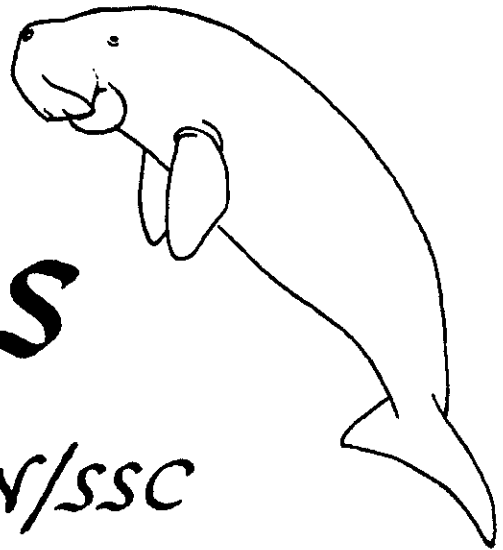


Sirenews



Newsletter of the IUCN/SSC Sirenia Specialist Group

NUMBER 16

OCTOBER 1991

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The Sirenia Specialist Group has been reorganized; an updated list of the current members follows. The previous distinction between Executive and Corresponding Members has been eliminated. Telex and Fax numbers are given where known.

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UNION INTERNATIONALE POUR LA CONSERVATION DE LA NATURE ET DE SES RESSOURCES
INTERNATIONAL UNION FOR CONSERVATION OF NATURE AND NATURAL RESOURCES

Commission de la sauvegarde des espèces—Species Survival Commission

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SIRENEWS FAX NUMBER: PLEASE CHANGE YOUR RECORDS!!!

We remind our readers that material faxed to Sirenews should be directed to Dr. D. Downing, Dept. of Anatomy, at the following number only: 1/202/2657055. Please do not use any of the other numbers formerly given in these pages, as this may result in charges to your editor for receipt (!) of the material.

SIRENIA WORKSHOP IN AUGUST 1993

The response from sirenian biologists to the prospect of a Sirenia Workshop as part of the International Theriological Congress to be held in Australia in 1993 has been enthusiastic, and Barry Fox of the ITC organizing committee has agreed to timetable it. Unfortunately for us, the venue for the conference has been changed to the University of New South Wales in Sydney (well south of the nearest dugongs) because the University of Queensland does not have a 900-seat lecture theatre for the plenary sessions.

At the Conservation Biology meeting in Brisbane in September, I participated in an excursion to look at dugongs and turtles in nearby Moreton Bay (see Tony Preen's report in this issue). We used the Sea World Boat, and the weather was kind. We had dugongs in clear water all around the boat. Sea World would be happy to allow their boat to be used for a similar excursion associated with ITC, and I am trying to organize this. The boat will take 40 and the cost was A\$40 per head including bus fares to the wharf (bring your own lunch, drinks provided). - Helene Marsh

RIVER COWS AND SEA PIGS?
A PROPOSAL FOR REVISION OF SIRENIAN POPULAR NAMES

In discussions with both biologists and the public I find myself repeatedly having to explain that a dugong is not a manatee. My explanation naturally starts with a few details of anatomy, and progresses to differences in ecology, presumed differences in physiology, and the still controversial period over which dugongid and trichechid evolutionary lines have been

evolutionarily separated. I point out that formal classification places the dugong and the manatees in a relationship similar to that existing between canids and felids.

The question I'd like to raise is whether my fellow sirenologists would look favorably on popular names that better reflect both classification and major niche differences among living and recently extinct sirenians. My proposal is as follows:

1) Manatees are grazers and browsers. As manatees may be obligated to drink fresh water, and as the two species which enter salt water may therefore be only secondarily marine, manatees should be referred to as river cows.

Although T. manatus does enter the marine environment and root out rhizomes, it is the atypical member of the extant manatees, departing from the riverine "mode" of the other contemporary trichechids (T. inunguis is exclusively riverine, and T. senegalensis is primarily riverine in habitat).

2) Hydrodamalis gigas is obviously a seacow, being both marine and a grazer on marine algae. No name change needed.

