

regional approaches to turtle conservation are needed. Because of the great mobility of these animals, vast numbers of turtles are vulnerable throughout their ranges to a myriad of threats, including intentional hunting/trapping and incidental capture in fishing nets. While WWF continues to support national efforts to conserve sea turtles, it is increasingly focusing on regional approaches to conservation in the Mediterranean, Indo-Pacific, eastern Pacific and Caribbean. In 1999, WWF co-funded production of a state-of-the-art publication, *Research and Management Techniques for the Conservation of Sea Turtles*, prepared by the IUCN/SSC Marine Turtle Specialist Group.

MEDITERRANEAN

Protecting nesting beaches

The major nesting areas for the Mediterranean's green and loggerhead turtles lie in the eastern part of the region, with Greece, Turkey and Cyprus hosting the highest numbers. The Mediterranean is thought to support the third largest loggerhead nesting population in the world, after those of Oman and the United States.

WWF and IUCN initiated nesting beach surveys in Turkey in 1978 along the Aegean and Mediterranean coasts, and started public awareness campaigns and a tagging programme. In 1987 the Turkish Society for the Protection of Nature (DHKD), a WWF affiliate, launched a successful campaign to stop a huge tourism development project for the Dalyan/Koycegiz region, considered the Mediterranean's most important loggerhead nesting area. Plans for hotels were scrapped and Dalyan was declared a protected area. In 1988, a survey of the entire Turkish Mediterranean coast identified 17 important turtle beaches. These beaches faced a number of threats: of the 606 km of beaches, 40 per cent were severely impacted by tourism. Moreover, about half of the beach areas used by nesting turtles had been destroyed by sand extraction. DHKD initiated a number of conservation actions at these sites and lobbied the government to reinforce existing conservation regulations and establish new protected areas. Thanks to these efforts, marine turtles have become a symbol of the conservation movement in Turkey.

The nesting density of loggerheads on Zakynthos Island, Greece, is among the highest in the world, partly because red foxes (*Vulpes vulpes*) do not occur, so predation pressure is low. The core area for turtles on Zakynthos is Sekania beach, on the southern coast of the island, where nesting turtles reach a density of 3,000/km². In 1981, WWF assisted Greek conservationists to map the beaches and start long-term monitoring of the Zakynthos turtles. Initially, turtle conservation met with hostility, because it was seen to be against development interests. However, thanks to a public awareness project started in 1986 by the Sea



Tourists on a turtle nesting beach in Zakynthos, Greece. In December 1999 the area was declared a national park by the Greek government.

Turtle Protection Society of Greece (STPS), the turtles of Zakynthos are now major tourist attractions. STPS is continuing to implement turtle monitoring, tourist awareness and school education activities with WWF support.

Until the late 1980s, little research had been carried out on marine turtles along the North African coast, although it was known that the extensive sea-grass beds in the Gulf of Cades constituted a major foraging area for green turtles. Around 3,000 were being killed annually in the Gulf of Cades, with up to 6,000 killed in Tunisia as a whole. From 1989 to 1993, WWF supported a study to identify major breeding, feeding and overwintering areas for turtles along the North African coast and to discover the extent of turtle mortality. The study concentrated on the Tunisian coast, although areas in Morocco and Algeria were also surveyed.

Further survey teams along Libya's coastline between 1995 and 1998 discovered unknown and significant loggerhead nesting beaches, especially along the northeastern coast. These "extra" turtles could explain the fact that Egyptian fisheries, which have been responsible for killing large numbers of adults for many years, have not exhausted stocks of Mediterranean turtles long before now.

Threats from fisheries

In 1977, WWF started to identify threats to adult and young turtles in the western and central Mediterranean and devise strategies to protect them. A survey of fishermen at Spanish ports found that the most pressing danger from coastal fisheries was accidental bycatch. A later study estimated that perhaps 16,000 turtles, mainly loggerheads, were killed each year by commercial swordfish longline fisheries. Although turtles are released after capture, many drown. If released alive, most have hooks in their mouths. Between 1987 and 1990, WWF funded a major study to determine the impact of longline fishing, and the survival rates of hooked turtles.

In 1994, WWF initiated a strategy to conserve turtles, especially loggerheads, throughout the Mediterranean. A main objective of this strategy is to prevent mortality of adult turtles at sea. Research undertaken by biologist Dr Luc Laurent combined field observations with studies of turtle genetics and population dynamics. His final report, *Conservation and Management of Mediterranean Loggerhead Sea Turtle (*Caretta caretta*) Populations*, was published in 1997. Laurent's surveys identified a number of significant threats to the loggerhead: thousands being killed each year by Egyptian fisheries, followed to a lesser extent by fleets from Turkey, Tunisia, Libya and Italy. He estimated that more than 20,000 turtles were being captured as bycatch by Spanish longline fisheries, with about 4,000 of these dying as a result. Significant numbers were also being killed by bottom trawls operated by Turkish, Greek and Egyptian fleets. In Egypt, sea turtle meat is still traded for human consumption, and turtle blood is occasionally drunk as a traditional medicine for anaemia. Green turtles, highly endangered in the Mediterranean, comprise one in every three turtles slaughtered in Egypt.

INDO-PACIFIC

Australia - Malaysia - Indonesia - Oceania

In the 1960s and 1970s, WWF funded turtle surveys in Australia, Thailand, Malaysia and western Indonesia. Dr Robert Bustard of the Australian National University undertook surveys of the Queensland coastline and offshore islands. He discovered several flatback "rookeries" (nesting beaches) situated safely in uninhabited Aboriginal reserves. He also confirmed the first recorded breeding of hawksbills in Australia, in Long Islands in the Torres Strait. As a result of these surveys, new national parks to protect key nesting beaches were approved by the Queensland government.

By the 1970s, the situation in Thailand was also very worrying. Turtle eggs were being collected on a commercial basis, the harvest was in steep decline, and regulations to limit the harvest were largely being ignored. Even more threatening was the increase in the number of drift-net vessels that were killing large numbers of adults. In 1980, WWF provided boats to the Thai National Park Division to combat nest poachers and undertake a status survey of turtles in the Tarutao National Park, composed of some 50 islands off the southwest coast of Thailand. In 1987 WWF funded protection of nesting turtles in southern Thailand. From 1990 to 1996 WWF assisted villagers in Phuket and Phang Nga Province to become "model self-sufficient sea turtle conservation villages". However, tourism or egg collection and accidental drownings of sea turtles in nets continue to challenge the survival of marine turtles in Thailand's coastal waters.



WWF/CNRS Leatherback nesting camp in French Guyana.

In Malaysia, WWF assisted the Fisheries Department to protect leatherbacks on the Terengganu coast in Peninsular Malaysia. Terengganu is the only place in western Malaysia where leatherbacks nest, and was in the 1970s probably the second largest leatherback rookery in the world after the one in French Guyana. Back then concerns were growing, however, over adult mortality as Terengganu leatherbacks had been caught by fishermen as far away as the Philippines and Japan. In 1977, recommendations were made to the Malaysian government for a marine national park and reserve which would protect important nesting beaches on Pulau Redang, an island off the Terengganu coast, and surrounding islets. Consumption and sale of leatherback eggs were banned in 1988.

In 1989, WWF provided funds for an advisor to assist the Malaysian Federal Department of Fisheries to coordinate marine turtle conservation. The advisor, Dr Jeanne Mortimer, conducted surveys of habitats critical for marine turtles in Peninsular Malaysia, Sabah and Sarawak; ran training courses for the establishment and management of a leatherback sanctuary at Terengganu and a number of hatcheries; and investigated causes of sea turtle mortality. Despite government and WWF efforts, the nesting leatherbacks of Terengganu have practically disappeared. The olive ridley population has suffered serious declines in



WWF/HERVE LETHIER/RAMSAR

the past 10 years in Terengganu, while the remaining nesting population of hawksbill is also very low, according to the Sea Turtle Research Unit of the University of Putra Malaysia, Terengganu.

