical modifications to the discharge area. This solution seemed to be an answer to providing new electric generation capacity when the various power plants in Florida outlived their planned operational cycles. This was especially important since virtually everyone involved with power plant siting agreed that we should not create new thermal discharges.

Only a few years later, however, a different and even more challenging problem arose, which in hindsight may have been a harbinger of more desperate times for manatees in Florida's future. It involved the FPL Ft. Myers (Tice) power plant. A contingent of researchers was converging on the power plant discharge to set up a large-scale capture operation to catch and fit manatees with electronic tags/transmitters. Just as we had hoped, there was a really major cold front barreling down on us that should have ensured that we would have a lot of manatees to choose from. Something, however, was very wrong. Upon our arrival we discovered that there was no warm water being discharged. Apparently the executives at FPL had decided (without consultation with their own environmental staff) that since they could buy power cheaper from Georgia, they would not run the Tice power plant. Needless to say we did what was necessary to avert what would have been a major catastrophe by getting Governor Graham to intervene with the President of FPL, who agreed to run the plant temporarily even though it would be more expensive to operate the plant than to purchase more power. Ultimately, FPL agreed to install warm-water wells at the Tice discharge that would be turned on in future winters when the discharge temperature dropped below 20 degrees Celsius.

Perhaps the single most important element in our quest to protect manatees from catastrophic losses at warm-water sites (on which they now had become thoroughly dependent during the winter) was requiring, as a condition for the National Pollution Discharge Permits (NPDES), the adoption of Manatee Protection Plans which maximized the reliability of the heated discharge from each utility that was already attracting manatees. At the same time, efforts have also continued to eliminate some thermal discharges that were not reliable and were putting manatees at greater risk of exposure during major cold fronts or simply during non-operation of the facility.

Deregulation Concerns. Having laid the above foundation I will finally get to the point of this article - which is that Florida will soon be facing deregulation of the retail electric power utility industry. Although this is probably still several years away, deregulation's potential adverse consequences for manatees and Florida's environment are monumental. Federal laws have already been passed which facilitate wholesale power deregulation, and several other states, such as California, Texas, Oklahoma, Nevada, Pennsylvania, and others, have already embarked upon retail wheeling. The essential premise is that through deregulation, competition will lower utility rates. The most analogous situation is what happened in the telephone industry. Unfortunately, this is expected to be much more complicated and have a more uncertain outcome.

For starters, even if electric rates eventually decline for most customers (which is in serious doubt), the reliability of service to customers is going to be threatened, especially when you take into account the uncertainties of who will be responsible for maintaining the transmission networks and at what cost. The real push behind the deregulation effort is coming from the larger power customers such as factories and businesses. At a minimum, deregulation and therefore competition will mean that the power companies will seek to operate only those facilities producing the cheapest power, which will lead to unpredictable and unreliable warm-water discharges. Although a particular plant may be needed one week,

it may be cheaper to buy electricity from another state the next week. Since coal and oil are some of the cheapest fuels for producing power, and since protecting the environment costs money and higher costs would mean less revenue, the environmental safeguards may be the first things to go. It is imperative that the utilities which have benefited financially all these years from discharging heated waters, upon which manatees have now become dependent, be held to providing safe alternatives for manatees should they choose to abandon or diminish the reliability of these warm-water sites for purely economical reasons.

If we are going to find reasonable solutions to promoting competition and protecting the environment, we will have to start working as soon as possible with the existing utilities to ensure that environmental costs and manatee protection costs are factored into any "stranded cost projections". Stranded costs are essentially the difference between the actual cost of a long-term asset, such as a power plant, and the current market value of that asset. Just as we expect that the existing utilities will seek to recover these uneconomic costs from customers during a transition from a regulated to a competitive process, we must also work to ensure that the environmental safeguards and obligations for manatee protection are also factored into those calculations.

Thanks to use of the existing "once through" cooling systems (which produce the warm-water discharges), the historical savings to the utilities have been enormous. Yet because the potential for future adverse impacts to manatees from unreliable effluents is so great, it will be necessary to consider a variety of alternatives for the future. With hundreds of manatees now dependent upon the several existing warm-water outfalls, we must have sufficient contingency plans for the future. One such alternative may involve setting up a network of smaller but more numerous warm-water areas for manatees within a larger network of refuges and preserves located up and down the coasts and within important rivers. Geothermal sources could be considered, along with deeper water sinks and/or thermal-assisted applications such as solar power during periods of most severe cold. In the meantime it will be important to ensure that the utilities meet their respective obligations to protect the manatees that they, for economic reasons, conditioned to become dependent upon these warmer waters.

The Uncertain Future Can Still Be Shaped. - With all of the uncertainties regarding the future of deregulation and its potential effects on Florida's environment and manatees in particular, it will be very important to gather the information necessary for appropriate action. Especially in Florida (where the existing utility companies are still reluctant to embrace open competition), there is still time to learn from other states and adequately plan for an orderly transition. The FWS and DEP must, however, immediately step up their efforts to ensure the future integrity of the existing important warm-water refugia until appropriate long-term alternatives can be found, if and when they are needed. More specifically, future approvals for deregulation in Florida should be conditioned upon the FWS and EPA preparing a complete Environmental Impact Statement which can be used to assess and facilitate needed environmental safeguards. Above all, it is essential that, once identified, the needed manatee protection and other environmental safeguards are incorporated into any future plans for deregulation in Florida. Please let the leaders at FWS, EPA, and DEP know that you won't stand for manatees being left out in the cold while utility providers fight over the future of retail electricity distribution in Florida. - Patrick M. Rose (Save the Manatee Club)

## NEW MANATEE NEWSLETTER

Volume 1, Issue 1 of *Manatee News Quarterly* (for January-March 1997) appeared in June 1997 with 12 pages of detailed news coverage concerning the State of Florida's research and conservation efforts on behalf of Florida manatees. Issue 2 (for April-June 1997), also with 12 pages, appeared in September. Published in Tallahassee by the Florida Department of Environmental Protection (FDEP), this new periodical is the direct continuation of the former "MTAC Update" series previously produced by the Department as internal documents mainly for the use of members of its Manatee Technical Advisory Council.

