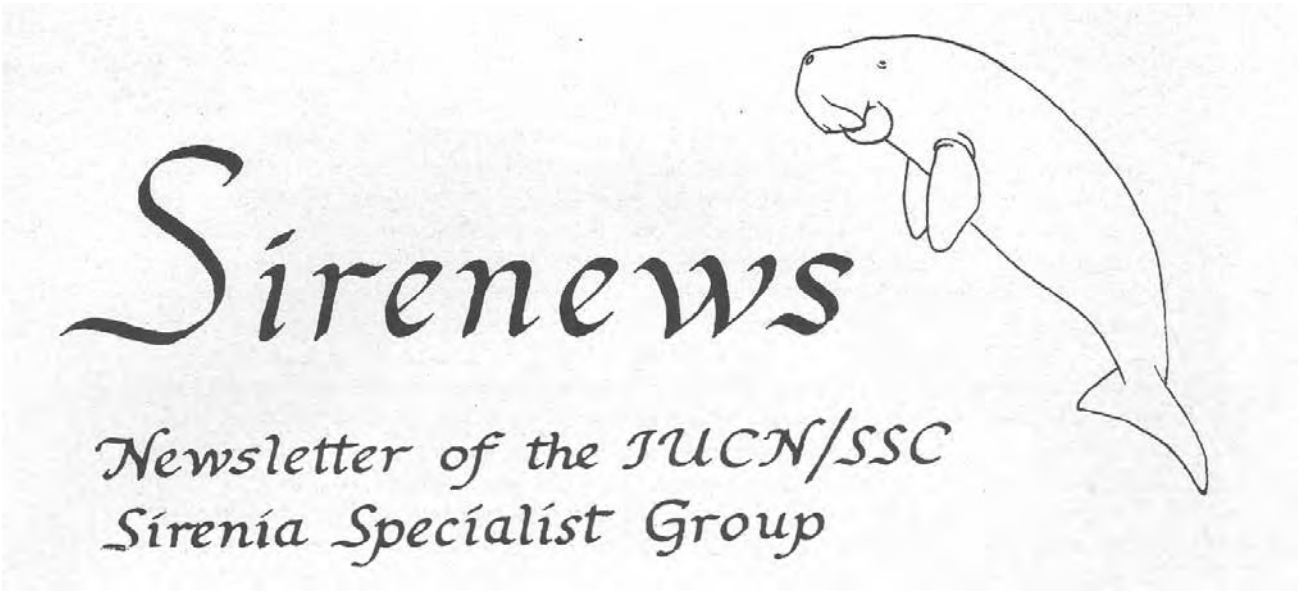

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THE VALLEY OF THE SIRENS
A Tribute to the Work of World Class Paleontologist, Dr. Daryl P. Domning

Situated high in the French Alps, surrounded by mountains and foliage, a unique fossil site lays undisturbed for 40 million years. It was first mentioned in 1938 by Albert de Lapparent, a geologist working near the town of Castellane, who discovered marine mammal bones in a ravine. At this time, Castellanes' sirens were called "HALITHERIUM".

In 1994, the Reserve Naturelle Geologigue in Haute Provence, invited Dr. Daryl Domning from Howard University, Washington, DC, to excavate this site. Dr. Domning and his students worked two years on this project and what resulted from intense hard work is a magnificent, one-of-a-kind Dugong experience. There is nothing in the world like this and for those of you who are not familiar with this special place, I would like to share my experience with biologists, scientists and all sirenian lovers.

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 especes-Species Survival Commission

UICN
Unión Mundial para la Naturaleza

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The site is located in the Ravine de Tabori, in the area of Taulanne, near a mountain pass (Col de Leques) in Haute Provence, the French Alps. Thirty minutes away is the picturesque town of Castellane. Dr. Domning and his esteemed colleagues from the Reserve Geologigue created a museum called the "Maison des Sirenes and Direnians". It is situated in the town square next to the post office. Painted on top of the post office are pictures of dugongs and mermaids. The museum has a wonderful interpretive exhibit about the site and the history of the siren or mermaid which is shown through a collection of Greek vases, old books, posters and sculpture. The exhibit is both visual and educational and many scientists contributed to the research. I found the following quite fascinating.

The siren was first found in Homer's *Odyssey* (720 BC). He wrote "First you will come to the sirens, enchanting all who come near them". "The maiden of the sea" and the "siren" came together in the seventh century, not in a beautiful way, but in a *Book of Monsters*. The author argues that sirens are women with a fishtail "who lure men with their voice and their beauty." During his first voyage, Christopher Columbus saw three "sirens". He used the word "siren" to designate a heavy animal, the peaceful manatee which has been taken as a mermaid for hundreds of years. The myth of the "siren" has given its name to a group of aquatic mammals call the Sirenians. For the most part, sirens were associated with pretty women with fishtails emanating mystery, eroticism and beauty.

There is a section which describes the fossil site with a short animated film, tracing the dugong from birth to death. There is a life size dugong; a replica of the dugongs that lived here and, finally, we are brought to the modern day manatee, living in Florida (*Trichechus manatus*). There is an excellent exhibit using films and photos, documenting the perils with which the manatee lives. These include boat hits, habitat destruction, pollution and red tide.

