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Editorial Introduction

Refocusing on Leatherbacks: Conservation Challenges and Signs of Success

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The leatherback sea turtle (*Dermochelys coriacea*) has been called Mercury's turtle since the Middle Ages (Rondelet 1554), because its teardrop body plan and ridges resemble the shape and strings of Mercury's instrument, the lyre (*leut*, *luc*, or *luth* in French, *laúd* in Spanish). And, because Mercury was the winged Roman messenger god, leatherbacks should perhaps be considered winged messengers themselves. Certainly, their graceful underwater flight, as illustrated on our cover, makes them appear winged as they glide through their blue watery oceanic realm, but they are also messengers—the harbingers of pelagic environmental change and threats occurring within their habitat. We would do well to heed their silent message, and this journal issue addresses many of the concerns relating to their survival.

Over a decade has passed since *Chelonian Conservation and Biology* published the initial special focus issue on the leatherback turtle (Vol. 2, No. 2, October 1996). This was the inaugural contribution in a series of 5 special issues or sections that have focused on hawksbills, Kemp's ridleys, Blanding's turtles, and gopherine tortoises. As the first journal to dedicate its pages exclusively to leatherbacks, that issue contained 18 contributions that focused on the biology and conservation of leatherbacks around the world. Those papers provided a broad perspective for a species that was fast becoming the symbol for the imperiled state of sea turtles. Collectively, the journal addressed many issues, but 2 papers that sounded the alarm on regional extinctions captured much of the attention. Chan and Liew (1996) chronicled the disappearance of leatherbacks at the once-remarkable Terengganu rookery in Malaysia, and Spotila et al. (1996) presented the grim potential of extinction for the entire Pacific Ocean. In addition to these sobering accounts, encouraging papers were presented on skeletochronology (Zug and Parham 1996) and chondro-osseous development (Rhodin et al. 1996, building on previous work by Rhodin 1985) that demonstrated rapid growth and relatively early maturation by leatherbacks. Thus, despite the real threat of extinction in the Pacific, data also suggested that leatherbacks, because of their relatively shorter generation times, could potentially respond to conservation efforts

more quickly than many of the hard-shelled cheloniid sea turtles.

Since the first special focus issue, the leatherback's status in the IUCN Red List has been upgraded from endangered to critically endangered because of a global decline in nesting frequency (Sarti-Martínez 2000). Yet, as captured in the pages of the first special focus issue, there were largely different nesting trends in the Atlantic and Pacific. Whereas most, if not all, known Pacific nesting populations had experienced precipitous declines during the previous decades (Chan and Liew 1996, Spotila et al. 1996), many rookeries in or near the Atlantic had been stable or increasing (e.g., Boulon et al. 1996; Girondot and Fretey 1996; Hughes 1996). Since then, it has become apparent that this trend continues (Spotila et al. 2000; Reina et al. 2002; Eckert and Kerr Bjorkland 2004; Dutton et al. 2005), and, based on the 2006 state of the world's turtles report (Mast et al. 2006), annual leatherback nesting numbers are substantially greater in the Atlantic than in the Pacific.

The burning question is: why are the 2 ocean basin populations behaving so differently? Perhaps this disparity results from marked differences in fisheries by-catch mortality and/or harvest rates between the 2 ocean basins. We know that marine fisheries have had major impacts on leatherbacks (Eckert and Sarti 1997; Lewison et al. 2004; James et al. 2005; Carranza et al. 2006), but it is debatable whether by-catch rates are sufficiently different to result in the observed regional trends. Egg and female harvest may also contribute to differences; like fisheries, these are ubiquitous threats (Sarti 2000; Kaplan 2005), but again, are they so different in the Atlantic vs. the Pacific? Others have suggested that the responsible factors may be lower reproductive output and hatching success and longer adult female remigration intervals in the Pacific vs. the Atlantic (Bell et al. 2003; Wallace et al. 2006; Saba et al. 2007). Indeed, the ocean basin dichotomy has been the focus of at least 2 sea turtle expert working groups (NOAA Turtle Expert Working Group; Pacific-Atlantic Sea Turtle Assessment Workshop-PASTA, Lutcavage et al. 2006). The reality, however, is that we still do not have a smoking gun fully explaining the regional patterns, and it is clear



Figure 1. A leatherback female emerging to nest on a dark tropical beach. Oil painting by Nicholas Mrosovsky titled “Memories of the Guianas” (original dimensions are 72 inches \times 44.5 inches).

that reaching that stage will require further focused examination of the population-level impacts of leatherback interactions with commercial and artisanal fisheries, as well as life table data on survival rates of all life-classes from hatchlings to adults. We also need a better understanding of leatherback energetic demands, their role in marine ecosystems, the consequences of varying oceanography, and the not-so-simple question of where hatchlings and juveniles disperse and reside.