In the 1960s, the turtle egg harvest had declined in Indonesia (at least in Java). The MTSG voiced grave concern over the extent of hawksbill carapace exports to Japan. Some 76,636kg were exported from Indonesia in the period 1966 to 1972. This is the equivalent of 150,000 adults. There was also significant trade in stuffed turtles, turtle oil, meat and leather. The increasing pressure from fisheries undoubtedly constituted the greatest threat to marine turtles in the whole Indo-Pacific region, except in Australian waters where they were protected by law.

In 1979, WWF funded a survey of the remote Aru Islands, south of Irian Jaya, Indonesia, where leatherbacks are hunted by some communities for subsistence, and green turtle meat and eggs are also eaten. However, there was also commercial exploitation of hawksbills for their shells and populations had declined. A 100,000 ha marine reserve in the southeastern part of the islands was proposed. In 1984, a turtle trade study was conducted on Bali, Ujung Pandang, Surabaya and Jepara.

WWF identified a number of important sea turtle nesting beaches at Jamursba-Medi as part of a larger programme

to establish a network of protected areas in Irian Jaya. WWF has also been involved in turtle protection activities in the Teluk Cenderawasih National Park.

Solomon Islands

Many years ago, clashes between hunting parties seeking turtles around the remote Arnavon archipelago were so fierce, and loss of life so high, that legends developed of beaches haunted by ghosts. By the 1970s, Arnavon still had the greatest aggregations of hawksbills in the South Pacific, but they were under threat because of the increased accessibility offered by outboard motors. From 1979 to 1981, WWF undertook a turtle status survey in order to plan for the sustainable utilization of this traditional resource. The first priorities were to strengthen protection of the Arnavon turtle sanctuary (which was set up in the 1930s), to train local wardens, and to achieve a higher hatching success. The project report recommended that, on the one hand, traditional subsistence use should be continued, with permits for leatherbacks and curbs on trade in meat from other species. Commercial exploitation on the other hand, should be controlled, with a total ban on tortoiseshell exports.

Philippines

In 1993, WWF funded the ASEAN Regional Symposium on Marine Turtle Conservation, bringing together experts from throughout the Asia Pacific region to develop a Regional Sea Turtle Conservation Programme. Among the recommendations was the establishment of transboundary protected areas to protect turtle populations. Areas proposed included the Philippine-Sabah Turtle Islands, Sipadan Islands, and the Berau Islands which support the largest breeding aggregation of green turtles in the region. WWF participated in a meeting between representatives from the Philippines, Malaysia and Indonesia, and collaborated on a conservation strategy for the island groups mentioned above. The Turtle Islands Heritage Protected Areas was declared in 1996. (See p. 30)

INDIAN OCEAN

Between 1969 and 1974, WWF supported extensive surveys in the southwest Indian Ocean. As a result of these surveys, five new Marine Reserves were created: Paradise Islands, Mozambique, and four islands belonging to Reunion. Observations were also used to propose four additional protected areas. WWF has also supported conservation of turtles along the Tongaland coast (now Kwa Zulu Natal) for some 30 years. (See p. 32)

Elsewhere in the Indian Ocean, WWF has funded surveys of nesting beaches on mainland India and its offshore islands in the Andamans and the Nicobars. WWF has also

helped protect nesting beaches in Pakistan and has been active on Cousin Island and the Aldabra Atoll in the Seychelles. In the 1980s, WWF funded a field study of hawksbill and green turtles in the Seychelles, leading to the government of Seychelles introducing a number of conservation measures.

A survey of Oman's turtle beaches, started in 1977, revealed that Masirah Island, off the southern coast, held more than 30,000 loggerheads (the largest loggerhead rookery in the world). The principal threats to loggerheads on Masirah were flooding of nests, and lights near the beach that distracted and disoriented the hatchlings. The shallow waters of the Masirah Channel and Sawqirah Bay were major green turtle feeding grounds, and large green turtle rookeries were sited at Ras al Hadd and Masirah. Masirah's green turtles, which had provided eggs and meat for generations of the island's people, were in severe decline and the government of Oman was concerned that they be adequately protected. Data collected by local people helped define turtle nesting seasons, local harvest rates and turtle populations.



WWF-CANONMAUR/ RAUTGARI

Green turtle rescue operation in Pakistan near Karachi.

In 1995, WWF drafted a Western Indian Ocean Marine Turtle Conservation Strategy so that national and international organizations working in the region could link their activities to the IUCN/SSC Global Action Plan for Marine Turtles.

CENTRAL AMERICAN REGION

Caribbean and Western Atlantic

WWF's work in Suriname started in 1967 and continues today. Surveys of beaches in Suriname and French Guyana in the 1970s by turtle biologist Peter Pritchard, Director of the Chelonian Research Institute, confirmed the region to be the world's most important breeding area for leatherbacks.

India – Home of World's Largest Olive Ridley Rookery

For years, the occurrence of the olive ridley turtle along India's Gahirmatha coast was known to the local inhabitants of the Kanika Raj area, who paid andakar (egg tax) on the boatloads of eggs they collected during the nesting season. News of the existence of the Bhitarkanika rookery was first brought to the scientific world and made public by Dr HR Bustard, then an FAO consultant, who visited the area in the early 1970s. He estimated that a large breeding population of olive ridleys migrate to the northern Orissa coast to nest, and urged the government to protect the sea turtles and their nesting grounds.

According to Dr Bustard about one million (male and female in equal ratio) olive ridleys visited the Gahirmatha to lay about 50,000,000 eggs every year. In 1975 the government declared the Bhitarkanika Wildlife Sanctuary (BWS), thus giving protection to the important turtle rookery and the mangrove forests. But over the years, the Orissa mangroves, the second largest mangrove ecosystem in India, has become increasingly imperilled by prawn aquaculture. More than 30 km² of the total 115.5 km² 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 ha of coastal Orissa.

In 1994, concerned over the threats to the marine turtles and the mangrove forests, WWF-India filed a petition in the Orissa High Court. The Bhitarkanika Sanctuary Case contended:

- 1. to restrain the State of Orissa from constructing jetties, fishing complex, roads and bridges etc. within and around the Bhitarkanika Wildlife Sanctuary,*
- 2. to direct the State to provide infrastructure, personnel etc. and to protect and conserve the mangrove forest and the endangered species of wildlife of the Sanctuary and its surrounding areas,*
- 3. to appoint a committee to carry out an Environmental Impact Assessment in and around the Sanctuary.*

The Orissa High Court gave its judgement on 14 May 1998 and the Court directed, inter alia, that:

- 1. no trawlers should enter the Gahirmatha area,*
- 2. immediate steps should be taken to evict the unauthorised occupants of forest land within the boundary of the BWS,*
- 3. all forest land including rivers and creeks within the boundary of the BWS should be declared as reserve forest and treated as a property of the Forest Department,*

Suriname's Foundation for Nature Preservation (STINASU) approached WWF to support research into the distinct green turtle population feeding in waters off Brazil and breeding in Suriname. In 1980, "Operation Headstart" was launched. Brazil's Projeto Tartaruga Marinha (TAMAR) was started by the Institute for Forestry Development (IBDF) in 1980 and executed by local conservation



S. BHASKAR

Researcher observes nesting turtle's return to sea.

4. no new lease of forest land or water bodies should be granted within the Sanctuary,
5. aquaculture farms should not be allowed within the Sanctuary boundary,
6. appropriate use of natural resources should be made for improving the quality of life of the people living in and around the Sanctuary,
7. all trawlers operating in the area shall be required to use Turtle Excluder Devices (TEDs).

