



Proyecto Carapacho

Presents:

“Incidental bycatch or directed harvest – Sea turtle mortality rate and causes in Baja California Sur, Mexico”

Final report for the Rufford Small Grants for Nature Conservation



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Abstract

The coastal waters of Baja California Sur serve as an important feeding and development habitat for five species of sea turtles: the Loggerhead turtle (*Caretta caretta*), the Black turtle (*Chelonia mydas agassizii*), the Hawksbill turtle (*Eretmochelys imbricata*), the Olive-Ridley turtle (*Lepidochelys olivacea*) and the Leatherback turtle (*Dermochelys coriacea*). All five species are listed as Endangered or Critically Endangered in the IUCN Red List.

Over-exploitation of sea turtles in Mexico caused the dramatic decline of all the populations especially between the 50s and 70s. Despite national and international legislation granting a protected status to sea turtles, in many cases it did not prevent illegal harvest and incidental bycatch in the region, where sea turtle meat is still considered a delicacy and the decline of several sea turtle populations is still ongoing. At present one of the major issues weakening the conservation policy in BCS is the habit of consuming turtle meat during special events, which fuels the illegal market in the area. Furthermore, incidental bycatch of turtles in artisanal gillnet fisheries is still very high.

This study is aimed to identify sea turtle mortality rates and causes and determine areas and seasons during which these animals are most affected. As well, we would like to determine cultural, social and economic factors that influence sea turtle consumption in the state of Baja California Sur. With this information that is critical but still missing, we hope to propose specific conservation measures to improve the protection of sea turtles and work closely with local communities and NGO to implement a new conservation strategy.

Background

Five of the seven world's sea turtle species are known to inhabit the coastal and marine waters of Baja California Sur: the black turtle (*Chelonia mydas agassizii*), the loggerhead turtle (*Caretta caretta*), the Olive-Ridley turtle (*Lepidochelys olivacea*), the hawksbill turtle (*Eretmochelys imbricata*) and the leatherback turtle (*Dermochelys coriacea*). These waters serve as an important feeding and breeding habitat for all the species, and also coastal beaches offer a nesting habitat to three of the five species. Each of these species is classified as either critically endangered (hawksbill and leatherback turtles) or endangered (black, loggerhead and olive-ridley turtles) by the World Conservation Union (IUCN, 2004). All these species are listed in appendix I of CITES which prohibits international trade (CITES, 2000).

For centuries people living along the coast have exploited sea turtles for their subsistence: in Sonora Seri Indians used to catch sea turtles, in Michoacan and Oaxaca Pomaros and Huaves Indians used to collect eggs from nesting beaches. After the Spanish colonization and the increasing number of people living along the coast, the fishery of sea turtles switched from a traditional to a commercial one. Specifically intense exploitation was turned towards black, Olive-Ridley and hawksbill turtles especially from the 1950's through the 1970's. Leatherback and loggerhead turtles were mainly caught incidentally in driftnet and long line. During this time Mexico was responsible for the capture of more than 50% of the world sea turtle fishery (which represents almost 375,000 sea turtles per year). Due to this systematic exploitation, sea turtle populations all around Mexico declined very quickly. In 1990 the Mexican government decided to protect sea turtle populations by banning sea turtle fishery and the use and trade of turtle products. Although legislation grants a protected status to sea turtles, in many cases it did not prevent illegal harvest and incidental bycatch in many areas, where sea turtle meat is still considered a delicacy and the decline of several sea turtle populations is still ongoing. At present many initiatives have been launched both by private and public organizations but most of them are focused on the protection of nesting sites. Very few projects are working towards the protection of the populations in their feeding and development habitats although sea turtles are known to migrate extensively and to aggregate in feeding areas such as the coastal waters of BCS. Recent studies demonstrate that exploitation rates in these areas are still very high: Koch et al. (2006) reported a minimum mortality rate of more than 600 dead turtles per year in the area of Bahía Magdalena; Nichols (2003) estimated a take of at least 7800 black turtles per year for consumption that can attend a total of over 35000 dead turtles in the BC peninsula. It is important to point out that assessments made on the basis of carapaces found on beaches and dump-sites are an under-estimate of real mortality rate as a lot of carapaces are hidden or thrown in the water.

At present one of the major issues weakening the conservation policy in the BCS is the habit of consuming turtle meat as delicacy during special events, which fuels the illegal market in the area. In particular, small-scale fisheries seem to have an impact more important than thought. Moreover Koch et al. (2006) showed that most of the turtles caught illegally or incidentally are juveniles whose conservation is critical for the survival of the population. This determines the urgent need for the implementation in BCS of a multidisciplinary study of the turtle mortality so that to know the mortality causes and rates in the BCS (bycatch and illegal catch). This information, which is critical for the implementation of a new conservation strategy, is still missing.

Objective

The objective of this study is to identify main sea turtle mortality causes and rates in the state of Baja California Sur so to propose specific conservation measures and help the recovery of depleted populations.

Specific Objectives

Specifically, our project addressed the following objectives:

1. Assess minimum mortality rate per species per year and identify major mortality causes in the area of BCS over a period of two years.

Specific objectives of this part of the study were:

- Identify which species are experiencing the highest mortality rate;
 - Determine the size classes most commonly caught;
 - Estimate the annual mortality rate of each species in the region;
 - Determine the fishing gears most commonly involved in incidental catch.
2. Identify high risk areas and determine the protection category to be assigned to the different study sites.

Specific objectives of this part of the project were:

- Determine the mortality distribution both spatially and temporally;
 - Mapping the fishing intensity of small-scale fisheries in the region;
 - Identify critical feeding habitat;
 - Suggest areas where fisheries closures would be most beneficial as well as areas that should be targeted for use of “turtle friendly” fishing gears.
3. Collect data about sea turtle consumption and illegal traffic of sea turtle meat and derived products.

Specific objectives of this part of the project were:

- Determine the size and demographic characteristics of the fishery-related work force residing in the area;
- Identify main groups involved in sea turtle mortality;
- Analyze the effects of the previous fishery policy with particular regard on cultural, social and economic issues;
- Identify the functioning of illegal trade of sea turtle products.

This one-year project served as a pilot study for a PhD thesis to standardize the data collection method, the interview process and to find the best way to analyze results

Methods

1. The study area

The state of Baja California Sur extends for an entire length of about 1000 km and has coastal areas both on the Pacific and Gulf of California sides. Thirteen index sites have been chosen all around the state corresponding to the areas where fishery is most

intensive (Fig. 1). The monitoring sites have been divided into three main regions: Gulf of California, Cape, and Pacific Ocean so to determine if there are differences between regions.

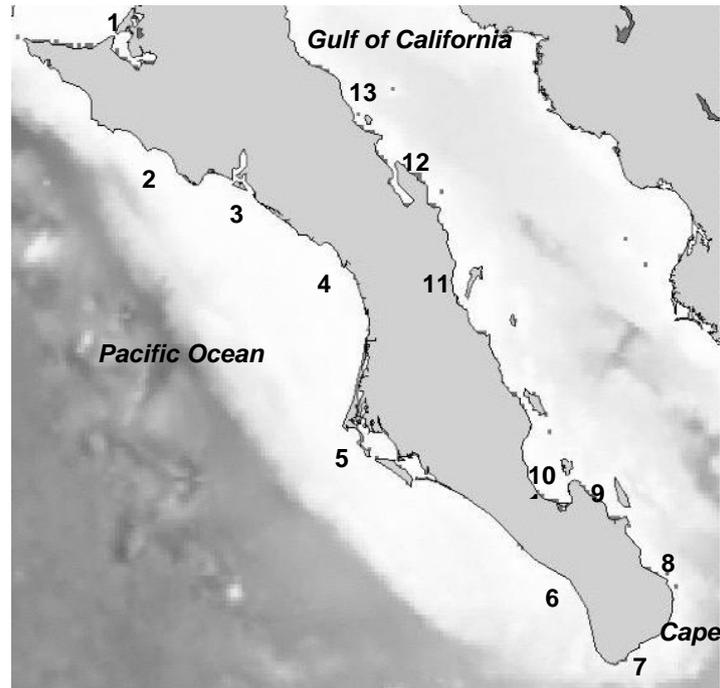


Figure 1 – Map of the study area. Sampling sites are described below: B= Beach / D= Dump-sites. The * indicates places where the sea turtle monitoring was already occurring.

- | | | |
|----------------------------|---------------------|----------------------------|
| Pacific: | Cape: | Gulf of California: |
| 1. Guerrero Negro (B/D) | 7. Los Cabos (B*/D) | 13. Santa Rosalia (D) |
| 2. Punta Abreojos (B/D) | | 12. Mulegé (B/D) |
| 3. San Ignacio (B/D) | | 11. Loreto (B/D) |
| 4. San Juanico (B/D) | | 10. La Paz (B) |
| 5. Bahía Magdalena (B*/D*) | | 9. Bahía La Ventana (B/D) |
| 6. Todos Santos (B*) | | 8. Cabo Pulmo (B/D) |

In general, monitoring has been carried out in beaches, villages and dumpsites. In table 1, there is a short description of all the sites that we have been monitoring. Every monitoring site has been checked at least three times (Tab. 1).

2. Assess minimum mortality

A census of sea turtle mortality took place since March 2006 along beaches and coastal communities following a protocol already in use in Bahía Magdalena for 5 years. Every specimen was identified and the carapace was measured (Curved carapace length and width). According to the carapace status, the cause of death was determined following four categories:

- 1) Consumption: carapace found on dump-sites, charred or with harpoon.
- 2) Bycatch mortality: carcasses entangled in fishing gears and/or with marks of fishing gears.
- 3) Natural mortality: sharks bite or fibropapilloma tumors.
- 4) Unknown mortality: no obvious cause of death observable.

After that, each carapace was marked with spray paint and cable ties to avoid double counting.

The distribution of carcasses of each species was averaged over the sampling period for each location. The total death count for each species provided a minimum mortality rate per year. The percentage of apparent mortality causes was calculated for each species. The percentage of juveniles and adults samples was estimated by using average nesting female sizes as an approximation.

Tab. 1 – Short description of the sites that have been monitored since March 2006. The sites have been divided in three main regions (Gulf of California, Cape and Pacific Ocean), in each region different areas have been identified corresponding to the most populated local communities.