Since the 1996 special focus issue, leatherbacks have continued to be the focus of substantial research and conservation. Notably, leatherbacks were chosen as a flagship species for the Tagging of Pacific Pelagics (TOPP; Block et al. 2002), a research program that uses large migratory species as oceanic platforms to study the impacts of climate and other oceanographic or biological factors on their behavior and physiology. In this sense, leatherbacks are now the researchers, collecting and transmitting oceanographic data wherever they go. With respect to fisheries, there has been considerable research to examine the effects of gear modifications on leatherback by-catch, as well as sea turtle sensory studies aimed at reducing by-catch (Watson et al. 2005, Swimmer and Southwood 2006; M. Hall, *pers. comm.*). Much of this work was at least partially instigated by a successful lawsuit against the U.S. National Marine Fisheries Service (NMFS) that resulted in the temporary closure of the Hawaii-based longline fishery (Federal Register 2001).

Although many questioned its true value for sea turtle conservation, this litigation was an important milestone, because it galvanized the support of U.S. agencies such as NMFS and the U.S. Fish and Wildlife Service for research and remediation of the leatherback declines and the incidental by-catch of endangered species in general, and it resulted in a greater responsiveness by NMFS when issues of sea turtle by-catch arise (Federal Register 2006).

Preventing leatherback declines has also been the focus of conservation plans, international accords, and specially managed marine zones. Setting the basis for many of these efforts was the Recovery Plan for U.S. Pacific Leatherback Populations (NMFS and USFWS 1998). This plan identified numerous research and conservation priorities and has served as a blueprint for leatherback recovery throughout the Pacific. Elements of this plan are present in several conservation initiatives that have been developed since, such as the North American Conservation Action Plan for the Pacific Leatherback Turtle, a trilateral effort by Canada, United States, and Mexico, that outlines the strategy for leatherbacks protection in jurisdictional waters of these 3 nations (Commission for Environmental Cooperation 2005), and Mexico’s Tri-state Leatherback Conservation Plan that brings together federal agencies and state governments of Michoacán, Guerrero, and Oaxaca to promote nesting beach conservation (A. Barragán and L. Sarti, *pers. comm.*). There have also been several memoranda of



Figure 2. Daytime emergence of leatherback turtle (*Dermodochelys coriacea*) hatchlings at Tortuguero, Costa Rica. (Photo by Sebastian Troëng).

understanding throughout the world that call for specific conservation actions, and one of particular relevance takes us to the western Pacific: the Memorandum of Understanding of a Tri-National Partnership between the Governments of Indonesia, Papua New Guinea, and Solomon Islands on the Conservation and Management of Western Pacific Leatherback Turtles. Signed in 2006, this agreement formalizes international cooperation for leatherback conservation in one of the species' last strongholds in the Pacific Ocean.

Sea turtle conservation is now more multidisciplinary than ever; often engaging sea turtle biologists, wildlife managers, economists, and policy experts to address the growing challenges. For example, at a 2003 workshop in Asilomar, California, leading leatherback researchers and government representatives met with oceanic environmental scientific advocates, such as Sylvia Earle and Carl Safina to discuss conservation strategies in the Pacific. This workshop was a staging ground for the DVD "Last Journey for the Leatherback" that documents the incredible life of leatherbacks and also details the threat industrial fishing poses to their survival (directed by Stanley Minasian). It also led to a well-received book by the award winning writer Safina (2006) that relates stories of leatherbacks, researchers, and the people who interact with these endangered marine turtles. Soon thereafter, in November 2003, a group of 25 economists, marine policy experts, fisheries professionals, sea turtle biologists, and natural resource management specialists met in Bellagio,

