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This document is a compilation of missing abstracts belonging in the 'Proceedings of the thirty-first annual symposium on sea turtle biology and conservation'. These abstracts have been incorporated into the current electronic version of TM-631, November 2012. Blank pages have been added for personal printing purposes and filing by subject.

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Conservation Through Social, Economic, Cultural, and Legal Pathways

SURPASSING THE WILDEST OF EXPECTATIONS: A NEWLY DISCOVERED HAWKSBILL (*ERETMOCHELYS IMBRICATA*) NESTING ROOKERY IN THE ESTERO PADRE RAMOS NATURAL RESERVE, NICARAGUA, PROVIDES NEW HOPE FOR RECOVERY OF THE SPECIES IN THE EASTERN PACIFIC*

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The hawksbill turtle (*Eretmochelys imbricata*) is a Critically Endangered species and is considered particularly threatened in the Eastern Pacific Ocean (EP), where it faces potential extirpation. While several remnant hawksbill nesting sites have been identified in the EP over the past two years, the majority of these rookeries are small (i.e. <20 nests per season), providing limited opportunities for research, conservation and population increase (i.e. through increased hatchling recruitment). Sea turtle conservation efforts in Nicaragua date back more than 30 years, but reports of hawksbill nesting along the country's Pacific Coast have remained scarce. Nonetheless, following clues provided by local community members and organizations of the Nicaraguan Sea Turtle Conservation Network, in 2009 we identified the Estero Padre Ramos Natural Reserve, a mangrove estuary located in northwest Nicaragua, as a potential nesting site for *E. imbricata*. Between May and October 2010, we developed a monitoring and conservation project in the area, the logistics of which have been particularly challenging due to the nesting characteristics exhibited by hawksbills at the site: scattered nesting on small beaches throughout the estuary at low density (e.g. 0-5 nests per night). The project successfully confronted these obstacles by implementing a community incentive program, ensuring the cooperation of locals in the location of nesting hawksbills and resulting in a near 100% nest protection rate. This approach has also facilitated local participation and ownership of the project, two cornerstones of the project's success to date. The first season of the project has surpassed even the most optimistic of expectations. A total of 280 hawksbill nesting events were recorded, representing approximately 40-50% of the known annual hawksbill nesting population in the EP and the most nests documented at any one site during any given year in the region. Additionally, a total of 75 nesting females were marked with flipper tags, allowing us to obtain unique biological data for the species, including the first robust estimates of re-nesting intervals and frequencies for hawksbill turtles in the EP. Such information is fundamental to the accurate evaluation of the population and effective management of the species. Our research has identified the Estero Padre Ramos Natural Reserve as the most dense hawksbill nesting site identified to date in the EP, providing new hope for recovery of the species in the region. Despite the project's unparalleled successes to date, the area faces serious ecological threats, including unsustainable development, fishing with explosives and a lack of adequate management. Continued and increased conservation efforts at Estero Padre Ramos to combat these challenges will likely play a pivotal role in survival of hawksbill turtles in the EP.

KEY FACTORS FOR SUCCESSFUL SEA TURTLE CONSERVATION IN THE TURTLE ISLANDS, SIERRA LEONE*

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The Sea Turtle Conservation Programme – Sierra Leone (STCP-SL) coordinated by the Conservation Society of Sierra Leone (CSSL) was initiated in early 2000 and finally gained momentum in 2006. The presence of five species—green turtles, hawksbills, olive ridleys, leatherbacks and loggerheads—was recorded in Sierra Leone and threats identified were bycatch, egg and meat consumption, ornamental use, pet trade, vehicles on nesting beaches, sand mining and improper disposal of wastes. Socio-economic surveys indicated that most coastal communities rely heavily on coastal resources for their living. Therefore, a bottom-up approach has been the corner stone in the development of the sea turtle project in the Turtle Islands where sea turtles were once abundant on the beaches and in the waters. In 2007, a successful sea turtle programme was launched in these islands that have minimized negative impacts on sea turtle populations within 3 years of the project. This was achieved through meetings with locals to prioritise community needs, through addressing the needs within the limited budget of the STCP and through education/sensitisation meetings and workshops. The involvement of locals including youths and community leaders in the beach and bycatch monitoring, and other project activities have largely contributed to the success of the programme in the Islands. Building on a two-way communication and a joint commitment to identifying what works for the communities has always been our goal and priority. STCP-SL has seen projects fail because the implementing agencies determined the problems and the solutions without input from the communities. The key factors in the evolution of this project that contributed to the success of the sea turtle programme in the Turtle Islands, within a relatively short time period, are outlined in this study.

THE STATUS OF SEA TURTLE CONSERVATION IN VIEQUES, AN EXAMPLE IN COOPERATION BETWEEN GOVERNMENT AGENCIES AND NON GOVERNMENT ORGANIZATIONS

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There is an informational void on the status of sea turtles and the conservation efforts being carried out in Vieques and the role that this island plays in the overall conservation of these endangered species in Puerto Rico. Therefore we aim to present information on the sea turtle monitoring program that has been taking place in Vieques (both on and off the Vieques National Wildlife Refuge) since the U.S. Navy left the island and transferred the property to the Municipality of Vieques, the Puerto Rico Conservation Trust and the Department of the Interior. The U S Fish and Wildlife Service (USFWS) and the Department of Natural and Environmental Resources (DNER) in Vieques have taken the lead on this project and have been working closely with other conservation agencies, such as Sea Grant at UPR in Humacao, the Vieques Historical and Conservation Trust and primarily with TICATOVE, a local community based conservation group. Although the program is still relatively young we believe that it is proving itself to be successful and may be useful as a model to other municipalities in Puerto Rico or might even be adapted to other islands in the Caribbean that could benefit from the work done in cooperation with well-developed and trained community based conservation organizations. This program aims at establishing sea turtle conservation through social, economic, cultural and legal pathways.

