

In this review:

- A. Recent publication(s) available online
- B. Recent articles with abstracts

O/A denotes an open access article or journal

A. Recent publications available online

Maison, K.A., Kinan-Kelly, I. and Frutchey, K.P. 2010. *Green Turtle Nesting Sites and Sea Turtle Legislation throughout Oceania*. U.S. Dep. Commerce, NOAA Technical Memorandum. NMFS-F/SPO-110, 52 pp.

Available at: <http://spo.nmfs.noaa.gov/tm/110.pdf>

Notes: This is a literature review compiled by the National Marine Fisheries Service (NMFS) to facilitate better understanding of green turtle nesting distribution in the Central and Western Pacific Ocean, including a summary of legal protections for sea turtles throughout the region. This synthesis of 189 Pacific green turtle nesting locations, nesting assemblage characteristics where available, and current national legislation provides the background information necessary to identify where gaps exist in monitoring and management. This will help NMFS (or other relevant stakeholders) prioritize and direct future research, management activities, and international collaborations to advance green turtle conservation and recovery efforts in the Pacific.

B. Recent articles with abstracts

Wallace, B.P., Lewison, R.L., McDonald, S.L., McDonald, R.K., Kot, C.Y., Kelez, S., Bjorkland, R.K., Finkbeiner, E.M., Helmbrecht, S., and Crowder, L.B. **Global patterns of marine turtle bycatch**. *Conservation Letters* 3(3): 131-142, 2010. O/A

Notes: Fisheries bycatch is a primary driver of population declines in several species of marine megafauna (e.g., elasmobranchs, mammals, seabirds, turtles). Characterizing the global bycatch seascape using data on bycatch rates across fisheries is essential for highlighting conservation priorities. We compiled a comprehensive database of reported data on marine turtle bycatch in gillnet, longline, and trawl fisheries worldwide from 1990 to 2008. The total reported global marine turtle bycatch was ~85,000 turtles, but due to the small percentage of fishing effort observed and reported (typically <1% of total fleets), and to a global lack of bycatch information from small-scale fisheries, this likely underestimates the true total by at least two orders of magnitude. Our synthesis also highlights an apparently universal pattern across fishing gears and regions where high bycatch rates were associated with low observed effort, which emphasizes the need for strategic bycatch data collection and reporting. This study provides the first global perspective of fisheries bycatch for marine turtles and highlights region-gear combinations that warrant urgent conservation action (e.g., gillnets, longlines, and trawls in the Mediterranean Sea and eastern Pacific Ocean) and region-gear combinations in need of enhanced observation and reporting efforts (e.g., eastern Indian Ocean gillnets, West African trawls).

de Quevedo, I.A., Cardona, L., de Haro, A., Pubill, E., and Aguilar, A. **Sources of bycatch of loggerhead sea turtles in the western Mediterranean other than drifting longlines.** *ICES Journal of Marine Science* 67(4): 677-685, 2010.

Notes: A survey, including questionnaires to fishers and observers on board fishing vessels, was conducted to assess turtle bycatch in the waters off Catalonia (northeastern Spain), a region inhabited mainly by loggerhead sea turtles (*Caretta caretta*) from the highly endangered eastern Mediterranean rookeries. Observer reports confirmed that the data produced by the interviewees were reliable, so interview results were used to estimate turtle bycatch. The number of turtles caught monthly per vessel was estimated at 0.01 for bottom longlines, 0.02 for trammelnets, 0.07 for bottom trawling, and 1.2 for drifting longlines. From these values, 481 (95% CI: 472-491) turtles were estimated to be taken annually as bycatch by the whole fleet. Bottom trawling and trammelnets were the most widely used fishing gears (33 and 31% of the total 11 237 fishing months), but most turtles were caught either by bottom trawlers (249; 95% CI 83-415) or by drifting longlines (124; 95% CI: 40-199). Ivlev's electivity index revealed that bottom trawler bycatch was higher than expected in areas with a wide continental shelf. Given the heavy turtle mortality associated with bottom trawling and the fact that, in southern Catalonia, the fleet mainly takes turtles from western Mediterranean rookeries, it is suggested that the fishery be regulated through winter fishing restrictions, reducing the number of bottom trawlers working in the area, reducing the time the net is in the water to prevent turtle suffocation, or being obliged to use turtle excluder devices.

