Marine Turtle Newsletter

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PRESENT STATUS OF GAHIRMATHA BEACH IN BHITARA KANIKA SANCTUARY, ORISSA

In 1997, the mass nesting (*arribada*) of the world's largest population of olive ridley turtles (*Lepidochelys olivacea*) did not take place on the Gahirmatha Beach of the Bhitara Kanika Sanctuary, situated on the east coast of India in Kendrapara district of Orissa state. The silence was deafening.

Generally the mass nesting takes place twice per year, once in the early part of January and again in early April; in some years, the event happens only once. While there are records of past years in which nesting failed to occur, the present situation cannot help but illicit grave concern. Historically, the pristine and remote beach at Gahirmatha has been well protected by a rich mangrove forest, and it has attained the pride of place as the site of the world's largest sea turtle nesting event. These mass nestings, which scientists refer to as *arribadas*, average 2-6 lakhs females per year [1 lakh = one hundred thousand], each laying more than 100-150 eggs.

Despite the usual mating aggregations in October 1996 off the coast of the sanctuary, the turtles did not commence with egg-laying. What happened? Offshore fishing is one explanation. Between October and April each year, fishing is prohibited within 20 km of the coast to avoid threatening the sea turtles. Notwithstanding, hundreds of trawlers and gill-netters operated in the area throughout the closed season last year (i.e. during the 1996-1997 nesting season), blatantly violating the law. They were mostly from Orissa and neighboring West Bengal, though foreign trawlers also intruded into the area. Thousands of turtles were entangled in these nets and were killed. Some were swept to the shore by tidal action — more than 4000 washed ashore dead during what should have been the nesting season. Some dead dolphins were also found.

The Orissa government has been very callous to this disastrous situation. The state's Fisheries Department indiscriminately licenses trawlers without judging the availability of fishing resources in the area. There are already two fishing harbours at Dhamra and at Paradeep to the north and south of Bhitara Kanika sanctuary. Without studying the economic viability of any proposal, landing facilities were recently constructed on the fringe of the Bhitara Kanika sanctuary at Talchua (construction is complete, but the site has yet to be commissioned

because a case is pending in the Orissa High Court). Two more fish landing sites (Kharanasi and Jambu) are under construction to the south of the sanctuary.

Singh (1996) summarizes the current situation: "The fate of the world famous Bhitarkanika Wildlife Sanctuary in Orissa is fast being sealed by state-condoned corporate greed. Orissa's mangroves, considered the second largest mangrove swamp ecosystem in the country, help counter the high salinity of coastal soils, resist strong wind velocity and tidal effects, [and protect] the coast which now lies damaged and near extinction in the race for 'prawn dollars'. More than 30 km^2 of the total 115.5 km^2 of Bhitarkanika mangrove forests have already been razed and the rest is threatened with ending up as one of the 6,500 or more prawn ponds already covering over 20,000 hectares of coastal Orissa. Ten big prawn entrepreneurs have been able to illegally acquire over 2,000 acres of the forest inside the sanctuary area, allegedly with political patronage, thus throwing Coastal Regulation Zone (CRZ) and Wildlife Protection Acts to the winds. Construction of fishing jetties, roads and bridges inside the sanctuary limits are viewed by experts as signs of impending disaster for this fragile ecosystem, considered to be one of nature's great wonders."

In addition to the responsibility we have to our national natural resources, we in India have a global responsibility to the survival of the olive ridley sea turtle. Instead of taking on this duty, we are acting with shameless arrogance. We are doing precisely what must be done if we want to single-handedly cause the extinction of this rare sea turtle for all time to come. Yet, the solution to this serious situation is not difficult. The technology to save sea turtles from death in shrimp trawls is simple and inexpensive, the laws are already in place for time and area (fishing) closures, and the groundwork has been laid for a marine sanctuary. All that is needed is the will. It is imperative that the following measures are implemented vigorously, and with the hope that there is still time to change the course of what is happening at Orissa:

1) The critical marine habitat offshore the Gahirmatha beach should be declared a marine sanctuary; all protective measures should be enforced according to the Wild Life Protection Act. This proposal has already been cleared by the Chief Hydrographer of the Indian Navy and the Union Ministry of Forest and Environment. It up to the State Government to declare the marine sanctuary. [*Editor's Note:* In September, Gahirmatha was declared the first marine sanctuary in India; see news release, this issue!]

2) The regulation prohibiting fishing in critical marine habitat offshore the Gahirmatha beach should be effectively enforced. Violators should be punished to the maximum extent allowable by law, including suspension of fishing permits and forfeiture of fishing boats.

3) The use of gill nets should be completely prohibited, not only in the area of Gahirmatha, but throughout the state. Turtle Excluder Devices (TEDs), a low cost technological solution to sea turtle bycatch, should be mandatory in trawls plying the waters of India.

4) The service of the Coast Guard should be regularly commissioned during the breeding season (mating, nesting, hatching) to guard the coast and prevent any intrusion into the area by trawlers or other fishing vessels.

Singh, D. N. 1996. Billion dollar nightmare. Sanctuary Asia 16(5):54-58.

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GAHIRMATHA BEACH DECLARED A MARINE SANCTUARY!

The Orissa Government's notification declaring Gahirmatha a marine sanctuary to provide the endangered Olive Ridley sea turtles [*Lepidochelys olivacea*] with a safe habitat will, probably, bring an end to the age-old struggle between man and nature that has been going on in this region for years. The 35 km long Gahirmatha coast is the world's largest rookery for the Olive Ridley turtles, which travel to it in lakhs from as far as the south of the Pacific Ocean every year to nest.

The step, perceived as a big victory for the conservationists, has been widely welcomed. However, thousands of fishermen who have traditionally been dependent on this region for their livelihood, are very upset. The notification, which came on September 27 following an international campaign to save the endangered turtles, encompasses an area of 1435 km^2 on the Bay of Bengal off the Orissa coast. The notification seeks to put an end to the economic exploitation of the area up to 10 km into the sea from south of the Dhamra fishing harbour in Balasore district to north of the Paradip port.

What was an environmental issue soon assumed the contours of a trade dispute. The Union Commerce Ministry was even forced to file a case, along with Thailand, with the World Trade Organisation (WTO) against the proposed U.S. embargo on shrimp imports from countries that do not require their fishermen to protect endangered sea turtles by using nets fitted with turtle exclusion devices (TEDs). Meanwhile, the World Wide Fund for Nature (WWF) also jumped into the fray, backing the U.S. threat of banning the import of turtle-threatening shrimps. In a recent report to the WTO, it accused countries like India, Thailand, Pakistan and others of using the trade body to evade their conservation responsibilities.

In 1993, the State Government responded to the mounting pressure by banning fishing within a 20-km radius off the Gahirmatha coast for a specific period every year, pending the declaration of the marine sanctuary. It also empowered the forest department officials to enact the Orissa Marine Fishing Regulation Act (1981) and the officials of the Fisheries Department were declared honorary wildlife wardens to deal with offences under the Wildlife Protection Act (1972). But these moves did not prove effective. In fact, since 1985, the Forest Department has been repeatedly submitting that unless Gahirmatha is declared a marine sanctuary, it would be difficult to protect the turtles.

Though the turtles had been visiting this beach for centuries, the phenomenon came under the scrutiny of the scientific world only in 1974. The very next year the Orissa Government declared Bhitarkanika, the nesting habitat of these sea turtles, a wildlife sanctuary. But the measure proved inadequate in the face of large-scale fishing activities in the area with the advent of mechanised trawlers. Developmental activities around the breeding grounds only made matters worse. There was the added problem of rampant poaching, since turtle flesh is considered a great delicacy.

To add insult to injury, the lack of proper vigilance along the coastline led to wild pigs and dogs destroying the eggs. So high was the rate of destruction that researchers estimate that only four or five hatchlings out of some 1,000 eggs survive. These ecological disturbances, both on land and at sea, forced the turtles to change their nesting sites several times in the recent past. They have been moving to more isolated regions north of Gahirmatha to avoid predators. But with very little being done to check fishing activities and poaching, they were slowly being driven toward extinction. The high rate of mortality before nesting also contributed to the decline in the number of turtles arriving in Orissa every year.

The Government moves to ban fishing during specified time spans did not work for the simple reason that while the Olive Ridley turtles come twice a year to this area — in January and March — this also happens to be the fishing season. According to Dr. Chandra Sekhar Kar, a Bhubaneshwar-based researcher on the Olive Ridley turtle, on an average 5,000 to 6,000 adult turtles are found dead each year during the season and the Gahirmatha coast invariably accounts for most of the deaths.

But the question of course is, will the notification achieve what it seeks to do? The Chief Wildlife Warden of the state Saroj Kumar Patnaik feels it will. Says he, "The idea is to create an awareness among the people to protect these innocent creatures." According to him the declaration regarding the marine sanctuary was a major achievement for the State Forest Department which has been crying itself hoarse over the past several years for more stringent measures against high-tech fishing. But he says the notification is not enough, "The true victory lies in its effective enforcement." The modalities are yet to be worked out.