For those wishing to follow the numerous and fast-changing developments relating to

Florida manatees in much greater detail than *Sirenews* provides, this official FDEP newsletter is an ideal complement to the more popularly-oriented and independent voice of the *Save the Manatee Club Newsletter*. The coverage of State agencies' manatee activities in *Manatee News Quarterly* and its predecessor series has been sufficiently exhaustive that it may justly be viewed as the definitive "newsletter of record" on this topic.

To receive copies of *Manatee News Quarterly*, and/or notices of MTAC meetings (which are held in various locations in Florida and are open to the public), send your request in writing to the FDEP Bureau of Protected Species Management, Mail Station 245, 3900 Commonwealth Boulevard, Tallahassee, Florida 32399-3000; fax: (850) 922-4338.

### READ SIRENEWS ON THE INTERNET

Dan Odell is continuing to post the text of *Sirenews* on the Society for Marine Mammalogy's web site, <<http://pegasus.cc.ucf.edu/~smm/>>. These posted versions of the newsletter do not include the illustrative material or most abstracts that appear in the hard-copy editions, since these items are printed from camera-ready copy rather than digitized. If you nonetheless find that the Internet versions are adequate for your needs and you no longer wish to receive the hard copies, please notify me so that I can delete you from the mailing list and save on printing and postage. - DPD

### NEW DUGONG WEBSITE

I am maintaining a private, rather extensive website (English and German) about the dugong under the address <<http://home.t-online.de/home/rothauscher/dugong.htm>> with over 1,500 worldwide visitors in this year. The aims are to: 1) supply a list of (as far as possible) all dugong links in the Web; 2) include an interactive image map of the Indian Ocean with hypertext links to information about the dugong populations in the various areas; 3) collect reports about dugong sightings, which are then included in the page information.

I need more contributions. I invite you to have a look at my pages, and I would be pleased to receive comments. - Hans Rothauscher (Süderende 23, 21782 Bülkau, Germany; tel.: (049)-04754/511; fax: (049)-02561/91316 35754 (until end of 1997); e-mail: <[Rothauscher@T-online.de](mailto:Rothauscher@T-online.de)>

### PICK A MANATEE'S BRAIN ON THE INTERNET

Wally Welker and his colleagues Roger Reep and John Johnson have for years been sectioning, staining, and studying the brains of manatees and other animals, and are now making some of the resulting images available on-line. If you have an interest in comparative neuroanatomy, or would just like to see what a manatee's brain looks like, inside and out, then visit their new website at <<http://www.neurophys.wisc.edu/Manatee/>>. A related site devoted to their large collection of other mammalian brains is <<http://www.neurophys.wisc.edu/Brain/>>.

### YET MORE MANATEE STUFF ON THE INTERNET

The website of the Florida Marine Research Institute, Florida Department of Environmental Protection, now carries monthly summary tables and graphs of data on Florida manatee mortality (through June 1997, as of 24 Oct. 1997). Access it at: <<http://www.fmri.usf.edu>>.

The "Regional Management Plan for the West Indian Manatee, *Trichechus manatus*" (*Caribbean Environment Programme Technical Report No. 35, 1995*), advertised in our last

issue as available from the CEP office in Kingston, Jamaica, is also available at the CEP website: <<http://www.unep.mx/cepnews/ing/ct35indx.htm>>.

Other Internet addresses relating to manatees are the following (quoted here from *Manatee News Quarterly*):

Caribbean Stranding Network: <<http://netdial.caribe.net/~mignucci/>>

Florida Department of Environmental Protection, Bureau of Protected Species Management: <<http://www.dep.state.fl.us/psm/>>

Save the Manatee Club: <<http://www.objectlinks.com/manatee>>

Sea World of Florida: <<http://www.bev.net/education/seaworld/teachersguides.html>>

U.S. Fish and Wildlife Service: <<http://bluegoose.arw.r9.fws.gov/nwrsfiles/Wildlifemgmt/SpeciesAccounts/Mammals/Flmanatee/FlmanateeTableofContents.html>>

#### SEA PIGS LEADING SEA COWS IN INDOPACIFIC POLL

In *Sirenews* No. 27 I requested readers to forward vernacular names used by local people for the dugong. I referred to the discussion raised during 1991 by Prof. Paul Anderson on sirenian vernacular names. In response to my request, I received a large number of vernacular names from all over the region, and I present the results below.

#### Summary of vernacular names for the dugong

REGION	CONTACT PERSON	LANGUAGE	NAME	MEANING
Sri Lanka	Anderson	Tamil	kadalpani	sea pig
		Sinhalese	cudalpani	sea pig
Indonesia Siberut	Persoon	Siberut	sakoko ka koat	sea pig
Andaman/ Nicobar Is.	Das	Andaman	pani suar suar machhi	sea pig pigfish
India/ Tamilnadu	Das	Tamil	kadal pasu	sea cow
Mozambique	De Boer	?	n'pfiwomati	sea hippo
Thailand	Pitaksinthorn	Thai	mu-nam mu-dut	water pig digging pig
Indonesia	Ismu Sutanto	Malay	babi laout putri duyung	sea pig mermaid

Although this list is certainly not extensive, it shows that the vernacular name of *sea pig*, *water pig*, or *digging pig* is common in the Asian region, with the exception of Tamilnadu, where the word *kadal pasu* (sea cow) is used. Dr. Das reported that here also, people eat dugong meat, irrespective of religion, maybe because of the low economic condition. He also

informed me that even if the majority of the coastal population are Hindus, for whom the cow is a sacred animal, they do not mind eating or selling the meat of the sea cow. Also, local people from the Andamans apparently had no religious taboos preventing them from eating dugong meat.

