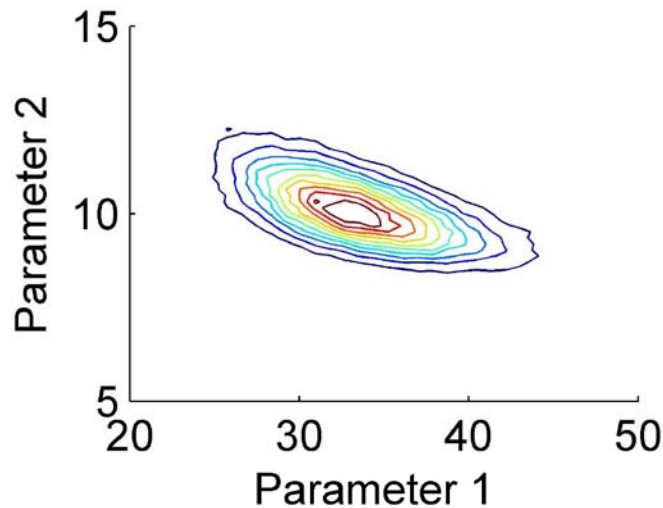


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Contour plot of random samples from a joint posterior distribution, where the height of the distribution is described by the contour lines (from Eguchi's introduction to Bayesian statistics, see pp. 1-5).

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An Introduction to Bayesian Statistics Without Using Equations

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Recently, Bayesian statistics have become a common analytical tool in ecological and biological studies. In 1996, the journal *Ecological Applications* had a special section on Bayesian Inference (Vol. 6, Issue 3). In the issue, one introductory note and seven articles were published, of which one was a technical introduction (Ellison 1996), four were applications (Ludwig 1996, Taylor *et al.* 1996, Ver Hoef 1996, Wolfson *et al.* 1996), and two were discussions of the Bayesian inferential process (Dennis 1996, Edwards 1996). The series of papers clearly describes how Bayesian statistics can be used in ecological studies, as well as the opposite viewpoint expressed by Dennis (1996). Others also have contributed materials to introduce the Bayesian concept to biologists and ecologists (Clark 2007, Reckhow 1990, Wade 2000, Wade 2001). To keep this note short and succinct, I refrain from reviewing the differences between Bayesian and traditional statistical approaches. Readers who are not familiar with the differences may consult the paper by Ellison (1996) or other Bayesian textbooks (e.g., Bernardo & Smith 1993, Clark 2007, Gelman *et al.* 2004, Lee 1997).

The rapid spread of the Bayesian approach among some ecological statisticians (or statistical ecologists) in the past few years has resulted in a bimodal trend of data analysis as some “traditional” ecologists, who are not well versed in mathematics, remain in the comfort zone of the traditional approaches, such as hypothesis testing, learned in introductory statistics classes. The mystery of Bayesian statistics is exacerbated by the lack of user-friendly software, which would facilitate the teaching of the principles to a general audience. Furthermore, publications with Bayesian statistics often contain mathematical equations and the terminology, which are not thoroughly explained in many instances. As Mrosovsky (2006) pointed out, methods of a scientific study should be explicitly stated in a publication so that readers can judge the validity of the reported findings. Simultaneously, in order for the readers to be a critical audience, they must learn the language and concepts of Bayesian statistics.

The goals of this paper are (1) to introduce the concepts of Bayesian statistics and (2) to point out some critical features of Bayesian statistics such that publications with Bayesian statistics can be read critically by a wider audience. Although many papers and books have been written to introduce Bayesian statistics in the past, all of them contained equations. In this short note, the basic concepts of Bayesian statistics are presented and explained in the absence of equations. This note is neither a comprehensive summary of Bayesian statistics in ecological studies nor a how-to guide to be used for data analysis. Rather, it explains the basic Bayesian principles in plain English. For those who seek a more comprehensive understanding of Bayesian statistics, consult the cited papers and reputable textbooks. Finally, coursework in Bayesian statistics classes ensures an understanding of and comfort with the Bayesian analytical approach in ecological studies.

Concepts of Bayesian statistics. The basic concepts of Bayesian statistics has been explained eloquently by some prominent ecologists, e.g., Dixon & Ellison (1996), Reckhow (1990), and Wade (2000). In a nutshell, Bayesian statistical methods are used to compute a probability distribution of parameters in a statistical model, using data and the previous knowledge about the parameters. Parameters are the unknown quantity of interest in a study. For example, if you are interested in determining the trend of a population, the population growth rate is the parameter of interest. For another example, to assess the size of a population, the abundance is the parameter of interest. In a simple linear regression analysis, the slope and intercept of the regression line are the two parameters of interest.

In a non-Bayesian statistical analysis, we have learned to treat a parameter as a fixed quantity without a distribution. We also have learned not to use prior knowledge about the parameter in the analysis. In Bayesian statistics, we consider a range of parameter values, where the possibility of any parameter value given the observed data is expressed with a probability, whereas the uncertainty about the parameter value is described with a “width” of the distribution. Some values are more likely than others, which is depicted by the difference in the height of the distribution (Figure 1). If all parameter values are equally likely, the distribution has an equal height over all possible parameter values. The curvature

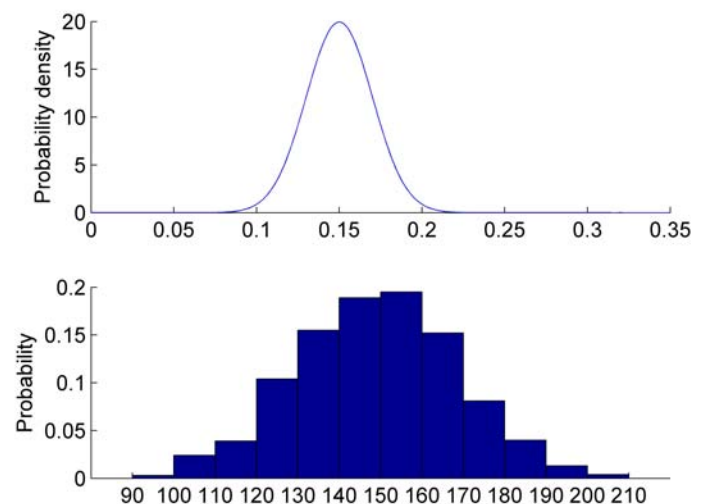


Figure 1. Examples of continuous (top) and discrete (bottom) probability distributions. The continuous distribution is a normal distribution with mean 0.15 and standard deviation 0.02. The discrete distribution was created from 1000 random numbers generated from a normal distribution with mean 150 and standard deviation 20. The 1000 random numbers were grouped into 12 equal-width bins.

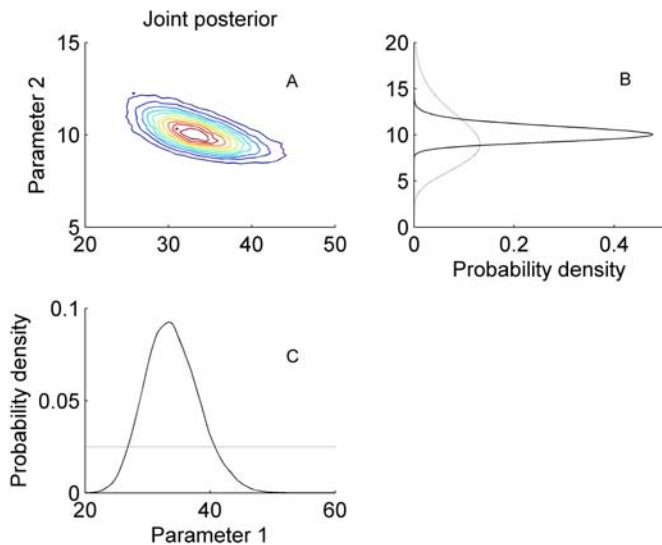


Figure 2. An example of numerically obtained joint and marginal distributions of a posterior distribution with two parameters. The top left figure (A) is a contour plot of random samples from the joint posterior distribution, where the height of the distribution is described by the contour lines. The top right figure (B) is the marginal distribution of one parameter (Parameter 2). This can be seen by looking at the joint posterior (A) from the y-axis in (A), ignoring the x-axis. The dashed line indicates the prior distribution for the parameter (informative prior). The bottom left figure (C) is the marginal distribution of the other parameter (Parameter 1). This can be seen by looking at the joint posterior (A) from the x-axis, ignoring the y-axis. The dashed line is the prior distribution (flat prior).

or shape of the distribution is defined by the functional form, i.e., a mathematical equation of the probability distribution, which is governed by one or more parameters, e.g., mean and variance.

At the end of a Bayesian analysis, a probability distribution of parameters, called the **posterior distribution** (or simply posterior), is obtained. This distribution is a result of the combination of the prior knowledge about the parameters (called the **prior distribution** or prior), newly collected data, and a statistical model. The statistical model describes, in a mathematical form, the relationship between the parameters and the data. When there are multiple parameters in an analysis, the posterior distribution of the parameters is called the **joint posterior distribution** (or joint posterior). This part of the analysis also informs about the relationship between the parameters, i.e., correlations between parameters. To make inference on just one parameter, we disregard the other parameters from the posterior distribution (Figure 2). This process is completed by the method of integration. Imagine a two-parameter situation as in Figure 2. If you tilt and rotate the joint posterior distribution (looks like a hill) to such an angle that you can see only one axis, you have just integrated the joint posterior along the other axis. Such distribution is called a **marginal posterior distribution** (or marginal). For a two-parameter model, a marginal posterior distribution can be visualized by changing the angle of the posterior distribution (Figure 2). For a higher dimension, analytical or numerical integration is necessary to obtain a marginal distribution.

Statistical model: A statistical model describes the relationship between the parameters and data. It summarizes the stochastic process which produced the data. It is also called a **likelihood function**, because it is used to compute which values of the parameters of the model are most likely to have produced the data we have observed. For example, you may conduct a capture-mark-recapture study to estimate the abundance of a population. The data, consequently, are series of capture/non-capture data for identified individuals. Such data need to be linked to your parameters, such as abundance, capture probabilities, and survival rates. Often, statistical models already exist for standard sampling protocols, such as mark-recapture. Make sure to follow the required sampling protocol so that assumptions in the chosen statistical model are met. With non-standard sampling, especially opportunistically collected data, more creativity may be necessary to build your own statistical model(s). The old adage about the importance of proper sampling to obtain valid results, “garbage in, garbage out” (Krebs 1989, p. 9), applies also to the Bayesian approach. Bayesian statistics, or any other analytical tools, should not be considered as a replacement for well-designed studies. Regardless of the use of Bayesian statistics, modeling is not a replacement for well-thought sampling and experimental designs and meticulous data collection practices. Statistical modeling does not and cannot save a poorly designed and executed study.

Although they may not be explicitly stated, statistical models are used in many analyses. For example, the normal distribution is used as its statistical model in a simple linear regression analysis. It is assumed that the response (or dependent) variable is distributed normally with a mean and variance, given a specific value of the predictor (or independent) variable. The implicit assumption is that the mean changes linearly with the independent variable, whereas the variance remains constant across all observed values of the independent variable (Figure 3).

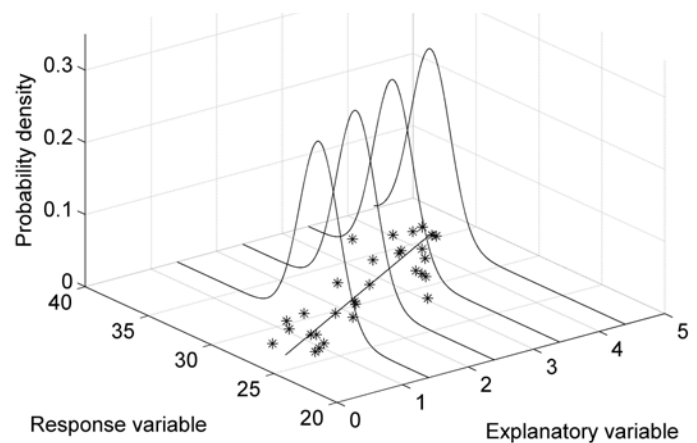


Figure 3. A schematic diagram of a linear regression analysis, where data ($n = 30$, indicated by *) were generated from the linear function with the slope = 2.5, intercept = 25.0, and standard deviation = 1.5. The estimated parameters using a linear regression were slope = 2.45, intercept = 25.3, and standard deviation = 1.48. The estimated regression line is shown as a straight line, whereas four normal distributions indicate the assumed normal distributions of data at four values of the explanatory variable (1.4, 2.4, 3.4, and 4.4)

Previous knowledge about parameters: The Bayesian philosophy about the distributions of parameters allows us to use the previous knowledge of the parameters to construct a distribution before collecting and analyzing data. The previous knowledge is updated with new data and a likelihood function via Bayes' theorem, which is a well-known theorem in mathematical statistics. Bayes' theorem guarantees that the probability of a specific value of the parameter is proportional to the product of the probability of the parameter value before seeing and analyzing the data and the probability of obtaining the observed data if the parameter value is true. The probability distribution of the parameter prior to analyzing your current data is called the prior distribution. In a Bayesian statistical analysis, each parameter requires a prior distribution. Consequently, you will have multiple prior distributions in multi-parameter situations. Because a prior distribution can be selected arbitrarily, this term of the Bayesian approach is a contentious issue between Bayesians and anti-Bayesians. Anti-Bayesians point out the potential subjectivity of prior distributions (e.g., Dennis 1996, Dennis 2004). In other words, prior distributions may be very different among researchers, even if the same parameters, likelihood function, and data are used in an analysis. The anti-Bayesians have made a good argument that one's belief should not influence a scientific study. Many Bayesian practitioners would agree with the idea of not incorporating someone's belief in a data analysis. Avoiding one's belief in a scientific study, however, is not limited to Bayesian statistics. Any scientist should avoid being influenced by his/her belief when data are analyzed and results are interpreted.