Gilman, E. et al. **Mitigating sea turtle by-catch in coastal passive net fisheries.** *Fish and Fisheries* 11(1): 57-88, 2010. O/A

Notes: There is growing evidence that small-scale, coastal, passive net fisheries may be the largest single threat to some sea turtle populations. We review assessments of turtle interactions in these fisheries, and experiments on gear-technology approaches (modifying gear designs, materials and fishing methods) to mitigate turtle by-catch, available from a small number of studies and fisheries. Additional assessments are needed to improve the limited understanding of the relative degree of risk coastal net fisheries pose to turtle populations, to prioritize limited conservation resources and identify suitable mitigation opportunities. Whether gear technology provides effective and commercially viable solutions, alone or in combination with other approaches, is not well-understood. Fishery-specific assessments and trials are needed, as differences between fisheries, including in gear designs; turtle and target species, sizes and abundance; socioeconomic context; and practicality affect efficacy and suitability of bycatch mitigation methods. Promising gear-technology approaches for gillnets and trammel nets include: increasing gear visibility to turtles but not target species, through illumination and line materials; reducing net vertical height; increasing tiedown length or eliminating tiedowns; incorporating shark-shaped silhouettes; and modifying float characteristics, the number of floats or eliminating floats. Promising gear-technology approaches for pound nets and other trap gear include: replacing mesh with ropes in the upper portion of leaders; incorporating a turtle releasing device into traps; modifying the shape of the trap roof to direct turtles towards the location of an escapement device; using an open trap; and incorporating a device to prevent sea turtle entrance into traps.

Alessandro, L. and Antonello, S. **An overview of loggerhead sea turtle (*Caretta caretta*) bycatch and technical mitigation measures in the Mediterranean Sea.** *Reviews in Fish Biology and Fisheries* 20(2): 141-161, 2010.

Notes: This paper reviews the gear parameters responsible for loggerhead sea turtle (*Caretta caretta*) capture and mortality while taking into account the mitigation measures tested in the Mediterranean Sea. Incidental catch is considered as one of the major threats for turtle survival; however, the loggerhead bycatch estimated in different areas seems to be unrealistic, which highlights the need of a method for homogenising the estimates. Drifting longlines and bottom trawls have the greatest impact on Mediterranean turtle populations, respectively in pelagic and demersal phase, while passive nets (gillnets and trammel nets) seem to be responsible for the highest direct mortality, due to drowning. Most of the experiments available for the Mediterranean are focused on drifting longline. The longline parameters, hook shape and size, bait type, setting position and the reaction to sensory stimuli, strongly affect the sea turtle bycatch and mortality. Circle hooks have the potential to reduce turtle mortality only in certain fisheries and areas; larger hooks are less likely to be swallowed by turtles due to physical constraints of the mouth, reducing the mortality rate and the catch of juveniles; branchlines, once ingested, appear to be one of the major causes of sea turtle mortality; squid bait, which consistently catches more turtles than mackerel, and lightsticks, which strongly attract turtles, should be banned, at least in some areas and seasons. On the contrary only two bottom trawl studies are available from the Mediterranean. Turtle excluder devices have been tested with promising results in Turkey and Italy, even if the loss of large fish should be carefully investigated. For set nets no practical solutions are available at this time.

The analysis allows the conclusion that technical parameters affecting turtle bycatch and mortality should only be studied one at a time, in order to avoid inconclusive results, studies on post-release mortality should be implemented and finally fishermen cooperation is paramount in reducing turtle bycatch and mortality.

Cambio, G., Caminas, J.A., Franquesa, R., and Mingozzi, T. **Fishing activity and impacts along the main nesting area of loggerhead sea turtle *Caretta caretta* in Italy: overwhelming discrepancy with the official data.** *Scientia Marina* 74(2): 275-285, 2010.

Notes: The southern coast of Ionian Calabria was recently recognized as the main nesting area of the loggerhead sea turtle *Caretta caretta* in Italy. The aim of this study was to characterize the fishing fleet in this area in terms of number of boats, economic situation, social aspects and impact on sea turtle specimens and target species. A multidisciplinary approach was essential to understand how the conservation problems of *C. caretta* are linked to various characteristics of the fishing fleet. Our data showed a vast discrepancy between the official census and the actual number of boats fishing in the area: 87% of the observed artisanal vessels lacked a required registration number, and thus were fishing illegally. This has caused serious social problems that worsened over the summer of 2007, when the presence of non-local registered vessels, using drift nets, generated a spatial conflict with the local artisanal fishermen. We identified 11 fishing gears used in the area and four of them were studied with on board observations: illegal drift nets, trammel nets, bottom longlines and longlines targeting swordfish. The total number of turtles caught during the summer in the area by longliners targeting swordfish was calculated to be 500 (± 180 SE). In addition the presence of drift netters had a negative impact from an ecological and social point of view.

Echwikhi, K., Jribi, I., Bradai, M.N., and Bouain, A. **Gillnet fishery – loggerhead turtle interactions in the Gulf of Gabes, Tunisia.** *Herpetology Journal* 20(1): 25-30, 2010.

