

- Prezas, B.H. 1997. *X'cacel: Propuesta para el establecimiento y manejo de una área protegida*. Tes. Maestría, El Colegio de la Frontera Sur. Chetumal, Q Roo. 90pp.
- UNEP/ACOPS, 1995. *Mexico City recommendations on Sustainable Development of Tourism in the Wider Caribbean*. Mexico City, 18-20 April 1995. 275 pp.
- Zurita, J., R. Herrera y B. Prezas, 1993. Tortugas marinas del Caribe. pp 735-751 In: *Biodiversidad Marina y Costera de México*. Salazar-Vallejo, S.I y N.E. González (Eds.). Com. Nal. Biodiversidad y CIQRO, México, 865
- Zurita, J.C., B. Prezas, R. Herrera y J.L. Miranda, 1994. Sea turtle tagging program in Quintana Roo, Mexico. In: *Proceedings of the fourteenth annual symposium on sea turtle biology and conservation*. 1-5 March 1994. Bjorndal, K.A., A. B. Bolten, D.A. Johnson y P.J. Eliazar (Comps.). NOAA-TM-NMFS-SEFSC-351. pp 300-303.
- Zurita, J.C., R. Herrera y B. Prezas, 1997. *Catálogo de marcas aplicadas a las tortugas marinas en Quintana Roo* (1965 - 1995). El Colegio de la Frontera Sur (ECOSUR), Chetumal, Quintana Roo. mimeo., 121 pp.

RESEARCH AND MANAGEMENT OF LOGGERHEAD SEA TURTLES, *CARETTA CARETTA*, AT THE CRIP SEA TURTLE RESEARCH STATION, BAHIA DE LOS ANGELES, BAJA CALIFORNIA, MEXICO

Antonio Resendiz S. Hidalgo¹ and², Beatris J. Resendiz², Jeffrey A. Seminoff³, and Wallace J. Nichols³

¹Centro Regional de Investigación Pesquera, El Sauzal de Rodríguez, Ensenada, Baja California, México. bandaa@cicese.mx

²Sea Turtle Research Station, Apartado Postal 135, Ensenada, Baja California, México

³Wildlife and Fisheries Science, School of Renewable Natural Resources, University of Arizona, Tucson, Arizona 85721, U.S.A.

INTRODUCTION

The origin of loggerhead sea turtles (*Caretta caretta*) along the coast of Baja California has until recently been a mystery. Various authors have cited the abundance

of subadult and adult individuals in this area (Shaw, 1947, Marquez, 1969, Ramirez Cruz *et al.*, 1991, Bartlett, 1989), but no nesting areas along the eastern Pacific are known.

Sternberg (1981) speculated that *C. caretta* nested in Panama and Cornelius (1982) in Nicaragua, but these reports are unsubstantiated. Bartlett (1989) was the first to suggest that these animals originate in the western Pacific (Australia).

In 1993 a group of geneticists from the United States and Mexico investigated the genetic affinities between individuals captured as bycatch in the Pacific high-seas fishery and individuals along the Baja California peninsula (Bowen *et al.*, 1995). They demonstrated that loggerheads found in the eastern Pacific had affinities with nesting populations in Japan (95%) and Australia (5%). Following this, two adult loggerhead sea turtles raised in the CRIP-Sea Turtle Research Station (STRS) and included in the Bowen *et al.*, survey were released along the Pacific coast of the Baja Peninsula in the summer of 1994. One of these two adults was later captured along the southeastern coast of Japan near Kyushu (Resendiz *et al.*, 1998). In the summer of 1996 an additional adult female raised at the CRIP-STRS was released with a satellite

tag along the Pacific Coast of the Baja Peninsula. The trans-pacific migration of this turtle, "Adelita", has been followed by thousands of people over the Internet (Nichols, *et al.*, 1997) and she has recently completed the journey (Nichols *et al.*, in prep).

