Sea Turtles of Baja

2004 FIELD SEASON PROJECT REPORT

Submitted by:

Jeffrey A. Seminoff, Ph.D.
Southwest Fisheries Science Center
National Marine Fisheries Service
8604 La Jolla Shores Drive
La Jolla, California 92037

T. Todd Jones
Department of Zoology
University of British Columbia
Vancouver, B.C. CANADA
V6T 1Z4

Research Site: Bahía de Los Angeles, Baja California, México

13 June 2004 – 27 July 2004

Total Earthwatch Members: 32

HIGHLIGHTS

a) The black turtle (also known as the East Pacific green turtle, *Chelonia mydas*) is listed as Endangered throughout its range (NMFS and USFWS, 1998) and the main purpose of this research is to increase scientific knowledge that will aid in the conservation and recovery of this vulnerable species. The Gulf of California is an important area for the development and feeding of black turtles. Our research site in Bahía de los Angeles historically hosted many black sea turtles, however, in recent decades this population has decreased through human pressures. Through studying the foraging strategies, energetics, and movement patterns of these turtles we can learn information that will assist in developing appropriate management strategies. In addition, this project involves a human component that we believe will facilitate the success of conservation attempts. Through education of local children and inclusion of adults in the field research, we aim to instill a 'sense of place' and conservation ethic that will last far into the future.

b) The summer 2004 research season was the ninth season with Earthwatch Institute participation for this project. Earthwatch volunteers assisted in the capture of 31 black turtles and helped in countless hours of field investigations. This season's research focused on increasing our understanding of the population biology of local black turtles. Special emphasis was put on calculating population trends and to determine the population maturity class structure of local turtles. Attachment of Satellite Transmitters to a three turtles enabled us to learn their movements in and around Bahia de los Angeles. When combined with prior field studies of movement behaviour and population abundance, these research emphases have provided new insights and continue to fill in the gaps in our understanding of the ecology and population dynamics of black turtles in Bahía de los Angeles.

OBJECTIVES

a) The black sea turtle is an isolated population of the pan-tropical green sea turtle (*Chelonia mydas*). Like most sea turtles, black turtles are migratory and use a wide range of broadly separated localities and habitats during their lifetime (see Hirth 1997 for review). Upon leaving the nesting beach, it has been hypothesized that hatchlings begin an oceanic phase (Carr 1987), perhaps floating passively in major current systems (gyres) that serve as open-ocean developmental grounds (Carr and Meylan 1980, Witham 1991). These turtles are then thought to recruit from oceanic habitats to near-shore developmental habitats where they forage and grow until maturity (Musick and Lutz 1997). Upon attaining sexual maturity green turtles commence seasonal migrations between foraging areas and breeding grounds in the eastern Pacific that are carried out at intervals of two to four years (Figueroa et al. 1993). Although much is known of the nesting biology of black turtles, little information is available on the biology of juvenile and adult sea turtles while in near-shore areas. Learning what habitats black sea turtles are using and energetic resources that they require will enable appropriate decisions regarding their protection.

b) Presented in this report is a summary of the field activities carried out during the 2004 summer season. Apart from our efforts focusing on biological research of black turtles in Bahía de los Angeles, this project incorporates a human component. Throughout our field season we utilized local boat guides for our turtle capture efforts and the 2003 field season marked the third year of an environmental education program designed to teach local school children about the biology of marine animals and their environment. Our aim is to cultivate trust and awareness from the local inhabitants and promote a long-term conservation ethic.

The research goals during the 2004 field season were to:

1. Estimate growth rate, population size, and survivorship through ongoing mark-recapture efforts.
2. Monitor local and long-distance movements of black turtles with satellite telemetry.
3. Determine energetic requirements of juveniles and adults,
4. Provide life history information to wildlife managers for integration into black turtle recovery efforts in the eastern Pacific and Gulf of California.