3) The dugong should be referred to as the seapig. Like the seacow it is strictly marine, but many months of watching dugongs feed on a variety of seagrasses, having observed dugongs deliberately foraging on two species of macroinvertebrates, and reflection on the unique aspects of dugong anatomy, all incline me toward regarding the dugong as a somewhat omnivorous rooter into the bottom (at the very least a rhizome specialist). The dugong's "pigness" is recognized by indigenous peoples who know it well, as indicated by the Sinhalese and Tamil names "cudalpandi" and "kadalpani", both of which translate literally as sea pig. I suspect even the Malay word "dugong" is similarly translatable. - Paul K. Anderson

[EDITOR'S NOTE: Comments on the above proposal are welcome! As for myself, I think of Hydrodamalis as more of a browser (= leaf-eater) than a grazer, and of the dugong as more like terrestrial grazers (= broad-snouted, relatively unselective croppers of "grassy" meadows) as well as being a rooter (though some extinct dugongids probably did a lot more rooting than dugongs do today). But what's in a name: could any single name, let alone one borrowed from some mammalian landlubber, ever do justice to the natural history of a sirenian? If a dugong is not a manatee, still less is it a cow or a pig. Maybe we should be content to use "dugong" and "manatee" and let the journalists draw the terrestrial parallels!]

LOCAL NEWS

AUSTRALIA

Indigenous Hunting of Dugongs in Queensland. - The current liberalization of community attitudes to indigenous peoples in Queensland is long overdue, but may have unfortunate consequences for dugongs. Dugongs are currently protected by the Fisheries Act, from which people who are resident on Trust Territories (formerly reserves) are exempt. Other people may apply for

permits to take dugongs, but these are rarely granted (once in the last five years). This has meant no legal hunting throughout most of the populous coastal areas of Queensland. The Act is now being interpreted differently. Aborigines and Islanders living in Trust Territories are being told they can hunt anywhere in the State. This means that any hunting party is legal as long as it is led by an Aborigine or Islander who is officially resident on a Trust Territory. As Aborigines and Islanders move around a lot, this change has effectively opened up the whole of the Queensland coast to traditional hunting, a development which I view as serious, in view of the large-scale movement of Aborigines and Islanders to coastal areas with limited dugong habitat. - Helene Marsh

Home Range and Movements of Dugongs in Subtropical Australia. - Thirteen dugongs in Moreton Bay, southeast Queensland, were tracked using satellite transmitters. Six were tracked in winter, four in spring and three in summer. Home ranges, based on 95% of fixes and calculated using the kernel estimator, averaged 64 sq. km and ranged from 28 to 123 sq. km. Because the dugongs were only tracked for an average of 50 days (range 20-88), these values probably underestimate the dugongs' annual range.

Females maintained larger home ranges than males. There was no difference in the range size between age classes or season of tracking. The dugongs did not have distinct core areas in their ranges, but they did have areas of concentrated use. On average, 50% of locations occurred in 15% of the home range area. There was extensive overlap between home ranges, averaging 55% for full ranges and 25% for "core areas."

Most locations (79%) occurred on seagrass banks. Most of the remainder came from low tide refuges (channels between banks, or deep water in the Bay). During winter, dugongs undertake regular migrations between the feeding areas on the seagrass banks in Moreton Bay and a warm-water refuge in the oceanic waters seaward of the Bay. By travelling 15-25 km from their feeding areas, the dugongs can move from water temperatures of 16-17 C to temperatures of 20-21 C. The dugongs synchronize these movements with the tidal currents. None of the dugongs undertook large movements or left the study area. The maximum rate of travel recorded was 4.7 km/h (14.3 km in 3 h). The dugongs were more active during the day than at night. - Tony Preen

BRAZIL

Manatee Exploitation in Brazil: A Reply. - In regard to the report by Monica Borobia excerpted in Sirenews No. 15, I would like to provide some clarifications that I consider very important.

First of all, the former government agencies IBDF and SUDEPE today form a single unit, responsible for enforcement of protective regulations for all flora and fauna in Brazil. This agency is IBAMA - Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis [Brazilian Institute of the Environment and Renewable Natural Resources] - which maintains

offices throughout the country in an attempt to minimize the impact of hunting and commercial capture on species in general, by means of laws and regulations that seek to protect them.

The Amazonian manatee is officially protected by law, as a species in danger of extinction, since 1967 (Fauna Protection Law, no. 5.197, 3 Jan. 1967; Portaria 3.481, 31 May 1973; Portaria N-11, 21 Feb. 1986). Nevertheless, it should not be overlooked that illegal hunting of manatees still occurs in Brazil, and although the number of captures is being reduced with every passing year, it has not yet reached zero. It is worth emphasizing that this hunting is neither encouraged in any way nor overlooked by government agencies, since there exists an agency (IBAMA) charged with enforcing and executing the protective laws and punishing those who break them.

However, the Amazonian region and its great extent should be taken into consideration. Many difficulties and unforeseen circumstances can arise in the course of enforcing a Fauna Protection Law in such a vast and inaccessible region. Each and every capture of manatees and other protected species is considered illegal, but it is not always possible to enforce the law, due to the conditions that exist in the region.

