

Sea turtle protection by communities in the Coast of Oaxaca, Mexico

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ABSTRACT

The "Red de los Humedales de la Costa de Oaxaca" together with PROTUMAR, coordinate sea turtle conservation in five communitarian turtle campsites. Since 2005, efforts of nest protection have been executed for Olive Ridley (*Lepidochelys olivacea*), Black (*Chelonia mydas*) and Leatherback turtles (*Dermochelys coriacea*). Thousands of hatchlings have been released to the ocean each year. For the Olive Ridley sea turtle, in "La Ventanilla" (four seasons of work), 1003 nests have been protected, 95778 eggs have been incubated and a total of 59997 hatchlings have been liberated. In the campsite of "El Tomatal" 1110 nests, 96997 eggs and 52737 hatchlings. For "Los Naranjos" (since 2006), 553 nests, 53698 eggs, and 19512 hatchlings. For "Cerro Hermoso", 249 nests, 20633 eggs and 13934 hatchlings. Finally for "La Tuza de Monroy", an important nesting beach, 965 Olive Ridley nests, 85470 eggs and 62795 hatchlings. For the Leatherback, the campsites that have protected more nests are "La Ventanilla" with a total of 45 nests and 516 hatchlings, "El Tomatal" with 19 nests and 435 hatchlings; for the Black sea turtle, "La Ventanilla" has registered 28 nests and 1239 hatchlings. This conservation work is highly significant because it is a communitarian initiative of people who in the past were egg collectors.

KEY WORDS

Marine turtles, Oaxaca, nests, hatchlings, liberation success.

RESUMEN

La Red de los Humedales de la Costa de Oaxaca, con el programa PROTUMAR, coordina el trabajo de conservación de las tortugas marinas en cinco campamentos tortugueros comunitarios. Desde el 2005 se protegen los nidos de tres especies de tortugas, tortuga golfina (*Lepidochelys olivacea*), prieta (*Chelonia mydas*) y laúd (*Dermochelys coriacea*) llegando a producir miles de crías que se liberan al mar cada año. En playa de Ventanilla, en las cuatro temporadas de trabajo se han protegido 1003 nidos de tortuga golfina, incubando 95778 huevos y liberando un total de 59997 crías, en El Tomatal 1110 nidos con 96997 huevos y 52737 crías, en Los Naranjos (que se involucró en la conservación en el 2006) 553 nidos, 53698 huevos y 19512 crías, en Cerro Hermoso 249 nidos con 20633 huevos y 13934 crías y La Tuza, playa de anidación muy importante, 965 nidos, 85470 huevos y 62795 crías. Para la tortuga laúd los campamentos que han protegido un mayor número de nidos son la Ventanilla con un total de 45 nidos y 516 crías, y el Tomatal con 19 nidos y 435 crías; para la tortuga prieta La Ventanilla ha registrado 28 nidos y 1239 crías. El trabajo realizado tiene mucha importancia al ser una iniciativa comunitaria de personas que antes se dedicaban al comercio de huevos y actualmente se dedican a su conservación.

PALABRAS CLAVE

Tortugas marinas, Oaxaca, nidos, crías, éxito de liberación.

Besides its biological (high biodiversity) and cultural importance (many different costumes are still living in this region), the coast of Oaxaca, Mexico, has been recognized for its importance in nesting sites for three species of sea turtle: olive ridley turtle (*Lepidochelys olivacea*), leatherback turtle (*Dermochelys coriacea*) and black turtle (*Chelonia mydas*).

For the leatherback turtle, considered as a critically endangered species by IUCN (2011), works of conservation and investigation in the state of Oaxaca were initiated in 1982 on the beaches of the national park of Chacahua, registering then 2841 females with nesting activities (Cruz & Ruiz 1984). Approximately one decade later, Barra de la Cruz was recognized as an important nesting site, with

1820 nests during the 1992/1993 season (Vásquez et al. 1994). Unfortunately, the increase in the efforts of protection of the leatherback, coincide with the collapse of the global population of this species. Sarti (2004) cites that the majority of the known populations have shown a drastic decline of more than 80% in less than 20 years and within the decade of 1980, it was estimated that the Mexican Pacific area accommodated 45% of the global population.

In past years, the olive ridley turtle, considered as endangered specie in vulnerable status (IUCN 2011), had a great economic importance that was attributed to the large concentration of individuals in front of nesting beaches, which presented minimal efforts of capturing. The commercial value of meat, eggs and skin, reached sufficient levels to support a wide market for sea turtle (Márquez et al. 1990). Due to this situation, the abundance in Mexico of this resource decreased towards the second half of the twentieth century, reaching dramatic levels in the 1980's. Because of this, regulatory measures have been recommended, for example, minimal capture size, adequate methods of fishing, quota of capture permitted, periods of closed season (Márquez et al. 1990), and protection of nests in hatcheries principally due to the heavy human depredation. In 1990, Mexican government prohibits marine turtles fishery in Mexican waters.

