

Marine Science Review - 221

Sea turtles

In this review:

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A. Recent articles – no abstract available

Dickerson, D.D., Smith, J., Wolters, M., Theriot, C., Reine, K.J., and Dolan, J. **A review of beach nourishment impacts on marine turtles.** *Shore and Beach* 75(1): 49-56, 2007.

B. Recent publications available online

Hamann, M.; Limpus, C.; Hughes, G.; Mortimer, J.; and Pilcher, N. 2006. ***Assessment of the Conservation Status of the Leatherback Turtle in the Indian Ocean and South East Asia.*** IOSEA Species Assessment: Volume I. IOSEA Marine Turtle MoU Secretariat, Bangkok. 166pp.

Available at: http://www.ioseaturtles.org/Features/Leatherback_Assessment-Full_Report-3107.pdf

Notes: Marine turtle experts in each of the countries in the Indian Ocean and South-East Asia region (including non-Signatory States to the MoU) were contacted and asked to complete a short survey regarding leatherback turtles in their country. The survey covered legislative aspects, nesting populations and foraging populations. Completed surveys were then edited for content by the compilers, and in some cases additional information was added. The final edited surveys on leatherback turtles are presented in this report.

Bräutigam, A. and Eckert, K.L. 2006. ***Turning the Tide: Exploitation, Trade and Management of Marine Turtles in the Lesser Antilles, Central America, Colombia and Venezuela.*** TRAFFIC International, Cambridge, UK. xiv + 533 pp.

Available at: <http://www.traffic.org/RenderPage.action?CategoryId=1947>

Notes: This review of exploitation, trade and management of marine turtles in the Wider Caribbean Region (WCR) highlights findings related to the legal framework for marine turtle management, patterns of domestic exploitation and use and international trade, and a variety of core management issues, including population monitoring, fishery controls and law enforcement. While there have been many advancements over the past half-century in our understanding of marine turtle biology and of the management needs of these species, the review concludes that actual management of marine turtles, and of marine turtle exploitation in particular, has in many ways not kept pace with this understanding nor with the contemporary scope of threats to their survival. The report documents the implications of management shortcomings in one country for the management and conservation efforts being made in others and, finally, calls attention to a range of activities that are being undertaken at the national level to address these problems and which could be expanded or adapted across the region.

C. Recent articles with abstracts

Mrosovsky, N. **Distorting gene pools by conservation: Assessing the case of doomed turtle eggs.** *Environmental Management* 38(4): 523-531, 2006.

Notes: Sea turtles have a high reproductive output and high mortality at early stages of the life cycle. In particular, many nests are laid below or close to high tide lines, and subsequently large numbers of eggs may be inundated and destroyed. A common conservation procedure is to relocate such doomed eggs to higher ground. This article examines this practice in the light of recent data revealing that some individual turtles tend to nest relatively near the water and others relatively higher up the beach. Discussion is focused on the question of why apparently poor placement of nests has not been selected against. Comparison between the ecology of leatherback and hawksbill turtle nesting beaches suggests that predictability of environmental conditions on the nesting beaches has an important influence on patterns of nest-site selection. Options are outlined for the management of nesting beaches where a high proportion of turtle eggs is subject to destruction by flooding.

Swimmer, Y., Arauz, R., McCracken, M., McNaughton, L., Ballesteros, J., Musyl, M., Bigelow, K., and Brill, R. **Diving behavior and delayed mortality of olive ridley sea turtles *Lepidochelys olivacea* after their release from longline fishing gear.** *Marine Ecology Progress Series* 323: 253-261, 2006.