He, however, feels that the implementation of the notification will not pose a big problem. The Forest Department and the Coast Guard will work in tandem to see that trawler operators obey the new law. While the Coast Guard will have three additional ground camps along the Orissa coast and press smaller vessels into duty, the Forest Department is trying to acquire a seaworthy boat for its own officials. What is worrying the Forest Department is the sizeable presence of unregistered mechanised boats, operating from outside the state, which come and fish off the Gahirmatha coast. The number of registered mechanised boats operating in the area would not exceed 1,000, but it is difficult to keep track of those operating from other states.

While the wildlife lobby in the state are happy over the notification, it has kicked up a furor in fishing circles. The Trawler Owners' Association has taken strong exception to it on the grounds that it would jeopardise the future of thousands. They are not averse to fixing TEDs, which are in any case inexpensive, costing only Rs 3,000, but worry that their catch would get considerably depleted once the device is fitted to the nets. The Orissa Government must remain sensitive to the plight of the local fisherfolk and provide the necessary safety net for those faced with a loss of income as a result of the notification. In its haste to protect the turtle, it cannot afford to throw its fishermen into the sea. Source: Srimoy Kar, Copyright (c) *Indian Express Newspapers (Bombay) Ltd.*, 12 November 1997.

ARTHROPOD SUCCESSION IN LEATHERBACK TURTLE CARRION AND IMPLICATIONS FOR DETERMINATION OF THE POSTMORTEM INTERVAL

Several types of insect attack on sea turtles have been reported, including attacks on eggs and hatchlings by flies (Andrede et al., 1992; Lopes, 1982; Lopez Barbosa, 1989), on eggs by coleoptera (Lopez Reyes and Bautista Huerta, 1991), on eggs by ants (Subba Rao, 1995; Mortimer, 1990; Duran Naiera, 1990) and on adult females by hematophagous insects (Fretey, 1989). In this study, the carcass of an adult female leatherback turtle (*Dermochelys coriacea* Vandelli 1761) was observed for one week in a shaded, grassy area of the nesting beach at Yalimapo, French Guiana. The study began on 28 June 1996, when the fresh carcass of a turtle, apparently entangled and drowned in the ropes of an Amerindian boat, was found washed ashore. No open wounds were visible.

In order to facilitate a study of the arrival of necrophagous insect assemblages, as well as their capture, the grass surrounding the carcass was cleared to 1 m away, exposing the sand.

During the observation of the progressive decomposition of the turtle under the action of various necrophagous organisms, two types of imago samples were collected approximately every three hours: (1) insects walking on the ground or on/in the carcass and (2) insects flying within the cleared range. Flying insects were killed with a quick spray of insecticide.

On the first morning, the eyes of the leatherback were gouged out by a group of black vultures (*Coragyps atratus*). By 1100 hr, the bleeding sockets were invaded by ovipositioning flesh flies (Sarcophagids). At 1500 hr, both flesh flies and blow flies (Calliphorids) were ovipositioning in the limb articulations. At several different times on the following day, Coleoptera (Scarabeids and Carabids), were observed along with the first two families. That night, cockroaches (Blattodea) and tenebrionid beetles appeared.

On the third day, all four limbs had noticeably collapsed and the skin had cracked, offering new ovipositional sites for the flies. By 1500 hr, the omnipresent black vultures had pecked six openings into the shell. Under the effect of the sun, fats drained from the adipose tissues. For the first time, anthomyiid flies were observed at the carcass. At 1800 hr, two new holes had been pecked, one toward the edge of the shell, the other in one of the forelimbs. Histerid and staphylinid beetles were captured. At nightfall, maggots emerged from the holes, using the body fats to help them migrate over the surface of the carapace. That evening (2100 hr), cockroaches reappeared and the entire forebody was covered with maggots.

Later that night, after a heavy rain, the entire surface of the sea turtle was covered with maggots, and one cricket (Gryllidae) was captured. Early the next morning, ñ30 black vultures were busy at the carcass. A 0900, 1300 and 1500 hr, calliphorid and anthomyiid flies were observed, and again some histerid and tenebrionid beetles. At 1800 hr, a single heteropter (a cydnid) was observed. On the fifth morning, several of the turtle's eggs had been scattered by the black vultures. Histerids were observed near the decomposing eggs. As on the second day, scarabeids reoccured on the carcass. Toward 1600 hr a soldier fly (Stratiomyidae) appeared for the first time, and remained until 5 July.

On the seventh day, the body cavity was almost entirely emptied and the bones, "picked clean", became visible. The insects observed belonged mainly to the Orders of Diptera and Coleoptera. The others (Dictyoptera, Orthoptera, Heteroptera) were far less frequent and it is difficult to evaluate their role in relation to the carcass. The omnivorous cockroaches could just as easily have fed on dead organic matter as live larva. Only one specimen of Heteroptera was captured and it belonged to the root-feeding cydnid family. Its presence was therefore probably not due to the sea turtle carcass. It is likely that the presence of a phytophagous cricket was equally accidental.

Blow fly and flesh fly larva are almost exclusively necrophagous. Both arrived on the carcass at nearly the same time; that is, once the vultures had provided ovipositional sites suitably sheltered from the sun. It is worth noting that while in our study flesh flies slightly preceded blow flies, in temperate climates, it is blow flies that are usually among the first necrophagous insects to arrive (Leclerc, 1978). Intense competition at these sites due to over-population forced larva to migrate to less exploited areas of the turtle. Rain and draining body fats seemed to aid the mostly nocturnal migration.

Three other families, occuring less frequently, appeared well after the first two. These included anthomyiids on the fourth day, stratiomyids on the fifth, and muscids on the seventh. The biology of these families is poorly known, but it would seen they played a not insignificant role in the decomposition of the carcass. As for stratiomyids, larva were also discovered under the plastral plates of a green turtle carcass on Aztec beach, 30 km south~ east of Yalimapo. The

carcass consisted of only a few scattered bones and a dried, empty carapace. Larva were hidden between the plastral plates and the fat-stained sand. These larva should therefore be considered saprophagous rather than necrophagous.

According to Leclerc (1978), necrophagous arthropods, which vary depending on climate and geographical zone, can actually be divided into four categories: (1) the necrophagous (Diptera, Coleoptera, Lepidoptera, Acarids); (2) the necrophiles (predators and parasites of necrophagous arthropods); (3) the omnivores (Hymenoptera); (4) the opportunists (Diptera, Collembola, Arachnids).

The coleopterans collected around the leatherback carcass had varied diets. Carabids, staphylinids and histerids are mainly predatory, while scarabeids are coprophagous and detritivorous. Tenebrionids are more eclectic, sometimes saprophagous, sometimes mycetophagous. We may suppose that members of the first three families prey on fly larva, hence their arrival occurs after development of their prey. The scarabeids feed on dead organic matter, contributing to the decomposition of the turtle carcass. The tenebrionids would play an intermediate role, sometimes acting as predators, other times saprophagous.

This hypothesis is reinforced by the variety of species collected, which illustrates the morphological heterogeneity related to the heterogeneity of the lifestyles specific to each family. And so the role of each insect family in the decomposition of the turtle carcass becomes clear. Each intervenes at the right moment depending on its possibilities and needs, its feeding habits and reproduction.

An entire series of organisms (including micro-organisms such as bacteria, mushrooms, and protozoa) are attracted to animal carcasses, including that of man (Leclerc and Verstraeten, 1992; Hewadikaram and Goff, 1991). When colonizing a carcass, the different species and their populations are subject to the laws of competition (Smith, 1986) and food and vital space are the primary factors of competition in larval stages. According to Leclerc (1978), necrophagous arthropods are selectively attracted to a carcass by the odors released over the course of decay. After thriving a certain time, a succession of insects finds the change of conditions in the substrate unfavorable, and is progressively replaced by the following.

The complex entomological successions that influence the rate of decomposition (Leclerc and Verstaeten, 1993) have been well identified in human legal medicine (forensic science), where their study allows for fairly accurate determination of the time elapsed since death. We can, therefore, suppose that by pursuing entomological study of sea turtle carcasses we may be able to identify the date at which a female was killed by poachers on the beach, or the beaching of a specimen whose death resulted from pollutants or fishing equipment.

A complex entomological fauna arrives by successive groups depending on the progressive changes in the substrate, thereby influencing the rate of decomposition of the carcass until complete mineralization (Leclerc and Verstraeten, 1993). Recycling is complete. The massive leatherback carcass appears a veritable ecosystem, itself only a time~/space subunit of the beach ecosystem (e.g., bullfrogs, *Bufo marinus*, feed the necrophagous insects).

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PRELIMINARY OBSERVATIONS ON GREEN TURTLES, *CHELONIA MYDAS*, IN FORAGING PASTURES OF THE UNITED ARAB EMIRATES

The Environmental Research and Wildlife Development Agency~ (ERWDA) of the United Arab Emirates (UAE) initiated a sea turtle research and conservation program in 1997 with funding from Shell Oil Co. Sea turtles in the Arabian (Persian) Gulf area have not been studied extensively; however, some research primarily on nesting beaches has been undertaken in Saudi Arabia (Miller, 1989), Iran (Kinunen and Walczak, 1971) and in Oman (Ross and Barwani, 1982). Published reports of sea turtles from the UAE are scarce. Brown (1985) provides a few records of green, *Chelonia mydas*, and loggerhead, *Caretta caretta*, turtles. Heath (1989) reports a hawksbill, *Eretmochelys imbricata*, in Das Island, and Brown (1990) reports green turtles from Qarnein Island. More recently, Aspinall (1995) and Baldwin (1996) confirm the nesting of greens and hawksbills and the occurrence of loggerheads, leatherbacks, *Dermochelys coriacea*, and possibly olive ridleys, *Lepidochelys olivacea*, in the UAE.