<i>Region</i>	<i>Area (Code)</i>	<i>Site Name</i>	<i>Type of site</i>	<i>Length (km)</i>	<i>Description</i>
Gulf of California	Santa Rosalia (SRO)	Basurero Santa Rosalia	Dumpsite	/	Large, not controlled
	Mulegé (MUL)	Playa El Mojon – Santa Inés	Beach	13	Sandy, open
		Playa El Gallito	Beach	7	Sandy, open
		Basurero Mulegé	Dumpsite	/	Small, enclosed
	Loreto (LOR)	Playa Ensenada Blanca	Beach	6	Rocky, open
		Basurero Loreto	Dumpsite	/	Large, cleaned every month
		Tiradero Zaragoza	Dumpsite	/	Illegal dumpsite
	La Paz (LAP)	Playa El Mogote	Beach	28	Sandy, open
	Bahia La Ventana (BLV)	Playa La Ventana-P.ta Arenas	Beach	30	Sandy, open
		Basurero El Sargento	Dumpsite	/	Long and large, cleaned every 2 months
		Cabo Pulmo (CPU)	Playa los Frailes	Beach	15
	Playa La Ribera-Buenavista		Beach	15	Sandy, open
Basurero Los Barriles	Dumpsite		/	Small, garbage burnt periodically	
Cape	Los Cabos (LCA)	Playa San Cristobal	Beach	12	Sandy, open
		Playa El Suspiro	Beach	4	Sandy, open
Pacific	Todos Santos (TSA)	Playa Agua Blanca	Beach	7	Sandy, open
		Playa Los Cerritos	Beach	4	Sandy, enclosed
		Playa Punta lobos	Beach	12	Sandy, open
	Bahia Magdalena	Islote Santo Domingo	Beach	22	Sandy, open
		Isla Magdalena-B.ca Soledad	Beach	8	Sandy, Open
		Bahia Santa Maria	Beach	14	Sandy, open
		Basurero P.to A. L. Mateos	Dumpsite	/	Large, washed away by hurricane
		Basurero Santo Domingo	Dumpsite	/	Large, divided into two parts (new and old dumpsite)
		Basurero P.to San Carlos	Dumpsite	/	Large, controlled
		Alcatraz	Dumpsite	/	Small, uncontrolled
	Alcatraz	Village	/	Illegal dumpsite, carapaces found in proximity of houses	
	San Juanico (SJU)	Playa Punta San Gregorio	Beach	23	Sandy, open
		Playa del Faro	Beach	8	Sandy, open
		Basurero San Juanico	Dumpsite	/	Large, with many areas
	Laguna San Ignacio (LSI)	Playa Laguna San Ignacio	Beach	13	Rocky, enclosed
		Basurero San Ignacio	Dumpsite	/	
		Basurero El Cardon	Dumpsite	/	
	Punta Abreojos (PAB)	Playa del Faro Norte	Beach	20	Sandy, open
		Playa Sur	Beach	16	Sandy, open
		Basurero Punta Abreojos	Dumpsite	/	Very long, built around the road
Basurero La Bocana		Dumpsite	/	Long entrance, small, garbage burnt	
Guerrero negro (GNE)	Isla Arena	Beach	25	Sandy, open	
	Basurero Guerrero Negro	Dumpsite	/	Very large	
	Tiradero El Chaparrito	Dumpsite	/	Illegal dumpsite	
	Tiradero El Tubo	Dumpsite	/	Illegal dumpsite	

3. Identify high risk areas and determine the protection category to be assigned to the different study sites.

Interviews were conducted with fishermen to establish fishing areas, sea turtle feeding areas and a fishery calendar to better identify correlation between sea turtle mortality and fishing gears. Using the Arcview 9.1 software (generously offered by the Society for Conservation GIS and ESRI Conservation Programme), the spatial and temporal distribution of sea turtle mortality was mapped in relation to fisheries activities throughout the year in BCS. Risk areas and seasons were identified and main mortality causes investigated in relation to external parameters such as presence/absence of fishers and local communities and the season. A protection category will be then assigned to each sub-region of the study area as conservation tool. The spatial distribution of sea turtle carcasses was determined using Global Positioning System (GPS). Fishing intensity was calculated in the main fishing communities and measured in number of day fished using the database from the Mexican Secretary for Fishery and Agriculture (SAGARPA). The SAGARPA database for the year 2006 is not available yet, thus we used fishing effort data for the 2003.

To identify high risk areas we used the MapAlgebra technique available in ArcView 9.1. For this kind of analysis we had to make two hypotheses:

1. All the boats registered in an area use to fish inside the fishing area. There are no boats from other places fishing in the same area;
2. All the dead turtles and carapaces encountered in beaches and dumpsites corresponding to a specific area have been caught in this area.

We also consider fishing seasons instead of months. We considered three fishing seasons for both sea turtle mortality and fishing effort:

- Winter: from January to April;
- Summer: from May to August;
- Fall: from September to December.

Basically, MapAlgebra divide fishing effort for the number of dead turtles directly on the map (Fig. 2).

This part of the study is still undergoing. We focused our efforts on the area of Puerto Adolfo Lopez Mateos in Bahia Magdalena to standardize the data collection and find the best way to analyze the data collected.

4. Collect data about sea turtle consumption and illegal traffic of sea turtle meat and derived products.

Semi-structured interviews have been conducted periodically at each monitoring sites. Each interview included four parts: 1) personal data concerning the person being interviewed; 2) general distribution status and biology of sea turtles; 3) consumption and trade; 4) law and conservation.

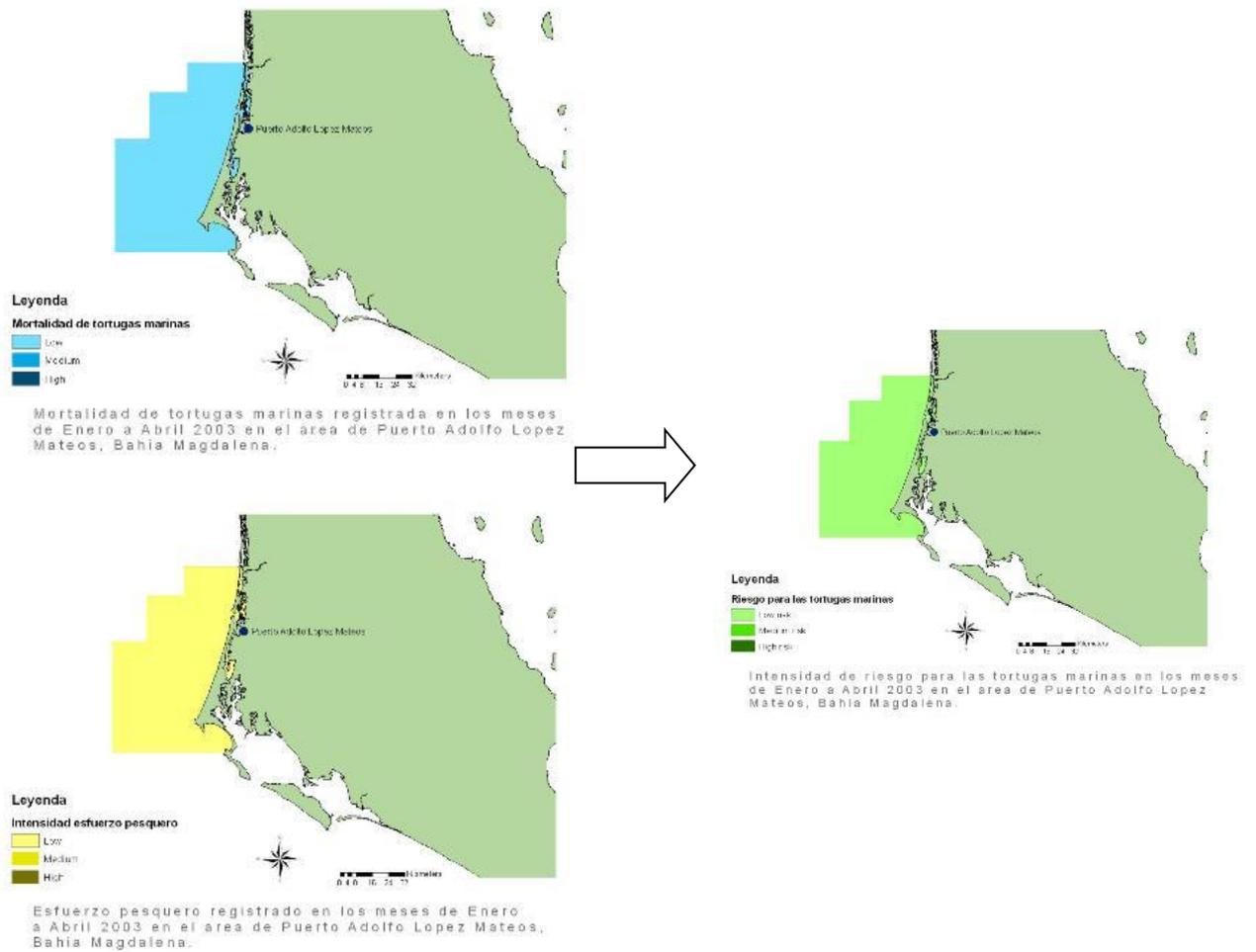
At the same time educational activities have been organized in partnership with local communities' members and people from the "Grupo Tortuguero de las Californias".

This part of the study is still undergoing. Actually, it is harder than what we had foreseen to gather this kind of information as it implies a certain degree of confidence

between the interviewer and the interviewed. After one year it is possible to say that we built a solid network of collaborators and partners which will facilitate the follow-up project.

All the activities have been carried out with the help of many local partners and collaborators (please check the Annex 1 for a complete list).

Fig. 2 – Functioning of MapAlgebra (from ArcView 9.1): a risk degree is assigned to each area for each fishing season.



