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Interactions Between Leatherback Turtles and Peruvian Artisanal Fisheries

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ABSTRACT. – From 1985 to 1999, data were gathered opportunistically on the bycatch of 33 leatherback turtles in coastal Peru, and from 2000 to 2003, a dockside observer program provided data on an additional 133 leatherbacks caught in the coastal gillnet and longline fisheries targeting mahi mahi, sharks, and rays. These data stress the need for programs to monitor bycatch in artisanal fisheries, enforce regulations prohibiting sea turtle capture, and increase the environmental awareness of fishermen.

Over the last few years, populations of leatherback turtles, *Dermochelys coriacea*, from the Pacific Ocean have undergone abrupt declines (Sarti et al. 1996; Eckert and Sarti 1997; Spotila et al. 2000; Reina et al. 2002). The Pacific coast of Mexico, once host to one of the largest nesting populations of leatherbacks, has seen dramatic

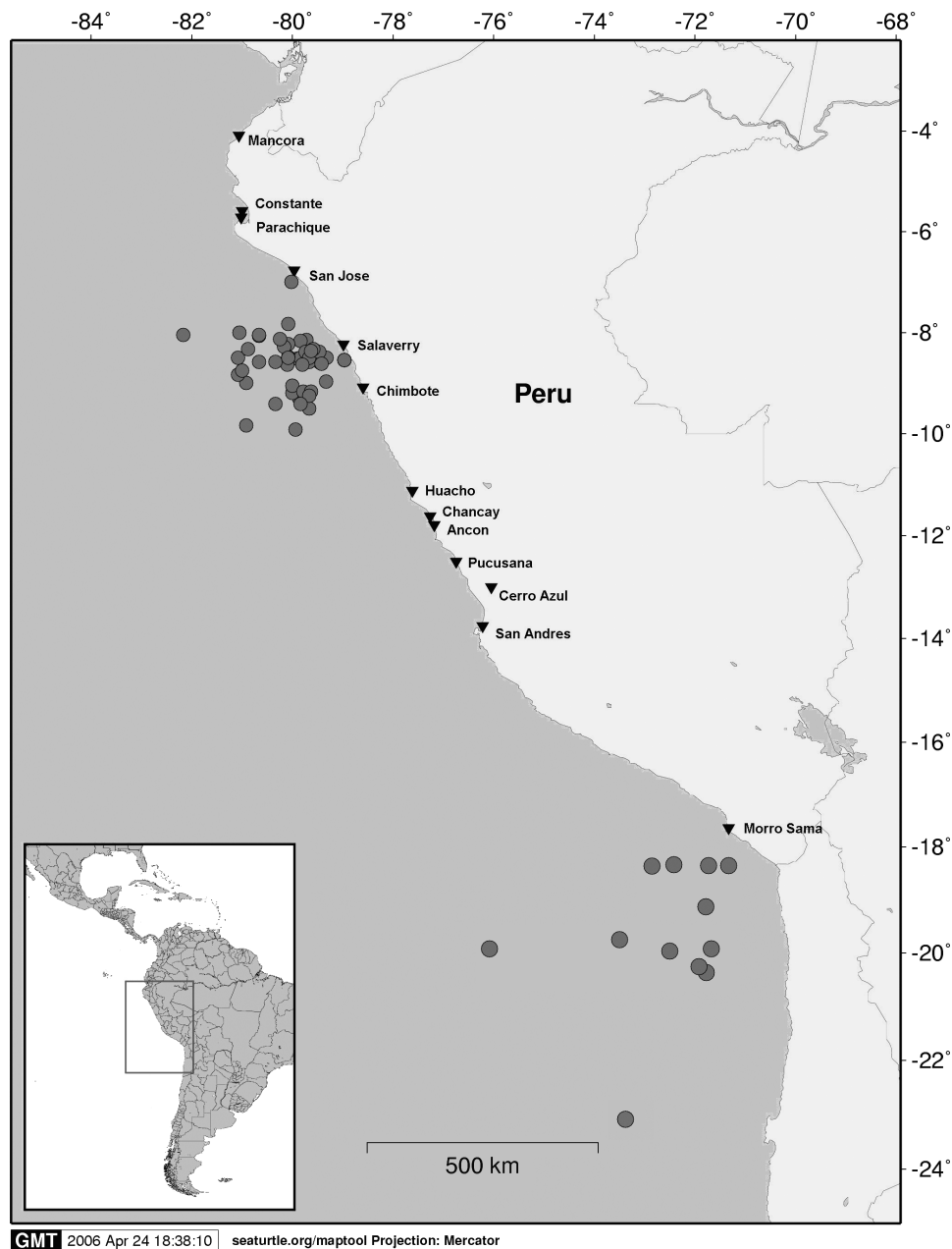


Figure 1. Ports and landing sites monitored and positions of leatherback turtles captured at sea (SEATURTLE.ORG, Maptool, 2006).

declines in the annual number of nesting females (Sarti et al. 1996). Similar declines have occurred at other key rookeries on the Pacific coast of Costa Rica (Spotila et al. 2000) and in Malaysia (Chan and Liew 1996), and prompted the World Conservation Union (IUCN) to list leatherbacks as Critically Endangered.

The harvest of eggs and adult females at nesting beaches has been a major threat to sea turtles. Conservation efforts have primarily focused on reducing this threat; however, impacts at sea from incidental take in various fisheries remain largely unquantified and may be linked to the decline of certain sea turtle populations (Lewison et al. 2004). Fisheries that may be linked to the observed decline of leatherbacks include those of Peru and Chile (Eckert and Sarti 1997), although much uncertainty exists as to the