How can we build an objective prior distribution? Some have used **non-informative prior distributions**. A non-informative prior distribution represents the equal probability of all possible parameter values (Figure 4). The phrase 'non-informative' is not really an appropriate term because a 'non-informative' prior distribution provides information about the equal probability of all parameter values within a certain range. This terminology, however, is conventional. We must be cautious that a non-informative (or flat) prior distribution may be not so non-informative when the parameter is transformed. For example, you may decide to set a non-informative prior distribution on the standard deviation. We know that the square of the standard deviation is the variance, which should provide the same information about the variability as the standard deviation. However, when you take the square of a non-informative (flat) distribution, you obtain a "not-so-flat" distribution (Figure 4). The original intention of "non-informativeness" on the standard deviation disappears when it was transformed into variance, even though these two quantities provide the same information. Consequently, the use of a non-informative prior distribution is not the cure-all answer to providing equal probability to all possible values of a parameter.

One way to avoid this problem is to build a **hierarchical** model, in which each of the parameters is assumed to come from another distribution, called a **hyper-distribution**. We then set flat prior distributions for the parameters of the **hyper-distributions (hyper-parameters)**. Because these hyper-distributions reside in the abstract parameter space, which you do not observe directly, the flatness of the distribution may be justified. The hierarchical approach is becoming more common because of its versatility to a wide variety of data structures. The hierarchical approach, for example, allows us to easily model mixed effects models, where

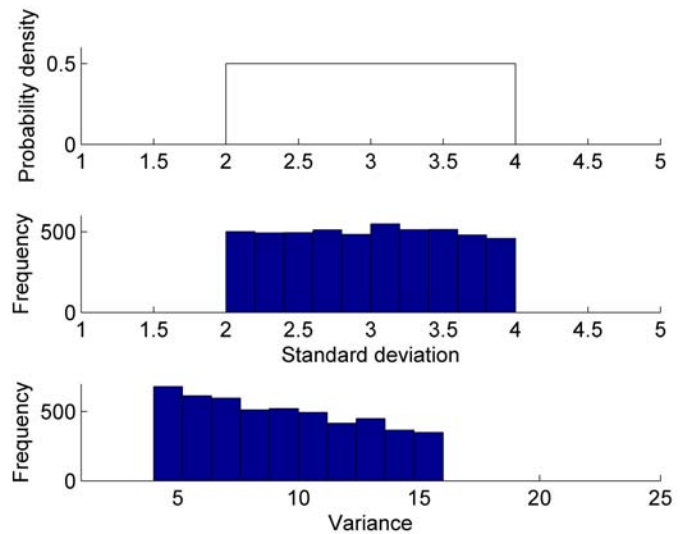


Figure 4. An example of a uniform distribution and its transformation. The top figure presents the continuous uniform distribution between 2 and 4. The middle figure is a histogram of 5000 random samples drawn from the uniform distribution. The bottom figure is the histogram of the squared transformation of the 5000 random samples from the uniform distribution.

some factors are considered fixed whereas others are considered random factors. For further discussion and examples of these models, which are somewhat advanced topics, see Clark (2007) and Gelman *et al.* (2004).

A prior distribution can be built from the historical data, a pilot study, and other sources. You may also use information from other closely related species and systems to construct prior distributions. For example, you may be interested in estimating the population growth rate of the snapping turtle (*Chelydra serpentina*). Even though you may not have any information about the population growth rate of your study population, a prior distribution can be constructed from the knowledge of the species from elsewhere. Construction of an informative prior distribution from historical and other systems provide an opportunity to search for the relevant information about the parameter of interest.

Presenting Bayesian data analysis: In this section, I will discuss how you may present your results when you use a Bayesian analysis. I will highlight the key features of Bayesian statistics which should not be overlooked when presenting results. The same features should be looked for when reading a research paper that contains Bayesian statistical analysis. First, prior distributions for all parameters should be stated clearly. The justifications for using particular prior distributions should also be included. It is not adequate to say 'non-informative prior distributions were used for all parameters.' Similarly, reasons for selecting certain prior distributions should be provided even if flat priors are used. The effects of prior distributions on the posterior should also be determined. In other words, several prior distributions may be used to compare how they affect the shape of posterior distributions and how sensitive the results of the analysis are to the choice of prior distributions. If the shape of the marginal posterior distribution for a parameter is affected by the prior distribution, the data provide little information on the

parameter. In other words, the knowledge about the parameter is not updated without new information. The important point is that no new inference should be made on the parameters whose posterior distributions are very similar to the prior distributions. Perhaps, those parameters should not be in the model to begin with.

Some things to consider about the prior distributions are: (1) Are the limits of each parameter appropriate? For example, the lower bounds of prior distribution for abundance should be zero or greater. (2) Is the shape of each prior distribution defensible? In other words, does the prior distribution adequately describe the uncertainty about the parameter? (3) Are there enough references given to defend the form of each prior distribution? (4) How does the prior distribution affect the posterior distribution? Do the priors affect posteriors? (5) Are the correlations between parameters considered, especially when the priors affect the posterior?

The second component of Bayesian analysis, the likelihood function, should be scrutinized as well. This is the connection between the data and the parameters of interest. Because statistical models are simplifications of the real ecological processes, multiple models are often applicable to the data. Consequently, the fit of each model to the data should be examined and the best model should be used for the inference. Gelman *et al.* (2004) recommend using a simulation approach. Using the posterior distribution(s) and the likelihood function, one can simulate "data" that could have been observed, given estimated parameters. By simulating a large number of possible "datasets," one can determine whether or not the observed real data are within the plausible range of simulated data based on the assumed underlying model. If there is a discrepancy between the real and simulated data, the model probably was not appropriate for the real data.

In a theoretical approach, Spiegelhalter *et al.* (2002) introduced a measure (deviance information criterion or DIC) that can be used to compare multiple models, similar to AIC (Akaike's Information Criterion; Akaike 1974). DIC can be used to select the best model among candidate models. Alternatively, the uncertainty among possible models can be incorporated into an analysis instead of selecting a simple model. Green (1995) introduced a method called the reversible jump Markov chain Monte Carlo (RJMCMC; Green 1995), which can be used to compute posterior probabilities for multiple models. The posterior probabilities of models, then, are included into the inference process of parameters. This, however, is an advanced feature of Bayesian analysis and beyond the scope of this short note. Although not all in the Bayesian framework, very good discussion about model selections in ecological studies can be found in Burnham & Anderson (2002), Clark (2007), and Hilborn & Mangel (1997).

Some issues to consider about likelihood functions are: (1) Are the likelihood functions defensible? As I mentioned previously, more than one statistical model may be appropriate for the data. In this situation, the selection of a particular model should be explained. (2) Did the model fit to the data? (3) Is it necessary to compare multiple models or is a single model sufficient?

The last component of a Bayesian analysis is the posterior distribution. Conclusions of the study depend on the posteriors. The main feature to look for is the difference between the prior and posterior. If they are very similar, the data did not have much information about the parameter. The conclusions drawn in these cases should be treated as such: the data did not provide new

information about the parameters. Correlations among parameters should also be examined. Summary statistics should be scrutinized. For example, when a posterior distribution is skewed, the mean is not a good statistic of the central tendency. The median or mode may be a better choice. Also, a point estimate, let it be mean, median, or mode, should not be presented without some measure of uncertainty, such as a standard deviation or posterior interval, the Bayesian analogue to a confidence interval. The practice of providing an error measurement in a scientific analysis is not unique to Bayesian statistics. It has been pointed out in many textbooks that no ecological estimate should be presented without some measure of errors (e.g., Krebs 1989). When providing the error of a point estimate in a Bayesian analysis, a posterior interval is preferred over standard deviation because it provides an understandable measure of uncertainty in a probability statement. For example, you may provide a 95% posterior interval from a posterior distribution. The limits of this interval can be interpreted with a simple probability statement; the true parameter is between the limits with probability 0.95, given the data, the statistical model, and the prior.

The difference between the definitions of confidence (CI) and posterior intervals (PI) needs an attention. The true definition of a confidence interval is often overlooked. An $x\%$ CI should be interpreted as the following: "we are $x\%$ confident that the true value will be between the two limits." Note that this is not a probabilistic statement. On the other hand, an $x\%$ PI of a parameter may be interpreted as "the true parameter value is in the interval with probability $x/100$." The practical difference between the two intervals, however, may be trivial. Either interval would provide a measure of uncertainty about the estimate of the parameter. You, as a critical reader or analyst, need to know if the result is interpreted correctly, especially when a manuscript is reviewed for publication.

A few last words: I hope I have successfully introduced the concepts of Bayesian statistics without using equations. I also hope this brief note has successfully explained the Bayesian analytical method in such a way that you, the reader, are better equipped to approach your own and other's research more critically. I have left out many topics of Bayesian statistics that cannot be covered in this introductory note. The intention of this paper was to provide insight on the basics of Bayesian statistics and encourage a pursuit of deeper understanding such as how to use and manipulate mathematical equations. Even though we, as biologists, tend to avoid equations, they should be considered as a tool or language that serves to improve our research methods and analyses. One line of an equation can provide as much information as a paragraph in English. You will gain clarity by first understanding some of the nuts and bolts of the mathematical statistics that lend themselves to analyses using either Bayesian statistics or other statistical modeling.

The basic concepts of Bayesian statistics are simple. Bayesian statistics take into account your prior knowledge or experience. Bayesian statistics are not magic. If something does not fit well in your mind, it is likely some things are askew. Also, never hesitate to ask questions about the terminology. If you do not understand something in a paper, it may be that methods are not fully thought out or that you require more information to fully comprehend the analytical technique to critically evaluate the findings. To enhance our knowledge in science, we should strive to use the best tools

available for analyzing data. Although some may argue against it (e.g., Dennis 1996), I think the Bayesian approach should be another set of tools in a biologist's analytical toolbox.

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Epibionts Associated with Green Sea Turtles (*Chelonia mydas*) from Cananéia, Southeast Brazil

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Sea turtles are frequently colonized by epibiotic organisms. This type of association involves all sea turtle species in several developmental life stages. Gathering knowledge on the species composition, distribution patterns and abundance of epibiotic species represents the first stage in understanding the nature of epibiotic relationships (Frazier *et al.* 1991, Miranda & Moreno 2002). It is also possible to obtain information about pre-reproductive migratory routes (Eckert & Eckert 1988) and population distribution and movements through more detailed studies about epibionts (Casale *et al.* 2004).

The majority of the studies on sea turtle epibionts refer to the epibiotic assemblages of adult sea turtles. However, recent studies involving juvenile loggerheads (*Caretta caretta*) (Frick *et al.* 2003a) present new associations that demonstrate the need for further

investigation and research projects concerning sea turtle epibiosis in feeding and development grounds. As a result, we initiated a study of the epibionts associated with a foraging population of juvenile green turtles (*Chelonia mydas*) in southeast Brazil.

Epibionts of fifty juvenile green turtles (curved carapace length = 39.6 cm ± 5.69 SD and curved carapace width = 36.4 cm ± 5.57 SD) from Cananéia, southeast Brazil, were collected during the activities carried out by Projeto Tartarugas – IPeC (Bondioli *et al.* 2005) in 2007, between January and September. Forty were captured by local fishermen that use artisanal fish traps, the “*cercos-fixos*”, where turtles remain alive and unharmed (Nagaoka *et al.* 2005). Ten of them were found dead on local beaches during beach monitoring activities. The biometric data of turtles were collected (Bolten 1999),

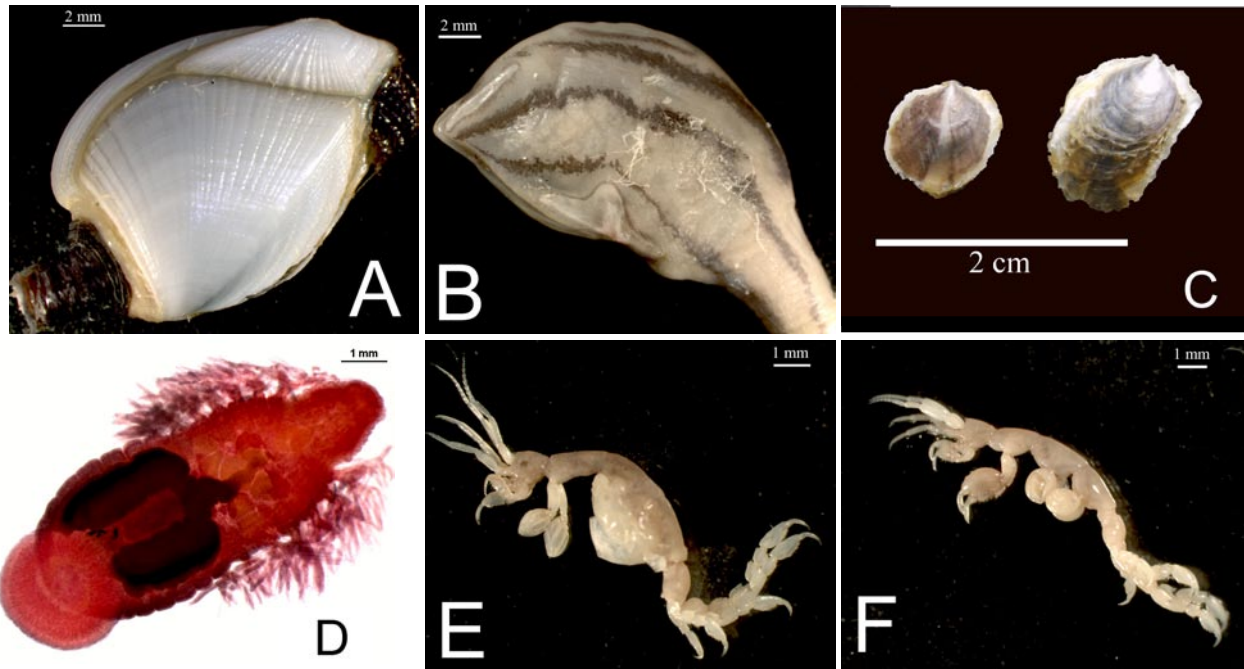


Figure 1. Epibionts collected from juvenile green turtles, in Cananéia, Southeast Brazil. See text for details.