The High Court has specifically asked the state government to set up a High Level Committee for protection, conservation and research on sea turtles. In 1997, the Orissa Government declared the relevant area as the Gahirmatha (Marine) Wildlife Sanctuary. This notification declared certain activities to be unlawful under the Wildlife (Protection) Act, 1972. In sum, the judgment of the Orissa High Court has, except for permitting part of the proposed road in the BWS, not allowed any other developmental activity in the Sanctuary. This road is also to be diverted to minimise any adverse impact.

In 1999, the West Bengal Forest Department reported 13,000 olive ridleys were killed in Orissa by fishing trawlers.

By Dr S.M.Satheesan, WWF-India

NGOs and government agencies. In 1986, WWF began assisting these bodies to implement measures for curbing poaching and increasing public awareness about the plight of turtles. An innovative approach was to hire former turtle egg poachers to become beach wardens. By 1992, about 1,000 km of nesting beaches were policed by project personnel and four of the ten most important beaches had been

declared as protected areas. The project became a model for a well-rounded conservation effort protecting all stages of the turtles' life-cycles, and incorporating local involvement, public outreach and education.

Elsewhere in the Caribbean, WWF funded surveys of Kemp's ridley turtles in Mexico, and the only known major green turtle rookery in the eastern Caribbean on Aves Island, Venezuela, which is now a sanctuary. WWF continues to be involved in turtle conservation efforts in this region. WWF also provided funds to strengthen protection of nesting green turtles in the Tortuguero National Park, Costa Rica, the largest green turtle rookery in the western Caribbean.

By the early 1980s hawksbill turtles, clearly in trouble worldwide, were almost extinct in the Caribbean. Little was known of their ecology or movements in the wild. WWF funded veteran turtle biologist Dr Archie Carr and his colleague Anne Meylan to undertake research into hawksbill ecology in Panama and the Leeward and Windward Islands where major coral reef feeding areas are found. Dr Carr also set out to solve "the riddle of the missing turtles" (the mystery of where hatchlings disappear to from the time they enter the sea until they turn up as adolescents a year or so later). He wanted to test a theory that hatchlings spend the first year of life floating and feeding in the rafts of sargassum weed drifting in the currents in the western Caribbean. He tagged more than 2,000 hatchlings at Tortuguero in Costa Rica, examined stomach contents of young loggerheads washed ashore after storms, and conducted interviews with fishermen. All evidence suggested that loggerheads from breeding colonies in eastern Florida, and green turtles hatched on Caribbean beaches, indeed spent much of their first year in the sargassum mats.

Eastern Pacific

In 1970, with WWF support, Peter Pritchard visited the Galapagos Islands (Ecuador) to determine the status of the East Pacific green turtle (sometimes called black turtles, *Chelonia mydas agassizi*) and their rookeries. He found that while they were generally undisturbed by humans, their nests at the important rookery in James Bay, Santiago Islands, were threatened by predatory feral pigs. To ensure the continued survival of both black turtles and the famous giant land tortoises, WWF subsequently assisted with control of feral pigs on Santiago and with a long-term green turtle monitoring programme implemented by scientists from the Charles Darwin Research Station.

In the early 1970s there were worrying reports of large catches of turtles by foreign fishing fleets operating in Galapagos waters. This problem would assume much larger proportions in the coming years and threaten not only sea turtles but also a number of other species including sharks

and seals. In 1971, a Japanese refrigerator ship purchased a capacity load of fish and turtles from local fishermen, an activity subsequently banned by the Ecuadorian government.

The mass slaughter of olive ridleys for their leather started in the 1960s. During the 1970s, an estimated 450,000 turtles, mainly Pacific olive ridleys, were slaughtered in Ecuadorian waters to supply the international trade. Most exports (clearly in contravention of CITES) were to the United States, but some were to European countries, mainly France and Italy. Although Ecuador officially closed the turtle fishery in 1981, it subsequently came to light that clandestine turtle fisheries and processing plants were operating. In 1989, WWF assisted Ecuador's Fundación Natura to make an undercover investigation of these operations.

The battle for Mexico's sea turtles

In 1967, WWF supported work in the Pacific coast of Honduras and Mexico to assess the status of marine turtles. Although still fairly abundant (on one "protected" beach in San Luis de la Loma, Guerrero, an estimated 30,000 olive ridleys were observed in a single *arribada*), commercial exploitation of nests and adults was rife, and even prominent local officials were flouting the law.

Monitoring in Mexico continued through the 1970s. By 1977, olive ridleys were in serious decline, but the harvest was still in full swing. WWF reported "70,000 ridleys, 98 per cent of them gravid (pregnant) females were harvested this year from a population estimated at 150,000 animals". Poaching and disturbance of nesting beaches of all turtle species left "little doubt that we will soon be without Mexican populations of Pacific, green, olive ridley and leatherback turtles. The hawksbill is already depleted... The Mexican people have been taking 500,000 to a million sea turtles per year since the early 1960s. This represents 70 per cent of the world harvest".

The East Pacific green (or black) turtle was also in serious trouble. In the early 20th century more than 10,000 females per night had nested in Michoacan state, but a mass slaughter in the early 1970s by leather hunters resulted in their almost total disappearance by 1977. Despite this, the Mexican government had granted a licence to a private turtle fishery to expand its operations in waters off two of the only three known nesting beaches of this species.

In 1978, in the face of official Mexican government policy to increase exploitation of its marine turtles, WWF biologist Richard Felger and his colleagues developed a comprehensive plan for the protection and management of all sea turtle species in Mexico. This was also the start of a long-term WWF project to save the turtles of Michoacan with the cooperation of the Mexican Fisheries Department, the Mexican Navy, and students and faculty of the University of Michoacan.

Despite setbacks, the conservation effort on the Michoacan beaches started to bear fruit by the early 1980s. Poaching was reduced, children were recruited to protect nests, and a number of Mexican biologists joined the team. By 1990, WWF's efforts to protect Mexico's turtles had become a multifaceted conservation endeavour which included public



Patrolling the beach as part of the TAMAR project in Brazil.

awareness, university training, protected area establishment and management, research and species protection. The project also served as a model for multi-institutional cooperation for marine turtle conservation.

Honduras

In 1987, WWF supported a study of the status of Pacific olive ridleys in the Gulf of Fonseca, Honduras. Seven local communities depended on income from turtle eggs, and the situation had not improved since Pritchard reported two decades earlier that there were more *hueveros* (egg collectors) than turtles on the beach. Education programmes were

started to prevent over-exploitation of the resource. In 1989, WWF gave funds to assist government efforts to conserve the Punta Raton population of turtles in the Gulf of Fonseca. The Gulf of Fonseca is the focus for the ongoing Central American Environment Programme (Programa Ambiental Centroamericano – PROARCA).



WWF/ARQUIVO PROYECTO TAMAR

Costa Rica

In 1982 WWF joined a research and monitoring project at Nancite Beach in the Santa Rosa National Park which hosts one of the greatest olive ridley *arribadas* in the world. Adult turtles from this population were vulnerable to heavy fishing pressure when they moved north to Mexico and south to Ecuadorian waters to feed, but were protected while nesting at Santa Rosa, which provided excellent conditions for research into their life cycles and movements. In 1990, WWF joined a National Science Foundation study of the factors that trigger the great *arribadas* at Nancite, and the area became the focus of a WWF-supported Wildlife Manage-

ment Programme at the National University of Costa Rica. This involved training ecologists in turtle research and management techniques.

In 1985, WWF co-sponsored the first Symposium on the Marine Turtles of the American Pacific and, in association with the University of Costa Rica, initiated funding of an international programme to monitor sea turtle movements on Latin America's Pacific coast.