level of impacts. Frazier and Brito (1990) estimated that 250 leatherbacks per year were caught in the gillnet swordfish fishery in the port of San Antonio, in central Chile. More recently, Donoso and Dutton (in press) reported 143 leatherbacks caught in the pelagic longline fishery for swordfish in Chile over a 2-year period between 2001 and 2002. All were released alive (Donoso and Dutton, in press). In Peru, Hays-Brown and Brown (1982) estimated that 200 leatherbacks were caught near the port of Pucusana during a summer season. Pritchard and Trebbau (1984) further noted that Peru was one of the few places in the world where leatherbacks were regularly and deliberately caught at sea. While these reports provide information on past incidental take of leatherbacks in gillnet fisheries of the southeastern Pacific, no information

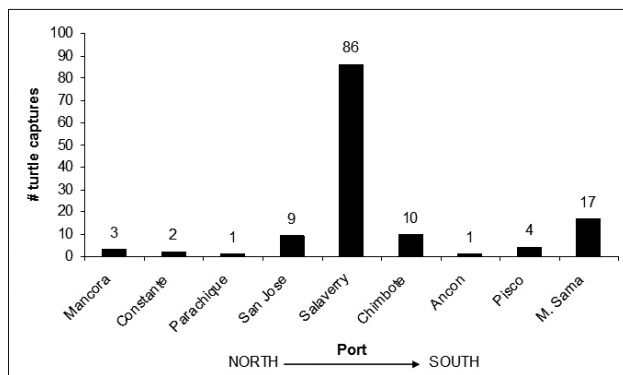


Figure 2. Number of leatherback turtles captured by port sampled in 2001–2003.

is available on current take levels in Peruvian fisheries. The objective of this study was to quantify incidental take of leatherbacks in the Peruvian artisanal fisheries.

Artisanal fisheries are defined here as including boats with $\leq 32.6 \text{ m}^3$ of storage capacity, $\leq 15 \text{ m}$ in length, and principally requiring manual work (as opposed to mechanized equipment) during fishing operations (Ley General de Pesca 2001). Although the capture of leatherbacks has been prohibited in Peru since 1976, retention of incidental take in artisanal fisheries remains a problem (FAO 2004). A combination of social, economic, and political factors have minimized the effectiveness of conservation measures (Hays-Brown and Brown 1982; Van Bressem et al. 1998; Van Waerebeek et al. 1999; Alfaro-Shigueto et al. 2004; FAO 2004). By quantifying the incidental take of leatherback turtles, we hope to aid the development and implementation of successful conservation and management measures for this species.