Species	% occurrence	Abundance	Number/ host (max)
<i>Chelonibia testudinaria</i>	62	314	70
<i>Platylepas hexastylus</i>	52	413	64
Family Balanidae			
<i>Amphibalanus improvisus</i>	18	33	12
<i>Amphibalanus trigonus</i> *	2	1	1
<i>Amphibalanus amphitrite</i> *	2	6	6
<i>Amphibalanus reticulatus</i> *	4	16	8
Family Lepadidae			
<i>Conchoderma virgatum</i>	6	9	3
<i>Lepas hilli</i>	4	23	12
<i>Lepas anatifera</i>	4	215	193
<i>Lepas anserifera</i> *	4	22	20
Family Caprellidae			
<i>Caprella</i> sp.*	2	50	50
Family Nereididae			
<i>Neanthes</i> sp.*	4	3	2
<i>Pseudonereis palpata</i> *	2	3	3
Family Ostreidae			
<i>Crassostrea</i> sp.*	14	60	22
Family Piscicolidae			
<i>Ozobranchus branchiatus</i>	34	n/a	n/a

Table 1. Epibiotic species that occurred in association with *Chelonia mydas* in Cananéia, Southeast Brazil, (*) denotes first record of association in Brazilian waters.

the animals were photographed and immediately released into the sea or left on the beach when found dead.

The macroscopic fauna were collected from turtles using small forceps and spatulas. The invertebrates collected were fixed and preserved in 70% ethanol with the exception of marine leeches that were pressed between two slides, fixed with AFA and later preserved in ethanol. The epizoans collected were quantified and identified to the lowest taxon possible. The material collected was deposited in the Instituto de Pesquisas Cananéia collection and in the Museu de Zoologia Universidade de São Paulo.

Fifteen invertebrate species were collected from fifty sea turtles (Table 1). Data on abundance and maximum number on hosts were not collected for the leech *Ozobranchus branchiatus* (Figure 1D) because of the difficulty in collecting all of the specimens present. These animals were found associated with the soft body parts of the turtle such as the neck, tail and flippers. This parasite was observed only between the months of January and March.

Cirripeds were the most frequent group observed as epibionts. *Chelonibia testudinaria* and *Platylepas hexastylus* (Balanomorpha: Coronuloidea) occurred with the highest frequency. *Lepas anatifera* occurred in the highest quantity on the same turtle and was always observed associated with two other species of the same genus, *L. anserifera* (Figure 1A) and *L. hilli*.

The amphipod *Caprella* sp. (Figure 1E & F) was found in association with a single turtle although in high abundance, representing both males and females. Polychaete worms (*Neanthes* spp.) also occurred in low frequency and abundance. Bivalves of the Family Ostreidae (Figure 1C) also occurred in low frequency and occurred only on turtle carapaces; however, the abundance was high: 60 specimens. The results of the present study show that diverse fauna may be associated with juvenile green turtles. Fifteen invertebrate species were recorded, of which seven have been previously recorded in association with green turtles in Brazilian

waters (Bugoni *et al.* 2001, Pereira *et al.* 2006, Shlenz 1999, Young 1990).

The barnacles found in high frequency coincide with the results of Bugoni *et al.* (2001) for green turtles in Rio Grande do Sul, Brazil and Pereira *et al.* (2006) who found 100% frequency for *C. testudinaria* on green turtles in Almofala, Ceará, Brazil. These barnacle species are primarily classified as specific epibionts of sea turtles, although there are some isolated records from other hosts (Monroe & Limpus 1979).

Barnacles of the genus *Amphibalanus* (Family Balanidae) are cosmopolitan and occur frequently in the region in association with other surfaces such as shells and artificial substrates. These barnacles are considered non-obligate epizoans. This work presents the first record of *Amphibalanus amphitrite*, *A. reticulatus* and *A. trigonus* species in association with green turtles in Brazilian waters.

Lepadomorph barnacles (*Lepas* and *Conchoderma*) are commonly attached to floating objects. In this study they were collected from dead or weak turtles that probably spent a long period floating at the water's surface, which favored the incrustation of these invertebrate species. Ours are the first records of *L. anserifera* and *L. hilli* as epizoans of green turtles in Brazil.

Polychaete worms have been recorded in association with *C. caretta* (Kitsos *et al.* 2005), however, this is the first record of this genus as an epibiont of green turtles from the Southwestern Atlantic. Another polychaete worm, *Pseudonereis palpate*, we collected is the first record of this association with sea turtles in Brazil.

Caprellid amphipods (genus *Caprella*) have been recorded in association with olive ridleys (*Lepidochelys olivacea*) and loggerheads (Caine 1986, Frick *et al.* 1998, Frick *et al.* 2003a, Kitsos *et al.* 2005, Vivaldo *et al.* 2006) in other parts of the world. Ours is the first record of this association in sea turtles in Brazil. Similarly, oysters have been found in association with loggerheads (Caine 1986, Frazier *et al.* 1985, Frick *et al.* 1998, Kitsos *et al.* 2005), but ours is the first record of these bivalves from *C. mydas* in Brazil.

Ozobranchus branchiatus is considered a specific sea turtle ectoparasite and they have been reported from turtles in our region before (Schlenz 1999). Specific information we have to add regarding this association is that these leeches were observed only in the summer in the hosts in the study and none of them had leeches associated with fibropapilloma tumors, however, this association between tumors and leeches had already been observed in some sea turtles in this region (Bondioli *et al.* 2007).

Globally, the majority of the studies about epibionts and sea turtles involve nesting adult females, especially loggerheads and hawksbills (*Eretmochelys imbricata*) (Frick *et al.* 2003b, Frick *et al.* 2004, Kistos *et al.* 2003, Kistos *et al.* 2005) and our results further demonstrate that research involving the epibionts associated with juvenile turtles are needed, as even generalized studies cataloging the epibiotic species present yield new records for regions that have been extensively surveyed in the past.

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Analysis of a Live Stranded Leatherback, *Dermochelys coriacea*, in Brazil

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Although leatherback sea turtles (*Dermochelys coriacea*) regularly occur along the Brazilian coast (Barata *et al.* 2006; Lima *et al.* 2007), few of these animals have been examined by veterinarians. On 16 November 2007, a live leatherback (*Dermochelys coriacea*) was found stranded in Jardim Alice beach, Praia Grande county, south shore of the state of São Paulo (24.0536°S, 46.5311°W). The turtle measured 137 cm curved carapace length (CCL) and 100 cm curved carapace width, with a mass of 330 kg. The turtle had no visible tags or tag scars (no scanner was available to check for subcutaneous PIT tags), and the turtle exhibited injuries on its flippers and was transferred to the Santos Aquarium for evaluation and veterinarian care.

Closer inspection revealed that the leatherback had a deep ulcerative injury on the front left flipper near the shoulder joint, and the entire limb was swollen. No other visible anomalies were observed. The turtle was kept in a 4000 liter pool with 3 water changes/day. The turtle was given prophylactic antibiotic injections (IM) of benzathine penicillin, dose = 10000 UI/kg, every 24 hours for 3 days. The injured area was also abraded daily and treated with Alantol® (active ingredients: allantoin, chlorohexidine, zinc oxide, and citronella). Within the first 24 hours of stranding, blood was collected from the interdigital blood vessel of the rear flipper (Wallace & George 2007), and stored in sodium heparin tubes for hemogram analyses and a dry tube for biochemistry. The biochemistry serum was analysed in a Bioplus 200 S® with the use of a commercially available kit (Labtest Diagnostic®). The hemogram was made by manual counting in the Neubauer chamber with Natt & Herrick satin (Tables 1 and 2).

After two days into the treatment pool, fresh abrasions were observed near the nostrils, edges of the front flippers, and along the sides of the carapace, caused by the turtle bumping against the

pool walls. It was decided to release the turtle as soon as possible, to avoid further injury in the pool, and antibiotic treatment was stopped after the third injection.

Prior to release, the leatherback was tagged using Inconel flipper tags (National Band and Tag Co., USA, model 681) numbered BR 52752 and BR 52751, placed on the rear flippers (Eckert & Beggs 2007). The turtle was released 20 November 2007, on the water near “Lage de Santos” (24.1110°S, 46.3269°W); the turtle was observed at the surface for a short period, subsequently diving out of sight.

We suspect that the flipper injury was caused by entanglement with fishing line or some other gear. Injuries caused by interactions with fishing gear have been reported previously in stranded leatherbacks in Brazil (Lima *et al.* 2007) as well as other marine turtle species elsewhere (e.g. Calabuig 1999). In the present case, the prognosis for recovery from the limb injury was favorable.

In terms of hematology, this individual turtle appeared to be within the normal range reported for leatherbacks from Gabon (Deem *et al.* 2006), except for higher heterophil levels (Table 1), possibly related to the injury observed on the flipper. There were no major differences observed in the blood biochemistry results of this stranded turtle compared to the nesting turtles in Gabon (Table 2). However, more blood chemistry work on leatherback turtles in Brazil is needed to develop baseline values.

We suspect that this individual was a female, because its tail did not extend beyond the carapace. Although Stewart *et al.* (2007) reported various cases of adult leatherback females with CCL <145 cm, we could not determine conclusively if this individual was a mature female.

The tank-related injuries observed on this turtle’s head, flippers and carapace are apparently common for leatherbacks kept in captivity (Jones *et al.* 2000), and present a challenge to treatment

	This note	Deem et al. (2006)
RBC (X106)	0.34	0.17-0.78
Hemoglobin (g/dl)	11.6	-
PCV (%)	38	28-56
MCV (fL)	1,101	-
MCHC (g/dl)	30.52	-
WBC (x 103/ μ l)	9.5	1.5 - 14.6
Heterophils (x 103/ μ l)	7.88	0.0 - 5.1
Lymphocytes (x 103/ μ l)	1.14	0.0 - 3.3
Monocytes (x 103/ μ l)	0.19	0 - 0.8
Eosinophils (x 103/ μ l)	0.28	0 - 0.5

Table 1. Hemogram values from a stranded *Dermochelys coriacea* found in Sao Paulo, Brazil. RBC = red blood cells, PCV = packed cell volume, MCV = mean corpuscular volume, MCHC = mean corpuscular hemoglobin concentration, WBC = white blood cells

of injured leatherbacks. Tethering the animal and/or lining the tank with soft material may help reduce tank-related injuries. Interestingly, we observed reduced swimming activity of the leatherback during night hours. Perhaps alteration of the light:dark cycle, in favor of more dark hours, may help reduce the likelihood of tank-related injuries.

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	This note	Deem et al. (2006)
AST (U/L)	151	159 \pm 49 (94-234)
Uric acid (mg/dL)	1.1	11.9 \pm 0.0 (11.9)
CK (U/L)	607	1,228 \pm 2,390 (20-7,086)
TP (g/dL)	3.8	4.6 \pm 1.0 (3.2-6.0)
Albumin (g/dL)	1.7	1.81 \pm 0.37 (1.07-2.39)
Glucose (mg/dL)	95	78 \pm 13 (55-92)

Table 2. Blood biochemistry values for a live leatherback found in Sao Paulo, Brazil. AST = aspartate aminotransferase, CK = creatine kinase, TP = total protein. Data from Deem et al. 2006 are presented as mean \pm SD and range in parentheses.

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Juvenile Hawksbill Tagged in The Bahamas Nests in Tobago

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In the Atlantic there are few, if any, reports of the length of time required for wild-caught immature hawksbills to grow to sexual maturity. Here we report on an immature hawksbill tagged in The Bahamas and seen nesting more than nine years later on Tobago (Fig. 1).

Although the longterm research project at the Union Creek Reserve (UCR), Great Inagua, Bahamas, has focused on green turtles (Bjorndal & Bolten 2008), about 10% of the turtles captured there each year are hawksbills. On 2 February 1996, a hawksbill was captured in UCR, and a light blue plastic jumbo-rotto flipper tag was applied to each flipper (BP4822/3/4/5). Two straight carapace lengths (Bolten 1999) were measured (± 0.1 cm). Straight carapace length notch to tip (SCLn-t) from the anterior point at midline (nuchal scute) to the posterior tip of the longer supracaudal was 45.1 cm, and minimum straight carapace length (SCLmin) from the anterior point at mid-line to the posterior notch at midline between the supracaudals was 42.4 cm. The turtle was not seen again in UCR.

In June 2005, members of the Save Our Sea Turtles program on Tobago twice encountered a hawksbill that carried tags BP4824 and BP4825 depositing eggs on the southwest coast of Tobago. On 13 June 2005 it nested on Mt Irvine Back Bay, and on 28 June 2005 (having lost BP4825) it nested on the nearby beach of Grafton or Stone Haven Bay. Also, a hawksbill with blue plastic tags had been reported nesting in the first two weeks of March on Turtle Beach, the beach north of Grafton, which was probably this turtle. Curved carapace length notch to tip (CCLn-t) was 84 cm.