I left the museum with great anticipation to see the site. As I drove higher into the mountains, I kept mulling over what I had just learned. Europe was covered by the Tethys Sea 40 million years ago. The Tethys Sea extended from the Far East through the Alpine area to the Caribbean. Dugongidae (Cocene) were ubiquitous throughout the coastal zones for millions of years. The Castellane Sirenian (Cosiren) lived near a rocky coast scattered with inlets. They lived in clear and tropical sea water grazing sea grass, resting and playing.

I parked my car and continued up the mountain on foot. I was surrounded with rocks, brush, trees, and not a drop of water. It was a bizarre feeling, hiking to an area once covered by water, yet now mountainous and so high up.

And there it was! Hundreds of Sirenian fossils in situ! Rare and intact, full skeletons, ribs, heads, all covered with thick bullet-proof glass to prevent vandalism. I was in awe; I actually could not move for an instant. Viewing this is an indescribable feeling – 40 million years old, pink fossil bones petrified by fluids due to the presence of a phosphate compound. There was a rib, deeply imbedded in the rock; it was outside the glass protection. I touched it and could only imagine that this animal was swimming in this area, living its life and now a fossil, probably buried in mud and perfectly preserved.

Why did this animal become extinct? How long were they there? I immediately e-mailed Dr. Domning and here are his answers:

"As to your questions: There's no telling how long the sirenians had been using that particular embayment, or how long they'd been in the region – probably millions of years. There wasn't just one storm recorded at that site, but probably a long series of them (not to mention ones that weren't recorded in the fossil record); and the storms weren't the cause of the sirenians' extinction, just an ordinary part of their lives and deaths, as is the case with sirenians today. The Taulanne sirenians probably didn't even become extinct biologically, only taxonomically; they probably evolved into another species (*Hallitherium schinzii*) that lived throughout Europe for millions of years more. Yes, it's the same Tethys seaway that extended from the Far East through the Alpine region, and even to the present Caribbean. Today, natural disasters (including typhoons, red tides, and cold snaps) are a part of the problems of sirenians and all other species, but added to these problems now are the mortality and habitat destruction caused by humans. These combined stresses can easily push a species over the edge when the natural catastrophes alone wouldn't have. The sirenians are certainly not out of the woods yet, and won't be as long as we continue to overpopulate the planet."

and –

"One new development: Taulanne sirenians were given a new name (*Halitherium taulannense*) by Claire Sagne in 2001. They are now seen as evolutionary intermediates between other Eocene seacows and *Halitherium schinzii*, the common early Oligocene European sirenian. So, that's a real advance in our knowledge.

Amateur collectors and fossil dealers have taken a substantial quantity of sirenian bones from that site in past years; it would be interesting to know if that is still going on. I discovered recently that a "skeleton" from that site (some bone, a lot of plaster) was collected in 1992 and sold by a German dealer as far away as Tokyo, where it now resides in the National Science Museum."

Thank you, Dr. Domning, your students and your colleagues who helped make this site a dugong wonder of the world and an achievement for present and future generations to enjoy. For me, my visit was an honor and a privilege. –***Lynda Green***

1st SYMPOSIUM FOR THE BIOLOGY AND CONSERVATION OF ANTILLEAN MANATEE (*Trichechus manatus manatus*) IN MESOAMERICA

The first symposium for the biology and conservation of Antillean manatee in Mesoamerica will be held on 1-2 November, 2006 during the X Congress of the Mesoamerican Society for Biology and Conservation (SMBC) in Antigua, Guatemala.

Purpose:

1. The purpose of this symposium is to update the current knowledge about the status and distribution of Antillean Manatee in Mesoamerica (Mexico, Guatemala, Belize, Honduras, Nicaragua, Costa Rica, and Panama). Representatives from each country will be invited to present a 20 minute presentation on the status and distribution within their country.
2. The second purpose of the meeting is so that those working with manatees in Mesoamerica can all meet and begin to collaborate in larger region-wide projects such as fine scale DNA collection and coordinated aerial surveys.
3. Finally, the symposium will be a place were new students and scientist in the field of sirenian work can interact with the more experienced ones and learn from their experiences. Potential for brief training in sonar use, DNA collection, and tagging and tracking might be available.

The call for abstracts closed on 5 September 2006. To participate in this symposium you must register for the congress. For more information please go to http://resweb.llu.edu/rford/courses/ESSC5xx/SMBC_manatee_symposium.html. Principal organizers of the conference are ***Daniel Gonzalez-Socoloske*** (dgonzalez01x@llu.edu), ***Leon David Olivera-Gomez*** (leon.olivera@dacbiol.ujat.mx), and ***Ester Quintana-Rizzo*** (equintana@mote.org).

DOWNLISTING THE FLORIDA MANATEE FROM ENDANGERED TO THREATENED STATUS: TWO VIEWPOINTS

Unwarranted State Action Puts Manatees In Clear and Future Danger. Despite growing threats to the manatee's long-term survival and overwhelming public opposition, the Florida Fish and Wildlife Commission (FWC) recently voted to prematurely downlist manatees from Endangered to Threatened. This decision plays right into the hands of those who want to exploit manatee habitat for development and high-speed recreation.

Even though the state found that the manatee population could be reduced by as much as 50% in the future and that manatees meet the federal and World Conservation Union's (IUCN) definition for Endangered, manatees no longer qualify for state Endangered status because the FWC arbitrarily changed its listing/delisting rules by adopting the IUCN criteria for Endangered and then calling it Threatened.