Notes: We deployed pop-off satellite archival tags (PSATs) on 14 olive ridley turtles *Lepidochelys olivacea* and 1 green turtle *Chelonia mydas* in the eastern tropical Pacific Ocean between November 2001 and June 2003 to determine dive behavior and post-release mortality following interactions with longline fishing gear. Nine olive ridleys and 1 green turtle were captured by longline fishing gear, and 5 free swimming olive ridleys were hand-captured at the surface to serve as controls. Hooks were removed from all longline-caught turtles, with the exception of 1 olive ridley turtle. PSATs remained on control- and longline-caught olive ridleys for an average of 61 and 54 d, respectively (range: 26 to 115) and on the green turtle for 26 d. Olive ridleys spent nearly all of their recorded time within the top 60 m, with very few dives exceeding 100 m. Over 95% of the time was spent between water temperatures of 22 and 28°C and turtles' dive behaviors appeared to be correlated with oceanographic variables (e.g. sea surface temperature and chlorophyll concentration). There were no clear differences evident either in horizontal movements, depth distributions, or associations with specific water temperatures between longline-caught and control turtles. Our data showed only one mortality event, that of a control turtle that died and sank 66 d after being tagged. We conclude that olive ridley turtles that are lightly hooked and handled properly survive and generally behave normally following interactions with shallow-set longline gear.

Blumenthal, J.M., Solomon, J.L., Bell, C.D., Austin, T.J., Ebanks-Petrie, G., Coyne, M.S., Broderick, A.C., and Godley, B.J. **Satellite tracking highlights the need for international cooperation in marine turtle management.** *Endangered Species Research* 2: 51-61, 2006.

Notes: We present detailed results of a satellite tracking project following 10 adult female turtles from the Cayman Islands, thought to have once been one of the world's largest rookeries. By tracking the movements of 7 green turtles *Chelonia mydas* and 3 loggerhead turtles *Caretta caretta* from now critically reduced rookeries we defined key habitats for interesting movement, migration, and foraging in a range of Caribbean jurisdictions. Turtles tracked from the Cayman Islands traveled to foraging grounds in Belize, Guatemala, Honduras, Mexico, Nicaragua and the USA. This range encompasses a >2000 km stretch of Caribbean coastline and the Florida Keys, highlighting the need for international cooperation in identifying and mitigating foraging ground threats. For one of the green turtles, foraging site fidelity was elucidated over the course of two reproductive seasons, and oceanic internesting intervals/post-nesting oceanic circles were defined for the first time in Atlantic loggerhead turtles. In addition to fundamental and applied insights into the biology of the 2 species, this research elucidates geographic scale for potential ecological effects of past decimation of rookeries in the Cayman Islands and highlights the effectiveness of community efforts in support of conservation research.

Arthur, K., Shaw, G., Limpus, C., and Udy, J. **A review of the potential role of tumour-promoting compounds produced by *Lyngbya majuscula* in marine turtle fibropapillomatosis.** *African Journal of Marine Science* 28(2): 441-446, 2006.

Notes: Harmful algal blooms (HABs) have increased in abundance and severity in recent decades. Whereas the implications for human impacts and intoxication resulting from blooms have been extensively studied, the ecological implications of these microalgae are less well understood. Many HAB species produce biologically active, secondary metabolites and the fate of these toxins through the foodweb is generally not well understood unless it culminates in extensive fish mortalities or human poisonings. This review focusses on one HAB species, the cyanobacterium *Lyngbya majuscula*, and presents a hypothetical role for its involvement in fibropapillomatosis (FP), a neoplastic disease of marine turtles. FP is expressed as benign tumours that grow both internally and externally on marine turtles, preventing vision, movement and organ function. The aetiology of FP is currently not conclusively understood, but virus material has been associated with tumours and previous studies have suggested a role for naturally produced tumour promoters. In this review, we present a hypothesis regarding the involvement of *L. majuscula* in FP, either through direct intoxication and action of tumour-promoting compounds or indirectly by causing seagrass loss and compromised immune function, thus leaving the turtles more susceptible to disease.

Lugten, G.L. **Soft law with hidden teeth: The case for a FAO International Plan of Action on Sea Turtles.** *Journal of International Wildlife Law and Policy* 9(2): 155-173, 2006.

Notes: From 18th to 22nd November 2002, the Second International Fishers Forum (IFF2) was conducted in Honolulu, Hawaii. The primary purpose of the forum was to evaluate and promote mitigation techniques for the incidental bycatch of sea turtles and seabirds by longline fishing gear. In its final session the Forum passed by overwhelming majority a Resolution (inter alia):

* requesting the Western Pacific Regional Fishery Management Council to present the Forum findings at the March 2003 session of the Committee of Fisheries (COFI) of the Food and Agriculture Organisation (FAO); and

* encouraging FAO to develop Guidelines leading to an International Plan of Action (IPOA) for the Reduction of Sea Turtle Bycatch from Marine Fisheries.