A preliminary survey was performed 19-20 February 1997 at Ras Al Khaimah Emirate, located on the eastern tip of UAE. Nearshore waters in this section of the Gulf are shallow and free of coral reefs. This habitat permits artisanal fishermen targeting finfish and cuttlefish to drag seines into shore. Generally, a 500 m seine is dropped approximately 1 km or more from the shore utilising two 5-8 m boats propelled by high powered outboard motors. One boat remains at the location where the seine is dropped as the second boat drops the seine in a half-moon direction, parallel to the shoreline, ending again about 1 km from shore. Both boats then drag the seine very slowly toward the beach to prevent the escape of the captured marine life. A total of 8 to 10 men are needed to pull in the seine by hand when the depth becomes too shallow for the boats to operate. Several hours are required from start to finish.

Three seine fishing performances by three different groups of fishermen were monitored. Turtles were captured alive and unharmed in all cases. A total of 14 green turtles were captured; 3, 5 and 6 turtles in each set. All fishing was done during the day time. Captured turtles were examined, measured, tagged, and released. Size classes based on curved carapace length (CCL) were tallied as follows: one turtle 35-39.9 cm (7%); three turtles 60-64.9 cm (21%); one turtle 65-69.9 cm (7%); one turtle 70-74.9 cm (7%); three turtles 75-79.9 cm (21%); two turtles 80-84.9 cm (14%); two turtles 90-94.9 cm (14%) and one turtle 100-104.9 cm (7%). Based on tail length, one turtle was estimated to be an adult male and one an adolescent male.

As turtles of considerable size range (37-102 cm) were observed, it is possible that there exists a resident population comprised of all post-pelagic age/size classes. This could be attributed to feed availability due to the fact that sea grass beds are present in the Arabian Gulf, composed of *Halodule uninervis, Halophila ovalis, Halophila stipulacea* and *Syringodium isoetifolium* (Sheppard et al., 1992). *Halodule* was noted washed up along the Ras Al Khaimah shoreline while observing the seine fishing. Residency of foraging turtles has been confirmed for the reef systems around offshore islands, the areas of north Jubail and Abu Ali and south of Safaniyah, in Saudi Arabia by Miller (1989). Aerial surveys over this area confirms the presence of turtles year round. Surveys in UAE waters will be continued to assess the age structure, habitat use, reproductive migrations and ecology, as well as other biological parameters, in order to create the necessary foundations to support an adequate management scheme for the Arabian Gulf turtles.

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RESULTS OF A 1996 SURVEY OF *CHELONIA* IN TURKEY

The majority of marine turtle nesting in the Mediterranean takes place in Greece, Turkey and Cyprus, with low density nesting reported in Libya, Egypt and North Africa. A large proportion of the Mediterranean *Chelonia mydas* [green sea turtle] population nests on the beaches of Turkey (Groombridge, 1988). Seventeen nesting beaches were identified during a 1988 field survey of the Turkish Mediterranean coast (Baran and Kasparek, 1989); three of them are important to *C. mydas*: Kazanli, Akyatan and Samandag. Negative developments associated with tourism are affecting the status of *C. mydas* populations in Turkey, as is the case in other Mediterranean countries. Other potential threats include human settlement, agriculture, industry, erosion, and pollution of coastal areas near nesting beaches (Table 1).

In 1996, a survey was conducted at Kazanli, Akyatan and Samandag beaches from 1 June - 1 September. Beaches were monitored nocturnally (2100-0600 hr). Track location, species and type of track were recorded; tracks were crossed to avoid duplicate counting. *C. mydas* nests were distinguished by the particular synchronous gait of the turtle (Ehrhart, 1982). Nests were located and labelled either as they were laid, or by using a probing stick the next morning (taking great care not to pierce any eggs). Nests were marked twice to minimise losses due to the removal of marks; one marking stake was planted near the nest (10 cm beneath the sand) and a second was planted 1 m behind the nest. Nests were excavated and the remains examined about one week after the first hatchlings emerged (cf. Whitmore and Dutton, 1985).

Table 1. Major threats to the sea turtle nesting beaches in Turkey.

Beach	Major threats	Protected status
Kazanli	Soda-chrome factory, agriculture, settlement, local tourism, lights	None
Akyatan	Coastal erosion, marine fishing, pollution	Wildlife Reserve
Samandag	Coastal erosion, sand mining, pollution, secondary houses	None

In all, 128 *C. mydas* nests were found on Kazanli Beach. Nest density was estimated to be 32 nests/km. On Akyatan Beach, 179 *C. mydas* nests were counted; 35 *C. mydas* nests were counted on Samandag Beach (Table 2). It is difficult to compare these results with previous studies due to differences in methodology; in particular, due to differences in survey time. However, comparisons are possible with a 1994 survey conducted of *Caretta caretta* and *C. mydas* nests along the Turkish Mediterranean (Yerli and Demirayak, 1997) because the 1994 and 1996 studies were conducted at the same time of year. A decrease in the numbers of nests is evident, particularly at Akyatan (Figure 1). We have insufficient data to conclude whether the decrease is due to natural fluctuation or man-induced harm. Natural fluctuations in the annual number of nests laid can be as high as 50% (Davis and Whiting, 1977; Talbert et al., 1980).

Table 2. Selected data from a survey of *C. mydas* nests laid in Turkey in 1996.

Beach	Total Crawls	Nests	% Nests	Beach Length	Nests/km
Kazanli	653	128	19	4	32
Akyatan	439	179	40	20	9
Samandag	127	44	35	9	5

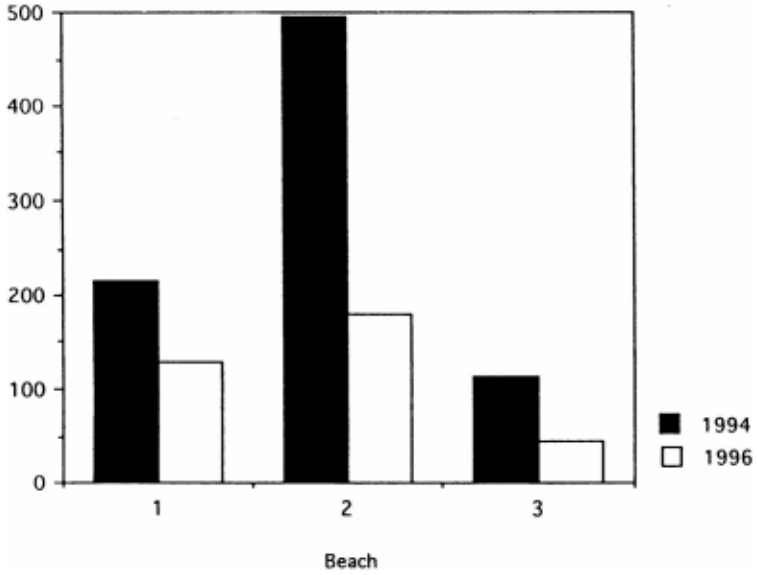

Figure 1. Comparisons between 1994 and 1996 survey results. 1 = Kazanli, 2 = Akyatan, 3 = Samandag.

The certain result of this survey is that these three beaches remain vital to the survival *C. mydas* in the Mediterranean Sea.

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POACHING THREATENS THE GREEN TURTLE ROOKERY AT TORTUGUERO, COSTA RICA

The 22-mile (35 km) beach of Tortuguero, Costa Rica, hosts the largest green sea turtle (*Chelonia mydas*) rookery in the Western Hemisphere. Tortuguero is also the site of the longest running sea turtle monitoring program in history, having begun in 1955 (Carr et al., 1978). The 1997 Green Turtle Program, organized by the Caribbean Conservation Corporation (CCC), extended from 1 July to 20 September. In total, 2,111 green turtles, eight hawksbills (*Eretmochelys imbricata*) and five leatherbacks (*Dermochelys coriacea*) were tagged during the course of the 1997 program.

In addition to the field research, several environmental awareness and education activities were conducted as part of the 1997 Green Turtle Program. These included a recycling program for the local community, the administration of a Visitors Center for tourists, information transfer and cooperation with local tour guides, and a program to involve the Tortuguero School in sea turtle and environmental conservation projects. The response from the local community to these activities has so far been very positive.

All is not well, however, for the sea turtles at Tortuguero. During weekly track (nesting) surveys along 18 miles (29 km) of beach, evidence of widespread poaching was found. We estimate that at least 1,500-2,000 green turtles from this population were illegally taken from the nesting beach in 1997. Poachers flip the turtles over under the cover of darkness as they crawl

onto the beach to nest. The turtles are placed in waiting boats and transported to Limon where they are butchered with turtles legally harvested (see Opay, this issue). Poachers prefer to seize the turtles as soon as they crawl out of the water. This conveys a dual advantage. First, the effort to haul them into waiting boats is reduced; second, the short track is soon erased by tidal action and thus the emergence may pass unrecorded by biologists. For this reason, our estimate of mortality due to poaching should be considered conservative.