Thirty conservation and animal welfare organizations representing millions of Americans around the nation urged FWC to fix its imperiled species classification system to properly align it with IUCN's. Thirty-nine manatee and dugong scientists from numerous countries around the world sent a letter in opposition to the manatee's downlisting. And people from all over the nation called the agency in protest, while hundreds more attended the Commission meeting. Out of scores of speakers at this meeting, only a handful of development, marine industries' and go-fast boaters' lobbyists spoke out in favor of downlisting manatees to Threatened!

Further, 17 organizations filed a legal petition asking the FWC to fix its imperiled species classification system. But, in the end, none of it mattered to the Commissioners.

The FWC insists protections won't change, but a review of Florida law shows Endangered species are afforded more protection than Threatened species.

The Commission claims their Management Plan will protect manatees. However, Florida's Legislature will be pressured to reduce FWC's authority and funding to protect manatees. This will undermine the implementation of the Plan, and prevent real recovery.

The FWC and Governor Bush are declaring this a victory for manatees but the facts show otherwise. The agency claims that the manatee population is growing, yet a state report shows that only the 2 smallest subpopulations clearly show growth. Together, these 2 subpopulations only account for 16% of the manatee population. Based upon the latest peer reviewed information, the largest subpopulation on the Atlantic coast shows a probable decline of about 3% per year over the last five years. The Southwest subpopulation is already in decline. Manatees continue to die from boat strikes in near-record numbers and there has been a 17% increase in manatee mortality from boat collisions over the last 5 year period as compared to the previous 5 year period!

Please ask yourself, can all of the organizations representing hundreds of thousands of Florida citizens and millions more people nationwide who have shared their concerns over the new listing process be wrong? I urge the Commission to take a step back from the situation and think about the repercussions to manatees and many other imperiled species if we are right and they are wrong. The consequences will be disastrous. If we are wrong and they are right, then no harm will have been done.

In the meantime manatees' projected loss of winter habitat could cause catastrophic future losses.

This is no time for celebration! –***Pat Rose, Save the Manatee Club***

Experts Agree: Manatees Not In Imminent Danger of Extinction. The Florida Fish and Wildlife Conservation Commission voted on June 7, 2006 to designate the manatee as having a **very high risk of extinction**. In Florida we call that level of imperilment *threatened*. The proposed reclassification is to move the manatee from e*ndangered* status which the state defines as an **imminent** danger of extinction. Judging from media coverage and comments from some stakeholder groups, this reclassification is widely misunderstood.

The FWC use guidelines for classifying species based on International Union for the Conservation of Nature (IUCN) standards. The scientific community worldwide has tested these guidelines. In fact, at least 30 countries are using IUCN standards as the basis for their own imperiled species classification process. One of the strengths of the Florida system is that it uses measurable criteria and has multiple levels of independent review. A Biological Review Panel (BRP) carefully reviewed the best available data in reaching a unanimous conclusion that the manatee should be listed as threatened. The work of this BRP was then reviewed by a panel of independent scientists.

Some have suggested that the work of the BRP was unfairly bound by the state's system itself – that these experts simply did the "math" but were using a flawed system. However, the state system allows for the BRP to make a recommendation to move a species up or down one level – independent of the specific mathematical criteria. In other words, the system allows for a listing "trump card" if the BRP feels there are special or unique circumstances. Yet the BRP members, with years of expertise in manatee

biology, ecology, and management, did not play the "trump card." Instead, they voted unanimously that the manatee should be classified at the state's threatened level.

As someone who grew up in Florida and has worked professionally on manatees for over twenty years it comes as no surprise to me that the manatee should no longer be classified as endangered (defined as imminent danger of extinction). It is clear that there are more manatees in Florida today then when some the pioneers of manatee research (Daniel Hartman, Buddy Powell, Dan Odell, and Tom O'Shea to name a few) did much of their groundbreaking work in the 1970s and 1980s. The best available science today indicates that even in the most recent ten year period manatee populations continue to grow or are at least stable in three of four regions of the state. The definition of imminent extinction just does not fit the manatee in Florida.

On the other hand, irrespective of statements by some groups and individuals, the reclassification proposal does not signal that manatees are fully recovered. While trends have been encouraging, the long-term risk is still high. Accordingly, the state system has yet one more safeguard. The manatee will not actually be reclassified from endangered to threatened until a manatee management plan is approved by the Commission. This management plan will be a blueprint of what needs to be done in order to keep the manatee population moving towards recovery. It will insure that the change in classification will not mean a reduction in protection. The management plan is being drafted and will be available for public review later this year. It is hoped that the plan will be ready for Commission consideration in early 2007. ***–Kipp Frohlich, Florida Fish and Wildlife Conservation Commission***

NEW YORK TIMES MANATEE ARTICLE

An interesting article about manatees appeared in the August 29, 2006 edition of the New York Times. The article can be accessed at: http://www.nytimes.com/2006/08/29/science/29mana.html?ei+5094&en=c0eaeb3c699.