Three years later, FAO has not produced an IPOA-Sea Turtles. In March 2005 at the Twenty-Sixth Session of the Committee on Fisheries, FAO adopted (a soft law instrument) Guidelines to Reduce Sea Turtle Mortality in Fishing Operations, but COFI has refused to support another IPOA on the subject of sea turtles. COFI members have agreed that it would be better to achieve some real progress on the existing International Plans of Action, rather than add another IPOA to the list of poorly implemented international soft laws. The purpose of this article is to evaluate the legal status of the FAO International Plans of Action, and assess whether a new FAO IPOA on sea turtles could achieve any significant protection for creatures experiencing "a catastrophic decline in populations." (4) The paper is divided into three parts. Part 2 provides an overview on the plight of sea turtles and the numerous threats to their continued existence which occur both on land and at sea. Part 3 of the paper looks to the four current FAO International Plans of Action, their status in law, and the potential effectiveness of a fifth IPOA dealing with sea turtles. Part 4 of the paper presents an argument for the customary law status of the IPOAs. The paper submits that to the extent that the law (as distinct from education of fishers and coastal communities, developments in fishing gear technology, or application of better management policies) can conserve the sea turtles, a FAO International Plan of Action on sea turtles, along with the other FAO IPOAs, may be soft law instruments with hidden teeth.

James, M.C., Sherrill-Mix, S.A., Martin, K., and Myers, R.A. **Canadian waters provide critical foraging habitat for leatherback sea turtles.** *Biological Conservation* 133(3): 347-357, 2006.

Notes: From 1998-2005, we collected 851 geo-referenced records of leatherback turtles, *Dermochelys coriacea*, from a volunteer network of commercial fishers and tour boat operators in Atlantic Canada. These data provide new insight into the spatial and temporal distribution of leatherbacks in temperate northwest Atlantic waters. Patterns in sightings data were consistent with the results of concurrent satellite telemetry studies, revealing a broad distribution of leatherbacks on the Scotian Shelf throughout the foraging season, and regular occurrence in the southern Gulf of St. Lawrence in late summer and fall. Our results suggest inter-annual variation in leatherback abundance in Canadian waters, with reported sightings across all years peaking on August 5 (95% CI: July 25-August 15). Weekly mean area sea surface temperature (SST) had a significant effect on the number of leatherback sightings reported, independent of day of year, with each 1°C rise in temperature increasing reported sightings by 12.5% (95% CI: 2.1-23.8%). Most turtles were reported inshore from the continental shelf break and

mean SST associated with sightings was 16.6°C (sd = 2.3°C). Our findings suggest that Canadian waters support one of the highest summer and fall densities of leatherbacks in the North Atlantic, and should be considered critical foraging habitat for this endangered species. Conservation efforts must be broadened to address threats to leatherbacks in this area.

Caminas, J.A., Baez, J.C., Valeiras, X., and Real, R. **Differential loggerhead by-catch and direct mortality due to surface longlines according to boat strata and gear type.** *Scientia Marina* 70(4): 661-665, 2006.

Notes: Surface longline gears are used to fish different species, mainly albacore *Thunnus alalunga* (Bonnaterre, 1788), bluefin tuna *Thunnus thynnus* (Linnaeus, 1758), and swordfish *Xiphias gladius* Linnaeus, 1758, and are considered highly dangerous for threatened marine turtles. Loggerheads *Caretta caretta* (Linnaeus, 1758) can be incidentally captured by surface longlines. A number of captured individuals die during the fishing operation, which we consider direct mortality due to fishing. We analysed the relative loggerhead by-catch and direct mortality associated with each type of boat and gear from April to December during the period 1999-2004 in the Spanish surface longline fleet that fishes in the western Mediterranean Sea, an important fishing area for this fleet. We used different indices to compute the catch per unit effort (CPUE) according to the number of hooks and to the number of fishing operations for each type of boat and gear. Both by catch and direct mortality differed significantly according to the type of boat and gear. With respect to the number of hooks, boats longer than 12 m not using a roller and targeting bluefin tuna captured the highest number of loggerheads, whereas boats longer than 12 m with a roller that targeted swordfish caused the highest direct mortality. With respect to the number of fishing operations, boats longer than 12 m without a roller that targeted albacore captured the highest number of loggerheads; the highest direct mortality was caused by this type of boat and by boats longer than 12 m using a roller and targeting swordfish.