Tortuguero is a national park; the taking of green turtles from the nesting beach is prohibited. However, the Tortuguero National Park Service (ACTo) lacks the human resources and necessary equipment to enforce the protective legislation. With an aim to reduce the serious problem of poaching, an agreement between CCC and ACTo was recently signed. According to the agreement, CCC will assist in the funding and organizing of additional guards which will patrol the beach during the nesting season.

The international importance of the Tortuguero rookery was acknowledged at the "Regional Workshop in Marine Turtle Conservation in Central America", which took place in Tortuguero from 26 September - 1 October 1997 (see Chacòn, this issue). Tortuguero was identified as the most important nesting beach in Costa Rica and poaching was identified as the most serious threat to green turtles in Costa Rica. The participants of the workshop (representing all seven Central American nations) signed a Resolution condemning the poaching of sea turtles from the nesting beach and urged the Government of Costa Rica to take swift action to resolve the problem.

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LEGAL ACTION TAKEN TO STOP THE HUNTING OF GREEN TURTLES IN COSTA RICA

Background: The green sea turtle (*Chelonia mydas*) has been and continues to be a key biological resource of Tortuguero, Costa Rica. Made famous by the dedicated research of the late Dr. Archie Carr, this turtle and its 22 miles (35 km) of nesting beach have focussed global attention on this remote tropical coast for nearly a half-century. While the surrounding inland canals and tropical wet forest have become part of the Tortuguero experience, many people still think of the green sea turtle when they think of Tortuguero.

Tortuguero has experienced many changes since the first green sea turtle was tagged in the 1950's. Unfortunately, some of these changes have been of a negative nature, and many of us who have worked to promote a healthy future for this part of Costa Rica remain concerned about the future of Tortuguero, its surrounding tropical wet forest, and of course the green sea turtle. The following is a brief update on the situation surrounding conservation and management of Tortuguero's most famous ambassador, the green sea turtle, and specifically the current controversy over permits which allow commercial hunting of this species.

The green sea turtle is an endangered species throughout most of its global range (Groombridge, 1993). Each June through September, gravid females migrate to 22 miles of beach extending between Parismina and Tortuguero on the Caribbean coast of Costa Rica. It is

one of the most important nesting sites for this species in the world and the largest in the Western Atlantic Ocean. Studies of remigratory periodicities show that the turtles return faithfully to this beach at intervals of 2, 3 or more years to lay their eggs (Carr, 1983), thus continuing the cycle of life which has repeated itself for centuries. The species may require several decades to reach reproductive maturity (e.g., Boulon and Frazer, 1990; Balazs, 1995).

The journey from egg to reproductive maturity is a dangerous and difficult one, thus the importance and value of those individuals who successfully recruit into adult age classes. Those hatchlings fortunate to make it out of the nest must avoid predators both on the natal beach and at sea. This is of course all part of the natural process, and for this reason the turtle lays thousands of eggs during her lifetime ... a strategy which has worked well over the millennia but falls short of coping with the newest predator, man. Direct and indirect human activity are making the odds ever more difficult for this species. Poaching of turtles and their eggs, disturbance by domestic animals, habitat degradation due to human activities, diseases such as fibropapillomas, and drowning in commercial fishing nets pose serious contemporary threats. Amid these dangers, we are faced in Costa Rica by the problem of legal and illegal commercial hunting.

Green Sea Turtle Hunting in Tortuguero: The green sea turtle is of great importance to the community of Tortuguero, the tourism industry (including the National Park), and the conservation of biodiversity. The green sea turtle of Tortuguero is truly an international species, traveling throughout the Caribbean Sea and entering the waters of numerous other nations when it is not nesting in Costa Rica (Carr et al., 1978). In Tortuguero, monitoring and safeguarding the green sea turtle during the nesting season is fundamentally important to the community. Local business and residents benefit from and are connected in one way or another to the turtle. Additionally, the turtle is an important resource for generating tourism business at local, national and international levels. However, there is been another group which is benefiting from the species with little regard for its sustainable future.

INCOPESCA (Instituto Costarricense de Pesca y Acuacultura) licenses commercial fishermen to hunt 1,800 green sea turtles per year. Nevertheless, INCOPESCA admits to no knowledge of any research which supports the figure of 1,800; that is, they do not know if the quota is sustainable or dangerous to the population (Defensoria de Habitantes, 1997). The hunt has no scientific basis and highlights a serious lack of informed management for this species. Moreover, while Costa Rican law prohibits fishermen to take turtles within the Tortuguero National Park, permits are given to fishermen knowing that very few turtles are available outside the park and that the fishermen will likely penetrate park boundaries to meet the quota (see Tro≈ng, this issue).

The official hunting season extends from 1 June to 31 August; however, fishermen ignore the seasonal limits. For example, during the Regional Marine Turtle Workshop, which convened in Tortuguero during the closed season at the end of September 1997, an exercise was undertaken to calculate the level of poaching over a period of two nights during the Workshop. The estimate was based on beach surveys conducted in the early morning hours. The evidence suggested that more than 150 turtles were taken from the beach during these two nights alone (Tro≈ng, this issue, estimates that a minimum of 1,500 turtles were poached over the course of the entire nesting season). Our two-day estimate is considered low because turtles poached at the water's edge leave no trace of their emergence.

It is of great concern that INCOPESCA grants permits knowing that some if not many of these fishermen will hunt within park boundaries, creating significant problems for park personnel. Park resources are inadequate to manage this problem. The Tortuguero National Park

includes approximately 22 miles of nesting beach and 50,000 hectares of marine park. The fishermen enter the park via the sea by boat. Turtles can be taken while at sea, but the easiest method involves searching the beach for females emerging from the sea to nest. (Females bring a higher price than males, and developing eggs are also taken during butchering.) Poachers have been known to tie large, empty sealed plastic containers with sections of rope to nesting females. When the marked female returns to the sea, she is retrieved via boat. Another method, especially when the sea is calm, is to land the boat and flip the female onto her back on the beach. When a sufficient number have been flipped, they are thrown in the boat and hauled away.

The primary market for turtles is the city of Limon in the Caribbean coastal province of Limon. On 1 October 1997, I passed through the city of Limon and found turtle meat and eggs still being sold openly in the center of the city. On 4 October 1997, several colleagues and I made a trip to the city of Limon to learn more about the turtle products being sold there. In the center of the city we countered fresh meat (the people selling the meat told us the turtles had been killed that morning), flippers, intestines, shelled eggs, and developing eggs. The meat can also be purchased smoked, something similar to beef jerky. While Limon appears to be the primary market, I have personally observed turtle eggs for sale in San José, which were not part of the Ostional egg harvest program, suggesting that this is a national problem. [N.B. The Ostional harvest program refers to the regulated seasonal collection of olive ridley turtle eggs from arribadas occurring on the Pacific coast of Costa Rica.]

The village of Tortuguero does not permit commercial hunting of sea turtles by villagers. Thus, while the local residents are expected to protect the turtle resource, it is fishermen from Limon (three hours south by boat) which are commercially harvesting this shared resource for profit, with no regard to the conservation or management of the species.

Fundamental Turtle Management Concerns: Hunting licenses are granted in support of a quota for which there is no scientific basis. Furthermore, there is insufficient control of the harvest, leading to widespread poaching within protected areas. This is a potentially lethal mix for the future of sea turtles in Costa Rica. A complete scientific analysis of the status of the Tortuguero green sea turtle population is needed, including conclusions as to the population's size, dynamics, and the effects of commercial hunting. It is clear that the commerical hunt is claiming a far greater number of turtles than is legally sanctioned, possibly three times or more (Tortuguero National Park staff, pers. comm., 1997). It is also clear that wholly illegal and non-commercial poaching of both turtles and their eggs is also occurring at an unknown level, and that there are additional hunting pressures on the population outside of Costa Rica, for instance in Nicaragua and Panama. Understanding all these elements is crucial to a credible management effort on behalf of this species.

Efforts to Address the Problem: In the first months of 1997, a group of concerned citizens, scientists, and conservationists joined together (through a socio-environmental committee, Comision Socio-Ambiental de la Region de los Cantones de Guacimo y Pococi) to seek a solution to the commercial hunting of the green sea turtle. The result was a "recurso de amparo"; in other words, a constitutional legal action which requests assistance from the court system. The action was an attempt to address the issues in a legal and peaceful manner, and sought to stop all hunting until (i) a sufficient amount of information concerning the turtle population is available to make a scientifically sound decision, (ii) the long term economic risks to all concerned are properly considered, and (iii) the future of the green sea turtle is properly guaranteed for generations who follow.