The recapture interval from 2 February 1996 to 13 June 2005 was 3419 days (9.37 yr). To calculate growth rate of the turtle, we converted our SCL measures to CCLn-t using equations generated from 10 hawksbills from UCR for which we measured SCLn-t,

SCLmin, and CCLn-t (Fig. 2). The resulting equations are:

$$\text{CCLn-t} = 1.0925 \text{ SCLn-t} - 0.9254 \quad [p < 0.0001; R^2 = 0.9997]$$

and

$$\text{CCLn-t} = 1.1819 \text{ SCLmin} - 1.9851 \quad [p < 0.0001; R^2 = 0.9988].$$

Thus, when the hawksbill was captured in UCR, its CCLn-t estimated from SCLn-t was 48.3 cm and its CCLn-t estimated from SCLmin was 48.1 cm. Taking the average value of 48.2 cm, we calculate that the rate of growth was 3.8 cm per year.

Of course, the hawksbill may have reached sexual maturity before it was seen nesting in 2005. If so, the duration for the 45 cm SCL hawksbill to grow to sexual maturity would be less than 9 years, and growth rates would have been more rapid, assuming growth slowed substantially once sexual maturity was attained. Until we have study aggregations of hawksbills at which growth to sexual maturity can be determined in tagged animals, such serendipitous encounters as that reported here are valuable to place bounds on our estimates. This report also underscores the importance of monitoring nesting beaches so that turtles tagged as immatures may be intercepted.

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Figure 1. Map showing location of original tagging (Great Inagua) and recapture (Tobago) locations.

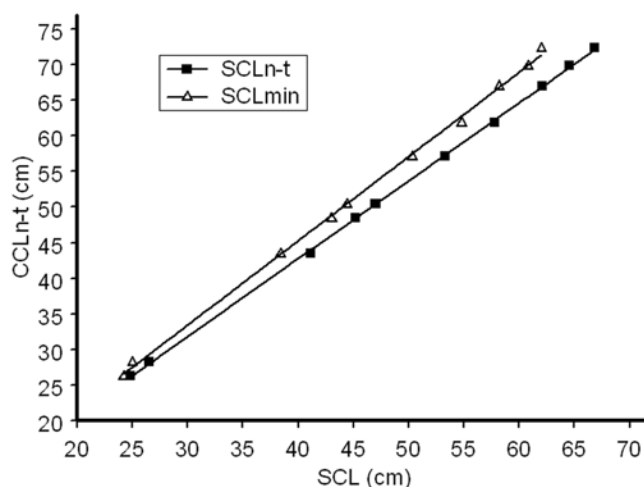


Figure 2. Relationship between CCLn-t and SCLn-t (closed squares) or SCLmin (open triangles) for 10 hawksbills measured in Union Creek Reserve, Great Inagua, The Bahamas.

National Fish and Wildlife Foundation, and the Caribbean Conservation Corporation. Morton Bahamas Ltd, the US Coast Guard and the people of Mathew Town, Inagua, have provided invaluable logistic support. UCR research was conducted in compliance with the Institutional Animal Care and Use Committee, University of Florida. We also thank the Glasgow University's 'Tobago Turtlewatch' Expedition Team of 2005; without their contribution of many sleepless nights, we might not have had the intense level of patrol coverage on Grafton and Back Bay that year that allowed us to see this turtle not just once but twice.

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LETTER TO THE EDITORS

Olive Ridley's Churning of the Ocean

It appears that our *Kurma* (sea turtle) from the sea is the cause of another churning of the ocean, the first one occurred when *Lord Vishnu* took the form of a giant *Kurma* to raise the *Mandara parvata* (mountain being used as a churning stone) which began to sink during the churning of the ocean by the Gods and Demons to extract the elixir of immortality (*Amruta*). Going through the Special Theme Section: "The Dhamra Port Debate-Prospectives and Lessons" in Marine Turtle Newsletter number 121, makes me feel that this is a modern day re-enactment of another churning of the ocean-21st Century style. I am waiting eagerly to see when the nectar (solution) will emerge from this exercise.

There is one problem which I would like to address as ultimately it is the survival of olive ridleys of Orissa we are talking about (I have been involved with these magnificent creatures since 1985 in different capacities). I would draw attention to the compendium "Marine Turtles of the Indian Subcontinent," Kartik Shankar and B.C.Choudhury (Eds), University Press (India) Pvt. Ltd.; and my review (Mohanty Hejmadi 2007). This compilation and my review indicate that marine turtles does not mean only olive ridleys of Orissa; there are bigger issues which have to be addressed for a holistic approach for the protection of the **five species of marine turtles in the Indian ocean**. There are so many gaps but I would only deal with one which is most important from my point of view. As I have said in the review, "Tamil Nadu is the only State in India which still has all the five species of marine turtles from Indian

waters. Again it has both breeding and foraging grounds. It is also a part of the migratory corridor for the olive ridleys of Orissa. The Gulf of Mannar is a major feeding ground and developmental habitat for olive ridleys and green turtles. Considering the size of the population, the mortality of all species is high. What is interesting that turtles and eggs regularly exploited along the southern coast especially in the Gulf of Mannar inspite of the fact that it is a Biosphere Reserve. It is unfortunate that no attempt has been made to tag and monitor the turtles in this critical area. The authors are silent about the impact of *Setu-Samudram* project on the biodiversity where massive dredging has been undertaken although it is a Biosphere Reserve." (In the *Setu-Samudram* project, a 167.22 km channel is being dredged in Gulf of Mannar).

So far my efforts to get information about any activities of different agencies involved in protection of marine turtles in Gulf of Mannar has not been successful. Does this mean that protecting olive ridleys only in Orissa and neglecting its migratory corridors, feeding and other nesting areas is sound from conservation point of view?

MOHANTY HEJMADI, P. 2007. Book review: *Marine Turtles of the Indian Subcontinent*. *Current Science* 92: 1010-1012.

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BOOK REVIEW

Title: Biology of Turtles: From Structures to Strategies of Life

Year: 2007

Author: Jeanette Wyneken, Matthew H. Godfrey & Vincent Bels

Publisher: CRC Press

ISBN: 978-0849333392

Pages: 408pp (hardcover)

Price: \$149.95 USD

To order: <<http://www.crcpress.com>>

Biology of Turtles is the latest contribution from CRC Press to synthesize information on turtle biology, with two previous books having focused solely on sea turtles. The book is edited by three well-known sea turtle researchers, although the coverage is not limited to sea turtles. There are 13 chapters co-authored by 35 scientists representing mostly academic institutions and museums in the United States and Europe. Although dated 2008, literature citations extend to 2006 (earlier in a few chapters), making most chapters relatively up-to-date in the fast-paced publishing world. The authors use color photographs well, and some of the black and white illustrations are outstanding. The book is printed on high quality glossy paper. Of particular help is the extensive index, although my reading of the text found *Terrapene carolina* mentioned more often than is listed in the index.

The book is the result of a symposium held at the 6th International Congress of Vertebrate Morphology in Jena in 2001. As such, the title is a misnomer, as little or nothing is included concerning many aspects of turtle biology, such as life history, behavior, genetics, veterinary medicine, biogeography, systematics, or conservation biology. To be fair, the editors acknowledge this in the preface, but note that their intention was to put morphology into an evolutionary context. In this regard, many (but not all) chapters are successful, and the book provides a solid basis for future morphological research. Still, a more appropriate title would have been *The Functional Morphology of Turtles*.

Chapters generally include an introductory section providing a somewhat historical summary of the topic to be covered, followed by a more in-depth review of specific aspects of the functional morphology and evolution of the structure or system discussed. There is a certain unevenness in the presentation of material, in that some chapters simply provide summaries of existing data (e.g., Chapter 3), some are similar to short journal articles (Chapter 4), whereas others include much more original data, interpretation, and an extensive historical and literature summary. A particularly good example of the latter is Snover and Rhodin's discussion of chondro-osseous growth and skeletochronology (Chapter 2). Most chapters have excellent **Conclusion** sections, whereas others have only a short paragraph or no summary statement at all. The best chapters, in my opinion, are those that provide discussions of the implications of their findings, and direct the thoughts of the reader

toward future research (e.g., Chapters 1, 6).

Chapter titles are as follows: 1. How the Turtle Gets its Shell; 2. Comparative Ontogenetic and Phylogenetic Aspects of Chelonian Chondro-osseous Growth and Skeletochronology; 3. Evolution and Structure of the Turtle Shell; 4. Long Bone Allometry in Tortoises and Turtles; 5. Evolution of Locomotion in Aquatic Turtles; 6. Hindlimb Function in Turtle Locomotion: Limb Movements and Muscular Activation across Taxa, Environment, and Ontogeny; 7. Cervical Anatomy and Function in Turtles; 8. Functional Evolution of Feeding Behavior in Turtles; 9. The Structure of the Cardiopulmonary Systems of Turtles: Implications for Behavior; 10. Reproductive Strategies of Turtles; 11. Mixed and Uniform Brood Sex Ratio Strategy in Turtles: the Facts, the Theory, and their Consequences; 12. The Physiology and Anatomy of Anoxia Tolerance in the Freshwater Turtle Brain; 13. The Relationships of Turtles within Amniotes.

Many chapters are difficult to read, what with the wealth of often unfamiliar morphological nomenclature and mechanistic function. For example, Chapter 3 is a litany of bones associated with particular taxa, which may be great as a reference but quickly draws the reader into a semi-conscious fog. As a non-morphologist, I found myself most interested in sections of chapters, such as the discussion (and worthy speculation) in Chapter 5 on why foreflipper action is asynchronous. On the other hand, Chapter 9 imparted a concise summary of chelonian respiratory structures and mechanisms that was enjoyable to read, with the added benefit of perhaps inducing a field biologist to actually learn something about how turtles breathe.

There are problems with certain chapters. In Chapter 11, the authors set forth to define and make sense of sex ratio "strategy" (a jargonistic term) in turtles. Sex ratios are defined in both genotypic and temperate-dependent modes, and the authors admittedly cover a great deal of territory. Unfortunately, much literature and many ideas are not discussed, including important early papers providing documentation, evolutionary hypotheses, or speculations of adaptive value (Bull and Charnov, 1989; Bull et al., 1990; Ewert and Nelson, 1991; Burke, 1993; Janzen, 1995; Shine, 1999), the role of male aggression in TSD (Freedberg and Wade, 2004), the role of estrogens, other hormones, and estrogen mimics in TSD (e.g., Wibbels et al., 1991; Bergeron et al., 1994), and molecular approaches to TSD (e.g., Spotila et al. 1994). At least 23 major papers (and probably more) were not cited. One gets the impression that all major work on TSD is published in English, ignoring the non-English literature (e.g., Pieau et al., 1988; Vogt and Flores-Villela, 1986). However, this bias occurs throughout the book, with the exception of Chapter 5.

Further, it might be well to acknowledge that not all counts of sex ratios in turtles are based on developmental processes. There are many factors which influence (whether primary or operational) sex ratios, including resource-based changes in age at maturity, differential dispersion or migratory patterns, and mortality. In a book on functional morphology, these factors might not be discussed; in a book on "turtle biology," however, the evolutionary interplay between development and post-hatching processes that shape

population sex ratios should be acknowledged. The evolution of sex ratios in turtles involves more than just what goes on in the nest (or brood, as the authors put it).

The editors have done a fairly good job of minimizing errors, but there are a few (e.g., ‘pygal’ misspelled in Figure 1.1; labels needed on Figure 3.2; ‘hyobranchium’ misspelled on p. 189; *Terrapene* misspelled in Table 10.1; *Trionyx* misused for *Apalone* in Chapters 10 and 11). In such a data-rich volume, however, a few mistakes may not be surprising. I was more concerned with several other errors I found. For example: 1) clarification needed (p. 280, section 11.2)-the **mean** brood size would be K/L. If the **total** brood size, then it would be K*L; 2) the next to the last paragraph in section 8.1 (p. 188) implies that *T. carolina* frequently forages in water, although this is not the case; 3) *T. carolina* does not produce 4 clutches annually as stated in section 10.4.5.3 (p. 247). I suspect turtle morphologists may find other statements with which they disagree, but perhaps one of the points of a book summarizing so much data is to stimulate discussion. Although I have some concerns with coverage and a number of individual statements or discussions (which I will not elaborate upon here), the concerns which I have mentioned are really quite minor, as I found the book generally of much interest and containing a concise compendium of information. For that, the turtle research community owes their thanks to the editors and chapter authors.

Finally, one must mention the cost. At nearly \$150 USD, this volume will be well beyond the means of much of the sea turtle research community. Although the paper and illustrations are of high quality, and the material is generally well-presented and largely up-to-date, what difference does it make if the book is unaffordable? *Biology of Turtles* will appeal more to the functional morphologist rather than to a general turtle biologist, with the possible exception of a few chapters. As such, it will be a book to consult, if necessary, at the library but not necessarily one to own. At the very least, the publisher should donate a few dozen copies to research libraries around the world so that the book will be available internationally to our less wealthy colleagues.

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MEETING REPORTS

5th “Saving the Sea Turtle” Festival: The Turtle’s Race for Survival

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Cerro Verde and La Coronilla Islands have been identified as one of the most important foraging and developmental grounds for the juvenile green turtle, *Chelonia mydas*, in the Atlantic coast of Uruguay (López-Mendilaharsu *et al.* 2006). As a result of continuous research and conservation efforts on the part of Karumbé, these areas have recently been declared the first Coastal Marine Protected Area, or CMPA, in Uruguay (Laporta *et al.* 2006). Since 2001, Karumbé has been developing an Environmental

Education Program in the region which includes the “Save the Sea Turtle” festival (Bauzá *et al.* 2004). This event takes place annually at La Coronilla (Rocha, Uruguay) near the CMPA Cerro Verde.