Notes: Some gillnets used in the south of Tunisia (Gulf of Gabes) target shark species (*Mustelus* sp., *Carcharhinus plumbeus*) and guitarfish (*Rhinobatos cemiculus*, *Rhinobatos rhinobatos*). These artisanal nets interact with sea turtles. Here we present an analysis of the bycatch of loggerhead sea turtles *Caretta caretta* in these gillnets in the Gulf of Gabes, an important Mediterranean wintering and foraging area for this threatened species. We quantified mean catch per unit effort (CPUE) in three ways to account for uncertainty and found high levels of interaction in each case. The number of turtle captures per km² of gillnet per day, the number of turtle captures per km of net and the number of turtle captures per set were 0.527 (0.403-0.649), 0.339 (0.250-0.438) and 0.800 (0.654-0.904), respectively. Captured loggerheads were mainly juveniles (mean = 56.6cm CCL_{n-t}) and direct mortality was estimated as 69.4% ($n = 25$). These are the first estimates of sea turtle interactions with artisanal fisheries for northern Africa, and one of very few estimates of turtle mortality in set gillnets in the Mediterranean. Our results indicate a need for research into ways for fishermen to avoid turtle captures and to raise awareness of this problem throughout the Mediterranean Sea. The following specific actions are recommended: 1) management of gillnet fisheries in the Mediterranean Sea, 2) minimizing gear soak time, particularly in foraging and inter-nesting habitats and along the migration pathways of sea turtles, 3) technical modifications of the gear by reducing the number of floats, and 4) carrying out an awareness campaign with fishermen to reduce post-release mortality.

Varghese, S.P., Varghese, S., and Somvanshi, V.S. **Impact of tuna longline fishery on the sea turtles of Indian seas.** *Current Science* 98(10): 1378-1384, 2010. O/A

Notes: Longline fishery is exerting an impact on the sea turtle populations of the seas around India, as in the case of many longline fisheries operating in other parts of the world. During the tuna longline survey conducted by four research vessels of Fishery Survey of India, 87 sea turtles were caught incidentally from the Arabian Sea, Bay of Bengal and Andaman and Nicobar waters of the Indian exclusive economic zone (EEZ) during 2005-08, registering an overall hooking rate of 0.108 turtles per 1000 hooks operated. There were marked differences in the hooking rates of turtles recorded from these three regions of the Indian EEZ, the maximum hooking rate being recorded from the Bay of Bengal (0.302), followed by the Arabian Sea (0.068) and Andaman and Nicobar waters (0.008). The species of sea turtles recorded in the bycatch, in order of abundance, were olive ridley (*Lepidochelys olivacea*), green (*Chelonia mydas*) and hawksbill (*Eretmochelys imbricata*) turtles. This study provides quantitative data on the magnitude of sea turtle incidental catch of the tuna longline fishery in the Indian EEZ.

da Silva, A.C.C.D., Castilhos, J.C., Santos, E.A.P., Brondízio, L.S., and Bugoni, L. **Efforts to reduce sea turtle bycatch in the shrimp fishery in Northeastern Brazil through a co-management process.** *Ocean and Coastal Management* 53(9): 570-576, 2010.

Notes: The neritic waters of the state of Sergipe in Northeastern Brazil is adjacent to the main nesting area of the olive ridley sea turtles (*Lepidochelys olivacea*) in the Western Atlantic Ocean and an important area for shrimp trawl fishery. To address the problem of incidental mortality of sea turtles captured during trawling and reduce the risk of overexploitation of shrimp stocks, Projeto TAMAR/ICMBio, a Brazilian sea turtle conservation program, has adopted two main strategies: (1) the implementation of a marine monitoring program and (2) active participation in local forums. This paper describes the conflicts among stakeholders, the arrangements and established mechanisms of negotiation aimed to protect sea turtles and shrimp grounds, and strategies to reduce conflicts between user groups. The analysis of this co-management process highlights the importance of stakeholder participation in resource management decision-making through a cooperative process, the role assumed by non-governmental organizations as mediators, and the factors that influence this system. The key factors and actions learnt from the current study include clear identification of the conflicts, identification of stakeholders – both local and external, and local leaders, encouragement of actors and leaders to participate, support and strengthening of local groups, legitimization of the discussion forums through involvement with government, formalization of decisions taken through legislation, and monitoring of the management efficacy.

Witt, M.J., Hawkes, L.A., Godfrey, M.H., Godley, B.J., and Broderick, A.C. **Predicting the impacts of climate change on a globally distributed species: the case of the loggerhead turtle.** *Journal of Experimental Biology* 213(6): 901-911, 2010. **O/A**

Notes: Marine turtles utilise terrestrial and marine habitats and several aspects of their life history are tied to environmental features that are altering due to rapid climate change. We overview the likely impacts of climate change on the biology of these species, which are likely centred upon the thermal ecology of this taxonomic group. Then, focusing in detail on three decades of research on the loggerhead turtle (*Caretta caretta* L.), we describe how much progress has been made to date and how future experimental and ecological focus should be directed. Key questions include: what are the current hatchling sex ratios from which to measure future climate-induced changes? What are wild adult sex ratios and how many males are necessary to maintain a fertile and productive population? How will climate change affect turtles in terms of their distribution?