PREPARING TOMORROW'S LEADERS THROUGH SEA TURTLE RESEARCH AND CONSERVATION

Joel Barkan

Ocean Discovery Institute

The future of humankind and our planet is reliant on innovation, strategic problem solving, and developing our leaders for the next generation. However, today we face a national crisis as a dearth of high quality science and conservation education is leaving tomorrow's leaders underprepared to address our greatest challenges. In the United States, the most promising untapped talent pool lies within our underserved communities – the population that is provided with the least access to science and stewardship opportunities. High quality science and environmental programs can awaken a love of science, build an environmental ethic, and motivate these young people to pursue careers in science and conservation. By engaging young people, from the most urban and diverse backgrounds, in ocean science education, scientific research, and environmental stewardship, ODI works to prepare tomorrow's science and environmental leaders. Partnering with scientists, ODI integrates authentic sea turtle conservation research into its programs. These programs provide participants with experiences that demonstrate how sea turtle conservation is relevant to their lives, build transferable knowledge of science and conservation principles, and develop research skills. Integrating authentic research and conservation priorities, has demonstrated remarkable results for the education and scientific community, including helping students to achieve previously unthinkable goals. These results include a generation of young people inspired to protect their natural resources, an increase in science knowledge by an average of 47% across school participants, and an increase in pursuit of science and conservation careers to 75% of students enrolled in college. We will highlight Ocean Discovery Institute's innovative model, research through partnerships with scientists and universities, and the impact this can make on the future leaders who will ultimately understand and protect our ocean resources.

COLOMBIAN NETWORK FOR THE CONSERVATION OF SEA TURTLES: A NEW GENERATION UNITED FOR THE SEA TURTLE CONSERVATION

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In Colombia, some people are dedicated to the conservation of sea turtles who visit our coast every year and through scientific work to understand their biology and ecology in order to access and try to mitigate the threats to which they are exposed. Our work involves local communities as key players in the conservation process. Historically, unilateral conservation efforts undertaken in our country to mitigate the threats to sea turtles have faced several problems related to the isolation of the work developed in different regions and its lack of continuity, which generates deficient conservation measures taking into account the complex life history of these species. The social network "Red Colombiana para la conservación de Tortugas Marinas" is a space created to know who is working in Colombia in the different areas in order to integrate efforts and knowledge that allow us to strengthen and spread our work nationally and internationally. The network plans to integrate the varied sectors to advance efforts to conserve sea turtles in their natural areas and to promote the exchange of experiences, and the standardization of methods through written reports and meetings, allowing periodical access to the state of conservation of resident stock population or the turtles that visits the Colombian coast. The priorities of the network are to socialize the information and experiences of its members and thus to promote scientific conservation programs, adequate to the local people, taking into account the environmental, economic and cultural issues. The goal is to involve as many people interested in marine turtle conservation as possible in order to conduct an empowerment about sea turtle conservation and everyone to contribute monitoring these species

in a continuous and organized manner. The network is open to national and international cooperation in the field of action such as research, environmental education and conservation. It permits the sharing of information and efforts, and promotes the implementation of appropriate management plans or measures to protect species in danger of extinction. It is necessary to carry out the dissemination of research to support policy initiatives and the community should be informed of what is happening with the sea turtles on the beaches and other habitats. To disseminate the research lines being developed in Colombia and to promote the science popularization is our responsibility and this space was created with these objectives.

PUUHONUA: PROTECTING HONU THROUGH EDUCATION AT WAIKIKI

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In 2009, over 4 million visitors came to Oahu, Hawaii. These visitors have a variety of expectations, and impact the island, its economy and resources, in various ways. Sightseeing opportunities and numerous beach or ocean-related activities are major reasons given by tourists for their visit. When these visitors treat the natural and cultural resources of the island with respect, residents and resources both benefit. When these same visitors relay their positive experiences with others in their home states or countries, conservation programs related to marine plants and animals may benefit. Focusing on the human dimensions of ecosystem-based management, PuuHONUa utilizes a two-part strategy to influence human behavior, particularly but not exclusively visitors, for the benefit of sea turtles in the Hawaiian Islands. Through partnerships with a number of visitor industry businesses, we distribute sea turtle awareness materials in high-density tourist locations on Oahu. In addition, we have developed an interpretive presentation at a partner hotel, coordinated and conducted by trained volunteer docents and hotel staff. Project content was developed in partnership with local resource managers, sea turtle specialists, and the representatives of the visitor industry. Reef Watch Waikiki is a project of the University of Hawaii Sea Grant College Program and funded by the Harold K.L. Castle Foundation, with support from the Waikiki Improvement Association. In addition to the promotion of PuuHONUa, we work to get local residents involved in biological monitoring (invasive algae and reef fish), monitoring of human uses of the beach and nearshore environments in the Waikiki area, and attending educational programs related to ocean health.