The 5th year of the “Save the Sea Turtle” festival was held from 11-16 March 2008, with the theme of “*Turtle’s Race for Survival*.” The festival activities introduced the children of the community to the life cycle of sea turtles and the biggest threats they face at a global scale. A primary goal of the festival was to

show children how important Uruguay is as a juvenile foraging and developmental ground and how negative impacts occurring at this stage may affect the populations worldwide. During the school week, activities with more than 500 children were carried at the primary and secondary schools in town (<http://www.seaturtle.org/cgi-bin/imagelib/index.pl?photo=3970>). At the secondary schools, workshops were held for all the classes about sea turtle biology, coastal-marine ecology, natural and manmade threats to the sea turtles, and research activities undertaken by Karumbé. At the primary school, these workshops took the form of interactive theater. Karumbé volunteers disguised themselves as the 5 different species of sea turtles reported for Uruguayan waters and acted out the main threats to the sea turtles in Uruguay, including incidental capture and ingestion of plastic. We also played the “Great Turtles Race” game, which focuses on the sea turtle life cycle and is a way to focus attention on sea turtles and their conservation.

A unique activity to this year’s Festival was the “1st Sea Turtle Olympic Games” (<http://www.seaturtle.org/cgi-bin/imagelib/index.pl?photo=3848>). For this event, children were divided into four teams and competed in different events. Events varied from collecting recyclables to track and field sporting events with an ocean and turtle theme. There was even a soccer tournament! During the recyclable collection event, participants (with the help of friends and family) rounded up more than 1650 plastic bottles from all over town. Following the week of activities, the Karumbé team showed the children and the community how these bottles could be recycled in a meaningful way by incorporating them into the construction of a green house at the primary school (<http://www.seaturtle.org/cgi-bin/imagelib/index.pl?photo=3973>).

On the last day of the festival, our volunteers dressed themselves as sea turtles and engaged in the “Treasure Hunt.” This activity involved pairing children with the turtle actors as they moved through different locations in the village and encountered threats to survival, which the children were encouraged to identify and manage successfully. The different solutions included cleaning the beach of trash, saving the turtles’ eggs, teaching the turtle to find Uruguay and other important areas on a world map and helping a fisherman to resuscitate and release a sea turtle accidentally captured in his net. At the end the day-long string of clues, the

children finally found the treasure: a live sea turtle that had been rehabilitated by Karumbé and was ready to be released to the sea by the children. On the last night of the festival week, Karumbé staff and volunteers organized a party for the participating children. Gifts and prizes donated from local shops were awarded for participation.

Each year we successfully increase awareness among young people in Uruguay about the problems facing sea turtles and the coastal-marine ecosystems they inhabit, thereby transforming today’s youth into tomorrow’s citizen guardians of their own natural treasures. Each time we hold this festival, we hope that we have increased the level of amusement and entertainment of the participants, while maintaining its educational components.

Acknowledgments: The Festival was only possible thanks to all the participants, the Karumbé team and volunteers, the primary and secondary school of La Coronilla, including Ms. Mariela and Ms. Dorley (headmistresses), the community of La Coronilla (Mr. Tono, Ms. Paola and Mr. Pastorino), Mr. Miguel from F.M. Coronilla, the lifeguards from La Coronilla, Parador La Coronilla, Alfa Games, shops and stores from Chuy and La Coronilla, and the British Petroleum Conservation Programme.

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United States Sea Turtle Stranding and Salvage Network (STSSN) State Coordinators Meeting (Shepherdstown, WV, 29-31 July 2008)

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The STSSN was formally established in the United States East Coast and Gulf of Mexico in 1980. Each of the U.S. Endangered Species Act Sea Turtle Recovery Plans, developed jointly by the United States Fish and Wildlife Service (FWS) and NOAA’s National Marine Fisheries Service (NMFS), recommend maintaining a stranding network as part of a comprehensive national program for the conservation and recovery of listed sea turtles. The STSSN is coordinated overall by NMFS, and consists of a coordinator for each state (Maine through Texas), as well as trained volunteers and

municipal, state and federal employees operating under the direction of the state coordinator and NMFS. The purpose of the STSSN is to document dead sea turtles, salvage specimens, and aid injured sea turtles that strand in coastal areas under United States jurisdiction. The STSSN collects the following information: name and address of observer/responder, date, stranding location, species identification, state of decomposition, description of any obvious wounds, injuries or abnormalities, standard carapace measurements, and carcass or live turtle disposition. Photographs are taken whenever possible to

verify species identification. NMFS holds regular meetings with the state STSSN coordinators to exchange information and to jointly develop recommendations for improving the STSSN.

The most recent state coordinators meeting occurred on 29-31 July 2008, at the National Conservation Training Center, in Shepherdstown, West Virginia. Twenty seven people from NMFS, FWS, state agencies, private organizations and aquaria participated. Sixteen states were represented at the meeting. The meeting began with short presentations by each state coordinator detailing their specific programs and stranding numbers. The meeting then progressed into a series of group discussions covering several topic areas, including: stranding data coordination, necropsy and sampling protocols, health and disease, rehabilitation, and funding options for stranding network programs

Notable Topics Covered:

Health and Disease: Each state in the STSSN encounters consistent strandings of debilitated turtles, and some states have seen increases in recent years. There was discussion on general disease monitoring of stranded turtles to gain a better understanding of what is occurring in the population. The stranding network is in a unique

position to necropsy and sample turtles, and to improve our ability to determine the cause of death and/or the cause of debilitation of stranded animals.

Unusual Stranding Events: Participants discussed the overall preparedness of the STSSN to identify and investigate unusual or mass stranding events. It was suggested that a more formal program (similar to the U.S. Marine Mammal Health and Stranding Response Program, Unusual Mortality Event) may be helpful in order to determine that an unusual stranding event is occurring earlier in the process, which will allow for a more comprehensive investigation of the cause.

Injury Assessment: Participants discussed if the STSSN should increase their level of investigating and documenting injuries to better determine the source of injury, and whether or not a particular injury contributed to the stranding. Injuries commonly encountered include vessel strikes, predator injuries, and fishery interactions.

Acknowledgements: We thank all the participants for engaging in the discussions and contributing to a successful meeting.

IV Meeting and III Symposium of Research and Conservation of Sea Turtles in the Southwestern Atlantic Ocean

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On 25-28 October 2007, the IV Meeting and III Symposium of Research and Conservation of Sea Turtles in the South West Atlantic (ASO) took place in Piriápolis, a sea side town in Uruguay. Piriápolis was chosen to be the event site, because of its important and active fishermen community. The main goals of the meeting were: to strengthen and consolidate the strategies of ASO Tortuga Network regarding the conservation of sea turtles regionally and internationally, and to continue with the exchange of scientific and educational results.

This meeting had 200 participants, principally from Argentina, Uruguay and Brazil, as well as other countries, that included researchers, students, fishermen, representatives of NGOs and governments. During the III Symposium, nine oral presentations, 35 posters and six theses were presented. In addition, there were three exceptional conferences on the following themes: the relevance of regional networks for the conservation of sea turtles (coordinated by Jack Frazier, USA); the impacts of climate change on sea turtles (coordinated by Carlos Drews, Costa Rica); and the use of bio-indicators to monitor and assess environmental quality (coordinated by Gabriela Eguren, Uruguay). There were other workshops and discussion groups held to facilitate the exchange of experiences in conservation and education work; these were led by members of the ASO Tortuga Network and other participants. Highlights

of these discussions included the participation of Ferrán Alegre (Fundación para la Conservación y Recuperación de Animales Marinos, Barcelona, Spain) and Ana Luisa Valente (Universitat Autònoma de Barcelona, Spain) in the Veterinarian Workshop; the participation of fishermen from industrial and artisanal fisheries in the ASO Tortuga Network region, in the Sea Turtle Bycatch Workshop; and the participation of José Matarezi (Universidade do Vale do Itajaí, Brazil) in the workshop entitled “Building the bases of environmental education in the ASO Tortuga Network.” The meeting benefited from the participation of two leaders from AVINA: Alessandra Peixoto (Rede Marinha Costeira e Hídrica, Brazil) and Daniel Corsino (Uruguay).

The main outputs of the ASO Tortuga Network meeting were: a) the approval of the ASO Tortuga Network statutes; b) the development of the ASO Tortuga Network website with its own domain (www.tortugasaso.org) that will be an essential communication tool between members and collaborators of the ASO Tortuga Network; c) generating an edited scientific publication with data on sea turtles in the ASO Tortuga Network region; update on the assessment entitled “Impacts of Fisheries on Sea Turtles in the South West Atlantic”; d) coordination of actors and groups involved in environmental education in the ASO Tortuga Network; and e) progress in developing Sea Turtles Action Plans for Uruguay and Argentina, modeled after the

Brazilian Action Plan, which is in the last stage of development.

The Meeting concluded with the reinforcing regional integration among the essential actors for the conservation of sea turtles and their habitats in the South West Atlantic. The proceedings of the meeting can be downloaded from: www.tortugasaso.org or http://www.seaturtle.org/PDF/Karumbe_2007_ASO4.pdf. The IV ASO Tortuga Network meeting was kindly supported by AVINA, ECOPLATA World Wildlife Fund (WWF-Latin American), Wildlife Trust and auspices of the Migratory Species Convention, the Marine Turtle Specialist Group and the Piriápolis Local Council.

ANNOUNCEMENTS

Juvenile Green Turtles as a Flagship Species: Starting Point for the First Marine Protected Area in Uruguay

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Since 1999, the organization Karumbé has worked throughout the Uruguayan coast to generate a comprehensive understanding of the biology, ecology and conservation status of the juvenile green turtle (*Chelonia mydas*) (Laporta *et al.*, 2006). The coastal-marine area of Cerro Verde and La Coronilla islands in the Rocha state (33 ° 56' S; 53 ° 30' W) is part of the *Bañados del Este y Franja Costera Biosphere Reserve* established in 1976 and has been a RAMSAR site since 1982 (Fig. 1). This area serves as developmental habitat for juvenile green turtles and has been recognized as essential habitat for the protection of these endangered populations. The area exhibits a great diversity of marine species (algae, invertebrates, fishes, marine birds, whales, dolphins and sea lions, among others) that are of conservation interest and which also play a significant role in this ecosystem. The green turtle was selected as a flagship species, to act as an ambassador for this habitat. By focusing on and increasing conservation actions related to sea turtles, the conservation status of many other species that share this habitat is also improved. The conservation success with green turtles has facilitated the development of new projects and studies on other

marine species with similar habitat requirements, such as marine mammals (*Tursiops truncatus*, *Eubalaena australis*, *Pontoporia blainvillei*, *Otaria flavescens*) and shorebirds (*Sterna* sp., *Calidris canutus*).

In the previous several decades, the Cerro Verde area suffered great degradation, principally due to overuse and inadequate development of the coastal zone, illegal fishing, overexploitation of the marine resources, incidental captures, motor vehicle access along the coastal zone, waste water runoff from agriculture and tourism developments, all with little to no management or oversight.

Since 2004, Karumbé and other organizations have campaigned to incorporate 2000 coastal hectares and 7000 marine hectares of the Cerro Verde area (Castro & Andrade, 2006) within the new National System of Protected Areas (SNAP). Finally, in 2006 the Cerro Verde area was presented as the first Coastal Marine Protected Area of Uruguay (CMPA) to the National Commission Advisors of the SNAP under the category "Habitat/Species Management Area" described by the Decree 52/2005¹ (Regulation of the National Law 17.234). The creation of this first CMPA, the development of an

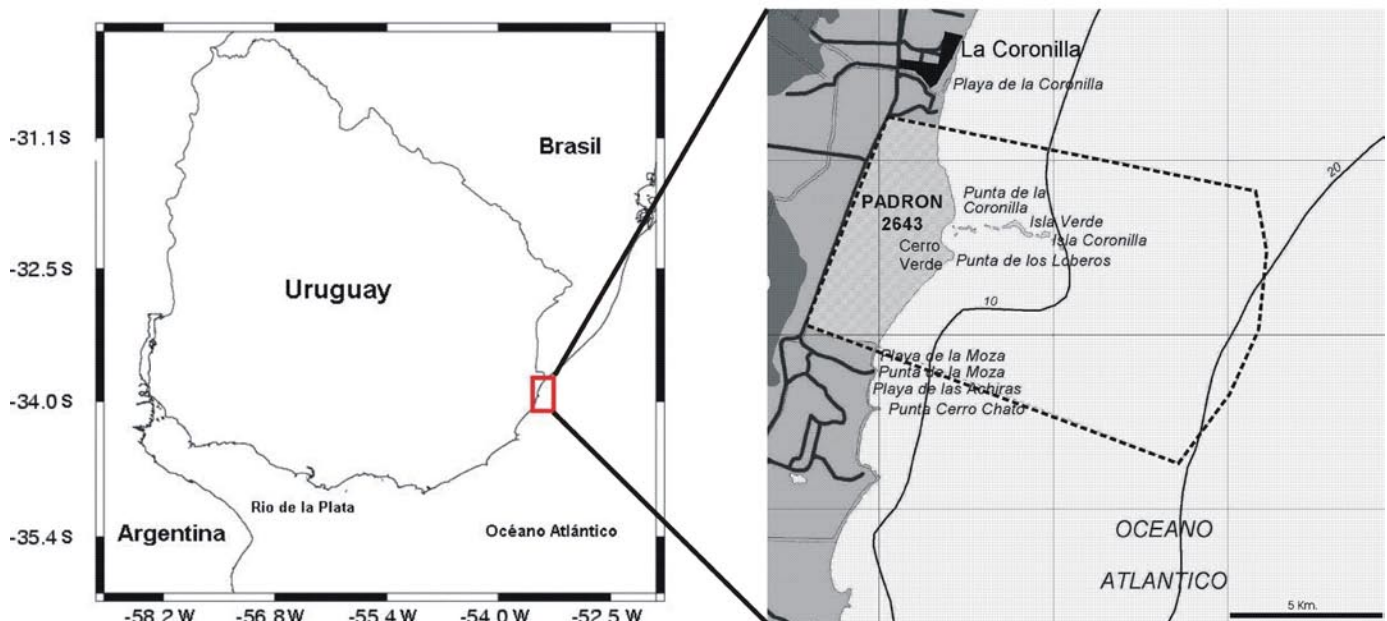


Figure 1. Extent of the CMPA that includes Cerro Verde and nearby islands. Dotted line indicates the limits of the CMPA in the marine habitat. (map source: Freplata).

effective management plan and the future integration of other marine areas to the SNAP, are important first steps towards the reduction of threats that occur in the most important developmental and foraging habitats for the green turtles in Uruguay.