Methods. — From 1985 to 1999, data on the capture of leatherbacks were gathered opportunistically by scientists of the Peruvian Center for Cetacean Research (CEPEC). Original data on the capture of marine turtles along the Peruvian coast from October 1985 to December 1999 were gleaned from CEPEC field books, diaries, specimen data sheets, fishery statistics files, and unpublished reports. The ports visited, the survey periods, and the methodology used are described in detail in Read et al. (1988), Van Waerebeek et al. (1997, 1999), and Van Bressem et al. (1998). When feasible, straight carapace length and width (SCL and SCW, respectively) measurements were taken, and sex was determined based on external morphological characteristics (i.e., elongated tail). Information from 1998 and 1999 also was gathered during 2 surveys to investigate the capture of leatherbacks along the Peruvian coast (Van Bressem et al. 1998; Van Waerebeek et al. 1999).

From July 2000 to November 2003, we conducted a bycatch monitoring program and established a network of shore-based observers in 8 ports (Fig. 1). Observers recorded species composition of bycatch, collected biological samples (skin, carapace scrapings, stomach contents) for further studies, and, when possible, measured

CCL and CCW. Information on the locations of leatherback captures was collected at 2 of the sampled ports (Salaverry and Morro Sama).

Results. — From 1985 to 1999, 33 leatherback turtles were recorded at the following landing sites: San Andres ($13^{\circ}45'S$, $76^{\circ}13'W$), Cerro Azul ($13^{\circ}00'S$, $76^{\circ}30'W$), Pucusana ($12^{\circ}30'S$, $76^{\circ}45'W$), Ancon ($11^{\circ}47'S$, $77^{\circ}11'W$), Chancay ($11^{\circ}37'S$, $77^{\circ}16'W$), Huacho ($11^{\circ}07'S$, $77^{\circ}37'W$), Chimbote ($09^{\circ}05'S$, $78^{\circ}36'W$), and Salaverry ($08^{\circ}14'S$, $78^{\circ}59'W$) (Fig. 1). Of the 30 leatherbacks for which we knew date of capture, 83% were observed during the austral spring and summer. SCL ranged from 111 to 165 cm ($n = 11$; mean = 135.7 ± 5.89 cm). Of turtles for which sex could be determined, 3 (carcasses) were female and 2 were male (Appendix 1).

From 2000 to 2003, 133 leatherbacks were caught by artisanal fisheries gear (5.1% of total sea turtle captures in sampled ports). Leatherbacks were captured in Mancora ($04^{\circ}05'S$, $81^{\circ}04'W$), Constante ($05^{\circ}35'S$, $81^{\circ}00'W$), Parachique ($05^{\circ}43'S$, $81^{\circ}01'W$), San Jose ($06^{\circ}46'S$, $79^{\circ}58'W$), Salaverry, Chimbote, San Andres, and Morro Sama ($18^{\circ}S$, $70^{\circ}52.5'W$) (Fig. 1). The ports of Salaverry and Morro Sama showed the highest number of leatherback captures (Fig. 2). Positions plotted for leatherbacks obtained from Salaverry suggest a coastal distribution while individuals caught in the south were further offshore (Fig. 1).

Seventy-six percent of leatherbacks were captured in artisanal gill nets ($n = 101$). Gill nets, made of multifilament with a mesh size of approximately 14–20 cm, were placed in nearshore coastal waters. Thirty-two animals were caught with longlines ($n = 32$). Leatherback bycatch occurred in fisheries targeting mahi mahi (*Coryphaena hippurus*), blue sharks (*Prionace glauca*), mako sharks (*Isurus oxyrinchus*), and rays (*Myliobatis* spp.). Other species from bycatch included green turtles (*Chelonia mydas*), loggerhead turtles (*Caretta caretta*), Burmeister's porpoises (*Phocoena spinipinnis*), and dusky dolphins (*Lagenorhynchus obscurus*). Of the 133 leatherbacks caught, 55 (41.4%) were released alive and 78 (58.6%) were retained for human consumption. We were able to measure 6 carcasses taken during the 2000–2003 surveys; CCL ranged from 98 to 123 cm (mean = 113 ± 11.59 cm).