From information I received from Mr. Pitaksinthorn in Thailand and from Mr. De Boer in Mozambique, also no religious taboos were evident. It is interesting to note that local Thai fishermen in east Thailand call the dugong *digging pig*, while in the south it is called *water pig*. In Africa the association with the hippo is evident. Also in South Africa, in Afrikaans the dugong is called *Nijlpaard*, a Dutch word for hippo. It seems that in Africa the dugong is not directly associated with a pig, but rather with a hippo.

From my own experience I learned that the dominant local name of sea pig does not prevent Muslim people in Indonesia from eating dugong meat. In the Moluccas I learned that Chinese often buy (accidentally-)captured dugongs, to release them. I was told that this is a Buddhist custom, which is certainly not related to the vernacular name, but is related to the reincarnation of ancestral spirits. Surprisingly, coastal villagers in Sumatra made mention of the "strand pig," which turned out to be groups of bearded pigs, *Sus barbatus oi*, foraging on tidal flats. Prof. Anderson informed me that he is in full agreement with pursuing the "sea pig" issue, although he does not feel at ease with "sea sows" or "sea piglets."

From his research, however, he confirms the bottom-rooting, semi-omnivorous niche of the dugong. Dugongs in his North Cove study area at Shark Bay fed in a "flukes up" posture with the body vertical and the flukes extending above the surface. He reported fresh craters in a dense meadow of *Halodule uninervis*. I have found craters of similar size in *Halodule* meadows of the Lease Islands, but did not catch the dugongs "red-handed."

In *Sirenews* No. 27, I mentioned as the main argument for a possible change in vernacular name the positive spinoff for conservation in regions where "pig meat" is a religious taboo. As from the anecdotal information I have gathered, there seems to be no direct relationship between the vernacular name and religious taboos for eating dugong meat, I conclude that there is no strong argument yet for a change in vernacular name. Of course I remain interested in further updates of vernacular names and religious taboos with reference to the eating of dugong meat. I will keep you informed on new developments! - Hans de Iongh (Roghorst 343, 6708 UX Wageningen, The Netherlands; e-mail: Iongh@RULCML.LEIDENUNIV.NL)

[EDITOR'S NOTE: The South African confusion between the hippopotamus and the dugong is a long-standing one. Afrikaans also uses the name *seekoei* for the hippo, and Beeckman in 1812 gave a description of "an amphibious creature, called by them manitee, or a sea-cow," encountered at the Cape of Good Hope, which was obviously a hippopotamus. This usage probably explains why P. L. S. Müller attributed to the dugong a range including the Cape of Good Hope when he named the species in 1776. Perhaps one of our South African correspondents with an antiquarian bent can disentangle the history of these names in their region.

Tony Preen, in his 1989 monograph on dugongs in Arabian waters (*MEPA Coastal & Marine Management Series Report* No. 10, vol. 1, pp. 52, 99, 115), reports that Sunni Muslims in Arabia are allowed to eat dugong meat, but that it is apparently prohibited for Shia Muslims. However, these customs seem to vary locally among different communities of fishermen, and may not be recognized or observed uniformly by all Sunnis or Shiites. We would welcome comments on this subject from our Muslim correspondents in various parts of the world.]

## REQUEST FOR RESEARCH PROPOSALS

The Center for Field Research invites proposals for 1998-99 field grants funded by its affiliate Earthwatch. Earthwatch is an international, non-profit organization dedicated to sponsoring field research and promoting public education in the sciences and humanities. Past projects have been fielded in, but are not limited to, the following disciplines: animal

behavior, biodiversity, ecology, ornithology, endangered species, entomology, marine mammalogy, ichthyology, herpetology, marine ecology, and resource and wildlife management. Interdisciplinary projects and multinational collaboration are especially encouraged. Information can be found at <<http://www.earthwatch.org/cfr/cfr.html>>, or you can contact The Center for Field Research, 680 Mt. Auburn St., Watertown, MA 02272 USA; tel.: (617) 926-8200, fax: (617) 926-8532, e-mail: <[cfr@earthwatch.org](mailto:cfr@earthwatch.org)>

## LATIN AMERICAN MARINE MAMMAL CONGRESS

The 8th Working Meeting of Specialists in Aquatic Mammals and the 2nd Congress of the Latin American Society of Specialists in Aquatic Mammals (SOLAMAC) will be held in Olinda, Pernambuco, Brazil, 25-29 October 1998. For information and registration, contact: Secretaria da Comissão Organizadora da 8a RT, C.P. no. 01, Ilha de Itamaracá - PE, CEP 53900-000, Brazil (tel. ++55 (081) 544-1056/544-1731; fax: ++55 (081) 544-1835; e-mail: [rplima@elologica.com.br](mailto:rplima@elologica.com.br)

## LOCAL NEWS

### AUSTRALIA

**Declaration of "Dugong Protection Areas" in the Southern Great Barrier Reef and Hervey Bay.** - Readers of *Sirennews* will be aware of the plans to declare "Dugong Protection Areas in the Southern Great Barrier Reef" in response to the serious decline in dugong numbers along a 2000-km stretch of the east coast of Queensland.

In August 1997, the Great Barrier Reef Ministerial Council (which is composed of the national and Queensland [state] Ministers of the Environment, Primary Industries and Tourism) finalized the establishment of a chain of dugong sanctuaries in the region of concern.

The Ministerial Council established a two-tiered system of Dugong Protection Areas (DPA's). In the Great Barrier Reef Region gill-netting is banned in six DPA(Zone A)'s with a total area of 2395 km<sup>2</sup>. These DPA's support an estimated 55% of the dugongs in the Southern Great Barrier Reef region. A further 13% of the dugongs in the region occur in eight DPA(Zone B)'s with a total area of 2235 km<sup>2</sup>. Gill-netting practices have been modified in the DPA B's with a view to reducing dugong mortality.