Fuentes, M.M.P.B., Dawson, J.L., Smithers, S.G., Hamann, M., and Limpus, C.J. **Sedimentological characteristics of key sea turtle rookeries: potential implications under projected climate change.** *Marine and Freshwater Research* 61(4): 464-473, 2010.

Notes: Sea turtles rely on reef islands for key parts of their reproductive cycle and require specific sediment characteristics to incubate their eggs and dig their nests. However, little is known about the sedimentological characteristics of sea turtle rookeries, how these sediment characteristics affect the vulnerability of rookeries to climate change, and the ecological implications of different sediment or altered sediment characteristics to sea turtles. Therefore, we described the sediment and identified the reef-building organisms of the seven most important rookeries used by the northern Great Barrier Reef (nGBR) green turtle population. We then reviewed the literature on the vulnerability of each identified reef-building organism to climate change and how various sediment characteristics ecologically affect sea turtles. Sediments from the studied rookeries are predominantly composed of well-sorted medium-grained to coarse-grained sands and are either dominated by Foraminifera, molluscs or both. Dissimilarities in the contemporary sedimentology of the rookeries suggest that each may respond differently to projected climate change. Potential ecological impacts from climate change include: (1) changes in nesting and hatchling emergence success and (2) reduction of optimal nesting habitat. Each of these factors will decrease the annual reproductive output of sea turtles and thus have significant conservation ramifications.

Mickelson, L.E. and Downie, J.R. **Influence of incubation temperature on morphology and locomotion performance of leatherback (*Dermochelys coriacea*) hatchlings.** *Canadian Journal of Zoology* 88(4): 359-368, 2010.

Notes: The journey of leatherback (*Dermochelys coriacea* (Vandelli, 1761)) hatchlings from nest to the sea is a vulnerable life-history stage. Studies have shown that nest incubation temperatures influence hatchling morphology and locomotor performance, which may affect hatchling fitness. We obtained incubation temperature profiles from 16 leatherback nests in Tobago, West Indies, during the 2008 nesting season (March-June). There was significant variation among mean nest incubation temperatures, which had a significant influence on hatchling morphology. Using principal components analysis, we determined the morphological traits that explained the most variation among hatchlings, which allowed investigation of the relationship between hatchling morphology and terrestrial locomotion speed. Hatchlings with a narrower carapace width and longer flipper reach (produced at lower incubation temperatures) had significantly faster terrestrial speed and total run time than those with opposite characteristics (produced at higher incubation temperatures). Our results demonstrate that lower incubation temperatures produce hatchlings with traits that are significantly advantageous to terrestrial locomotion. These findings suggest that nest incubation temperature is important in determining hatchling fitness, as nest incubation temperature significantly influences hatchling morphology and locomotor capabilities. This study supplements related findings in green turtles (*Chelonia mydas* (L., 1758)), but also illustrates some unique features in leatherbacks.

Stacy, B.A., Foley, A.M., Greiner, E., Herbst, L.H., Bolten, A., Klein, P., Manire, C.A., and Jacobson, E.R. **Spirorchiidiasis in stranded loggerhead *Caretta caretta* and green turtles *Chelonia mydas* in Florida (USA): host pathology and significance.** *Diseases of Aquatic Organisms* 89(3): 237-259, 2010.

Notes: Spirorchiid trematodes are implicated as an important cause of stranding and mortality in sea turtles worldwide. However, the impact of these parasites on sea turtle health is poorly understood due to biases in study populations and limited or missing data for some host species and regions, including the southeastern United States. We examined necropsy findings and parasitological data from 89 loggerhead *Caretta caretta* and 59 green turtles *Chelonia mydas* that were found dead or moribund (i.e. stranded) in Florida (USA) and evaluated the role of spirorchiidiasis in the cause of death. High prevalence of infection in the stranding population was observed, and most infections were regarded as incidental to the cause of death. Spirorchiidiasis was causal or contributory to death in some cases; however, notable host injury and/or large numbers of parasites were observed in some animals, including nutritionally robust turtles, with no apparent relationship to cause of death. New spirorchiid species records for the region were documented and identified genera included *Neosporichis*, *Hapalotrema*, *Carettacola*, and *Learedius*. Parasites inhabited and were associated with injury and inflammation in a variety of anatomic locations, including large arteries, the central nervous system, endocrine organs, and the gastrointestinal tract. These findings provide essential information on the diversity of spirorchiids found in Florida sea turtles, as well as prevalence of infection and the spectrum of associated pathological lesions. Several areas of needed study are identified with regard to potential health implications in the turtle host, and findings caution against over-interpretation in individual cases.

Sarmiento-Ramírez, J.M., Abella, E., Martín, M.P., Tellería, M.T., López-Jurado, L.F., Marco, A., and Diéguez-Uribeondo, J. ***Fusarium solani* is responsible for mass mortalities in nests of loggerhead sea turtle, *Caretta caretta*, in Boavista, Cape Verde.** *FEMS Microbiology Letters* 312(2): 192-200, 2010.