Eastern Atlantic

With help from WWF, Senegal established a number of marine protected areas in the 1970s, including Iles de la Madeleine, Langue de Barbarie and Delta du Saloume National Parks. In 1980 and 1981 WWF gave funding to the Marine Biological Department of Senegal to carry out basic research and to discover if any coastal areas important for turtles were not yet protected. Beaches were being threatened by development and turtle fishing had become commercialized with meat being sold in urban centres. WWF also provided equipment for turtle protection to the Delta du Saloume and Kalissaye ornithological reserve.

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*hat
WWF is
doing
for marine
turtles*



Monitoring a turtle beach in the Mediterranean.

MEDITERRANEAN

In 1998, WWF published recommendations¹ for a new approach to conserving the Mediterranean's turtles, based on Luc Laurent's wide-ranging study of their ecology.² This approach sets out a number of urgent measures to reduce mortality of adult and sub-adult turtles, including: reduction of deliberate killing, especially in Egypt; reduction of bycatch in bottom trawls (especially in the eastern part of the Mediterranean), longline fisheries and a variety of small coastal fisheries; and education aimed at reducing mortality of turtles accidentally caught by all kinds of fisheries. Efforts to protect nesting beaches in Greece, Turkey and Cyprus, to limit damage by urban and tourist developments and to reduce predation by dogs and foxes need to continue.

WWF is working to establish a fully representative network of protected areas, as part of its "Out of the Blue" programme for the conservation of the Mediterranean. The present number of marine and coastal reserves and national parks is grossly inadequate, and management of the few that do exist is often poor or totally lacking. Scientists have been



WWF-CANON/MICHEL GUNTHER

carrying out a “gap analysis” to ensure critical habitats of threatened species such as monk seals (*Monachus monachus*), marine turtles, and certain fish, are protected, particularly outside European Union states. They have paid special attention to the opportunities for Integrated Coastal Zone Management, in an effort to ensure that nature conservation and sustainable development move forward together. One of the most important priorities is to initiate protection of the newly-discovered turtle beaches in North Africa, particularly those in Libya, as well as the sea-grass beds that support turtles in shallow coastal waters.

WWF has started to place observers on Italian longline fishing fleets to monitor fish catches and document the extent of sea turtle and shark bycatch and mortality.

Greece

In the early 1990s, tourism development threatened to overwhelm efforts to protect nesting turtles in Laganas Bay. WWF purchased the area surrounding Sekania beach, which has the highest nesting density of loggerheads in the Mediterranean and hosts more than half the nests in

Zakynthos. In doing so, the immediate threat from tourist disturbance has been reduced. A study commissioned by WWF has led to steps being taken to address other threats to the site such as erosion, sedimentation and vegetation encroachment. Local people have been employed as wardens on the beach during the nesting season, and a programme of raising public awareness about turtles has been started. Sekania beach is part of a Marine National Park in Zakynthos, declared by the Greek government in 1999. Shortly before the government announcement, the European Commission made an application to the European Court of Justice citing Greece’s failure to fully protect its loggerhead turtles in accordance with the EU Habitat’s Directive. The Sea Turtle Protection Society, WWF and Greenpeace are all working to conserve the nesting sites.

Turkey

WWF’s “Out of the Blue” programme is continuing efforts to conserve Turkey’s turtle beaches in collaboration with DHKD and the Turkish Sea Turtle Committee. Current work is based on a recent report on sea turtle status.³ Within a framework of integrated coastal zone management, the



programme includes raising public and local government awareness, enhancing local expertise on turtles, and developing methods of monitoring nesting populations.

INDO-PACIFIC

In 1999, WWF, together with a network of NGOs and governments, participated in the second Association of Southeast Asian Nations (ASEAN) sea turtle meeting, 15 to 17 July in Sabah, Malaysia. Coordinating measures for marine turtle protection on a regional basis is a priority for marine turtle conservationists. The region's marine turtles and other species are threatened by coastal development, sand and coral reef mining, pollution, unsustainable egg collection, and entanglement in fishing nets or accidental killing by long-line fisheries. In Malaysia alone, four species of marine turtles have fallen dramatically in recent decades with leatherbacks in critical danger. Despite government and WWF efforts over the past 30 years sea turtles are in a state of decline not only in Malaysia but also throughout the region. The creation in 1996 of the Turtle Islands Heritage Protected Area, a group of nine islands shared by the Philippines and Malaysia offers some hope for the future.

Indonesia

In 1991, Indonesia's Directorate General for Forest Protection and Nature Conservation (PHPA) asked WWF to help strengthen its marine conservation programme. Measures to protect marine turtles are urgently needed; recent surveys have shown that at least 20,000 adult and juvenile green turtles are killed annually, even in marine reserves, to supply the Bali meat market. Other threats include the annual harvesting of up to nine million turtle eggs of all six species, ill-planned tourist developments, and the destruction of sea-grass "pastures" used by green turtles. WWF has launched a Regional Sea Turtle Conservation Project to lobby for stricter laws, enforcement of trade regulations and coordination of conservation efforts throughout the country.

The Marine Reserve of Aru Tenggara, established in 1991, is a focus for WWF-funded research on the ecology of green and hawksbill turtles. Despite its protected status, the Aru Reserve's marine resources, including turtles and their eggs, are exploited commercially in large quantities. Data from these studies will underpin conservation efforts and help formulate a sound management plan for the reserve, including measures allowing for a more sustainable harvest of turtles by local communities.

Unplanned development in the tourist paradise of Bali threatens disaster for its precious marine biodiversity, which is also a key attraction for visitors. WWF is supporting efforts to introduce responsible ecotourism and to protect the last nesting beaches of olive ridleys and hawksbills in the northwest of the island. Although the Bali government has



Terengannu, Malaysia. Despite WWF and government efforts, 98 per cent of leatherback nests have been lost in the past 40 years.

announced measures to limit the numbers of green turtles imported to the island from throughout the region, quotas are largely ignored. The government of Indonesia needs to improve enforcement. (See p. 37)

Philippines

Since 1993, WWF has been encouraging ASEAN countries to seek ways of coordinating the management of their marine turtles. A major achievement was the establishment in 1996 of the Turtle Islands Heritage Protected Area, the world's first transboundary protected area for marine turtles.

Seventy per cent of the Turtle Islanders live below the poverty line and health and welfare facilities are basic or totally lacking. Fishing and turtle egg collecting are traditional (and very important) sources of income. In fact, highly nutritious turtle eggs are usually sold rather than eaten, even though many of the islands' people are malnourished. WWF's wide-ranging programme for the Turtle Islands has several goals: to help raise health and living standards; to ensure that use of marine resources is sustainable; and to educate islanders about the significance of their new



WWF/MALAYSIA/MALAYSIA PHOTO SERVICE

and unique protected area. In order to ease the pressure on turtle eggs and other resources, innovative ways of making a living are urgently needed. Guidelines for ecotourism to the islands have been drawn up and economic opportunities for the islands' women are being explored, as well as ways to involve them fully in the conservation effort.

Turtle research is also being undertaken and the results will be incorporated into a management plan that is being developed for the islands. A database is being set up for Baguan Island, which has the highest nesting density of any of the Turtle Islands, to assist scientists to monitor short- and long-term turtle population changes and cycles. A few turtles have been fitted with radio transmitters and their movements tracked by satellite. (See website: www.oneocean.org/ambassadors)

Malaysia

As a result of pressure from coastal development, sand mining, pollution, collection and consumption of eggs, and entanglement in fishing nets, numbers of nesting marine turtles (of four species) in Malaysia have fallen drastically in

recent decades, with leatherback nests declining by 98 per cent since the 1950s. The most important remaining turtle beaches are in the states of Terengganu (east coast of peninsular Malaysia), Sabah and Sarawak.

