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BEACH AND NEST
TEMPERATURES, AND
ESTIMATES OF
LEATHERBACK HATCHLING
SEX RATIOS AT BIRD'S HEAD
PENINSULA, PAPUA,
INDONESIA

by Ricardo Tapilatu

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NOAA Technical Memorandum NMFS-SEFSC-645

PROCEEDINGS OF THE THIRTY-THIRD ANNUAL SYMPOSIUM ON SEA TURTLE BIOLOGY AND CONSERVATION



2013 INTERNATIONAL SEA TURTLE SYMPOSIUM

Baltimore, Maryland USA

5 to 8 February, 2013
Baltimore, Maryland, USA

Compiled by:

Tony Tucker, Lisa Belskis, Aliko Panagopoulou, Alan Rees, Mike Frick,
Kris Williams, Robin LeRoux, and Kelly Stewart

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southeast Fisheries Science Center
75 Virginia Beach Drive
Miami, Florida 33149

May 2013





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2013 INTERNATIONAL
SEA TURTLE SYMPOSIUM

Baltimore, Maryland USA

PRESIDENT'S REPORT (abridged*)

33rd Annual Symposium on Sea Turtle Biology and Conservation

"Connections"

2-8 February 2013, Baltimore, Maryland, USA

Raymond R. Carthy, President, ISTS

The 33rd Annual Symposium on Sea Turtle Biology and Conservation was held on February 2-8, 2013 in Baltimore, Maryland, USA. Baltimore is within the National Capital Region which is a hub for important scientific research, policy and decision-making by the nation's government and many leading conservation organizations. The pioneering 1st World Conference on Sea Turtle Conservation was held in Washington, D.C., 26-30 November 1979, and having this year's meeting in the National Capital Region just over 33 years later provided an inspirational link through time and location.

"Connections" was the theme for the Baltimore Symposium, and our focus for the meeting was to explore the biological and ecological linkages that sea turtles share with their environments, while also examining and celebrating the connections that they impose on us as we try to learn about and conserve them. The theme was evident in the attendance, the program, the special sessions and activities, and the partnerships that made the meeting a success. There were 1016 registrants, representing 67 countries, and an additional 130 local students and educators attended particular sessions. The program included 7 regional meetings, 5 workshops, 4 special sessions, and a Video Night. There were 144 oral presentations and 248 posters- an additional 53 talks were given during a three-day Terrapin, Tortoise and Freshwater Turtle Meeting preceding the main Symposium. Forty-three Vendors and Exhibitors, including many that were new to the event, contributed to an engaging venue. The National Aquarium in Baltimore was a key partner in hosting the Symposium, providing volunteer personnel and access to their facilities, and the Virginia Aquarium and Marine Science Center were strong partners in our education efforts.

The Symposium was held at the Baltimore Marriott Waterfront in Baltimore's Inner Harbor. The venue provided ample meeting and lodging space for the participants. The convenient facilities and the very accommodating staff were conducive to both intellectual and social interactions.

Educational Outreach: Positive local impact has become a strong tradition in hosting ISTS Symposia. In Baltimore we enjoyed proximity to Washington, D.C. and increased participation by government agencies and NGOs, but the primary outreach effort was a multi-faceted educational program. In cooperation with the Virginia Aquarium and Marine Science Center and the National Aquarium, a Teachers and Educators Workshop was held on February 2nd. Twenty-five local teachers and five Symposium participants learned techniques and received materials that will aid them in incorporating marine science, sea turtles, and the Chesapeake Bay into their curricula. Local schools (St. Demetrius Bilingual Day School, Poolesville H.S., South River High School, Furman Templeton Prep, Dr. Rayner Browne Academy, and Friends Meeting School) participated in a "Threats to Sea Turtles" Art Contest sponsored by ISTS, and the winning artwork was displayed at the Symposium. The opening session on Tuesday was followed by an early highlight- the "Sea Turtles Revealed" plenary was attended by 80 students and teachers from Baltimore middle and high schools (St. Demetrius Bilingual Day School, Dr. Rayner Browne Academy, Western High School, and Augusta Fells Savage Institute of Visual

February 2013 Baltimore, Maryland, USA

Arts). The students engaged a panel of renowned sea turtle biologists and conservationists with a question and answer session where the panel was surprised to find themselves not only answering the usual “how big “ and “how old” queries, but pondering some of the same difficult ecological questions that drive their own work. The students and teachers that attended the Symposium's morning session had lunch with various biologists, graduate students and others in the sea turtle community as an opportunity for more personal "connections" between participants and students. Their lunch was followed by a trip to the National Aquarium. The “Sea Turtles Revealed” session and the “Sea Turtle Success Story” sessions on Tuesday afternoon were made available as a live webcast to 250 web sharepoints that were provided to schools, colleges, and universities.