METHODS

This research required the open-water capture of sea turtles in Bahía de los Angeles with the use of entanglement nets. Nets were set at traditional capture sites and monitored regularly. Directly after capture all turtles were measured, weighed, photographed, and marked with Inconel flipper tags (National Band and Tag Co.) in the first proximal scale of each rear flipper. Assessment of maturity status and sex was based on straight carapace length (SCL) and tail length (TLC), respectively. Average size of nesting females at the rookery in Michoacán, México, was used as a reference for assessing maturity status: turtles with a SCL ≥77.3 cm were considered adults (Alvarado and Figueroa 1992). Straight carapace length was measured from the nuchal notch to the posterior-most portion of the rear marginals using a forester's caliper. Tail length was defined as the distance from the trailing edge of the plastron to the cloacal opening. Following the protocol of Limpus and Reed (1985), adults with elongated tails (>20 cm) were classified as males.

In addition to measurements, blood samples were drawn from all capture turtles for analysis of stable isotope values in the blood. All blood samples were drawn from the venous cervical sinus using non-additive Vacutainer™ tubes with 21G X 1 ½ needles. A subsample of blood was immediately transferred to duplicate microcapillary tubes and centrifuged so that hematocrit could be determined. The remainder of the blood was centrifuged at 3000 rpm for 5 minutes. Plasma was transferred to cryo-safe plastic tubes and stored in a freezer for later stable isotope analysis.

RESULTS

The following is a breakdown of the results of each aspect of this research. These results have been divided into eight different sections: Turtle Captures, Size and Sex, Growth, Diving Behavior, Metabolism and Energetics, Blood Chemistry, Passage Rate and Digestive Modeling, and Environmental Education Workshops.

<u>Turtle Captures:</u>

We captured a total of 31 turtles during the 2004 season (Table 1). This was a year of tradition as all of our captures came from our most notable hotspots of years past: El Cardon, El Bajo, and El Barco.

Table 1. Summary of sea turtle captures during the 2004 field season at the Bahía de los Angeles foraging habitat. All captures were green/black turtles. Letter codes in this table include: U = undetermined, and M = adult male,

ID#	Name	Sex	Capture Date	Location	SCL (cm)	Weight (lbs)	Recapture
BLA 904	Kristen	U	17-Jun-04	El Cardon	60.8	64	N
BLA 905	Pepita	U	23-Jun-04	El Bajo	86.0	180	N
BLA 507	Reyna	U	23-Jun-04	El Bajo	84.6	204	**Y**
BLA 906	-	M	24-Jun-04	El Bajo	77.3	136	N
BLA 909	Capewell	U	7-Jul-04	El Cardon	75.9	129	N
BLA 910	Maria	U	7-Jul-04	Estero	64.4	97	N
BLA 814	Estiban	U	7-Jul-04	El Bajo	81.0	156	**Y**
BLA 911	Nelli	U	8-Jul-04	El Bajo	94.3	227	N
BLA 912	Good Call	U	9-Jul-04	El Cardon	66.0	81	N
BLA 913	Nemo	U	9-Jul-04	El Bajo	69.5	119	N
BLA 914	Kimberly	U	14-Jul-04	El Bajo	89.8	195	N
BLA 823	Jalapeno	M	16-Jul-04	El Cardon	91.8	226	**Y**
BLA 916	Mamota	U	16-Jul-04	El Bajo	88.4	241	N
BLA 921	Big Red	U	17-Jul-04	El Bajo	84.1	185	N
BLA 917	Hyde	U	17-Jul-04	El Cardon	67.6	92	N
BLA 918	Jekyll	U	17-Jul-04	El Cardon	71.1	105	N
BLA 919	Simon	U	17-Jul-04	El Cardon	65.1	90	N
BLA 920	Garfunkel	U	17-Jul-04	El Cardon	70.2	108	N
BLA 922	Joshua	U	19-Jul-04	El Bajo	64.6	95	N
BLA 923	Baby Trav	U	20-Jul-04	El Barco	50.1	35	N
BLA 924	Golden Glory	U	21-Jul-04	El Barco	71.9	123	N
BLA 925	Toddy	U	22-Jul-04	Estero	71.3	101	N
BLA 926	Jeffrey	U	22-Jul-04	Estero	72.0	115	N
BLA 927	Lilly	U	24-Jul-04	El Cardon	76.2	114	N
BLA 821	Bandini	U	24-Jul-04	El Cardon	65.8	85	**Y**
BLA 928	Rey	U	8-Aug-04	El Estero	72.4	101	N
BLA 929	Hantifi	U	10-Aug-04	El Estero	58.0	57	N
BLA 930	Traviesa	U	10-Aug-04	El Estero	66.3	100	N
BLA 933	Nitro	U	13-Aug-04	El Bajo	80.2	175	N
BLA 931	Charles	U	13-Aug-04	El Bajo	70.6	103	N
BLA 932	Steve	U	13-Aug-04	El Bajo	75.9	150	N