NEW TECHNIQUES FOR THE RESCUE OF SEA TURTLES AND FIELD DATA ASSESSMENT TO ESTIMATE THEIR POPULATION STATUS IN THE GULF OF VENEZUELA

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Worldwide there are several conservation strategies developed to increase sea turtle's (ST) survival, focusing on the most critical stages of their development, such as those at feeding grounds. Most of these strategies are active, that is, they must necessarily involve man to be really effective. One of many tools used in conservation strategies is the rescue of ST that interact with fisheries (artisanal and industrial), which has been widespread through several guides and methods that explain an easy, fast and effective application of first aid, tagging mode or different release procedures, among others. In the northwestern region of Venezuela, specifically in the Gulf of Venezuela, the Grupo de Trabajo en Tortugas Marinas del Golfo de Venezuela (GTTM-GV, by its Spanish acronym) has been working with a methodology called the "Red de Aviso Oportuno del Estado Zulia" (RAO-Zulia), which through a call from a fishing port where it has been captured incidentally a ST starts the actions to its rescue and early release. Gradually, we have been improving some details and through the education and teaching of the Wayuu communities (indigenous fishing) the chances of survival of ST individuals has improved. Based on the experience and expertise

gained both by fishermen and by the research team, we have added some modifications to the previous work protocols (f.e.: metal tag loss). Therefore, the protocol for assessing field data of rescued ST begins with traditional biometrics: curved carapace length (CCL), curved carapace width (CCW), and weight in kilograms. Then we remove with a scalpel epibionts present on the carapace, head, and plastrom of the animal and store the samples in Eppendorf tubes and plastic bags properly labeled. All the samples are fixed with ethanol and/or iodine, depending on the sample predominant proportion of fauna/flora respectively. Later on, we take detailed photographs of their profiles and dorsal head region, in order to create a database of photographs for photo-identification of recaptured individuals that have lost the metal tags; we also take photographs of the carapace and some remarkable characteristic on the body (scars, deformity, fibropapilloma, etc). Finally we evaluate whether the animal should be admitted to an urgent rehabilitation process or be immediately returned to their natural habitat. In the latter case, we proceed to put two Monel metal tags: the first one in the second scale of the right flipper, and the other between the first and second scales of the left flipper. Under this new methodological scheme of work, during 2009 and 2010, 114 ST have been released, from which 85.08% were green turtles (*Chelonia mydas*), 7.01% loggerheads (*Caretta caretta*), 6.14% hawksbills (*Eretmochelys imbricata*) and 1.75% olive ridleys (*Lepidochelys olivacea*). We recommend continuing the application of these new techniques, as well as adding new protocols or methods to complete effective conservation work.

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Foraging, Physiology, and Movements

HAWAIIAN GREEN TURTLES UP AND DOWN THE ANAHULU RIVER

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Green turtles (*Chelonia mydas*) have become very numerous and popular in Hawaii. Tourists flock to see them on the North Shore of Oahu most notably at Laniakea Beach causing traffic congestion and safety concerns. Here we provide preliminary information on what may be some of the densest concentrations of green turtles in the Hawaiian Archipelago outside of seasonal nesting at French Frigate Shoals. Green turtle movements were monitored by visual counts at the Anahulu River mouth at Haleiwa for a total of 9 evening and 2 morning observation sessions during the months of September and October 2008- a period of almost no surf or rainfall on Oahu's North Shore. During 22 hours of observation 968 green turtle sightings were made moving either upstream or downstream. 122 (12.6%) were recorded as being juveniles <50 cm, and 87.4% as either sub-adults or adults. The greatest number seen (N=205) was during a morning observation session; most were moving downstream, while 31 were moving upstream (although some may have been counted more than once). In other instances sightings were not as impressive with as few as 11 turtles observed during a 120 minute evening viewing session. Up to 20 individuals were recorded during a 5-minute period. On average during a 2-hour viewing session 88 individuals were recorded. All turtles appeared in good health, with only 1% being recorded with tumors and 2 with missing fins. One turtle was observed with fishing line and a plastic bobber attached to its fin, but it was moving freely. A total of 26 adult males were identified but no gender breakdown was determined during observations unless a lengthened tail was obvious. We satellite tagged two of the turtles and confirmed heavy use of the Anahulu River habitat, along with adjacent sea areas of Kaiaka, Waialua, and Haleiwa. The tracks clearly showed the turtles moving up and down the river, inland as far as approximately 3 km. A hypothesis for these movements may be related to the safety the river provides, as most predators like large tiger sharks apparently do not venture up the river. The Anahulu River mouth was observed to be an area of considerable water-based recreational activities including swimming, stand-up, canoe and kayak paddling and fishing. The human activities appeared to have little or no impact on the turtles' movements. Tides and water flow appeared to be greater issues for the turtles. At certain times of the year, and periods of the day, the Anahulu River mouth may be one of the best and safest areas in all of Hawaii to view turtles in their natural environment. This study documents what may be one of the most significant green turtle resting habitats in the Hawaiian Islands and further monitoring and investigation are highly recommended.