Acknowledgements: This work would not have been possible without the financial support of the British Petroleum Conservation Programme and Rufford Small Grants.

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LÓPEZ-MENDILAHARSUM., A. ESTRADES, M.N. CARACCIO, V. CALVO, M. HERNÁNDEZ & V. QUIRICI. 2006. *Biología, Ecología y etología de las tortugas marinas en la zona costera uruguaya*. In: Menafrá R., Rodríguez-Gallego L., Scarabino F. & D. Conde (Eds), *Bases Para la Conservación y Manejo de la Costa Uruguaya*. Vida Silvestre Uruguay, Montevideo. pp 247-258.

1° "Habitat and/or species management area", that will achieve the following:
1°. Maintain the habitat in the necessary conditions to protect important species, group of species, biotic communities or physical characteristics of the environment, when certain types of human concrete manipulation is required for an optimum management;
2°. Facilitate scientific research and environmental monitoring as principal activities associated to the sustainable management of resources;
3°. Establish limited areas for educational purposes and for the appreciation of the characteristics of these habitats and the management activities of the wildlife, by the general public;
4°. Exclude (and prevent) the overexploitation or hostile occupation of the designated area; and,
5°. Contribute to the local populations that live inside the designated area, with the benefits derived from the different activities that are compatible with the other management objectives.

Third Announcement: 29th Symposium on Sea Turtle Biology and Conservation, Brisbane, Australia, 17-19 February 2009

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Welcome event: The welcome event is going to be something a bit special at 2009's *Symposium on Sea Turtle Biology and Conservation*, so be sure to go online and purchase your tickets (\$20 pp). The event will be held on the night of Monday 16 and highlights include a Welcome to Country by Traditional Owners, the official opening of the Symposium, and entertainment by indigenous Australian dancers.

Speaking of things indigenous, we would like to reiterate our invitation to indigenous delegates from around the world to join indigenous Australians in the 'Talking Circle' on the night of Sunday 15. This is an opportunity for indigenous delegates to get to know each other in advance over a barbeque and to share stories from the breadth of indigenous turtle work being conducted around the world. For more information keep an eye on the Turtle Talking Circle page of the website: (<http://www.turtlesbrisbane2009.org/page-7-61-IndigenouseventTurtleTalkingCircle.htm>) or contact Scott Whiting, Indigenous Liaison Working Group Chair (E-mail: scott.whiting@nt.gov.au).

Scientific program: The Program Committee is currently assessing the hundreds of abstracts received as submission for the main Symposium sessions on 17-19 February. Authors will be notified of the results in November. Don't forget, a wide variety of associated meetings are taking place from February 14 to 16 just prior to the main Symposium sessions. For example, there has been a very strong interest from local groups in participating in the Australian Sea Turtles Mini-symposium on the 16th. There is something for everyone so consider coming in early to be part of the associated

meeting action as either a participant or an observer. Two training workshops are being held during this period also – one on stable isotopes, the other on statistics. (A necropsy workshop will be held the day *after* the symposium). These are free for delegates, but numbers may be limited by space available.

Sponsorship & exhibition: We would like to acknowledge the wonderful support we are receiving from both new and returning sponsors so far. Without them these symposia would not be possible. We encourage everyone to have a look at the (growing) sponsor and exhibitor list on the website.

Where to get more information: The website www.turtlesbrisbane2009.org is the "go to" reference for details on the 29th symposium, and continues to be updated with new information. Email magazines (ezines) on the symposium are distributed periodically to the CTURTLE listserv and individual subscribers (see the website page). The website also contains information on:

- Visas – how to apply for visas and what we are doing to assist
- Customs – what you can and can't bring into Australia
- Symposium tour options
- Other tourist options/attractions – websites & tips from the locals
- Koala Challenge photos from around the world

See you soon: The Banquet band is booked, the exchange rate gets more favourable for visitors by the day, and we're warming up the auctioneer's microphone. See you in Brisbane!

IUCN-SSC Marine Turtle Specialist Group Quarterly Update

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IUCN World Conservation Congress, Barcelona: IUCN holds its World Conservation Congress (WCC) every four years (the last was in Bangkok in 2004). This event is the premier IUCN meeting, and it is the forum at which the Specialist Groups and their work are featured in front of a global audience. The Barcelona WCC once again called to global attention the ever-growing biodiversity crisis, especially as it relates to climate change and increased extinction risks (based on latest Red List Assessments) across all major biomes. The forum highlighted the rigorous assessments of taxonomic groups including the MTSG. Great emphasis was placed on the need for more innovation in addressing the biodiversity crisis, but also a re-doubling of the use of proven tools such as protected areas. There was also a significant emphasis on people and nature, with sessions on ecosystem services, community conservation, climate change adaptation, and livelihood issues linked to protected areas. Rod, Nick and Brian were all present in Barcelona, as were a number of MTSG members from around the globe. We managed to meet with many of them and catch up on turtle matters, but more importantly we linked-up with a suite of IUCN colleagues from the Secretariat who play a key role in the activities of the MTSG – from the Species Programme, the Red List team, the SSC Chair and many others. Over 7500 participants from more than 120 countries attended the WCC, during which over 800 conservation sessions (lectures, knowledge cafés, workshops, book launches, receptions, media events, award ceremonies and conservation cinemas) were held. One book launch featured a volume co-edited by Nick and the Marine Conservation Sub Committee of SSC/IUCN called *Drift-Tales of Ocean Fragility*, which featured a chapter on sea turtles.

Key changes in the IUCN structure that are pertinent to the MTSG occurred during the week, including the election of a new SSC Chair, Dr. Simon Stuart, and a new IUCN President, Ashok Khosla. We wish them the best in their new appointments.

Burning Issues Workshop 4: The 4th Burning Issues Workshop (BI-4) was hosted in August in Shepherdstown, WV, USA, and is the most recent in an on-going series of expert gatherings at which the MTSG is fine-tuning global priorities for sea turtle conservation.

The MTSG began to conduct Burning Issues Workshops to tap into the collective millennia of life experiences of its membership and we are committed to continuing to use these gatherings to look at different angles of sea turtle conservation in a pragmatic way. This series of annual workshops derives its name from an exercise conducted among 30-some seasoned sea turtle experts gathered in West Virginia in December 2003, which resulted in a “Top Ten List” of the world’s most threatened sea turtle populations. This Top Ten List has been broadly communicated within the sea turtle community through lectures and publications and has been

disseminated in several languages as a poster produced by the MTSG, CI, ProPeninsula and others.

The 2nd Burning Issues Workshop (BI-2, August 2005) further refined the Top Ten List, adding background status information to each of the Top Ten, and it also added a first-draft of Critical Research Needs that highlighted areas where greater study is needed to understand poorly-known turtle populations. BI-2 also defined a set of 5 Hazards, “*threats that will result in decline, local extinction and/or prevent the recovery of sea turtles,*” that have also been widely publicized and have become part of the jargon of our community.

BI-3 created a new structure to improve delivery and quality of IUCN Red List assessments, and the 26 experts present designed a survey that has since been implemented among the full MTSG membership to determine the relative impacts of the 5 Hazards in all the regions of the Earth where sea turtles occur. BI-3 also took a broad look at the Major Un-answered Questions of sea turtle natural history, as a means to better direct future research efforts within our community. The results of this undertaking are described in a special feature in *SWOT Report, Vol. 2* (see “Unsolved Mysteries: The Sea Turtle Files,” pp. 6-13).

Priority-setting for sea turtles must be done at the scale of management units that take into account multiple factors such as population genetics and geographic ranges, as these are the units at which extinction poses the most pertinent threat, and at which most conservation actions can be implemented. For some sea turtle species and populations, genetic and geographic range definitions are relatively advanced, while for others a good deal of work must still be done. The MTSG’s Burning Issues Workshops continue to support the refinement of population definitions for all sea turtle species and serve to extract up-to-the-moment expert opinion (since much of what is known is still unpublished) on the top issues of importance to preventing turtle extinctions and conserving marine habitats.

The BI-4 Workshop had two primary objectives:

1. To define sea turtle populations/management units for the purposes of conservation priority-setting, and;
2. To develop specific criteria and a process for ranking/prioritizing the conservation status of all sea turtle populations/management units on a global scale.

These two objectives represent a pretty tall order, yet the team took on the challenge with gusto. The BI-4 participants agreed upon definitions and a framework for describing management units for all sea turtle species, taking into account all available information on population genetics, tag returns, and satellite telemetry. Following

this, the BI-4 group began development of scientifically sound and mutually agreeable criteria for defining priority sites for sea turtles at the global scale, priority management units, and methods by which to rank those sites and populations by order of importance based on multiple conservation objectives—another major “first” for the sea turtle conservation movement. We are also designing processes that will assure that priority-setting products are dynamic, regularly updated, and that they allow for input from a wide variety of sources. Consensus will always be a holy grail when it comes to priority setting, yet we believe that by including a broad array of expert opinions we can approach it.

We would like to extend a special thanks to all the MTSG members and others who participated in BI-4: Alberto Abreu, Brian Bowen, Raquel Briseño, Paolo Casale, Alice Costa, Naamal De Silva, Alejandro Fallabrino, Elena Finkbeiner, Brian Hutchinson, Colin Limpus, Neca Marcovaldi, Andrea Margit, Jeanne Mortimer, Jack Musick, Nicolas Pilcher, Earl Possardt, Joca Thome, Sebastian Troëng, Bryan Wallace, Lucy Yarnell, and Blair Witherington—with a special thanks to Michelle Pico and the National Fish and Wildlife Foundation for their financial and technical support, and to the standing committee for the Burning Issues Workshop Series: Alan Bolten, Milani Chaloupka, and Rod Mast.

First MTSG Regional Vice-Chairs Meeting: On August 15, 2008 eight of the thirteen MTSG Regional Vice-Chairs gathered in Shepherdstown, WV to discuss a variety of MTSG issues and take advantage of their mutual presence for the Burning Issues 4 meeting. A number of topics were discussed including MTSG member reappointment, communications, and the role of the vice chairs. Notes from this meeting will be circulated to the entire MTSG membership in the near future for review.

Dhamra Port: The Dhamra Port project continues to make positive strides in conservation. Nick visited the Port in late September to review progress in implementation of conservation efforts, and to discuss further work. Construction of the port is well underway, and the site has shielded most lights as per their commitment after the earlier lighting mission (see *MTN 121*). Those lights which were unshielded were new, and the Port promised to have those shielded as soon as possible. Several changes in dredgers have occurred over the past few months, but all gear has arrived to Dhamra fitted with deflectors and screening devices as directed through the dredging consultations. As an offshoot of the dredging operations, which has 100% observer coverage, the team at Dhamra have developed a street theatre group to educate children and local villages concerning the plight of marine turtles. The troupe is made up of observers who are not on duty (the project currently employs over ten observers who rotate time on the ships), and the street performance has been received with great warmth by the children in the local villages. Nick held a ‘biology of turtles’ update for those who were on leave during his visit, in order to answer questions the observers were being posed by the schoolchildren – many of which had them stumped! A technical cum shareholders meeting originally scheduled for September has been rescheduled to the end

of November to adjust for conflicting schedules amongst several of those who needed to attend. Invitations for the meeting have gone out to MTSG members in India.

State of the World’s Sea Turtles (SWOT) Advances: The MTSG was a founding partner in the State of the World’s Sea Turtles (SWOT) initiative that has now been growing for more than four years. Dr. Bryan Wallace now chairs the SWOT Scientific Advisory Board (SAB), which has recently updated its volunteer membership to include top experts in sea turtle data standards and statistics: Milani Chaloupka, Scott Eckert, Marc Girondot, Colin Limpus, Suzanne Livingstone, Neca Marcovaldi, Nicolas Pilcher, Jeff Seminoff, and Andrea Whiting. SWOT also hired a part-time Database Coordinator in July 2008, Andrew DiMatteo, who will oversee the acquisition and management of the data used to produce SWOT maps. Andrew is based in the Marine Geospatial Ecology Lab (MGEL) at Duke University and is helping reinvigorate SWOT’s long-term partnership with MGEL and OBIS-SEAMAP, another of the original SWOT partners. This important partnership allows us to overlay our valuable data on sea turtles with other global-scale data sets on marine mammals, seabirds, fish stocks, bycatch, etc. for better conservation priority-setting and analyses. Duke’s MGEL is recognized as one of the top geospatial analysis groups in the world, and Andrew will be central in ensuring that SWOT’s mapping stays on the cutting edge. Both Bryan and Andrew are also leading SWOT’s efforts at developing minimum data standards for monitoring projects and related statistical models to improve our ability to detect and monitor population trends over time (see *MTN 121:36-38* for more information).