Seeking to better protect manatees, officers of IBAMA, during the low-water season, inspect areas near large lakes where the animals are concentrated for the duration of the dry season, and where they eventually become very vulnerable to hunters. This inspection is in order to prevent possible large-scale massacres of the manatees. Whenever lawbreakers are met with, their equipment is confiscated, fines are imposed, and the data are recorded and compiled in the Anuário Estatístico of IBGE. This registration of the information does not in any way represent approval of the hunting on the part of the government agencies, but rather a recognition of the real situation, without omission of data.

In regard to the published issues of IBGE's Anuário Estatístico which were quoted in Sirenews No. 15, we are trying to contact the office of IBGE in Brasília to find out the source of these figures and to ask that this type of information be identified as pertaining to illegal captures of animals threatened with extinction, in order to avoid further misunderstandings in relation to the figures presented.

It is worth emphasizing here once more that we consider correct the attitude of IBGE in publishing the data on captures of manatees, since if the hunting is taking place, even if it is illegal, this should be made public. We believe it would be worse for such data to be omitted, in the attempt to present a false image of what is really happening today in regard to manatee hunting in this country.

On the other hand, regarding T. manatus, it is worth remembering that the Manatee Study and Conservation Center of IBAMA is doing very interesting work in preserving the manatee and raising consciousness among the populations of fishermen on the Brazilian coast. They are providing talks, educational campaigns, posters, videos, and teaching materials to the schools, and thereby obtaining very promising results. Planned for 1992 is a similar project of manatee protection and

consciousness-raising in Amazonia, to be developed by us here at the Aquatic Mammals Laboratory of INPA, in cooperation with the group working with T. manatus. - Ioni Colares [translated from the Portuguese]

Manatees Found in Maranhão, Northeastern Brazil. - A recent marine mammal survey along the Ceará and Maranhão coasts, northeastern Brazil, revealed the presence and hunting of West Indian manatees (T. manatus) in areas not previously investigated. On 21 April 1991, I interviewed a former manatee hunter at the locality of Rasgado, Prefecture of Alcântara, Maranhão. He informed me that he hunted and caught at least eight manatees, as recently as September 1990, at which time he was advised by officials of the Department of Environment, Prefecture of Alcântara, that this activity was illegal. Skeletal remains of these specimens, caught in two distinct areas (Rasgado and Jenipaúba) in Alcântara, were retrieved. These included two mandibles, one partial skull, four ribs and other damaged bones, reportedly from the last manatees he killed in September 1990.

Since D. P. Domning's collection of an indeterminate rib fragment in 1978, from an animal killed circa 1975-76 in the lower Mearim River, my findings are the first confirmed evidence of manatee occurrence in Maranhão. Further investigation should be carried out in the future to determine whether T. manatus also occurs in other parts of the state and to evaluate how illegal hunting is affecting the species in the region.

This survey was sponsored by World Wildlife Fund-US through a grant to Salvatore Siciliano. The Prefecture of Alcântara, through its Department of Environment, provided logistical support. A paper containing details of the survey is being prepared for Marine Mammal Science. - Salvatore Siciliano

CAMEROON

Status and Distribution of Manatees in Cameroon. - During June, July, and August of 1989, a preliminary survey of manatees (T. senegalensis) in Cameroon was conducted under the supervision of James Powell, with support from the World Wildlife Fund and Wildlife Conservation International. The objective was to determine the distribution and status of this species in Cameroon by conducting land and boat surveys of specific watersheds in conjunction with standard village interviews. The study was intended to complement the biological research activities of Korup National Park. For this reason, priority was given to locating manatee populations in the Korup vicinity. After this inventory was complete, other regions in Cameroon were surveyed to determine the relative importance of Korup manatees to other manatee populations in the country.

Information on manatee distribution and status was obtained for four regions: (1) Korup region (Rio del Ray estuary, Ndian and Akpa-Yafe rivers); (2) Mamfe region (Cross, Manyu, and Munaya rivers); (3) Edea region (Sanaga and Nyong rivers); and (4) Kribi region (Lokoundje, Kienke, and Lobe rivers). These all lie on the Atlantic coast with the exception of the Mamfe region.

Manatees inhabit estuarine and riverine habitats in the

first three of these four regions. Manatee occurrence, based on the frequency of reported sightings, appears to be high in certain areas of Korup, such as the Ndian River and its tributaries. Ndian fishermen see manatees regularly and can observe up to five manatees a day during the rainy season. Manatees are seen in the Akpa-Yafe River as far upstream as Korup National Park, where a waterfall is located. Fishermen in the Akpa-Yafe report seeing at least one manatee a day during the rainy season. The Akpasang is a small river directly off of the Akpa-Yafe where an average of two manatees are seen each week during the rainy season. To a lesser extent, manatees are distributed throughout the Rio del Ray estuary, and are usually seen during the dry season when the upstream rivers become shallower and less suitable for manatees. Rio del Ray fishermen see the animal a few times a year; usually no more than one animal is sighted per observation.