ISTS Awards 2013: The 2013 ISTS Awards Committee was chaired by Sally Murphy and the members were Kimberley Maison, Stephen Dunbar, Jim Spotila, Dean Bagley, Ana Barragan, Ray Carthy, and Roldan Valverde. The Committee did an excellent job and presented this year's meeting with an incredible group of awardees. The ISTS Lifetime Achievement Award was presented to Jack Woody for a career dedicated to sea turtle conservation, including establishment of the sea turtle program in the U.S. Fish and Wildlife Service, focusing attention on critical sea turtle conservation issues in Mexico and Central America, garnering international protection for Kemp's and olive ridley turtles, and advocacy for TEDs. Hoyt Peckham received the ISTS Champions Award for his tireless work in tackling difficult and pressing conservation issues for North Pacific loggerhead sea turtles, and communicating effectively with stakeholders at all levels. There were two recipients of the Ed Drane Award for Volunteerism. Betsy Brabson was recognized as an outstanding volunteer Project Leader for the South Carolina Department of Natural Resources and for her role as a catalyst in protecting nesting beaches against invasive flora and fauna. Daniela Freggi was honored for her pioneering volunteer work in sea turtle veterinary care in Italy and as a dedicated promoter of national and international cooperation and skill exchange in the Mediterranean. The ISTS President's Award was presented to Marydele Donnelly for over twenty-five years of profound involvement in global sea turtle conservation efforts, including successful support of the TED requirement for U.S. shrimpers, the InterAmerican Convention for the Protection and Conservation of Sea Turtles, and the U.S. Marine Turtle Conservation Act.

Archie Carr Student Awards: There were 50 oral presentations and 89 poster presentations submitted by students for consideration in the Archie Carr Awards. The winner for Best Biology Poster was Vanessa Bezy and Runners Up were Deasy Lontoh, Tomoko Hamabata, and Jake Lasala. Best Conservation Poster went to Nicole Reintsma. The Best Biology Oral was won by J. Roger Brothers. Nicole Mazouchova won the Best Biology Field-based Oral and Justin Perrault was Runner Up. The Conservation Oral winner was Elizabeth Bevan, and Francese Domenech and Monette Schwoerer received Runners Up honors in Conservation Field-based Oral and Conservation Experimental Oral respectively.

(The full text of the 2013 President's Report can be found in the Marine Turtle Newsletter.)*

COMMITTEES, CHAIRS, AND KEY ORGANIZERS

Symposium Coordinator	Donna Broadbent
Internet Communications Coordinator	Michael Coyne
Baltimore Symposium Registrar	Rick Herren
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Poster Session Chairs	Jane Provancha, Barbara Schroeder
Student Judge Committee	Matthew Godfrey, Andrea Phillott
Student Judges	Marc Girondot, Jen Keller, Manjula Tiwari, Craig Harms, Yakup Kaska, Erin Seney, Mike James, Dave Owens, Jesus Tomas, Amanda Williard, Catherine McClellan, Emma Harrison, Cynthia Lageux, Cathi Campbell, Ana Barragan, Kate Mansfield, Paolo Casale, Sheryan Epperly, Mark Dodd, Sally Murphy, Stephen Dunbar, Kim Maison, Dean Bagley, Jim Spotila
ISTS Awards Committee	Cathi Campbell
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Auction Co-Chairs	Emma Harrison
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Proceedings Coordinators	Kelly Stewart, Michael Jensen
Printed Program	

February 2013 Baltimore, Maryland, USA

Africa Regional Meeting	Manjula Tiwari, Jacques Fretey, Angela Formia
Indian Ocean & Southeast Asia Regional Meeting RETOMALA (Latin American Meeting)	Lalith Ekanayake, Nadia Swidan Juan Manuel Rodriguez, Nineve Espinosa, Rocio Alvarez
WIDECAST (Caribbean) Regional Meeting Mediterranean Regional Meeting Pacific Island Meeting	Karen Eckert Paolo Casale Irene Kinan Kelly
Terrapin, Tortoise & Freshwater Turtle Meeting Statistics & Data Analysis Workshop Dive Behavior Workshop Sea Turtle Medicine Workshop NMFS Permit Workshop Cultivating Resilience: Processes and Skills Workshop IUCN Marine Turtle Specialist Group	Chuck Schaffer Tomo Eguchi Elizabeth Whitman, Junichi Okuyama Daniela Freggi, Leigh Clayton Amy Hapeman Elena Mustakova-Possardt Brian Hutchinson

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Nature Conservation Egypt	World Society for the Protection of animals
Pentair Aquatic Eco-Systems	WWF
Sea Turtle Conservancy	

STUDENT AWARDS

There were 139 student presentations in the Archie Carr Prize Competition - 50 oral presentations and 89 posters. Award amounts: Winners = US \$300 each, Runners-up = US \$150 each. Grand total for all student awards = US \$2400.