LOCAL NEWS

AUSTRALIA

Is Dugong Management in the Coastal Waters of Urban Queensland Effective Species Conservation? Attention is increasingly focused on measuring the effectiveness of conservation measures. The arrangements introduced to ameliorate human impacts on dugongs in the 12.5^{o} latitude of coastal waters off Queensland, Australia, include: banning the dugong oil industry in the 1960s; establishing the world's most extensive network of ecosystem-scale Marine Protected Areas; controls on fisheries, shark netting, vessel movements and speeds; phasing out the use of high explosives in the Great Barrier Reef region; partnerships with Traditional Owners to manage Indigenous hunting; and initiatives to improve water quality. Since the mid 1980s, aerial surveys of dugong distribution and abundance have monitored the species conservation outcomes of these initiatives. The surveys suggest that dugong numbers are now stable at the scale of the entire urban coast although populations fluctuate at the level of individual bays, probably largely due to changes in seagrass habitats. However, it is impossible to evaluate the cumulative success of the management initiatives because policy is silent on whether

population maintenance or recovery is the management objective. The results indicate the importance of: (1) developing cross-jurisdictional objectives for management at ecosystem scales, and (2) co-coordinating management at both culturally and ecologically relevant scales. -- ***Helene Marsh, Ivan Lawler, Amanda Hodgson, and Alana Grech*** **(**School of Tropical Environment Studies and Geography, James Cook University, Douglas, Townsville, 4811 and Marine and Tropical Scientific Research Facility P.O. Box 2320, Townsville, 4810, Australia).

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PDFs of most of Helene Marsh's publications are on line at http://www.locus-nq.net/helene/

INDONESIA

Dugong Survey of Derawan Island and Adang Bay, East Kalimantan, Indonesia. In Indonesia little scientific information is available on the abundance, distribution and behavior of dugongs. No accurate data on population size and distribution are known (Marsh et al., 2002; Dugong Status Report and Action Plan). In the 1970s the dugong population was estimated to be around 10,000. In 1994, the population was estimated to be around 1,000. Both population estimates are guesses and should not be considered as evidence for a decline in the intervening period, although studies have indicated a dramatic decline in numbers in specific areas such as the Aru (De Iongh, 1996). The main research effort to date on dugong-seagrass interactions has been implemented in the Moluccas province. Dugongs in Indonesia have been demonstrated to depend very much on intertidal mono-specific seagrass meadows of *Halodule univervis* (De Iongh *et al.*, 1995a,;De Iongh *et al*.,1995 b; De Iongh, 1996a; De Iongh, 1996b; De Iongh *et al*., 1998). In addition, De Iongh *et al.* (2005) recently reported in *Sirenews* (No. 45) on dugong seagrass interactions in Balikpapan Bay, East Kalimantan.

It is concluded that to date very little information is available about the distribution and population size of dugongs in Indonesia and in East Kalimantan in particular. Also, there is a strong need for new surveys on distribution, size and threat status of dugongs in Indonesia, building on the initial status report and action plan of Marsh *et al* (2002). Within the framework of our research programme on dugong-seagrass interactions in East Kalimantan, from 28-30 August 2005 a field survey was made in the Adang Bay (situated south of Balikpapan Bay), and from 25-30 October 2005 a field visit was made to the Archipelago of Derawan (situated in the northeastern part of Kalimantan). Adang Bay may provide habitat for dugongs, since it is close (approximately 80 km) to Balikpapan Bay and the presence of dugongs was previously reported in the Derawan Archipelago (Kreb and Budiono, 2005).

Survey Derawan Archipelago

In the village of Derawan 16 interviews were conducted with local fishermen in order to gather information on local knowledge of dugongs. All the interviewees were living and/or working in the village of Derawan. In addition, during a snorkeling survey

near the shore of the Island Derawan, a seagrass field dominated by *Halodule uninervis* was found. Green turtles were grazing, but no evidence of dugong grazing was observed.

Of all interviewees, 14 (87%) claim to have seen a dugong. Of the people interviewed, nine have regularly seen a dugong around Derawan Island and 11 people claim to have also seen dugongs around the other islands. Our initial survey shows that the presence of a small population of dugongs in the Derawan Island archipelago is likely, but further evidence needs to be gathered. It is our intention to expand our research effort to this archipelago, since it seems to be the most intact remaining dugong habitat in East Kalimantan.

The surroundings of Derawan Island seem to be a suitable habitat for dugongs, because seagrass beds (*H. uninervis*) are present in sufficient quantity, local villagers regularly see dugongs, and the presence of dugongs is also cited in Kreb & Budiono (2005). This area is approximately 350 km from Balikpapan Bay, and interaction with dugongs in Balikpapan Bay cannot be excluded since satellite tracking of dugongs in Indonesia has demonstrated that dugongs migrate substantial distances (De Iongh *et al*, 1998).

Survey Adang Bay

From 28-30 August 2005 a field survey was conducted in Adang Bay, situated in the south of Balikpapan Bay. Daytime observations for dugongs and seagrass were made by surveying the shores of the bay in an 7 m engine-powered vessel while taking bottom samples every 100 meters in order to check for the presence of seagrass. Interviews were carried out in the village of Pasir Mayang by using a semi-structured interview format. In total, 11 interviews were held. All the interviewees were living and/ or working in the area around Adang Bay. Only people who were regularly on the water (fishermen) were selected.