DIET OF THE OLIVE RIDLEY TURTLE, *LEPIDOCHELYS OLIVACEA*, ALONG THE COAST OF SERGIPE, BRAZIL

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The diet of olive ridley sea turtles, *Lepidochelys olivacea*, was studied along the coast of the state of Sergipe, Brazil, through the analysis of 30 stomach contents of stranded animals found on shore, from August 2008 to September 2009. Prey items were grouped in categories and identified to the lowest taxonomic level possible. The items were ranked based on the frequency of occurrences and the relative volume of each category, and an index of relative importance (IRI) was calculated to estimate the importance of each prey item in the diet. The analyzed specimens had curved carapace lengths (CCL) ranging from 61.0 to 74.0 cm (mean = 68.1 cm; SD = 3.43 cm) with 93.3% larger than the minimum CCL known for nesting females (62.5 cm). We were able to assign sex of 16 turtles: 4 males and 12 females. Among the 30 analyzed stomach contents, 16 (53%) had some food

items while 14 (47%) were empty. Six large categories were created according to their taxa: Osteichthyes (bony fishes), Crustacea, Mollusca, Sediment, Digested Organic Matter (DOM) and Non Identified Material. A total of 14 taxa was identified. Regarding volume, the most important groups were Osteichthyes and Crustacea, responding for 59.5 and 24.7% of the food content volume, respectively. Meanwhile, the most frequent food items in the turtles´ stomachs were: Crustacea (56.2%), DOM (37.5%), Osteichthyes (31.2%) and Sediment (25%). Eggs were found in the reproductive tract of 10 females. Four of these reproductively active females had food in their stomachs, suggesting feeding activity during their reproductive period. Two females in which no eggs were found had CCL of 64.0 and 73.0 cm, both number higher than the minimum CCL known for nesting females. The results indicate that the *L. olivacea* that inhabit the coast of Sergipe are carnivorous with preferences for benthic decapods, using opportunistic resources such as demersal fishes and fishery discards.

INDIVIDUAL BASED MODELING OF GREEN TURTLE POPULATIONS IN SOUTH-WEST OF INDIAN OCEAN(SWIO): A LINK BETWEEN SPATIAL CONSTRAINTS AND BIOLOGICAL PROCESSES

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In the case of sea turtles, migrating thousands of kilometers, space and spatial structure play a very critical role with important consequences at population level. Individual based modeling offers a great opportunity to take space explicitly into account in a very intuitive manner. We developed a computer simulation on green turtles (*Chelonia mydas*) in the South West Indian Ocean (SWIO) using the freeware NetLogo 4.1.1, a multi-agent programmable modeling environment. Our simulation world explicitly represents the SWIO region. Turtles are modeled as individuals (or agent) that can feed, migrate or breed. Nesting sites and feeding grounds have been accurately implemented according to current knowledge in the region. Each turtle is associated with an energetic status. Energy intake takes place exclusively on feeding grounds. Energy expenditure depends on turtle action. At this stage, only adult individuals are considered. Simulations are run over time for a range of energetic parameters. The simulation results helped us to assess how the regional spatial structure drives the repartition of green turtles populations from various rookeries. It also allowed to point out the possible migrating roads between well identified breeding and feeding sites. Moreover part of the conclusions have been validated by early results from a regional satellite tagging campaign. Another interesting output of the model is to empirically assess the consequences of space and energetic parameters over the individual remigration interval under different behavioral hypothesis. Nevertheless such results are rather hard to verify due to the long time scale involved. It is also interesting to notice that the modeling process itself helps in apprehending the biological subject because individual-based modeling requires very precise description of the underlying system. Finally, a considerable asset of our model framework is that it would require few efforts, if any, to be applied elsewhere outside the SWIO. Next step of the modeling process should take into account oceanic variables like sea surface temperature and sea currents. Moreover, future work should consider individual survival. This will help us understand how physical environment constraint spatial distribution of green turtles in the SWIO and how it affects population parameters and viability. We believe that improving the knowledge on mechanisms driving spatial distribution of sea turtles will lead to efficient conservation of these species migrating without borders. Individual based modeling emerges as a formalized and practical solution to achieve this goal.

FORAGING ECOLOGY OF LEATHERBACK SEA TURTLES IN THE WESTERN NORTH ATLANTIC DETERMINED THROUGH MULTI-TISSUE STABLE ISOTOPE ANALYSES

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Leatherback turtles, *Dermochelys coriacea,* are highly migratory, spending most of their lives at depth or offshore where their feeding habits are difficult to observe. Stable isotope analyses were used to investigate the foraging ecology of leatherbacks off Massachusetts, USA from 2005-2009. Stable isotope ratios of nitrogen and carbon were determined in whole blood, red blood cells, blood plasma, muscle, liver and skin from adult male, female and sub-adult leatherbacks. Isotopic values were grouped by body size (curved carapace length) and sex, and groups were tested for dietary differences. Gelatinous zooplankton samples were collected from leatherback foraging grounds using surface dip nets and stratified net tows, and prey contribution to leatherback diet was estimated using a two-isotope Bayesian mixing model. Significant size effects were found for δ13C values of skin and whole blood and δ15N values of red blood cells, while δ13C values of red blood cells, whole blood and blood plasma differed by sex. Mixing model results suggest that leatherbacks foraging off Massachusetts primarily consume the scyphozoan jellyfish *Cyanea capillata* and *Chrysaora quinquecirrha* and ctenophores, while a smaller proportion of their caloric intake comes from holoplanktonic salps and sea butterflies. Our results are consistent with historical observations of leatherback turtles feeding on scyphozoan prey in this region and offer new insight on size- and sex-related differences in leatherback diet. We thank C. Merigo, C. Innis, A. Myers, M. Dodge, G. Purmont, M. Leach, B. Sharp, S. Landry, M. Murphy, G. Tomasian, N. Fragoso, K. Sampson, R. Smolowitz, K. Hirokawa, J. Casey, S. Leach, J. Wilson, E. Eldredge, M. Dodd, T. Norton, , M. Zani, T. Naessig, K. Sutherland, K. Houtler, I. Hanley, P. Wiebe, A. Ouimette, B. Stacy, J. Wyneken, and the late J. Vickery and his crew of the R/V Marguerite. This work was conducted under the authority of the National Marine Fisheries Service Endangered Species Act Section 10 Permit #1557-03 and University of New Hampshire IACUC #060501, and funded by National Oceanic and Atmospheric Administration Grant #NA04NMF4550391 and National Fish and Wildlife Foundation Grant #2008-0076-000 to M. Lutcavage. Turtle disentanglement was conducted under the authority of NOAA 50 CFR Part 222.310 and supported by the Massachusetts Division of Marine Fisheries through the National Oceanic and Atmospheric Administration Grant #NA07NMF4720052. Additional funding was provided by the Cape Cod Commercial Hook Fishermen's Association. K.D. was supported by a UNH Marine Program Fellowship. Travel support was provided by International Sea Turtle Society, Western Pacific Regional Fishery Management Council, U.S. Fish and Wildlife Service, U.S. National Marine Fisheries Service and the International Sea Turtle Symposium.