Results and Discussion

1. Sea turtle mortality

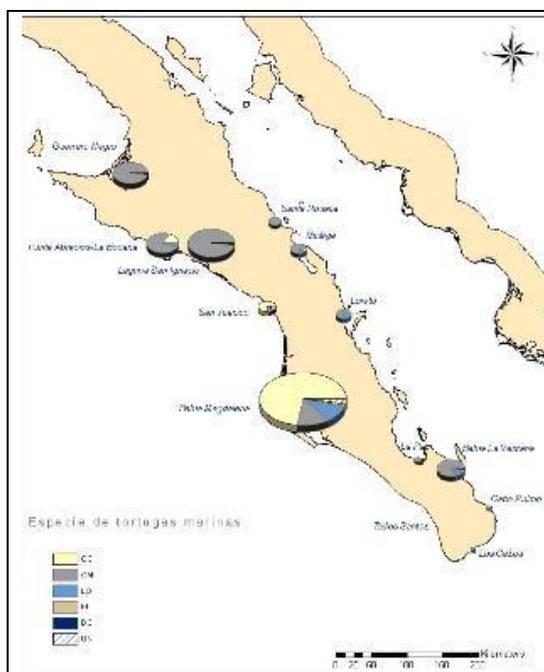
From March to December 2006, 630 sea turtle carapaces have been found: 299 belonging to black turtles, 266 belonging to loggerhead turtles, 45 belonging to olive-ridley turtles, 8 belonging to hawksbill turtles, 1 belonging to a leatherback turtle and 11 for which we could not identify the species (Table 2).

Tab. 2 – Specie-specific composition of sea turtle carapaces encountered from March to December 2006 in the three studied sub-regions: Pacific, Gulf of California and Los Cabos (cape).

	<i>Pacific</i>	<i>Gulf of Calif.</i>	<i>Los Cabos</i>	<i>Tot.</i>
<i>Chelonia m. agassizii</i>	243	56	0	299
<i>Caretta caretta</i>	266	0	0	266
<i>Lepidochelys olivacea</i>	35	9	1	45
<i>Eretmochelys imbricata</i>	5	3	0	8
<i>Dermochelys coriacea</i>	0	1	0	1
Unknown specie	11	0	0	11
Tot.	560	69	1	630

The distribution of sea turtle carapaces corresponds to the sea turtle distribution in their feeding and growing areas. For example, if we consider the loggerhead turtles, it is known that they are rarely encountered in the Gulf of California as their major feeding areas are in the Pacific Ocean, 100 km from the main land (Fig. 3).

Fig. 3 – Sea turtle mortality distribution in the monitored area. The monitoring started in March 2006 and ended in December 2006. All the sites have been visited at least three times. CC= *Caretta caretta*; CM= *Chelonia mydas agassizii*; LO= *Lepidochelys olivacea*; EI= *Eretmochelys imbricata*; DC= *Dermochelys coriacea*; UN= Unidentified species.



Carapaces sizes varies from 30 to 105 cm, all the species together, being a loggerhead turtle the smallest one (curved carapace length of 30) and a black turtle the biggest one

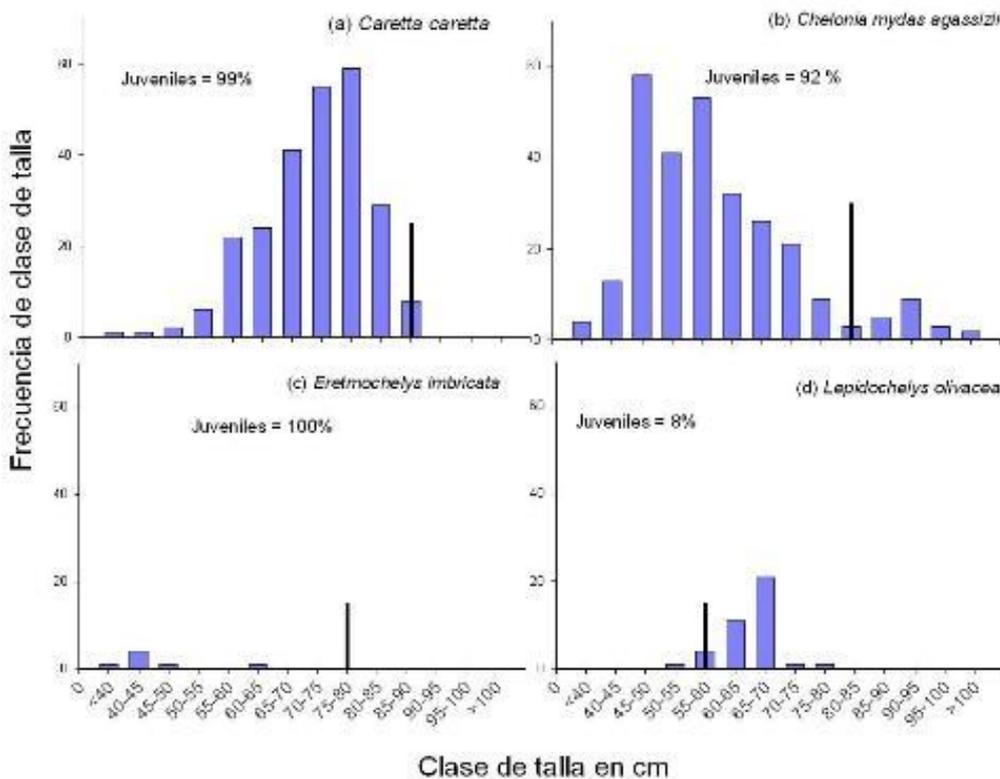
(curved carapace length of 105 cm). For each species we calculated the curved carapace length range, the median and the average value (Tab. 3). It is important to point out that the median value is not significantly different from the average value, which means that we can consider the average value as a good approximation of sea turtle carapaces sizes.

After comparing the measures of sea turtle curved carapaces length with average size of nesting female, we found out that 90% of the encountered carapaces belong to juveniles: 99% of loggerhead turtle carapaces, 92% of black turtle carapaces, 100% of hawksbill turtle carapaces and only 8% of olive-ridley carapaces (Fig. 4). The only leatherback turtle found was an adult female.

Tab. 3 – Range, median, average size, and Standard error (SE) of sea turtle carapaces encountered from March to December 2006. The only leatherback turtle encountered is not included in this table.

	N	Range	Median	Average	SE
<i>Chelonia mydas agassizii</i>	279	38.50 -105.00	58.00	60.16	±13.17
<i>Caretta caretta</i>	248	30.00-90.00	73.00	71.77	± 8.99
<i>Lepidochelys olivacea</i>	39	55.00-80.00	66.50	65.82	± 4.76
<i>Eretmochelys imbricata</i>	7	40.00-65.00	41.50	45.37	± 8.87

Fig. 4 – Size class frequency of sea turtle carapaces encountered with percentage of juveniles per species: a) *Caretta caretta*, b) *Chelonia mydas agassizii*, c) *Eretmochelys imbricata*, d) *Lepidochelys olivacea*. The only leatherback turtle (*Dermochelys coriacea*) that we found does not appear in this figure as it is an adult female.



A one-way ANOVA was realized to detect if there are differences in average carapace length between regions. We only consider the black turtle and the olive-ridley turtle as

these are the only two species that have been found both in the Gulf of California and in the Pacific regions. The hawksbill turtle, which is encountered as well in both regions, has not been taken into account because only 7 carapaces were found. Considering a “ α ” of 0.5, the ANOVA showed no significant difference between average carapace curved length between the two regions. Nevertheless we need to consider that there is a huge difference in the amount of carapaces found in the Pacific and the Gulf regions, this can modify the final results (Tab. 4).

Tab. 4 – Results of the one-way ANOVA realized to detect significant differences of sea turtle carapaces length between individuals found in the Pacific and the Gulf region ($\alpha=0.05$). CM = *Chelonia mydas agassizii*, LO = *Lepidochelys olivacea*.

		N	Average	SE	df	p
CM	Gulf	54	61.17	± 1.80	1	0.531
	Pacific	225	59.92	± 0.88		
LO	Gulf	5	68.30	± 2.11	1	0.217
	Pacific	34	65.46	± 0.81		

As the loggerhead turtle is only found in the Pacific region, we realized a one-way ANOVA to detect possible differences among sea turtle carapace sizes in three different areas of the Pacific (from North to South): Punta Abreojos, San Juanico and Bahia Magdalena. The ANOVA shows that there is no significant difference ($p=0.151$) (Tab. 5), but again the different number of individuals encountered in each area can affect the final result.

Tab. 5 – Results of the one-way ANOVA realized to detect significant differences of loggerhead turtle carapaces length between individuals found in the areas of San Juanico (SJU), Punta Abreojos (PAB) and Bahia Magdalena (BMA) ($\alpha=0.05$).

		N	Average	SE	df	P
<i>Chelonia m. agassizii</i>	PAB	8	67.06	± 3.17	2	0.151
	SJU	10	68.50	± 2.83		
	BMA	230	72.07	± 0.59		

Density of sea turtles found stranded on beaches for each monitoring site is shown in table 6. Density has been calculated as the number of stranded animals/km of recurred beach. Beaches of Laguna San Ignacio and Bahía Magdalena have the highest stranding density (respectively 7.38 and 5.86).

Tab. 6 – Sea turtle stranding density along beaches of monitoring sites. For each site the total distance recurred, the beach length, the number of strandings and density are shown.

	Recurred distance (km)	Beach length (km)	Sea turtles	Density
Guerrero Negro	109.00	30.00	5	0.17
Punta Abreojos	147.00	36.00	7	0.19
Laguna San Ignacio	52.00	13.00	96	7.38
San Juanico	84.00	29.00	11	0.38
Bahia Magdalena	134.00	40.94	240	5.86
Los Cabos	24.00	17.00	1	0.06
Cabo Pulmo	15.00	25.00	0	0.00

Bahia La Ventana	84.00	20.92	5	0.24
La Paz	110.00	25.64	2	0.08
Loreto	4.00	4.00	0	0.00
Mulegé	17.00	17.00	7	0.42
<i>TOT.</i>	800.00	258.00	374	1.28

In the case of Laguna San Ignacio, the high number of strandings coincides with the halibut fishing season (Mayoral, personal communication). During this season, a high number of turtles are caught incidentally in the nets.