ORAL PRESENTATIONS

Winner- Biology Experimental: J. Roger Brothers, UNC-Chapel Hill, USA.

A mathematical model consistent with geomagnetic imprinting hypothesis of natal homing.

Winner- Biology Field-Based: Nicole Mazouchova, Temple University, USA.

Effects of granular incline angle on the locomotion of loggerhead sea turtle hatchlings in the field.

Runner Up- Biology Field-Based: Justin Perrault, Florida Atlantic University, USA.

Bioaccumulation and biomagnification of mercury and selenium in leatherback sea turtles: a cause for concern in this species.

Winner- Conservation: Elizabeth Bevan, University of Alabama-Birmingham, USA.

Implications of hatchling sex ratios and survival in the recovery program for the endangered Kemp's ridley sea turtle.

Runner Up- Conservation Field-based: Francesc Domenech, University of Valencia, Spain.

Incidental catch of the loggerhead turtle (*Caretta caretta*) by bottom trawling in the Valencian community.

Runner Up- Conservation Experimental: Monette Schwoerer, University of Central Florida, USA.

Shading in situ marine turtle nests: a potential practice to mitigate nest temperatures in response to climate change.

POSTER PRESENTATIONS

Winner- Biology: Vanessa Bezy, College of Charleston, USA.

Preliminary results: olive ridley sea turtle embryo mortality as a function of the nest microbial community at Ostional, Costa Rica.

Runner Up- Biology: Deasy Lontoh, Mos Landing Marine Laboratories, USA.

Variation in remigration interval is linked to the foraging destination of Western Pacific leatherback turtles.

Runner Up- Biology: Tomoko Hamabata, Kyoto University, Japan.

Genetic structure of green turtles nesting in Northwestern Pacific Ocean.

Runner Up- Biology: Jake Lasala, Georgia Southern University, USA.

New microsatellite DNA analyses may confound current population models for loggerhead sea turtles (*Caretta caretta*).

Winner- Conservation: Nicole Reintsma, Florida Atlantic University, USA.

Assessing a potential lighting problem for loggerhead hatchlings near the brightest lighthouse in the world: Arena assays at Hillsboro Beach, Florida, USA

ISTS AWARDS 2013

Chair- **Sally Murphy**

Members: Kimberly Maison, Stephen Dunbar, Jim Spotila, Dean Bagley, Ana Barragan, Ray Carthy, and Roldan Valverde.

President's Award

Marydele Donnelly

Ed Drane Award for Volunteerism

Betsy Brabson

Daniela Freggi

Life Time Achievement Award

Jack Woody

Champions Award

Hoyt Peckham

PLENARY AND SPECIAL SESSIONS

SEA TURTLES REVEALED: MARVELS, MYSTERIES, AND NEWS YOU CAN USE

Chair- **Blair Witherington**-Florida Fish and Wildlife Research Institute

Panel Members: **Bryan Wallace**-Oceanic Society, **Jeanette Wyneken**- Florida Atlantic University, **David Godfrey**- Sea Turtle Conservancy, **Kiki Jenkins**-University of Washington, **Pam Plotkin**- Texas Sea Grant, **Thane Wibbels**- University of Alabama-Birmingham, Baltimore middle and high schools.

SEA TURTLE CONSERVATION SUCCESS STORIES

Chairs- **Hoyt Peckham**- Center for Ocean Solutions and SmartFish, **Lekelia Jenkins**-University of Washington

Moderator- **Juliet Eilperin**- Washington Post

Invited Speakers:

THE SUCCESS OF THE US MARINE TURTLE CONSERVATION ACT AND ITS UNCERTAIN FUTURE
Marydele Donnelly, Sea Turtle Conservancy

CONSERVING SEA TURTLES BY LAND AND BY SEA IN PERU
Joanna Alfaro, ProDelphinus and University of Exeter

BUILDING SUSTAINABLE TED PROGRAMS WORLDWIDE
Marlene Menard, US Department of State/Office of Marine Conservation