Preparations for *SWOT Report—The State of the World’s Sea Turtles, Vol. 4*, are now in full swing with an intended release in February 2009 at the 29th Annual Symposium on Sea Turtle Biology and Conservation in Brisbane, Australia. This issue will feature the biology of flatback sea turtles among a variety of articles on other recent findings and successes in sea turtle research and conservation from around the world.

Re-Establishing the MTSG Membership for the New IUCN Quadrennium: Every four years marks a new term—*quadrennium*—for the IUCN, in which the entire organizational structure is wiped clean and all positions are re-appointed. This begins at the top with positions such as the IUCN president, councilors, and the chairs of the various commissions like the Species Survival Commission, and eventually leads down to the appointment of the heads of the various Specialist Groups and Task Forces, and ultimately the members of these bodies.

As mentioned above, a new SSC Chair has already been appointed (Simon Stuart) during the World Conservation Congress, and we now await our own reappointment as MTSG co-chairs before we are able to begin re-appointing the MTSG membership. Members are invited individually for reappointment in the group. We anticipate that this process will begin within the next few months, and we will keep the current membership informed via the MTSG email listserv.

NEWS AND LEGAL BRIEFS

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AMERICAS

Record Year for Sea Turtle Nests

Rare loggerhead sea turtles are having a record nesting season on the Georgia coast and have been laying eggs in promising numbers on southern Atlantic beaches from Florida to the Carolinas. Still, biologists warn the population of mammoth turtles, which weigh up to 300 pounds, remains fragile. And the federal government is considering a proposal to classify loggerheads as endangered after 30 years of listing them as a threatened species. Along the 100-mile Georgia coast, biologists and volunteers working with the state Department of Natural Resources have counted 1,544 loggerhead nests since the nesting season began May 1. That's the most turtle nests recorded since Georgia began keeping count in 1989, breaking the previous record of 1,504 nests in 2003. And new nests discovered since August 1, the final month of the season, haven't been tallied yet. Mark Dodd, the biologist in charge of the Georgia sea turtle recovery program, said Wednesday he suspects the state will top 1,600 nests by the end of the season. That's still short of the state goal of 2,000 nests per year for 25 years. Researchers use nest counts as a barometer for the overall loggerhead population, as the turtles spend most of the year at sea. Each summer, turtle watchers comb the beaches from Florida to North Carolina to look for new nests, marking them and adding a wire-mesh cover to keep out predators. About 90 percent of loggerhead nests in the U.S. are found in Florida, which had its worst nesting season since 1989 last year. Florida biologists counted 28,074 nests in 2007, less than half the state's peak of 59,918 in 1998. Beth Brost, who compiles sea turtle nesting data for the Florida Fish and Wildlife Research Institute, said no numbers have been tallied so far this year. She said nesting appears to have increased on the 28 beaches Florida uses to compare year-to-year progress. In South Carolina, sea turtle program coordinator DuBose Griffin said she expects 4,000 to 4,500 loggerhead nests by the end of the month, which would be one of the state's best nesting years since 1980. North Carolina sea turtle biologist Matthew Godfrey said nesting there has been above average, with nearly 800 nests counted so far. Dodd said a sharp decline in shrimp boats trawling off the Georgia coast, because of high fuel costs and low market prices, this year may have contributed to Georgia seeing so many nests. Boat collisions and fishing net entanglements are the top killers of loggerheads. Overall, the loggerhead sea turtle population remains so low that the U.S. Fish and Wildlife Service and the National Marine Fisheries Service could declare loggerheads an endangered species in the U.S. next year. The species has been listed as threatened, a less-critical classification, since 1978. Sandy MacPherson, national sea turtle coordinator for the Fish and Wildlife Service, said a team of biologists must first determine if loggerheads nesting in the U.S.

are genetically distinct enough to be considered separately from the worldwide population. If so, she said, the agencies could list them as endangered in early 2009. Source: *International Herald Tribune*, 14 August, 2008

Some Question Effectiveness of Turtle Protection Law

Many people in Manatee County, Florida, are questioning the usefulness of a local law meant to protect sea turtles. Since 1998, Bradenton Beach has required residents and resorts to remove furniture after sunset as well as shield all lighting from the beach. However, year after year, residents say many businesses violate the rules. Some of them blame a lack of punishment for the problem. Dr. Tony Tucker, head of Mote Marine Laboratory's Sea Turtle Conservation and Research Program, said these ordinances are important because removing lights from turtles' sight is critical for their survival. "That can cause them to get trapped in the vegetation, fall in the pool, or spin around on their back until the next morning," he said. Despite the awareness of the regulations, not everyone is in compliance, and violators are not being punished for it. Since May, there have been 13 light violations with no fines. Last week, a resort on the beach was cited for violating the city's light statute for the second time. Code enforcement officers say in both instances, a group of hatchlings became disoriented. However, the second time, 15 of the hatchlings died. An investigation is underway to see if the lights caused their deaths. If investigators determine that they did, the owner of the condo could face a fine of up to \$150,000. Code enforcement officers said they've never issued a fine larger than \$1,000. However, the potential fine for the condo owner is so much larger because sea turtles are protected by law. Officers say violators only face a fine if they are repeat offenders or if a turtle is involved during a violation. They said that the matter then goes to a hearing, where the city's special master decides on the amount of the fine. Source: *Bay News 9*, 6 September 2008.

Another Dead Turtle Surfaces

The reports of dead leatherback turtles in South Coast, Massachusetts, has continued to rise with one reported at Salters Point in Dartmouth on Sunday. Staff from Mass Audubon in Wellfleet Bay were notified but the turtle was so decomposed they will get almost no data by examining it. Three leatherback deaths have been reported on South Coast's beaches so far this month. They include a 600-pound leatherback removed from Pico Beach in Mattapoisett on Sept. 9. A decomposed leatherback was still lying on the sand at East Beach in Westport on Saturday after being reported about a week earlier. The highway surveyor said he wasn't aware of it and would make sure it was removed. There were 14 confirmed deaths of leatherbacks in Massachusetts waters this season and 14 reports of sightings of dead leatherbacks in coastal waters. The number of offshore sightings

can't be confirmed because boaters could be reporting the same turtle. The total number of sightings are probably the highest on record. Many of the dead sea turtles have been too decomposed by the time they reach shore for the New England Aquarium or Mass Audubon to determine the cause of death. There are often signs that the leatherback has been hit by a sea vessel, although it is impossible to tell if the vessel hit the turtle before or after it was dead. In July, a 500-pound female that was tagged from West Trinidad was found dead on Cuttyhunk Island. Dead leatherbacks were also found in July at Popponeset Beach in Mashpee and Ricketson's Point in Dartmouth. Source: *Standard Times*, 17 September 2008.

Congress to Investigate Las Baulas Marine National Park

The Costa Rica Legislative Assembly's Special Commission on the Environment approved a series of motions aimed at investigating anomalies supposedly taking place at Guanacate's Las Baulas Marine National Park. The investigation would deal with alleged illegal constructions within the park's restricted Land Maritime Zone (ZMT) — 125 meters of land from the tide line that according to law must be kept from human intervention. However, since 75 meters of this strip are in private hands, an expropriation order by the Ministry of the Environment and Energy (MINAE) was issued in December 2004 to comply with the Law for the Creation of the Las Baulas Marine National Park, No. 7542 of July 10, 1995). However, due to bureaucratic processes and divergent interpretations of the law, the government is yet to acquire such lands. The group investigating Las Baulas is currently working on three files: No. 16.417 and No.16.916, both related to "the single interpretation of article 1 of the Law for the Creation of the Las Baulas Marine National Park"; and No. 16.915, "Law for Protection of Leatherback Turtle Habitats in Costa Rica." These are being studied in a sub-commission coordinated by legislator Maureen Ballesteros of the ruling National Liberation Party (PLN), along with Patricia Romero and Jose Merino del Rio, of opposition blocs Citizen Action Party (PAC) and the Broad Front, respectively. These three legislators were expected to visit the park last weekend, but suspended the tour because they felt "their safety could be in jeopardy. However, two other congressmen, PLN's Salvador Quiros and Jose Luis Vasquez, of the Social Christian Unity Party (PUSC), visited the Santa Cruz canton national park in an independent tour, as citizens. One of the decisions taken by Congress is to ask the government's Peace with Nature initiative, led by Pedro Leon, to provide the final report of the investigation this office conducted regarding Las Baulas. Several individuals have also been asked to testify before the Legislative Assembly, including Rodney Piedra Chacon, director of Las Baulas; Emel Rodriguez, director of the Tempisque Conservation Area, to which the park belongs; Ronald Vargas, director of the National Conservation Areas System; and MINAE Vice Minister Jorge Rodriguez. There's also interest on the part of Congress to analyze scientific studies indicating that leatherbacks that have been subject to installation of radio tracers on their shells for research have not come back to lay eggs in Playa Grande — one of the world's main nesting grounds for this endangered sea turtle species. Source: *Guanacaste Journal*, 12 August 2008.

Governor Concerned About Sea Turtles

Efforts to preserve the endangered sea turtles in the Cayman Islands have attracted the attention of H.E the Governor Stuart

Jack who has volunteered his services to the cause. Governor Jack accompanied Department of Environment's (DoE) Research Officer Joni Kirkconnell and a group of DoE interns on one of their weekly surveillance trips to beaches in search of turtle nests. The group fanned out along a Seven Mile Beach stretch with the Governor and Mrs Kirkconnell walking from Boggy Sand Road in West Bay to Heritage Club. Citing the need for unity in the effort to protect the globally endangered sea turtle, Governor Jack noted that turtles are an important part of Cayman's biodiversity. He said that recent incidents where nesting turtles were slaughtered were a major concern, both to him and to the DoE. Mrs Kirkconnell explained that the DoE conducts beach surveillance during the nesting season (May to October), an exercise that identifies where turtles lay their eggs. "When nests are found we process, mark and monitor them to protect them from poachers and prevent damage from any recreational activity on the beach," she said. Adult turtles breed in Cayman's waters and nest on the beaches. After the breeding and nesting season is over they migrate to forage overseas. It is illegal to harm turtles or their eggs and doing so carries a maximum fine of \$500,000 and one year imprisonment. DoE research puts the nesting turtle population in the Cayman Islands to around 30, down from the millions cited in historical accounts. Source: *Cayman Net News*, 9 September 2008.

Turtle Numbers on the Rise

In Barbados, the sea turtle population appears to be on the rebound. But all could be for nought, one outspoken environmentalist says, if development along the island's coast lines continues unabated. During a recent marine clean-up of Carlisle Bay, St Michael, marine biologist Andre Miller was pleased to report that divers had come face to face with many of the friendly sea creatures. He explained the area near the Hilton Hotel was a big turtle nesting site, and the turtles usually swam into Carlisle Bay to forage. "What we don't want to see," Miller said, "is turtles eating this plastic — which is why we try to get it out, because if algae grows on the plastic, they (turtles) sometimes try to graze, [that is], get the algae off the plastic and swallow some of it as well." Founding member and secretary/treasurer of the Barbados Marine Trust, James Blades, attributed the increase in the turtle population to their having been "strictly managed for the last 25 years". However, he felt the population could be heading for trouble, due to development taking place along the South and West Coasts. "While we have been successful in managing them now, we have a new wave of development that is going to have significant impact on a globally endangered species." The endangered hawksbill and leatherback turtles have been protected by the Barbados Sea Turtle Project, which was started in 1987. Source: *Weekend Nation News*, 10 October 2008.

EUROPE

Tourism Facilities to be Built on Coastal Area in Turkey

The Turkish Culture and Tourism Ministry has given permission for the construction of 12 tourism facilities on a coastal area, called Taşdibi Sülüklü, in the Mediterranean province of Antalya, even though the area is a nesting spot for the endangered loggerhead sea turtle. The Demre district is one of 20 nesting areas of the loggerheads in Turkey, said members from the Turkey desk of the World Wildlife Fund, or WWF. According to a statement by the

ministry, "Tourism firms' application for preliminary authorization has been examined. The intended tourism investments in Demre can be carried out after assessment of the applications is completed." According to plans, the 622,159-square-meter coastal area, the allotment of which has not been completed yet, will be home to seven four-story hotels or seven holiday villages with a bed capacity of 2,640 in total, as well as a convention center, two tourism complexes and two facilities for day-trippers. Süleyman Topçu, the district head of Demre, said he has not seen loggerhead turtles in Sülüklü so far. "Loggerheads had existed in Sülüklü in the past. I was born in Sülüklü and know the area well. I have never seen loggerheads there so far. I might have seen only one or two," said Topçu. He noted the area attracts 4,000 tourists each year. "These tourists have to leave Sülüklü after they spend at most two hours for sightseeing simply because there are no hotels in the area for them to stay in. If there were hotels, then they would stay in them. This is the reason why we want tourism facilities to be constructed there," he said. Because agricultural activity has declined in the area, a shift is needed towards tourism for economic betterment, he added. Source: *Turkish Daily News*, 13 August 2008.