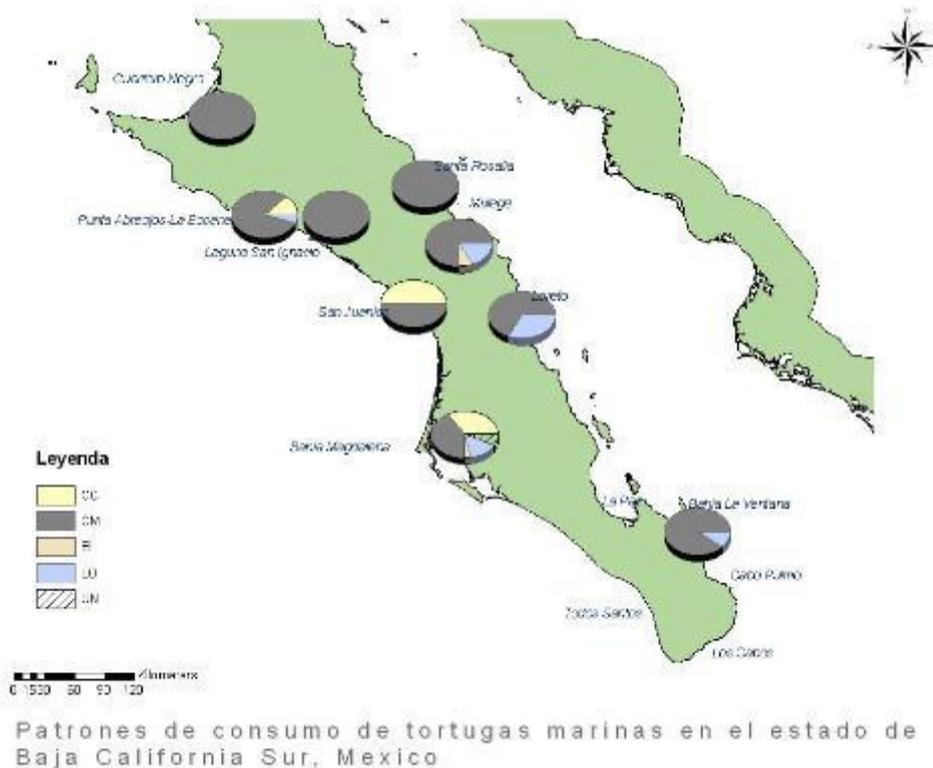
In the case of Bahía Magdalena, this corresponds to exceptional events that occurred on Magdalena Island and Islote Santo Domingo from the end of August to October 2006. This high mortality is a unique event. More than 800 turtles stranded on a 60 km long beach in less than two months (Peckham et al., unpublished data). Most of the stranded turtles are loggerheads with an average size between 65 and 75 cm (Curved carapace length). Up to now we are not sure of the main cause of these strandings, anyway many hypothesis have been done:

1. El Niño: this year the water is largely hotter than during previous years (22°C – 25°C against 13°C – 16°C), this is due to the fact that El Niño is undergoing.;
2. Hurricane John: the hurricane John hit the state of Baja California Sur at the beginning of September 2006 and was followed by intense rains. Many dumpsites, usually located on *arroyos*, have been washed away and a huge amount of garbage flowed into the sea. Beaches are rich of contaminants and most of them have flowed into the sea as well;
3. A strong pollution of loggerhead turtle feeding areas: feeding areas are located far from the shore and an unknown pollution could have taken place there as tanks containing an unknown substance were found on the same beaches with the animal carcasses;
4. Incidental fishing: many shrimp trawlers, probably coming from other states of Mexico and/or other countries, have been seen working in the area of Bahía Magdalena;
5. Sickness: there is the possibility that some turtles are suffering of a parasite infection (Peckham, personal communication);
6. “Agua roja”: it means literally red waters. It is due to the bloom of red toxic algae that happen regularly and can be dangerous for many marine species.
- 7.

Up to present, none of these hypotheses has been proved. Some studies are still undergoing. Some of the necropsies that have been realized on different animals revealed different diseases (high concentration of cadmium, heart diseases, and evidence of incidental fishing). Anyway, no matter what the cause is, the situation is really serious especially considering a recent study (Hart et al., 2006), in which strandings on beaches seem to represent only 20-30% of real mortality occurring in an area closed to the shore. Many fishermen reported a high number of dead sea turtles in high sea waters from Bahía Magdalena to San Juanico.

Concerning sea turtle mortality causes, consumption (or directed harvest) represents 43.56% of total mortality, incidental fishing is only 5.56%, mortality for natural causes only represents 0.48%, sea turtles killed by boats represents 0.32%, mortality for unknown cause represents 50.08% of total mortality (this is the case for most of the sea turtles stranded on the beaches). Concerning consumption, of 274 encountered carapaces, 46 belong to loggerhead turtles (16.79%), 189 belong to black turtles (68.98%), 27 belong to olive-ridley turtles (9.85%), 5 belong to hawksbill turtles (1.82%) and 7 could not be identified (2.55%). The distribution of these carapaces reflects the abundance level of the species in the area surrounding the site but also the preference of people. In a general way, black turtles are considered as the tastiest, but there also is a high level of consumption of loggerhead turtles especially in certain communities (Santo Domingo as an example) and discrete consumption of olive-ridley turtles. Hawksbill turtle meat is not considered particularly tasty but is still consumed from time to time when a turtle is caught in the net (Fig. 5).

Fig. 5 – Sea turtle consumption distribution for each monitored site. CC= *Caretta caretta*; CM= *Chelonia mydas agassizii*; EI= *Eretmochelys imbricata*; UN= Unidentified species.



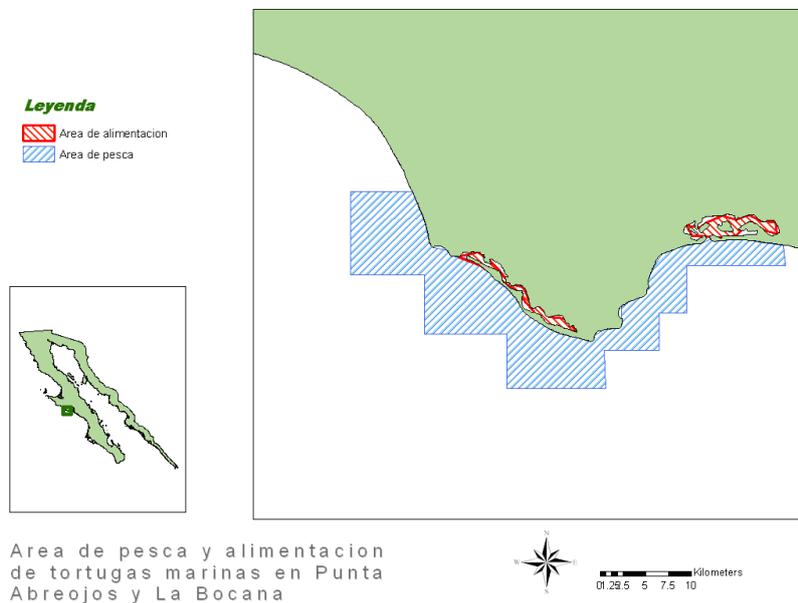
2. Fishing areas and fishing calendars

Up to now we have been able to collect data for 4 of the 13 monitoring sites. Tables 7 to 10 show fishing calendars for the areas of Punta Abreojos, Laguna San Ignacio, Puerto Adolfo Lopez Mateos (part of Bahía Magdalena) and Santa Rosalia. For these 4 areas we also delimited fishing areas and sea turtle feeding grounds (Fig. 6 to 9).

In Punta Abreojos (Fig. 6 and table 7) is quite hard to obtain information about sea turtle illegal fishery and consumption. We could not get any information neither about how the illegal fishery is occurring nor about most dangerous fishing seasons for these

animals. We had the chance to talk to people working in a camping near a mangrove area, they are working for the protection of sea turtles from poachers and illegal fishers. In this area there are a lot of black turtles that feed of most abundant algae. Nevertheless, sea turtle meat consumption is still high as we found many burnt carapaces in hidden areas called *arroyos*.

Fig. 6 – Fishing area (blue) and sea turtle feeding ground (red) in the area of Punta Abreojos.



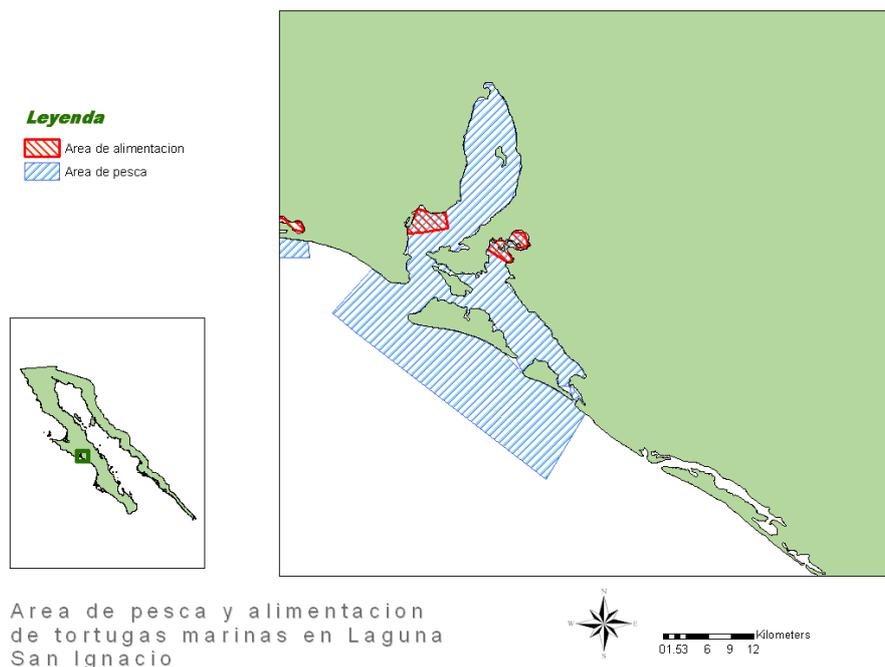
Tab. 7 – Fishing calendar of Punta Abreojos.