Sediment sampling and interviews all indicated that no extensive seagrass beds were present in Adang Bay. Four of 11 interviewees claimed they had seen dugongs in this bay, but since dolphins are very common it is possible that those people confused dugongs with dolphins. However, we can also not exclude that dugongs occasionally visit the bay due to the proximity to Balikpapan Bay. The absence of seagrass and lack of reliable information on dugong presence indicates that Adang Bay is not likely a favoured habitat for dugongs. -- ***Hans de Iongh, Marloes Moraal, and Caroline Souffreau*** (Institute of Environmental Sciences, Leiden University, POB 9518,2300 RA Leiden, Netherlands).

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Rotational grazing by dugongs in Indonesian coastal waters. Research on dugong-seagrass interactions in Indonesia was implemented from 1990 through 2005 in East Aru, Maluku Tenggara and East Kalimantan (De Iongh, 1996). During field surveys in East Aru in 1990 and 1991, for the first time grazing swards were discovered showing signs of intensive rotational grazing by dugongs in intertidal inshore *Halodule univervis* meadows.

Aerial surveys in the Lease islands confirmed the presence of a small population of at most 37 dugongs. Four individual dugongs were tracked with buoyant, tethered conventional and satellite radio transmitters between 45 and 285 days (De Iongh *et al*., 1998). The patterns of movement and the results of snorkelling surveys confirmed a practice of regular recropping of restricted grazing swards by small feeding assemblages of dugongs. Dugong grazing in an intertidal seagrass meadow dominated by *H. univervis* showed a significant correlation with carbohydrate content of the below-ground biomass and no significant relation with total N (De Iongh et al., 1995). It was concluded that the timing of dugong grazing in these intertidal meadows coincides with high below ground biomass and high carbohydrate content in the rhizomes of *H. uninervis* in the upper 0-4 cm sediment layer. A small population of at most 12 dugongs was discovered in Balikpapan Bay during the nineties and research on dugong-seagrass interactions was carried out during 2000-2005 (De Iongh, 2005, 2006). Similar to the research results of the Moluccas province, in Balikpapan Bay the timing of intensive dugong grazing in seven inshore intertidal *H .uninervis* seagrass beds coincided with high levels of carbohydrates in the below-ground biomass, while dugongs also showed rotational grazing in grazing swards.

It is concluded that our research findings support the hypothesis that temporal dugong grazing in intertidal meadows is ruled by carbohydrate content in below-ground biomass. The mechanisms of rotational grazing in restricted grazing swards are not yet well understood, and the maximization of carbohydrates does not fully explain this phenomenon. Our findings of small herds of dugongs showing rotational grazing inside

grazing swards exhibit similar characteristics to what Preen (1993, 1995) defined as cultivation grazing of larger herds of dugongs in coastal waters of Australia. He defined "cultivation grazing" as intensive grazing by large herds of dugongs in order to keep seagrass meadows in a pioneer stage. The form of rotational grazing which we observed in our study areas does not completely meet with the definition of cultivation grazing of Preen (1993,1995). Dugongs in our study areas graze in much smaller herds and obviously show rotational grazing inside mono-specific *H. univervis* meadows, thus keeping the meadow at a pioneer stage is not a factor of importance. Our research confirms that intertidal *H. univervis* seagrass meadows form a crucial resource for dugong survival. These relatively unknown biotopes need, therefore, more attention in research and conservation programmes. – ***Hans de Iongh*** (Institute of Environmental Sciences, Department of Environment and Development, POB 9518, 2300 RA Leiden, The Netherlands, tel +31-71-5277431, Iongh@cml.leidenuniv.nl).

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MEXICO

Five Years of the Manatee Recovery Plan in Mexico: It Is Time to Evaluate Its Effectiveness. In 1997 the Ministry of Environment (SEMARNAT) called for the integration of a Manatee Advisory Committee (STC), which consisted of around 20 technical experts from academic institutions, wildlife managers, and representatives from government, non governmental and private organizations. Over the course of several

meetings, steps were taken to prepare a manatee recovery plan which was finally adopted in 2001. Until 2006, the authority responsible for implementing the recovery plan was the Department of Wildlife (DGVS). As with many federal agencies, DGVS is centralized and has limited human and financial resources. Consequently, during the last five years DGVS has had very limited participation, playing more a role of institutional moderator.

In developing countries such as Mexico, allocation of the federal budget follows other priorities. As environmental professionals, we know we cannot expect to have a recovery plan funded by SEMARNAT. So, how is the manatee recovery plan being implemented? We have been working in an "altruist model" of advisory committees where members not only "steer" the recovery actions but also implement all of them. Thereby, the STC works also as a recovery team supported by the efforts and funding of all the volunteer members.

The manatee recovery plan is now five years old. As a founding member of the recovery team, I consider that the absence of an evaluation framework to assess the effectiveness of the efforts undertaken so far is problematic. While an informal mechanism of self-review has been incorporated through recovery team annual meetings, a more formal scheme for monitoring and measuring the progress is needed. Regular evaluation in a five-year cycle is required for new knowledge about the status of manatees in Mexico to be incorporated into the plan. The evaluation framework should also include an analysis of the appropriateness of objectives, actions implemented and outcomes. Lessons learned from strengths or weaknesses should be recognized and collated. This information could be incorporated into the annual report prepared by the recovery team. Thus, lessons learned from experience of the manatee recovery team could be disseminated to other recovery teams. A financial summary may also be added to the evaluation report by tallying all the different sources of funding as a reference for defining future resource requirements.