THE GOOD, THE BAD, AND THE UGLY: CONSERVING SEA TURTLES IN NICARAGUA
Jose Urteaga, Fauna and Flora International

THE DECLINE AND RISE OF A SEA TURTLE: HOW KEMP'S RIDLEYS ARE RECOVERING IN THE GULF OF MEXICO
Larry Crowder, Center for Ocean Solutions

BRAZIL'S SEA TURTLES ARE NOW WORTH MORE ALIVE: TAMAR'S SOCIAL PRODUCTION CHAIN
Neca Marcovaldi, Projecto TAMAR

February 2013 Baltimore, Maryland, USA

UNDERSTANDING RESILIENCE: CORE CONNECTIONS THAT SUSTAIN

Speaker- **Elena Mustakova-Possardt** Spoke as special session and workshop

SATELLITE TELEMETRY (PRESENTATIONS ARCHIVED ON SEATURTLE.ORG)

Chairs: **Brian Stacy and Kristen Hart**

ECOLOGICAL IMPLICATIONS OF BIOTELEMETRY DRAG IN MARINE TURTLES

T. Todd Jones, NMFS

OVERVIEW OF TAG TECHNOLOGIES: A MANUFACTURER'S PERSPECTIVE

Thomas Gray, Desert Star

TAG SELECTON AND TECHNIQUES FOR SATELLITE TRACKING SMALL HARD-SHELLED SEA TURTLES

Kate Mansfield, Florida Atlantic University and **Erin Seney**, Erin Seney Consulting

TAG SELECTION AND TECHNIQUES FOR SATELLITE TRACKING LARGE HARD-SHELL SEA TURTLES

Kristen Hart, USGS

USE OF SATELLITE TELEMETRY TO DETERMINE SEA TURTLE MORTALITY

Yonat Swimmer, NMFS

AN UPDATE ON LEATHERBACK TURTLE SATELLITE TRACKING TECHNIQUES

Sabrina Fossette, NMFS

VIDEO PRESENTATIONS

Les Amis de la Nature (Friends of Nature), Epidosde 2: Mayumba

Aimee Sanders, Gabon Sea Turtle Partnership & Wildlife Conservation Society

3M Project

Anfani Msoili, Association for the Social-Economic Development of Itsamia

Europa: 40 Years of Scientific Adventure

Jerôme Bourjea, Alefa Production and Kélonia

Ulithi Marine Turtle Project

Jennifer Cruce & JR Rulmal, Ulithi Marine Turtle Program & Oceanic Society

Tracking the Nicaraguan Eastern Pacific Hawksbills

Jose Urteaga, Eastern Pacific Hawksbill Initiative & Flora & Fauna International

Moochula- Giving Hawksbill Sea Turtles Hope

Barry Erdeljon & Sarah Gulick, Marymount University

A Non-Invasive Approach to Documenting Human Interactions with Nesting Sea Turtles

Ray Mojica & David Godfrey, Barrier Island Ecosystem Center & Sea Turtle Conservancy

Verde Salaje

Veronica de los Llanos & Belen Orsin, CNAC, Morocota Films & Xenon Films

Our Dreams Don't Age

Neca Marcovaldi, Proyecto TAMAR

Karumbé, Tortugas Marinas del Uruguay

Daniel Gonzalez-Paredes, Karumbé

Los Amigos De Las Tortugas (Turtle's Friends)

Augustin Balestini, Programa Regional de Investigación y Conservación de Tortugas Marinas de Argentina & Reserva Natural Bahía Blanca, Bahía Falsa, Bahía Verde

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Katherine R. Shaw and Dave Addison
201. DARKER BEACHES, BRIGHTER FUTURE: REDUCING THE IMPACTS OF ARTIFICIAL LIGHTING ON SEA TURTLE NESTING BEACHES
Karen Shudes and David Godfrey
201. EVALUATION OF SEX RATIOS OF THE OLIVE RIDLEY SEA TURTLE (*LEPIDOCHELYS OLIVACEA*) AT AN ARRIBADA NESTING BEACH IN MEXICO: SECOND YEAR FOLLOW-UP
Itzel Sifuentes-Romero, Annelisse Bárcenas-Ibarra, Rosina Varela-Valenzuela, Martha Harfush-Meléndez, and Alejandra García-Gasca
202. OLIVE RIDLEY SEA TURTLE (*LEPIDOCHELYS OLIVACEA*) EMBRYO DEVELOPMENT AS A FUNCTION OF BEACH ZONES AND AN ASSESSMENT OF A METHODOLOGY TO DETERMINE EMBRYO DEVELOPMENT
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205. GREEN TURTLES NESTING ON ARUBA 2001-2012
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206. GREEN TURTLE NESTING ACTIVITY AT JUANI ISLAND, TANZANIA, DURING THE 2012 PEAK NESTING SEASON
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207. GREEN TURTLE (*CHELONIA MYDAS*) NESTING ON AKYATAN BEACH: RESULTS OF SIX YEARS SURVEY
C. Yilmaz, A. Oruc, and O. Türkozan
207. HATCHING AND EMERGENCE SUCCESS OF GREEN TURTLE (*CHELONIA MYDAS*) IN THE GALAPAGOS ISLANDS*
Patricia M. Zárate, Karen A. Bjorndal, Macarena Parra, Peter H. Dutton, Jeffrey A. Seminoff, and Alan B. Bolten