Month	Target species	Fishing gear	Sea turtle catches
January	Common Jack, Corbina, Cabrilla	Nets, line	
February	Common Jack, Corbina, Cabrilla	Nets, line	
March	Abalone		
April	Abalone		
May	Abalone		
June	Abalone		
July	Abalone		
August	All*	Nets, line	
September	Lobster	Traps	
October	Lobster	Traps	
November	Lobster	Traps	
December	Lobster	Traps	

Source: 1

In Laguna San Ignacio (Fig. 7 and table 8), summer is the most dangerous season for black turtles. Being a lagoon, the area is an exceptional feeding ground for these animals especially in summer. From May to August, fishermen use gillnets to catch halibut and longlines. These gears are very dangerous as hundreds of sea turtles get entrapped in the net. As it is shown in fig. 7, fishing and feeding areas are overlapping but often fishermen consciously choose to throw the net in a feeding area to catch one or two turtles to be consumed in family. The *guaterismo* (illegal catch of sea turtles) is still commonly practiced in this area.

Fig. 7 – Fishing area (blue) and sea turtle feeding ground (red) in the area of Laguna San Ignacio.



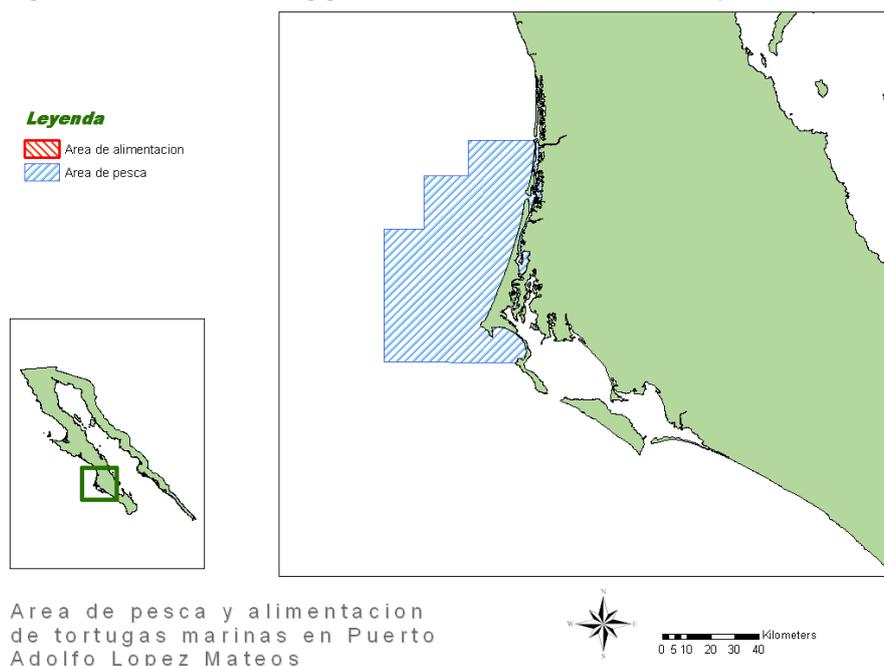
Tab. 8 – Fishing calendar of Laguna San Ignacio.

Month	Target species	Fishing gear	Sea turtle catches
January	Whale		
February	Whale		
March	Whale		
April	Whale		
May	Grouper, Halibut, Guitar fish	Longline and Gillnet (6-8 inches)	High
June	Grouper, Halibut, Guitar fish	Longline and Gillnet (6-8 inches)	High
July	Grouper, Halibut, Guitar fish	Longline and Gillnet (6-8 inches)	High
August	Grouper, Halibut, Guitar fish	Longline and Gillnet (6-8 inches)	High
September	Corbina	Entanglement nets	
October	Lobster	Traps	
November	Corbina, Lobster	Entanglement nets, Traps	
December	Corbina, Lobster	Entanglement nets, Traps	

Source: 5

In Puerto Adolfo López Mateos (Fig. 8 and table 9), most of the sea turtles get caught in gillnet and trawlers used for the halibut and shrimp fisheries respectively. Since 2003 sea turtle strandings have been monitored constantly in Playa San Lazaro (44.30 km) on Magdalena Island. During the summer months, June, July and August, there are picks of mortality (between 220 and 368 from 2003 to 2005). Feeding areas of loggerhead turtles are located far from the shore in areas where the red crab (*Pleuroncodes planipes*) is particularly abundant.

Fig. 8 – Fishing area and sea turtle feeding ground in the area of Puerto Adolfo Lopez Mateos.



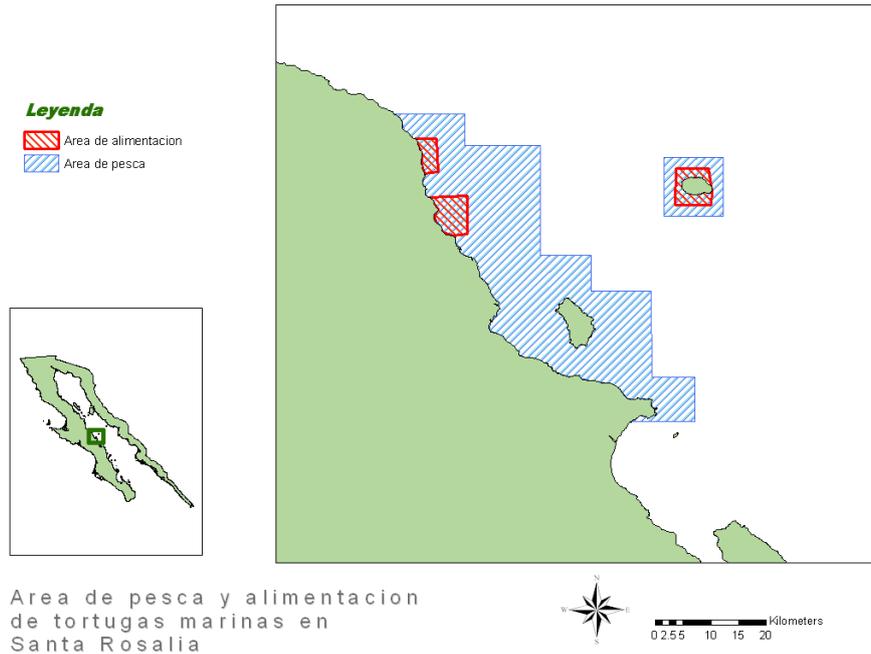
Tab. 9 – Fishing calendar of Puerto Adolfo Lopez Mateos.

<i>Month</i>	<i>Target species</i>	<i>Fishing gear</i>	<i>Sea turtle catches</i>
January	Whale		
February	Whale		
March	Whale, All*	Gillnet (4-8 inches)	
April	All*	Gillnet (4-8 inches)	
May	All*	Gillnet (4-8 inches)	High
June	All*	Gillnet (4-8 inches)	High
July	All*	Gillnet (4-8 inches)	High
August	Allé	Gillnet (4-8 inches)	High
September	Shrimp, All*	Trawlers, Gillnet (4-8 inches)	High
October	Shrimp, All*	Trawlers, Gillnet (4-8 inches)	
November	Shrimp, Lobster, All*	Trawlers, Traps, Gillnet (4-8 inches)	
December	Lobster, All*	Traps, Gillnet (4-8 inches)	

Source: 1

In Santa Rosalía (Fig. 9 and table 10), illegal and incidental fisheries occur all along the year but with picks corresponding to holyday periods (Easter, Christmas and the fathers' day in particular). Incidental fishery is not a real threat in this community as usually fishermen use to catch sea turtles while diving for the squid fishery.

Fig. 9 – Fishing area (blue) and sea turtle feeding ground (red) in the area of Santa Rosalía.



Tab. 10 – Fishing calendar of Santa Rosalía.

<i>Month</i>	<i>Target species</i>	<i>Fishing gear</i>	<i>Sea turtle catches</i>
January	Common Jack	Gillnet (6 inches)	
February	Common Jack	Gillnet (6 inches)	High
March	Common Jack	Gillnet (6 inches)	High
April	Octopus, Squid	Dive	
May	Octopus, Squid	Dive	
June	Octopus, Squid	Dive	High
July	Octopus, Squid	Dive	High
August	All*	Dive, line	High
September	All*	Dive, line	High
October	All*	Dive, line	High
November	Common Jack	Gillnet (6 inches)	High
December	Common Jack	Gillnet (6 inches)	High