FIRST SEA TURTLE SATELLITE TRACKING IN BANGLADESH

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Marinelife Alliance, conservation and research organization working for marine life particularly on sea turtle, cetacean, coral reefs and water birds along the coast and marine waters of Bangladesh. As part of sea turtle research we started satellite tracking on sea turtles to explore their critical offshore biological information needed to apply the conservation measures to save them. All sea turtlse are endangered throughout the world including Bangladesh. Most of the offshore scientific information is unknown to us about this rare animal and each year thousands of sea turtles die due to bycatch in Bangladesh marine waters. Sea turtles are highly migratory and share international waters including many countries maritime territory that increases their chance of being caught by various types of fishing nets spread over the vast marine waters. Bangladesh is signatory of the regional and international conventions and treaties to save the endangered sea turtle. To save these global flagship species we need to uncover

their migratory routes through which they come to breed and lay eggs in our long sandy beaches each winter, the coastal habitat they use during nesting season and pathways to long distance migrations at post nesting period. To understand this critical information we attached SPOT5 Satellite transmitters (PTT) on olive ridley and green turtle for the first time in Bangladesh. All the PTT of Wildlife Computer with output power 0.25 Watt, set in the 12h/24h Transmission Duty Cycle and speed limit to 0.5 m/s. The first Olive ridley named URMEE laid her last clutch on Sonadia Island on the 28th night and the PTT has been attached on 29 March, 2010 evening. This will reveal migratory routes of our sea turtles, depth they dive with temperature, nesting intervals and foraging habitat they use.

IDENTIFYING MIGRATORY PATHWAYS AND FORAGING HABITAT USE BY LOGGERHEAD TURTLES (*CARETTA CARETTA*) NESTING ON FLORIDA'S EAST COAST

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Nesting trends in Florida's loggerhead sea turtles have been the subject of concern among the scientific community, conservationists and the general public. Florida's beaches play a key role in the persistence of this species as they host the largest loggerhead rookery in the western hemisphere and the second largest in the world. An updated analysis of Florida's loggerhead nesting trend by the Florida Fish and Wildlife Conservation Commission indicates a nesting decline of 25% from 1998 to 2010. With the recent increase in nesting in 2010, it appears that the 22-year trend (1989 to 2010) may be stabilizing. Between 2008 and 2010, thirteen loggerheads nesting at the Archie Carr National Wildlife Refuge were fitted with satellite tags. Satellite tracking identified three major migratory pathways and foraging areas: (1) a seasonal North-South migratory pattern between Virginia and North Carolina; (2) a residency in southern foraging areas; and (3) a residency in an area adjacent to the nesting beach. Half of the individuals migrated north, revealing for the first time that the coast of the United States constitutes an extremely important feeding area for nesting loggerheads from Florida. Turtles that migrated north from Florida over the course of the year showed a seasonal movement between Virginia/Delaware (warmer months) and North Carolina (cooler months). Loggerheads moving south showed a year-round residency two feeding areas: Bahamas (n=2) and Florida Bay/Florida West Coast (n=2). The remaining loggerheads (n=3) did not make long post-nesting migrations. Instead they remained in the shallow waters off the east central Florida coast with no evidence of nesting activity. While in-water studies have consistently captured sub-adult loggerheads (less than 90 cm SCL) in these areas, there has been no documentation of these areas being important as a year round feeding area for Florida's nesting loggerheads. With the recent trends in Florida's loggerhead nesting numbers, it has become even more important to identify all of the pathways and areas being used by its nesting turtles as well as the threats to these turtles based on fisheries methods, seasons, and by-catch data. The results of this further analysis will be of importance to the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and the Florida Fish and Wildlife Conservation Commission in establishing better regulations to reduce by-catch in US fisheries, and for evaluating protections at both the National and State levels.