Gill-netting practices have also been modified throughout Hervey Bay, an important dugong habitat south of the Great Barrier Reef.

The Ministerial Council also agreed that appropriate compensation will be paid to

fishers affected by the establishment of Zone A DPA's.

These initiatives have not received wide support. Conservationists regard the closures as inadequate. They believe that the DPA B's should also be closed to gill-netting and that gill-netting should also be banned in the tidal reaches of the creeks which flow into the DPA's. The fishers are also upset by the impact of the closure.

I would have liked the measures to be more extensive and to include additional measures such as a seasonal closure in August-October (when most dugong carcasses are recovered). However, I regard these initiatives as a significant first step.

**Helene Marsh**

### BELIZE

**More Manatee Poaching.** - Evidence of clandestine manatee butchering in Belize has repeatedly surfaced in recent years, as reported in *Sirennews* Nos. 24 and 27. The latest report comes from **Oscar Salazar**, an Environmental Field Educator at The Belize Zoo. On 17 April 1997, together with Peace Corps volunteer Larry Saulnier, he discovered yet another heap of manatee bones, this one near the village of Punta Negra in southern Belize.

Mr. Salazar plans to incorporate the story of this sad discovery into his regular slide-show presentations on manatee conservation, which are given to schoolchildren and

teachers in the nearby communities. Though such local educational efforts are desirable and necessary, however, the more urgent need would seem to be for increased law enforcement - especially in view of evidence (previously reported here) that the poachers are coming from outside Belize, possibly from Guatemala. We impatiently await some news of arrests and stiff penalties in these cases. - DPD

## BRAZIL

**Captive Manatee Births.** - Newton Banks reports the following breeding successes with *T. manatus* held at the Manatee Conservation and Handling Center, Itamaracá, Pernambuco:

On 19 December 1996, a 36-year-old female gave birth to her first-born, a male 1.13 m in length and 33 kg in weight. This is said to be the first manatee known to have been conceived in captivity in South America.

On 10 April 1997, another female gave birth to twin female calves, 91 and 101 cm long and 16 and 18 kg in weight, respectively. This is the first case of manatee twins conceived in captivity.

## COSTA RICA

**New Manatee Conservation Project.** - For over a year, Ignacio Jiménez Pérez has been carrying on manatee research in Costa Rica. The following abstract is adapted from a progress report he prepared in June 1997.

"Papers written up to 1995 on manatees in Costa Rica, based on short-term surveys in the country, report a very small and endangered population. Small-scale distribution, conservation status, and threats are poorly known. In June 1996 I started field research for a MSc thesis on manatee conservation in northeastern Costa Rica. The objectives are to assess: 1) manatee distribution, 2) presence of suitable habitat, and 3) principal threats. I also designed management and educational activities as part of an overall manatee conservation project for Costa Rica.

"Activities carried out up to now include: 1) assessment of manatee distribution and relative abundance for the region between Aguas Muertas on the San Juan

River and Pacuare Lagoon; 2) measurement of habitat variables that could be related to manatee abundance; and 3) identification and evaluation of principal threats. I found that: 1) manatees are relatively common animals in northeastern Costa Rica, with almost continuous distribution through lowland freshwater watercourses; 2) there is abundant suitable habitat, due to existence of protected areas and high adaptability of this species; 3) existing threats are: a) some hunting which is decreasing; b) boat traffic that doesn't seem to be affecting the population significantly; c) increasing use of gillnets in freshwater lagoons and river mouths; and d) hypothetical impact of pesticides.

"Pending research activities are surveys in the southern area and data analysis and thesis preparation. Pending management activities are GIS database development and writing of a Manatee National Conservation Plan for Costa Rica. I will also be developing educational presentations, workshops, booklets, and posters, and an educational theater play for children in local villages.

"This project is funded by: the Spanish International Cooperation Agency, Chiquita Brands, the European Union, the Ministry of Environment and Energy, the Fundación Salvemos al Manatí de Costa Rica, the Regional Wildlife Management Program of the National University of Costa Rica, and the NGO Idea Wild." - Ignacio Jiménez Pérez (Programa Regional en Manejo de Vida Silvestre para Mesoamérica y el Caribe (PRMVS), Universidad Nacional, Apdo. 1350-3000, Heredia, Costa Rica; e-mail: <ijimenez@irazu.una.ac.cr>

## FLORIDA

**Riverboat Gamblers Roil Crystal River.** - A major legal battle has been sparked by attempts to operate a 98-foot, 150-passenger gambling cruise ship out of a marina on the Crystal River, the most important natural warm-water refuge for manatees on the Gulf Coast of Florida.

A company called River Marina Enterprises, Inc., sought permission in July 1997 to modify an existing marina on the north shore of the Crystal River, just opposite the mouth of its tributary the Salt River, so that it could better accommodate the casino ship *SunCruz IV* and its two daily



trips out into the Gulf of Mexico's international waters, where gambling is legal. (The docking facility is leased to another company, Paradise of Port Richey, which operates the ship.)

However, permitting authorities raised objections not only to the dredging that would be required inside the confines of the marina, but especially to the operation, during all tidal conditions, of such a deep-draft vessel in the shallow river channel itself, which at low tide is only 4½ feet deep in places (about the same as the ship's draft). It was feared that seagrasses would be damaged, manatees and boats traveling to and from the river's headwaters would be forced out of the channel into shallower areas where they might collide, and some manatees might be crushed under the hull of the gambling ship itself.