In response to this situation, a national seminar on the conservation management of marine turtles (and terrapins) was organized in October 1996 by the Fisheries Department of Malaysia, in conjunction with WWF, other NGOs, research institutions and corporate partners. Following up on the seven resolutions arising from the seminar, WWF is working together with the Fisheries Department to formulate model legislation for the protection of turtle nesting and feeding sites, together with guidelines for hatchery management. It is hoped that individual states will enact legislation based on this model: currently there is wide variation between states. WWF is leading calls for a nation-wide ban on the collection, sale and consumption of turtle eggs, whilst the Fisheries Department is experimenting with TEDs, to try to reduce the number of net deaths.

In May 1999, WWF-Malaysia published the fourth handbook in its Integrated Coastal and Estuarine Area Management series, dealing specifically with marine turtles (and terrapins) and aimed at planners and decision-makers. One month later saw the opening of the Ma'Daerah Turtle Sanctuary at Kertih, in Terengganu. WWF managed the process of establishing this important educational and public awareness facility, with funding provided by a subsidiary of BP Amoco Malaysia.

Vietnam

At present, no legal limits are imposed in Vietnam on the use of marine resources, including turtle eggs and meat. Populations of leatherback, loggerhead, green and hawksbill turtles are in serious decline. With WWF's help, the government is identifying suitable areas along the Vietnamese coastline for establishment of a network of marine protected areas. An existing coastal reserve is the Con Dao National Park in southeastern Vietnam, one of the most important sea turtle nesting areas in Southeast Asia. WWF and park staff are continuing a research and monitoring programme on marine turtles, started four years ago, as part of a wider plan to improve management of Con Dao. There are plans to involve more local people, especially fishermen, in the effort to conserve marine turtles within this archipelago of 16 islands.

WESTERN INDIAN OCEAN

In November 1995, WWF co-sponsored an MTSG-IUCN regional meeting in the Western Indian Ocean to identify priority activities for marine turtle conservation. WWF is following up on the recommendations of the MTSG's *Marine Turtle Conservation Strategy and Action Plan for the West-*



WWF/RICK WEYERHAUSER

Hawksbill turtle from waters off Bazaruto Island, Mozambique.

ern Indian Ocean and working to strengthen the network of turtle biologists in the region. Since 1996, WWF has sponsored regional scientists in attending international marine turtle meetings and in 1997 co-sponsored a workshop on TED technology for resource managers and fishermen from Kenya, Tanzania, Eritrea, Madagascar and Mozambique.

WWF is involved in a number of marine protected areas on the east coast of Africa, including Mafia Island in Tanzania, the Kiunga Reserve in Kenya, and the Bazaruto Archipelago in Mozambique. A prime objective in all these areas is to ensure that marine resources are used sustainably by local communities and that critical habitats for coral fish, marine turtles, and dugongs are protected.

WWF-India has also funded a project titled "Status, ecology and management of olive ridley sea turtles and their nesting habitats along north coastal Andhra Pradesh" through its Conservation Corps Volunteer Programme of CCV Division and Protected Area Programme of Forest & Wildlife Division. The project was executed from January 1997 to June 1998.

Kenya

WWF is working in partnership with the Kenya Wildlife Service and other organisations on a wide-ranging conservation and development project for the relatively new Kiunga Marine Reserve on Kenya's northern coast, and the villages that occur within its boundaries. Turtle nesting beaches are regularly surveyed. For example, local people contributed almost 100 reports in 1998, and there is a lively programme of conservation education in the local primary

schools. The remoteness, lack of infrastructure and relative insecurity of this area near the Somali border make this a challenging task, but there has been an enthusiastic response from several of the local communities. WWF encourages implementation of the *Sea Turtle Recovery Action Plan* for Kenya, published by the Kenyan Sea Turtle Conservation Committee and the Kipini Community Conservation and Development Programme.

Madagascar

The southern coast of Madagascar has great potential for ecotourism based on its landscapes and wildlife, including marine turtles. Community-based conservation programmes are being started up in the Fort Dauphin area, where green, hawksbill and loggerhead turtles come ashore to nest. The area has been identified by the Malagasy government as a priority area for tourism development.

Southern Africa

WWF-South Africa is continuing to support the government of South Africa's Tongaland Sea Turtle Project based on the northern coast of KwaZulu-Natal Province. This study, which includes southern Mozambique and the Comores, has been going for more than 30 years and is providing valuable data on long-term trends in loggerhead and leatherback nesting populations, and migratory movements of turtles. In South Africa, the main focus is on a 56 km stretch of beach north and south of Bhanga Nek, which is regularly patrolled by field rangers and students. Since 1997, several tagged females have been tracked by satellite. The wanderings of one female leatherback were of epic proportions; she was recorded swimming south past the southern tip of Africa into the Atlantic, then headed east towards Australia, covering 7,000 km in five months before the transmitter battery failed.



WWF/GENS HUGOT/BIOS

Hawksbill turtle swimming offshore in the Bahamas.

LATIN AMERICA AND THE CARIBBEAN

Marine turtles are a “species of special concern” or flagship group for WWF’s Latin America and Caribbean Programme. In late 1999, WWF sponsored, together with IUCN/SSC Marine Turtle Specialist Group, WIDECAST and UNEP, a regional meeting in the Caribbean to promote a discussion on the need for regional management of marine turtles. The meeting was attended by 31 resource managers from 27 governments who represented 35 of the countries and territories of the Wider Caribbean. Recommendations of the meeting included the need to: strengthen collaboration among stakeholders; promote greater community participation; support scientific research and monitoring of turtles and their habitats; develop regional and national management plans; improve implementation of national laws; and

Leading scientists at the meeting presented clear evidence that the populations of all six species in the Caribbean are severely depleted and endangered. It became obvious that no population has a chance of recovery unless major changes to the patterns of use occur and there is regional management among range states. The only exception to this is the Kemp’s ridley. While it remains a fraction of its original population, it is recovering after decades of conservation effort by its range states, the United States and Mexico. (See next page.)

CENTRAL AMERICAN REGION

Annually, more than 80,000 turtles, mainly greens and hawksbills, are still captured off the coasts of Central America. Among the direct measures urgently needed are the prevention of accidental capture of olive ridleys by shrimp fishermen, (throughout the region), and of leather-



WWF/DI DOMENICOPANDA PHOTO

WWF is working with TRAFFIC to monitor and stop the illicit trade in hawksbill turtles like the one pictured here.

harmonize national policies for sea turtle conservation throughout the Wider Caribbean. National resource managers identified the elements of effective scientific management. What also emerged was a consensus with two key elements:

1. the understanding that marine turtles have traditionally been a consumptive resource in the Caribbean; and,
2. true management can only occur through regional coordination among range states.

backs and other species by longline fishing fleets, (particularly in the Pacific). While populations of olive ridleys in the Mexican Pacific, Kemp’s ridleys in the Gulf of Mexico, and hawksbills in the Yucatan of Mexico appear to be recovering, thanks to more than a decade of focused protection and conservation efforts, other populations, such as Caribbean green turtles, are still in dire straits. Nevertheless, Cuba and Dominica are proposing to reopen international trade.

In Central America, WWF is working to encourage local communities and fishermen to protect turtles through use of TEDs. Other initiatives include campaigns to keep trash such as plastic bags and twine from banana plantations out of rivers and oceans. WWF is also encouraging establishment of wildlife refuges and sanctuaries and supporting patrols on turtle beaches. In addition, WWF is supporting measures to reduce the harmful effects of street lighting near beaches. On the trade front, the organization is working to halt the sale of tortoiseshell products and bring poaching activities to the attention of the authorities.