The area of highest manatee density in the Mamfe region is at the confluence of the Cross and Munaya rivers. They are seen several times a year at this place, and sometimes as many as 3-5 are spotted during one sighting. Manatees are distributed up the Munaya as far as the village of Tabo. They are rarely seen in the Manyu or the Awa River (which flows into the Cross River at the Nigerian-Cameroonian border). Neither the Munaya nor the Manyu is entirely suitable for manatees because they are shallow and rocky in several areas. In addition, rapids are frequent, particularly in the Munaya where a series of rapids occurs near Korup National Park.

In the Edea region, the highest concentration of manatees is where the Sanaga River meets the Atlantic Ocean. Manatees occur in the Sanaga up to the hydroelectric dam in Edea, but are not observed as frequently in Edea as in areas downstream. They are seen in both the Dihende and the Dipombe rivers, but rarely in the Nyong. There are also two lakes in this region where manatees can be found: Lake Ossa (which is connected to the Sanaga River) and Lake Tissongo. We were unable to visit Lake Tissongo to confirm reports of manatee presence. The Sanaga River hydroelectric dam, which regulates the amount of water flowing into the Sanaga River, may have an adverse effect on local manatee populations. A large area of potential manatee habitat upstream of the dam may no longer be available to manatees since the dam's construction. More important is its impact on manatees downstream. The dam can potentially affect manatee habitat by amplifying tidal changes downstream and hence altering food availability and habitat suitability.

Most of the major rivers in the Kribi region are interrupted by waterfalls and rapids where bands of harder rock cut across the river bed. While in Kribi, we obtained no positive reports of manatees inhabiting the Lokoundje, Kienke, or Lobe rivers. The Ntem River, which flows between Cameroon and Equatorial Guinea, may contain excellent habitat for manatees, particularly near the Campo Reserve. Unfortunately, we were not able to census this area.

The vegetation varied throughout each region, but most areas contained a diverse array of overhanging trees and emergent vegetation. Due to poor water quality, submerged aquatic

vegetation was difficult to observe. Natant vegetation was found predominantly in the Edea region.

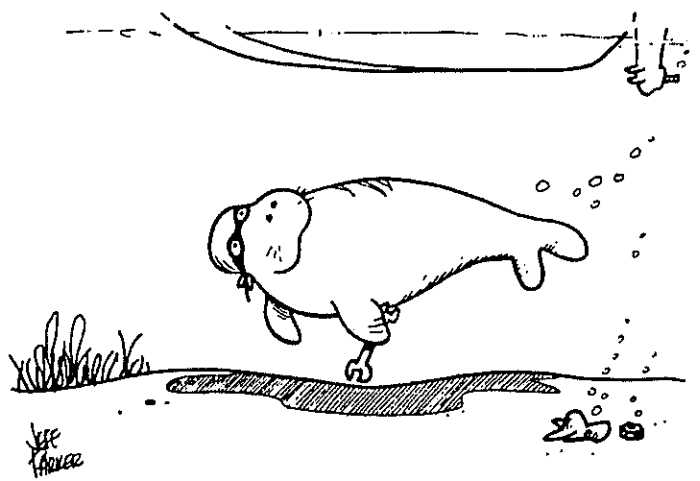
Most villages do not use manatee meat, so heavy exploitation is unusual. In Edea, permits are issued to high-level ministry officials that allow them to take a manatee for a special occasion. Two manatees were killed for such an occasion in 1987. Nigerian exploitation of manatees appears to be heavy in the southern Korup region. Due to Korup's proximity to Nigeria, Nigerians regularly fish in Rio del Ray near Korup National Park.

This three-month study enabled us to assess the possibility of a manatee conservation project in Cameroon. One promising strategy would be to extend the borders of Korup National Park in order to safeguard an aquatic sanctuary for manatees. What is needed now is a qualitative estimate of manatee status, movements, and behavior in Cameroon. In addition, in order to assess the manatee population trend, monitoring both the manatees and the degree of hunting pressure is necessary. - Melissa M. Grigione

FLORIDA

Florida Manatee Mortality Update. - The mortality total for the year as of the end of September has reached 131, which is one more than the total by September of 1990 with the exception of cold stress deaths (46), and greater than the September 1989 total of 125. Of the 131 manatees recovered in 1991, 43 were killed by watercraft, 6 by floodgates or canal locks, 4 by other human-related causes, and 1 by cold stress. Perinatal deaths amounted to 40, other natural causes accounted for 6, and 30 deaths were from undetermined causes. Finally, an abandoned calf died at Sea World after valiant attempts to save its life over the last three months.