The black turtle, considered as an endangered specie (IUCN 2011), is not very common in the coast of Oaxaca, in fact in the pacific side of Mexico, the most important recognize nesting area is located in Michoacán (Colola and Maruata beaches) and Oaxaca is considered a less important nesting area (National Marine Fisheries Service 1998).

"Red de los Humedales de la Costa de Oaxaca" (RHCO) is a regional organization born in 2003 that unify 22 communitarian groups that work in favor of the conservation of natural resources under an outline of community participation. Today, the RHCO operates different programs of work that protect species like mangroves and reptiles, and develop ecotourism in the coast. The organization operates the "Marine Turtle Protection Program" (PROTUMAR) in six beaches along the coast of Oaxaca with the principal objective of protecting marine turtle nests from the heavy human depredation in this area.

PROTUMAR arose as a regional program since the nesting season 2003-2004, with the participation of three communitarian campsites. Between 2007 and 2009 seven nesting beaches were integrated to the work of conservation along the coast of Oaxaca: La Ventanilla, in the municipality of Santa Maria Tonameca, El Tomatal, Los Naranjos and Barra de Navidad in Santa Maria Colotepec, Cerro Hermoso and El Venado in San Pedro Tututepec and La Tuza en Santiago Jamiltepec.

Objectives

- Protect the higher number of marine turtle's nests along six beaches in Oaxaca's coast.
- Produce the higher number of hatchlings from the protected nests.

Area of Work

The beaches protected until 2009 by the PROTUMAR program were: La Ventanilla, El Tomatal, Los Naranjos, Barra de Navidad (start in 2009), El Venado (start in 2009), Cerro Hermoso (stop in 2009) and La Tuza de Monroy. These beaches are located in the Coast of Oaxaca on the Pacific Ocean in the eastern side of Mexico. This work presents results of only five beaches where the patrolled zone covers a total of 35km of beach (Fig.1).

METHODOLOGY

This paper contains data collected during four years from 2005 to 2009. The protection work starts the 1st of August of every year and end the 30th of April the following year. Hatcheries have a fenced area of about 8 x 5 meters and they are bolted about 20 meters from the line of the highest tide, therefore the ocean occasionally present very high tide that can flood the hatchery. In the beach of La Ventanilla the hatchery is covered by a sheet of shading net during all the season of protection and eggs incubation work.

Beach patrols generally begin from 21:00 until 02:00 depending on the number of nests founded on the beach. All nests that are found are also collected and taken to the hatchery where they are incubated again and protected until they hatch. Once they emergence, they are immediately liberated. Each nest is then revised after the liberation to value the liberation success.

The data taken of incubated nests were the following: date and hour of the collection, species, number of eggs, zone nest was found (near the shoreline, in the middle of the beach, near the vegetation), number of nests preyed on (this data is inconstantly collected), estimated hatch date to monitor the nests. Once the nest has hatched, a datasheet is filled out, where the revision of the nest and number of hatchlings produced is registered.

The data collected is analyzed in order to evaluate the protection activities. The following formulas is used to evaluate the liberation success:

$$\% \text{ Liberation} = (\text{hatchlings liberated} / \text{total number of eggs}) * 100$$



FIG. 1. Mexico, areas protected by PROTUMAR.

TABLE 1
General characteristics of surveyed beaches.

Beach	UTM Geog. coordinates (start)	UTM Geog. coordinates (end)	Total Length patrolled (Km)	Way of monitoring	Hatchery with Shade
La Ventanilla	755771,95 E 1734897,67 N	759990,01E 1733641,58 N	From 4,5 to 7	ATV (2008)	40%
El Tomatal	717555 E 1747378 N	712853 E 1748449 N	From 5,5 to 10	Foot	No
Los Naranjos	717555 E 1747378 N	712853 E 1748449 N	5,0	Foot	No
Cerro Hermoso	660853 E 1765074 N	656686 E 1766162 N	4,5	Foot	No
La Tuza de Monroy	621826 E 1772623 N	624333 E 1770998 N	4,0	Foot	No

It is not possible to calculate hatch success due to lack of needed data therefore were not considered in our calculations. The total number of protected nests, number of protected eggs and number of hatchlings released for species are calculated considering four seasons.

The communitarian work is not constant so data are not enough to calculate statistic parameters or make some kind of analysis. This is due to main actors that are partially involved in the work; in fact, people are still unable to sustain their families with the conservations activities.

During the season 2007/2008 in the community of El Tomatal, a group of biologist with ATV vehicle and a research equipment were help the protection work in the beach with people of the village.