Discussion. — Our study shows that leatherbacks continue to be caught in artisanal fisheries in Peru. This is of great concern because the eastern Pacific leatherback populations have severely declined (Eckert and Sarti 1997; Spotila et al. 2000).

The incidental take of sea turtles in pelagic and coastal fisheries has been the focus of attention in recent years (FAO 2004). Although uncertainty continues over the relative magnitudes of the impact from different fisheries, clearly, the waters off Peru and Chile are important foraging and migratory regions for leatherbacks, and reduction of mortality from fisheries interaction in this region is a necessary component of a broad suite of

measures needed for long-term recovery of leatherbacks in the Pacific (FAO 2004; Dutton and Squires, in press).

Our results indicate that gill nets are the primary cause of leatherback bycatch at the sampled ports; longlines represent a lesser threat. Recognition of the impact of net fisheries on sea turtles is not new. Gill nets were also reported as the main cause of turtle mortality in artisanal fisheries from 1986 to 1999 in Peru (Estrella and Guevara-Carrasco 1998a, 1998b; Estrella et al. 1998, 1999a, 1999b, 2000). Drift nets also have potentially been a large source of mortality for sea turtles in the North Pacific (Wetherall et al. 1993). Our finding that most leatherbacks were encountered by fishers based out of just 1 of the ports (Salaverry; Figs. 1 and 2) suggests that conservation measures focused in this community has the potential for significant impact on bycatch reduction.

Poverty in coastal communities has led to a continued dependence on marine wildlife, including leatherbacks, as a source of food (Alfaro-Shigueto and Van Waerebeek 2001). Indeed, our results show that 58.6% of the leatherback bycatch was retained for human consumption. Socioeconomic and cultural issues therefore are significant factors preventing implementation of conservation measures for sea turtles in this case. The increasingly clandestine nature of this take makes monitoring and sampling difficult. The number of turtle landings reported during this period should therefore be considered as a minimum and does not consider fishing effort. Nonetheless, valuable data and biological samples can still be obtained on sea turtle bycatch through a sustained effort and the establishment of shore-based observers.

Leatherbacks are reported to have a coastal distribution in the summer (Hays-Brown and Brown 1982). The locations of leatherbacks taken in front of Salaverry port further confirm that they occur in nearshore waters (Fig. 2) and are vulnerable to coastal fisheries. These findings may also indicate a coastal foraging "hotspot" for leatherbacks similar to ones identified in the North Pacific (Benson et al., in press) that warrants further investigation. Because the sampling in this case is biased by the coastal distribution of the fishery, these results do not mean that leatherbacks are not found further offshore. In fact, telemetry studies have tracked adult females from nesting beaches in Mexico (Eckert and Sarti 1997; Sarti et al., unpubl. data) and Costa Rica (TOPP, unpubl. data, www.TOPPcensus.org) into both coastal and offshore waters. Bycatch in the large-scale commercial fisheries operated by international and national fleets based in Peru that fish offshore waters remains unmonitored and unknown.

The smallest nesting leatherback reported in the eastern Pacific was 128.3 cm CCL (124.6 cm SCL) (Steyermark et al. 1996). The limited information we collected on sizes of leatherbacks suggests that both adults and subadults are caught. It is also interesting to note that the turtles caught in 2000–2003 were on average smaller than those reported in earlier years (mean SCL of 104.8 cm

for 2000–2003 versus 135 cm as reported by Hays-Brown and Brown in 1982, and 135.7 cm as reported in this study for 1985–1999). This may be an artifact of the small sample size, but it may also indicate that fewer large adults exist in the population due to mortality associated with the population decline in the last 20 years.