Size and Sex:

The size and sex of the 31 captures we had this season continued the population structure trends observed in the past: (1) there are both immature and adult turtles utilizing the bay, and (2) most adult turtles are female (Table 1). Straight carapace length of green turtles in this study ranged from 50.1 To 94.3 cm (mean = 73.6 ± 1.8 cm). Considering that most sea turtles attain maturity at or near mean nesting size this range is representative of both juvenile and adult turtles (mean nesting size in Michoacán is 77.3 cm SCL; Figueroa et al., 1993).

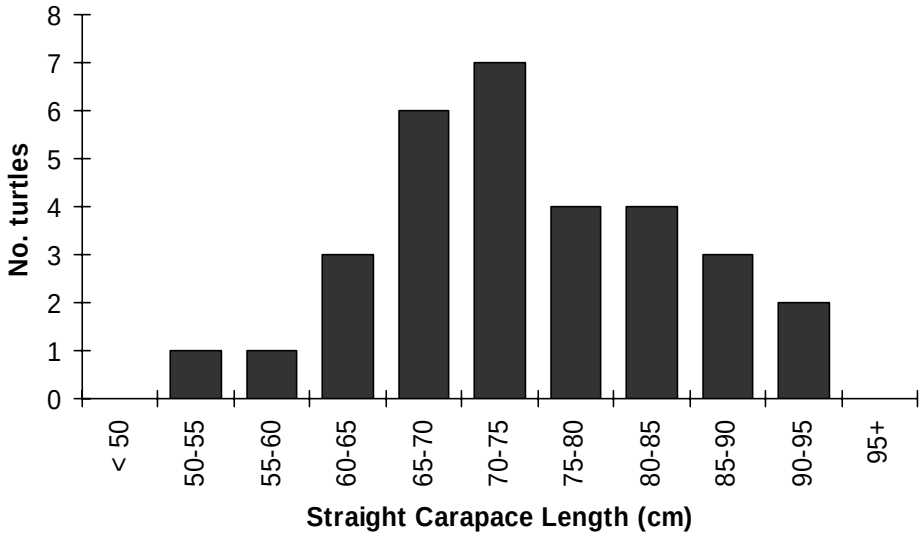

Figure 1. Histogram of straight carapace length for 31 green turtles captured near Bahía de Los Angeles during the Summer 2004 research season.

Growth:

A total of four turtles were recaptured from previous years: BLA 507 from the 2000 field season, and BLA 814, BLA 821, and BLA 823 from the 2003 field season. See Table 2 for details.

Table 2. Summary of recaptured black turtles during the 2004 research season at Bahia de los Angeles, Baja California, Mexico.

Turtle	Initial Capture Date	Initial Capture SCL (cm)	2004 Capture Date	2004 Capture SCL (cm)	SCL change
BLA 507	16-Jul-00	77.6	23-Jun-04	84.6	9.0 cm in ~4 years
BLA 814	7-Mar-03	79.8	16-Jul-04	81.0	1.2 cm in 17 months
BLA 821	19-Jul-03	63.9	24-Jul-04	65.8	1.9 cm in 12 months
BLA 823	19-Jul-03	91.6	16-Jul-04	91.8	0.2 cm in 12 months

DISCUSSION

The 2004 research season was a tremendous success with the continuation of ongoing research into the ecology, behavior, and physiology of black sea turtles as well as new biochemical studies. We continued our tradition of expanding our research to encompass new aspects of the biology of black sea turtles and, with the help of Earthwatch team members, we were able to get the most out of our research effort.