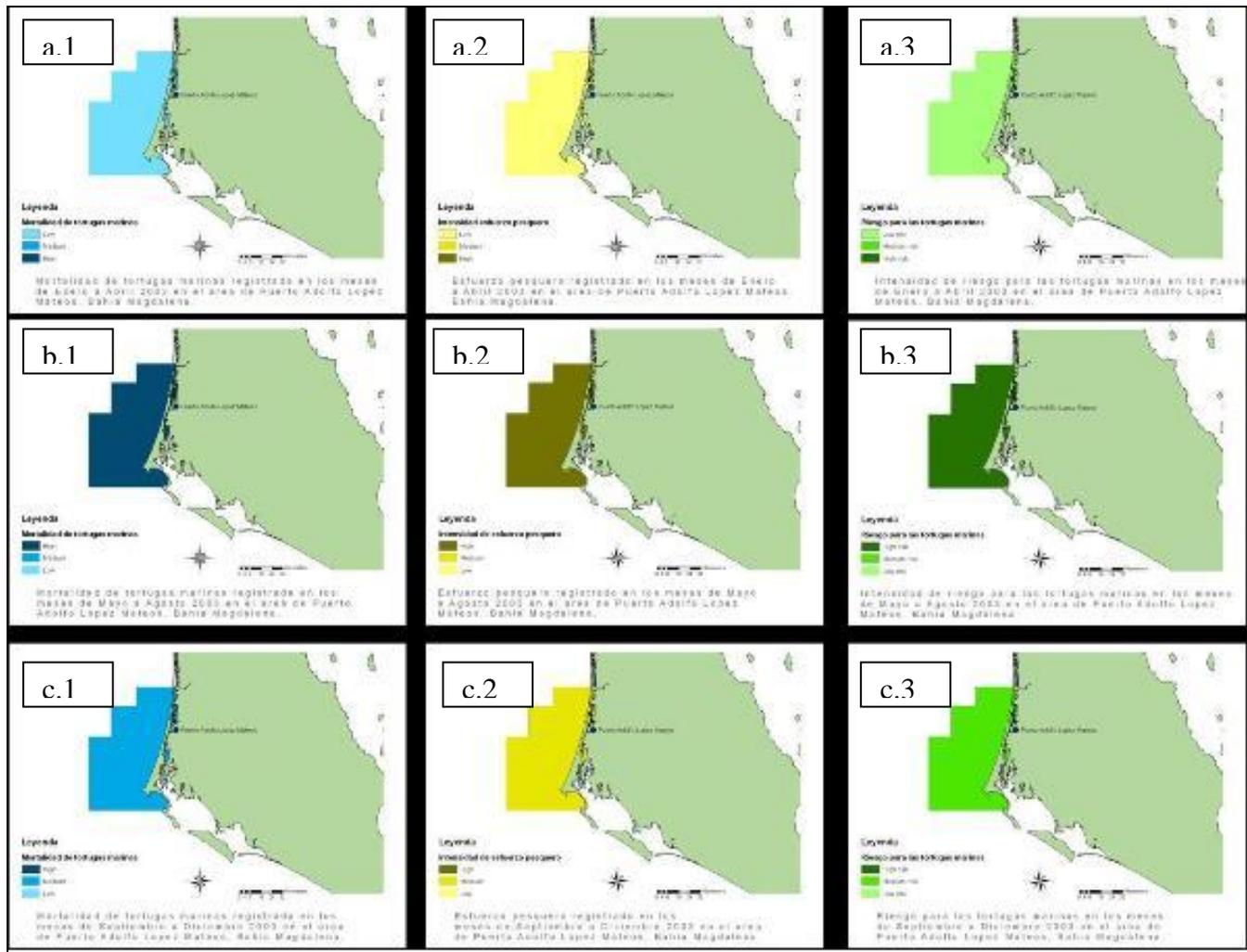
Source: 3

*All means every kind of fish available during the season.

3. Fishing effort and sea turtle mortality.

Currently, data on fishing effort for the 2006 are not available. Thus we prepared a simulation representing the type of analysis we will realize when these data will be published. For our simulation we used real sea turtle mortality data collected in 2003 by Peckham et al. (2006), fishing area is the same that we identified during our interviews with fishermen. Fishing effort data have been taken from the SAGARPA database. The area we are analyzing is Puerto Adolfo Lopez Mateos, part of the complex of Bahía Magdalena

Fig. 10 – Sea turtle risk seasons in the area of Puerto Adolfo Lopez Mateos: winter (a), summer (b), fall (c). For each season we reported fishing effort maps (1), sea turtle mortality distributin maps (2) and risk intensity associated (3).

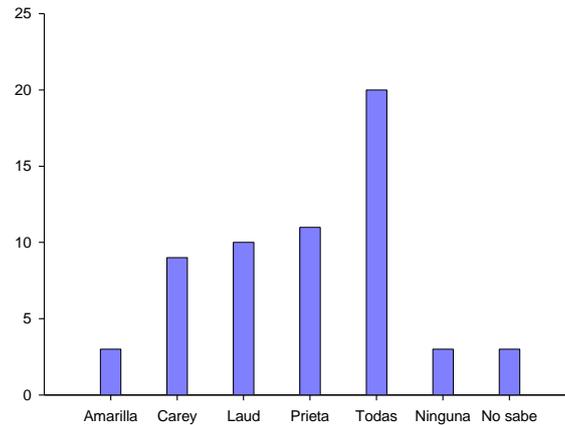


This analysis confirms what we suspected: summer is the most dangerous season for sea turtles as the fishing effort is particularly high; during winter, as the fishing effort is very low due to the whale season (it is forbidden to fish on the bay during the whale season), sea turtle mortality is low too. Fall is a moderate risk season as there still are boats fishing in the area and using gillnets and trawlers (Fig. 10).

4. Interviews

Up to now, 61 interviews have been carried out, which is largely less than what we expected to have at present. We are thus looking for volunteers willing to carry the interviews at their local community. We are actually working with the EcoAmigos of Mulegé and asked some of the members to interview their friends and family members. We are now collecting filled interviews and verifying if these data can be used. In a general way, concerning sea turtle biology, 39% of the interviewed think that compared to 10 years ago, the number of sea turtles has grown, 35% think that there are less turtles, 17% think that the number of sea turtles declined a few years ago but was followed by a rise which means that's at present the number of turtles is the same of that 10 years ago, the resting 9% had no opinion or no knowledge. All the species are considered at risk but the black, leatherback and hawksbill turtles are the most endangered (Fig. 11).

Fig. 11 – Sea turtle species mentioned during the interviews when people were asked “Which is the most endangered species?”

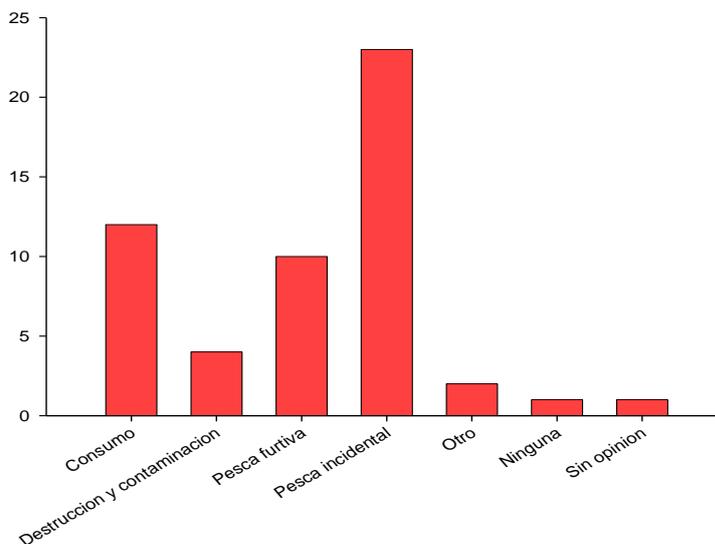


Incidental fishery is considered the main mortality cause jointly with consumption and directed illegal harvest. Other mortality causes have been mentioned: habitat destruction and pollution (Fig.12).

Concerning consumption, we were told that only 10 to 50% of people living in local communities eat or have eaten sea turtle meat at least once. Consumption can be occasional (when a turtle gets caught in the net) and up to 5 times per month. The positive data is that there is a negative trend in consumption compared to the situation ten years ago (see paragraph 5 for further details).

All the interviewed (100%) knew about the total ban of sea turtle fishery and trade of derived products. Most of the people think that the ban was the right thing to do and it was needed but it may need to be changed at present. Another information, which we obtained with the interviews, is that educational activities are very unequal, in the sense that some communities seem to be abandoned. This is strictly tied to the presence of local NGO, research programs and community members interested in the topic.

Fig. 12 – Main sea turtle mortality causes mentioned during the interview process.



5. Trade and traffic

In Baja California Sur, it is very hard to establish a limit between illegal fishery and bycatch. Fishermen admitted that when a turtle get caught in the net, it is not released but taken at home to be eaten. This habit is very old and come from a strong tradition and it is not easy to make people change their habits. Furthermore, fishermen have a perfect knowledge of sea turtle feeding areas and sometimes, as the areas are relatively small, they can decide if catch or not a turtle. Luckily in most of the cases, consumption is limited to fishermen families or the local community.

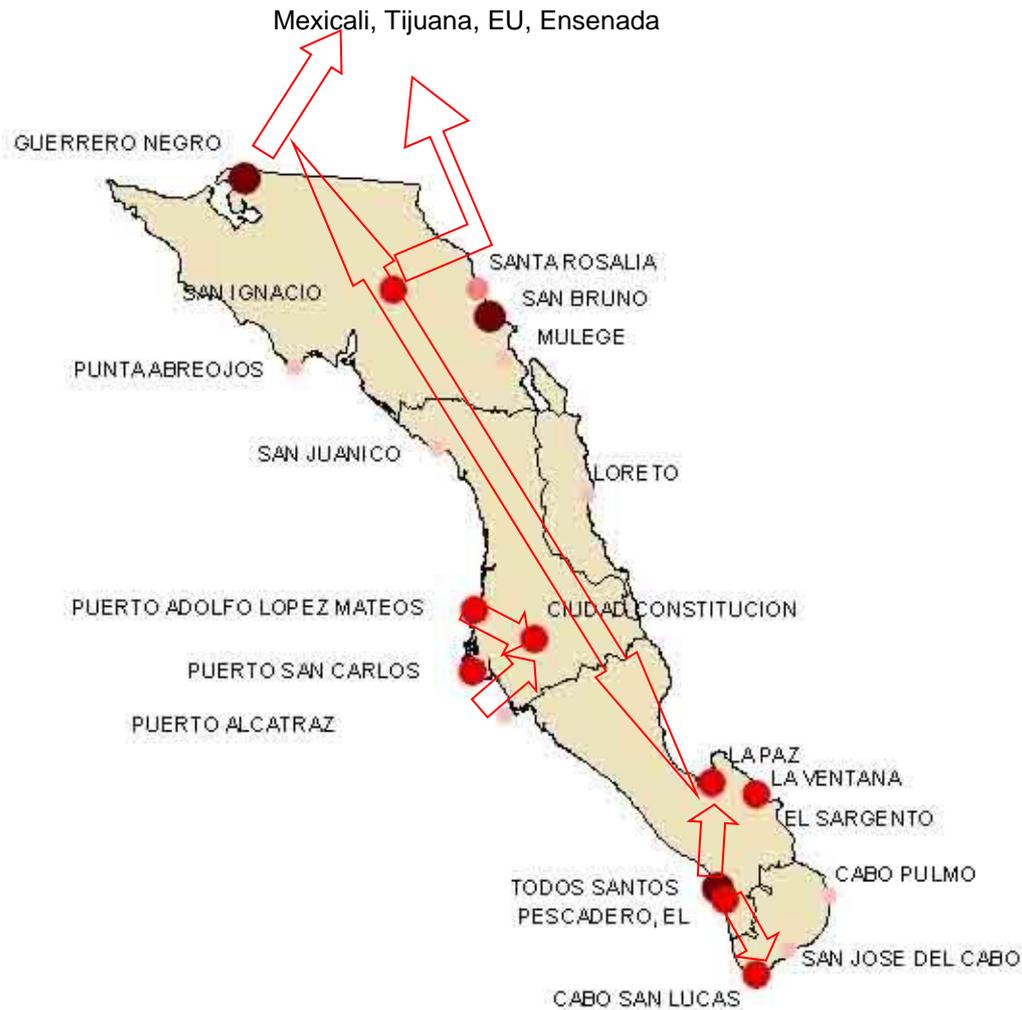
In a general way, it can be said that there are two kinds of trade: a merely local market and a national/international market based on a huge organization that control all the steps since the capture of these animals up to the selling of the final product. The local market is not a real danger: prices, depending on the species vary from 20 to 250 Mexican pesos/kg. The “most wanted” species is the black turtle which meat is considered the most delicious. Nevertheless this kind of market is slowly disappearing; it is more about sharing an incidentally caught turtle with family and friends during special events. The national market has a complex organization and can reach some U.S. cities. In general customers pass on an order of a certain amount of meat to a dealer that then make arrangement with his *guateros*. Customers are usually restaurants and important people.