Hamann, M., Cuong, C.T., Hong, N.D., Thuoc, P., and Thuhien, B.T. **Distribution and abundance of marine turtles in the Socialist Republic of Viet Nam.** *Biodiversity and Conservation* 15(11): 3703-3720, 2006.

Notes: To establish baseline data on the distribution, abundance and threats to marine turtles in Viet Nam we conducted surveys with local fishers, community members and provincial Ministry of Fisheries staff from 17 of Viet Nam's 29 coastal provinces. These data indicate that five species of marine turtle reside in Viet Nam's waters (loggerhead, olive ridley, leatherback, green and hawksbill turtles), and four species nest on Viet Nam's beaches (all of the above except the loggerhead turtle). It is evident from these data that significant declines have occurred in both foraging and nesting populations of all five marine turtle species found in Viet Nam. The greatest current threats to marine turtle populations in Viet Nam are habitat degradation, the accidental and opportunistic of turtles capture by fishers and the direct take of nesting females and their eggs. Successful conservation efforts have been made in recent years through collaboration between international Non Government Organisations and several Vietnamese Government Ministries. Continued success of these projects and the development and implementation of marine conservation policy will depend upon building awareness among Government employees, fishers and the general public about marine turtle biology, ecology, and the need to protect them.

Naro-Maciel, E., Becker, J.H., Lima, E.H.S.M., Marcovaldi, M.A., and Desalle, R. **Testing dispersal hypotheses in foraging green sea turtles (*Chelonia mydas*) of Brazil.** *Journal of Heredity* 98(1): 29-39, 2007.

Notes: Testing theories of dispersal is challenging in highly migratory species. In sea turtles, population size, geographic distance, natal homing, and ocean currents are hypothesized to affect dispersal. Little is known, however, about these mechanisms in sea turtles foraging along the South American coast. Green sea turtles feeding at Ubatuba (UB, $n = 114$) and Almofala (AF, $n = 117$), Brazil, were sequenced at the mitochondrial DNA (mtDNA) control region (486 bp) and genotyped at 7 microsatellite loci to test dispersal hypotheses. Fifteen mtDNA haplotypes were revealed, including a previously undescribed sequence, and the average observed heterozygosity (H-o) was 76.4%. Overall short-term temporal differences were not detected, and differentiation was less pronounced in microsatellite than in mtDNA analyses. Mitochondrial results reveal significant differentiation between the Brazilian feeding grounds and most other Atlantic groups, whereas microsatellites uncover similarities to some of the geographically closest populations. Ubatuba and Almofala are mixed stocks, drawn primarily from Ascension, with lesser contributions from Surinam/Aves and Trindade. Costa Rica is also a significant source of individuals feeding at AF. The results are consistent with a model of juvenile natal homing impacted by other factors.

Effective protection of turtles foraging along the extensive Brazilian coast may enhance breeding populations thousands of kilometers away.

Bell, C.D., Solomon, J.L., Blumenthal, J.M., Austin, T.J., Ebanks-Petrie, G., Broderick, A.C., and Godley, B.J. **Monitoring and conservation of critically reduced marine turtle nesting populations: lessons from the Cayman Islands.** *Animal Conservation* 10(1): 39-47, 2007.

Notes: Historically, nesting marine turtles were abundant in the Cayman Islands and were an integral part of the economy and culture. Today, nesting of loggerhead turtle *Caretta caretta* and green turtles *Chelonia mydas* takes place at very low levels. Hawksbill *Eretmochelys imbricata* nesting has not been recorded since 1999. We overview highly detailed monitoring data gathered over a 6-year period allowing insight into the magnitude and spatial and temporal patterns of marine turtle nesting, cost-effectiveness of monitoring such reduced populations, impacts of development on reproductive success and current threats to the recovery of the population. Nesting is diffuse and widely distributed for both nesting species on Grand and Little Cayman. Modelled nesting detection profiles for Grand Cayman show that in order to maintain data resolution, most sandy coastline must be surveyed throughout each season. However, in Little Cayman it may be possible to reduce effort. Legal take of adults and illegal take of eggs may be significantly impacting the remaining population. Surprisingly, we observed no significant correlation between density of coastal development and clutch density, adult emergence success or hatching success for either species. A significant relationship exists however, between density of coastal development and incidence of misorientation events in loggerhead hatchlings but not in green turtle hatchlings. Effective protection of known nesting habitat and the elimination of exploitation of remaining adults and eggs within the population are critical to its recovery.