DEVELOPING AN AERIAL PHOTOGRAPHY AND AUTOMATED IMAGE PROCESSING METHOD TO QUANTIFY JELLIES, PREY OF THE CRITICALLY ENDANGERED LEATHERBACK TURTLE, *DERMOCHELYS CORIACEA*, IN SURFACE WATERS OFF CENTRAL CALIFORNIA

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We tested the efficacy of an automated method to quantify aggregations of moon jellies, *Aurelia* spp., from the sea surface to approximately 1m depth with aerial photographs taken with a 10 megapixel digital still camera. Images were obtained during

aerial line-transect surveys conducted at altitudes of 190-210m to assess distribution and abundance of the critically endangered leatherback turtle, *Dermochelys coriacea*, that migrates long distances to forage on jellies. Following existing protocols, jellies observed within the strip-transect under the plane (approximately 230m strip width) were recorded using a categorical index: none, low (0-30), moderate (31-300), or high (>300). Several photographs of each jelly category were chosen from different aerial surveys to minimize autocorrelation. For each photograph, jellies were manually counted using ArcGIS to obtain a proxy total number of individuals. A second, more automated method used a MATLAB program that: calibrated each aerial photo for water color, assessed the pixel color of jellies contained in the photo, and counted the total number of pixels containing jellies. Mean bell diameter was calculated by counting pixels from 100 randomly selected jellies in each photograph (mean±SD=15±3 pixels, assuming horizontal orientation) and converting to mean number of pixels occupied by each individual jelly. The number of jelly colored pixels was divided by the mean number of pixels per jelly yielding a second estimate for total number of jellies in each photo. A regression was used to test the relationship between the two count methods and indicated a significant, positive relationship (y=0.619(ArcGIS count)-17.240, r2=0.988, p<<0.001, n=9). A t-test indicated the regression slope was significantly different from 1.0 resulting in a downward bias in the automated MATLAB count. Preliminary results indicate the automated method is precise, but underestimates the count. Additional photos will be analyzed to refine the ArcGIS and MATLAB regression relationship so that future MATLAB jelly counts can be corrected using this equation. We conclude that the MATLAB method is efficient and has potential for use in tracking significant changes in the abundance of moon jellies in sea surface waters, thus allowing the development of a quantitative index of moon jelly biomass to support leatherback turtle prey studies and critical habitat assessments.

DETAILED MOVEMENTS OF A FEMALE GREEN TURTLE (*CHELONIA MYDAS*) DURING HOMING PROCESS IN COMOROS ARCHIPELAGO

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In July 2010 we deployed an Argos-linked GPS tag (MK10-AFB, Wildlife Computers) and a multi-sensor data-logger (W1000-3MPD3GT, Little Leonardo Co.) on a female green turtle nesting on a beach of Moheli Is., Comoros Archipelago, that was then transferred to an open-ocean release site 150 km south from the nesting beach. Having been captured early during her nesting season, the turtle was highly motivated to return to the nesting beach to complete the egg lying cycle, and this permitted us to recover the logger and to reconstruct in detail all the movements of the turtle during her homing trip. In this study we provide a basic description of the movements and behaviour of the turtle as derived from GPS locations and from data on her heading directions, dive profiles, flipper movements. The animal reached the shallow waters around the island 3 days after release, during daytime, and emerged to nest on Itsamia beach in the subsequent night, remaining one day swimming around the island. We subdivided the homing route obtained through satellite telemetry into two periods: the travelling period during which the turtle swam in the open ocean toward Moheli (3.5 days) and the island period, after her arrival in the shallow waters around Moheli (1.5 days), for a a total of 117 hours of registrations. Throughout the route, we recorded a total of 78 deep dives (> 15 m in depth), that were more abundant during night time (45 dives) than daytime (33 dives), when the turtles mostly performed superficial dives (< 5 m in depth). The deepest dive recorded was 44 meters deep, just before sunrise. During the two periods the turtle displayed different heading and diving behaviour, mainly heading northward during the travelling period and heading in a random way during the island one. In the travelling period the animal performed 10 deep dives in daytime and 30 dives during the night while during the island one the turtle dived at depth 23 times during the day and only 15 times during the night. During all the routes the dive profiles were different between day and night hours and changed radically between travelling and island periods. A more detailed analysis revealed that it is possible to subdivide the dives performed by the turtle into four different categories, each one typical of different behaviour achieved by the animal during its homing travel and that during all the dives

the turtle swam actively. In addition we compare the turtles' recorded heading directions with the oceanic surface currents encountered during the homing journey, to evaluate if they have played a role in determining the route followed.

SATELLITE TELEMETRY REVEALS NOVEL INSIGHTS INTO THE BIOLOGY AND CONSERVATION OF HAWKSBILL TURTLES (ERETMOCHELYS IMBRICATA) IN THE EASTERN PACIFIC OCEAN

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Elucidating spatio-temporal movements of organisms is an integral component of wildlife management and life-history characterization. In the case of hawksbill turtles (*Eretmochelys imbricata*), research in the Caribbean has found adults to be coral reef dwellers, with females undertaking long post-nesting migrations. Until recently, hawksbills were thought to have been essentially extirpated in the eastern Pacific Ocean due to scant reports of their presence and because coral reefs are relatively few in the region. Nonetheless, the recent identification of several remnant foraging and nesting sites created new opportunities for research and conservation. Here we report on a region-wide satellite telemetry effort that has tracked thirteen adult female hawksbills in the eastern Pacific. In contrast to the use of coral reef habitats by their Caribbean conspecifics, the majority of these turtles exhibit home ranges in mangrove estuaries. Post-nesting migrations for all turtles were extremely short (range: 18.1 km - 283.1 km), with several individuals remaining in local habitats after nesting. Our findings suggest that common perceptions of hawksbill habitat use and migrations, which have been largely Caribbean-based, have overlooked some key characteristics of eastern Pacific populations. The consistent use of mangrove habitats for foraging (and nesting) and non-migratory behaviors represent a new life-history paradigm for the species and may explain why hawksbills went virtually undetected in the eastern Pacific for decades. From a conservation standpoint, the spatially restricted and neritic life cycles of hawksbills present both threats and conservation opportunities for the species. Although a large proportion (>60%) of turtle location points fell within protected areas, many of these sites lack enforcement and monitoring. Our results underscore the importance of strengthening protected area management and mangrove conservation in the eastern Pacific, as well as hawksbill research and recovery efforts in this region. Furthermore, our findings highlight the variability in life-history strategies that sea turtles and other long-lived marine wildlife may employ among ocean regions. Special thanks to the Southwest Fisheries Science Center (NOAA), National Fish and Wildlife Foundation, International Sustainable Seafood Foundation and the US Fish and Wildlife Service for their critical and ongoing support of this research.