estuary, those located in the high zone near the vegetation only reached Stage I, while those located in the middle zone reached Stage II. These preliminary data suggest that studying differential hatchling success rates among different beach zones is an area that deserves further investigation. Our results also show that embryos categorized into earlier development stages weigh less than those in later development stages. Thus, categorizing embryos into development stages could be a useful tool in determining hatchling success rates and embryo development. However, the high standard deviations in the embryo weights within the defined development stages indicate that the methodology may need improvement.

BEACH AND NEST TEMPERATURES, AND ESTIMATES OF LEATHERBACK HATCHLING SEX RATIOS AT BIRD'S HEAD PENINSULA, PAPUA, INDONESIA

Ricardo F. Tapilatu¹, Thane Wibbels², and Manjula Tiwari³

¹ Marine Laboratory and Department, The State University of Papua (UNIPA) Manokwari (98314), Papua Barat Province, Indonesia

² Department of Biology – University of Alabama at Birmingham (UAB), AL, USA

³ Protected Resources Division, Southwest Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, La Jolla CA, USA

Sex determination and hatching success in sea turtles is temperature dependent. Warmer sand temperatures may skew sea turtle population sex ratios towards predominantly females and high sand temperatures may also decrease hatching success. Therefore, understanding beach and nest temperatures is important for conservation programs, including the evaluation of the long-term impact of temperature changes. We recorded sand temperatures during the boreal and austral summer nesting seasons for eight years (2005 to 2012) to estimate sex ratios and evaluate hatching success at the two primary nesting beaches for the western Pacific leatherback (both located on Bird's Head Peninsula, Papua, Indonesia). We also measured rainfall, sand albedo, and sand particle size at both beaches during the main nesting months in 2009-2010. During the boreal summers (2005-2012), the daily average sand temperatures at nest depth (80cm) ranged from 26.4 to 34.9°C. During the austral summers, sand temperatures ranged from 27.2 to 33.0°C. Typically, the average monthly temperatures at nest depth were relatively warm suggesting the production of female-biased sex ratios. Furthermore, average monthly temperatures were very high during certain months, potentially lowering hatching success. Location, sand color, and vegetation affected sand temperature throughout the boreal and austral summer nesting seasons; the lower-open beach sections with dark grey sand were significantly warmer (0.5-3°C) than the white sandy beach and the upper beach section adjacent to the vegetation. Rainfall occurs throughout the year at Bird's Head and had a significant episodic effect resulting in decreasing sand and nest temperatures. The size distribution of sand particles was similar among beaches with predominantly small particle size (500µm or less). Thermal absorbance varied between beaches, with the highest absorbance occurring on beaches with darker sand (Wembrak of Jamursba Medi and Wermon). Nest temperatures were positively correlated with beach temperatures and increased up to 2.9°C above sand temperatures during the later part of incubation due to metabolic heating. Histological examination of dead hatchlings from the boreal and austral summer nesting seasons in 2009-2010 produced a female-biased sex ratio. This finding is consistent with the relatively warm thermal profiles of the majority of the nesting beaches. This also included some extremely warm sand temperatures that were associated with lower hatching success. However, certain areas of the nesting beaches (the white sandy areas and also some vegetated areas in the upper zones of the dark grey beach) were relatively cool, resulting in high hatching success potentially producing both male and female hatchlings. Information from this study provides a foundation for developing conservation strategies for enhancing hatchling production with optimal sex ratios at the most important nesting beaches for the western Pacific leatherbacks. Further, this information represents the initiation of a long-term database that can be used at a local level to develop strategies that could potentially offset the impact of long-term climate change on the Pacific leatherback turtle.

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