The total watercraft mortality is up slightly from 40 as of September 1990 and 41 as of September 1989. Perinatal deaths are also up from 37 (1990) and 32 (1989). Floodgate/canal lock deaths are up markedly from 1 (1990) and 3 (1989).



THE LONE MANATEE STRIKES AGAIN!

Dr. Bruce Ackerman evaluated the mortality data and came up with the following conclusions. During the decade of the 80's (1980-89), the average annual increase in mortality was 6.8% per year from all causes and 12.9% due to watercraft impacts. One may infer from these data that the threat from watercraft is increasing faster than the overall threat to manatees. (Source: Florida Dept. of Natural Resources)

INDONESIA

Fifteen Dugongs Sighted near Ambon, Indonesia. - Within the framework of the Dugong Management and Conservation Project in the Maluku Province of eastern Indonesia, an aerial survey was carried out covering dugong populations in coastal waters of East Ambon and the nearby islands of Haruku, Saparua, and Nusalaut. The project is a cooperative one between the Environmental Study Centre of the Pattimura University (UNPATTI), Ambon, Indonesia; the Foundation AID Environment; and the State University of Leiden, The Netherlands. It aims at improved conservation and management of dugong stocks in the province.

No aerial census of dugong populations in coastal waters of Ambon and its surroundings has so far been reported. The main objective of the survey was to make a first estimate of the numbers of dugongs surviving in the coastal waters of these densely populated islands.

The flight was carried out on 19 December 1990 with a Piper Aztec lower-decker rented from the Summer Institute of Linguistics, starting at 9:11 AM during low tide and comprising one and a half hours of effective survey time. The position of the wings was clearly a disadvantage for a more quantitative survey, but the view was sufficient to obtain confirmed observations from more than one observer. Five observers joined the flight, two UNPATTI staff and three Dutch staff and students. The survey was carried out at 400 m distance from the shoreline, at a height of 135 m and a speed of 180 km/hr, covering a strip of 200 m on both sides of the plane. There was little cloud cover, low wind velocity, and no glare. All dugongs were recorded by more than one observer.

A total of 15 dugongs was sighted, of which none was near the east coast of Ambon, 9 were near the coast of Haruku, 5 near the coast of Saparua, and 1 near Nusalaut. Of these, one was a cow with a neonate calf. All dugongs observed were within 500 m of the shoreline.

The number of dugongs observed is very encouraging, considering the limited scope of the survey and the fact that Ambon and surrounding islands belong to the most densely inhabited part of the province. The project will continue to implement aerial surveys in order to compile more specific data on dugong population size and distribution. - Hans H. de Iongh and Bob Wenno

IVORY COAST

Road Threatens Coastal Manatee Habitat in Ivory Coast. - A major road is being built directly through one of the last intact

blocks of tropical rainforest in the Ivory Coast, and also threatens coastal ecosystems, particularly mangrove forests around lagoons, that support West African manatees. The road, which runs along the Atlantic coast between Sassandra and Grand Lahou, was being funded by the African Development Bank, which agreed in March 1990, at the request of the World Bank, to delay construction until money to minimize the habitat destruction could be found. However, an economist employed by the New York-based Environmental Defense Fund (EDF) subsequently found road building fully underway before any protection measures had been taken. Sirenews will welcome further information on this project and the status of manatees in the affected area. (Source: EDF Letter 22(2), April 1991)

JAMAICA

Status of Captive Manatees at Alligator Hole River. - In June 1991, Antonio A. Mignucci Giannoni, acting with UNEP funding under the auspices of the Jamaican Natural Resources Conservation Department (NRCD), led a team to the Alligator Hole River nature reserve in southern Jamaica, where four Antillean manatees were introduced into a semi-captive environment in the early 1980's (see Sirenews No. 12). The team's objective was to determine the status and gender of the impounded manatees.

They were able to account for three of the animals, but did not locate the fourth, which had not been seen by the reserve wardens in the two previous months. Two of the others appeared externally healthy, but the third had suffered a deep cut to its peduncle as a result of having once been tethered to the shore by its tail (as were all the manatees), and was only observed to swim slowly with its front flippers. All the animals are now allowed to swim at liberty in the river, but are extremely shy and could not be approached closely or captured by the team. The data available to the team led them to conclude that at least two, and possibly all three, of these manatees are female.

The team stated that "no justification exists, not even for education, to hold four, possibly reproducing female manatees (actually 4 to 8% of the total Jamaican population) apart [from] the rest of the Jamaican manatee gene pool." They recommended that a thorough environmental impact statement be drafted to assess the effects of the manatees on the river system; that a dedicated local biologist be found, hired by NRCD, and trained to monitor the manatees; that the manatees should meanwhile be left to roam the river undisturbed; and that no more manatees should be impounded in the river, especially since "it is not clear whether the river can sustain indefinitely the small manatee population now impounded there."