A major effort to conserve marine turtles in the Central American region is being made through the Central American Environment Programme (Programa Ambiental Centroamericano – PROARCA) which seeks to promote integrated coastal management and protected areas programmes. PROARCA is carried out in partnership with the Central American Commission for Environment and Development and supported by the US Agency for International Development. It is implemented by The Nature Conservancy, WWF, and the University of Rhode Island. Since 1995, WWF has focused its activities on two areas: the Miskito Coast in northeast Nicaragua and the Gulf of Fonseca, which is shared by Honduras, Nicaragua and El Salvador. At both sites, WWF is working closely with local communities to promote sustainable use and management of coastal resources, including marine turtles. In the Gulf of Fonseca, WWF is working with the three governments to secure a network of ten protected areas.

WWF is also expanding its programme to bring about a “sea change” in national and international policy in the region regarding turtles. WWF supported a study by the Costa Rican Environmental Law Centre, which was followed-up by a Regional Marine Turtle Conservation Workshop held in Tortuguero, Costa Rica, in 1998.

WESTERN ATLANTIC – THE WIDER CARIBBEAN

Because turtles are highly migratory, a decline in a local population may be a direct consequence of human activity hundreds or even thousands of kilometres away. The proposals made at the 1997 CITES Conference of Parties to reopen trade in hawksbill products thus have region-wide implications and will only add to the long list of serious and growing threats from human activities. Within the Wider Caribbean, WWF has addressed this and other threats to the region’s six endangered species of marine turtles. One of the first steps taken by WWF was its co-sponsoring a meeting in November 1999, *Marine Turtle Conservation in the Wider Caribbean: a Dialogue for Regional Management*. Recommendations arising from this meeting will be used to implement regional consensus about marine turtle conservation identifying actions needed for their recovery, and ways gov-

ernments could cooperate to undertake these actions. Other WWF initiatives include measures to develop a network of protected areas within the MesoAmerican Caribbean Reef Ecoregion to protect critical habitat (mangroves, sea-grass beds and coral reefs) for hawksbill and green turtles.

GUYANA SHIELD ECOREGION

WWF has been supporting marine turtle conservation in the Guyanas since the 1960s. This biologically rich area comprising Guyana, Suriname, French Guyana, and part of Venezuela, Colombia and Brazil, has many important turtle nesting beaches along its coasts. Suriname is host to four species, including the only remaining nesting population of the olive ridley in the western Atlantic. The imminent extinction of the olive ridley makes protection of this area of prime importance. The leatherback population nesting in Suriname and French Guyana has increased over the past 30 years and is probably the largest in the world. The nesting population of green turtles appears to have stabilized.

Through a number of initiatives, WWF is confronting threats from the shrimp industry, overharvesting, and erosion of nesting beaches. A Regional Marine Turtle Conservation Programme is being implemented from WWF’s newly established office in Paramibo, Suriname. Other current activities include conservation measures in Suriname’s Galibi Nature Reserve, where thousands of green turtles come ashore to nest, and at sites in French Guyana. WWF is also continuing its long-running support for conservation efforts at Hattes beach, French Guyana, which hosts 15,000 to 20,000 nesting female leatherbacks each year, and has recently been declared a reserve.

Brazil

WWF provides support to Projecto TAMAR, the Brazilian national sea turtle programme. A “mini-guide” project has been developed in which schoolchildren between 8 and 13 years old learn about marine ecosystems and sea turtle ecology, and ways of protecting the turtles. After the course, the children are given the chance to work as interns at the TAMAR visitor centre at Praia do Forte, where they inform tourists about sea turtles and help biologists in field activities. Their involvement not only gives them valuable skills for interacting with tourists, but also an extra source of income.⁴ WWF is also supporting conservation efforts at Noronha Island on the northeast coast, where three million hatchlings have been released over the past 19 years.

Costa Rica

WWF is supporting the ANAI Association, a local NGO, to protect Gandoca beach and its leatherback, green and hawksbill turtle rookeries. Last year, 449 volunteers helped to relocate clutches from vulnerable nests to hatcheries,

camouflage other nests, and count turtles. By providing lodging for these volunteers, the local community earned four times more than they would have earned from the illegal selling of turtle eggs.

Anguilla

WWF has supported the Anguilla National Trust to manage their sea turtle conservation programme, which included a survey of turtle nesting beaches. Anguilla imposed a five-year moratorium on harvesting of both adult turtles and eggs in 1995, but the number of nesting turtles is still declining. In the last few years, more young hawksbills and greens have been seen in Anguillan waters, but the conservation effort will have to continue for many more years before populations begin to recover.

Venezuela

WWF's associate in Venezuela, FUDENA, has worked for two decades on sea turtle conservation on the Isla de Aves and in the Laguna de Tacarigua National Park. The organizations activities on Isla de Aves include yearly monitoring and tagging of females during their nesting period. FUDENA's "Adopt a Sea Turtle" campaign helps to support this programme. In Laguna de Tacarigua, FUDENA collaborates with several partners to involve local communities in protection of sea turtle nests.

NORTHERN ATLANTIC

Canada

Between 1824 and 1992, only 60 leatherbacks were reported in Canadian waters. Since 1997, WWF Canada has supported a project to enlist the help of fishermen along the southern coast of Nova Scotia. In 1998 alone, over 200 were sighted. Thanks to this project, more is being learnt about leatherback distribution and movements – knowledge that will help reduce the number of turtles becoming entangled in fishing lines.

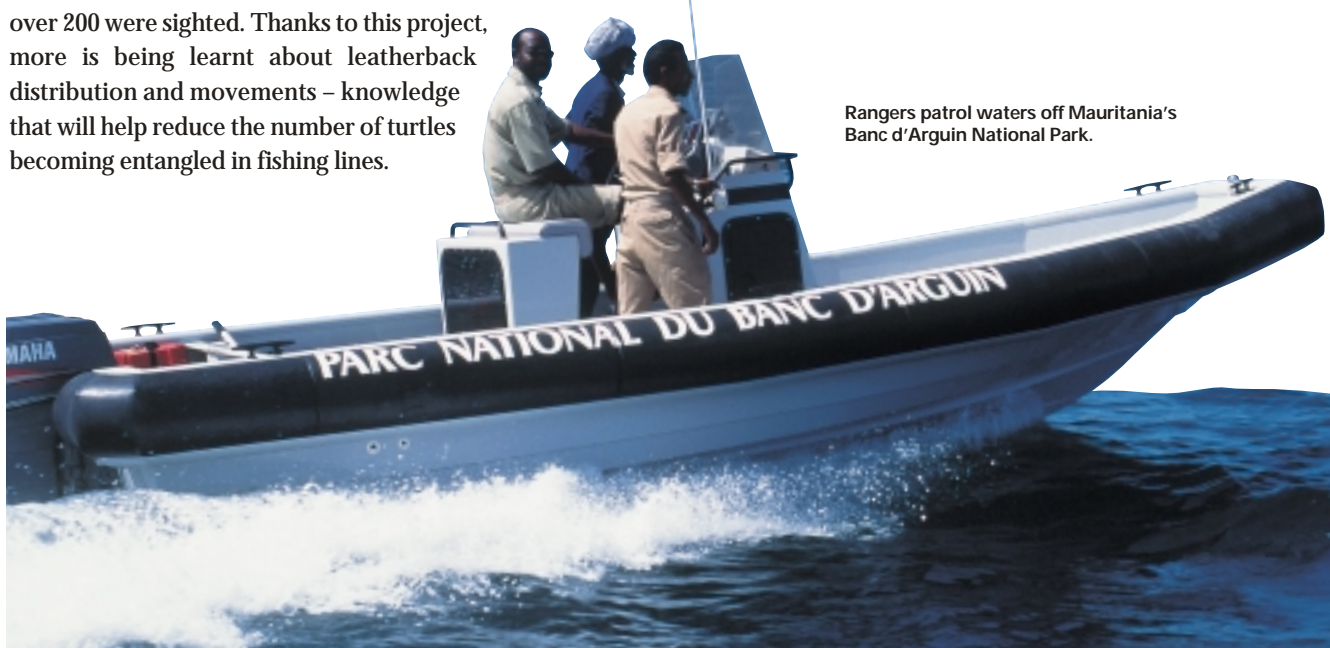
EASTERN ATLANTIC

Mauritania

The Banc d'Arguin National Park, an important nesting and feeding ground for green and loggerhead turtles, has been supported by WWF since 1976. Observers estimate that several thousand turtles are killed each year as bycatch in the offshore shark fisheries. It is hoped that WWF's work on fisheries management will have a positive impact on solving this problem. Tag recoveries show that the Banc d'Arguin's green turtles come from as far away as Florida, although others originate in the Archipelago dos Bijagos in Guinea-Bissau.