While the efforts of the committee and other groups who joined to help resulted in a temporary court order suspending the hunt (all previously issued permits were voided and no new permits were issued for the majority of this [1997] season), a legal technical error prompted a decision by the constitutional court to declare the legal action "sin lugar" (the legal action was not accepted). Poaching was reported during the period of suspension. Even though the legal action was not completely successful, the case did heighten awareness and stimulate greater discussion of the problem. We now await the official court resolution and any recommendations it may make. We hope that the resolution will result in pressures on INCOPESCA to revaluate the quota system.

We realize that our efforts to help the turtle cannot die, and we are currently considering the next step necessary to encourage the government to adopt a rational, scientifically based and comprehensive solution to the serious problems we have identified, including poaching within the Tortuguero National Park, hunting out of season, and issuing permits without any scientific foundation. The solution will require attention to the cultural aspects of turtle consumption, and should include educational programs, strengthening institutional capacity and coordination among agencies and stakeholders, and acquiring solid scientific support for any decisions made.

The participants who attended the recent Regional Marine Turtle Workshop represented sea turtle conservation efforts from throughout Central America, as well as México, Venezuela and the USA. International conservation organizations (e.g., PROARCA, Wider Caribbean Sea Turtle Conservation Network-WIDECAST, IUCN Marine Turtle Specialist Group, Caribbean Conservation Corporation) were also represented. Participants worked hard and long hours seeking solutions to the challenges of commercial hunting and poaching, as well as a variety of other threats facing sea turtles in the Western Hemisphere. Many of the ideas put forward in this article, such as strengthening institutional capacity, enhancing capacity and improving coordination, etc. were discussed during the Workshop and identified as priorities throughout the region, not just in Costa Rica. International gatherings such as this one, which represent the cumulative dedication of many nations and provide a forum for the sharing and strengthening of ideas, are crucial to ensuring the survival of sea turtles.

Conclusions: The endangered green sea turtle is an important local, national, and international marine resource. The turtle faces a number of threats to its survival. Legal and illegal commercial hunting is but one. Finding ways to address the cultural basis for eating turtle, achieving proper control of illegal hunting, improving institutional management capacity and cooperation, seeking economic alternatives for turtle fishermen who truly depend on the resource, as well as integrating conservation biology into the decision-making process are several key elements in identifying a rational conservation policy for the green sea turtle.

The recent legal action by concerned citizens, scientists, and conservation groups and the continuing efforts which will follow are attempts to address one inadequately researched, inadequately managed, and improperly controlled pressure — that of hunting — on the green sea turtle. Proper follow-up and continued work after review of the constitutional court's resolution (when it is released) will be necessary if we are to ensure that every effort is made to properly conserve this species. Any decision to allow the continued commercial harvest of the green sea turtle is economically suspect, biologically unsound, and morally incorrect if not based on proper scientific study, adequate management and control, and some level of assurance that we are conserving this endangered species for future generations.

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TESTING HYPOTHESES OF THE KEMP'S RIDLEY HEAD-START EXPERIMENT

In 1976, the U. S. National Park Service (NPS) proposed discussions with the U. S. Fish and Wildlife Service (FWS) concerning a project whose goal was the establishment of a nesting population of Kemp's ridley sea turtles (*Lepidochelys kempii*) at Padre Island National Seashore (PINS) near Corpus Christi, Texas (Woody, 1989). Under contract with FWS, NPS evaluated the suitability of PINS as a sea turtle nesting beach. By January 1977, NPS and FWS had convinced Mexico's Departamento de Pesca, Texas Parks and Wildlife Department, and the U. S. National Marine Fisheries Service to join them in a Kemp's Ridley Recovery Program, part of which was the feasibility study called "head-start" (see reviews by Donnelly, 1994 and Eckert et al., 1994). Florida Audubon Society and the Gladys Porter Zoo (Brownsville, Texas) also participated.

Now that two nestings by head-started Kemp's ridleys have been documented at PINS (Shaver, 1996a,b), it seems an appropriate time to place these nestings in the context of the experiment's working hypotheses. In their peer review conducted in 1992, Eckert et al. (1994) stated the hypotheses as follows: (1) Head-starting can produce Kemp's ridley juveniles which are able to join the natural, wild populations, find their way to nesting beaches, procreate and hatch viable offspring of their own; and (2) head-started turtles demonstrate equivalent or superior biological fitness, defined as equal or better survival rates from egg to reproductive adult, and equivalent or better fecundity when compared to wild Kemp's ridleys. The two nestings (Shaver 1996a,b) and the accumulated mark-recapture evidence of the distribution of head-started turtles throughout the geographic range and typical habitats of the species (see Caillouet et al., 1995 for references) essentially prove the first hypothesis. We expect further support for this hypothesis to emerge as more attention is focused on examination of Kemp's ridleys for head-start tags (Byles, 1993; Fontaine et al., 1993; Williams, 1993; Caillouet et al., 1997).

The second hypothesis concerning biological fitness is yet to be tested. It will be more difficult to test than the first hypothesis due to sample size differences (head-started vs. wild) and confounding effects. Eckert et al. (1994) recommended a wild hatchling tagging program to provide a control for comparison with head-started turtles. In response, 3,336 hatchlings were tagged with non-magnetized wire tags at Rancho Nuevo, Tamaulipas, Mexico in 1996. An additional 10,002 hatchlings were similarly tagged in 1997, and current plans call for tagging up to 10,000 more in 1998 (Caillouet et al., 1997). Sample sizes of captive-reared Kemp's ridleys released from year-class 1996 (174 turtles) and of those to be released from the 1997 year-class (currently rearing 179 turtles) will not be comparable to sample sizes of the same cohorts of tagged wild turtles (Caillouet et al., 1997), unless the wild cohorts experience first-year mortality rates of 90% or more. Such high mortality rates in pelagic immatures are not expected (Byles et al., 1996; Heppell and Crowder, 1996).

Eckert et al. (1994) emphasized that head-started turtles represent only a small proportion of the total population, virtually guaranteeing they will not be detected at current levels of nesting beach coverage, despite bearing one or more tags. Turtles bearing external tags are more likely to be reported than those without such tags (Eckert et al., 1994), so reporting of head-started turtles may still be biased upward as compared to wild ones bearing only internal wire tags. Another confounding factor is that most head-started turtles were released during years in which turtle excluder devices (TEDs) were not required in shrimp trawls (Eckert et al., 1994), whereas the wild turtles tagged as hatchlings will only have been exposed to shrimping with TEDs. One would expect survival rates of head-started turtles to be lower for that reason alone.

Examination of Kemp's ridleys for tags, especially those applied to captive-reared turtles (Byles, 1993; Fontaine et al., 1993; Williams, 1993; Caillouet et al., 1997), will likely provide more support for hypothesis 1. Fecundity has been determined on only two head-started Kemp's ridleys released into the wild (Shaver 1996a,b). A comparison of survival rates of head-started (Caillouet et al., 1995) and wild Kemp's ridleys will require maturation and nesting of wild wire-tagged turtles, but this comparison will be confounded with TED effects.

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HAWKSBILL TAGGED IN THE BAHAMAS RECAPTURED IN CUBA

In recent years, there has been increased interest in the degree to which hawksbill turtles (*Eretmochelys imbricata*) in Cuban waters are isolated from other populations in the Greater Caribbean and the extent to which hawksbills move into and out of Cuban waters (Moncada Gavilan, 1994; Bowen et al., 1996; Heppell and Crowder, 1996). We have just received a tag return from Cuba for a hawksbill that we tagged at Union Creek, Great Inagua, Bahamas (21°07'N, 73°34'W). The hawksbill, which had a straight carapace length (SCL, from nuchal notch to tip of posterior marginal) of 51.6 cm, was tagged on 1 October 1992 with four plastic tags (Dalton Jumbo-Roto). We did not see it again after release. In August 1997, Luis Alfredo Diaz Alavarez, a Cuban fisherman from Banes, Cuba, captured the turtle over a reef about 1 km offshore from Puerto Rico Beach, Banes, Holguín, Cuba. He reported that all tags were still attached to the turtle. This recapture represents a minimum distance of approximately 200 km over water depths of more than 3000 m.

Although our long-term studies at Great Inagua focus on immature green turtles, we also tag hawksbills whenever they are encountered. Since 1975, we have tagged 46 hawksbills with a range of SCL from 24.3 to 71.3 cm. The recapture of only one other hawksbill tagged at Inagua has been reported to us. In September 1983, an immature hawksbill (46.9 cm SCL) tagged at Inagua on 10 September 1982 was recaptured on Providenciales, Turks and Caicos (Bjorndal et

al., 1985). This recovery was in the opposite direction and represented a minimum distance of about 150 km over waters at least 3500 m in depth.

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TURTLE VOYAGES FROM PAKISTAN TO AFRICA

A green sea turtle (*Chelonia mydas*) was tagged on 12 December 1995 at Hawkes Bay, Karachi, Pakistan, with a monel metal tag W4801 on the right front flipper and W4802 on the left front flipper. Curved carapace length and width were 98 and 83 cm, respectively. At the time of tagging, egg-laying was unsuccessful due to cement debris in the nest cavity. The turtle was tagged as she returned to the sea.