In conclusion, I believe that in Mexico we have an outstanding and passionate group of people collaborating in our recovery team, but as manatee conservationists we should look forward to seeing if our efforts are effectively assisting the recovery of manatees from the verge of extinction. ***--Alejandro Ortega-Argueta*** (Mexico Manatee Recovery Team, University of Veracruz, Mexico/University of Queensland, Australia aortegarg@yahoo.com.mx).

Behavior of West Indian Manatees (Trichechus manatus) in captivity.
Manatees in captivity represent a great opportunity to study certain behavioral displays. A goal of this kind of study must be to understand individual reactions against external factors, as well as reproductive and aggressive performances. In addition, behavioral observations on captive animals help to improve conditions of captivity. Hence these studies are important in facilities with captive animals.

On the other hand, controlled conditions help to promote conservation (Portilla-Ochoa *et al.*, 2002), because care is provided to ill animals (Padilla-Saldivar and Morales-Vela, 2004), and there is the potential to increase the number of births (for example see Da Silva, 2004). This study was conducted at "Acuario Veracruz" using eight captive manatees (four females, three males and one newborn) in well-conditioned tanks. This Aquarium is visited by numerous tourists throughout the year and provides

security to keep manatees in a quiet environment (i.e. camera flashes and noise are restricted in manatee areas). In order to record behavioral data, three observational periods were established: 0800 – 0900; 1100 – 1200; and 1700-1900. Observations were recorded for 24 days during February, July, and August.

Results were obtained in percentages to determine differences between behaviors. Due to the confined conditions the activities displayed were conspicuous and restricted. We divided clearly distinguished behaviors into five categories: sleeping, feeding, swimming, quiet and other. We found in almost all the animals (with the exception of two males) statistical differences between the five behaviors in February (ANOVA, significance $p<0.05$). During July and August, statistical differences between all five behaviors were present in all individuals. The behavior displayed most frequently was swimming during February and July, and sleeping during August. In the case of the newborn manatee, the most common behavior was sleeping.

These results do not coincide with observations of Cortez-Aguilar *et al.* (2002). They reported feeding as the behavior displayed most frequently. Differences between studies could be due to different study methods and the number of observed individuals. We suggest that individuals are constantly moving, possibly for high interaction. In August the manatees spent more time sleeping, perhaps due to the amount of tourists visiting the Aquarium. In spite of the statistical differences, additional studies of this type are needed in order to determine the impact of tourism on individual captive manatees as well as the relationships between individuals in a confined environment.

This work was made possible by the support of the Acuario Veracruz personnel, in particular Fabian Vayone. – ***P. Zúñiga-Melgar[1] and J. Meraz[2]*** ([1]Biología Marina, Universidad del Mar. Mexico; [2]Instituto de Recursos, Universidad del Mar. Mexico sula@angel.umar.mx).

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MOHÉLI ISLAND

Dugong Research and Conservation on Mohéli Island, Union of the Comoros. The Comoros Archipelago, consisting of the islands of Grande Comore, Anjouan, Mohéli and Mayotte (France), is located in the western Indian Ocean, between Madagascar and Mozambique. In the 1970's, dugongs (*Dugong dugon*) were known to range throughout the islands. However they are now believed to be very rare and are thought to occur only in the coastal waters of Mohéli and Mayotte. This apparent decline may be due to a number of causes. The Comoros Islands have experienced, over

the last few decades, an increase in population size which has resulted in environmental degradation. Urbanization, poor farming practices and the clearing of coastal and inland forests and mangrove stands have contributed to a marked increase in coastal erosion, sedimentation and siltation. These processes may decrease salinity and intensity of light radiation, both of which are thought to cause a decline in seagrass abundance, thereby decreasing the sole food source for dugongs.

There is a pressing need for research to be conducted on the dugong in the Comoros. No up-to-date information currently exists on the distribution of dugongs or seagrass beds on the island of Mohéli. To address this need, a British NGO, "Community Centered Conservation" (C3), has been working on the island in collaboration with Moheli Marine Park since May 2006 to establish research, monitoring and awareness-raising activities for dugong and seagrass conservation. A preliminary assessment of dugong distribution within Moheli Marine Park was carried out in 2002 through 109 fisher interviews within the 10 villages located inside the Park boundary. C3 has recently replicated this study in 13 villages outside the Park, with a total of 97 fishers interviewed. This survey has recorded a total of 13 dugong sightings since the beginning of 2006, with 20 sightings being reported for the years 2000 – 2005. Dugongs were predominantly sighted in seagrass habitats (51%), with 49% of fishers sighting them from traditional canoes (pirogues), which are normally confined to coastal waters (i.e. less than 5km offshore) and cause less disturbance compared to motorized craft. Most fishers also perceived a recent decline in dugong numbers, although a considerable number in the northwestern region had never heard of, or seen a dugong before. There were 14 documented deaths recorded between 1976 and 2005, with 7% caused by spear gun fishing, 29% by gill net fishing, and the remainder from unknown causes. It is likely, however, that the main contemporary threat to dugongs is accidental capture in fishing nets.