Notes: The fungus *Fusarium solani* (Mart.) Saccardo (1881) was found to be the cause of infections in the eggs of the sea turtle species *Caretta caretta* in Boavista Island, Cape Verde. Egg shells with early and severe symptoms of infection, as well as diseased embryos were sampled from infected nests. Twenty-five isolates with similar morphological characteristics were obtained. Their ITS rDNA gene sequences were similar to the GenBank sequences corresponding to *F. solani* and their maximum identity ranged from 95% to 100%. Phylogenetic parsimony and Bayesian analyses of these isolates showed that they belong to a single *F. solani* clade and that they are distributed in two subclades named A and C (the latter containing 23 out of 25). A representative isolate of subclade C was used in challenge inoculation experiments to test Koch postulates. Mortality rates were c. 83.3% in challenged eggs and 8.3% in the control. Inoculated challenged eggs exhibited the same symptoms as infected eggs found in the field. Thus, this work demonstrates that a group of strains of *F. solani* are responsible for the symptoms observed on turtle-nesting beaches, and that they represent a risk for the survival of this endangered species.

Tomás, J., Godley, B.J., Castroviejo, J., and Raga, J.A. **Bioko: critically important nesting habitat for sea turtles of West Africa.** *Biodiversity and Conservation* 19(9): 2699-2714, 2010.

Notes: We evaluate the conservation status and threats faced by sea turtle nesting populations at Bioko Island, Equatorial Guinea (Central Africa). Beaches were monitored to obtain a detailed sea turtle nest census and, where possible, tagging of adult females was undertaken. Four sea turtle species were found nesting in the area: the green turtle (*Chelonia mydas*), the leatherback (*Dermochelys coriacea*), the olive ridley (*Lepidochelys olivacea*) and the hawksbill (*Eretmochelys imbricata*); with the former two species nesting in regionally important numbers. Nesting activity was concentrated between November and February, with a peak in December-January. Tagging and recapture of green turtles in two consecutive seasons suggested an estimated 560 (interquartile range: 420-1,681) and 414 (interquartile range: 190-1,255) nesting females in the area, respectively. Estimated numbers of nesting leatherbacks ranged from 123 to 215 and 243 to 293 in the first and second season, respectively. The other two species were less abundant (olive ridley: 19-29 and 28-43; hawksbill: 4-10 and 2 turtles). Data were compared with more recent surveys in the area and contextualised with information on human related threats. Despite the size of nesting stocks, ongoing permitted and illegal take of adult turtles at the nesting site constitutes a serious threat for these breeding aggregations. Additionally, tag returns from throughout the Gulf of Guinea suggest that the level of take in regional fisheries may also be a major threat.

Browne, D.C., Horrocks, J.A., and Abreu-Grobois, F.A. **Population subdivision in hawksbill turtles nesting on Barbados, West Indies, determined from mitochondrial DNA control region sequences.** *Conservation Genetics* 11(4): 1541-1546, 2010.

Notes: A new mitochondrial DNA control region survey of the Barbados hawksbill nesting population was undertaken using larger sample sizes, reanalysis of previously reported samples, and new primers that increase the fragment length sequenced. This work revealed that haplotypes originally identified as endemic to Barbados were misread sequences. Genetic variants and a geographic subdivision on a finer scale than has previously been recorded for sea turtles were identified between the Barbados leeward and windward coasts, indicating the need for sampling at multiple sites to reveal comprehensive genetic variation at national scales. Using the updated haplotype profiles to re-estimate Barbados' contribution to Caribbean hawksbill foraging grounds indicated a presence several-fold larger than previously calculated; a result congruent with the breeding population being one of the largest in the region.

Monzón-Argüello, C., Rico, C., Marco, A., López, P., and López-Jurado, L. F. **Genetic characterization of eastern Atlantic hawksbill turtles at a foraging group indicates major undiscovered nesting populations in the region.** *Journal of Experimental Marine Biology and Ecology* 387(1-2): 9-14, 2010.

Notes: Despite the considerable population genetic and connectivity research on the hawksbill sea turtle (*Eretmochelys imbricata*) and the species being critically endangered, the eastern Atlantic remains understudied. We present the first analysis of mitochondrial DNA (mtDNA) sequences ($n = 28$) of hawksbill juveniles in a foraging aggregation at the Cape Verde Islands. Our results showed three haplotypes non-reported in any nesting population to date, with one of them accounting for 68% of the samples. These three haplotypes were closely related to each other but highly divergent from all known Caribbean and Western Atlantic haplotypes. These findings highlight the necessity of additional research, particularly expanding the genetic analyses throughout the western coast of Africa to include unsampled areas. Furthermore, we found three haplotypes (A, B, and F: 14% of the total samples) previously detected in rookeries from the western Atlantic. The genetic data presented here carried significant conservation and research applications.