Lewis, R.I. and Crowder, L.B. **Putting longline bycatch of sea turtles into perspective.** *Conservation Biology* 21(1): 79-86, 2007.

Notes: Although some sea turtle populations are showing encouraging signs of recovery, others continue to decline. Reversing population declines requires an understanding of the primary factor(s) that underlie this persistent demographic trend. The list of putative factors includes direct turtle and egg harvest, egg predation, loss or degradation of nesting beach habitat, fisheries bycatch, pollution, and large-scale changes in oceanographic conditions and nutrient availability. Recently, fisheries bycatch, in particular bycatch from longline fisheries, has received increased attention and has been proposed as a primary source of turtle mortality. We reviewed the existing data on the relative impact of longline bycatch on sea turtle populations. Although bycatch rates from individual longline vessels are extremely low, the amount of gear deployed by longline vessels suggests that cumulative bycatch of turtles from older age classes is substantial. Current estimates suggest that even if pelagic longlines are not the largest single source of fisheries-related mortality, longline bycatch is high enough to warrant management actions in all fleets that encounter sea turtles. Nevertheless, preliminary data also suggest that bycatch from gillnets and trawl fisheries is equally high or higher than longline bycatch with far higher mortality rates. Until gillnet and trawl fisheries are subject to the same level of scrutiny given to pelagic longlines, our understanding of the overall impact of fisheries bycatch on vulnerable sea turtle populations will be incomplete.

Eckert, S. **High-use oceanic areas for Atlantic leatherback sea turtles (*Dermochelys coriacea*) as identified using satellite telemetered location and dive information.** *Marine Biology* 149(5): 1257-1267, 2006.

Notes: The movements and behavior of nine female leatherback sea turtles, *Dermochelys coriacea* (L.) were monitored for up to 370 days from their nesting beaches on the Caribbean island of Trinidad between 1995 and 2004 using satellite-linked time and depth recorders. During the inter-nesting period (typically March-July) turtles ranged widely, but frequented the area around Galera Point on the NE corner of Trinidad. Diving depths were typically <51 m. Upon leaving Trinidad, the three longest tracked turtles moved to higher latitude foraging areas, NE of the Flemish Cap; along the continental shelf of the Iberian peninsula to the Bay of Biscay; and along the N. Atlantic subtropical front, where they remained until the end of November. Dives were initially deep (100-300 m) and long (>26 min) as the turtles left the Caribbean, but became very shallow (>50 m) and short at high latitudes. Between mid-October and mid-November, the turtles left high latitudes for a presumed foraging area in the Mauritania upwelling where they resided until their tracking records ended. Diving remained relatively shallow. It is proposed that movements of these turtles from one foraging area to another are driven by the opportunity to forage in areas

of distinct oceanic structure which serve to concentrate their gelatinous prey (e.g., salps, Scyphomedusae, Siphonophora) either at or below the surface.

Saba, V.S., Santidrian-Tomillo, P., Reina, R.D., Spotila, J.R., Musick, J.A., Evans, D.A., and Paladino, F.V. **The effect of the El Nino Southern Oscillation on the reproductive frequency of eastern Pacific leatherback turtles.** *Journal of Applied Ecology* 44(2): 395-404, 2007.