Gabon

Marine turtles are heavily exploited along Africa's Atlantic seaboard, and all four species occurring along Gabon's coast are threatened by unsustainable harvesting of adults and eggs, and through the bycatch of multinational fishing fleets. Gabon hosts the second most important breeding site for leatherbacks in the world and offshore seagrass pastures are important feeding areas for green turtles. With the exception of leatherbacks, which are partially protected, there are no laws in Gabon to protect sea turtles. In northwest Gabon, turtles are trapped with special nets; in other areas they are killed when they come ashore to nest. In 1997, as part of a regional action plan for turtles, WWF held a workshop in Pointe Pongara to collate data from scientists on turtle status and define measures needed for their conservation in the Gulf of Guinea. The workshop was timed to coincide with the turtle nesting season so that participants could learn field-monitoring techniques. WWF is pursuing a number of priorities highlighted in the Marine Turtle Action Plan.



Rangers patrol waters off Mauritania's Banc d'Arguin National Park.



WWF/JEANNE MORTIMER

Pictured here is a small "bekko" factory in Japan that produces tortoiseshell products.

Monitoring trade in turtle products

Most countries have national laws restricting turtle fishing and egg collecting and many are members of CITES. Some national laws do not recognize some species of marine turtle as threatened or endangered. In Indonesia, for example, the green turtle is not considered endangered and large numbers are still killed for meat. Many tropical and subtropical countries allow harvesting of turtle eggs and theoretically this harvest is controlled. But abuses often occur, in Mexico, poachers removed 500,000 olive ridley eggs from a beach in Oaxaca in 1996.⁵

TRAFFIC, the wildlife trade monitoring arm of WWF and IUCN, documents the extent of the illegal international trade and is working to bring violations of international treaties to the attention of government authorities. Such violations appear to be widespread: there is still a substantial underground trade in tortoiseshell, leather boots, whole turtles, meat and eggs. For example, customs officials made a number of seizures of illegal turtle shells from Indonesia at EU borders between 1990 and 1995.⁶ In September 1998, police officers in Japan arrested five people attempting to smuggle 66 kg of tortoiseshell into the country.⁷ In the United States, a number of arrests have been made recently at international airports in Florida, New York and California where people have been caught smuggling turtle eggs and meat in their luggage.⁸ The contraband finds its way to ethnic restaurants, where it is sold as a delicacy at high prices. As the trade in sea turtle eggs appears to be on the increase, TRAFFIC is increasing its efforts to collect and disseminate information on its extent, so that more effective protection and management can be implemented.

TRAFFIC is also working with governments on improving protection of species threatened by trade, even

where that trade is largely internal and legal. For example, in Vietnam, large numbers of hawksbill turtles are legally caught for meat and medicine, and their coastal habitats are threatened by development. Numbers of tourists have been growing steadily and stuffed hawksbill turtles and tortoiseshell products are often found for sale in local markets. Many tourists are not aware that taking such items back to their home countries is illegal. A 1993 to 1994 TRAFFIC study of the effects of this trade on hawksbill populations found that the trade was contributing to the decline of Vietnam's hawksbills, already under threat from other factors. As a result of this study, TRAFFIC was able to make a number of recommendations to the government of Vietnam on suspending commercial exploitation of hawksbills.⁹

TRAFFIC North America is carrying out a trade review and legal analysis of the fisheries and primarily commercial trade of marine turtles in the Bahamas, Cuba, Dominican Republic, Haiti, Jamaica, Mexico, Puerto Rico, Turks and Caicos Islands, British Virgin Islands, and U.S. Virgin Islands.

Turtle Conservation in Bali

Bali has been the world's largest consumer of green turtles since the 1970s. Turtle meat is used particularly in the Badung and South Denpasar areas for religious purposes and in traditional ceremonies. These practices have been in place for generations.

During the last several decades, however, there has been a shift from using turtles within sustainable limits for ceremonial and religious purposes, towards large-scale commercial exploitation. The need to conserve the stock in the wild has been largely ignored; consequently, there has been a dramatic decline as shown by the significant decrease in the numbers of female turtles coming ashore on Indonesian and neighbouring beaches in recent years.

WWF, working together with the office of Natural Resources Conservation in Bali and the local government, is addressing this problem in a number of ways. The first priority has been to record the numbers of turtles coming into Bali through several major ports such as Tanjung Benoa near Denpasar and Padangbai in the eastern part of the island. Attention is also being given to recording which species of turtles are brought to these ports as hawksbills as well as greens are being butchered. These data include analyses of the size of the turtles caught.

A second focus is on developing and implementing a Bali-orientated education and awareness programme designed to reach those who use turtle meat, turtle traders from outside Bali, and both foreign and domestic tourists. The goal is to reduce the amount of turtle meat consumed in Bali annually to within the current quota system. This quota, established by Bali's Governor in 1990, is set at 5,000 turtles per year, but is intended to function within the national guidelines for turtle population



WWF/ELIZABETH KEIM

Ketut Putra, head of WWF's marine turtle programme in Bali.

management which only allows an annual consumption of 3,000 turtles per year.

WWF's education and awareness programme focuses on the status of the turtle population, its biological profile and the laws protecting it. Together with local conservation groups, WWF has launched a two-pronged programme to monitor the trade and, through Balinese religious, traditional and community leaders, to educate devotees and young people to the fact that the green turtle is endangered. In Prancak village, on the coast of west Bali, local religious leaders have joined the awareness campaign and school-children have become "rangers" protecting turtle nests. Ex-turtle hunters are among the many people now fighting for the survival of turtles, and a number of Balinese youngsters have formed their own group, the Kelompok Pecinta Penyu Bali, which promises to become a major force for turtle conservation. This programme must ultimately address ways to find alternative income sources for turtle hunters.

by Ketut Sarjana Putra



Leatherback turtle rescued at the last minute from being killed for sacrifice in Bali.

WWF-CANON/KETUT PUTRA

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needs to
be done*



Leatherback returning to the sea after nesting in Brazil.

WWF/ARQUIVO PROJETO TAMAR

Six of the world's seven species of marine turtles are threatened with extinction. Many populations which were abundant 100 to 200 years ago are now depleted, declining or remnants of their former size. Local extinctions have occurred in all ocean basins, and no population, not even those that are stable as a result of long-term conservation and management, is completely safe. Marine turtles present enormous conservation challenges because they grow slowly and require numerous and diverse habitats as they mature. They also move great distances in their lifetimes, frequenting the waters of many nations and must come ashore to lay their eggs.