Ongoing genetic studies in Chile and Peru (Donoso and Dutton 2000; P. Dutton, unpubl. data) have complemented previous telemetry studies (Morreale et al. 1996; Eckert and Sarti 1997) and indicate that leatherbacks in the southeastern Pacific are primarily from the eastern Pacific nesting stock. These studies highlight once again the urgency of regional conservation efforts.

There is a complex dependence of coastal communities on the use of marine endangered species as a food source (Alfaro-Shigueto and Van Waerebeek 2001; FAO 2004). We recommend that managers consider the socioeconomic issues of these communities as a significant factor preventing implementation of enforcement and conservation measures for sea turtles in Peru.

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Appendix 1. Leatherback turtles ($n = 33$) taken in fisheries off Peru during 1985–1999.

Day	Month	Year	Port	Sex	Carapace (cm)		Comments
					SCL	SCW	
18	Mar	1985	Huacho				Skull found at dump
1	Apr	1985	Cerro Azul				Several carcasses found at fish offal dump
20	Nov	1985	Cerro Azul				Taken in artisanal fishery
8	Dec	1985	Pucusana				SCL = 175 but may include head
9	Jul	1986	Chimbote				Freshly cut carapace seen at fish market
10	Jul	1986	Chimbote		165		Landed alive at the fish market; slaughtered afterwards
26	May	1987	Pucusana		115	63	Length including head = 185 cm
18	Feb	1989	Pucusana		157	87	Landed at fish terminal; plastron length/width = 123/85 cm
21	Feb	1989	Pucusana				Alive when landed
2	Mar	1989	Pucusana			63	Released alive, length including head = 151 cm. Turtle was turned upside down.
26	Feb	1991	Ancon				Landed alive at pier; decapitated alive; no cetaceans
27	Feb	1991	Ancon				Landed with long-beaked common dolphins and Burmeister's porpoises
7	Mar	1991	Ancon				Landed with porpoises and other turtles (probably green turtles)
12	Mar	1991	Ancon				Landed with common dolphins and porpoises
7	Dec	1992	Ancon	Female	129.5		Sold at fishmarket
11	Jan	1993	Salaverry				Fresh head at dump
11	Jan	1993	Salaverry				Fresh head at dump
10	Feb	1993	Chancay	Male	146	83	Landed alive; length plastron = 114 cm
13	Feb	1993	Chimbote	Female	156	78	Landed alive but shot by port authority personnel; gravid with eggs; skin sample collected
15	Mar	1993	Chimbote	Female			Landed alive; gravid with eggs; reportedly caught near mouth of Santa River
1	Apr	1993	Cerro Azul				Alive at departure of observer, most likely killed
3	Jun	1993	Cerro Azul				Alive; landed together with green turtle
19	Jul	1993	Cerro Azul		137	84	Dried remains found on beach Los Reyes, down current from fish market
31	Jul	1993	Cerro Azul		113.5	83.5	Dried remains found on beach Los Reyes, down current from fish market; head still attached
24	Aug	1993	Cerro Azul				Landed alive and butchered in situ; very large specimen
25	Oct	1993	Chancay	Male	145		Landed alive; plastron length 119 cm
24	Mar	1994	Cerro Azul				Landed alive; captured in gill nets
15	Jun	1994	Cerro Azul				Captured but released alive
10	Apr	1996	Pucusana		111		Found freshly dead and butchered on Naplo beach
11	Dec	1998	Pisco				Burned remains found at beach
19	Feb	1999	Chimbote				JAS-90; part of plastron found on beach close to fish market; L/W = 99/68.5 cm; skin sample
12	Aug	1999	Chimbote		117.5		MFB-809; carapace found on beach close to fish market; not fresh; skin sample collected
14	Aug	1999	Chimbote				MFB-815; large head found on beach close to fish market; quite fresh; skin sample collected