Meanwhile, the cruise company began operating the ship on 19 September under a Temporary Use Agreement which prohibited it from causing turbidity that would degrade the river. Turbidity was created, however, and cease-and-desist orders were issued by the U.S. Army's Corps of Engineers and by the State of Florida's Departments of Environmental Protection and Community Affairs on 23 and 25 September. The company ignored these orders, and even after one of the ship's captains was cited for felony violation of pollution laws and a second captain was jailed (on 12 October), the twice-daily gambling trips sporadically continued.

The gambling ship has already run aground at least once at the mouth of the river. Inspectors traveling in the vessel's wake have reportedly witnessed chunks of bottom sediment containing seagrasses being churned up, and increases in turbidity from dredging of sediment by the ship's propeller have been measured at 40 times the legal limit. So far no manatee injuries have been reported, but the weather is still warm and the season of the manatees' heavy winter use of the river has not yet begun.

The casino company protests that the water-quality tests are flawed, and that the law is being selectively enforced because none of the smaller boats using the river have been similarly cited. On 17 October, however, a federal judge found these arguments unconvincing and denied the company's request for an injunction against the State's

law-enforcement efforts. The judge set a 2 February trial date for the case, and as of 21 October the gambling cruises had once again ceased.

Suits and countersuits have been filed by the various parties to the dispute, and with four government orders and two court cases instituted so far, prolonged, complex, and lively negotiations are anticipated. The casino's attorney has already complained that the Circuit Court judge hearing one of the cases is biased against him. Watch this space. - [Based in part on reports in the *St. Petersburg Times*.]

## FRANCE

### New Museum to Feature Fossil Sirenians From Spectacular Eocene Site. -

For several years I have been working with personnel of the Réserve Géologique de Haute Provence at a fossil locality in southeastern France known as Taulanne. This site, perched in a picturesque mountain valley in the Maritime Alps just inland from the French Riviera, preserves the most abundant remains of Late Eocene sirenians of any place known, and in terms of the number of sirenian bones per cubic meter of sediment it is probably the richest fossil sirenian locality in the world. Indeed, sirenians are almost the only fossil vertebrates found in these rocks.

The Taulanne site was worked by Dutch paleontologists in the 1960s, and subsequently suffered somewhat at the hands of amateur collectors. It has now been incorporated into an official Geological Reserve, giving it additional legal protection. The recent excavations, besides collecting specimens for scientific study, are aimed at developing a permanent outdoor exhibit showing many of the bones preserved *in situ*. This will consist of a huge section (some tens of meters long and several meters wide) of a single exposed layer of rock, protected under a thick glass or plastic cover. On this surface, scores of sirenian bones have been chiseled out of the hard limestone, forming a snapshot of the ancient seafloor at one moment in time. Other noteworthy fossil sites in France's system of Geological Reserves have been preserved in a similar fashion.

To provide interpretive context for this outdoor exhibit, a museum is being created several miles away in the nearest

town, Castellane, which is a popular tourist destination. Located next door to the city hall, this museum will occupy the upper floors of a refurbished building that once served as the jail and still houses the city post office. In addition to offices and space for temporary exhibits, the new museum will include a permanent exhibit in a single large room (taking up the entire top floor). Half of this permanent exhibit will be devoted to the history of mermaids and mermaid legends (must bring in the tourists, you know). The other half will explain the geology and paleontology of the Taulanne site and the biology and evolution of sirenians. Few of the actual Taulanne fossils will be displayed, however, because the intent is to pique the visitors' curiosity and induce them to make the journey to the site itself, which is accessible only by hiking trails. Appropriately, the museum's exterior has been decorated with a handsome impressionistic frieze of mermaids alternating with swimming dugongs.

The official public openings of the museum and outdoor exhibit are scheduled for sometime in the summer of 1998. Meanwhile, the scientific study of the Tau-

lanne site has so far generated at least two thesis projects for French graduate students; the sirenians themselves are being studied by Claire Sagne, a student of Prof. Pascal Tassy at the Muséum National d'Histoire Naturelle in Paris. - DPD

## NICARAGUA

Manatee Survey Planned. - In addition to my work in Costa Rica (see above), I am planning an expedition to southeastern Nicaragua (Indio and Maiz rivers and several large coastal lagoons) to assess local manatee conservation status. I have reports that the species is quite abundant there, in a huge protected area (Reserva Biológica Indio-Maiz) almost uninhabited by humans. So far as I know, no research has been done in that area. A Brazilian student from the master's program where I am doing my thesis, who also did some research on *T. manatus* in Brazil, will be the other half of the expedition team. We are still seeking US\$500 to pay for field expenses. - Ignacio Jiménez Pérez

## ABSTRACTS

Recognition of phylogeographic units for the conservation management of the dugong (*Dugong dugon*) (Dani Tikel). - Distributed throughout the coastal tropical and subtropical waters of the Indo-West Pacific, the dugong is rare over much of its range and listed by the IUCN (1996) as "vulnerable to extinction". The largest numbers of dugongs are believed to occur in Australian waters. The main threats to dugong numbers are anthropogenic activity, such as accidental netting, habitat deterioration and Indigenous hunting. The primary objective of this study is the recognition of phylogeographic units for the dugong (*Dugong dugon*). Complementing ecological studies, these findings have immediate and practical relevance to the conservation management of the dugong.

Samples from approximately 230 dugongs were collected by carcass salvage, from dugongs hunted by Indigenous peoples, and by remote sampling of free-ranging dugongs. Advances upon established sampling approaches for marine mammals include a biopsy system tailored to dugongs and the extraction, amplification and sequencing of dugong DNA from their feces.

From dugong samples collected from Australia (n=92), West Indian Ocean (n=4), and Asia (n=7), three genetic markers were investigated: the cytochrome *b* gene and control region of mitochondrial DNA (mtDNA), and microsatellites. Cytochrome *b* proved to contain insufficient variation for an interpopulation comparison, whereas a block of DNA sequence (194 bases) positioned 5' in the control region of mtDNA was identified as suitable for interpopulation comparison because of its high variation. A substantial foundation for the development of microsatellite markers for future research has been established by this study. In addition to recognizing a six-base repeat located 3' in the control region of mtDNA, five GT-AC compound microsatellites were located from a dugong genome library.