Italy, producing the Bellagio Blueprint for Action on Pacific Sea Turtles (Bellagio Steering Committee 2004) that called for a broad-based approach by using direct protection strategies, as well as economic alternatives. This was followed in late 2004 by a Food and Agriculture Organization (FAO) Technical Consultation on Sea Turtle Conservation and Fisheries in Bangkok, Thailand (FAO 2005). For the first time, the plight of the sea turtles was brought to the forefront of a world trade body, and, like Bellagio, resulted in a series of recommendations for future sea turtle conservation, targeting all phases of leatherback life history. The Western Pacific Regional Fisheries Council has since become involved (Dutton 2005) and has further demonstrated the value of partnerships between fisheries bodies and on-the-ground leatherback conservation programs.

The leatherback decline has also resulted in the proposal for a marine protected area throughout much of the eastern Pacific Ocean. Launched by Conservation International, UNESCO World Heritage Centre, and the United Nations Foundation, the Eastern Tropical Pacific Seascape Initiative is developing an expansive international marine protected area (MPA) delineated by the exclusive economic zones of Panama, Costa Rica, Ecuador, and Colombia, including their offshore islands, such as Cocos, Gorgona, Mal Pelo, and the Galapagos Archipelago (UNESCO 2006). The boundaries of this seascape encompass feeding zones and migratory corridors determined from satellite tracking of leatherbacks during

research in the mid 1990s (Morreale et al. 1996) and as part of the TOPP (G. Schillinger, unpubl. data.), and it is clear that this project will help the long-term survival of not only leatherbacks but also a variety of other pelagic species.

Although we remain hopeful that these conservation efforts will result in the future recovery of Pacific leatherbacks, it is to the past that we must look to see how these efforts got started. In fact, many of today's conservation strategies are built on the foundation created years earlier by a series of leatherback special focus events held during the annual symposia of the International Sea Turtle Society. In 1999, for example, a leatherback workshop was held during the 19th Annual Sea Turtle Symposium in South Padre Island, Texas, that focused on aspects such as nesting beach conservation and remigration intervals, at-sea studies, and passive integrated transponder (PIT) tagging strategies (Paladino 1999). Interest peaked 2 years later, when the 21st Annual Sea Turtle Symposium in Philadelphia, Pennsylvania, hosted a special mini-symposium on leatherbacks, during which experts from around the world presented their recent advances in leatherback research and management (Coyne and Clark 2004). The data presented at this meeting were a driving force behind the aforementioned lawsuit in Hawaii, and it certainly crystallized our acknowledgment of the disparity between population trends in the Pacific vs. the Atlantic. While planning this event, it became clear that many new data were available from throughout the world, so much so that the 21st symposium's president, Jim Spotila, a world leader in leatherback conservation, proposed the idea to us (Rhodin and Paladino) that the mini-symposium would be a perfect impetus for a second special focus issue on leatherbacks. This plan was put in motion, and, during the last 5 years, we have worked hard to bring this second leatherback issue to the pages of *Chelonian Conservation and Biology*. Many of the original presenters from Philadelphia contributed papers in the current issue (e.g., Karen Eckert, Peter Dutton, Marc Girondot, Frank Paladino, Richard Reina, Laura Sarti, Jim Spotila, Sebastian Troëng), and we have the pleasure of presenting papers from several new contributors.

As we mobilized our efforts to pull together this special focus issue, Paladino and Rhodin took the early lead in soliciting and processing papers for publication. Being the senior people we are, we soon found ourselves slipping behind our schedules and, therefore, enlisted Seminoff to help bring us back on track. And that he did, taking over admirably and driving the process to completion. This issue now stands ready primarily as a testament to his concerted efforts. In this special focus issue, we are proud to present 22 contributions on leatherbacks, representing input from 76 authors, including many of the world's most respected sea turtle scientists. With 10 papers focused on the Atlantic basin and 11 focused on the Pacific, there is a balanced coverage of the 2 ocean basins. And, although we do not cover the Indian

Ocean in this current volume, the recent assessment carried out by the Indian Ocean—South-East Asian (IOSEA) Marine Turtle MoU Secretariat fills this role (Hamann et al. 2006). In developing this issue, we invited contributions that provide information that could directly assist conservation efforts. To that extent, the papers herein address 5 major areas: conservation planning, population status, stock structure, demography, and fisheries interactions.