Sirenews endorses the team's recommendations, and hopes that NRCD will implement them.

MOZAMBIQUE

Dugong Study Planned in Mozambique. - A graduate student and I are beginning a study of dugongs and dolphins in Mozambique. The work will examine dolphin and dugong occurrence and

distribution in Maputo Bay in relation to increasing gillnet use and environmental degradation through massive population increase and demographic changes. The work will encompass four broad facets:

1. Monitor and document the gillnet fisheries of the Bay area, through direct observations at landing points and markets and interviews with fishermen.

2. Assess the occurrence of marine mammals (dolphins and dugongs) in Maputo Bay through boat surveys and searching beaches surrounding the bay for carcasses, etc.

3. Document any fisheries interaction, through interviews and observations at markets, etc., and the examination of carcasses found.

4. Determine which factors, other than fisheries, influence marine mammal distribution and abundance (an assessment of organic pollution and hydrographic features of the Bay). - Vic Cockcroft (Centre for Dolphin Studies, Port Elizabeth Museum, Humewood, South Africa)

PALAU

Dugongs in Palau Resurveyed. - Dugongs have been exterminated from several isolated archipelagoes through direct human exploitation. In the Micronesian region, dugongs now occur only in Palau, and Palauan waters support what is probably the most isolated dugong population in the world. The closest dugongs are found in Irian Jaya to the south and the Philippines to the west. In both these areas, dugongs are believed to be under threat from human exploitation. Thus it is very unlikely that the Palauan population is being supplemented by recruitment from these areas.

Last August, the Nature Conservancy sponsored a visit to Palau by Galen Rathbun, Tom O'Shea, Tony Preen, and myself. The objective of our visit was two-fold: (1) to repeat the aerial surveys for dugongs that had been carried out in 1977, 1978, and 1983; and (2) to resurvey the area using the more quantitative fixed-width transect techniques that Tony and I have used in the Arabian region and Australia, respectively.

Unfortunately we managed to complete only the first half of our mission. The transect survey was terminated by aircraft engine problems (luckily we were in a seaplane) and bad weather.

We saw 26 dugongs, including four calves, on the more qualitative survey. This is within the range of the numbers counted in the other surveys; however, we consider that, unless numbers have declined, more dugongs should have been sighted in 1991 than in past years. We used four very experienced observers. Only three observers, some of whom were inexperienced, were used in each of the other surveys. On the basis of all the surveys in Palau and our experience in other areas, we consider that there are likely to be fewer than 200 dugongs in Palau and that their numbers are probably decreasing.

We interviewed knowledgeable residents and dugong hunters with the assistance of government agencies. The deliberate poaching of dugongs for sport and meat still occurs regularly even though it is illegal. The hunters regard the penalties as

trivial and the likelihood of their being caught as negligible. The illegality of hunting adds to the thrill!

Although hunting is done primarily for meat, we found jewelry locally crafted from dugong ribs on sale in four shops. All the retailers knew this was illegal.

Some hunters readily conceded that dugongs are much less common than in the 1960's and 1970's. However, they are reluctant to stop hunting while others continue to do so, despite social pressure from other Palauans, particularly women. We believe that unless the poaching is stopped as a matter of urgency, dugongs will become extinct in Palau as they have in many other archipelagoes. - Helene Marsh

PERSIAN GULF

Gulf War Oil Spill. - In the previous issue of Sirenews, I reported on the Gulf War oil spill, up to early April 1991. Here I provide an update on the die-off of marine mammals which occurred during the spill.

On the order of six million barrels of oil flowed into the Arabian (Persian) Gulf during the spill that commenced in late January 1991. Most of the oil impacted the coast of Saudi Arabia. It took the oil almost four weeks to reach Abu Ali, a prominent island nearly halfway down the Saudi coast [see map in previous issue]. This island prevented the further spread of the main slick. Huge volumes of oil remained buoyant and mobile until May, eventually covering nearly all of the 460 km of shoreline north of Abu Ali in a blanket of thick oil. In addition to the main slick, large sheen slicks, made up of a very thin layer of oil and covering thousands of square kilometers, moved through the open waters of the central Gulf.

At least 93 marine mammals, representing four species, died in the western Gulf during the spill (see Table 1). Based on my estimates of the time-since-death for 81 carcasses, the die-off commenced in late February, peaked in late March, and had finished by mid-April.