The hypervariable region 1 of mtDNA was sequenced for a total of 103 dugongs, as well as in an outgroup, the Florida manatee (*Trichechus manatus latirostris*). Among the dugong sequences, 39 variable sites and 37 haplotypes (specific DNA sequences) were found. Phylogenetic trees constructed from the mtDNA haplotypes showed three clusters: West Australian, East Australian and Asian. These haplotype clusters suggest a closer relationship between the Asian and East Australian dugongs, in comparison to the West Australian dugongs. Surprisingly, haplotypes of West Indian Ocean dugongs are extremely similar to haplotypes from East Australian dugongs despite their large geographical separation. This suggests that the West Indian Ocean and East Australian dugongs shared a more recent ancestor compared to the Asian or West Australian dugongs. The geographical range of the Asian mtDNA haplotypes does not overlap with the Australian haplotypes. The two Australian mtDNA haplotype clusters overlap geographically in the Great Barrier Reef region.

Considering geography and the three mtDNA haplotype clusters, five intraspecific units for the dugong are recognized: 1) North & West Australian (coastal locations from latitude 22.20° S to 9.17° S, longitude 114.09° E to 143.07° E), 2) Great Barrier Reef (12.58° S to 23.22° S, 143.31° E to 150.32° E), 3) South East Queensland (27.22° S to 24.57° S, 152.40° E to 153.20° E), 4) Asian (10.47° N to 3.41° S, 98.35° E to 128.10° E), and 5) West Indian Ocean (26.00° N to 1.00° N, 38.00° E to 52.00° E).

The intraspecific genetic partitioning of dugong populations from Australia, Asia, and the West Indian Ocean can be partly explained in terms of historical geography. Dugongs have probably existed on the northern Australian coast since the Pleistocene (two million years ago). The distinction of the two Australian mtDNA haplotype clusters may be attributed to the Torres Strait (land bridge) acting as a periodic barrier to dugong movements during the Pleistocene low sea level phases. It is of particular interest for management that West Australian haplotypes have such a limited spread to the south and east Australian dugong range. Similarly, East Australian haplotypes do not extend north and west along the Australian coast beyond Torres Strait. Considering the dugong's potential for dispersal, the spread of the two Australian haplotype clusters is remarkably limited. The pattern of overlap between the two major Australian clusters of haplotypes in the Great Barrier Reef region indicates low rates of female-mediated gene flow.

Dugongs have a high genetic diversity and rate of evolution comparable to most land mammals. The apparent low level of migration between populations suggests that successful recolonization of an area by dugongs will be extremely slow. With respect to management, the Australian dugong units should be treated as distinct Management Units with some degree of overlap. To maintain this genetic diversity, fragmentation of the dugong's Australian range is discouraged. A chain of dugong sanctuaries connected by protected corridors is recommended. [Abstract of a thesis for the degree of Doctor of Philosophy, submitted to James Cook University of North Queensland, Australia, in 1997 and supervised by Helene Marsh.]

The following abstract is of a paper presented at the symposium on "Tropical Diversity: Origins, Maintenance and Conservation" at the annual meeting of the Association for Tropical Biology and Organization for Tropical Studies, San José, Costa Rica, June 15-20, 1997:

JIMENEZ PEREZ, IGNACIO. Universidad Nacional, Apdo.1350-3000 Heredia, Costa Rica. [ijimenez@irazu.una.ac.cr](mailto:ijimenez@irazu.una.ac.cr). Relationship between boat traffic and manatee (*Trichechus manatus*) abundance in Northeastern Costa Rica.

Local people in Northeastern Costa Rica tell that manatees started to become scarce in the region because of an increment in boat traffic due to the touristic industry. Effects of motorboats on the manatee population could be due to: 1) collisions that kill or injure the animals, 2) displacement from traditional feeding areas, 3) changes on behaviour. I tested these three effects in my study. I assessed manatee relative abundance through interviews to key informants (n>20) and other inhabitants (n>100), feeding signs and direct manatee sightings. Relative traffic was estimated through interviews and vessel counting. I compiled cases of manatees killed by motorboat collisions on the region. Relationship between boat traffic and manatee abundance was tested through independence tests for 62 watercourses without finding a significative relationship between both factors. Manatees are still present on those areas where used to be common and they even frequent high traffic areas. I found only two trustable cases of manatees' deaths due to collisions with motorboats on the last 15 years. Boat traffic increment doesn't seem to be displacing manatees from their feeding areas, but could be increasing their shyness to people and forcing them to develop nocturnal habits.

The following abstract is of a poster presented at the annual meeting of the American Society of Mammalogists, Stillwater, Oklahoma, June 16, 1997:

**RADIOGRAPHIC ANALYSIS OF THE DEVELOPMENT OF OSSIFICATION CENTERS IN THE MANUS OF THE FLORIDA MANATEE (TRICHECHUS MANATUS LATIROSTRIS) AS AN AGE-ESTIMATION TECHNIQUE.** Danette M. S. Goodyear, Alastair G. Watson, and Larry E. Stein. Dept. of Anat., Path., and Pharm., Oklahoma State Univ., Stillwater, OK 74078.