Prince Charles Speaks on Plastic Threat to Marine Life

The Prince of Wales has spoken of his deep concern for the threat posed to marine wildlife by Britain's "throwaway culture" that is dumping plastic bags and other litter at sea. In a speech to celebrate the 25th Anniversary of the Marine Conservation Society (MCS), the Prince pledged his support for the new marine reserves being set up by the Scottish and UK governments and moves to prevent over fishing. However he said litter continues to be a massive problem for ocean life. Rare creatures like the leatherback turtle, the albatross and countless seabirds are killed by ingesting plastic bags and the Prince was shown the remnants of plastic found in the stomach of a dead leatherback turtle. "It is an eyesore on the beaches, but at sea, largely out of sight and thus out of mind, the remnants of our throwaway society are causing incalculable suffering to turtles, whales and seabirds," he said. The Prince praised the MSC for organising beach cleans and campaigning to reduce the amount of rubbish dumped in the sea. "Albatrosses, those magnificent and magical birds, are being found dead with their stomachs almost full to bursting with plastic litter of all kinds - and that is when they haven't actually been drowned by long-line fishing hooks," he continued. "Here, in Britain, our largest native breeding seabird, the gannet, is equally threatened - over 90 per cent of the nests at Grassholm Island contain plastic debris which entangles the feet, wings and sometimes the beak of the chicks. And our largest marine reptile, the magnificent leatherback turtle is particularly susceptible - their favourite food is jellyfish, which bears a striking similarity to a floating plastic bag - a bag that can block their gut and so they starve to death," he said. "We simply cannot continue to treat the oceans in this way. How can we talk about sustainability and stewardship when we are allowing this to happen?" The Prince's comments came as Sainsbury's stores announced moves to limit the use of carrier bags. From next month, shoppers will no longer be able to help themselves to the store's distinctive orange bags. Instead they will be kept under the counter and only given out on demand. Source: *The Telegraph*, 12 September 2008.

INDIAN OCEAN

Shrimpers are Killing Our Turtles

Shrimp fishing is responsible for more than half of all turtle deaths in Bahrain, a study has revealed. The study, conducted by the Bahrain Centre for Studies and Research (BCSR), revealed that a sharp increase in dead marine turtles coincided with the beginning of the shrimping season, in mid July. The Dead Marine Turtle Monitoring Programme found 41 dead turtles during the last two weeks of July, indicating a mortality rate of 2.6 turtles/day. Two weeks of shrimping season accounted for 54% of the total number of dead marine turtles monitored during the first seven months of this year, said BCSR fisheries studies head and programme co-ordinator Dr Ebrahim Abdulqader. He said the sharp increase was evidence that shrimp trawl nets were responsible for most marine turtle deaths in Bahrain's waters. He called upon the Public Commission for the Protection of Marine Resources, Environment and Wildlife and other authorities to implement legal and technical measures to minimise the impact of shrimp trawling on marine turtles. He also called for an awareness campaign, particularly among fishermen, on the proper handling of live marine turtles trapped in their nets. "We must improve the function of shrimp trawls and have turtle-excluding devices in trawl nets to allow them an exit to escape," Dr Abdulqader told the GDN. "If people are reluctant to introduce modifications, then there should be restrictions in certain areas at certain times." Dr Abdulqader said another study was required to find out where and when turtles were most vulnerable. He also called for funds to support programmes aimed at minimising the impact of the shrimp trawl nets on marine turtles and monitoring the incidences of marine turtles in shrimp trawls. Source: *Gulf Daily News*, 18 August 2008.

Tata Group Hits Out at Greenpeace Protests

Mumbai, India. Tata Steel has condemned protests carried out by Greenpeace activists demanding a halt to the construction of Tata's Dhamra port in Orissa which the environmental group says threatens the Olive Ridley sea turtles, an endangered species. The activists blockaded Bombay House, the Tata Group's headquarters, on Wednesday calling on the company to demonstrate corporate environmental responsibility. But Tata Steel, in a release, stated that it was a "clear indication of an organisation which is trying to gain publicity for itself through agitations instead of addressing the issues they have across the table". Tata Steel says it is aware of certain concerns being voiced about the future welfare of turtles in the Bay of Bengal as a consequence of the development of a port in Dhamra, off the coast of Orissa. The company sought to draw attention to various studies since 1994 on the nesting habits of the Olive Ridley turtles along the Orissa coast, including the Gahirmatha marine sanctuary. The studies clearly established that the port limits of the upcoming Dharma port are clearly outside the turtle nesting area as well as the Bhitarkanika Park, the release stated, adding that the National Environmental Appellate Authority had visited the site and found nothing objectionable. The release said Dhamra Port Company Limited is working in partnership with the International Union for Conservation of Nature (IUCN), an organisation which brings together countries, organisations, experts and scientists, to explore all possible ways to avoid any harm to wildlife in the area. Various steps are being taken to ensure adequate safeguards are

deployed in accordance with the IUCN's advice, the release said. "Tata Steel has had discussions with Greenpeace on Dhamra Port and the issue of turtles. All issues stand clarified," the company said, adding it was ready to engage in further discussions. Greenpeace has been campaigning for several years against the port and says it would endanger the Olive Ridley sea turtle whose nesting grounds at Gahirmatha are threatened by the deep water port, barely 15km away. If constructed, the port will disturb the fragile ecological balance, thereby pushing this species one step closer to extinction, Greenpeace contends. Source: *Gulfnews.com*, 21 August 2008.

ASIA

Release of 100-kg Turtle Marks Start of Nesting Season

Zambales residents in the Philippines marked the start of the annual turtle nesting season in the province by releasing a 100 kg female green turtle to the South China Sea on Aug. 26. The turtle joined more than 17,500 hatchlings that had been freed to the sea since 2002, under the Zambales Turtle Conservation Program (ZTCP), said Bruce Oliver, chair of the Environmental Protection of Asia Foundation Inc. (Epafi), in a telephone interview. The ZTCP is implemented by the Department of Environment and Natural Resources, Epafi and the Zambales government. It maintains three hatcheries near the Punta de Uian Resort in San Antonio, Rama Resort in Botolan and Palmera Gardens in Iba. The hatcheries are run by ZCP volunteers and resort workers, Oliver said. He said a resident in Barangay Pundaquit in San Antonio, found the green turtle at 1 a.m. near her house. It was released 10 hours later by residents and village officials led by barangay captain Erwin Saderna. Coming at the onset of the nesting season that lasts from August to March, Oliver said the release of the green turtle signified the commitment of the villagers to conserve the eggs rather than sell or consume these for their supposed aphrodisiac value. Based on the monitoring of the ZTCP, three species of marine turtles nest on the coast of Zambales. These are the olive ridley, green turtle, and hawksbill turtle. Source: *Philippine Daily Inquirer*, 3 September 2008.

Group Dismayed Over Rampant Catch of Turtles

Officials of the World Wide Fund for Nature (WWF)- Philippines has expressed dismay "to find the animals we work so hard to conserve slaughtered on a wholesale basis" by foreigners encroaching the country's territorial waters. WWF-Philippines Project Manager Rene Jay dela Calzada said Thursday that "again and again, foreign national have encroached upon Philippine waters to plunder our nation's dwindling marine resources" citing the recent arrest of Vietnamese fishermen off northern Palawan. The Philippine Navy's Joint Task Force Malapaya (JTFM) arrested 13 Vietnamese fishermen while fishing illegally around 6:30 p.m. of August 29, some five nautical miles east of Cabulawan Island, Linapacan town, Palawan. The JTFM personnel found 101 dead hawksbill turtles in the vessel's cargo hold. It is one of the largest illegal wildlife hauls of the year. Distinguished from other sea turtles by a hooked beak and heavily-serrated carapace, the hawksbill has for millennia been hunted for food and tortoiseshell—a material used as far back as the ancient Greek and Roman eras to fashion jewelry, combs, and brushes. Calzada said hawksbill turtles are now classified by the International Union for Conservation of Nature (IUCN) as critically endangered—the highest risk rating for a living animal save for being

completely extinct in the wild. He said it is illegal to capture and kill sea turtles and to trade in turtle by-products under Philippines and international laws. The WWF officials noted that in the last decade there were over a thousand foreigners have been arrested and charged for poaching in the waters off Palawan alone. Over 660 poachers were Chinese. However, only one case -- the January 2004 arrest of 17 Chinese poachers caught with 54 dead sea turtles -- has ever led to a conviction, but they were even pardoned after paying a light fine. Source: *The Sun Star News*, 5 September 2008.

Ecologists Facing Poachers in Saving Sumatran Turtles

In Bangka Belitung (Babel), a new province in Sumatra, sea turtle hunting has been increasing over the past few years. Dozens of Leatherback sea turtles are hunted and killed each month to be used as ingredients for production of traditional medicines and as raw materials for leather good accessories, the head of Babel's Agriculture and Forestry Service said. As a result of rampant hunting, the population of leatherback turtles, locally called 'Penyu Belimbing' (*Dermochelys coriacea*) in the province has fallen to only about 1,000. The five local turtle species facing a serious risk of extinction in Babel include 'Penyu' or Kemp's ridleys and 'Penyu Sisik' or hawksbills, which according to the World Conservation Union (IUCN) are at the greatest risk of becoming extinct. The others are 'Penyu Hijau' or green turtles, 'Penyu Lekang' or olive ridleys and 'Penyu Tempayan' or loggerhead turtles. Although turtle eggs are prone to natural predators, their main threat comes from human beings. Local people usually collect turtle eggs for consumption or for money. They sell them at Rp1,200 (about 13 cents) each, and it is easy to find turtle eggs in food stalls in Muko-Muko district. The West Sumatra regional administration is developing the coastal lines as a tourist resort to help promote the Visit Indonesia Year 2008. The head of the West Sumatra Tourism, Arts and Culture Office said during an expo in Singapore earlier this year: "We have places where tourists can see something more unique, namely the turtle breeding process. For such an experience, why should we go to Brazil? Let's come to Pulau Penyu (Turtle Island) in West Sumatra." Source: *Antara News*, 5 September 2008.

Marine Police Seize Smuggled Turtle Eggs

Marine police in Sabah, Malaysia, succeeded in seizing 3,000 turtle eggs worth about RM 8,400 (US\$ 2,400) smuggled in from a neighbouring country for sale here in an operation in Kampung Forest here Friday. Acting Sandakan marine police chief, ASP Muhammad Sallam Spawi, said the eggs were found after a boat was boarded in waters near the village about 4.30 am. A man who was on board fled leaving the boat in shallow waters. "The man was believed to be on his way to Sandakan town to sell them," Muhammad Sallam said at a news conference here Friday. He said the eggs were obtained from several islands near Malaysian waters. Smugglers prefer to sell them here as they fetch a high price of up to RM2.80 (US\$ 0.80) each and the demand was high, he said. Source: *Malaysian National News Agency*, 26 September 2008.

OCEANIA

Feds: Help Stop Illegal Sea Turtle Poaching

Sea turtle poaching is an ongoing problem on Guam and the Northern Marianas Islands and the federal government is asking

for the public's help to stop the practice. Last month, the federal government began offering up to \$1,000 for information leading to the arrest or conviction of people poaching sea turtles in Guam and the Northern Marianas Islands, or information leading to the rescue of living sea turtles. Guam's sea turtles are decreasing in numbers, according to the Department of Agriculture. Both green and hawksbill turtles can be found on Guam. The decline of green sea turtles is attributed to people poaching the species and the threat posed by monitor lizards, stray dogs and cats. Off-roading, people accidentally stepping on nesting areas, development and unawareness of poaching regulations are examples of human actions that displace the turtles and its eggs. Special agents with NOAA have been investigating cases involving the sale and consumption of protected turtle meat and eggs. According to government officials, there is an increase amount of poaching in the Marianas. Source: *Pacific Daily News*, 01 September 2008.

Tilly the Turtle's Excellent Adventure

The adventurous Tilly the turtle will today farewell the Unanderra couple who nursed her back to health following an amazing journey,

a dramatic rescue, a shock disappearance and a fight to survive. The journey of Tilly, a three-year-old loggerhead sea turtle from North Queensland, ended when she washed up on Corrimal Beach in June, 2500 km from home. Rescued from the sand, she was taken into care at Lindsay Smith and Janice Jenkin-Smith's Unanderra home. The couple immediately began a rehabilitation program. "She was floating which is always a serious concern, and we believe she may have ingested some plastic," Mrs Jenkin-Smith said. "We eventually got her to eat some food and obviously she did the right thing - she did her business - and then she started to sink down a little and now she sits down on the bottom of the tank." Tilly's health continued to improve but later in June she disappeared. "She was gone from the tank and there was no way she could have got out on her own," Mrs Jenkin-Smith said. A frantic search ensued and 48 hours later Tilly was returned by some neighbourhood boys. Tilly thrived over the next 12 weeks, growing more than 4 cm in length, meaning it was time for her to return home. Today she will travel by car to Taronga Zoo before continuing on to Queensland where she will hopefully live out her next 147 years. Source: *Illawarra Mercury News*, 17 September 2008.

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This section is compiled by the Archie Carr Center for Sea Turtle Research (ACCSTR), University of Florida. The ACCSTR maintains the Sea Turtle On-line Bibliography: (<http://accstr.ufl.edu/biblio.html>).

Included in this section are publications that have been pre-published online prior to the hardcopy publication. These citations are included because of the frequent delay in hardcopy publication and the importance of keeping everyone informed of the latest research accomplishments. Please email us <ACCSTR@zoology.ufl.edu> when your papers are published online. Check the online bibliography for final citation, including volume and page numbers.

It is requested that a copy of all publications (including technical reports and non-refereed journal articles) be sent to both:

- 1) The ACCSTR for inclusion in both the on-line bibliography and the MTN. Address: Archie Carr Center for Sea Turtle Research, University of Florida, PO Box 118525, Gainesville, FL 32611, USA.
- 2) The editors of the Marine Turtle Newsletter to facilitate the transmission of information to colleagues submitting articles who may not have access to on-line literature reviewing services.

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