Table 1. The number of marine mammals known to have died and washed ashore during the Gulf War oil spill. Data current for period 27 February to 1 May 1991 (for Bahrain, current to 8 April 1991 only). One dugong in Bahrain was found in a gillnet. One additional dolphin carcass was seen floating off Khafji.

Country	<u>Dugong</u> <u>dugon</u>	<u>Tursiops</u> <u>truncatus</u>	<u>Sousa</u> <u>chinensis</u>	<u>Neophocaena</u> <u>phocaenoides</u>	Unident. cetacean	Total
Saudi Arabia	11	55	11	0	4	81
Bahrain	3	2	2	1	3	11
Total	14	57	13	1	7	92

Only one dolphin is known to have died along the north coast of Saudi Arabia, where the impact from the oil pollution was greatest. Dolphins continued to live in this area for at least the first three months of the spill. All other carcasses were located at least 120 and as far as 250 km south of Abu Ali.

Equal numbers of male and female dugongs and dolphins died. The 11 dugongs for which body lengths were available comprised mainly adults (7/11) over 2.2 m long and calves (3/11) less than 1.5 m long. The distribution of body lengths of Tursiops truncatus was normal, but skewed towards large adults.

Although coincident in time with the oil spill, the die-off was not obviously related to it. No marine mammals washed ashore along the northern Saudi coastline, where the impact of the oil was greatest. All but one of the animals were found at least 120 km and as far as 250 km beyond Abu Ali, where the main oil slick was stopped. In the Gulf of Salwa, where most of the carcasses washed ashore, a thin layer of oil sheen was the only evidence of the spill. The lack of carcasses in the northern area was not due to the absence of dolphins. Both Tursiops truncatus and Sousa chinensis were frequently seen in the area, often within hundreds of meters of oil, or even surfacing through sheen.

The concentration of carcasses along the southern coast is not likely to be due to an accumulation of wind-driven carcasses originating in the polluted northern areas. This is because: (1) dugongs do not normally occur north of Bahrain (Preen, 1989) and so had to have died locally; (2) very few turtle carapaces (old or recent) were found along the shores of the Gulf of Salwa, suggesting floating marine vertebrates may not drift far before sinking or being consumed; and (3) the relative abundance of T. truncatus and S. chinensis carcasses in the northern and southern parts of the Gulf of Salwa reflected the distribution of these species in this area (Preen, unpublished data).

Other possible causes of the deaths of these marine mammals include poisoning by a different pollutant, poisoning by natural toxins, or disease. At present there is no evidence to support any of these possibilities. Natural poisoning by red tide toxins has been implicated in the death of hundreds of dolphins along the Atlantic coast of the United States (Geraci, 1989) and the death of 37 manatees in Florida (O'Shea et al., 1991). The tissue samples collected during this die-off should be analyzed for clues to the cause of death.

Viewed in isolation, this die-off is not necessarily of great concern. The Gulf War oil spill was an exceptional event and large numbers of many types of animals died. However, there have now been a series of marine mammal die-offs in the western Arabian Gulf in recent years. In 1983, at least 38 dugongs and 33 dolphins died coincident with the Nowruz oil spill (Preen, 1989). In this spill there was no direct evidence to implicate oil in the cause of death. In 1986, over 500 dolphins and seven dugongs died in Saudi Arabia, Bahrain, and Qatar (Preen, unpublished data). Again there was no obvious cause of death, although I suspect a red tide. This series of die-offs (and there are likely to have been more: the 1986 and 1991 die-offs would not have been detected if I had not been conducting fieldwork in the area) may also be a manifestation of the poor health of the marine mammal

populations of the Gulf, perhaps as a result of chronic pollution. This possibility should be investigated. - Tony Preen

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PERU

Peruvian Nature Reserve Threatened by Oil Exploration. - A Houston-based American oil company, Texas Crude, Inc., has (as of May 1991) reportedly negotiated an illegal contract for petroleum exploration in Peru's Pacaya-Samiria rainforest wildlife reserve, which supports Amazonian manatees. Nearly 75% of the 2.4-million-acre exploration area lies within the reserve, which is the only flooded-forest reserve in Peru. Any such exploration in reserves is forbidden under the Environmental Code enacted in Peru in September 1990. According to the Peruvian Environmental Law Society, Texas Crude's \$24 million contract directly violates this law and will have a devastating impact on the Pacaya-Samiria reserve, especially if oil spills occur. Sirenews will welcome information on further developments in this area. (Source: Rainforest Action Network Action Alert #60, May 1991)