RESULTS AND DISCUSSION

Olive Ridley Turtle

Results of olive ridley protection during the four seasons are resumed in Table 2. The beach of El Tomatal is the one that registered more protected nests, followed by La Tuza. In the 2007/2008 season people of El Tomatal monitored constantly the beach thanks to a group of researcher that realize the protection work and census with them. The number of protected nests was quite high

thanks to the available technology (ATV vehicle) (Vannini et al. 2008).

Compared to other beaches of the Oaxaca's coast the number of total nests of the six beaches shows that this is not an "arribada" area, even that the olive ridley is the most common turtle in the area. Extraordinary concentration of females nests in the beach of Escobilla, Oaxaca, where thousand of nests are found every season (Pritchard 2002). Outside Mexico, like in Costa Rica are located important beaches that present 70,000 nesting females in a year like Playa Nancite, which is considered an "arribada" beach (Honarvar et al. 2008).

Results of protection eggs and liberation success of all beaches are showed in Table 3. The liberation success is very low but the compromise of people working to protect turtle's nests is appreciable: in fact, all nests left in the beach are poached. Ramírez (2002), declared that liberation success that is reported in *L. olivacea*, whether it be natural or unnatural (incubation corrals) conditions, goes from 65% to 85% approximately. Even that, result of liberation success increase year by year and this indicate that the handling is improving season next season.

The beach of La Ventanilla use a shade net to cover the hatchery but there is not a big difference of the liberation success (54,4%) from the average of all beaches result; probably it is necessary temperatures study before shade the hatchery.

TABLE 2

Results of total number of olive ridley's (*Lepidochelys olivacea*) nests during the four seasons 2005/2009.

Beach	2005/2006		2006/2007		2007/2008		2008/2009		Totals four seasons	
	Tot nests	Prot nests	Tot nests	Prot nests	Tot nests	Prot nests	Tot nests	Prot nests	Tot nests	Prot nests
Ventanilla	335	335	229	229	257	118	352	321	1173	1003
El Tomatal	227	227	317	317	446	446	376	142	1366	1110
Los Naranjos	Nd	Nd	366	366	126	126	111	82	603	553
Cerro Hermoso	82	82	89	89	135	135	154	39	460	249
La Tuza de Monroy	105	105	184	184	392	392	677	317	1358	965
Totals	749	749	1185	1185	1356	1356	1670	901	4960	3880

TABLE 3
Total number of olive ridley's (*Lepidochelys olivacea*) incubated eggs and liberated hatchlings during the four seasons 2005/2009.

Season	El Tomatal		Ventanilla		La Tuza de M.		Los Naranjos		Cerro Hermoso		Total		Lib. succes (%)
	Eggs	Hatch	Eggs	Hatch	Eggs	Hatch	Eggs	Hatch	Eggs	Hatch	Eggs	Hatch	
2005/2006	32559	15481	21169	10853	0	0	9834	6516	7031	4788	70593	37638	53,3
2006/2007	21989	16714	2933	1592	35701	8848	17067	13873	7637	4222	85287	45249	53,1
2007/2008	10858	7037	33265	16335	10139	7224	29593	21495	3103	2387	86958	54778	63,0
2008/2009	30412	20765	13213	9329	7858	344	28976	20911	2862	2537	83321	53886	64,7
Totals	95778	59997	70580	38409	53698	16416	85470	62795	20633	13934	326159	191551	58,7

Leatherback turtle

Leatherback turtle protection results are presented in Table 4. La Ventanilla is the beach with more nesting activities for this species, because of the availability of the ATV vehicle that make the protection more successfully. For the same reason, in El Tomatal during 2007/2008 season the protection of leatherback's nests present the real number of turtle activities and a higher number of protected nests with a good liberation success result (Vannini & Rosales 2009).

The presence of leatherback turtle females is not so common in these six beaches compared to the index beaches of Oaxaca's coast like Barra de la Cruz, San Juan Chacahua and Cahuitan (Sarti et al. 2007).

Numbers of leatherback eggs and hatchling are showed in Table 5. The liberation success is very low due to the difficulty of handling this kind of eggs.

The results of leatherback turtle protection are not satisfactory. Global liberation success for each season is quite low and only in 2007/2008 results (51%) reaches the global result of index leatherback beaches of the Mexican Pacific, which on average is 44,5% (Barragán et al. 2007). During that season El Tomatal presents the highest results because of the presence of a group of biologist that organize and supervise the work (Vannini & Rosales 2009).

TABLE 4
Results of total number of leatherback's (*Dermochelys coriacea*) nests during the four seasons 2005/2009.