CRIP SEA TURTLE RESEARCH STATION

The CRIP Sea Turtle Research Station in Bahía de Los Angeles, Baja California, Mexico was founded in 1979. During times of a legal sea turtle fishery in Bahía de Los Angeles, the monitoring of this fishery was carried out by the local Canal de Las Ballenas fishing cooperative. Originally, all harvested turtles were inventoried at the Coronado Island lagoon north of town. In 1980 monitoring efforts were upgraded and a holding facility (later to become CRIP STRS) was constructed on the northern edge of Bahía de Los Angeles. The first studies of captive sea turtles at this facility occurred in 1981 when several juvenile loggerheads and black sea turtles were donated from the Canal de Las Ballenas fishing cooperative. The original goal was to house and rehabilitate turtles injured in fishing nets and keep undersized animals (< 75 cm) for studies and eventual release. In 1982, economic hardship in Mexico and declining sea turtle populations brought about the collapse of the fishing cooperative in Bahía de Los Angeles and marked the independence of the CRIP Sea Turtle Research Station.

METHODS

Loggerhead sea turtles (*Caretta caretta*) captured in the central province of the Gulf of California near Bahía de los Angeles, Baja California, Mexico (28°58' N, 113°33' W) were held in outdoor circular concrete tanks (5 x 1.5 m). Turtles were fed a variable diet consisting of fish, shark, and ray in addition to seasonally available items such as the California sea hare (*Aplysia californica*), giant squid (*Dosidicus gigas*), mussels (*Modiolus capax*), blue swimming crabs (*Gallinectes arcuatus*), princely fiddler crabs (*Uca princeps*) and pelagic red crabs (*Pleuroncodes planipes*). Weight and straight carapace length were taken every month. Cleaning occurred every day. Tanks were shaded with plastic mesh. Turtles were identified with plastic tags placed on the front flippers. All loggerheads were released offshore from Santa Rosalita, Baja California, Mexico (28°40' N, 114°12' W).

RESULTS

Loggerhead #1

ID# 309 and 39;
Origin: Donated from local Fish Coop. "Canal de Ballenas" BLA;
In Captivity: 1981-1994;
Released: July 19, 1994;
Growth: From 42.0 cm / 12.7 kg. to 79.8 cm / 80.8 kg. (Female);
Comments: This loggerhead had the longest stay (13 yrs) at the STRS and was released with "Rosita" in 1994 (see Resendiz *et al.*, 1998).

Loggerhead #2

ID# 27 and 310;
Origin: Donated from a sport fisherman;
In Captivity: 1986-1994;
Released: July 19, 1994;
Growth: From 32.9 cm / 6 kg. to 85.6 cm / 97 kg. (Female);
Comments: 478 days after her release from Baja California waters, this turtle ("Rosita") was caught by a fisherman off-shore from Kyushu, Japan (Resendiz *et al.*, 1998).

Loggerhead #3

ID# 38;
Origin: Donated by Canal de Las Ballenas Fish Coop., BLA;
In Captivity: 1981-1991;
Released: Oct. 18, 1991;
Growth: From: 46.7 cm. / 11.4 kg to 74.6 cm. / 69.9 kg. (Male);
Comments: Released with Loggerhead #4 (Resendiz *et al.*, 1992).

Loggerhead #4

ID# 40;
Origin: Donated by Canal de Las Ballenas Fish Coop., BLA;
In Captivity: 1981-1991; Released: Oct. 18, 1991;
Growth: From 36.2 cm / 7.2 kg to 77.9 cm / 78.0 kg. (Fe-

male);

Comments: Released with loggerhead #3 (Resendiz *et al.*, 1992).

Loggerhead #5

ID# 37 and 333;
Origin: Donated by Canal de Las Ballenas Fish Coop., BLA;
In Captivity: 1982-1993;
Released: Donated to Museo*;
Growth: From 40.0 cm / 10.4 kg. to 65.4 cm / 48.12 kg. (Female);
Comments: This individual was donated to the Museo de La Tortuga, Mazunte, Oaxaca, Mexico for Pacific loggerhead exhibit (Nov. 1993).