NEAR-SHORE DISPERSAL OF PAPUAN LEATHERBACK HATCHLINGS USING ACOUSTIC TELEMETRY

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As part of a multi-year effort to study the oceanic dispersal of leatherback hatchlings departing the nesting beaches of Papua's Bird's Head Peninsula (Indonesia), a pilot study was carried out to determine the most efficient tracking method and yield preliminary data on near-shore dispersal. Both acoustic and VHF (radio) tags were tested in the field, using stationary buoys and live hatchlings. The results show the superiority of acoustic tags in terms of directionality, the most important parameter when tracking small organisms at sea. This led to the development of an optimum setup for acoustic tracking and the first recorded tracks of western Pacific leatherback hatchlings. Fifteen trajectories with lengths of up to 7 km and 6 hours duration show the feasibility of the method and provide preliminary information on swimming behavior and surface currents that mediate dispersal. The high temporal resolution of the data enabled us to measure the impact of (1) the drag of the tracking set (bobber and transmitter) and (2) the influence of age at release (time elapsed between natural emergence and release for tracking) on displacement speed and swimming direction (offshore bearing). The results suggest that the tracking set slows down the displacement speed of the hatchlings by 38 %, however, when entrained in a Westward surface current, there was no difference in displacement speed of turtles dragging the tracking set vs. turtles swimming freely. Overall, hatchlings' swimming direction was not affected by the tracking set. The same results were obtained when comparing the displacement speed of turtles that emerged naturally from their nests vs. hatchlings dug up from hatched/predated nests ("stragglers"). Refining the analysis to take into account the age at release on displacement speed, it was found that hatchlings less than 24 hrs old swam significantly faster than hatchlings of 48 hours or more. Interestingly, "stragglers" performed better than 48+ hatchlings. The results suggest that when entrained in currents matching or exceeding their sustained maximum swimming speed, the tracking set did not influence hatchlings' swimming behavior. These findings furthermore suggest that hatchling dispersal is primarily influenced by their initial ability to become entrained in the strong near-shore current. Conversely, in calm waters, hydrodynamic drag becomes an issue. The impact of the hatchling's age on displacement speed provides additional evidence supporting the immediate release of hatchery turtles.

DISTRIBUTION AND SEASONAL MIGRATIONS OF JUVENILE GREEN TURTLES (*CHELONIA MYDAS*) IN DEVELOPMENTAL HABITATS OF THE SW ATLANTIC

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This study reports the habitat use of juvenile green turtles (*Chelonia mydas*) in developmental habitats of the SW Atlantic. From 2008 to 2010, we deployed satellite transmitters on 8 green turtles (mean CCL = 42.4 ± 3.7 cm, range = 38.1 – 47.8 cm, mean weight = 9.5 ± 2.9 kg, range = 6.8 – 14 kg) accidentally caught in an artisanal gillnet fleet of Argentina. The turtles transmitted an average of 193 days and more than 6600 locations were obtained. Locations were filtered and resampled, and then seasonal home ranges were estimated through Kernel method. During summer and fall, the turtles remained within the Argentine continental shelf (summer: 50%KDE = 11.200 km^2, 95%KDE = 58.272 km^2; fall: 50%KDE = 20.480 km^2, 95%KDE = 100.864 km^2), where they used only shallow waters close to the coast. By the end of the fall, the turtles migrated to southern Brazil, probably triggered by a decreased in water temperature. During winter and spring, turtles remained either in deeper waters far from the coast (30-35ºS) or used near-shore areas of Uruguay and Brazil (winter: 50%KDE = 38.688 km^2, 95%KDE = 158.096 km^2; spring: 50%KDE = 10.480 km^2, 95%KDE = 31.641 km^2). Tagged turtles travelled a net distance of 971 to 8.042 km (mean = 4.621 ± 2.425 km). Core habitats where the turtles spent most of their time included not only seagrass meadows (i.e. along the Brazilian coast), but also were associated with frontal, highly productive systems. An example of these systems is the Río de la Plata estuary, where an herbivorous diet cannot be sustained. Instead, this estuary is characterized by abundant gelatinous macrozooplankton on which turtles could feed. To our knowledge, this is the first study documenting seasonal migrations between foraging areas with different diet offers and the use of both neritic and oceanic habitats by small juveniles in the SW Atlantic. These results have conservation relevance because the same turtles that are accidentally captured by coastal fisheries of Argentina are also affected by coastal and pelagic fisheries of Uruguay and Brazil. We wish to thank the International Sea Turtle Symposium and all the generous donators (International Sea Turtle Society, Western Pacific Regional Fishery Management Council, U.S. Fish and Wildlife Service, and U.S. National Marine Fisheries Service) that allow us to attend at this symposium. Many thanks also to the Buenos Aires Zoo, Wildlife Conservation Society and the Inter-American Institute for Global Change Research for the financial support to this research.