Jean, C., Ciccione, S., Ballorain, K., Georges, J.Y., and Bourjea, J. **Ultralight aircraft surveys reveal marine turtle population increases along the west coast of Reunion Island.** *Oryx* 44(2): 223-229, 2010.

Notes: Reunion Island in the south-west Indian Ocean once had significant nesting populations of marine turtles but they declined rapidly after human colonization. In 1996, after regular sightings of turtles offshore, an aerial survey programme was initiated to monitor the occurrence of marine turtles and their distribution along the west coast of the island. Between 1998

and 2008, along a 30-km coastline transect between Saint Leu and Saint Paul, a total of 1,845 marine turtle sightings were recorded during 146 flights with an ultralight aircraft. The mean number of turtle sightings per survey increased significantly between 1998 and 2008, and a variety of sizes were recorded throughout the year. Marine turtles were found over coral reef zones and on the outer reef slopes. Spatial distribution may be linked to the topography and substrate of the bottom, which determine the availability of food and shelter. The marine protected area located off Saint Paul seems to have benefited marine turtles as they frequent this area more than other regions on the west coast. These results are encouraging for local organizations working for the conservation of marine turtles on Reunion Island.

van de Merwe, J.P., Hodge, M., Whittier, J.M., Ibrahim, K., and Lee, S.Y. **Persistent organic pollutants in the green sea turtle *Chelonia mydas*: nesting population variation, maternal transfer, and effects on development.** *Marine Ecology Progress Series* 403: 269-278, 2010.

Notes: Persistent organic pollutants (POPs), such as polychlorinated biphenyls (PCBs), organochlorine pesticides (OCPs) and polybrominated diphenyl ethers (PBDEs), have a wide range of toxic effects on humans and wildlife, and have been reported in a number of endangered sea turtle populations. The present study screened for POPs in a green sea turtle *Chelonia mydas* population in Peninsular Malaysia and investigated the maternal transfer and effects of POPs on embryonic development. At the Ma'Daerah Turtle Sanctuary, blood, eggs and hatchling blood were collected from 11 nesting female *C. mydas*. Samples were analysed for 83 PCBs, 23 OCPs and 19 PBDEs using gas chromatography with tandem mass spectrometry. The chemical profiles of eggs from individual turtles were significantly different, indicating variable contaminant uptake during foraging. There was evidence of maternal transfer of POPs to eggs and hatchlings, with significant correlations in sum of PCBs (Σ PCB), sum of PBDEs (Σ PBDE), γ -hexachlorocyclohexane (γ -HCH), **trans**-chlordan and mirex concentrations between maternal blood and eggs ($p < 0.05$, $R^2 < 0.71$), between eggs and hatchling blood ($p < 0.05$, $R^2 < 0.83$), and between maternal and hatchling blood ($p < 0.05$, $R^2 < 0.61$). In addition, there was congener-specific transfer of PCBs with less lipophilic congeners (e.g. PCB 99) more readily transferred to hatchlings than the more lipophilic congeners (e.g. PCBs 180 + 193). There was also a significant correlation between increasing egg POP concentration and decreasing hatchling mass:length ratio. POPs may therefore have subtle effects on the development of *C. mydas* eggs, which may compromise offshore dispersal and predator avoidance.

Tuttle, J. and Rostal, D. **Effects of nest relocation on nest temperature and embryonic development of loggerhead sea turtles (*Caretta caretta*).** *Chelonian Conservation and Biology* 9(1): 1-7, 2010.

Notes: The purpose of this study was to determine the effects of short-distance nest relocation on nest parameters and embryonic development of loggerhead sea turtles (*Caretta caretta*). The nesting biology of the loggerhead sea turtle was studied on Blackbeard Island National Wildlife Refuge in 2005 and 2006 during the nesting season. Research nests were randomly assigned 1 of 2 treatments (**in situ** or relocated). **In situ** nests ($n = 35$) were left in the original location, while relocated nests ($n = 34$) were moved above the spring high-tide line and into areas that were considered to have favorable nesting conditions. Data-loggers were placed in the center of nests to record the temperature during incubation. Incubation durations, nest temperatures, hatch success, and hatchling straight carapace lengths were compared for all research nests. The observed nests showed similar nest parameters and embryonic development regardless of nest treatment. Differences in nest parameters and embryonic development seemed to be driven by abiotic conditions of the nesting site. This study shows that nest relocation can be used to alleviate nests of extreme abiotic conditions to increase hatch success, without altering embryonic development.

Steckenreuter, A., Pilcher, N., Kruger, B., and Ben, J. **Male-biased primary sex ratio of leatherback turtles (*Dermochelys coriacea*) at the Huon Coast, Papua New Guinea.** *Chelonian Conservation and Biology* 9(1): 123-128, 2010.