Notes: Pacific leatherback turtle *Dermochelys coriacea* populations have been declining precipitously. It has been suggested that fishery-associated mortality is the leading factor causing the decline; however, the sensitivity of leatherbacks to climate variability relative to their population ecology is unknown. We investigated the effects of interannual climate variability, as governed by the El Nino Southern Oscillation (ENSO), on leatherback nesting ecology. We used equatorial Pacific sea surface temperature (SST) anomaly data over various time scales derived from both moored buoys and remote satellites as signals of ENSO. We then incorporated these data into a remigration probability model for the largest nesting population of eastern Pacific leatherbacks at Parque Nacional Marino Las Baulas (PNMB), Costa Rica. Our results showed that nesting females of PNMB exhibited a strong sensitivity to ENSO, as reflected in their nesting remigration probabilities. Cool La Nina events corresponded with a higher remigration probability and warm El Nino events corresponded with a lower remigration probability. We suggest that productivity transitions at leatherback foraging areas in the eastern equatorial and south-eastern Pacific in response to El Nino/La Nina events result in variable remigration intervals and thus variable annual egg production. This phenomenon may render the eastern Pacific leatherback population more vulnerable to anthropogenic mortality than other populations. *Synthesis and applications.* Physical indices of environmental variation can be used to estimate the probability of leatherbacks remigrating to nest at PNMB. This type of modelling approach can be extremely useful for understanding the effects of climatic variation on the population dynamics of sea turtles. Our remigration probability model can be applied to any monitored sea turtle nesting population where nesting site fidelity and beach monitoring coverage remains high. This modelling approach can help nesting beach monitoring programmes forecast remigrant numbers based on prior climate data, and can further quantify anthropogenic mortality by validating survival estimates.

Hays, G.C., Hobson, V.J., Metcalfe, J.D., Righton, D., and Sims, D.W. **Flexible foraging movements of leatherback turtles across the north Atlantic Ocean.** *Ecology* 87(10): 2647-2656, 2006.

Notes: Some marine species have been shown to target foraging at particular hotspots of high prey abundance. However, we show here that in the year after a nesting season, female leatherback turtles (*Dermochelys coriacea*) in the Atlantic generally spend relatively little time in fixed hotspots, especially those with a surface signature revealed in satellite imagery, but rather tend to have a pattern of near continuous traveling. Associated with this traveling, distinct changes in dive behavior indicate that turtles constantly fine tune their foraging behavior and diel activity patterns in association with local conditions. Switches between nocturnal vs. diurnal activity are rare in the animal kingdom but may be essential for survival on a diet of gelatinous zooplankton where patches of high prey availability are rare. These results indicate that in their first year after nesting, leatherback turtles do not fit the general model of migration where responses to resources are suppressed during transit. However, their behavior may be different in their sabbatical years away from nesting beaches. Our results highlight the importance of whole-ocean fishing gear regulations to minimize turtle bycatch.

Hannan, L.B., Roth, J.D., Ehrhart, L.M., and Weishampel, J.F. **Dune vegetation fertilization by nesting sea turtles.** *Ecology* 88(4): 1053-1058, 2007.

Notes: Sea turtle nesting presents a potential pathway to subsidize nutrient-poor dune ecosystems, which provide the nesting habitat for sea turtles. To assess whether this positive feedback between dune plants and turtle nests exists, we measured N concentration and $\delta^{15}\text{N}$ values in dune soils, leaves from a common dune plant (sea oats [*Uniola paniculata*]), and added eggs of loggerhead (*Caretta caretta*) and green turtles (*Chelonia mydas*) across a nesting gradient (200 - 1050 nests/km) along a 40.5-km stretch of beach in east central Florida, USA. The $\delta^{15}\text{N}$ levels were higher in loggerhead than green turtle eggs, denoting the higher trophic level of loggerhead turtles. Soil N concentration and $\delta^{15}\text{N}$ values were both positively correlated to turtle nest density. Sea oat leaf tissue $\delta^{15}\text{N}$ was also positively correlated to nest density, indicating an increased use of augmented marine-based nutrient sources. Foliar N concentration was correlated with $\delta^{15}\text{N}$, suggesting that increased nutrient availability from

this biogenic vector may enhance the vigor of dune vegetation, promoting dune stabilization and preserving sea turtle nesting habitat.

Hitipeuw, C., Dutton, P.H., Benson, S., Thebu, J., and Bakarbesy, J. **Population status and interesting movement of leatherback turtles, *Dermochelys coriacea*, nesting on the northwest coast of Papua, Indonesia.** *Chelonian Conservation and Biology* 6(1): 28-36, 2007.