When first presented with the theme of Pacific-wide leatherback extinctions in 1996, Peter Pritchard warned that, before amplifying the alarm, we must fill in the gaps for annual nesting numbers and examine more nesting abundance time series data (Pritchard 1996). In the present volume, these needs are addressed head-on with the publication of long-term (10+ years) data sets for 6 different nesting areas: French Guiana/Suriname (36 years), the Pacific Coast of Mexico (24 years), Las Baulas National Park, Costa Rica (15 years), Gandoca Beach, Costa Rica (15 years), Espírito Santo, Brazil (14 years), and Tortuguero, Costa Rica (11 years). Shorter-term data are presented for Playa Langosta in Las Baulas National Park, Costa Rica (5 years); Papua, Indonesia (3 years); Chiriqui Beach, Panama (1.5 years); Vanuatu (1 year); and Margarita Island, Venezuela (1 year). Together, these papers represent the largest collection of leatherback nesting abundance data ever published together in one place.

We also present a series of much-anticipated papers on leatherbacks in the western Pacific (Indonesia, Papua New Guinea, Vanuatu, and Solomon Islands). In addition to nesting numbers, these contributions describe the genetic stock structure, internesting and postnesting movements, and ongoing conservation strategies in these island nations. Among the notable inclusions are the first-ever trans-Pacific satellite tracks of leatherbacks, the recognition of several previously undiscovered nesting sites, and, most importantly, data indicating that the annual nesting numbers of leatherbacks in the western Pacific are substantially higher than previously believed (e.g., Spotila et al. 1996, 2000).

There is also a collection of papers that addresses demographic aspects, all of which should help to further refine our understanding of the ocean basin dichotomy. These papers address aspects such as clutch frequency (4 papers), hatching success (3 papers), female nesting success (3 papers), and survivorship (2 papers). In addition, 2 contributions describe the impacts of coastal artisanal fisheries by-catch in the Pacific, which, to date, have been largely overshadowed by the clear and present threats of high-seas commercial fisheries, and 1 paper presents an improvement in leatherback blood collection methodology.

Many new data have become available since 1996, when the first leatherback special focus issue was published, and we are thankful that the authors have worked so diligently to bring much of this information to

the pages of this issue. We also gratefully acknowledge the 7 CCB Editorial Board members who assisted with the review process (Scott Eckert, Brendan Godley, Kenneth Lohmann, Anne Meylan, Nicolas Pilcher, Jim Spotila, and Jeanette Wyneken) and the 31 manuscript reviewers (Larisa Avens, Jason Baker, Sean Blamires, Milani Chaloupka, Tomoharu Eguchi, Alan Foley, Matthew Godfrey, Jonathan Houghton, Michael James, T. Todd Jones, Jennifer Keller, Jeffrey Miller, Stephen Morreale, Sally Murphy, Andrew Myers, Ronel Nel, Toshinori Okuyama, Pamela Plotkin, Earl Possardt, Alan Rees, Richard Reina, J. Perran Ross, David Rostal, Vincent Saba, Amanda Southwood, Ed Standora, Tony Tucker, Manjula Tiwari, Jason van de Merwe, and Bryan Wallace). With their assistance and attention to detail all the papers in this issue have been improved.

We are confident that this second special focus issue will be a valuable resource, a reference manual of sorts, for biologists, conservation managers, and turtle enthusiasts alike. Leatherbacks are the most widely distributed of all reptiles, a consequence of which is the continual challenge to develop appropriate conservation strategies throughout the species' range. This is a conservation arms race that will constantly require new and updated information on leatherbacks around the world. To this end, we believe that this special focus issue will facilitate conservation planning and ultimately help our efforts to recover and preserve this marvelous species. The leatherback is an indicator of ocean health and ecological balance; it represents the desperate challenges and threats that sea turtles face throughout the world and also the still-present opportunity that we have to preserve the beauty and health of marine ecosystems and biodiversity. By working together and sharing information and conservation strategies on these topics, we can ensure that leatherbacks remain a part of the seascapes of all oceans for many generations to come.

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