Loggerhead #6

ID# 302;
Origin: Donated by local fishermen;
In Captivity: 1986-1996;
Released: Aug. 10, 1996;
Growth: From 29.9 cm / 4 kg. to 83 cm / 95.3 kg. (Female);
Comments: This turtle ("Adelita") was released with a Telonics ST-3 satellite transmitter supplied by the United States Fish and Wildlife Service. It has recently completed an east-west transpacific migration that was followed by many via the Internet (Nichols *et al.*, 1997).

Each of these six turtles was used in the initial genetic analysis of the Pacific loggerhead assemblage (Bowen *et al.*, 1995) and have been confirmed to have haplotypes consistent with those found on Japanese nesting beaches.

DISCUSSION

The migratory and genetic research that has been facilitated by this station has been important to our understanding of Pacific loggerhead ecology. The genetic analyses (Bowen *et al.*, 1995), the flipper tag recovery (Resendiz *et al.*, 1998), and the migratory route as demonstrated through satellite tagging efforts (Nichols, this symposium) all support the transpacific migratory nature of this endangered species. Movements that encompasses the entire North Pacific emphasize the importance of increasing the geographical scale of investigations and modifying our approach to sea turtle conservation to incorporate such vast migrations.

We suggest that efforts must continue to perform similar flipper-tagging and satellite tracking efforts with wild-caught individuals so that our findings may be supported. Regardless, the research efforts carried out at the CRIP-STRS illustrate the importance of an interdisciplinary approach to sea migratory studies and the benefit of cooperative multi-national investigations of sea turtle biology.

ACKNOWLEDGEMENTS

We would like to thank the local community of Bahía de los Angeles (Ejido) and the hundreds of volunteers and

fishermen who have been involved with this project. In addition, Dr. Grant Bartlett, One World WorkForce, Coastal Conservation Foundation were critical to the success of these projects. We would especially like to thank CRIP-PESCA, the Bartlett Lab, Foundation For Field Research, Sea Turtle Center, and University of Arizona for their generous financial assistance.

LITERATURE CITED

- Bartlett, G. 1989. Juvenile *Caretta* off Pacific coast of Baja California. *Noticia Caguamas* 2:2-10.
- Bowen, B.W., F.A. Abreu-Grobois, G.H. Balazs, N. Kamezaki, C.J. Limpus and R.J. Ferl. 1995. Trans-Pacific migrations of the Loggerhead sea turtle demonstrated with mitochondrial DNA markers. *Proc. Natl. Acad. Sci. U.S.A.* Vol. 92, pp. 3731-3734.
- Cornelius, S.E. 1982. Status of sea turtles along the Pacific coast of Middle America. Pages 211-219 in K. Bjorndal (Ed). *Biology and conservation of sea turtles*. Smithsonian Institution Press, Washington, D.C.
- International Union for Conservation of Nature and Natural Resources*. 1995. By UCN/SSC Marine Turtle Specialist Group.
- Marquez, M.R. 1969. Additional records of the Pacific Loggerhead turtle, *Caretta caretta gigas*, from the North Mexican Pacific Coast. *J. Herp.* 2:108-110.
- Nichols, W.J., J.A. Seminoff, and L. Jimenez. (In Press.) Sea turtles, Science, and surfing: Riding the Internet from the classroom to the field. *Proceedings of the Seventeenth Annual Sea Turtle Symposium*. Sharon Epperly (Comp.).
- Ramirez Cruz, J.C., I. Pena Ramirez and D. Villanueva Flores. 1991. Distribucion y abundancia de la tortuga perica *Caretta caretta* Linnaeus (1758) en la costa occidental de Baja California Sur, Mexico. *Archelon* 1:1-4.
- Resendiz, A., B. Resendiz. 1992. Loggerhead turtles released after ten years in captivity. *Marine Turtle Newsletter* 57: 7-9.
- Resendiz, A., B. Resendiz, W.J. Nichols, J.A. Seminoff, and N. Kamezaki. 1998. First confirmed east-west transPacific movement of a loggerhead sea turtle, *Caretta caretta*, released in Baja California, Mexico. *Pacific Science*, Vol. 52, no. 2: pp. 151-153.
- Shaw, C.E. 1947. First record of the red brown loggerhead turtle from the eastern Pacific. *Herpetologica* 4:55-56.
- Sternberg, J. 1981. *The worldwide distribution of sea turtle nesting beaches*. Center for Environmental Education, Washington DC.
- Uchida, S., and H. Teruya. 1988. Transpacific migration of a tagged loggerhead *Caretta caretta*. *International Symposium on Sea Turtles*, Hiwasa, Japan. Poster presentation.