Notes: The northwest coast of the province of Papua in Indonesia is thought to host the largest remaining leatherback nesting population in the Pacific Ocean. We conducted a census of nesting activity at Jamursba-Medi from 2001 through 2004 and of Wermon from 2002 to 2004, and tracked interesting movements of female leatherbacks by using satellite telemetry during the nesting season in 2003. We recorded 1865-3601 nests each season at Jamursba-Medi and 1788-2881 nests at Wermon. Nesting occurred year-round, with a peak in activity between May and September at Jamursba-Medi, and between October and March at Wermon. Comparing these data with previous records of nesting activity from 1981 to 2001 indicates that, although there are indications of a long-term decline, this population has not been depleted to the extent found at other major rookeries in the Pacific. Satellite telemetry indicates that nesters frequent waters around the Raja Ampat Islands and coastal waters to the west of Jamursba-Medi, and may also nest outside the monitored area. We recommend establishing a marine protected area to ensure protection of this population in these critical nearshore marine habitats and implementation of conservation measures in partnership with local communities at these nesting beaches before this population becomes depleted.

Dutton, P.H., Hitipeuw, C., Zein, M., Benson, S.R., Petro, G., Pita, J., Rei, V., Ambio, L., and Bakarbesy, J. **Status and genetic structure of nesting populations of leatherback turtles (*Dermochelys coriacea*) in the western Pacific.** *Chelonian Conservation and Biology* 6(1): 47-53, 2007.

Notes: A group of researchers, managers, and tribal leaders with extensive local knowledge from Papua New Guinea, Solomon Islands, Vanuatu, and Papua, Indonesia, provided new information on the status of leatherback nesting populations in the western Pacific Ocean. Twenty-eight nesting sites were identified, of which 21 were previously unknown or poorly described. Although data are still incomplete, we estimate a total of ca. 5000-9200 nests currently laid each year among these 28 sites, with approximately 75% of this nesting activity concentrated at 4 sites along the northwest coast (Bird's Head Peninsula) of Papua, Indonesia. Genetic analysis by using mitochondrial deoxyribonucleic acid sequences identified a total of 6 haplotypes among the 106 samples analyzed for Solomon Islands, Papua, and Papua New Guinea, including a unique common haplotype that is only found in these western Pacific populations. There was no significant difference in haplotype frequencies among these rookeries, which suggests that they represent a metapopulation composed of a single genetic stock. Further work is needed to define the demographic structure within this metapopulation.

Tomillo, P.S., Vélez, E., Reina, R.D., Piedra, R., Paladino, F.V., and Spotila, J.R. **Reassessment of the leatherback turtle (*Dermochelys coriacea*) nesting population at Parque Nacional Marino Las Baulas, Costa Rica: Effects of conservation efforts.** *Chelonian Conservation and Biology* 6(1): 54-62, 2007.

Notes: The number of leatherback turtles (*Dermochelys coriacea*) nesting at Parque Marino Las Baulas declined precipitously in the 15 years that we monitored the population (1988-1989 to 2003-2004). We estimate that the annual survival rate of adults was 0.78 (95% CI: 0.75-0.80) and that mortality rates for juveniles and subadults in the ocean appear to be double those of a stable population. The proportion of hatchlings produced from deposited eggs increased since the park was established as a result of conservation practices. Because the number of nesting females decreased, the overall production of hatchlings per season declined but was much greater than would be expected without protection efforts. There were similar numbers of hatchlings leaving the beaches of Las Baulas in 1998-2003, with 68 to 188 nesting females under the current conservation regime as there were in 1988-1989 with ca. 1500 nesting females and no park. Female leatherback turtles that nest at Las Baulas have a high level of exchange between nesting beaches; thus, protection of both Playa Grande and Playa Langosta is critical for the survival of the population. Despite current protection efforts, the population at Las Baulas is still threatened by mortality at sea and development on and behind the nesting beaches.

Sarti-Martínez, L., Barragán, A.R., García-Muñoz, D., García, N., Huerta, P., and Vargas, F. **Conservation and biology of the leatherback turtle in the Mexican Pacific.** *Chelonian Conservation and Biology* 6(1): 70-78, 2007.