Notes: This study investigated the sex ratio of leatherback turtle hatchlings along the Huon Coast, Papua New Guinea, from January to March 2007. Results show that this population predominantly produces male hatchlings throughout the peak of the nesting season. The long-term decline of leatherback nesting along the Huon Coast, in conjunction with the highly male-biased sex ratio, presents serious challenges for the management and recovery of the western Pacific leatherback meta-population.

Fuentes, M.M.P.B., Limpus, C.J., Hamann, M., and Dawson, J. **Potential impacts of projected sea-level rise on sea turtle rookeries.** *Aquatic Conservation: Marine and Freshwater Ecosystems* 20(2): 132-139, 2010.

Notes: 1. Projected sea-level rise (SLR) is expected to cause shoreline erosion, saline intrusion into the water table and inundation and flooding of beaches and coastal areas. Areas most vulnerable to these physical impacts include small, tropical low-lying islands, which are often key habitat for threatened and endemic species, such as sea turtles. 2. Successful conservation of threatened species relies upon the ability of managers to understand current threats and to quantify and mitigate future threats to these species. This study investigated how sea-level rise might affect key rookeries (nesting grounds) ($n = 8$) for the northern Great Barrier Reef (nGBR) green turtle population, the largest green turtle population in the world. 3. 3-D elevation models were developed and applied to three SLR scenarios projected by the IPCC 2007 and an additional scenario that incorporates ice melting. Results indicate that up to 38% of available nesting area across all the rookeries may be inundated as a result of SLR. 4. Flooding, as a result of higher wave run-up during storms, will increase egg mortality at these rookeries affecting the overall reproductive success of the nGBR green turtle population. Information provided will aid managers to prioritize conservation efforts and to use realistic measures to mitigate potential SLR threats to the nGBR green turtle population.

Sales, G., Giffoni, B.B., Fiedler, F.N., Azevedo, V.G., Kotas, J.E., Swimmer, Y., and Bugoni, L. **Circle hook effectiveness for the mitigation of sea turtle bycatch and capture of target species in a Brazilian pelagic longline fishery.** *Aquatic Conservation: Marine and Freshwater Ecosystems* 20(4): 428-436, 2010.

Notes: 1. Incidental catches by the pelagic longline fishery is a major global threat for loggerhead (*Caretta caretta*) and leatherback (*Dermochelys coriacea*) sea turtles. 2. The reduction of incidental capture and post-release mortality of sea turtles in the Brazilian pelagic longline fishery, operating in the south-western Atlantic Ocean, was investigated by comparing the performance of 18/0 circle hooks with 9/0 J-type (control) hooks. Hook selectivity experiments were performed between 2004 and 2008, in a total of 26 trips, 229 sets and 145 828 hooks. The experimental design included alternating control and experimental hooks along sections of the mainline. 3. An overall decrease in capture rates for loggerhead turtles of 55% and for leatherbacks of 65% were observed when using circle hooks. In addition, deep-hooking in loggerheads decreased significantly from 25% using J-hooks to 5.8% with circle hooks, potentially increasing post-release survival. 4. Circle hooks increased catch rates of most of the main target species, including tunas (bigeye *Thunnus obesus* and albacore *T. alalunga*), and sharks (blue *Prionace glauca* and requiem sharks of the genus *Carcharinus*), with no difference in the capture rates of yellowfin tuna (*T. albacares*), shortfin mako shark (*Isurus oxyrinchus*), hammerhead sharks (*Sphyrna lewini* and *S. zygaena*), and dolphinfish or mahi mahi (*Coryphaena hippurus*). On the other hand, a significant decrease in the capture rate of swordfish (*Xiphias gladius*) was detected when using circle hooks. 5. Overall, results support the effectiveness of using circle hooks for the conservation of loggerhead and leatherback sea turtles, with positive effects on capture of most target species of the south-western Atlantic longline fishery.

Moore, J.E., Cox, T.M., Lewison, R.L., Read, A.J., Bjorkland, R., McDonald, S.L., Crowder, L.B., Aruna, E., Ayissi, I., Espeut, P., Joynson-Hicks, C., Pilcher, N., Poonian, C.N.S., Solarin, B., and Kiszka, J. **An interview-based approach to assess marine mammal and sea turtle captures in artisanal fisheries.** *Biological Conservation* 143(3): 795-805, 2010.