There are many ways in which the meat or the turtles are transported. The most frequent one is by hiding the meat in tracks used for fish transportation. The turtle meat is hidden in the back of the track under the boxes carrying fish and the ice, it is almost impossible to find it during normal controls at military check points. It is also known that most of the times militaries receive a “tip” to let the tracks pass with no control. Another way to transport the meat is by the intermediate of the “Green Angels”. These are people driving up and down Baja to help people that have troubles with their car. The Green Angels can circulate freely and are never checked. Another frequent way of transport is by using unpaved streets that are almost unknown, the same routes that are often used by drug dealers. Obviously, the gain rises as you rise in the organization pyramid: fishermen are on the lowest step and their gain depends of the amount of turtles they catch, they also are the ones facing the highest risks (6 months to 3 years of jail and a penalty of up to 2000 minimu diary salary). Fishermen give the product to an intermediate who is usually in charge of the transportation (personally or paying someone else) to its final destination.

In many restaurants in Baja California Sur, you can still eat sea turtle meat. In general it is identified in menus as *caguamanta*, the *caguamanta* is usually mantarray fillet prepared with sea turtle oil. If a normal customer asks for this dish, he will usually get mantarray soup; but if a “special” customer asks for it, a sign with the head is enough to get real sea turtle soup.

Concerning traffic routes, many are known. The first one begins in Todos Santos where sea turtle fishery still is a good source of money. From there the meat is carried to la Paz or to Los Cabos. Another route begins in Bahia Magdalena (usually Puerto San Carlos and Puerto Adolfo Lopez Mateos), from there the meat is transported to Cd. Constitucion where many intemediates are in charge of it: meat can be transported to la Paz or up to the north of the state. Other known places are Laguna San Ignacio and Guerrero Negro, from there sea turtle meat is usally transported to Tijuana, Mexicali, Ensenada and some US cities (San Diego, Los Angeles) (Fig. 13).

Fig. 13 – Traffic routes and black market of sea turtle in Baja California Sur. Usually main routes are used to transport the meat but sometimes unpaved roads are taken. The point size corresponds to the intensity of national and/or international trade.



Conclusion

After one year of mortality census, we found out a minimum annual mortality rate of 630 sea turtles per year. This is largely less than what estimated by Dr Nichols in 2000. Nevertheless we know that what we found represents probably a small percentage of real mortality. Through informal talks we collected the testimony of an illegal poacher in Mulegé that uses to catch 1-2 turtles every day which represents 365-730 turtles per year. If we consider that in each fishing community of Baja California Sur there is at least one illegal poacher catching a minimum of 1-2 turtles per day, we obtain a minimum mortality rate of 5475-10,950 turtles. And again this is a minimum estimation as we only considered the 15 largest local communities. The problem for us is that, especially in the case of illegal fishery, carapaces are now thrown directly into the sea by illegal fishers (or hidden under the sand) as it reduces the risks to be discovered. None of these carapaces will reach the shore. This practice has become more and more common since the mortality census started in 1995. We are supplying to the lack of carcasses with data collected through interviews and informal talks.

Another alarming data emerging from this preliminary study is that 90% of the turtles found dead were juveniles, confirming previous studies. This is a dangerous sign as the survival of large juveniles is critical for the recovery of sea turtle populations. The

fact that sea turtles are cosmopolitan make harder the work of conservationists as protection should be granted at all the age stages. As an example we can consider the loggerhead turtles. It is known the loggerheads coming to Baja California Sur were born on Japanese beaches. Sea turtles are known to spend 10 to 15 years in BCS waters to feed and grow before reaching the adult age and going back to their natal beaches where females use to nest. In Japan, nests and eggs are strongly protected and surveyed by volunteers and researchers. Nevertheless the number of nests is lower and lower. This is due to the high mortality of large juvenile individuals caught incidentally in open waters and near the shores of Baja California Sur. This means that the high mortality near Mexican waters has a strong impact on sea turtle populations up to Japan. Mexican fishermen are not the only ones to blame, it is known that many shrimp trawlers from Corea, Japan, United States and other countries use to fish in the international waters just in front of Baja California Sur and sometimes they enter illegally national waters. Due to the extent of the area and the limited resources, controls of these boats are practically impossible. Police enforcement and a stronger international cooperation are urgently needed.

As we have seen, in Baja California Sur the major problem is due to the habit of local people to eat sea turtle meat. Nevertheless local consumption is slowly disappearing thanks to the intense educational activities that are being carried on by different local NGOs. The real problem is the national and international market that is based on a solid organization of illegal fishers, dealers and rich customers. In one day a *guatero* can earn as much money has he would have obtained in a month of legal fishery. This is the reason for which there still are many illegal fishers in Baja California Sur. Local people think that most of these *guateros* are immigrants coming from other states of Mexico (Sonora and Sinaloa in particular) and arrived to BCS in search of a better life. This is actually true in communities like Puerto Adolfo Lopez Mateos and Puerto San Carlos, where the highest immigration rate was registered, and where new illegal fishers joined the "local" ones. Another issue that makes the situation particularly hard to solve, is that the traffic of sea turtle meat is often linked to the traffic of drug, some fishermen are protected by drug dealers and often are not put in jail. It is also known that most of the purchasers are politics and police men.

Our study pointed out the extensity of the problem around the state of Baja California Sur and also identified some of the most dangerous areas for turtles, in Bahia Magdalena, Laguna San Igancio and Guerrero Negro, in correspondence with the higher fishing effort. Nevertheless we need to continue our mortality census at least for another year to obtain more complete information on sea turtle consumption, black market and traffic.

Further work

This Project was started as a pilot study for a larger one that will be started in March 2007. The preliminary results proved the need for a complete study including all the major local communities of Baja California Sur, as the sea turtle mortality rate is still high although the 1990 total ban. We plan to:

- continue the mortality census in all the previous sites focusing more on the Pacific side, where most of the turtles have been found, for one more year to be then able to compare mortality rates;
- complete the GIS database, identifying the fishing areas corresponding to all the major local communities and compiling the respective fishing calendar;
- compile at least 200 interviews with people from all the state on sea turtle conservation issues;

- collect genetic samples of stranded turtles found on the beaches to identify their origin (we have already been collecting genetic samples and we finally found a laboratory that will help us with all the DNA extraction and analysis process);
- strength the network of partners and collaborators that we have been building during this last year and organize with them educational activities involving the population.

A part of the data collected during this project will be included in a PhD at the University of Baja California Sur. Once collected and analyzed all the data, results will be presented to the local communities at the Annual Meeting of El Grupo Tortuguero de las Californias, to the international scientific community at the International Sea Turtle Symposium, and published in international scientific journals.

A report will be send to the Mexican Ministry for the Environment, which is already supporting the project, with suggested conservation measures that we hope will be taken into account for a new improved sea turtle conservation strategy.

Some relevant literature

- Bird, K.E., Nichols, W.J. and Tambiah, C. 2002. Value of local knowledge in sea turtle conservation. Proceeding of the conference "Putting Fisher's knowledge to work". Pp 178-183.
- Caldwell, D.K. 1963. The Sea Turtle Fishery of Baja California, Mexico. *California Fish and Game* 49(3):140-151.; Davis, E.H. and E.Y.
- CITES. 2000. CITES Secretariat Web site. <http://www.cites.org>
- Dawson, 1945. The Savage Seris of Sonora-I. *The Scientific Monthly* 60(3):193-202.;
- Felger, R.S. and M.B. Moser 1985 *People of the Desert and Sea*. Tucson, Arizona: University of Arizona Press.;
- Garcia-Martínez, S. & W.J. Nichols, 2000. Sea turtles of Bahía Magdalena, BCS, Mexico: Demand and supply of an endangered species. 10th Conf. Int. Inst. Fish. Econ. Trade. Oregon State University, Corvallis, Oregon. 07/2000
- IUCN (The World Conservation Union) 2004 *2004 iucn Red List of Threatened Species*. Retrieved November 18, 2004. Available at: <http://www.iucnredlist.org/>
- Koch, V.,W.J. Nichols, H. Peckham, and V. de la Toba. 2006. Estimates of sea turtle mortality from poaching and bycatch in Bahía Magdalena, Baja California Sur, Mexico. *Biological Conservation* 128: 327-334.
- Marquez, R., 1990. Sea turtles of the world. An Annotated and illustrated catalogue of sea turtle species known to date. FAO Species Catalogue, FAO Fisheries Synopsis 11(125), 81p.
- Marquez, R., Doi, T., 1973. A trial of theoretical analysis on population of Pacific green sea turtle *Chelonia mydas carrinegra* Caldwell, in waters of Gulf of California, Mexico. *Bull. Tokai Regional Fisheries Res. Laboratory* 73, 1–22.;
- Marquez, R., Peñaflores, C.S., Villanueva, A.O., Diaz, J.F., 1982b. A model for diagnosis of populations of olive ridleys and green turtles of west Pacific tropical coasts. In: Bjorndal, K.A. (Ed.), *Biology and Conservation of Sea Turtles*. Smithsonian Inst. Press, Washington, DC, pp. 153–158.;
- Nabhan, G.P. 2003. *Singing the Turtles to Sea: The Comcáac (Seri) Art and Science of Reptiles*. Berkeley, California: University of California Press.;
- Nichols WJ 2003. Biology and conservation of the sea turtles of the Baja California peninsula, Mexico. Ph.D. Dissertation., University of Arizona, Tucson
- Nichols WJ Aridjis H et al. 2002. Black market sea turtle trade in the Californias. Unpublished report. WildCoast, Davenport, CA, 9p
- O'Donnell J 1974. Green turtle fishery in Baja California waters: history and prospect. Master's thesis, California State University, CA. 119p
- Peckham, S.H., Nichols, W.J., Dutton, P., de la Toba, V., Caballero-Aspe, E., Salazar-Oropeza, O., in press. Reducing bycatch of loggerhead turtles in coastal fisheries of the Baja California peninsula, Mexico. In: Proceedings of the 24th Annual Symposium on Sea Turtle Biology and Conservation, San Jose, Costa Rica
- S. Delgado and W.J. Nichols. Saving Sea Turtles from the Ground Up: Awakening Sea Turtle Conservation in North-Western Mexico. *Mast* 2005, 3(2) and 4(1): 89–104.
- Zuniga-Arce, F. 2001. Conservación de las tortugas marinas en Baja California Sur. Unpublished report