Management and conservation of endangered Florida manatees (Trichechus manatus latirostris) require life-history data based on accurate age estimations. Radiographs from a developmental series of 179 flippers salvaged from 167 dead Florida manatees (0.9 - 3.6 m total body length) were analyzed for the first appearance of 34 carpal and epiphyseal ossification centers in the manus. Chronological age has been estimated by analysis of petrous temporal bone growth-layer-group counts and correlated with known-age manatees (Marmontel et al. 1996). Radiographed flippers from 106 of these same age-estimated individuals were included in our study. In neonates (0.9 - 1.3 m) the diaphyses of the radius, ulna, metacarpals I-V and most phalanges were ossified; 15% (n=26) did not have ossified diaphyses for one or both of the second and third phalanges of digit five. Manus centers ossified in proximodistal and caudocranial sequences. Ossification events that may be useful in age estimation include the following two examples: First, in weaned immatures, the caudally located ulnare carpal bone was first detected radiographically in 1.9 m manatees and was seen in all manatees 2.1 m and longer. This ossification event corresponded to about two years of age. The proximal epiphysis of the first phalanx of digit four first appeared at 2.1 m - thus detection of an ossified ulnare without this epiphysis indicates that the manatee is most likely less than 2.1 m, whereas the detection of the ulnare and this epiphysis indicates that the manatee is at least 2.1 m and at least two years of age. Second, the cranially located radiale carpal bone was consistently ossified at 2.8 m and corresponded to 3 - 8 years of age which approximates the onset of sexual maturity. The distal epiphysis of the second phalanx of digit two first appeared at 2.8 m and was ossified in all adult manatees. The above radiographic method can be used on flippers from salvaged or living manatees to estimate the age of and to differentiate between neonate, weaned immature, pubescent, and adult manatees. Supported by National Biological Survey P.O. #83023-4-0213.

## RECENT LITERATURE

- Anonymous. 1996. Manatees and boats. *Mote News* (Sarasota, Florida, Mote Marine Laboratory) 41(3): 5. [On compliance with speed zone regulations by boaters.]
- Anonymous. 1996. Effects of red tide on manatee immune function. *Mote News* (Sarasota, Florida, Mote Marine Laboratory) 41(3): 11. [Brief popular account of in-vitro study of manatee lymphocytes.]
- Anderson, P.K. 1997. Shark Bay dugongs in summer. I: Lek mating. *Behaviour* 134(5-6): 433-462.
- Arnold, D.W. 1996. Saving the manatees ... the State's approach to manatee recovery. *Mote News* (Sarasota, Florida, Mote Marine Laboratory) 41(3): 6-7.
- Au, W.W.L. 1997. Some hot topics in animal bioacoustics. *Jour. Acoust. Soc. Amer.* 101 (5, Part 1): 2433-2441.
- Banks, N., and V.A. Lima. 1995. *Enciclopédia dos sirênios: peixes-bois e dugongos*. Recife (Brazil), Univ. Federal Rural de Pernambuco: 1-229. [A compilation of quotations and data from published literature, arranged by topics including history, paleontology, distribution, systematics, morphology of organ systems, predators and parasites, economic aspects, and conservation. In Portuguese.]
- Barnett, A.A., and M.L. Prangley. 1997. Mammalogy in the Republic of Guinea: an overview of research from 1946 to 1996, a preliminary check-list and a summary of research recommendations for the future. *Mammal Rev.* 27(3): 115-164.
- Cozzuol, M.A. 1996. The record of the aquatic mammals in southern South America. In: G. Arratia (ed.), Contributions of southern South America to vertebrate paleontology. *Münchener Geowiss. Abh., Reihe A, Geol. u. Pal.* 30: 321-342.
- Craig, B.A., M.A. Newton, R.A. Garrott, J.E. Reynolds, III, and J.R. Wilcox. 1997. Analysis of aerial survey data on Florida manatee using Markov chain Monte Carlo. *Biometrics* 53(2): 524-541.
- Domning, D.P. 1997. Fossil Sirenia of the West Atlantic and Caribbean region. VI. *Crenatosiren olseni* (Reinhart, 1976). *Jour. Vert. Pal.* 17(2): 397-412.
- Edmonds, J.S., Y. Shibata, R.I.T. Prince, A.R. Preen, and M. Morita. 1997. Elemental composition of a tusk of a dugong, *Dugong dugon*, from Exmouth, Western Australia. *Marine Biology* 129: 203-214.
- Griebel, U., and A. Schmid. 1997. Brightness discrimination ability in the West Indian manatee (*Trichechus manatus*). *Jour. Exper. Biol.* 200(11): 1587-1592.
- Jackson, J.B.C. 1997. Reefs since Columbus. *Coral Reefs* 16 (Suppl.): S23-S32.
- Jefferson, T.A., and G.D. Baumgardner. 1997. Osteological specimens of marine mammals (Cetacea and Sirenia) from the western Gulf of Mexico. *Texas Jour. Sci.* 49(2): 97-108.
- Kataoka, T., and S. Asano. 1990. The life of dugong. In: N. Miyazaki and T. Kasuya (eds.), *Biology of marine mammals*. Tokyo, Scientist Inc.: 206-217.