Notes: Proyecto Laúd coordinates the conservation activities for the leatherback turtle on 4 index beaches of the Mexican Pacific, combining efforts of different government and nongovernment institutions. With more than 20 years of tagging and conservation data, this project represents the most solid source of knowledge about the biology and ecology of the leatherback turtle in Mexico. Daily nesting track counts done from 1982 to 2004 showed a declining trend for the number of leatherback nests on the 4 index beaches of the Mexican Pacific (Mexiquillo, Tierra Colorada, Cahuitán, and Barra de la Cruz). The worst nesting season was 2002-2003, in which only 120 leatherback nests were recorded on the index beaches combined. The decline is attributed to a combination of extensive egg harvest on all Mexican Pacific beaches before conservation activities and high mortality of large adults in pelagic fisheries. A total of 5314 females were individually identified since 1982; the average remigration interval is 3 years, and there is evidence of interchange of females between some beaches. The female population has an average curved carapace length of 143.8 cm and an average clutch size of 62 eggs. The average estimated clutch frequency is 5.5 ± 1.9 , with an average clutch interval of 9.7 ± 1.2 days. From 1982 to 2004 a total of 270,129 leatherback hatchlings were released to the wild population. This comparatively small number was not enough to offset the mortality of juveniles and adults offshore. This may explain the continuing population decline in spite of 20 years of protection activities. Currently, hope for the future of the population relies on the protection of at least 80% of the clutches laid on the priority beaches, the participation of local communities in conservation activities, and increased awareness of the leatherback's status among Mexican society.

Chacón-Chaverri, D. and Eckert, K.L. **Leatherback sea turtle nesting at Gandoca Beach in Caribbean Costa Rica: Management recommendations from fifteen years of conservation.** *Chelonian Conservation and Biology* 6(1): 101-110, 2007.

Notes: Field research was conducted, from 1990 to 2004, at Gandoca Beach (9°59.972'N, 82°60.530'W), located within the Gandoca-Manzanillo National Wildlife Refuge at the southernmost extreme of the Caribbean coast of Costa Rica. Nightly patrols of the 8.85-km nesting beach were undertaken annually from the second week of February through the last week of July, and pertinent information regarding the nesting process was recorded. An estimated 90% of all nesting females were documented and uniquely tagged; these 2751 females deposited 8766 nests (believed to be a complete count). Averaged over the 15-year study period, 12.5% of all nests were left unaltered in situ; 12.9% were left in situ, with tracks camouflaged by beach patrollers; 33.9% were relocated to lower risk zones on the beach; and 25.4% were relocated to beach hatcheries. Poaching, which had once claimed nearly 100% of all eggs laid, averaged 15.5% annually during the study period, demonstrating a clearly declining trend, attributable to the presence of beach patrollers, policies associated with the wildlife refuge, and changing attitudes within proximal communities. A comparison of tag registries indicates an interchange of gravid females among nesting beaches both within Costa Rica and internationally with Panama and Colombia. The interchange reinforces the importance of joint efforts to address primary threats, including beach erosion, egg poaching, direct harvest of adults for meat (especially in Panama), and coastal development. The population is statistically stable but shows a steadily declining trend in the number of nests laid since 2000.

Troëng, S., Harrison, E., Evans, D., de Haro, A., and Vargas, E. **Leatherback turtle nesting trends and threats at Tortuguero, Costa Rica.** *Chelonian Conservation and Biology* 6(1): 117-122, 2007.

Notes: Leatherback turtle (*Dermochelys coriacea*) nesting activity was monitored, individual movements via flipper tag recoveries and satellite telemetry were determined, and illegal egg collection was quantified at Tortuguero, Costa Rica from 1995 to 2006. Annual nest deposition was estimated at 199-1,623 nests per year; a Bayesian regression model suggests that leatherback nesting decreased by 67.8% between 1995 and 2006. Tag recaptures from fisheries bycatch and strandings have been reported from Cuba, Nicaragua, and the United States. Two leatherbacks were followed with satellite telemetry; 1 swam to Cuba and 1 moved into the northwest Atlantic Ocean. Minimum rates for illegal egg collection from 2000 to 2005 were estimated at 13.0%-21.5%.