Annex 1 – Collaboration and partnership

- Universidad Autónoma de Baja California Sur (www.uabcs.mx)
- Grupo Tortuguero de las California (www.grupotortuguero.org)
- Propeninsula (www.propeninsula.org)
- Procaguama
- A.C.Los Eco-Amigos de Mulegé
- Comision Nacional de Areas Naturales Protegidas (CONANP)– Parque Marino de Bahia de Loreto
- Comision Nacional de Areas Naturales Protegidas (CONANP)– Reserva del Vizcaino
- Comision Nacional de Areas Naturales Protegidas (CONANP)– Parque Marino de Cabo Pulmo
- A.C. Antares – Loreto
- A.C. Amigos para la conservación de Cabo Pulmo
- ASUPMATOMA
- Grupo Tortuguero de Pescadero

Annex 2 – Brief summary of our findings for each monitoring site

Guerrero Negro

The Guerrero Negro lagoon is part of the Biosphere Reserve of Vizacino. Although there is a strong presence of people from CONANP (National commission for Protected Areas), *guaterismo* is still a very common practice. Local consumption is still pretty high, and even higher is the black market and international trade. *Guateros* are usually well known by both members of police and local people but due to the low number of controls it is very rare to capture them while fishing turtles illegally. A few months ago, members of CONANP discovered more than 50 carapaces in a backyard. Most common destinations of sea turtle meat are restaurants in Mexicali, Ensenada, Tijuana and San Diego.

The lagoon hosts seagrass beds (*Zoostera marina*) which are the main feeding ground for black turtles which is consequently very abundant in the area. The black turtle is the most wanted and consumed as its meat is considered the best one.

Punta Abreojos

In Punta Abreojos we encountered many problems to get information from local people. We know that the consumption is still frequent as we found many carapaces in dumpsites. We also found some *arroyos* where people used to meet for “*caguamadas*”, family meeting during which sea turtle meat was shared with friends and family.

As in Guerrero Negro, the most consumed is the black turtle, very abundant in this area because of the presence of ideal feeding grounds at the Estero Coyote. In this area there is a private camp and the owners try to protect turtles but they have no control on illegal poachers. At present there mainly is a local market.

Laguna San Ignacio

In Laguna San Ignacio incidental and directed fishery are often overlapping especially in winter when fishermen use gillnets to catch halibuts.

“Fishermen know exactly where sea turtles feed and from time to time they throw their nets in this area to catch one or two turtles. They said that it is incidental but it is not, if you know where a turtle feed, why do you throw your net in that same place?”

- Anonymous, 2006-

Black turtles are present in the lagoon all around the year because of the presence again of seagrass beds and algae. This area was one of the major producers of sea turtle meat during the 1970-1990.

San Juanico

In San Juanico, there still is a high level of illegal fishery. Most of the fishermen, organized in a cooperative, are fishing abalone and lobster. These two products are very expensive and grant a decent gain. Nevertheless fishermen admit to catch turtles when they have the chance. Meat is destined to the family and is almost never sold.

San Juanico beaches are the northeast nesting beaches known in Baja California Sur, even if nesting events are very rare.

Bahía Magdalena

Bahia Magdalena is the Baja California Sur area with the highest concentration of fishing activities, and one of the most important in Mexico. During the last few years, many immigrants from other Mexican states (*i.e.* Sinaloa, Sonora, Michoacan) settled in Bahia Magdalena and started to work as fishermen to improve their life quality. The problem is that most of these people are not really fishermen, they chose an activity that could grant them enough money to feed their family and it is easy for some of them

to become *guateros*. Local consumption is still very high, as the amount of carapaces found in dumpsites witnesses. There is also a relevant black market, even if we could not get exact information on the number of caught turtles. Prices vary from 40 to 250 Mexican pesos, depending if it is the pure meat or the entire turtle.

We identified different patterns: in Santo Domingo there is a higher consumption of loggerhead turtles; in Puerto Adolfo Lopez Mateos and Puerto San Carlos there is a preference for the black turtle.

In Puerto Adolfo Lopez Mateos, the Grupo Tortuguero of las Californias and Procaguama, two conservation NGOs, are present all year round and conduce a lot of activities involving mainly local communities' members of all ages.

Todos Santos

In Todos Santos there is an organization dedicated to the illegal fishery of sea turtles. Fishermen use very different techniques to sell and carry the meat. In general sea turtles are caught and killed directly on the boat, the meat is taken and the carapaces are drowned and will never reach the beach. The meat is hidden in the gasoline tanks that are provided with a double-bottom. From Todos Santos, meat is transported to Cd. Constitucion, where some dealers sell it ("If you want to buy sea turtle meat, go to Cd. Constitucion, at the Health Centre and ask for Doña M. She has everything", anonymous 2006).

In Pescadero, there are many *guateros*, although the presence of two different sea turtle conservation groups and the black market of sea turtle meat is uncontrolled.

"I got to know that someone was going to sell five turtles, I knew where and when they were going to sell them and I called PROFEPA (the Mexican police in charge of environmental issues) and explained them the situation. But none came, the turtles were sold and there is nothing I can do."

- Anonymous, 2006 –

The situation in Todos Santos is quite complicated as there are a lot of rumors concerning the traffic of sea turtle meat but we could not find any carapaces. Talking with fishermen, they just affirmed that this area was once very important for the capture of turtles when sea turtle fishery was still permitted.

Sea turtle conservation groups working in this area use to monitor nesting beaches daily and nightly during the nesting season. Leatherback and Olive-ridley turtles are known to nest here.

Los Cabos

We have very few information about sea turtle fishery and consumption in this site. We did not carry out census in the dumpsites as they are too large. From talks with researchers and members of conservation organizations, we found out that consumption is not very common because of the presence of a high number of foreign peoples (U.S. citizens in particular). Nevertheless in nesting beaches between Cabo San Luca and San José del cabo, poaching is becoming very common as there is a massive migration of people from other Mexican states (Sonora, Sinaloa, Michoacan and Oaxaca) that are employed as masons.

Cabo Pulmo

Cabo Pulmo is part of a marine national park and fishery activities are constantly checked by park employees. Furthermore the main activity in Cabo Pulmo is tourism and none catch turtles illegally. Nevertheless in other communities like La Ribera and Los Barriles, sea turtle consumption and directed harvest is still a common practice even if there is no market. Most of the turtles are caught for celebrating Easter (Semana Santa).

Bahía la Ventana

In Bahía la Ventana, illegal fishery is a common practice especially in El Sargento and La Ventana. In particular in El Sargento, *guateros* catch turtles, take them home and take the meat for selling. A few months ago, PROFEPA closed two houses where they found many dead turtles. The beach from Punta Arenas to La Bocana is a well-known nesting site for the olive-ridley turtle. Volunteers and researchers in charge of the survey of this beach told us that this year they experienced a high level of poaching due to the presence of many workers from Oaxaca just next to the beach.

La Paz

La Paz is a big town (250.000 inhabitants) hosting people from different backgrounds and a lot of students. Sea turtle consumption is very common among people living since ages in town and in some areas of the town, where most of the fishermen live, there still is a lot of illegal fishery. There also are at least three places where you can buy sea turtle soup or meat and you can also order whatever you want. Usually sea turtle meat comes from Cd. Constitucion.

"I still remember when I was a child we used to have a huge alive sea turtle in our garden. It was for *Semana Santa* and all my uncles and aunts and cousins gathered in the backyard and my grandmother and my uncle prepared the turtle. It was a big party and a very special event."

- Anonymous, 2006 –

Loreto

Loreto is part of a marine national park and the employees regularly check the fishery activities and work closely with fishermen to reduce the risk of illegal fishery. According to Everardo Mariano, coordinator of the sea turtle project in Loreto, there still is a local consumption of sea turtle meat and there is illegal fishery out of the limits of the park, but it is at a local level. In the oldest neighbours of Loreto, where most of the fishermen live, we found many carapaces hidden under mangroves and trees. Nevertheless even consumption is becoming a sporadic phenomenon as Loreto is growing quickly and there are a lot of foreign people living in town now.

Mulegé

In Mulegé the level of *guaterismo* quickly decreased since the Grupo Tortuguero started its activities. This is due to the fact that there are much more controls by members of grupo Tortuguero and EcoAmigos of Mulegé (a local NGO). There are at least two places that are still used by illegal fishers, El Gallito Island and Santa Ines Island. These two places are hidden and offer a good location to the *guateros* as they can easily take the meat and throw the carapaces or hide them under the sand and the mangroves. At present it seems that there only is one person whose main activity is the illegal fishery of sea turtles. He is known to fish at least 1-2 turtles per day, but there are some other illegal fishers that use to take an animal from time to time to share it with friends.

Santa Rosalía

In Santa Rosalía the consumption of sea turtle meat is still very high as it has been abandoned by NGOs and there is no activity to protect sea turtles. Generally fishermen believe that there are a lot of turtles and did not trust data we showed to them. This is due to the fact that they see huge groups of turtles feeding on the same area but they do not have a global vision. Fishermen admitted to take turtles voluntarily when they dive during the squid season in particular. The black turtle is the most abundant but there also is consumption of olive-ridley and hawksbill turtles. Fishermen from a small area admitted to take at least 15 turtles per year but we know that it is largely more as we found a lot of carapaces in the dumpsite.