- Koelsch, J.K. 1996. Sarasota's manatees. *Mote News* (Sarasota, Florida, Mote Marine Laboratory) 41(3): 8-10.
- Marmontel, M., S.R. Humphrey, and T.J. O'Shea. 1997. Population viability analysis of the Florida manatee (*Trichechus manatus latirostris*), 1976-1991. *Conserv. Biol.* 11(2): 467-481.
- Marsh, H., P.W. Arnold, C.J. Limpus, A. Birtles, B. Breen, J. Robins, and R. Williams. 1997. Endangered and charismatic megafauna. In: *The Great Barrier Reef: science, use and management. A national conference .... 25-29 November 1996, James Cook University of North Queensland, Townsville, Queensland, Australia. Proceedings, Volume 1, Invited Papers*: 124-138.
- Marsh, H., P.J. Corkeron, I. Lawler, J.M. Lanyon, and A.R. Preen. 1996. The status of dugongs in the Great Barrier Reef region, south of Cape Bedford. *Great Barrier Reef Marine Park Authority Research Publication No.* 41: 1-80.
- Miller, D.J., and S.K. Donovan. 1996. Geomorphology, stratigraphy and palaeontology of Wait-A-Bit Cave, central Jamaica. *Tertiary Research* 17(1-2): 33-49. [Eocene sirenian ribs]
- Ojeda-C., M.M. 1997. Wildlife management in Venezuela: experiences and future perspectives. *Wildl. Soc. Bull.* 25(1): 49-56.
- Ozawa, T., S. Hayashi, and V.M. Mikhelson. 1997. Phylogenetic position of mammoth and Steller's sea cow within Tethytheria demonstrated by mitochondrial DNA sequences. *Jour. Molec. Evol.* 44(4): 406-413.
- Pervesler, P. 1996. Rekonstruktion einer Sirenenfundsituation aus dem Untermiozän von Niederösterreich. *Der Präparator* 42(3): 75-80.
- Russell, B.J. 1996. Hugh and Buffett. *Mote News* (Sarasota, Florida, Mote Marine Laboratory) 41(3): 5. [On two captive manatees.]
- Springer, M.S., G.C. Cleven, O. Madsen, W.W. de Jong, V.G. Waddell, H.M. Amrine, and M.J. Stanhope. 1997. Endemic African mammals shake the phylogenetic tree. *Nature* 388(6637): 61-64.
- Wakai, Y. 1997. Keeping dugongs and conservation activities in Toba Aquarium. *Aquabiology* (Tokyo) 19(1)(108): 25-28. [In Japanese.]

#### CHANGES OF ADDRESS

- Dr. Toshio Kasuya, Faculty of Bioresources, Mie University, Kamihamacho, Tsu, Mie, 514 JAPAN (fax: +81-59-231-9538)
- Dr. Christopher D. Marshall, Dept. of Structure and Function, Ross University School of Veterinary Medicine, P. O. Box 334, Basseterre, ST. KITTS, West Indies (fax: 1-869-465-1203; e-mail: ROSSLRC@CARIBSURF.COM Subject: Dr. Christopher Marshall)
- Dr. Virginia Pierce, Tri-State Bird Rescue, 110 Possum Hollow Road, Newark, Delaware 19711 USA

Dr. Alistair G. Watson, Dept. of Anatomy, Pathology, and Pharmacology, College of  
Veterinary Medicine, Oklahoma State University, Stillwater, Oklahoma 74078 USA  
(fax: 1-405-744-5275; e-mail: awatson@okway.okstate.edu)

>>> COPY DEADLINE FOR NEXT ISSUE: APRIL 1, 1998 <<<

The *Sirenews* fax number is 1-202-265-7055 (USA).



Printed on recycled paper with soy ink

\* \* \* \* \*





## OPINION SURVEY

I am continuing to update my *Bibliography and Index of the Sirenia and Desmostylia*, with a view to making the digital version available in some form. It is also necessary to plan how best to maintain and adapt this database for use by the marine mammal research and conservation community into the indefinite future. Now that the printed version has been available for over a year, I would like to get feedback from those who have used it, and I hereby solicit your comments on its format, ease of use, desirable enhancements, etc. Your responses to the following questions would be much appreciated. If you know others who have used the bibliography, please give copies of this questionnaire to them also. Return completed questionnaires to me by mail or fax (1-202-265-7055). Feel free to make further comments on additional sheets. Thank you! - DPD

1. In what ways have you used the bibliography? (Check all that apply.)

- Retrospective literature searches of particular topics (give examples of topics?)
  
- Verification of references you were seeking in libraries or via interlibrary loan
- Verification or completion of bibliographic citations to be used in your own manuscripts
- Casual browsing
- Paperweight or doorstep
- Verification of nomenclatural information (spelling of scientific names, citations of author or date, references to original descriptions, synonymies, etc.)
- Consultation of appendices other than the nomenclatural ones (which?)
  
- Other (please specify):

2. Were you able to locate the information you wanted with little or no difficulty? If not, what difficulties did you encounter? Did you eventually find the information using some other (what?) means of information retrieval?

3. What feature(s) of the work did you find most useful? (Check all that apply.)

- Bibliography (citations)
- Bibliography (annotations)
- Appendices (which?)
- Index (headings and cross-references)
- Index (citations)
- Index (annotations)
- Index (page references)
- Other (please specify):

4. Are there any subject headings or cross-references that should be added to the Index?

5. In what other ways could the work be improved or made easier to use?

6. By far the most time-consuming task in maintaining this database is the indexing, i.e., the creation of the Index entries, annotations, and detailed page references (these are all done individually by hand and not by computer sorting on keywords). In your opinion, are the Index annotations and page references useful enough to justify someone's continuing to create them for works added to the database in the future (or for the backlog of old works not yet fully indexed)?

7. With some clever computer programming, it would probably be possible in principle to retrospectively convert the existing indexing to a keyword-based system, including writing lists of keywords to the main bibliographic entries as a supplement to the present main-entry annotations. (From then on, future citations added to the Index would include only year and author(s) and would lack annotations and page references, like the incomplete citations in the present Index, but would be generated automatically by computer rather than by hand.) In your opinion, would this be an acceptable substitute for the present system, or even an improvement?
  
8. If a digital version of the bibliography were available on the Internet, would you be able to access it?
  
9. Given a choice between equally up-to-date printed and digital (on-computer) versions of the bibliography, which would you prefer to use for most purposes? What use(s) would you have for a digital version that could not be met, or met as well, by a printed version? What use(s) would you have for a printed version that could not be met by a digital version?
  
10. If a copy of a digital version (e.g., high-capacity diskette or CD-ROM) were available for purchase and use on your own computer instead of on-line, would you be interested in purchasing one? Would you still want it if it were also available on-line?

Your Name (optional) \_\_\_\_\_

Thank you!