One year later, in December 1996, the turtle was recovered at Beraisole near Askoma Hill off the South Central coast of Eritrea, northeast Africa (13°39"00' N, 42°08"05' E) by a fisherman named Adem Mahammad Hamadu living in Beraisole village. Data from the recovery were contained in a letter penned by Dr. J. C. Hillman, Marine Resources Advisor, Resources and Environment Division, Ministry of Marine Resources, Massawa, Eritrea. The fisherman reported that he removed the tag after capturing the sleeping turtle from shallow (2 m) water. No mention was made of the tag placed on the left front flipper. The turtle was released alive. A T-shirt was forwarded to the fisherman as a thank you for his efforts.

This is only the second long-distance recovery of a turtle tagged in Pakistan. In 1990, a tagged green turtle was reported from Gajarat, India.

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LONG-TERM TAG RETURNS FROM JUVENILE KEMP'S RIDLEYS

Tagging efforts of juvenile kemp's ridley turtles (*Lepidochelys kempii*) sponsored by the U. S. National Marine Fisheries Service (NMFS) Cooperative Marine Turtle Tagging Program (CMTTP) are providing important information regarding habitat utilization, migratory behavior, and age and growth. Four juvenile ridleys tagged in 1989/90 have been recaptured nesting at Rancho Nuevo, México. Three of the turtles were originally tagged on the east-central coast of Florida and the fourth was tagged further north in the Chesapeake Bay. These turtles ranged in size from 26-55 cm straight-line carapace length (notch-to-tip) and were free 5-8 years before nesting. All turtles were double flipper tagged and all had lost at least one of the original tags when recaptured.

Carr (1980) suggested that the juvenile ridley turtles found along the east coast of the U. S. may not be able to migrate back to Rancho Nuevo when mature, and may therefore be lost to the breeding population. As researchers slowly gathered more data on the juvenile ridleys of the Atlantic coastal habitats, it became apparent that these coastal waters were undoubtedly critical developmental habitat for a large portion of the Kemp's ridley population. Although researchers have been intuitively questioning the "lost waif" hypothesis, the theory continues to be perpetuated because of the lack of published scientific evidence (Caillouet et al., 1995; Musick and Limpus, 1997). These four tag returns, however, indicate that coastal juvenile ridley turtles are potentially viable breeders and are able to return to Rancho Nuevo.

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PLASTIC "ROTOTAGS" MAY BE LINKED TO SEA TURTLE BYCATCH

Throughout the course of our investigations of black [Eastern Pacific Green] sea turtle (*Chelonia mydas agassizii*) ecology in Bahia de Los Angeles, Baja California, México we have had the opportunity to observe and learn about the interactions between sea turtles and fishing nets and to discuss these observations with local fishermen. Our findings suggest that plastic flipper tags (two-part "rototags" manufactured by Dalton Supplies, U.K.) used by the Gulf of California Black Sea Turtle Project over the past decade may contribute to sea turtle bycatch in a variety of fishing net types.

On two separate occasions in July 1996 we observed black turtles at the surface, entangled in monofilament gill nets of 5 cm mesh size. Both turtles were especially tangled around the dorsal and ventral components of the two-part flipper tags. Both turtles were tagged on both the left and right foreflippers. The turtles were removed from the net, measured, their tags removed, and then released. The fishermen who owned the nets were contacted and interviewed.

Over the next several months, interviews were conducted with local fishermen to learn more about sea turtle bycatch in the area. Through these interviews we learned that several tagged turtles had been accidentally captured in gill nets in the past. All of the fishermen interviewed noted that, in their opinion, the presence of plastic flipper tags increases the chance that a turtle may become entangled in a net, no matter the mesh size. They also noted that sharp carapace abnormalities and epibionts (e.g., *Murex* sp.) may also contribute to entanglement in nets.

Preliminary observations of both tagged and untagged turtles in captivity indicate that turtles are capable of back-swimming out of nets, provided that their tags do not become hooked in the net. Specifically, we conducted trials in cement holding tanks (8 m diameter) at Campo Archelon, Bahia de Los Angeles, in July 1996. A gill net was stretched across the center of the tank from the floor to above the waters' surface. Of ten turtles tested, only the tagged turtles (n=6) became tangled, while the untagged turtles (n=4) always escaped. Experienced fishermen support these observations by pointing out that untagged turtles literally "bounce off" of gill nets with small mesh sizes.

It is clear that additional research is needed (and we are certainly aware that in many parts of the world, untagged sea turtles are routinely captured in gill nets), but based on our preliminary observations of captive turtles, personal observations, and interviews, it appears that these plastic flipper tags, with their projecting leading edges, may make the turtles more available to entanglement once a net is contacted. As a result, the use of plastic tags by the Gulf of California Black Sea Turtle Project has been discontinued.

Gill nets are abundant in the Gulf of California (e.g., Ruiz-Durá, 1985; authors, pers. observ.) and many of the turtles utilizing Baja California waters are migrating from distant nesting beaches, some as far away as Japan (Bowen et al., 1995; W. J. Nichols, unpubl. data). Unrecorded mortality of tagged turtles in the Gulf will lead to erroneous population assessments and may lead to further declines in this already drastically diminished regional population. We recommend further studies on the effects of tagging on incidental capture of turtles, both on feeding grounds and along nesting beaches.

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FIRST RECORD OF A LOGGERHEAD TURTLE IN THE FERNANDO DE NORONHA ARCHIPELAGO, BRAZIL

On 21 September 1995, a loggerhead sea turtle, *Caretta caretta*, was recorded on video in the Fernando de Noronha Archipelago, at a depth of 14 m, in a place known as Pedras Secas (03°51'00" S, 32°22'04" W). The site is frequently visited by SCUBA-diving companies. The video runs for approximately five minutes. The video indicates that the turtle was not tagged, it was in apparent good health, and it lacked any evidence of injury. Comparing the size of the turtle to the size of the divers, we estimate that it was an adult and probably a female (based on the absence of a long tail).

Fernando de Noronha is a nesting area for green turtles, *Chelonia mydas*, and a feeding area for green and hawksbill, *Eretmochelys imbricata*, turtles (Bellini and Sanches, 1996). There is only one record of a leatherback turtle, *Dermochelys coriacea*, and one of an olive ridley, *Lepidochelys olivacea*, in Fernando de Noronha; both turtles were incidentally captured in fishing nets in the vicinity of the archipelago (Bellini and Sanches, 1997). Prior to September 1995, loggerheads had never been documented.

Of the five species of sea turtle found in Brazil, the loggerhead is the most common along the continental coast. Its main nesting areas are located in the State of Bahia, including the Abrolhos Archipelago, and in the State of Espiríto Santo. Nesting areas are also found in the States of Sergipe and Rio de Janeiro (Marcovaldi and Marcovaldi, 1987). In Brazil, the nesting season for loggerheads is mainly from September to March (Marcovaldi and Laurent, 1996).

Due to the unexpectedness of this record, the authors intend to intensify the diving activity at the site where the turtle was found, in order to obtain further information about the seasonality and abundance of loggerheads in the Fernando de Noronha Archipelago.

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LOGGERHEAD NESTING ON AKROTIRI PENINSULA, CYPRUS

Although the southern and western coasts of Cyprus have experienced extensive tourist development in the past few decades, the Akrotiri Peninsula has been spared such development due to its designation as a U.K. Sovereign Base Area occupied by the Royal Air Force (RAF). Consequently, most beaches on the peninsula are still used as nesting sites by the loggerhead sea turtle, *Caretta caretta*. Members of the RAF have been running the Turtlewatch conservation project on these beaches since 1990. However, 1996 was the first year that surveys were consistently carried out each day of the season and nests were correctly identified, due to the presence of volunteers from the U.K. (the authors). This report gives details of the 1996 nesting season.

The beaches surveyed in 1996 are located on the western coast of the Akrotiri Peninsula, on the southeast coast of Cyprus; the beaches are approximately 3.5 km in total length. Half of the shoreline is characterised by a sandy upper shore and reef-like expanses of rock on the lower shore. The most northerly half is a shallowly sloping beach with no rocks on the lower shore, and is thus a more classical nesting site for sea turtles. Turtlewatch volunteers patrolled these beaches daily at sunrise during the nesting and hatching seasons (12 June to 5 September 1996) to record the presence or absence of turtle tracks on each beach and the characteristics of the tracks. These were designated as follows:

FCU (False crawl, U-turn) - the turtle returned to the sea without making any attempt at nesting.

FCA (False crawl attempt) - the turtle made one or more attempts to nest (there was evidence of digging), but had not nested successfully.

Nest - the turtle was presumed to have successfully laid eggs, as indicated by nest digging and covering.

The beaches were also surveyed nightly on the majority of nights throughout the nesting season. If a turtle was present, the time of each stage of the nesting activity was recorded, and measurements of the carapace (curved length and curved width) were made. Conservation measures involved moving nests to safer locations when the original nest site was deemed to be too close to the sea or was close to vehicle tracks. Nests were moved the day after laying. We protected the nests with cages consisting of a metal frame covered with wire netting, partially buried in the sand, to deter predators. During the hatching season, hatchling tracks were traced back to their epicentre and the number of tracks estimated. To determine hatch success, nests were excavated within two days of hatching, or two months after laying if hatching had not occurred by that date.