Of the 31 turtles captured this season, we had four recaptures: 3 from the 2002 research season, and one from the 2000 research season (see Table 2). These data are very useful to develop a growth curve for black turtles and help determine the age at which these animals

reach sexual maturity. In addition, the date on overall capture rate this season as compared to previous seasons will help develop a population trend model. Such information will be useful to determine priority conservation areas along the Baja California peninsula. As we prepare for future research seasons our main research goals will be to continue to build upon the information that we gathered this season. Plans are currently underway for the development of a marine park in this region and our information will be used for the development of this protective measure.

PUBLICATIONS

Seminoff, J. A., G. J. Marshall, and A. Resendiz. In review. Underwater foraging behaviors of green sea turtles (*Chelonia mydas*) elucidated through turtle-borne video imagery. Marine Biology. Submitted 11/04

Hays, G.C., J.A. Seminoff, and G. Marshall. In review. Universal Rules for Locomotion. Ecology Letters. Submitted 9/04.

Seminoff, J.A., S. Karl, T. Swartz, and A. Resendiz. 2003. Hybridization of the green turtle (*Chelonia mydas*) and the hawksbill turtle (*Eretmochelys imbricata*) in the Pacific Ocean: Indication of an absence of gender bias in the directionality of crosses. Bulletin of Marine Science 73:643-652

Seminoff, J.A., A. Resendiz, B. Resendiz, T.T. Jones, and W.J. Nichols (In Press) Biologia y situacion actual de tortugas marinas. En: G.D. Danemann y E. Ezcurra (eds.), Bahia de los Angeles: recursos naturales y comunidad. Instituto Nacional de Ecologia, Mexico.

McDermott, A., J. A. Seminoff, T. T. Jones, and A. Resendiz. In press. Sea turtles and science in the classroom: Cultivating a conservation ethic through environmental education in Baja California, Mexico. In: Proceedings of the Twenty-Fourth Annual Symposium on Sea Turtle Biology and Conservation. San Jose, Costa Rica. 22-27 February 2004.

Seminoff, J. A., A. Resendiz, B. Resendiz, and W. J. Nichols. 2004. Occurrence of loggerhead sea turtles (*Caretta caretta*) in the Gulf of California, Mexico: evidence of life-history variation in the Pacific Ocean. Herpetological Review 35:24-27

Seminoff, J.A., T.T. Jones, A. Resendiz, W.J. Nichols, and M.Y. Chaloupka. 2003. Monitoring green turtles (*Chelonia mydas*) at a coastal foraging area in Baja California, Mexico: multiple indices describe population status. Journal of the Marine Biological Association of the United Kingdom. 83: 1355-1362

Presentations:

Ecology and conservation status of green turtles in the Gulf of California: is recovery possible? *Presented by Jeffrey A. Seminoff* at The Gulf of California Conference, Tucson, Arizona. 13-16 June 2004.

Trumping the need for taxonomic resolution with effective conservation infrastructures: the case of green/black sea turtles in the eastern Pacific Ocean. *Presented by Jeffrey A. Seminoff*

at the Conference on Cetaceam Systematics: Approaches in Genetics, Morphology, and Behaviour Symposium. La Jolla California, 10 April 2004.

The Sea Turtles of Baja. Presented by Jeffrey A. Seminoff at the 2003 Earthwatch Institute Conference on 'Making Connections for a Sustainable Environment", Boston, Massachusetts. November 2003.

Building partnerships in Baja California: the role of Earthwatch in sea turtle research and conservation. *Presented by Jeffrey A. Seminoff* at the Earthwatch One-day Conference, Oxford, UK. March 2004

OTHER ACCOMPLISHMENTS and BENEFITS

1. The local Marine Group 'Grupo Marino' continued working with *Sea Turtles of Baja* Project. For the third season Guillermo Smith, Pancho Verdugo, Ramon Verdugo, and Joel Prieto joined our research team and acted as guides during team 1.