Notes: Recent case studies have highlighted high bycatch mortality of sea turtles and marine mammals in artisanal fisheries, but in most countries there are few data on artisanal fishing effort, catch, or bycatch. With artisanal fisheries comprising >95% of the world's fishermen, this knowledge gap presents a major challenge to threatened species conservation and sustainable fisheries initiatives. We report on results from an intensive pilot study to evaluate whether interview surveys can be effective in assessing fishing effort and threatened species bycatch. Fisheries and bycatch data from interviews with >6100 fishermen in seven developing countries were collected in <1 year for approximately USD \$47,000, indicating that this approach may rapidly yield coarse-level information over large areas at low cost. This effort provided the first fisheries characterizations for many areas and revealed the widespread nature of high bycatch in artisanal fisheries. Challenges to study design and implementation prevented quantitative estimation or spatial comparisons of bycatch during this pilot research phase, but

results suggested that annual sea turtle bycatch may number at least in the low thousands of individuals per country. Annual odontocete bycatch may number at least in the low hundreds per country. Sirenian bycatch occurred in all study areas but was frequent only in West Africa. We discuss lessons learned from this survey effort and present a revised protocol for future interview-based bycatch assessments.

Schofield, G., Hobson, V.J., Lilley, M.K.S., Katselidis, K.A., Bishop, C.M., Brown, P., and Hays, G.C. **Inter-annual variability in the home range of breeding turtles: Implications for current and future conservation management.** *Biological Conservation* 143(3): 722-730, 2010.

Notes: We assessed home range size for breeding loggerhead turtles (*Caretta caretta*) near the limit of the species range at the Greek island of Zakynthos in the Mediterranean. Thirteen adult females and seven adult males were tracked using GPS units (loggers and transmitters) during May and June of 2006, 2007 and 2008. Kernel analysis indicated that core home range sizes (50% estimator; range: 2.9-19.7 km²) for both males and females were restricted to a 7.5 km tract of coastline. 15% of GPS locations fell outside of the national park protection zones, while within the protected breeding area 88% of GPS locations occurred in zones of minimal protection. Female home ranges were 64% larger in 2008 than in 2006 and 2007, indicating that several years monitoring may be required for the most effective designation of marine protected areas (MPAs). Ten of the tracked females departed the core breeding area on 15 occasions for periods of 1-15 days travelling distances of 10-100 km, although none nested at alternative breeding sites. The inter-annual variability of breeding area home range size and likelihood of incidence of forays appeared to be correlated with barometric pressure. The movement responses of loggerheads to environmental conditions implicates an ability to switch nesting areas over small scales in response to climate change. However, such behaviour suggests the protection of existing core breeding sites may be inadequate, with policy makers being required to consider the protection of broader areas to encompass potential changes in the habitat needs of this species.

Hamman, M. et al. **Global research priorities for sea turtles: informing management and conservation in the 21st century.** *Endangered Species Research* 11(3): 245-269, 2010. O/A

Notes: Over the past 3 decades, the status of sea turtles and the need for their protection to aid population recovery have increasingly captured the interest of government agencies, non-governmental organisations (NGOs) and the general public worldwide. This interest has been matched by increased research attention, focusing on a wide variety of topics relating to sea turtle biology and ecology, together with the interrelations of sea turtles with the physical and natural environments. Although sea turtles have been better studied than most other marine fauna, management actions and their evaluation are often hindered by the lack of data on turtle biology, human-turtle interactions, turtle population status and threats. In an effort to inform effective sea turtle conservation a list of priority research questions was assembled based on the opinions of 35 sea turtle researchers from 13 nations working in fields related to turtle biology and/or conservation. The combined experience of the contributing researchers spanned the globe as well as many relevant disciplines involved in conservation research. An initial list of more than 200 questions gathered from respondents was condensed into 20 metaquestions and classified under 5 categories: reproductive biology, biogeography, population ecology, threats and conservation strategies.

Valverde, R.A., Wingard, S., Gómez, F., Tordoir, M.T., and Orrego, C.M. **Field lethal incubation temperature of olive ridley sea turtle *Lepidochelys olivacea* embryos at a mass nesting rookery.** *Endangered Species Research* 12(1): 77-86, 2010. O/A

Notes: Hatching success in olive ridley mass nesting arribada beaches is typically low. We conducted a short study to understand whether incubation temperature in dry months accounts for exceedingly low hatching success at Ostional Beach, Costa Rica, a mass nesting rookery. We measured *in situ* incubation temperatures in nests from 4 arribadas recorded in October to December 2008, and January 2009. Mean incubation temperatures for all months exceeded the upper lethal limit of 35°C, and no nests produced hatchlings when incubated at this or higher temperatures. Embryo development was inversely related to mean incubation temperature. Hatching success was low (2%) for the study period, and only 5 of 37 marked nests produced hatchlings. Mean incubation temperature for successful nests was <35°C. Since incubation temperatures of 32°C and higher recorded during the gonadal thermosensitive period were above the mean pivotal temperature of 30.5°C, the few

hatchlings produced were presumably female. Incubation temperatures were significantly higher during the second and third trimesters of incubation during all months as a result of metabolic heating. However, during January to March when embryos did not develop, higher incubation temperatures of **in situ** nests relative to controls indicated that heating was a result of microbial activity associated with egg decomposition. Our study demonstrates that after the onset of the dry season, incubation temperatures at this beach become lethal.