FORAGING TRENDS OF HAWKSBILL TURTLES ON HAWAI`I ISLAND: A STUDY UTILIZING STABLE ISOTOPES AND SATELLITE TRACKING

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Results from satellite tracking studies on nine hawksbill females (*Eretmochelys imbricata*) that reside within the Hawaiian waters suggest that the majority of these females forage along the Hamakua Coast, on the northeastern side of Hawai`i Island. Prey preferences within this segment of the population are unknown; it has been assumed that the species prefers sponges at other sites. To date, the only foraging information on hawksbill females in Hawai`i comes from turtles observed in Maui waters feeding on marine invertebrates and algae at wide depth ranges. Hamakua Coast's relatively low hawksbill population density, limited access, and rough ocean conditions hinder traditional foraging research such as stomach content analysis and in-water observations. In the present study, stable isotope analytical methods were utilized to determine the dominant prey species of Hamakua Coast foragers by sampling post-nesting females. Since this coast is known to be a significant area for adult females, it is essential to understand forage species and behaviors, and stable isotope analysis allows for alternative approaches to species confirmation. Dive behaviors were also investigated. Two Hawai`i Island post-nesting females were outfitted with satellite transmitters with pressure sensor capabilities, one each in 2007 and 2008. Each unit was programmed to record percentage of time spent within 10m depth increments and to accumulate dive count over two-12 hour periods. A broad spectrum of potential prey organisms was collected from four different sites along the coast and epidermal tissues from four post-nesting females were sampled for stable isotope analyses. Carbon (δ13) and Nitrogen (δ15) values were entered in a two-source mixing model to determine contribution of prey resources in hawksbill diets. The two instrumented hawksbill females spent most of their time between 0-10m (74% - 97%) throughout 24 hours; however, one female infrequently dove as deep as 30m. Dive count ranged from 1.5 to 2.7 dives per hour. These data showed variations in feeding and resting activities, with a biphasic trend significant for only one of the two females. Foraging activity occurred as deep as 30m during morning to afternoon hours with resting in shallower water (<20m) occurring in the evening/night. Tissues of four females from three different foraging sites (O`ahu, Maui, and Hawai`i Island) resulted in a slight variation in δ13C (-14.3 per ml and -16.8 per ml) and no variation in δ15N. This suggests differences in prey species or inter-island disparity of carbon signatures among similar prey organisms. Out of 12 potential prey organisms collected, three sponge species constituted the highest carbon contribution to the Hamakua Coast forager's diet (meandering sponge, *Chondrosia* sp., X=86%, SD=12; one unknown sponge species, X=82%, SD=15; and vagabond boring sponge, *Spirastrella* cf. *vegabunda*, X=43%, SD=6). Despite this study's small sample size, these novel research methodologies for Hawaiian hawksbills yielded informative results, contributing significantly to previously limited knowledge of hawksbill foraging ecology. The expansion of this study is recommended, with findings applied to the conservation and management of this critically endangered species.

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Addendum: Missing Abstracts

Health and Rehabilitation

SURGICAL REMOVAL OF A HOOK FROM AN ADULT MALE LOGGERHEAD

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Sea turtle populations have declined over the past decades owing to anthropogenic threats. Entanglement in fishing nets, the swallowing of hooks and fishing lines and marine debris ingestion are the main causes of sea turtle deaths along the Brazilian coast. A 98 kg, adult male loggerhead, *Caretta caretta*, was found stranded on November 1st 2010, in the Linguado Channel, Babitonga bay, in Araquari municipal district, northern region of Santa Catarina state, Brazil. The turtle presented a fishery line exiting the cloaca which could possibly indicate the presence of a hook in his digestive tract. The animal was housed in the rehabilitation facilities of Tamar Florianópolis Station (Projeto Tamar-ICMBio) in Florianópolis, Santa Catarina, Brazil. Initially the turtle was kept out of the water, placed into a dry fiberglass container padded with foam. A light coating of vaseline ointment was applied over the entire carapace, head and flippers to avoid dehydration and to prevent the shell from drying out. A dorsoventral radiograph, confirmed the presence of a hook in the esophagus, close to the cranial portion of the plastron. The turtle was pre-anesthetized with 15 mg/kg of Ketamine and 0.5 mg/kg of midazolam (IM) and 5mg/kg of Propofol (IV). Anesthesia was induced slowly using a face mask with isoflurane and oxygen, and maintained with 1.5% isoflurane in 1 litre/min oxygen. A tracheal tube was inserted orotracheally for intubation. The turtle was kept under spontaneous ventilation manually assisted by Baraka system. The veterinarians attempted to retrieve the lodged hook, sliding an endoscope through the mouth into the esophagus. However, it was not possible to remove the hook. Surgical exploration was then performed to dislodge the hook from the esophageal wall. The turtle was placed in dorsal recumbency, and a 10 cm longitudinal midline incision was made on the ventral portion of the neck in order to assess the esophagus. A tube was inserted into the esophagus through the turtle's mouth to help with its identification. A longitudinal incision on the ventral esophageal wall was made to reach the hook. Then, the eye of the hook was cut and it was finally dislodged from the wall and removed through the incision. After a couple of hours the turtle completely recovered from anesthesia. The hook is a 5/0 J-type without offset, with monofilament nylon 0.60. Such hooks are used in different kind of fisheries, as coastal mahi-mahi (*Coryphaena hippurus*) longline, coastal red porgy (*Pagrus pagrus*) longline, trolling for mahi-mahi, among others. This article discusses the anesthetic and surgical procedures used for a hook removal of an adult male loggerhead in Florianópolis, Santa Catarina, Brazil.