ABSTRACTS

Territoriality, Display, and Mating in Shark Bay Dugongs: A Marine Mammal Lek (Paul K. Anderson). - Between late August and early January, solitary adult dugongs resided in a shallow cove. Exceptional conditions made possible observation to distances of >500 m from a 10 m sailing catamaran. Most patrolled exclusive territories. Patrollers had high rates of acoustic signalling. Despite near absence of food, individuals recognizable by scars held territories for up to 6 weeks. Patrollers were unusually alert. Approach of another dugong to a boundary provoked confrontation and display. Intrusion led to combat followed by flight and pursuit. Patrollers were inferred to be male. Cow-calf herds used rich feeding grounds nearby during late summer, but the only calf seen in the cove was nearly full-grown and the accompanying cow was herded and mated by a presumed male. This pair was briefly interrupted by two males from adjacent territories, but both returned to their territories and the

mating continued. Within its territory a patroller apparently could maintain exclusive access to a female; a pair followed for 6 hours copulated 10 times. Between copulations the presumed female was herded against the shallows. All data were consistent with the classic lek pattern. These observations contrast with "gang-rape" mating described for West Indian manatees in Florida and for Australian dugongs elsewhere. The cove was occupied in both 1988 and 1989. I conclude it is a traditional arena site and that patrolling dugongs were participants in a lek. This is the 6th instance of a classic lek among mammals and the first for a marine mammal. [From Annual Meeting of the American Society of Mammalogists, Manhattan, Kansas, June 15-19, 1991.]

The following are abstracts of papers to be presented at the annual meeting of the Society of Vertebrate Paleontology, San Diego, Cal., Oct. 26, 1991.

Metaxytherium (Mammalia, Sirenia) from California and Baja California (Aranda-Manteca, F. J., Daryl P. Domning, and Lawrence G. Barnes). - New Middle Miocene specimens of the halitheriine dugongid Metaxytherium (including possibly the best-preserved fossil sirenian skull yet found) have been discovered at La Mision, Baja California, in the Rosarito Beach Formation, and in Orange County, California, in the Topanga Formation. Both formations have yielded rich vertebrate and invertebrate assemblages that aid in correlations and provide data on paleoecology. Species of Metaxytherium (or "Halianassa") previously reported from California and Baja California are now referred to other genera and subfamilies (the hydrodamaline Dusisiren or the dugongine Dioplotherium). Our new discoveries, the only valid records of Metaxytherium in the eastern North Pacific, demonstrate greater diversity of sirenians in this region during Middle Miocene time than previously known, as well as a range extension of the genus. We are presently determining the relationships of these North Pacific Metaxytherium to those of the eastern South Pacific, the Caribbean-West Atlantic, and Europe, and to the hydrodamaline dugongids of the North Pacific, which were derived from some species of Metaxytherium.

A Phylogenetic Analysis of the Sirenia (Daryl P. Domning). - Cladistic analysis of 62 cranial and dental characters in 36 species and subspecies of sirenians, using the Hennig86 computer program with successive character weighting, yielded 6 maximally parsimonious trees of which the Nelson consensus tree shown below has a length of 162 steps, a consistency index of 76, and a retention index of 91. Sample size and intrapopulational variation are pointed out as insufficiently studied problems in cladistic analysis, and a statistically-based method for scoring variable characters is introduced.

The tree topology is least certain in three groups of taxa: Eocene dugongids; dugongines (here including rytiodontines); and species of Metaxytherium. The most novel results of this study are: (1) The Miosireninae are the sister group of the Trichechidae as previously defined, and are here placed in that family. (2) The Trichechidae in this broader sense appear to have

arisen somewhat later than previously supposed (late Eocene or early Oligocene rather than middle Eocene), and are rooted well within the Dugongidae instead of being separately derived from the Protosirenidae. (3) *Dugong* is placed within the clade heretofore called the Rytiodontinae; this is the first strong evidence of where among the Dugongidae the living dugong's phyletic affinities lie. The subfamilial name Dugonginae is extended to this entire clade in place of the junior name Rytiodontinae.

Cladogram of the Sirenia



A New Specimen of Behemotops proteus (Mammalia: Desmostylia) from the Oligocene of Washington (Daryl P. Domning, Clayton E. Ray, and Malcolm C. McKenna). - A new specimen of the primitive desmostylian Behemotops proteus, from Middle or Upper Oligocene rocks of Washington state, increases knowledge of its dentition and confirms close relationship to Eocene anthracobunid proboscideans of Asia. This specimen and new material of Behemotops from Japan indicate synonymy of B. emlongi with B. proteus, provide knowledge of the upper dentition, and enable reinterpretation of the anterior dentition of the immature type specimen. We now regard "p1" of the B. proteus holotype as the true lower canine. M2 and M3 of B. proteus are very similar to M2 and M3 of Anthracobune pinfoldi. However, we continue to regard Anthracobune as a proboscidean.

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