2. The economic benefit to the local community was great. Often, research teams show up in foreign countries with a self-contained unit that includes all food, equipment, and staff. This leaves little benefit from the project with the local community. While it is difficult to accurately assess the economic impact of our project on the community, it was certainly significant. We paid rent to Campo Archelon, employed three guides/boatmen and a cook, hired several carpenters and masons to update the facility, hired mechanics to work on project vehicles, purchased the majority of our water, ice, food and gas in town, supplemented our equipment needs at the local hardware store, and heavily patronized the "phone store". Ecotourism is one way to sustainably use a resource, however it only works if the local community gains. For us this was a priority.

ACKNOWLEDGEMENTS

a) Marcos Blanco, Marta Diaz, Peter Dutton, Herman Hill, David Jones, Misty-Anne Marold, Angelica Narvaez, Antonio Resendiz, Bety Resendiz

b) Cooperating Institutions: Centro Regiónal de Investigaciones Pesquera, National Marine Fisheries Service - Southwest Fisheries Science Center, Secretaria Marina de México; Secretaria del Medio Ambiente, Recursos Naturales y Pesca; Uiversity of British Columbia, United States Embassy-México City, United States Fish and Wildlife Service.

c) Additional Funding Sources: National Geographic Television, Wallace Research Foundation, National Marine Fisheries Service - Southwest Fisheries Science Center, University of British Columbia.

LITERATURE CITED IN THE REPORT

Alvarado, J. and A. Figueroa. 1992. Recapturas post-anidatorias de hembras de tortuga marina negra (*Chelonia agassizi*) marcadas en Michoacan, México. Biotropica 24(4):560-566.

Carr, A. 1987. New perspectives on the pelagic stage of sea turtle development. Conserv Biol 1:103

Carr, A. and A.B. Meylan. 1980. Evidence of passive migration of green turtle hatchlings in Sargassum. Copeia 2:366-368.

Cliffton, K., D.O. Cornejo, and R.S. Felger. 1982. Sea turtles of the Pacific coast of México. In: K. Bjorndal (ed.), Biology and Conservation of Sea Turtles. Smithsonian Institution Press, Washington, D.C. pp. 199-209.

Figueroa A., J. Alvarado, F. Hernández, G. Rodríguez, J. Robles. 1993. The ecological recovery of sea turtles of Michoacán, México. Special attention to the black turtle (*Chelonia agassizi*). Final Report to WWF-USFWS, Albuquerque, NM.

Hirth, H.F.1997. Synopsis of the biological data on the green turtle, *Chelonia mydas* (Linnaeus 1758). United States Fish and Wildlife Service Biological Report 97-1.

Limpus, C.J., and J. Reed. 1985. The green turtle, *Chelonia mydas*, in Queensland: a preliminay description of the population structure in a coral reef feeding ground. Pages 47-52 *in* G. Grigg, R. Shrine, and H. Ehmann, editors. Biology of Australian Frogs and Reptiles. Surrey Beaty and Sons, Chipping Norton, N.S.W. Australia.

Music, J.A. and P.L. Lutz. 1997. The Biology of Sea Turtles. CRC Press, Boca Raton, FL

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1998. Recovery plan for U.S. Pacific populations of the East Pacific green turtle (*Chelonia mydas*). National Marine Fisheries Service, Silver Spring, MD

Scmidt-Nielsen, K. 1997. Animal Physiology Adaptation and Environment. Cambridge University Press, pp. 170-172.

Southwood, A. L**.** (2002). The effects of seasonal cold exposure on metabolism and behaviour of juvenile green sea turtles (*Chelonia mydas*). PhD Dissertation. University of British Columbia, Vancouver, BC, Canada. pp. 117.

Whitham, R. 1991. On the ecology of young sea turtles. Florida Sci 54:179

Wyneken, J. (2001). The anatomy of sea turtles. U.S. Dept. of Commerce NOAA Tech Memo NMFS-SEFSC-470. pp. 1-172.