TEMPORAL AND SPATIAL VARIATION OF THE HATCHING TEMPERATURE IN TRANSPLANTED LEPIDOCHELYS KEMPI NESTINGS AND THEIR INFLUENCE ON THE SEX RATIO, AND EGG SURVIVAL AND MORTALITY

G. Vázquez Luna¹, R. Sanchez Trejo², R. Márquez Millan³, and R. Castro Melendez¹

¹CRIP- Tampico Tamaulipas, C.P. 89090, México.

²Lab. Ecología Costera y Pesquerías, UAM-X, A.P. 23182, C.P. 04960, México, D.F. México

³CRIP-Manzanillo, A.P. 591, Colima, C.P. 28200, México. rtrejo@cueyatl.uam.mx

The influence of temperature on the sex ratio has been studied for almost all the known species of marine turtles since the 1970's and in different parts of the world. Nevertheless, the influence of the thermal gradients which develop within the nests of *Lepidochelys kempi* on the determination of the sex ratio, and egg survival and mortality has scarcely been studied. The thermal gradients within the nests of this species were determined through temperature records obtained with thermocouple thermal sensors at different points and depths of the incubatory chamber during the months of maximum anidation of this turtle in Rancho Nuevo, Tamaulipas, México. The information thus obtained was further statistically studied in order to determine if significant thermal gradients occurred, as well as, their relation to sex ratio, and egg survival and mortality. These results show significant differences in the temperature of the peripheral regions of the nest as compared to the core region which are due to the aggregation of the eggs at this latter and

to the higher metabolic heat thus produced by the embryonic development. Nevertheless, these differences did not affect the sex ratio, as they occurred after the critical period for the sex determination and did not exceed 0.4 °C. Egg mortality, which was 24 % could not be related to thermal differences within the nest, as no correlation to temperature of the nest was statistically proven.



NOAA Technical Memorandum MFS-SEFSC-436

PROCEEDINGS OF THE EIGHTEENTH INTERNATIONAL SEA TURTLE SYMPOSIUM



3 - 7 March, 1998
Mazatlán, Sinaloa
México

Compilers

F. Alberto Abreu-Grobois
Raquel Briseño-Dueñas
René Márquez-Millán
Laura Sarti-Martínez

U. S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southeast Fisheries Science Center
75 Virginia Beach Drive
Miami, FL 33149
June 2000



NOAA Technical Memorandum NMFS-SEFSC-436

**PROCEEDINGS OF THE EIGHTEENTH
INTERNATIONAL SEA TURTLE SYMPOSIUM**

**3-7 March 1998
Mazatlán, Sinaloa MEXICO**

Compilers:

**F. Alberto Abreu-Grobois
Raquel Briseño-Dueñas
René Márquez-Millán
Laura Sarti-Martínez**

**U. S. DEPARTMENT OF COMMERCE
William M. Daley, Secretary**

**NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
D. James Baker, Administrator**

**NATIONAL MARINE FISHERIES SERVICE
Penelope D. Dalton, Assistant Administrator for Fisheries**

June 2000

Technical Memoranda are used for documentation and timely communication of preliminary results, interim reports, or special-purpose information, and have not received complete formal review, editorial control, or detailed editing.