Beach	2005/2006		2006/2007		2007/2008		2008/2009		Totals four seasons	
	Tot nests	Prot nests	Tot nests	Prot nests	Tot nests	Prot nests	Tot nests	Prot nests	Tot nests	Prot nests
Ventanilla	23	23	3	3	6	5	15	14	47	45
El Tomatal	6	6	1	1	14	11	1	0	22	18
Los Naranjos	nd	nd	2	1	2	2	0	0	4	3
Cerro Hermoso	nd	nd	1	1	0	0	0	0	1	1
La Tuza de Monroy	5	5	1	1	1	1	9	1	16	8
Totals	34	34	8	7	23	19	25	15	90	75

TABLE 5
Total number of leatherback's (*Dermochelys coriacea*) incubated eggs and liberated hatchlings during the four seasons 2005/2009.

Season	El Tomatal		Ventanilla		La Tuza de M.		Los Naranjos		Cerro Hermoso		Total		Lib. succes	
	Eggs	Hatch	Eggs	Hatch	Eggs	Hatch	Eggs	Hatch	Eggs	Hatch	Eggs	Hatch	(%)	
2005/2006	1652	222	287	82	262	0	0	0	0	0	0	2201	304	13,8
2006/2007	252	57	68	0	48	35	72	0	52	0	492	92	18,7	
2007/2008	197	161	631	353	62	0	117	0	0	0	1007	514	51,0	
2008/2009	358	76	0	0	75	70	0	0	0	0	433	146	33,7	
Totals	2459	516	986	435	447	105	189	0	52	0	4133	1056	26,6	

Black Turtle

Protection results for black turtle are showed in Table 6. This turtle is not so common along the worked area.

Black turtle eggs and hatchling results are showed in Table 7. Liberation success is also quite low compared to other protected beaches like Tierra Colorada, Guerrero, where it reaches 94% of liberation success (Ocampo et al. 2010, 2011).

DISCUSSION

Difficulty of the work

The efforts made by Red de los Humedales de la Costa de Oaxaca and the PROTUMAR program, have permitted achievement in the protection of a considerable number

of nests thanks to the initiative of the communitarian groups that are worried about the conservation of natural resources and their rapid disappearance. The poaching of sea turtles eggs is the most important problem, which is why these worker groups start nests protection. All the people that now are working for the protection were involved in the poaching during the past.

Due to the organization of the communitarian field-work, data don't show the real total number of nests for each beach, the effort of the realized work is still not 100% (means every night during the protection work season) because the salaries they receive don't cover the effort needed to work all the nesting season. All nests they cannot protect remain in situ but we don't know their destiny. Despite this situation, these are the only data available for this beaches that cover a big area of the Coast of Oaxaca.

Turtles in the future do not depend only of their capability as species to recover their populations, but of the

TABLE 6
Results of total number of black turtle's (*Chelonia mydas*) nests during the four seasons 2005/2009.

Beach	2005/2006		2006/2007		2007/2008		2008/2009		Totals four seasons	
	Tot nests	Prot nests	Tot nests	Prot nests	Tot nests	Prot nests	Tot nests	Prot nests	Tot nests	Prot nests
Ventanilla	2	2	8	8	2	2	16	16	28	28
El Tomatal	2	2	0	0	2	2	0	0	3	3
Los Naranjos	nd	nd	2	2	0	0	0	0	2	2
Cerro Hermoso	1	1	0	0	0	0	1	1	2	2
La Tuza de Monroy	2	2	1	1	2	2	3	3	8	8
Totals	7	7	11	11	6	6	20	20	43	43

TABLE 7
Total number of black turtle's (*Chelonia mydas*) incubated eggs and liberated hatchlings during the four seasons 2005/2009.

Season	El Tomatal		Ventanilla		La Tuza de M.		Los Naranjos		Cerro Hermoso		Total		Lib. succes (%)
	Eggs	Hatch	Eggs	Hatch	Eggs	Hatch	Eggs	Hatch	Eggs	Hatch	Eggs	Hatch	
2005/2006	186	147	202	70	184	156	0	0	107	0	679	373	54,9
2006/2007	477	250	78	68	0	0	188	0	0	0	743	318	42,8
2007/2008	162	0	191	142	110	0	0	0	0	0	463	142	30,7
2008/2009	1068	842	201	130	0	0	0	0	59	38	1328	1010	76,1
Totals	1893	1239	672	410	294	156	188	0	166	38	3213	1843	57,4

activities than in favor of them be accomplished by man and the work conducted by the communities in Oaxaca is an example.

Conclusions

- It is important to continue and increase the work of nest protection for sea turtles in this area.
- More training and a better management of leatherback turtle nests are needed in order to increase the recruitment of this species.
- It is priority to do more studies in order to understand the parameters that influence in the recruitment of hatchlings.

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