A total of 15 nests were recorded during the nesting season. Three were lost (two swamped by waves and one depredated) before they could be caged. Two nests were lost when their cages were stolen, leaving ten that were caged and followed through from laying to hatching. Four uncaged nests were found during the hatching season. We do not know if some of these were the nests that had been "lost", or if they were nests that had gone undetected at the time of laying. In any event, the recorded total of 15 nests laid may be an underestimate of the number of nests laid during the season. If we assume a mean of three nests laid per female per season (Groombridge, 1990), this indicates a population of at least five females nesting on these beaches in 1996.

Nesting females were observed on five occasions, and carapace measurements were taken from four of them. Mean curved carapace length was 76 cm (SE = 2 cm) and mean curved carapace width was 68 cm (SE = 2 cm). The size of these turtles is well within the size range for loggerhead turtles nesting elsewhere in Cyprus (e.g., Broderick and Godley, 1996).

Three of the four uncaged nests that hatched had been depredated, whereas no caged nests were depredated. Clearly, caging nests is an important element of the conservation programme on these beaches. Of the caged nests, seven were moved after laying, and three were left *in situ*. The number of eggs per nest varied more than two-fold, ranging from 52 to 118 eggs, with a mean of 77 (SE = 6) eggs per nest. Overall, hatching success was good, with a mean of 72% (SE = 32%) of the eggs hatching successfully. Again, these are typical figures for Cyprus (e.g., Broderick and Godley, 1996). Hatching success was as good in moved nests as those left *in situ*. The incubation period ranged between 48-58 days, with nests laid later in the season taking longer to hatch. This could have been due to differences in temperature over the season, but temperature was not recorded.

Based on an estimated 75 loggerheads nesting annually at Lara, the main nesting site in southern Cyprus (Demetropoulos and Hadiichristophorou, 1989, 1995; Groombridge and Whitmore, 1989), we conclude that the five or more females using the Akrotiri beaches constitute a small but not insignificant contribution to the breeding population of southern Cyprus.

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CENTRAL AMERICAN WORKSHOP ON SEA TURTLE CONSERVATION: HOPES AND ACTION

From 26 September to 1 October 1997, 66 representatives of Government agencies, NGO's, universities and local communities from throughout Central America (Guatemala, El

Salvador, Honduras, Nicaragua, Costa Rica, Belize, Panama), as well as Observers from the USA, México and Venezuela, met in Tortuguero, Costa Rica, to discuss sea turtle conservation issues. The landmark gathering focused on the promotion of conservation and sustainable use of sea turtles in Central America.

The Workshop was facilitated by Asociación ANAI (a Costa Rican NGO) and supported by a large number of international and national organizations, including World Wildlife Fund (WWF) as part of PROARCA-COSTAS (Regional Project for Central America/USAID-G/CAP, The Nature Conservancy, WWF, and Marine-Coastal Center from the Rhode Island University), CCC (Caribbean Conservation Corporation), CCAD (Central America Commission for Environment and Development), the Marine Turtle Restoration Program for Costa Rica (Earth Island Institute), and Help for Threatened Wildlife (Frankfurt Zoological Society). In addition, complementary support, including travel funds and Workshop documents, was provided by IUCN (World Conservation Union), WIDECAST (Wider Caribbean Sea Turtle Conservation Network), and USAID (Mexico and Nicaragua missions).

The Workshop resulted in several notable accomplishments. Participants exchanged ideas and agreed to a set of standardized field techniques for sea turtle conservation. The Workshop established a conceptual base for the development of national, subregional, and regional action plans, policies, and compromises. Comprehensive national "Sea Turtle Recovery Action Plans" developed by the WIDECAST network for Belize and several Eastern Caribbean island nations provided a basis for discussion of national conservation planning. Presentations on the new Western Hemisphere Sea Turtle Treaty and contemporary CITES issues resulted in meaningful discussions on how Central American NGO's can (and should) become more involved in international affairs. Participants elected national and regional representatives to assure implementation of the Workshop's conclusions, as well as to plan a future reunion. Finally, six Resolutions and agreements were signed by participants.

In summary, the Workshop emphasized the importance of sea turtle conservation in the geopolitical region of Central America. Sea turtles represent a highly migratory resource, shared among political jurisdictions, as well as a charismatic resource with highly public identification. There was consensus that sea turtles need real and concrete conservation measures, including, in particular, the protection of nesting colonies and turtles of breeding age in foraging pastures. For more information, including requests for Proceedings, please contact Didiher Chacòn, Director of Sea Turtle Conservation at Asociación ANAI (address below).

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LEGAL BRIEFS

GAHIRMATHA BEACH DECLARED A MARINE SANCTUARY — The Orissa [India] government has decided to declare the Gahiramatha beach, the world's biggest nesting ground of the Olive Ridley sea turtles, as a marine sanctuary, according to official sources in Bhubaneswar on Thursday. The limits of the sanctuary, ensconced within the magical Bhitarkanika National Park, would extend from the south of Dhaa in Bhadrak district to 15 km north of the Paradip port. This was exclusively done to protect the Olive Ridleys, which died in thousands last year, probably caught in the gill nets of fishing trawlers, when they neared the coast for their annual mass nesting, the sources said. Source: excerpted from *India News Network*, 10 October 1997.

* * *

NEW CITES PARTIES — A further six countries have acceded to CITES, the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Jamaica acceded on 24 March 1997, Yemen on 5 May, Myanmar on 13 June, Cambodia on 4 July, Antigua and Barbuda on 8 July and Uzbekistan on 10 July, bringing the total number [of Parties] to 142. These accessions enter into force on 22 June, 3 August, 11 September, and 2, 6 and 8 October, respectfully. Source: *CITES Secretariat*, 9 July 1997 [*in* Oryx, 1997, 31(4):230].

* * *

FIRST LEATHERBACK TO NEST IN HAWAII — The first leatherback to lay eggs on the shores of Hawaii, USA, in recorded history nested on Lanai's Hulopoe Beach on 20 July 1997. A total of 89 eggs were laid. The nest did not hatch. The contents were exhumed after 76 days; the eggs were infertile. Leatherbacks do swim into Hawaiian waters and are occasionally seen by sailors and fishermen. Source: adapted from the *Hawaii Star-Bulletin*, 13 October 1997.

SEE YOU IN MAZATLAN! 18TH ANNUAL SYMPOSIUM ON SEA TURTLE BIOLOGY AND CONSERVATION

The 18th Annual Symposium on Sea Turtle Biology and Conservation will take place on 3-7 March 1998 at El Cid Hotel in Mazatlan, Sinaloa, México. Your symposium hosts will be: Instituto de Ciencias del Mar y Limnología (UNAM); Facultad de Ciencias (UNAM), Universidad de Guadalajara (UdeG); Secretaría del Medio Ambiente, Recursos Naturales y Pesca (SEMARNAP); H. Ayuntamiento de Mazatlán; Comité Nacional para la Protección y Conservación de las Tortugas Marinas; Facultad Ciencias Marinas (UAS), and Acuario Mazatlán.

Registration will begin Tuesday, 3 March. Sessions will take place all day on 4-6 March and on the morning of 7 March. The Symposium plenary session will take place on Saturday, 7 March, followed by a meeting of the IUCN Marine Turtle Specialist Group. Prior to the Symposium, there will be a meeting of the Latin American Sea Turtle Specialists (28 February-3 March). For more information, contact Dr. Jack Frazier, CINVESTAV, A.P. 73 "Cordemex", Mérida C.P. 97310, Yucatán, México; fax: (52 99) 81 29 17, -19; email: frazier@kin.cieamer.conacyt.mx.

The Program Coordinator is Lic. Laura Sarti (Depto. de Biología, Facultad de Ciencias, UNAM, Circuito Exterior, Ciudad Universitaria, México D.F. 04510; tel: (52 5) 622 -4918; fax:

(52 5) 622-4828; email: lsm@hp.fciencias.unam.mx); the deadline for paper and poster abstracts has passed.

The Announcement and Call for Papers has been issued over the internet (CTURTLE, email). Full documentation is available in the Symposium home page at http://ola.icmyl.unam.mx/tortugas and is also being sent out by mail and fax to past Symposium participants. For those not registered last year (and/or who are unable to access the home page), please request a copy of the Announcement and Call for Papers from Jane Provancha, Symposium Secretary (DYN - 2, Kennedy Space Center, Florida 32899, USA; tel: (407) 853-3281; fax: (407) 853-2939; email: provancj@bonsmtp.ksc.nasa.gov). Pre-registration can be sent by fax to Jane Provancha or using the electronic formats available in the home page.

Please make your reservations directly with El Cid Hotel. Contact Mr. Einar Broden at tel: 1 (800) 525-1925, 1 (888) 733-7308; fax: (52 69) 14-13-11; email: sales@elcid.com. Prices are US$ 75+tax for Std Rooms (2 DB, w/o kitchenette) and US$ 180+tax for Suites (2 QB, 1 sofa, 2 bathrooms, kitchenette). Book early! International air travel arrangements are being taken care by Don Laver at "Don For Travel" (c/o Regency Travel, 1075 Duval Street #19, Key West, Florida 33040; fax: (305) 294-3631; email: DonForTravel@compuserve.com). Please contact him for the best airfares!