Although marine turtles are ancient creatures, the science of marine turtle biology is relatively new. Scientists have amassed a great deal of data about the amazing life history of these animals, but as one set of questions is answered, new ones emerge. In recent years powerful new tools, such as genetic analysis and satellite telemetry, have been developed to answer the riddles surrounding marine turtles, but much remains to be discovered, and much needs to be done. The following activities need to be undertaken:

Carry out long-term conservation action

Clear and comprehensive conservation programmes are needed everywhere if marine turtles are to survive well into the future. Ensuring many populations recover to abundance (so that turtles can fulfill their ecological roles in the marine environment) is a necessary goal.

Recognizing that regional cooperation and collaboration are essential to marine turtle conservation and management, resource managers have started international initiatives, collaborating with near and distant neighbour nations. More is needed.

Long-term commitments to conservation are essential. Those started long ago are reaping rewards. Some depleted nesting populations, such as green turtles in Malaysia, loggerheads and leatherbacks in South Africa, and hawksbills and Kemp's ridleys in Mexico, have stabilized and increased in recent years. But this is after more than two decades of protection and management. While the future of these populations remains tenuous, their improved status demonstrates the value of focused conservation efforts.

Develop regional conservation and management programmes

Marine turtle conservation and management need to be addressed regionally so that activities in one area do not undermine (but complement) programmes in others. Breeding and feeding areas are often widely separated, and within each region, critical nesting, foraging, resting and migration areas for each species must be identified and formally protected. Conservation hotspots in each region should also be identified so that attention can be focused on resolving prob-

lems, such as overexploitation of feeding grounds in one country where turtles from other nations may congregate. Regional agreements that provide legal frameworks, such as the Inter American Convention for the Protection and Conservation of Sea Turtles and an initiative in the Indian Ocean to negotiate a treaty for marine turtles, need to be supported. Successful regional programmes must involve the participation of numerous sectors and include participants from the local to national to international level. To date, regional networks of biologists, conservationists, and resource managers have evolved in Southeast Asia, the South Pacific, the Mediterranean, Latin American, and the wider Caribbean, while new groups are emerging in the northern and western Indian Ocean, Arabian Gulf and Eastern Atlantic. These networks need to be strengthened, thus ensuring that cooperation, collaboration and the sharing of information, such as through regional databanks, should be promoted on all levels. Financial support from governments and donor organizations is also needed.

Reduce accidental capture in fisheries

After the shrimp trawl fishery was identified as a major source of mortality in the early 1980s, net inserts or Turtle Excluder Devices (TEDs) were developed to allow entrapped turtles (and other bycatch) to escape. Although TEDs are used widely in the western hemisphere, they are not employed extensively in shrimp and other trawl fisheries around the world. Mortality in longline fisheries for pelagic species such as swordfish and tuna is a grave and increasing threat, as these fisheries, which set billions of hooks each year, continue to expand. Marine turtles swallow longline hooks or become entangled in lines and drown. Many animals that are released alive but with hooks embedded in their gastro-intestinal tracts subsequently succumb to their injuries. Modifications to hooks and bait, as well as area and seasonal closures, will be needed to address this problem satisfactorily. Marine turtles are also captured and drowned in various gill net fisheries and in the lines of fish traps. Programmes to reduce mortality through modified gear and fishing techniques, or closing particular areas at particular times, are needed. Fishermen should be encouraged to assist in these efforts.

Enforce CITES, laws and agreements

Most species of marine turtles have been prohibited from international trade since 1975 when CITES came into force. By 1981, all marine turtle species were listed on Appendix I of CITES. This list prohibits trade by all CITES member nations. However, Japan continued to import large quantities of green, olive ridley and hawksbill products until the early 1990s under "reservations" or exceptions to the CITES listing. In 1992, Japan agreed to comply with CITES and stop marine turtle trade and retrain the *bekko* or tortoise-

shell artisans. Today, more than 140 countries have acceded to CITES, but tortoiseshell jewellery, turtle oil and stuffed turtle curios are still entering international trade. Marine turtles and their parts are sold in tourist markets and international airports in many areas of the western hemisphere and Asia. WWF encourages CITES member nations to stop illicit international trade and urges all countries to pass and implement national laws and regional agreements to conserve marine turtles.

Protect marine turtle habitat

Marine turtles move in and out of ocean and coastal habitats as they grow and mature. Although crucial nesting and foraging habitats can be conserved within national parks and marine protected areas, other areas utilized exceed the capacity of any government to provide full protection. Marine turtle conservation requirements should be included in coastal zone management plans as well as ecosystem conservation programmes. Regulations for maintaining water quality and contingency plans for oil and chemical spills are critical to maintain the health and productivity of the ecosystems on which marine turtles depend. The threats posed by dynamite fishing, marine debris, and oil pollution should be eliminated. Where necessary, legislation must be encouraged, such as lighting restrictions on nesting beaches. Erosion, accretion, sand mining, and foot and vehicular traffic on nesting beaches also need to be addressed to ensure that nesting females, eggs and hatchlings are protected. Long-term monitoring programmes are also critical to assessing the impact on these habitats.

Support development of sound ecotourism based on marine turtles

Sound ecotourism not only benefits local guides, food vendors, and small hotel operators, but, as shown by the cooperatives run by Projecto TAMAR in Brazil, can also help support entire communities. In Tortuguero, Costa Rica, the village's major source of income is generated by tourists who visit the area to see its famous green turtles: in recent years the influx of visitors has enabled the community to install electricity and other modern amenities. These programmes demonstrate that living marine turtles can be more beneficial to coastal communities as "renewable" resources rather than harvested resources which are only used once.

Develop guidelines for use

Recognizing that some communities are dependent on marine turtles and their eggs, WWF supports the need to develop guidelines for use, with the goal of ensuring use is sustainable and these programmes benefit local coastal people. Opinions vary about what constitutes sustainable use of marine turtles. Thus, in developing guidelines, resource managers and biologists have to address the status of the

population within its full range. Various approaches will need to be explored, such as weighing the value of an adult female for her production of eggs versus meat or harvesting nesting turtles that come ashore after a number of breeding seasons. In many countries harvest regulations focus on the wrong part of the population because they protect sub-adult turtles at the expense of adult breeders. Although egg collection is less controversial, these programmes are not without problems, as in the case of an authorized egg collection for one species that jeopardizes the eggs of other species needing full protection. Egg collection programmes need to be flexible enough to ensure that a sufficient proportion of eggs successfully hatch each year.

Support sea turtle research

Many gaps in our knowledge of marine turtle biology still exist, such as how many hatchlings survive to reach maturity or how long marine turtles live. While “full knowledge” is not necessary to make many informed decisions about conservation and management, additional research is needed about factors that affect health, reduce reproductive output, or address the ecological roles of marine turtles in their environment. For example, in the last ten years, scientists have become increasingly concerned about the impact of fibropapillomas, debilitating and life-threatening tumour-like growths found in all species, but especially in green turtles. The effects of pathogens, pollutants and climate changes on sea turtles also need to be determined. While it is impossible to determine how depleted populations may have functioned when they were more abundant, studies demonstrate that nutrients from turtle eggs and egg shells play a critical role in maintaining the roots of beach grass and the stability of the associated dune ecosystem while offshore seagrasses regularly grazed by green turtles are more productive.

Promote public awareness and education

For many populations of marine turtles around the world, the day-to-day support of local coastal communities is crucial to their survival. Public awareness and educational programmes to instill understanding and appreciation are the cornerstones of local and national initiatives to conserve marine turtles. In Greece, for example, programmes developed by Archelon – the Sea Turtle Protection Society, reach thousands of school children and visitors to turtle beaches each year. This growing public awareness has enabled the government to establish the National Marine Park of Zakynthos, a major loggerhead nesting area in Greece. Other sectors of society that need to be targeted include developers, industrialists, and the media. Only by understanding the needs of marine turtles will they be encouraged to address the threats these species face.

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