To complement the fisher interviews, Dugong Sighting Cards have been distributed to all of the villages around the island, providing a means for fishers (and villagers) to record sightings of dugongs in the future. Additionally, data from interviews within and outside the Marine Park are being combined to identify hotspots of dugong and seagrass bed distributions. C3 is currently mapping and assessing the species' composition of seagrass beds around the island, starting in the north western region of Moimbasa. Seagrass areas will then be identified for quarterly monitoring, and local communities will be trained in seagrass survey techniques to ensure the long-term sustainability of the program. C3 has further engaged the community by organizing awareness-raising events such as the 'Day of the Dugong' in several villages. The fisher interviews have also assisted in prioritizing certain villages for awareness raising efforts over the coming months.

C3 aims to expand dugong research onto the islands of Grande Comore and Anjouan where it will work in collaboration with AIDE (Association d'Intervention pour le Developpement et l'Environnnement), in order to draw up a comprehensive action plan for the conservation of the dugong and its associated habitats in the Union of the Comoros. This work has been generously funded by the BP Conservation Program, PADI Foundation and Rufford Small Grants for Nature Conservation. –Bjorn Alfthan and Patricia Davis (Community Centered Conservation (C3), www.c-3.org-uk, info@c-3.org.uk).

MOZAMBIQUE

Em Perigo. Earthmedia Imaging and Film and Catembe Productions in association with the Maputo Museum of Natural History are currently producing a film on the endangered dugongs of the Bazaruto Archipelago in Mozambique. It is a part of a broad scoping initiative called Em Perigo (Endangered). Em Perigo is a multi-media education program following the mission of two young Mozambican environmentalists as they learn about the vast amount of endangered marine life living off the coast of Mozambique and find out what can be done to save it.

The six films will have English and Portuguese versions with the dugong episode being translated into Chitswa, the local language in the archipelago. There will be a printed booklet and structured guides for teachers, community workers and community radio presenters.

General objective: To contribute towards an increased awareness of, and support for, the conservation and protection of marine resources in Mozambique.

Specific objectives:

-To encourage Mozambican youth to get involved in science and conservation work and to make a difference in terms of protecting their countries' marine biodiversity.

-To provide new dynamic tools for education and awareness raising on the endangered marine fauna of Mozambique.

-To provide a powerful visual tool for schools, community media centers, organizations and educational institutions involved in environmental conservation work throughout the country.

We are already shooting high quality sequences of dugongs underwater. Partial funding has already been secured but we are currently seeking partners to work with us on the rest of this important initiative. For more information and a full proposal please contact James Ewen at james@earthmedia.co.uk.

Earthmedia and Catembe Productions are the production companies of two award winning British filmmakers, James Ewen ("Mangais- Raizes das Mares", Best environmental education film CINE ECO 2005 Portugal) and Karen Boswall ("Marrabentando", best television documentary for 2005 RTP Portugal). Both long-term residents in Mozambique and passionate about the environment, this duo have decided to join forces to co-produce the first ever environmental series made in Mozambique.
-***James Ewen*** (Earthmedia Imaging & Film, 00258 823132450, Maputo, Mozambique www.earthmedia.co.uk).

USA

Florida manatee travels to Cape Cod, Massachusetts! Every summer reliable sightings of Florida manatees in waterways beyond their usual summer range are reported. However this year, as has happened on only a few previous occasions, these

sightings were extraordinary in their distance from familiar manatee haunts. On July 11, 2006, a manatee was seen and photographed in Ocean City, Maryland. Many immediately wondered whether this manatee could be "Chessie", a manatee previously documented in northeastern US waters. Chessie was rescued from the Chesapeake Bay, MD, on October 1, 1994, transported to Florida, released with a radio transmitter, and monitored by the USGS, Sirenia Project for 11 months. During the summer of 1995 he traveled all the way to Port Judith, RI, before turning back south on 22 August 1995. The last verified sighting of Chessie was on August 30, 2001 at the Great Bridge Locks in Virginia (see http://cars.er/usgs.gov/Manatees/Manatee_Sirenia_Project/Manatee_Chessie_Surfaces/manatee_chessie_surfaces.html).

Photographs taken at Ocean City of the most recent wanderer were not adequate for individual identification. However, more sightings in the Indian River Inlet, Delaware Bay, Delaware on July 14, in Barnegat Inlet, New Jersey on July 22-23, and in New York's Hudson River from August 1-8 were reported, spurring our hopes that Chessie had again made the news. However, without photographs to attempt a match to a known manatee previously documented in the Manatee Individual Photo-identification System (MIPS catalog), we could not confirm whether this was Chessie, or even if all the sightings were of the same manatee. Then a northern distribution record was made when a manatee was reported in Quisset Harbor, Falmouth, MA on August 17. On August 20, the manatee lingered long enough to drink fresh water from a culvert in nearby Greenwich Bay, Rhode Island, where many photographs and videos were obtained. The images confirmed this manatee was not Chessie, but a new, previously unidentified northern traveler! Most likely the same manatee was reported in Bristol Harbor, RI on August 28 and near Long Beach Island, NJ on 8 September. This manatee still has time to reach Florida waters before the onset of cooler weather. We hope to receive more photo-documentation sightings as it makes its way home. – ***Cathy Beck*** (U.S. Geological Survey, Florida Integrated Science Center, Sirenia Project)

Temporal habitat use of the Florida manatee (Trichechus manatus latirostris) at a natural water spring in relation to human activity and vegetation. Wildlife refuges are designed to provide suitable habitat as free as possible from human interaction and impact. Kings Bay in the Crystal River National Wildlife Refuge (CRNWR) is located approximately 60 miles north of Tampa Bay, Florida. Kings Bay serves as critical habitat for the endangered Florida manatee (*Trichechus manatus latirostris*); yet limiting human activity cannot be strongly enforced because of the legal limitations involving the bay's navigable waterways.