Last year, more than 700 participants from about 38 countries presented over 200 papers. This year we hope to beat that record! The central theme for the symposium is sea turtle conservation, and we hope to promote this goal through a multinational dialogue in which sea turtle scientists, managers and decision-makers from a broad range of backgrounds can listen, talk and offer their expertise and points of view. See you there!

F. ALBERTO ABREU GROBOIS, 1998 Sea Turtle Symposium President, Estacion Mazatlan, Instituto de Ciencias del Mar y Limnologia (UNAM), A.P. 811, Mazatlan, Sinaloa 82000 MEXICO; tel: (52 69) 85-28-45; fax: (52 69) 82-61-33; email: abreu@ola.icmyl.unam.mx

PLOT YOUR OWN COURSE!

The Sea Turtle Survival League (STSL) is a program of the nonprofit Caribbean Conservation Corporation (CCC). The mission of the STSL is to protect sea turtles by reducing threats to them and preserving their nesting habitats through a program of public awareness, advocacy and education. In 1996, the STSL offered an exciting new educational program based on the satellite-tracked migration of five sea turtles that nested in the Archie Carr National Wildlife Refuge (ACNWR), located on Florida's east coast. In mid-October 1997, STSL will continue this satellite tracking educational program with five new turtles from the ACNWR. In addition, the STSL is receiving the satellite information from projects involving a male sea turtle from Tampa Bay, Florida and two female turtles from Baja [California], Mexico.

The three new turtles are an exciting addition to the ACNWR turtles. The five turtles from the ACNWR are green sea turtles, similar to last year, the male [from Tampa Bay] is a loggerhead turtle, one Pacific female is a 'black' [East Pacific green] turtle and the other is a loggerhead. Results of a study done last year with a female loggerhead from the Pacific coast of Mexico showed the turtle swimming across the Pacific Ocean to Japan (the last satellite positions were received at the end of August 1997, almost a year later). Researchers attached satellite transmitters to the backs of the sea turtles in order to track their mysterious and unknown

migration. The STSL will use the stream of data sent back by satellite in its educational program distributed on the Internet's World Wide Web.

In addition to a full range of information about sea turtles and the Carr Refuge, the web site includes a map that is regularly updated with the most recent migratory movements of all participating turtles. The migration of these turtles could cover hundreds and even thousands of miles. Where the turtles will go is anyone's guess. Students will have an opportunity to have their questions answered through a tracking bulletin board and over email. There are blank maps that can be printed for students to plot their own points of the turtles as they migrate from their release site. Data points are also available.

Teachers wishing to include the program in their curriculum can sign up either over the phone (1-800-678-7853) or through a registration form on our web site (located at http://www.cccturtle.org). Participating educators will be sent a free Educator's Guide on the program, which includes an array of information and diagrams about sea turtle biology, a full description of the satellite research and ideas for classroom activities. The Guide is also designed so that relevant sections can be easily photocopied for distribution to students.

Through this program, people around the world, especially school children, will learn as researchers learn about the migration of marine turtles, the global range of the species and the importance of protecting all coastal waters and habitats. The program will also add to students' general awareness about marine conservation, sea turtles, geography and "cutting edge" technology.

As part of the program, participants are given the opportunity to "adopt" one of the satellite-tagged sea turtles with a US$ 25 donation. Through the program and optional adoptions, it is hoped that children and adults will take personal interest in sea turtle preservation, learn about sea turtles and become aware of the issues impacting the species. In addition, because the program will be available on the Internet, this fun new communications tool will be used and promoted in schools and the general public. We look forward to hearing from you!

~~~~~~CARIBBEAN CONSERVATION CORPORATION and SEA TURTLE SURVIVAL LEAGUE, 4424 NW 13th Street, Suite A-1, Gainesville, Florida 32609 USA; e-mail: stsl@ cccturtle.org, Web Page: http://www.cccturtle.org
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RESEARCH ASSISTANTS AND VOLUNTEERS SOUGHT: TALAMANCA, COSTA RICA

Asociacion ANAI has been working to protect the sea turtles nesting in the Gandoca/Manzanillo area, on the Caribbean coast of Costa Rica, for 12 years. Gandoca Beach is a major nesting beach for leatherback turtles (*Dermochelys coriacea*) with 1,135 nests recorded in 1997. Green (*Chelonia mydas*) and hawksbill (*Eretmochelys imbricata*) turtles also nest at this site, but in smaller numbers.

ANAI's Leatherback Sea Turtle Project at Gandoca/Manzanillo Wildlife Refuge in Talamanca, Costa Rica, offers 10 scholarship places each year to applicants with a background in Marine Biology, Zoology or with experience in working with sea turtles. Applicants must speak Spanish *and* English and commit to a minimum of 10 weeks at the project. The project will cover the cost of food and lodging at the project site.

Volunteers are also needed to help in the conservation work. Volunteers have the opportunity to stay with local families in Gandoca village. The minimum stay for volunteers is one week. Program dates are 1 March - 31 July 1998. For further information about scholarship and volunteer opportunities, please contact the Volunteer Coordinator (address below).

STEVE CANSELL, Volunteer Coordinator, Sea Turtle Conservation Project, Asociacion ANAI, Box 170-2070 Sabanilla, COSTA RICA; Fax: (506) 253-7524, e-mail: anaicr@correo. co.cr

RESEARCH ASSISTANTS SOUGHT: TORTUGUERO, COSTA RICA

The Caribbean Conservation Corporation (CCC) is currently accepting applications for Research Assistant positions for our 1998 Green Turtle Program. The location of the program is the John H. Phipps Biological Field Station in Tortuguero, Costa Rica. The program dates are 1 June 1998 to 30 November 1998. The deadline for completed application materials is 1 April 1998. Selection and notification of Research Assistants will be made by 15 April 1998. Please do not contact CCC offices to check on the status of your application; all applicants will be notified whether or not they have been selected.

All Research Assistants (RA's) will be supervised by the resident Research Coordinator. RA's will oversee the nightly tagging operations, monitor hatching success and partake in other monitoring activities. They will serve as group leaders for teams of participant turtle taggers and ensure that monitoring activities are carried out correctly. RA's will be responsible for applying turtle tags, and for recording data and correct monitoring information. Data collected from turtles include size measurements, old tag numbers, location of nests and other pertinent information. Predation and illegal harvest rates will also be studied. In addition to the monitoring activities, RA's will be expected to assist with a variety of other research station operations, including assistance with other research projects, orientation of visitors, training of new staff, working in the visitor center, maintenance, etc.

Applicants must be 20 years of age or older; hard working, responsible and self-motivated; able to live in a rustic environment under adverse climatic conditions; able to work cooperatively in a group; keenly interested in wildlife and resource conservation; possessive of leadership skills and problem-solving abilities. In addition, applicants should be in excellent physical condition, with an ability to walk 10 miles or more every night in soft sand. A working knowledge of English is mandatory; a basic knowledge of Spanish is helpful but not necessary. A background in biological or marine sciences, wildlife management, resource conservation, environmental education or related fields is preferred.

CCC requires a firm commitment of a minimum of six weeks from Research Assistants selected for the program. RA's who are able to commit to the entire duration of the program are preferred. RA's will be responsible for their own travel expenses to the location, although logistic assistance with travel arrangements will be available from CCC. Room and three meals a day will be provided free of charge to all participating RA's. Accommodations are dormitory style, 4-6 people per room. Incidental costs (e.g., travel and accommodations or meals away from the station) are to be borne by the RA. No salaries, stipends or other compensation are provided. Application materials are available from the Research Coordinator (address below).

SEBASTIAN TROENG, Research Coordinator, Caribbean Conservation Corporation, 4424 NW 13th St. Suite A-1, Gainesville, Florida 32609 USA; fax: (352) 375-2449, e-mail: ccc@ cccturtle.org

VOLUNTEERS SOUGHT: GREEK ISLES

The Sea Turtle Protection Society of Greece (STPS) announces opportunities for volunteers from mid-May to mid-October 1998 on the primary nesting beaches in Greece: Zakynthos, Crete and Peloponnesus. Volunteers are involved in both field work and public awareness. Field work includes counting tracks and nests, protecting nests, tagging turtles and excavating hatched nests. Public awareness is aimed at informing tourists and is carried out mainly through Information Stations, slide shows in hotels and on-site interpretation. Volunteers stay in designated free camp sites with very basic sanitary and cooking facilities. Volunteers are trained and supervised by experienced project members.

Volunteers are also needed throughout the year at the Sea Turtle Rescue Centre in Glyfada, near Athens. Volunteers will be mainly involved with daily treatment of injured turtles, maintenance, construction works and informing visitors. Accommodation is provided at the Centre. In either case, candidates must be at least 18 years of age, able to communicate in English, and prepared to participate in very demanding work. Travel costs, food and other expenses must be borne by the volunteers. Minimum participation is four weeks. For further information and application materials, please contact the Sea Turtle Protection Society (address below).

SEA TURTLE PROTECTION SOCIETY OF GREECE, 35 Solomou Street, GR - 106 82 Athens, GREECE; Tel/Fax +30-1- 38 44 146, e-mail: stps@compulink.gr

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