Manatees use Kings Bay's natural springs as a warm water refuge in winter (November–April) when Federal sanctuaries for manatees are annually put in place. Historically, with thermal release during the non-winter months (May-October), manatees left the bay in search of better forage after depletion during the winter. Recently, manatee numbers during the non-winter season have been increasing, but how manatees use the bay at this time is undetermined. Humans recreate and attempt to interact with manatees throughout the year.

Our current study documented the seasonal 1) dispersion and 2) behavioral habitat use patterns of manatees in Kings Bay with regard to human activity and vegetation from May '05-May '06. Survey stations were established across the bay and the number of

manatees, people in the water, and boats were counted. To examine behavioral patterns, focal animal observations were conducted, and the time spent feeding, resting, traveling, or other activities was recorded. The amount of edible vegetation was determined using point sampling.

The number of manatees and percent of edible vegetation differed significantly by season, but the number of people in the water or boats did not. During the winter, manatee dispersion was positively correlated to springs while negatively correlated to areas of high edible vegetation. During the non-winter season, manatees were found more in areas of high vegetation and not at springs. In both seasons, humans frequented the springs, and manatees fed more and traveled less in areas of low versus high human activity.

These results suggest further study on year round habitat use by manatees in Kings Bay is needed to determine if additional regulations of human activity, especially in the non-winter season, are warranted. --***Ryan Berger[1], Iske L. Vandevelde Larkin[2] and Bruce A. Schulte[1]*** ([1]Department of Biology, Georgia Southern University, Statesboro, GA 30460, USA; [2]Aquatic Animal Health Program, Veterinary Medical Center, University of Florida, Gainesville, Florida, USA).

RECENT LITERATURE

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See page 5 for recent publications from James Cook University researchers.

SIRENIAN WEBSITE DIRECTORY

The Call of the Siren (Caryn Self Sullivan): <**http://www.sirenian.org/caryn.html**>

Caribbean Environment Programme, Regional Management Plan for the West Indian Manatee: < **http://www.cep.unep.org/pubs/Techreports/tr35en/index.html** >

Columbus (Ohio) Zoo manatee exhibit: <**http://www.colszoo.org/animalareas/shores/manatee_coast/index.html>**

Dugongs: <**http://www.hans-rothauscher.de/dugong/dugong.htm>**

Dugong necropsy manual (available for downloading):
<**http://www.gbrmpa.gov.au/corp_site/info_services/publications/research_publications/rp064/research_publication_no._64** >

Florida Fish and Wildlife Conservation Commission, Bureau of Protected Species Management: <**http://www.floridaconservation.org/psm/**>

Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute (Florida manatee mortality data): <**http://www.floridamarine.org/manatees/**>

Fundación Salvemos al Manatí de Costa Rica: <**www.fundacionmanati.org**>

Great Barrier Reef dugongs: **<http://www.gbrmpa.gov.au/corp_site/info_services/publications/misc_pubs/dugongs**>

IBAMA manatee project, Brazil: **<www.projetopeixe-boi.com.br>**

Jacksonville University (Florida) Manatee Research Center Online:
< **http://www.ju.edu/academics/research_marco.asp** >

Philippines Dugong Research and Conservation Project:
< **http://www.wwf.org.ph/about.php?pg=wwd&sub1=00015** >

Save the Manatee Club: <**http://www.savethemanatee.org**>

Sea World of Florida: <**http://www.seaworld.org**>

Sirenews (texts of current and recent issues): <**http://www.marinemammalogy.org/snews.htm**>; <**http://www.sirenian.org/sirenews.html**> (for archive of most older issues)

Sirenia Project, U.S. Geological Survey: **<http://cars.er.usgs.gov/Manatees/manatees.html>**

Sirenian International, Inc.: <**http://www.sirenian.org/**> [Includes a bibliography of sirenian literature, and an archive of *Sirenews* issues.]

Smithsonian Institution sirenian bibliography: <**http://www.si.edu/resource/faq/nmnh/sirenia.htm**> [This is a relatively short bibliography, compiled by Joy Gold, that provides a very good introduction to both the technical and the popular literature.]

Steller's sea cow: < **http://www.hans-rothauscher.de/steller/steller.htm**>. This site also includes a searchable database of museum collections worldwide that contain bones of *Hydrodamalis gigas*: <**http://www.hans-rothauscher.de/steller/museums.htm**>. See also the website [in Finnish] of Dr. Ari Lampinen, Univ. of Jyvaskyla, Finland: <**http://www.jyu.fi/~ala/ilmasto/steller.htm**>

Trichechus senegalensis skull: <**http://digimorph.org/specimens/Trichechus_senegalensis/**>. [CT imagery of an African manatee skull and mandible, viewable as individual thin slices, 3-D rotational movies, and slice movies. Excellent detail!]

West African manatee in Chad (Jonathan H. Salkind): <**http://members.aol.com/neebii/manatee-index.html** >

Tracking rehabilitated manatees in Florida and Antillean manatees in Belize: <**www.wildtracks.org>**

Xavier University manatee web site (Midwest Manatee Research Program; Chuck Grossman): <**www.xu.edu/manateeresearch**>

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